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PP-Splitting in Classical Greek
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1. Introduction

Free constituent order is well attested in Classical Greek (5th-4th century BCE). This is apparent in the following examples from within a few pages of Hippocrates' medical text *On Headwounds* (all examples in this paper come from prose sources):

(1.) SVO

    spasmòs gàr epilambánei tòn tmēt^{h}énta
    spasm$_{mns}$ for seizes$_{3s}$ the$_{mas}$ incised$_{mas}$
    'for spasm seizes the incised (patient)' (13.47)

(2.) SOV

    tà dè toiáuta tòn helkéōn tomês déitai
    the$_{nap}$ and such$_{nap}$ the$_{ngp}$ wounds$_{ngp}$ incision$_{fgs}$ require$_{3p}$
    'and such kinds of wounds require incision' (13.35)

(3.) OSV

    tà epì deksià ho spasmòs epilambánei
    the$_{nap}$ on right$_{nap}$ the$_{mns}$ spasm$_{mns}$ seize$_{3s}$
    'the spasm seizes the (parts) on the right' (13.48)

(4.) VOS

    suŋkléptousi gàr tền gnó:mēn kaì tền ópsin tóu
    deceive$_{3p}$ for the$_{fas}$ mind$_{fas}$ and the$_{fas}$ eye$_{fas}$ the$_{mgs}$

    hiatróu autaì hai hrap^{h}aí
    doctor$_{mgs}$ themselves$_{fnp}$ the$_{fnp}$ sutures$_{fnp}$

    'for the sutures themselves deceive the mind and the eye of the doctor' (12.29)

(5.) VSO

periék^{h}ei   gàr hē   kep^{h}alḕ hē   állē   tò   métōpon pân
surrounds$_{3s}$ for the$_{fns}$ head$_{fns}$ the$_{fns}$ rest$_{fns}$ the$_{nas}$ forehead$_{nas}$ all$_{nas}$
'for the rest of the head surrounds the whole forehead' (13.11)

(6.) OVS

tê   hédrē   prosgénētai rhḗksis kaì p^{h}lásis
the$_{fds}$ hedra$_{fds}$ accompany$_{3p}$ fissure$_{fns}$ and contusion$_{fns}$
'fissure and contusion accompany the hedra' (14.30)

Head-first order is pragmatically neutral, with a base order of SVO, and generally with the head preceding its complement (1).

  A striking aspect of free word order in Greek is a phenomenon known from classical scholarship as *hyperbaton*, which has been studied in great detail by Devine & Stephens (1994, 2000). It is a focalization process characterized by the optional fronting of material within a lexical XP around the governing head (7)-(9) and it often yields discontinuous constituent order (shown in **bold**).[i] The following are all cases of split PPs.

(7.) **es   tàs   állas**   épempe **summakhías**
     into the$_{fap}$ other$_{fap}$ sent$_{3s}$ allies$_{fap}$
     'he sent (messengers) to the other allies' (Herodotus 1.82)

(8.) **katà   toùs   tóu   patròs** epitáttonti **nómous**
     according the$_{map}$ the$_{mgs}$ father$_{mgs}$ ordering$_{mnp}$ laws$_{map}$
     'ordering things according to the laws of their fathers'
     (Plato, *Critias* 120b)

(9.) **hypò   taútēs** agómenoi **tês   élpidos**
     by   this$_{fg}$ inspired$_{mnp}$ the$_{fg}$ hope$_{fgs}$
     'inspired by this hope' (Plato, *Phaedo* 68a)

These cases involve hyperbaton around a lexical verb. The same local discontinuity, however, is found around nouns, prepositions and adjectives. Longer distance hyperbaton may also occur, as shown in (10)-(14).

(10.) **táuta** estoùs pántas héllēnas apérripse ho   kûros **tà   épea**
      these$_{nap}$ to the$_{map}$ all$_{map}$ Greek$_{map}$ directed$_{3s}$ the$_{mns}$ Cyrus the$_{nap}$ words$_{nap}$
      'Cyrus directed these words to all the Greeks' (Herodotus, 1.153)

(11.) **houtō** tis érōs **deinós**
so a$_{mns}$ passion$_{mns}$ terrible$_{mns}$
'a passion so terrible' (Plato, *Thaeatetus* 169c)

(12.) **polù** sùn phronḗmati **meízdoni**
far with confidence$_{nds}$ greater
'with far greater confidence' (Xenophon, *Anabasis* 3.1.22)

(13.) **pasin** éreske taûta **tóis állois présbesin**
all$_{mdp}$ pleased$_3$ these$_{nnp}$ the$_{mdp}$ other$_{mdp}$ ambassadors$_{mdp}$
'these things pleased all the other ambassadors' (Demosthenes 19.157)

(14.) **mónais taútais** apagoreúousin hoi nómoi **táis gunáiksin**
alone$_{fdp}$ these$_{fdp}$ forbid$_{3p}$ the$_{mnp}$ laws$_{mnp}$ the$_{fdp}$ women$_{fdp}$
'the laws forbid these women alone' (Demonsthenes 59.86)

Though these cases involve hyperbaton around more than the governing head, hyperbaton does have its limits, being clause-bound (Devine & Stephens 2000).
  As we saw in (7)-(9), split PPs are both grammatical and well-attested. (15)-(17) give additional cases:

(15.) moi **katà taúteen** prosēke krínest^{h}ai **tền graphḗn**
me$_{ds}$ on this$_{fas}$ is.right$_{3s}$ be.judged$_{inf}$ the$_{fas}$ charge$_{fas}$
'it would be right for me to be prosecuted on this charge' (Isaeus 11.35)

(16.) **apò tôn humetérōn** hūmîn poleméi **summák^{h}ōn**
from the$_{mgp}$ your$_{mgp}$ you$_{dp}$ battle$_{3s}$ allies$_{mgp}$
'from your own allies he battles with you' (Demosthenes 4.34)

(17.) **hyp^h' henòs** toiáuta pepónt^{h}en hē hellàs **ant^{h}rṓpou**
from one$_{mgs}$ such$_{mgp}$ suffered$_{3s}$ the$_{fns}$ Greece$_{fns}$ man$_{mgs}$
'from one man Greece suffered such things' (Demosthenes 4.34)

Devine & Stephens (2000) propose that hyperbaton results from syntactic movement of the kind illustrated in (18).

(18.)
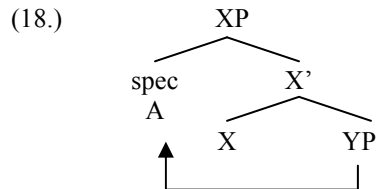
Their analysis posits movement of material from the complement of a head to its local spec, the extreme locality of which is itself problematic. More importantly, cases like (7)-(17) involve moving a non-constituent in syntax. This casts doubt on the plausibility of the type of account Devine & Stephens argue for.

We observe, however, that the fronted strings in all of these cases form a *phonological constituent*—a phonological word (ω) or phrase (ϕ). The extreme locality of the operation and the nature of the constituent that is moved suggest that *phonological* constituents undergo movement to *phonological* positions. This suggests movement at PF. We therefore propose that hyperbaton involves PF movement of phonological constituents to phonological positions, accounting for the otherwise anomalous extremely local fronting of syntactic non-constituents.

2. Observations

2.1. Hyperbaton ignores a number of syntactic constraints

Hyperbaton fails to obey a number of robust syntactic constraints. First, as we have just seen, it moves syntactic non-constituents. Second, heads and phrases apparently move to the same position immediately preceding the governing head (Mathieu 2004). (19) and (20) show movement of nominal phrases past a governing head (fronted strings in bold italic),

(19.) ***kalôn te kaì dikaíōn kaì agathôn*** péri
beautiful$_{ngp}$ both and just$_{ngp}$ and noble$_{ngp}$ about
'about the beautiful and just and noble things' (Plato, *Republic* 520c6)

(20.) ***toùs paróntas mónon*** apoktéinai
the$_{map}$ present$_{map}$ only kill$_{inf}$
'to kill only those who are present' (Thucydides 3.36.2)

while (21) and (22) show fronting of a quantificational head to the same position.

(21.) ***pántōn*** péri **tôn állōn** (cf. 19)
all$_{ngp}$ about the$_{ngp}$ other$_{ngp}$
'about all the other (things)' (Plato, *Republic 353b)*

(22.) ***polloùs*** apoktéinai **tôn polemíōn** (cf. 20)
many$_{map}$ kill$_{inf}$ the$_{mgp}$ enemy$_{mgp}$
'to kill many of the enemy' (Isocrates, *ad Archidamum* 9.5.2)

Thus, it looks as if phrases and heads target the same landing site, a problem from the perspective of structure preservation in syntax.

Furthermore, the extreme locality of the movement does not respect anti-locality, the constraint against syntactic movement to a landing site that is 'too close' to the original launching site (Grohmann 2001, Abels 2003). This is illustrated clearly in (23), where material from a nominal complement is 'tucked in' in between the determiner *tền* 'the' and the nominal head *dóksan* 'opinion'. The movement appears to proceed from the complement of the governing head noun to its left edge, a case of movement that should be barred by any version of anti-locality.

(23.) tền ***tôn pollôn*** dóksan **antʰrɔ́pōn**
the$_{fas}$ the$_{mgp}$ many$_{mgp}$ opinion$_{fas}$ people$_{mgp}$
'the opinion of the many people' (Plato, *Protagoras* 353a)

As should be clear from all of the examples, hyperbaton also does not observe Ross's (1967) left branch condition. This is also true of wh-movement, shown in (24), whose pied-piped version is also grammatical (25).

(24.) ***tína***   ékʰei dúnamin
what$_{fas}$ has$_{3s}$ power$_{fas}$
'What power does it have?' (Plato, *Republic* 358b)

(25.) ***tína   dúnamin*** ékʰei
what$_{fas}$ power$_{fas}$ has$_{3s}$
'What power does it have?' (Plato, *Laws* 643a)

Most striking, however, is the fact that movement does not respect the coordinate structure constraint (Ross 1967). This is illustrated by 'conjunct hyperbaton' in (26)-(29).

(26.) ***aretês*** péri **kaì kakías**
virtue$_{fgs}$ about and vice$_{fgs}$
'about virtue and vice' (Plato, *Republic* 365a5)

(27.) ***tarakʰês*** mestà **kaì pollês epimeleías**
trouble$_{fgs}$ full$_{fns}$ and much$_{fgs}$ care$_{fgs}$
'full of trouble and much care' (Isocrates, *Nicocles* 31.4)

(28.) tè:n ***tóu pantòs*** génesin **kaì tôn moríōn**
the$_{fas}$ the$_{mgs}$ whole$_{mgs}$ origin$_{fas}$ and the$_{ngp}$ parts$_{ngp}$
'the origin of the whole and parts' (Aristotle, *Meteorologica* 356b35)

(29.) **_hoplítas_**   ékʰō̄n **kʰilíous kaì peltastàs pentakosíous**
     hoplites_map having 1000_map and peltasts_map 500_map
     'having 1000 hoplites and 500 peltasts' (Xenophon, *Anabasis* 1.2.6.2)

(26)-(28) are examples of local fronting of the first conjunct. (29) is an example of extraction *out of* the first conjunct (we have found no cases of second conjunct fronting).
  Additionally, movement does not observe the adjunct condition (Huang 1982, Chomsky 1986, Takahashi 1993), as shown below:

(30.) **_eks állēs_**   eltʰónta **kómmēs**
     from another_fgs coming village_fgs
     'coming from another village' (Herodotus 1.196)

(31.) **_en tóis pʰonikóis_**   gégraptai **nómois**
     in the_mdp homicide_mdp is.written laws_mdp
     'it is written in the homicide laws' (Demosthenes 9.44)

(30) and (31) involve non-constituent fronting out of an adjunct PP, which should be barred by the adjunct condition. Such things are well-attested in Classical Greek, however, suggesting that hyperbaton is insensitive to the condition against extraction from adjuncts.

2.2 Hyperbaton obeys a number of phonological constraints

Although hyperbaton is insensitive to these syntactic constraints, it obeys a number of phonological constraints. First, we observe that hyperbaton respects phonological constituency; that is, it cares about whether something is a phonological word or a phrase but not whether it is a syntactic head or phrase. In most cases, the fronted string is a phonological word (ω). In (32)-(33), we show that the string targeted for fronting is not a syntactic constituent, but it does constitute a phonological word.

(32.) [_VP_ eltʰónta [_PP_ **eks**   [_DP_ **állēs**   kómmēs]]] →
          coming   from   another village

     (**_eks állēs_**_ω_) (eltʰónta_ω_) (kómmēs_ω_)
      from another   coming   village

(33.) [_VP_ gégraptai [_PP_ **_en_** [_DP_ **_tóis_** [_DP_ **_pʰonikóis_** nómois]]]] →
         is.written   in   the   homicidal laws

(***en tóis pʰonikóis***ω) (gégraptaiω) (nómoisω)
  in the homicide   is.written   laws

(34) shows that the problematic head movement cases also involve fronting of a phonological word.

(34.) [VP apoktéinai [QP ***polloùs*** [DP tôn polemíōn]]] →
         kill   many   the enemy

     (***polloùs***ω) (apoktéinaiω) (tôn polemíōnω)
      many   kill   the enemy

We assume that a phonological word (ω) is aligned with the right edge of a lexical head, and may have a string of function words (including prepositions) preceding the lexical head (Selkirk 1986; Golston 1995 for Classical Greek). In addition, the fronted material may constitute a phonological phrase (φ), defined as the right edge of an XP in the syntax (Selkirk 1986):

(35.) péri [NP ***kalôn te kaì dikaíōn kaì agathôn***] →
     about   beautiful both and just   and   noble

(36.) (***kalôn te kaì dikaíōn kaì agathôn***φ) péri
      beautiful both and just   and noble   about

As we might expect from movement at PF, hyperbaton respects prosodic boundaries: we know of no cases of fronting beyond an intonational phrase in Classical Greek; this is in accordance with the reported clause-boundedness of hyperbaton (Devine & Stephens 2000).
  More surprisingly, Golston (1995) has shown that hyperbaton obeys a version of the Obligatory Contour Principle (Leben 1973), insofar as it is blocked when homophonous function words would be brought together. To see this, consider possessor DPs, which generally follow their nouns.

(37.) hē   tólma   tōn   legóntōn
     thefgs couragefgs themgp speakingmgp
     'the courage of the (ones) speaking' (Lysias 12.41)

(38.) tês arkʰês   tês   póleōs
     thefgs dominionfgs thefgs cityfgs
     'of the dominion of the city' (Plato, *Statesman* 275a)

  A possessor can also be tucked in between the head D and the head N, creating a center-embedded construction:

(39.) tḕn **tóu prosó:pou** pʰúsin
the$_{fas}$ the$_{mgs}$ face$_{mgs}$ nature$_{fas}$
'the nature of the face' (Plato, *Statesman* 257d)

(40.) tà **tôn póleōn** prágmata
the$_{nap}$ the$_{fgp}$ city$_{fgp}$ affairs$_{nap}$
'the affairs of the cities' (Plato, *Statesman* 291c)

This occurs even with multiple possessors:

(41.) tò **tês tóu ksaínontos tékʰnēs** érgon
the$_{nns}$ the$_{fgs}$ the$_{mgs}$ carder$_{mgs}$ art$_{fgs}$ work$_{nns}$
'the work of the art of the (wool-)carder' (Plato, *Statesman* 281a)

(42.) tà **tês tôn pollôn psukʰês** ómmata
the$_{nnp}$ the$_{fgs}$ the$_{mgp}$ many$_{mgp}$ soul$_{fgs}$ eyes$_{nnp}$
'the eyes of the soul of the many' (Plato, *Sophist* 254a)

Possessor hyperbaton is blocked if it results in adjacent homophonous function words in the same ω (Smyth 1920; Golston 1995):[ii]

(43.) * (tês tês póleōs$_ω$) (arkʰês$_ω$)
the$_{fgs}$ the$_{fgs}$ city$_{fgs}$ dominion$_{fgs}$
'the dominion of the city' [construct]

Instead, the possessor surfaces to the left of the entire DP:

(44.) (**tôn tʰeôn$_ω$**) (tôn onomátōn$_ω$)
the$_{mgp}$ god$_{mgp}$ the$_{ngp}$ name$_{ngp}$
'the names of the gods' (Plato, *Cratylus* 400d)

Thus it appears that hyperbaton is blocked by the phonological identity of adjacent function words, since the adjacent *non*-homophonous articles in (42)-(45) do not block it.

2.3 Hyperbaton is semantically vacuous

Although it has the pragmatic effect of focus, hyperbaton is semantically vacuous *sensu stricto*. This can be seen from the insensitivity of hyperbaton to anaphor binding. In cases like the following, an anaphor (bolded italics) precedes its antecedent:

(45.) hōs dè ***pròs   heautòn$_i$*** ékhei ho   spoudáios$_i$
      as   and towards himself$_{mas}$ holds the$_{mns}$ earnest$_{mns}$
      'and as the earnest man is towards himself'
      (Aristotle, *Nicoma. Ethics* 1170b5)

(46.) ***allḗous$_i$*** ep^{h}ilop^{h}ronḗsanto [kheirísop^{h}os   kaì   ksenop^{h}on]$_i$
      e.o.$_{.map}$ greeted$_{3ppf}$ Cheirisophos$_{mns}$ and   Xenophon$_{mns}$
      'Cheirisophos and Xenophon greeted each other'
      (Xenophon, *Anabasis* 4.5.34)

(47.) ei dé ge mēdamóù ***heautòn$_i$*** aêpokrúptoito ho   poiētēs$_i$
      if and prt never   himself$_{mas}$ conceal$_{3sg.opt}$ the$_{mns}$ poet$_{mns}$
      'and if the poet should never conceal himself' (Plato, *Republic* 393c11)

Thus hyperbaton exhibits obligatory 'LF undoing' effects, as discussed by Saito (1989) for long distance scrambling in Japanese and Sauerland & Elbourne (2002) for putative cases of PF movement. Obligatory 'LF undoing'/reconstruction is expected for movement at PF, which should have no effect on LF.

3. Analysis

Hyperbaton's surprising insensitivity to syntax and its equally suprising sensitivity to prosody suggests that it occurs in the phonological component of the grammar (PF), where it affects elements of the prosodic hierarchy. We may define Classical Greek hyperbaton as follows:

(48.) Hyperbaton: *front p, where p ranges over ω and ϕ.*

The simplest and commonest case is where the material is fronted past a single phonological word: this will of course be the syntactic head that governs the moved material in the syntax, resulting in the extremely local fronting that is unexpected syntactically. If the narrow syntax has the right-branching structure below, the prosodic output of hyperbaton has a different structure consisting of three phonological words, with *eks állēs* 'from another' fronted immediately before the head *elt^{h}ónta* 'coming':

(49.) [$_{VP}$ elt^{h}ónta [$_{PP}$ **eks**   [$_{DP}$ **állēs**   kốmmēs]]] →
            coming   from   another village

(***eks***   ***állēs***_w)   (elt^hónta_ω) (kőmmēs_ω)
   from   another   coming   village

Again, (49) shows that a phonological constituent fronts to an extremely local position immediately before the head; this is completely unexpected if hyperbaton is a syntactic operation moving syntactic constituents to syntactic positions. The following shows the same pattern

(50.) [$_{VP}$ gégraptai [$_{PP}$ ***en***   [$_{DP}$ ***tóis*** [***p^honikóis*** nómois]]]] →
      is.written   in   the   homicide   laws

(***en tóis p^honikóis***_ω) (gégraptai_ω) (nómois_ω)
 in the homicide   is.written   laws

as does the following, this time with a phonological phrase (φ) fronted before the governing head (*péri* 'about'). Note that we omit phonological word boundaries in (51) for clarity:

(51.) péri [$_{NP}$ ***kalôn***   ***te***   ***kaì***   ***dikaíōn kaì***   ***agathôn***] →
      about   beautiful both and just   and noble

(***kalôn***   ***te***   ***kaì dikaíōn kaì***   ***agathôn***_φ) péri
 beautiful both and just   and noble   about

We can summarize the special properties of hyperbaton as follows:

(i)   movement of syntactic non-constituents,
(ii)   sensitivity to syntactic islands (CSC, Adjunct Condition),
(iii)   insensitivity to anti-locality,
(iv)   semantic vacuity with respect to binding
(v)   fronting of phonological constituents (ω and ϕ),
(vi)   sensitivity to phonological conditions (the OCP),
(vii)   phonological boundedness of movement (intonational phrase).

Properties (i)-(iv) suggest that hyperbaton is not a syntactic operation. Properties (v)-(vii) suggest that it is a phonological operation. Together this constitutes an argument for (phonological) movement at PF.

4. Comparison with Slavic

Slavic languages exhibit something similar to hyperbaton. Languages like Serbo-Croatian allows left branch extraction of adjectives and demonstratives out of a DP. Compare the following cases with those in Classical Greek:

(52.) *Serbo-Croatian*

visoke je on video **devojke**
tall   aux he seen girls
'Tall girls, he saw.' (Bašić 2004: 76)

ta   je   vidio **kola**
that aux seen car
'That car, he saw.' (Bošković 2005: 2)

(53.) *Classical Greek*

tēlikoútōn héneka...   **tekmēríōn**
so.great_{ngp} for.the.sake.of evidence_{ngp}
'for the sake of such great evidence' (Demosthenes 57.64)

toútōn plêt^hos **tôn   ō̂ôn**
these_{mgp} mass_{nns} the_{mgp} eggs_{mgp}
'mass of these eggs' (Aristotle, *de Generatione Animalium* 755b27)

There are important differences between Slavic and Classical Greek left branch extraction, though. One cannot front two left branch modifiers in Serbo-Croatian, for instance,

(54.) *visoke lepe   on gleda   **devojke**
tall   beautiful he watches girls (Bašić 2004:77, citing Bošković 2002)

but this is attested in Classical Greek:

(55.) *ekeinou monou* aist^hanontai **tou   melōs   okséōs**
that_{mgs} sole_{mgs} hear_{3p}   the_{mgs} song_{mgs} clearly
'they hear that sole song clearly' (Plato, *Ion* 536c)

Thus, despite surface similarities, hyperbaton in Classical Greek has characteristics distinct from Slavic adjectival/demonstrative LBE. The differences are particularly interesting when we look at hyperbaton from within a PP. This goes under the name of PP-splitting in the Slavic literature.

4.1 Franks & Progovac (1994), Bašić (2004)

Consider the following, again from Serbo-Croatian:

(56.) ***u   veliku*** on ude   **sobu**
      in big   he entered room
      'He entered the big room.' (Bošković 2005)

According to Franks & Progovac (1994), this is derived by first postposing the NP (*sobu*), then fronting the remnant of the PP (*u veliku* t). Bašić (2004) proposes that the NP undergoes leftward movement to the clausal middle field, followed by remnant PP movement to the clause periphery.
Crucial for both of these approaches is the impossibility of fronting just the NP, stranding the preposition and adjective:

(57.) *****sobu*** on ude   **u   veliku**
      room he entered in big

This *is* attested, however, in Classical Greek:

(58.) ***astrôn*** dḗ   **péri pántōn**
      stars$_{mgp}$ indeed   about all$_{mgp}$
      'about all stars' (Plato, *Laws* 899b)

This suggests that the remnant movement analyses won't work for the Classical Greek data. More generally, when the material is moved to an extremely local position (eg, between a determiner and the noun it governs), it cannot be the case that the material has landed in a clausal 'middle field'. The same problem confronts scattered deletion analyses, which must rely on multiple feature checking positions for moved constituents whose material is spelled out discontinuously (e.g., Ćavar & Fanselow 2000, Nunes 2004).

4.2 Bošković (2005)

Bošković (2005) proposes a different type of analysis that assumes an AP-within-NP structure. For Bošković, the adjective moves to a position c-commanding the preposition, which then cliticizes onto the adjective and moves with it when the adjective moves further leftward. Crucially, the adjective may not extract alone, stranding the preposition and noun:

(59.) *****veliku*** on ude   **u   sobu**
      big   he entered in room

Nor may the preposition and noun front, stranding the adjective:

(60.) *__*u__ __sobu__* on ude **veliku**
        in room he entered big

But both types of data are attested in Classical Greek: [iii]

(61.) *__automátou__* péri **bíou**   (cf. 59)
        spontaneous_mgs about life_mgs
        'about spontaneous life' (Plato, *Statesman* 271e)

(62.) *__ep'__   __ándras__* strateuómet^ha **agat^hoús**   (cf. 60)
        against men_map fight_1p   noble_map
        'we are fighting against noble men' (Herodotus 7.53)

In Classical Greek, the same patterns that are found with clitic prepositions are found with verbs, nouns, and adjectives, none of which are in any sense phonological clitics, as pointed out by Devine & Stephens (2000). So a clitic-based analysis has no chance of generalizing to the Classical Greek data. Moreover, even though some monosyllabic prepositions are proclitic, polysyllabic and tone-bearing prepositions are not. They work the same way, however:

(63.) *__hypò__ __taútēs__* agómenoi **tês   élpidos**
        by   this_fg inspired_mnp the_fg hope_fgs
        'inspired by this hope' (Plato, *Phaedo* 68a)

(64.) *__katà__ __toùs__ __tóu__   __patròs__* epitáttonti **nómous**
        by   the_map the_mgs father_mgs ordering_mnp laws_map
        'ordering things by the laws of their father' (Plato, *Critias* 120b)

Note that the PP-splitting in (64) involves extraction of a possessor (*__tóu patròs__* 'of the father') as well as the determiner associated with the possessed noun. All such PP data show that a clitization analysis cannot extend to a large portion of the PP-splitting cases in Classical Greek.

5. Conclusion

We have noted a number of problems with syntactic analyses of hyperbaton in Classical Greek as well as a number of factors that point to hyperbaton being

phonologically driven. The former include properties (i)-(iv) above, repeated below for convenience:

(i)   movement of syntactic non-constituents,
(ii)   sensitivity to syntactic islands (CSC, Adjunct Condition),
(iii)   insensitivity to anti-locality,
(iv)   semantic vacuity with respect to binding.

If hyperbaton occurs at PF, though, we expect it to categorically ignore syntactic constituency, islands, and anti-locality and to be semantically vacuous. The factors that point to a phonological analysis are:

(v)   fronting of phonological constituents (ω and ϕ),
(vi)   sensitivity to phonological conditions (the OCP),
(vii)   phonological boundedness of movement (intonational phrase).

These properties suggest movement at PF, where phonological words and phrases are available, where constraints like the OCP are presumed to apply, and where intonational phrases exist.

  Again, properties (i)-(iv) argue against a syntactic analysis of hyperbaton, just as (v)-(vii) argue for a prosodic one. More programmatically, it may be that properties like those in (i)-(vii) constitute necessary and sufficient conditions for movement at PF, where syntax should be ignored and prosody obeyed. Future work will have to determine whether this is the case.

Notes

[i] Discontinuous constituency is well attested in modern languages (e.g., Baker 1996, Hale 1983, Jelinek 1984), as it is in Classical Greek. Devine & Stephens (1994: 483) observe that such cases of extremely local hyperbaton around a verb accounted for 29% of the occurrences of verb + complement constructions within a sample from a single text (the *Troades*). This percentage is almost equal to the respective individual frequencies of cases within the sample where the verb's complement is entirely following or preceding the verb. According to Devine and Stephens, "[u]se of interrupted constituents is a typical feature of verse word order and is also well attested in classical prose…[I]nterrupted constituents are found in texts, which, whatever degree of literary pretension they may have, are unlikely to use stilted or otherwise artificial word order... So it is probably safe to assume that this typical feature of verse word order has a basis in ordinary speech." (1994: 483)

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[ii] The lack of this pattern was confirmed by a computerized search of the Classical Greek corpus made possible via the Thesaurus Linguae Graecae, which yielded zero results for instances of homophonous adjacent function words (with a single orthographically ambiguous case in Aristotle). An utterance in Classical Greek, has as many phonological words as it has lexical heads (N, V, A) and the right edge of every lexical head is co-terminus with the right edge of a phonological word (Golston 1995, based on Selkirk 1986).

[iii] Devine & Stephens (2000: 112) note that cases of the form *Y1 V Prep Y2* (where *Y1* is an adjectival modifier of Y2 in hyperbaton) occurs in verse, but not in prose. (68), however, shows that the adjective may front past the preposition in prose in the extremely local cases. What is important here is that at least in these local cases the adjective may strand the preposition, which is unexpected under the cliticization analysis. As for the absence of the *Y1 V Prep Y2* pattern in prose, note that it violates the preferred phonological parsing in which (Prep + Y1) form a phonological constituent together (a phonological word), which is the target of fronting. In verse, this constraint is relaxed.

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Comparative Sandwichology

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1. Introduction and Data

This paper points out some new observations regarding the truth conditions of *less*-comparatives, involving what are now known as SANDWICH SCENARIOS, as invoked originally in Sharvit and Stateva (2002) (henceforth S&S).

In S&S, sandwich scenarios provide the basis of a forceful argument for an individual based semantics of superlatives. A possible degree based alternative is dismissed, since it wrongly predicts a second reading for superlatives which isn't there.

The main observation in this paper is that S&S's argument regarding superlatives can be replicated for *less*-comparatives, contrary to S&S's own conclusion about comparatives. As a consequence, we should look for an analysis that captures both superlatives and comparatives alike.

Two such analyses are considered: A degree based one, along the lines of the one S&S dismiss because it overgenerates, and an individual based one, essentially S&S's superlative analysis adapted to comparatives.

The degree based analysis, it turns out, can derive the correct truth conditions, but always predicts a second reading which is unattested. The individual based semantics handles the simple cases correctly (and unambiguously), but has severe problems with more complex cases, including ones in which an ambiguity is in fact observed.

We are thus left with two incomplete proposals: the individual based analysis, which captures the superlative data nicely, but arguably fails to extend to the comparative case, and the degree based proposal, which treats comparatives and superlative alike, but too often generates an unattested reading.

2. Sandwich Scenarios

Here's a sandwich scenario: Suppose Sue, Mary and Bob each own a small plant that manufactures conversive carbon links (CCLs). In a search for the most efficient way to produce CCLs, the three have come up with various manufactur-

ing methods, which range from the rather expensive 'immerse in gold' (incurring costs of $2.33 a piece) to the downright cheap 'whack with a hammer' (at $0.03 a pop). CCL manufacturing being the highly competitive business that it is, the three competitors of course try to keep their methods secret, so not all are known to all. The situation is diagrammed in table 1 (as you see, there are also some other methods which are not as yet known).

method	$ cost/piece	known to...		
		Bob	Mary	Sue
Uranium mold	88.00	-	-	-
immerse in gold	2.33	-	Y	-
heat to 500F	1.20	-	-	Y
coat with aluminum	.11	Y	-	-
whack with a hammer	.03	-	Y	-
use replicator	.008	-	-	-

Table 1: Methods, prices, and the people who know them.

This type of scenario is called sandwich scenario because the cost of the method that Bob knows is 'sandwiched' between the costs of two different methods that Mary knows.

2.1. Judgements for *more/most*

To warm up, what are the judgement for ordinary *more/most* comparatives and superlatives in this scenario? The following, quite clear pattern emerges (# here means 'false'). (To aid judgement for the *more/most* cases, assume that for some reason it is desirable to incur high production costs, so the more expensive a method you know, the better — maybe think no-bid government contract.)

(1)   a.   Mary knows the most expensive method.
      b.   #Bob knows the most expensive method.

(2)   a.   Mary knows a more expensive method than every/anybody else.
      b.   #Bob knows a more expensive method than every/anybody else.

(3)   a.   Mary knows a more expensive method than Bob.
      b.   #Bob knows a more expensive method than Mary.

These judgments are predicted by any semantic theory of superlatives and comparatives that I know of. Yet, it is worth pointing out the following fact. Take (3b): Bob does know a method that is more expensive than *some* method Mary knows (he knows the 'coat with aluminum' method, which is more expensive than the 'whack with a hammer' method, which Mary knows). Yet (3b) is clearly false,

which indicates that *a more expensive method than Mary* is interpreted as (4a), not as (4b).

(4)   a.   a method that is more expensive than *all* methods Mary knows
        b.   #a method that is more expensive than *some* method Mary knows

2.2.   Judgements for *less/least*

Let us now turn to *less/least*. The judgements for the scenario in table 1 are as follows (in this case, quite naturally, assume that knowing a cheap method is a good thing):[1]

(5)   a.   Mary knows the least expensive method.
        b.   #Bob knows the least expensive method.

(6)   a.   Mary knows a less expensive method than every/anybody else.
        b.   #Bob knows a less expensive method than every/anybody else.

(7)   a.   Mary knows a less expensive method than Bob.
        b.   #Bob knows a less expensive method than Mary.

Again, we might expect (7b) to be true, since Bob knows a method ('coat with aluminum') which is less expensive than *a* method Mary knows ('immerse in gold'). Since (7b) is false, we conclude that *less expensive* must mean 'less…than all' rather than 'less…than some'.

    So in sum *Bob knows a more/less expensive method than Mary* is true iff Bob knows a more/less expensive method than *all* methods Mary knows, not if Bob merely knows a more/less expensive method than *some* method Mary knows.

2.3.   The Dilemma

The judgments provided above seem rather solid, but in the *less*-case, they differ from the predictions made by many standard, degree-based semantic proposals for comparatives. Assume that expensiveness is measured by a function COST, which maps each method onto its degree of expensiveness (roughly: its price). The *than*-clause in e.g. examples (3a)/(7a) above then denotes (8), the set of cost-degrees d s.t. Bob knows a method that is d-expensive or more than d-expensive:

(8) $\{d \mid$ for some method x that Bob knows, $d \leq COST(x)\}$ $\boxed{=D_{than}}$

For Mary to know a *more* expensive method means that she knows some method whose cost-degrees are a superset of Bob's (i.e. D_{than}), (9):

(9)   Mary knows a more expensive method than Bob (does).
        Mary knows a method y s.t. $\{\lambda d \mid d \leq COST(y)\} \supset D_{than}$

Putting (9) and (8) together, we correctly derive that (3a) is true iff Mary knows a method that is more expensive than the *most* expensive method Bob knows.

Turning to the *less* comparative, the natural move seems to be to replace ⊃ in (9) by ⊂, i.e. Mary knows a method whose cost degrees are a subset of Bob's:

(10)　　Mary knows a less expensive method than Bob (does).
　　　　Mary knows a method y s.t. $\{d \mid d \leq COST(y)\} \subset D_{than}$

Unfortunately, combining (10) with D_{than} from (8) above yields the wrong result: (7a) is predicted to be true iff Mary knows a method that is less expensive than the *most* expensive method Bob knows.

The problem is rooted in the semantics of the *than*-clause in (8), which only reflects the cost of the most expensive method Bob knows, regardless of which other methods he might know. What we need for the *less* comparative, however, is information about the *least* expensive method Bob knows. I will call this problem the COMPARATIVE SANDWICH DILEMMA. It is the same problem observed for *least*-superlatives in S&S — unsurprisingly, since one can simply think of the semantics of the superlative as a comparative (as in (8) above), with a variable ranging over all (relevant) COMPETITORS in place of 'Bob'.

3.　A Solution Based on Negative Degrees

3.1.　Basic Idea

On way to solve the sandwich dilemma is to assume that a *less*-Comparatives like (11a) is in fact interpreted as (11b) (see Heim, 2006; Kennedy, 2001; Rullmann, 1995; Seuren, 1978, 1984; von Stechow, 1984):

(11)　　a.　Mary knows a less expensive method than Bob.
　　　　b.　Mary knows a cheaper method than Bob

The cheapness of an object x, in the technical sense, is the set of degrees *above* its cost: $\{d \mid COST(x) < d\}$ (the complement of its expensiveness degrees); hence the lower its cost, the bigger its cheapness. To illustrate, the denotation of the *than*-clause in (7a) is now (12), the set of cost degrees above the cheapest method Bob knows (compare to (8) above):

(12)　　⟦than Bob ~~knows a cheap method~~⟧ = $\{d \mid$ for some method x that Bob knows, $COST(x) < d\}$

Note that the shift from the most expensive to the cheapest comes about purely as a side effect of dealing in cheapness degrees, rather than expensiveness degrees. You can think of the denotation of the *than* clause as the union of the degree sets for each method Bob knows. The set of expensiveness degrees of the most

expensive method is a superset of the sets of expensiveness degrees of all cheaper methods, so the result is the expensiveness of the most expensive method. But the set of cheapness degrees of the *cheapest* method is a superset of each set of cheapness degrees of the more expensive (less cheap) methods, so that the union is the same as the cheapness of the cheapest.

Now if Mary knows a method whose cheapness degrees are a superset of (12) (i.e. a cheaper method), she knows a less expensive method than the cheapest one Bob knows. This yields the correct truth conditions for (7a).

3.2. Implementation (Sketch)

The implementation of this follows Heim (2006) and Büring (2007a,b). *Expensive* maps any object to the set of cost degrees lesser or equal to its costs; LITTLE maps a set of degrees to its complement, e.g. the expensiveness degrees onto cheapness degrees:

(13) a. $[\![\text{expensive}]\!] = \lambda x_e.\{d_d \mid d \leq COST(x)\}$
      b. $[\![\text{LITTLE}]\!] = \lambda i_{dt}.\{d_d \mid \neg i(d)\}$
      c. $[\![\text{LITTLE expensive}]\!] = \lambda x.\{d_d \mid \neg[d \leq COST(x)]\}$
          $\equiv \lambda x.\{d_d \mid COST(x) < d\}$

The logical form for *less expensive method than Bob (does)* in (7a) is (14), where *more* LITTLE *expensive* gets spelled out as *cheaper* in the main clause, and *knows a* LITTLE *expensive method* is elided in the *than*-clause:

(14) more [LITTLE expensive] method than Bob knows a [LITTLE expensive] method

3.3. Superlatives

The semantics sketched above can be extended to the superlative cases quite naturally. Intuitively, this is easy to see: the truth conditions of the superlative are the same as those of (15), repeated from (6a) above, which in turn is just the semantics for *Mary knows a less expensive method than Bob* with a generalized quantifier in place of Bob:

(15) Mary knows a less expensive method than every/anybody else.

The truth conditions for *Mary knows the least expensive method* are thus the ones in (16) (recall that a method *m* is d-LITTLE-expensive iff $COST(m) < d$):

(16) Mary knows a method *m*, and for all competitors *x* to Mary, $\{d \mid x$ knows a method which is d-LITTLE-expensive$\} \subset \{d \mid m$ is d-LITTLE-expensive$\}$

4. Individual Comparison

4.1. S&S's Proposal

Let us now turn to S&S's proposal to deal with sandwich scenarios in superlatives. The truth conditions they assume are given in (17):

(17)   *Mary knows the least expensive method* is true iff Mary knows the method which is less expensive than any other method in K

K in (17) is contextually instantiated as the set of methods Mary's competitors know. It is important to note that this COMPARISON SET consists of methods, not degrees of expensiveness. We then directly compare the cost of each method to that of Mary's method, and derive the correct truth conditions. I will henceforth refer to this type of analysis as INDIVIDUAL COMPARISON (as opposed to DEGREE COMPARISON).

S&S do not, however, propose an analogous, individual comparison semantics for the comparative; the interpretation they propose for *less*-comparatives instead is illustrated in (18):

(18)   *Bob knows a less expensive method than Mary* is true iff there is a degree d s.t. Bob knows a method which is *not d*-expensive, and Mary knows a method that *is d*-expensive

Applied to sandwich scenarios, this proposal suffers from the now well-known problem: it generates the 'less than some' reading; it thus predicts both of the following (and probably also (20)) to be true in the scenario in table 1:

(19)   a.   Bob knows a less expensive method than Mary.
              (true, because Bob knows the 'coat with aluminum' method, which is not as expensive as 'immerse in gold', which Mary knows)
        b.   Mary knows a less expensive method than Bob.
              (also true, because Mary knows the 'whack with a hammer' method, which is not as expensive as 'coat with aluminum')

(20)   Mary and Bob each know a less expensive method than the other.

4.2. An Alternative (More Like S&S's Superlative Semantics)

Let us try to adapt S&S's individual based superlative analysis to the comparative case. The trick, recall, was to compare methods, rather than degrees. This is illustrated in (21):

(21)   *Bob knows a less expensive method than Mary* is true iff Bob knows a method which is less expensive than any other method in K, and $K = \{x \mid x$

> is a method Mary knows}

(21) reflects the correct truth conditions. Now, evidently, *K* here is not contextually provided; it is given by the *than*-clause, which then must denote a set of individuals, rather than degrees:

(22) $\llbracket$than Mary (does)$\rrbracket = \{x \mid \text{Mary knows (method) } x\}$

It thus seems that we can give a semantics for the *less*-comparative that works fine in sandwich scenarios, and for the same reason S&S's analysis does for superlatives. But (21) can't in general be the correct logical form for attributive comparatives, as I will now show.[2]

4.3. *Than*-Clauses in Attributive Comparatives Can't Generally Denote Sets of Individuals

The semantics just given, generally, fails to work in any context in which the *than* clause contains a modal expression. Consider (23):

(23) You bought a more expensive house than I though you would.
   a. you bought a house which is *d*-expensive, and I didn't think you'd buy a *d*-expensive house.
   b. *you bought a house which is more expensive than any house I thought you'd buy

With degree comparison, (23) is true if (23a) holds, which accords to intuitions. With individual comparison, however, its truth conditions are wrongly predicted to be those in (23b). To see what's wrong with that, note that in (23b), the *than*-clause denotes the set of houses that I thought you would buy. But in order for (23) to be true, I don't have to think of any particular house that you would buy it (I don't have to have a *de re* belief about any house at all). If I thought you'd spend $400,000, and you bought one for $600,000, (23) is true, even if I don't have the first idea of which houses $400,000 could buy.

The same problem can be seen in (24):

(24) You bought a more expensive gift than you had to.
   a. you bought a *d*-expensive gift and you didn't have to buy a *d*-expensive gift
   b. *you bought a gift that was more expensive than any gift you had to buy

Clearly, (24) is true if you spent more money than was necessary; there doesn't have to be any particular gift you had to buy.

In conclusion then, *than*-clauses in DP-internal comparatives can't generally denote sets of individuals. Accordingly, DP-internal comparatives can't generally compare individuals. Individual comparison, then, can't be the solution to the comparative sandwich dilemma.[3]

5. Problem Not Quite Solved

At this point we have seen the following: The sandwich dilemma occurs in *least*-superlatives and *less*-comparatives alike. An interval-based semantics can handle the comparative cases, as well as the superlatives. S&S's proposal for superlatives, too, avoids the sandwich dilemma, but their proposal for comparatives doesn't. Adapting their superlative semantics, which is based on individual, rather than degree, comparison, to comparatives solves the sandwich dilemma, but is genuinely unable to handle modal operators in *than*-clauses. So on balance, the degree based semantics seems preferable.

There is, however, one problem with the degree comparison proposal (as S&S note in discussing a possible alternative to their superlative semantics). It works as long as it is assumed, crucially, that *less/least expensive* is necessarily interpreted as 'more/most cheap' (rather than 'less/least expensive'). But there is independent evidence that in fact either interpretation is available.[4] Consider (25):

(25)   He drove less fast than he had to.
    a.   his slowness is more than the slowness he has in every permitted world (he could have gone faster)
$\{d \mid SPEED(@)(he) < d\} \supset \{d' \mid \forall w \in Deon(@), SPEED(w)(he) < d\}$
    b.   his fastness is less than the fastness he has in every permitted world (he was too slow)
$\{d \mid d \leq SPEED(@)(he)\} \subset \{d' \mid \forall w \in Deon(@), d' \leq SPEED(w)(he)\}$

(25a) corresponds to the analysis given in section 3. above: He drove slower than how slow he had to drive ('below the maximum'; note that we have $SPEED(he) < d$, and $\supset$; @ stands for the world of evaluation, Deon maps every world to the worlds deontically accessible from it).

But (25) has a second, in fact more prominent reading, (25b): he drove too slow ('below the minimum'). This corresponds to interpreting *fast* as fast ($d \leq SPEED(he)$) and *less* as the inverse of *(mo)re* ($\subset$) (see Rullmann, 1995; Heim, 2006; Büring, 2007a,b, for more on these readings).

What this ambiguity suggests is that the interpretation of *less expensive* as 'more cheap' is optional; alternatively, and in fact preferably, it can be interpreted as 'not as (i.e. less) expensive'.

But crucially, the 'less fast'/'below the minimum' construal must not be avail-

able for attributive comparatives such as *a less expensive method than...*, and therein lies the problem for the degree based account proposed in section 3. above.[5] If both construals were available, we would wrongly predict two readings, which are truth conditionally distinct in sandwich scenarios:

(26)   Mary knows a less expensive method than Bob does.

    a.   less expensive = more cheap:
       Mary knows a method y s.t. $\{d \mid COST(y) < d\} \supset \{d \mid$ for some method x that Bob knows, $COST(x) < d\}$
       '(for some d) Mary knows a method that is d-cheap and it is not the case that Bob knows a method that is d-cheap'

    b.   #less expensive = less expensive
       Mary knows a method y s.t. $\{d \mid d \leq COST(y)\} \subset \{d \mid$ for some method x that Bob knows, $d \leq COST(x)\}$
       '(for some d) Mary doesn't know a method that is d-expensive and Bob knows a method that is d-expensive'

(26a) are the correct truth conditions. But (26b) gets us straight back to the unattested 'less than some' reading (note that (26b) is true as long as Mary knows the most expensive method, regardless of whether she also knows the cheapest). And as usual, an individual-based semantics such as the one from section 4.2. above fares better here, since it doesn't generate the 'not as expensive' reading to begin with (the same is true for the superlative cases, as S&S discuss in their paper).

What are we to make of this? Two possibilities come to mind: An advocate of degree comparison may argue that the 'less expensive' construal is, for reasons yet unknown, unavailable in attributive comparatives. An advocate of individual comparison may take the lack of ambiguity as a further argument for having the *than*-clause denote individuals in attributive comparatives (which wouldn't predict any ambiguity), though not in adverbial ones such as (25) (and that the modal cases discussed in section 4.3. have to await an alternative analysis).

Unfortunately, neither of these seems feasible, for an ambiguity does arise if we combine an attributive comparative with a modal in the *than*-clause:

(27)   He bought a less expensive car than he could have (ten years ago).

    a.   '(for some price) he bought a car that inexpensive, and (ten years ago) he couldn't have bought a car that inexpensive (he used to have to spend more money)'   'less than any'

    b.   '(for some price), he bought a car that wasn't that expensive, and he could have bought a car that expensive (he's modest)'   'less than some'

To bring out the two readings, first assume that ten years ago he had to spend a lot of money on cars (maybe he needed a prestigious car for his job, or maybe the

kind of car he needs just got a lot cheaper); this is described by reading (27a), the familiar 'less than any' reading ('less expensive than any car he could have bough (in any permitted world) ten years ago').

Alternatively, ignore the *ten years ago* in (27), and assume that he simply refrained from spending as much money on his new car as he could afford. This is reading (27b), the so far unattested 'less than some' reading ('less expensive than some car he could have bought (in some permitted world)').

Clearly, these cases are beyond the reach of the individual based analysis (which in fact can't derive either reading, for the reasons discussed above), whereas the interval-based semantics predicts them correctly. We also see that whatever one would stipulate to block the 'more cheap' reading in an interval based account should not be too fundamental, since we need to 'revive' it in these modal cases.

6. Summary and Conclusion

There are two ways to avoid the Sandwich Dilemma in *least*-superlatives: Comparing individuals rather than degrees (Sharvit and Stateva, 2002), and comparing negative degrees.

What has not been noted in the literature is that the sandwich dilemma applies in *less*-comparatives just the same as in superlatives (*pace* S&S's claim). Whatever route one chooses to analyze the *least*-superlative should therefore be viable for *less*-comparatives as well.

S&S's own semantics for comparatives yields incorrect truth conditions in sandwich scenarios. A treatment more along the lines of their superlative semantics can be devised. But it runs into severe problems with intensional contexts.

The degree-based semantics gets the right truth conditions in *less*-comparatives, but predicts an ambiguity (both in comparatives and superlatives) which isn't there.

Clearly, more research is needed. Either the individual comparison approach needs to be augmented to extend better to modal cases, or the degree comparison approach must be restricted to exclude the 'less expensive' reading in simple comparatives.

Notes

[1] S&S draw a different conclusion, essentially that the truth conditions for *less*-comparatives are unclear or controversial; this, I submit, is an artefact of their particular examples, which are pragmatically rather odd, and not at all representative of the whole class.

[2] I say 'for attributive comparatives', because it is easy to see that *than*-clauses can't generally denote sets of individuals; two counter examples are given in (28):

(28)   a.   You know this better than I do.
         b.   The tree is taller than the ladder is long.

There are no individuals that would be candidates for the denotation of the *than*-clause in (28a), and it seems clear that the *than*-clause in (28b) contains its own measuring function, denoted by *long*, and hence denotes a set of degrees. But the sandwich dilemma doesn't seem to arise in adverbial comparatives, and comparative sub-deletion seems bad in adnominal comparatives. . .

(29)   a.   ?They sit on a longer pole than we have a ladder.
            b.   *They live on a taller tree than we have a long ladder.

. . . one could maybe claim that at least *attributive* comparatives always have individual type gaps.

[3]Sharvit and Stateva (2002) note a problem for superlatives — the so-called *upstairs de dicto* reading — which may be the superlative counter-part of the problems discussed here. Whether it really is, and whether their approach to the superlative could be imported to the comparative case is not clear to me.

[4]The discussion here is phrased in terms of *less/least expensive* being ambiguous between 'more/most cheap' and 'less/least expensive'. Alternatively, it can be seen as a matter of scope ambiguity for the operator LITTLE, as is done in Heim (2006) and S&S. Nothing in the discussion hinges on this choice, see also the references in the main text.

[5]Some speakers have a difficult time getting the 'below the maximum' reading for (29) at all. The following naturally occurring examples, however, suggest that this reading is in fact possible:

(30)   a.   "In the late 90s, most towns didn't need all that money so they taxed **less than they had to**. As things got bad, they cranked it into the red and started collecting every last tax dollar they could." (http://www.bluemassgroup.com/showDiary.do?diaryId=4905)
            b.   "The landlord was really nice to me. [. . .] He's old Brooklyn, Italian. It seemed too good to be true. [. . .] When the rent was supposed to go up, he raised it **less than he had to**." (http://www.villagevoice.com/nyclife/0550,schlesinger,70894,15.html)
            c.   "If you choose a mystery shopping company that does not allow you and your team secure and remote access to data 24/7, you will be settling for much **less than you have to**." (http://www.coylehospitality.com/mystery-shopping/mystery-shopping-service.asp)
            d.   "Let's face it: you are probably working for far **less than you need to**." (http://www.articlecity.com/articles/business_and_finance/article_8365.shtml)

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Strong/Weak Verb Asymmetry in Arabic: A Consequence of OP Faithfulness

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1. Introduction

Traditional root-based studies of Arabic morphology have long recognized two classes of Arabic verbs: strong verbs derived from three purely consonantal root radicals, and defective or 'irregular' verbs whose surface representations do not always exhibit three autonomous root radicals. This latter class in turn further subdivides into three subclasses: biliteral or geminate verbs derived from a bi-radical root, hollow verbs derived from a glide-medial root, and finally weak verbs derived from a glide-final root. The verb stem of each type is identifiable by certain prosodic characteristics. The stem of sound verbs is disyllabic ending in a consonant, as can be seen in the following examples:[1]

(1) Strong Verbs

Root	Verb	Gloss
/ktb/	katab	'wrote'
/nzl/	nizil	'left'
/Hml/	Hamal	'carried'
/rkb/	rikib	'rode'

Disyllabicity and final consonantality then define the default size and alignment of the Arabic verb. In Optimality-theoretic (OT) terms, the two requirements are translatable as markedness and alignment constraints governing verb stems, defined in (2):

(2) Constraints on verb stems
- $Stem_{(MCAT)} = Foot_{(PCAT)}$ (Markedness)
  This templatic binarity constraint can be captured as FT-BIN (McCarthy & Prince 1993) or PRBRANCH (Ussishkin 2005)[2]
- FINAL-C: Stems are consonant final. (Alignment)

   The optimal shape and size of the verb stem is that which conforms to the two constraints in (2). Verbs dubbed "irregular", "non-sound" or "weak" are those whose stems <u>violate</u> one or both constraints. The first type of non-sound verbs is that traditionally referred to as "weak" because the third root radical is a glide which deletes stem-finally, yielding a stem with two open syllables. I will hence refer to this class as "open verbs". Examples of open verbs are listed in (3).

(3) Open (Weak) Verbs

Root	Verb	Gloss
/rmy/	rama	'threw'
/rDy/	riDi	'agreed'
/bky/	baka	'cried'
/nsy/	nisi	'forgot'

The disyllabic stems of open verbs satisfy the size constraint FT-BIN, but the vowel-final edge violates Final-C.
   The second type of non-sound verbs is the geminate type, derived traditionally from biliteral root; thus the third radical is not an autonomous root segment, but a copy of the second. Examples of this type are shown in (4):

(4) Geminate Verbs

Root	Verb	Gloss
/Hb/	Habb	'loved'
/rd/	radd	'answered'
/mr/	marr	'passed by'
/lf/	laff	'wrapped'

The monosyllabic stems of this type violate FT-BIN, but the final consonant edge satisfies Final-C; the reverse of the weak type.
   The third and final type to be discussed is the "hollow" verb deriving from a glide-medial root in root-based analyses. The surface form is monosyllabic, consonant-final with a medial long vowel; I will hence refer to this group as long verbs.

(5) Hollow (Long) Verbs

Root	Verb	Gloss
/zwr/	zaar	'visited'
/jyb/	jaab	'brought'
/rwH/	raaH	'went'
/syl/	saal	'leaked'

Similar to geminate verbs, long verbs satisfy Final-C but violate Ft-Bin.

   The point of focus in this paper is the paradigmatic difference between strong or sound and non-sound verbs in spoken Arabic. In many modern dialects, the inflectional paradigm of the perfective sound verbs consists of outputs faithful to their base components (stem+affix), while first and second person affixes appended to defective verbs appear in an augmented form with an initial long stressed mid (or high) vowel. The following table shows the two allomorphs of the first and second person, vs. the invariable allomorph of the 3p marker.

(6) Person markers

	1p strong	1p weak	2p strong	2p weak	3p strong	3p weak
-f -pl	-t	-éet	-t	-éet	-0	-p
+f -pl	-t	-éet	-ti	-éeti	-at	-at
+pl	-na	éena	-tu	-éetu	-u	-u

   Previous analyses have viewed this paradigmatic inconsistency as arbitrary exceptions requiring special allomorphy statements (McCarthy 1986), or special phonological rules and rule ordering statements (Brame 1970), thus treating the two systems as two distinct types. In this paper I provide an explanatory account of affix allomorphy in Arabic within the framework of Optimality Theory (Prince and Smolensky 1993, McCarthy and Prince 1993a, 1995), and paradigm-based morphology (Gafos 2003, Kenstowicz 2005, McCarthy 2001/2005 and works in Downing 2005), I show that affix allomorphy is not arbitrary, but is governed by the prosodic well-formedness of the output on the one hand, and the symmetry of the paradigm on the other. The verbal system is therefore treated uniformly despite the nonuniformity of the base verbs. Section (2) gives an overview of the affix allomorphy observed in the strong and weak verb classes, while section (3) offers an analysis of the observed allomorphy within Optimality Theory (OT), showing how such an approach can account for all cases of allomorphy through the proper ranking and interaction of faithfulness, markedness, and paradigm uniformity constraints. Section (4) focuses on the hollow verb class which seems to defy the analysis presented for weak and biliteral verbs.

2. The Arabic Verb System

The majority of Arabic verb stems, termed strong verbs in the Arabic grammar tradition, display three or four consonantal realizations in their surface representations. The inflectional paradigm of the perfective form of strong verbs is systematic preserving the identity of both the stem and the affix, the paradigm for the verb [katab] 'write' in (7) is exemplary.

(7) Strong verb paradigm

		1P	2P	3P
-f	-pl	katábt	katábt	kátab
	+F -pl	katábt	katábti	kátab-at
+Pl		katábna	katábtu	kátabu

Contrary to consonant-final strong stems, weak verb stems are vowel final, with only two consonantal realizations CVCV.[3] The inflectional paradigm of this group is shown in (8), using for illustration the verb [rama] 'throw'

(8) Weak Verb Paradigm

		1P	2P	3P
-f	-pl	raméet	raméet	ráma
	+f -pl	raméet	raméeti	rámat
+pl		raméena	raméetu	rámu

The paradigm of the weak verb class shown in (8) is somewhat different from that of regular triliteral verbs shown in (7). here we find an augmented allomorph of the first and second person marker with an initial long stressed mid front vowel. Similarly, geminate verbs with a stem-final geminate (C1VC2C2) show the same augmented affix allomorph as in the paradigm of [Habb].

(9) Biliteral Verb Paradigm

		1P	2P	3P
-f	-pl	Habbéet	Habbéet	Hább
	+f -pl	Habbéet	Habbéeti	Hábbat
+pl		Habbéena	Habbéetu	Hábbau

As McCarthy (1986) points out, The final stressed vowel in augmented allomorphs of the non-third affix cannot be an epenthetic vowel inserted to preempt consonant hiatus, since no language documented so far has long stressed epenthetic vowels. The augmented affixes are then the result of allomorphy and not the phonology. Preoptimality derivational analyses have viewed allomorphy responsible for this and similar paradigmatic inconsistency as class-specific stipulative statements specifying the form of the exceptional allomorph and its distribution, thus treating the strong and weak verbal systems as two distinct types. In this paper I contend that an OT approach recognizing paradigmatic correspondence is superior to earlier derivational approaches. I demonstrate that affix augmentation is not arbitrary, and need not rely on ad-hoc rules. Rather, it is governed by the prosodic well-formedness of the output and the uniformity of the inflectional subparadigm. The two verbal systems are therefore treated as a unified phenomenon.

3. Affix Allomorphy in inflectional paradigms

An ideal account of the Arabic verb system is that which treats all verb forms as equivalent, regardless of the size and quality of the stem. The proposal developed in this paper aims to accomplish this goal within Optimality Theory. The analysis derives affix allomorphy through the interaction of markedness constraints which shape the optimal form of the output with identity constraints governing members of inflectional subparadigms (intraparadigmatic identity) as well as identity across paradigms (interparadigmatic identity).
  The proposal assumes that the Spoken Arabic lexicon consists of fully-specified stems not roots. this assumption is based on empirical evidence from Arabic and Hebrew including broken plurals (McCarthy & Prince 1990, Ratcliffe 1998), diminutives (M & P 1990, Ratcliffe 1997), hypocoristics (Farwaneh 2006, 2007), vocalic patterns (Benmamoun 2003), loan words (Bat-El 1994), denominal verbs (Bat-El 1994, Ussishkin 1999, Farwaneh 2006), verb morphology (McCarthy 1993, Benmamoun 1999, 2003, Ussishkin 2005). Central to the analysis is the assumption that Arabic verbs are realized in paradigms (Gafos 2003) with internal structure, following Kenstowicz (2005). The perfective verb paradigm in Arabic draws a distinction between the 3rd and non-3rd subparadigms. Central to the analysis is the notion of paradigmatic identity which recognizes layers of identity relations between members of the same paradigm as well as identity across related paradigms exemplified in (10).(10) Levels of Faithfulness (Identity relations)
IO-FAITH: monitoring identity relationships between input (stem) and output.
OP-FAITH: monitoring identity relationships among members within a paradigm (intraparadigmatic correspondence).
PP-FAITH: monitoring identity relationships across related paradigms (interparadigmatic or paradigm-to-paradigm correspondence).

  Faithfulness constraints encompass the now familiar MAX, DEP, and Integrity which guard against deletion, epenthesis and copying respectively. MAX and DEP are further expanded into MAX-C, MAX-V, DEP-C and DEP-V to account for the unequal status of consonants and vowels where vowels are more susceptible to deletion and epenthesis in Arabic. ; yielding the following subhierarchy: INTEGRITY » MAX-C » DEP-C » Markedness » MAX-V » DEP-V
With this partial hierarchy and with Markedness constraints introduced as needed, we now examine the inflectional paradigms of various verb types.

3.1 Analysis of geminate verbs

Geminate alternation is observed in Modern Standard Arabic (MSA), but not in the Regional Arabic dialects (RA), where the geminate is retained throughout the paradigm as shown in (11).

(11) Geminate Verbs

MSA		RA	
1/2P	3P	1/2P	3P
madádtu	mádda	maddéet	madd
madádta	máddat	maddéet	máddat
madádna	máddu	maddéena	máddu

Geminate verbs in Literary Arabic show surface alternation between a strong disyllabic CVCiVCi allomorph preconsonantally, and a monosyllabic geminate CVCiCi prevocalically. Within derivational approaches, the strong variant is assumed to be the underlying form from which the geminate output is derived by syncope (Brame 1970). The Arabic dialects I have examined   have dispensed with such alternation in favor of the geminate monosyllabic form which appears throughout the inflectional paradigms of both the perfect and the imperfect. Given the absence of a surface strong allomorph such as *[madad-], there is no reason to postulate it as the input of derivation. I assume, then, following Gafos (2003) in his analysis of Literary Arabic, that the monosyllabic form CVCiCi is the base for the geminate verb.

Beginning the discussion with third person vocalic affixes using the stem [Habb] for illustration, affixing vocalic suffixes to the stem [Habb], result in an output faithful to its base: /Habb-at/ > [Habbat], /Habb-u/ > [Habbu]. In contrast, consonantal affixes added to the stem result in outputs violating one or more markedness and/or faithfulness constraints. A geminate stem like [Habb] when inflected with a consonantal suffix may yield the following possible outputs: *[Hábbt] a faithful candidate with gemination retained, *[Hábt] with degemination, *[Habábt] with geminate split, or *[Hábbit] with epenthesis.

The first candidate *[Habbt] invokes a markedness constraint on the distribution of geminates. Geminates show a pattern of distribution akin to that of consonant clusters: both geminates and clusters may occur word-finally, intervocalically, or before a syllable; both are restricted before extrasyllabic consonants.

(12) Distribution of Geminates and Clusters in Levantine

Position	Geminates	Gloss	Clusters	Gloss
CC#	Habb#	'loved'	katabt#	'I wrote'
VCCV	Habbu	'loved-3pl'	katabtu	'2pl'
VCC.CV	Habb.ha	'loved-3m-3f'	ka.tabt.ha	'1-3f'
VCC.C#	*Habb.t#	'loved-1'	*ka.tabt.š#	'1-neg'

The similar distribution of and restriction on geminates and clusters suggests the constraint in (13)

(13) Constraint on Moras
*XXX]$_\mu$ - trisegmental moras are prohibited.

The constraint on trisegmental moras rules out the first candidate *[Habbt]. The second and non-optimal form [Habt] with degemination can be eliminated by a constraint on length faithfulness proposed by Davis and Zawaydeh (1999) for their treatment of hypocoristics. The constraint formulated in (14) requires that length in the input is preserved in the output.

(14) Length Faithfulness
MAX-μ-IO: Moraic structure of the input is preserved in the output; no shortening or degemination.

MAX-μ likewise rejects the third candidate with geminate split *[Hababt] as spreading compromises input length as well as the integrity of the CVCC stem. The fourth epenthetic output *[Habbit] seems to fare well on all candidates and is expected to incorrectly emerge as the winning candidate as the comparison tableau illustrates.[4]

(15) Geminate Stems with Consonantal Affixes
INTEGRITY » MAX-C, *XXX]$_\mu$ » MAX-μ-IO, DEP-C » MAX-V » DEP-V

Candidate	INTEGRITY	*XXX]$_\mu$	MAX-μ-IO	DEP-V
a. Habbt		*!		
b. Habt			*	
c. Hababt	*!		*	
d. ☞ Habb(i)t				*

To explain the failure of a seemingly optimal form like [Hábbit] requires departure from the familiar input or base-output relationship into a global view of verbs as stems in paradigms (Gafos 2003). In particular, it requires an examination of stress placement in inflectional paradigms. The stress rule of Palestinian Arabic are stated roughly as follows: Stress the last heavy syllable in the word, otherwise, stress the initial one. Consonantal affixes of the 1st and 2nd person inflection create ultimate or penultimate syllables targeted by stress; vocalic affixes of the 3rd person paradigm, on the other hand, yields series of open syllables forcing stress to fall on the initial syllable, as the [katab] paradigm repeated here shows:

(16) Inflection of [katab]

		1P	2P	3P
-F	-PL	katábt	katábt	kátab
+F	-PL	katábt	katábti	kátab-at
+PL		katábna	katábtu	kátabu

Returning to the epenthetic form [Habbit] which passed all the proposed constraints, epenthesis creates a final light syllable, forcing stress to fall on the initial stem syllable, thereby creating a non-uniform stress pattern across first/second inflectional paradigms, as the comparison with [katab] shows:

(17)

			[katab]	[Habb]
1		-PL	katábt	Habbéet
2	-F	-PL	katábt	Habbéet
2	+F	-PL	katábti	Habbéeti
2		+PL	katábtu	Habbéetu
1		+PL	katábna	Habbéena

Stress uniformity between strong and weak paradigms suggests a inter-paradigmatic constraint mandating stress uniformity across members of same subparadigms (e.g., third person, ½ person).

(18) Paradigmatic Constraints

  PP-IDENTACCENT: Stress position is invariant across similar paradigms.
  OP-IDENT-WT: Vowel length must not alternate within a paradigm.
(Urbanczyk 1996 cited in McCarthy 2005).

IDENTACCENT is a constraint on paradigms rather than individual output. It assesses each possible paradigm for uniform stress placement. In (19), PP-IDENTACCENT compares the two paradigms {katábt & Hábbit} and {katábt & Habbéet}. By appending a long vowel to consonantal affixes, stress lands on the final or penultimate syllable on par with other first/second subparadigms in satisfaction of PP-IDENTACCENT.

(19) Paradigm comparison

Paradigm	IDENT-ACCENT
a. {katábt & Hábbit}	*!
b. ☞ {katábt & Habbéet}	

PP-faith favors a weak paradigm with augmented affixes over one with epenthesis (deemed optimal in (15)).But if augmentation is needed before consonantal affixes, it is not warranted before syllabic affixes, yielding the

possible hybrid paradigm in (20) where monosegmental but not bisegmental affixes are augmented:

(20) Possible Paradigm

	1P	2P
-F	Habbéet	Habbéet
+F	Habbéet	Hábbti
-PL	Hábbna	Hábbtu

This stress and length mismatched paradigm loses on intra-paradigmatic grounds, which favor a more symmetric paradigm as the comparison in (21) shows.

(21) Paradigm Comparison

Paradigm Candidate	IDENT-ACCENT	IDENT-WT	…
a. Habbéet, Hábbna, Hábbtu, …	*!	*!	?
b. ☞ Habbéet, Habbéena, Habbéetu, …			

Length uniformity regulated by IDENT-WT optimizes paradigm B where all affixes are preceded by a long stressed vowel. Thus, the role of the affix-augmenting vowel is twofold: to augment the output to disyllabicity to satisfy FT-BIN, and to ensure a uniform stress placement across all same person paradigms in the verbal system.

3.2 Open (weak) verbs

Weak verb stems are those ending in a vowel (traditionally analyzed as derived from a glide final root). Appending consonantal affixes to the stem [rama] used to exemplify the weak verb type yields outputs with initial stress: *[rámat], *[rámana] and *[rámatu]. Once again, IDENTACCENT would reject these forms despite their disyllabicity and faithfulness to their base in favor of the augmented candidates [rameet], [rameena] and [rameetu] to parallel [katábt], [katábna] and [katábtu].

(22) Open verbs: rama + Consonantal Affixes

Paradigm	Comments
a. *rámat; *rámana; *rámatu vs. katábt; katábna; ..	Stress falls on initial instead of second syllable; violates PP-IDENT-ACCENT
b.☞ raméet; raméena; raméetu vs. katábt; katábna; …	Stress uniform but missing final stem vowel; violate MAX-V.

Now we shall consider the consequences of appending vocalic affixes to the stem of open verbs which yields a number of possibilities four of which will be examined shown below in (23)

(23) rama + u
- a. .ra.ma.u.　　　Faithful with onsetless syllable
- b. .ra.mau.　　　Faithful with vowel hiatus
- c. .ra.ma.Cu.　　Consonantal epenthesis
- d. .ra.mu.　　　Vowel deletion (melodic overwriting)

The worst candidate is the one most faithful to its input. The vowel hiatus resulting from appending a vocalic affix to a vowel-final stem, if heterosyllabic, runs afoul of ONSET, whose undominated status has been demonstrated repeatedly; if the two vowels are tautosyllabic, as in candidate B, then the resulting output violates *VV, which bans hiatus (proposed in Davis & Zawaydeh (1999)). Two possible resolutions of vowel hiatus can be considered; epenthesizing a consonantal onset, or deleting the stem-final vowel. Epenthetic onsets are banned except in word-initial position, as in ['uktub] 'write-imperative'; attesting to the high rank of DEP-C over DEP-V. The winning candidate D [ramu] satisfies all size-controlling constraints; its only problem is the loss of the second stem vowel; a minor violation of the constraint max-V[5]. Tableau (24) shows the outcome of the evaluation. .

(24) Candidate Evaluation for /rama-u/
ONSET » INTEGRITY » MAX-C, *xxx]$_\mu$ » MAX-μ-IO, DEP-C » *VV » MAX-V » DEP-V

Candidate	ONSET	DEP-C	*VV	MAX-V
a. .ra.ma.u.	*!			
b. .ra.mau.			*!	
c. .ra.ma.Cu.		*!		
d. ☞ .ra.mu.				*

If hiatus can be avoided without sacrificing the stem vowel, that is, without violating MAX-V, the stem vowel is preserved. This is the case with perfective open verbs with high vowels, where the plural affix and the ensuing hiatus forces hardening of the stem vowel into a glide onset.

(25) Open Verbs with High Vowels
3-SG	3-PL		Gloss
rimi	rimyu	*rimu	'threw'
li'i	li'yu	*li'u	'found'
riDi	riDyu	*riDu	'agreed'
biki	bikyu	*biku	'cried'

In summary, the account of geminate and open verbs is basically the following: augmented affixes are required to augment inflected stems to disyllabicity thereby preserving a uniform stress placement throughout the same inflectional subparadigm. Vowel hiatus is resolved in favor of deleting the stem vowel over epenthesizing an internal onset consonant, unless the stem vowel can be preserved by glide-formation.

4. Long (Hollow) Verbs: The Role of Alignment

The fourth verb type to be investigated here, that of long or hollow verbs, present an interesting challenge to the analysis developed so far. In traditional analyses, Hollow verbs are derived from glide-medial roots.   They are dubbed "hollow" because the medial glide /w/ or /y/ manifest itself as a long vowel in the output form. Since this account assume stems not roots as inputs, I will refer to monosyllabic CVVC stems as long stems. Hollow verbs exhibit a more interesting pattern that does not parallel that of weak and biliteral verbs. The augmented allomorph expected before consonantal affixes is substituted instead by an unexpectedly reduced allomorph. The basic allomorph appears before vocalic affixes as usual, as the paradigm in (26).

(26) Open Verb Paradigm

		1P	2P	3P
-F	-PL	zurt	zurt	zaar
+F		zurt	zurti	zaarat
	+Pl	zurna	zurtu	zaaru

  Assuming that the third person singular form is the base stem, the input to inflectional derivation is then [zaar]. Consider first the adjunction of vocalic affixes to the bare stem. This yields the third person paradigm zaar zaarat and zaaru, all of which satisfy all constraints except the form [zaar] which violatesFT-BIN. Since the input to the output [zaar] is identically [zaar], IO-Faith which supercedes markedness constraints and OO-faith constraints preserves the prosodic and segmental structure of the input. Thus, violating FT-BIN is necessitated by input-output faithfulness.
  Augmenting the stem [zaar] with consonantal affixes yields a number of possibilities; a faithful [zaart], a shortened form [zart], and an augmented form [zaareet, evaluated in the tableau (27).

(27) zaar + t
ONSET » INTEGRITY » MAX-C, *[xxx]$_\mu$ » MAX-μ-IO, DEP-C » *VV » MAX-V
» DEP-V

Candidate	*XXX]$_\mu$	MAX-μ-IO	DEP-V
a. zaart	*!		
b. zart		*	
c. ☞ zaareet			*

   Candidate A *[zaart] is ruled out by the ban on trisegmental moras, while
Candidate B appears to violate MAX-μ-IO since input vocalic length has not
been retained. The unattested Candidate C fares well on all constraints, except
DEP-V. How can we explain the optimality yet absence of *[zaareet]? Such
forms are not only disyllabic, as required byFT-BIN, they are also syllabically
well-formed in terms of the presence of syllable onsets and the absence of
epenthetic material, and are faithful to the structure and quantity of the input.
Additionally, augmenting the output with the long /ee/ in *[zaaréet] satisfies the
paradigm uniformity IDENTACCENT as it places stress on the final syllable on
par with [katábt] and [Habbéet].
   The answer lies in the notion of edge alignment McCarthy and Prince (1993b)
later reintroduced as ANCHOR.

(28) ANCHOR (McCarthy & Prince 1995)
Any element at the designated periphery of the input or base has a correspondent
at the designated periphery of the output.

   In Farwaneh (2006), a more specific interpretation of Anchor referencing
syllabic position of edged segments was introduced to account for the invariant
onset position in partial reduplication , e.g., [faraH] > [farfaH] and not
*[fafraH]. The constraint is given below in (29).

(29) Relativized ANCHOR
ANCHOR-ONSET (IO): All output correspondents of the left edge of the input
must occupy onset position in the output.
ANCHOR-CODA (IO): All output correspondents of the right edge of the input
must occupy coda position in the output.

   The preservation of the syllabic position of edged segments required by
ANCHOR[6] in ( )rules out an output like *[zaareet] since the final stem
consonant [zaar] occupies a coda position but shifts to an onset position after
augmentation of the affix. The Anchor constraint in (30) stipulates that the right
edge segment occupying coda position be situated at the right edge of the

syllable, i.e., the stem-final consonant must also be syllable-final. Thus, stems with augmented affixes where the vowel /ee/ follows the stem-final consonant, as in *[zaareet] would constitute an Anchor violation. Biliteral root stems, on the other hand, may safely be augmented since the final root segment surfaces as a geminate which violate alignment requirements anyway given the positional duality of geminates. Tableau (30) reevaluates the same candidates

(30) zaar + t
ONSET » INTEGRITY » MAX-C, *[XXX]μ » ANCHOR-CODA » MAX-μ-IO, DEP-C » *VV » MAX-V » DEP-V

Candidate	*XXX]μ	ANCHOR-CODA	MAX-μ-IO
a. zaart	*!		
b. ☞ zart			*
c. zaareet		*	

The hierarchy established so far again incorrectly selects the unattested form *[zart] which appears to possess the correct shape but wrong vowel quality since the attested allomorph is [zurt]. The reduced allomorph [zur] emerges consequence to the conflict between intra- and interparadigmatic uniformity constraints forcing perfective outputs to parallel other perfective outputs on the one hand and their corresponding imperfective outputs on the other (Gafos 2003). (31) illustrates the segmental correspondence between perfective and imperfective forms.

(31) Segmental Correspondence: Perfective & Imperfective

Perfective	Imperfective	Gloss
zurt	'azuur	'visit'
jibt	'ajiib	'bring'
nimt (*namt)	'anaam	'sleep'

The imperfective form /-zuur/ imposes its segmental identity on the perfective allomorph selecting [zurt] over *[zart].

The effect of paradigmatic correspondence or leveling on Output optimization is a promising approach to elucidating the apparently inconsistent behavior of so-called irregular" verbs. The strong/weak verb dichotomy attributed in traditional analyses of Arabic verb morphology to a dual system was accorded a unified account under OT. The interaction of markedness and alignment constraints with intra- and inter-paradigmatic constraints needed elsewhere in the grammar of Spoken Arabic is sufficient to account for the observed augmentation in the paradigms of non-strong verbs without recourse to special statements.

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[1] I am listing the roots of all verbs for illustrative purposes. As I state later in the paper I subscribe to a surface stem-based approach to verb derivation.

[2] Ussishkin (2005) proposes the Prosodic branching constraint (PrBranch) to avoid the ambiguity of FT-BIN, since foot binarity could be interpreted quantitatively to mean bimoraic or disyllabic foot. I hesitate to adopt this constraint pending an examination of its effect on the syllable layer in a quantity-sensitive language like Arabic.

[3] Members of this class derive from a triliteral root whose final radical is a glide /w/ or /y/. However, there is ample evidence that the final glide has been lost in the dialectsOne such evidence comes from the stem neutralization of w-final and y-final roots in both the perfect and imperfect; e.g., the root /SHw/ yields [Sihi ~ yiSHa] 'wake up' nad /rDy/ yields [riDi ~ yirDa] as well.

[4] The order *[xxx]μ » MAX-μ captures the generalization that long vowels shorten persistently before tautosyllabic clusters; thus length faithfulness is sacrificed to satisfy the ban on trisegmental moras; e.g., /ztaar-t/ > *ztaart > [ztart].

[5] The low effect of MAX-V is also observed in Standard Arabic, where vowel-final imperfective forms lose the final vowel before a vocalic affix; e.g., /ya-rmii-uun/ > [yarmuun] 'they throw'.

[6] A similar relativized alignment constraint is introduced in Kenstowicz (2005) to account for the distribution of diminutive affix allomorphs in Spanish, [casa] > [casita] vs. [limon] > [limoncito].

Verb Phrase Ellipsis in Indonesian[*]
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1 Introduction

My goal in this paper is to make and defend the novel claim that Indonesian allows auxiliary-stranding verb phrase ellipsis (VPE), in subordinate as well as coordinate clauses, in active as well as passive clauses, under identity with an antecedent (1).

(1) Saya tidak bisa pergi ke toko sekarang,
    1SG   NEG   can   go   to store now
    tapi   mungkin Siti   bisa [~~vP pergi ke toko sekarang~~].
    but   maybe   Siti   can   [~~vP go   to store now~~]
    'I can't go to the store now, but maybe Siti can (go to the store now).'

  As has recently been argued for English VPE (e.g. Goldberg 2005; Merchant 2008), I claim that Indonesian VPE is actually *v*P ellipsis (2).

(2) [TP subject T [ModP ~~subject~~ Mod [vP AGENT *v*+V [vP ~~V~~ THEME] [1,2,3]
                                         Indonesian VPE domain

  In Section 2, I demonstrate that Indonesian VPE is quite similar in character to English VPE, with respect to the TP-level elements which license the ellipsis, the variety of syntactic environments in which VPE is attested, and the identity readings that arise when a pronominal is contained within the elided constituent. In Section 3, I argue that the putative Indonesian VPE data cannot be analyzed as another type of ellipsis yielding a null 'VP', showing that it cannot be assimilated to stripping (bare argument ellipsis), null complement anaphora, a confluence of elided individual vP-internal constituents, or comparatives. In Section 4, I identify and propose an account for two divergences between Indonesian and English VPE.

2 Indonesian and English VPE: A Comparison

2.1 Licensors of VPE

English VPE is licensed by an inflection-bearing head (Lobeck 1995). Similarly, an Indonesian null 'VP' must be preceded by a modal (3), auxiliary (4), temporal (5) or aspectual marker, or negation.[4]

(3) Saya   ingin beli   gaun   baru,
    1SG   want   buy   dress new,
    tapi   Ibu   bilang saya   tidak **boleh** [$_{vP}$ ~~beli gaun baru~~]. [5]
    but   mother   say   1SG   NEG   may   [$_{vP}$ ~~buy dress new~~]
    'I want to buy a new dress, but mother said I may not (buy a new dress).'

(4) Siti   belum   menikah,   tapi   Dewi **bakal**[6] [$_{vP}$ ~~menikah~~].
    Siti   not.yet   ACT-marry,   but   Dewi FUT   [$_{vP}$ ~~ACT marry~~]
    'Siti hasn't gotten married yet, but Dewi will (get married).'

(5) Siti   belum   menikah,   tapi   Dewi **sudah/telah** [$_{vP}$ ~~menikah~~].
    Siti   not.yet ACT-marry, but   Dewi already   [$_{vP}$ ~~ACT marry~~]
    'Siti hasn't gotten married yet, but Dewi has already (gotten married).'

2.2   Environments

English VPE is attested in a wide range of syntactic environments (many of which resist other types of ellipsis, such as gapping; see Goldberg 2005 for discussion). The distribution of English VPE is virtually mirrored by Indonesian putative VPE. An elided *v*P and its antecedent can be found in coordinated CPs (6) as well as in 'adjacent' (i.e., not coordinated) CPs, both uttered by the same speaker as well as across a discourse boundary.

(6) [$_{CP}$ Siti   mau   pulang,   karena   anak+nya   sakit],
    [$_{CP}$ Siti   want go.home, because   child+3SG   sick],
    [$_{CP}$ dan   Ali   mau   [$_{vP}$ ~~pulang~~]   juga].
    [$_{CP}$ and   Ali   want [$_{vP}$ ~~go.home~~] too].
    'Siti will go home, because her child is sick, and Ali will (go home) too.'

  Additionally, the elided constituent can be separated from its antecedent by one or more levels of sentential embedding, and can be contained within an island – such as an adjunct island (7) – that excludes its antecedent.

(7) Ali membersihkan rumah [_{CP} karena   Siti tidak [_{vP}~~membersihkan rumah~~]]
    Ali ACT-clean   house [_{CP} because Siti NEG [_{vP} ~~ACT clean   house~~]]
    'Ali cleaned the house because Siti didn't (clean the house).'

2.3 Identity Readings

As does English VPE, Indonesian VPE yields both 'strict' and 'sloppy' identity
readings for pronominals in the elided constituent. Under a strict identity
reading, the pronominal in the ellipsis site is interpreted as having the same
referent as its congener in the antecedent. Under a sloppy identity reading, the
pronominal in the ellipsis site is interpreted as a variable. Strict and sloppy
identity readings arise for both non-reflexive and reflexive (8) pronominals.

(8) Siti   tidak bisa   merekomandasikan diri+nya sendiri,
    Siti   NEG   can   ACT-recommend   self+3SG self
    tapi   Ali   bisa   [_{vP} ~~merekomandasikan dirinya   sendiri~~].
    but   Ali   can   [_{vP} ~~ACT -recommend   self+3SG self~~]
    'Siti can't recommend herself, but Ali can.'
    <u>strict reading</u>:   ' … recommend <u>Siti</u>.'
    <u>sloppy reading</u>:   '…recommend <u>himself (=Ali)</u>.'

3   Alternative Analyses of Putative VPE

In the preceding section, I demonstrated that Indonesian putative VPE is similar
in its distribution and characteristics to English VPE. The next question that
must be considered is whether the putative VPE is a distinct elliptical
phenomenon in Indonesian, or whether it should be collapsed with another kind
of ellipsis. I argue that four plausible alternative analyses of the putative VPE –
stripping, null complement anaphora (NCA), a confluence of individually elided
vP-internal elements, and comparatives, all of which result in a null 'VP' – are
insufficient to account for the putative VPE data, leading to the conclusion that
this data is best analyzed as a unique type of ellipsis.

3.1 Stripping

Under the first alternative analysis, the putative VPE data is assimilated to
stripping (bare argument ellipsis). A 'stripped' clause contains no overt material
save a single constituent (typically either a DP or a PP), and some contrastive
element, such as negation. As in English, Indonesian stripped clauses are
ambiguous; in (9), for example, *Siti* can be interpreted as either the subject or the
object of *suka* 'like'.

(9) Ali suka   sayur-mayur,   tapi Siti   nggak.[7]
   Ali like   vegetable-REDUP, but   Siti   NEG
   'Ali likes (all kinds of) vegetables, but Siti not.'
   interpretation 1: Ali likes vegetables, but Siti does not like vegetables.
   interpretation 2: Ali likes vegetables, but Ali does not like Siti.

  Stripping yields an additional identity reading – the 'object reading' – that is not available in putative VPE.

(10)   Siti   melihat   dirinya   di cermin,   dan   Ali   juga.
      Siti   ACT-see   self-3SG   in mirror,   and   Ali   too
      'Siti sees herself in the mirror and Ali too.'
      strict reading: '… and Ali also sees Siti in the mirror.'
      sloppy reading: '… and Ali also sees himself in the mirror.'
      object reading: '… and Siti is also looking at Ali.'

  The availability of this third reading under stripping is due to the fact that in a stripped clause, there is no disambiguating TP-level material (such as an auxiliary or a modal) present to force the single argument to be interpreted as the subject of the clause. Conversely, in putative VPE, the mandatory presence of a TP-level element ensures that the single argument can be understood only as the subject of the clause.

3.2 Null Complement Anaphora

Under a second alternative analysis, the putative VPE data is assimilated to NCA, which involves a null CP complement to V (11).

(11)   Siti lupa siapa yang menelpon tadi, tapi aku ingat   [CP Ø].
      Siti forget who   COMP ACT-phone now, but 1SG remember [CP Ø]
      'Siti forgot who called just now, but I remember (who called just now).'

  Hankamer and Sag (1976) (and, more recently, Depiante 2000) argue that English NCA – unlike English VPE – is not the result of a deletion process, but instead is a null proform with no internal structure (a 'deep anaphor' in Hankamer and Sag's terminology). Evidence for this contrast comes from the 'missing antecedents' phenomenon (Hankamer and Sag 1976): VPE permits missing antecedents, which arguably indicates the null vP contains the antecedent, while NCA does not. In this domain as well, the Indonesian facts mirror the English: Indonesian putative VPE permits a missing antecedent (12), while Indonesian NCA does not (13).

(12) Saya tidak akan menemui   seorang wanita, tapi Siti bakal,
      1SG NEG FUT ACT-meet   CLASS   woman, but Siti FUT,
      [vP ~~menemui~~ ~~seorang~~ ~~wanitaᵢ~~], dan diaᵢ   akan orang yang kaya.
      [vP ~~ACT~~ ~~meet~~ ~~CLASS~~ ~~woman~~] and 3SG FUT person COMP rich
      'I won't meet a woman, but Siti will (meet a womanᵢ), and sheᵢ will be
      rich.'

(13) * Saya belum   menemukan teman sekamar,
       1SG not.yet   ACT-find   friend ONE-room
       tapi Siti berhasil   [CP Ø], dan dia orang yang kaya.
       but Siti have-result [CP Ø], and 3SG person COMP rich
       'I haven't yet found a roommate, but Siti succeeded, and sheᵢ is rich.'

Additionally, Indonesian NCA – unlike Indonesian putative VPE – does not permit sloppy identity readings (14). This difference would be unexplained if the same type of ellipsis underlied both Indonesian putative VPE and NCA.

(14) Ali tahu kenapa dia   dimarahi,   dan Siti   tahu [CP Ø] juga.
      Ali know why 3SG PASS-scold   and Siti   know [CP Ø] too
      'Ali knows why he was scolded, and Siti knows too.'
      Strict reading: '… and Siti knows (why <u>Ali</u> was scolded) too.'
      Sloppy reading: * '… and Siti knows (why <u>Siti</u> was scolded) too.'

3.3 Multiple null *v*P-internal constituents

Under a third possible alternative analysis of the putative VPE data, the 'VPE-like' character of the ellipsis is merely epiphenomenal, the result of a sequence of individual null *v*P-internal constituents. There are, however, identifiable differences in the distributions of the putative VPE and individual null constituents that falsify this hypothesis. Consider, first, gapping. The possibility of eliding the verb in Indonesian is somewhat unstable, and is generally more limited than putative VPE; for example, as in English, gapping is not permitted in subordinate clauses (15), while putative VPE is (16).

(15) Ali   memakan kue, **dan/*sedangkan** Siti ~~memakan~~ pisang.
      Ali   ACT-eat cake, and/*while   Siti ~~ACT-eat~~   banana
      'Ali ate cake, and/*while Siti (ate) a banana.'

(16) Anak ini sudah   bisa berbicara,
      child DEM already   can   INTR-speak,
      sedangkan   bayi itu belum bisa [vP ~~berbicara~~]
      while   baby DEM not.yet can   [vP ~~INTR-speak~~]
      'This child can already talk, while that baby can't yet (talk).'

An examination of the distribution of null objects yields a similar disparity. Third-person objects in Indonesian can be realized as null under identity, whether the object is non-specific or specific, while first and second person pronouns cannot (17). Within putative VPE, however, there is no such restriction (18).

(17) * Ali belum   kenal saya, tapi Siti   sudah   kenal **[DP saya]**.
     Ali not.yet   know 1SG, but Siti   already   know [DP ~~1SG~~]
     'Ali doesn't know me yet, but Siti already knows *(me).'

(18)   Ali sudah   kenal saya, tapi Siti   belum [vP ~~kenal~~ **[DP saya]**]].
     Ali already   know 1SG, but Siti   not.yet [vP know [DP 1SG]]
     'Ali already knows me, but Siti doesn't yet (know me).'

The distribution of manner adverbials, locative PPs, and benefactive PPs follows the now familiar pattern. As illustrated here with a locative PP, all three types of adjuncts easily elide as part of putative VPE (19), but are unable to be realized as null independently (20).

(19)   Siti   tidak akan menaruh buku di meja   itu,
     Siti   NEG   FUT   ACT-put book on table DEM
     tapi Ali   bakal [vP ~~menaruh   buku~~ [PP ~~di meja   itu~~]].
     but   Ali   FUT   [vP ~~ACT put   book~~ [PP ~~on table   DEM~~]]
     'Siti won't put a book on that table, but Ali will (put a book on that table).'

(20)   Siti   menaruh buku di meja itu,
     Siti   ACT-put book on table DEM
     sedangkan Ali   menjatuhkan dompet+nya [PP ~~di meja   itu~~].
     while   Ali   ACT-drop   wallet+3SG [PP ~~on table   DEM~~]
     'Siti put a book on that table, while Ali dropped his wallet *(on that table).'

In sum, Indonesian putative VPE is not epiphenomenal, given differences in the distribution of null *v*P-internal elements within and without a null *v*P.

3.4 Comparatives

Under a fourth alternative analysis of the putative VPE data, the data are assimilated to comparatives. Comparatives involve *wh*-movement of a null operator, which corresponds to the overt compared element in the main clause (e.g. Chomsky 1977). Comparatives are possible with a null *v*P (21).

(21)　Siti lebih suka pisang　daripada [[*x banyak pisang*]$_i$ Ali ~~suka~~　t$_i$].
　　　Siti more like banana　than　　[[*x many　banana*]$_i$ Ali ~~like~~　　t$_i$]
　　　'Siti likes bananas more than Ali (likes bananas).'

　A modal, such as *bisa* 'can', or an auxiliary, such as *bakal* 'will', can – at least in some cases – remain overt in the comparative following ellipsis (22), as in the putative VPE data under consideration, indicating that the elided constituent appears to be (at least superficially) identical.

(22)　Ali sudah　makan lebih banyak nasi　daripada Siti　**bisa**.
　　　Ali already eat　　more　much　rice　than　　Siti　can
　　　'Ali already ate more rice than Siti can.'

　In order to distinguish between comparatives and VPE, it is necessary to find evidence of movement in the comparative – for example, with respect to island effects – that is lacking in VPE. As is well-known, Indonesian prohibits *wh*-extraction of the object directly to [Spec, CP] if the verb is marked with 'the active voice' prefix *meng*-; the presence of *meng*- on the verb thus renders the *v*P an 'island' to movement of the object DP.[8] Indeed, comparatives on the object of a verb bearing *meng*- are impossible (23). Given that ellipsis is generally known to 'ameliorate' island effects, however, it is unsurprising that (23) becomes acceptable if the *v*P containing the island is elided (24).

(23) * Siti　　membaca　　lebih　banyak　buku
　　　　Siti　　ACT-read　　more　much　book
　　　　daripada　[[*x banyak*]$_i$　Ali　　membaca　　[t$_i$　buku]].
　　　　than　　　[[*x many*]$_i$　Ali　　ACT-read　　[t$_i$　book]]
　　　　'Siti read more books than Ali read books.'

(24)　Siti　　membaca　　lebih　　banyak　buku
　　　Siti　　ACT-read　　more　　much　book
　　　daripada　[[*x banyak*]$_i$　Ali　[$_{vP}$ ~~membaca　　[t$_i$　buku]~~]].
　　　than　　　[[*x many*]$_i$　Ali　[$_{vP}$ ACT-~~read　　[t$_i$　book]~~]]
　　　'Siti read more books than books were read by Ali.'

　Do the putative non-comparative VPE cases allow analogous movement of the object DP comitant with ellipsis of the *meng*-marked V? Pseudogapping, which has been argued to be VPE that has been preceded by movement of the object DP to some position external to the *v*P (Jayaseelan 1990, Lasnik 1995), provides a useful testbed. It appears that pseudogapping of this type simply cannot occur in Indonesian (25), a contrast that would be unexplained if the putative VPE were indeed a (type of) comparative construction.

(25) * Ali bakal membaca buku dan Siti bakal ~~membaca~~ majalah.
     Ali FUT ACT-read book and Siti FUT ~~ACT read~~ magazine.
     'Ali will read a book and Siti will *(read) a magazine.'

  In sum, there is no perfect match between the putative VPE data and stripping, null complement anaphora, or comparatives, a lack which mitigates against a unified analysis of VPE and another of the elliptical phenomena. I conclude that the putative VPE data is not best handled by any of these four possible alternative analyses, but instead is best treated as a distinct elliptical phenomenon: VPE.

4 Divergences between Indonesian and English VPE

In the preceding sections, I demonstrated that Indonesian VPE and English VPE are qualitatively very similar; in this final section, I consider instead two apparent differences. These differences involve the possibility of voice mismatch between the antecedent and elided *v*Ps, and the sets of elements licensing VPE.

4.1   Voice mismatches under VPE

As is well-known, English VPE permits voice mismatches between the verb in the subordinate clause and the verb in the antecedent clause (26) (see e.g. Sag 1976; Kehler 2000; Merchant 2008).

(26)   The system can be used by anyone who wants to [$_{vP}$ ~~PRO use it~~].

Indonesian VPE, however, is prohibited under these conditions (27).[9]

(27) * Rumah+ku belum **dibersihkan** selama dua minggu,
     house+1SG not.yet PASS-clean ONE-long two week,
     jadi saya mesti [$_{vP}$ **~~membersihkan+nya~~**] akhir minggu ini.
     therefore 1SG must [$_{vP}$ ACT-clean+3SG] end week DEM
     'My house hasn't been cleaned in two weeks, so I must *(clean it) this weekend.'

  This restriction on voice mismatches in Indonesian ellipsis appears to be simply one particular instantiation of the more general restriction on mismatches in argument structure alternations under ellipsis observed crosslinguistically (see e.g. Chung, Ladusaw and McCloskey 1995). For example, voice mismatches are disallowed under sluicing in English and Indonesian (28).

(28) * Dapur itu sudah dibersihkan,
 kitchen DEM already PASS-clean,
 tapi saya tidak tahu siapa [$_{TP}$ ~~yang membersihkannya~~].
 but 1SG NEG know who [$_{TP}$ ~~COMP ACT clean+3SG~~]
 'The kitchen was cleaned, but I don't know who (cleaned it).'

Merchant (2008) has recently argued that voice alternations are, in fact, universally disallowed under ellipsis. Voice alternations only appear to be possible in English VPE because the locus of the voice mismatch – for him, the VoiceP – lies outside the ellipsis site (29).

(29) [$_{TP}$ Subject T^0 [$_{VoiceP}$ Voice^0 [$_{vP}$ ~~Subject~~ v^0 [$_{VP}$ verb]]]]
 VPE domain in English (Merchant 2008)

To reconcile the Indonesian and English facts, I propose that the locus of the voice mismatch in Indonesian, unlike English, lies <u>within</u> the ellipsis site. In particular, the 'voice' markers *meng-* (found in active voice clauses) and *di-* (found in canonical passives), as well as the null head found in subjective passives, are located in *v* (Fortin 2007). Thus, the locus of the voice mismatch in Indonesian lies within the ellipsis site – the *v*P – in Indonesian VPE (30).

(30) [$_{TP}$ Agent T [$_{ModP}$ ~~Agent~~ Mod [$_{vP}$ ~~Agent~~ *v*+V [$_{vP}$ ~~V~~ Theme]
 VPE domain in Indonesian

4.2 Licensors of VPE

As described in Section 1, Indonesian appears to allow VPE – or a type of ellipsis that is, at least, superficially similar to VPE – in the environment of a wider array of licensors than does English. The fact that the VPE is licensed by auxiliaries and modals in Indonesian is consistent with Lobeck's (1995) observation that null VPs in English must be licensed by an inflection-bearing head. On the other hand, there exist other elements in Indonesian which appear to license the ellipsis which are instead arguably adverbial in nature (i.e., they do not bear inflection): temporal and aspectual markers, and negation.

To reconcile the English and Indonesian data in this respect, there appear to be at least three possibilities. Under the first possibility, Lobeck's licensing requirement for English VPE is demonstrated to simply be too strong for Indonesian. Under the second possibility, the ellipsis after temporal and aspectual markers is shown to be a different kind of ellipsis, one not forming a natural class with ellipsis after inflection-bearing modals and auxiliaries. Under the third (and arguably the most plausible) possibility, the temporal and aspectual markers will prove to be reanalyzable as functional heads that can surface in different positions within the clausal skeleton, in order to account for their variable placement with respect to auxiliaries and modals (i.e., along the

lines of Cinque's 1999 treatment of adverbs). This third possibility, outside the scope of this paper, is to be addressed in future research. Nonetheless, whatever the resolution may prove to be, Indonesian has been shown to allow VPE following (at least) inflection-bearing heads, such as auxiliaries and modals.

5 Conclusion

I've argued that Indonesian has auxiliary-stranding VPE (specifically, ellipsis of the *v*P). When compared to other elliptical phenomena, auxiliary-stranding VPE is believed to be relatively uncommon cross-linguistically; auxiliary-stranding VPE has previously been reported to exist only in Moroccan Arabic, European and Brazilian Portuguese, Serbo-Croatian, and Mandarin (see Goldberg 2005, and references therein). As VPE is quite uncommon cross-linguistically, the identification of VPE in Indonesian is an interesting finding. To be sure, the phenomenon of Indonesian VPE has only been sketched out here; careful future research on this phenomenon is required to further our understanding of VPE as a syntactic phenomenon attested in human language. Important questions which currently remain open involve the types of elements which license VPE (as described in Section 4), as well as the precise identity condition under which VPE occurs.

Notes

[1] For the purposes of this paper, I simply assume this basic clause structure for Indonesian; for the details, please see Fortin (2007).
[2] In active voice clauses, the AGENT raises to [Spec, TP] (i). In passives (both 'subjective' and 'canonical' passives), the THEME raises (ii).

(i) active voice clauses: [$_{TP}$ AGENT T [$_{vP}$ ~~AGENT~~ *v*+V [$_{VP}$ ~~V~~ THEME
(ii) passive voice clauses: [$_{TP}$ THEME T [$_{vP}$ (AGENT) *v*+V [$_{VP}$ ~~V~~ ~~THEME~~

[3] V to T movement does not occur overtly in Indonesian (pace Guilfoyle, Hung, and Travis 1992). Empirical evidence for lack of V→T includes (i), which demonstrates that verbs cannot precede *v*P-edge adverbs.

(i) a. Siti sering menutup pintu itu.   b. *Siti menutup sering pintu itu.
         Siti often   ACT-close door DEM   Siti ACT-close often   door   DEM
         'Siti often closes the door.'   'Siti closes often the door.'

[4] These four types of elements do not form a natural class in Indonesian, and so it is not a logical necessity that they all license the same type of ellipsis (i.e., that of a vP). In Indonesian clauses, temporal/aspectual information needs not be overtly expressed. There is no affixal inflection; all temporal and aspectual markers, modals and auxiliaries are free-standing lexical items, and there is no adjacency requirement between any of these items and the main verb. All future markers (*akan* [Musgrave 2001], *bakal*/*mau*) are auxiliaries, located in T^0, as demonstrated by their fixed position within the clause. Similarly, modals (e.g. *bisa/mampu* 'can', *harus/mesti* 'must', *perlu* 'need') are inflection-bearing heads, located in Mod^0. Conversely. past markers (*telah*/*sudah)*, aspectual markers (e.g. *pernah/sedang/lagi)*, and negation (*tidak*) are non-inflection-bearing adverbials, and like other adverbials can adjoin to different positions within the clause (TP, ModP, and vP), yielding different scopes of interpretation (i).

(i)   [$_{TP}$ (adverb) [$_{TP}$ T [$_{ModP}$ (adverb) [$_{ModP}$ Mod [$_{vP}$ (adverb) [$_{vP}$ AGENT v+V [$_{VP}$ V THEME]]]]]]

It is possible that temporal/aspectual markers and negation license a different kind of ellipsis than inflection-bearing auxiliaries/modals. In the remainder of this paper, I take a conservative approach, focusing on those instances of ellipsis occurring in the environment of an inflection-bearing head; for further details, please see Fortin (2007).

[5] Throughout, for the sake of brevity, I omit the trace of the subject DP within the elided vP.

[6] VPE in Indonesian appears to be limited to relatively informal contexts, such as casual conversation; it is not often found in written documents, where the language tends to more strictly adhere to prescriptive guidelines. VPE appears to be much less felicitous with auxiliaries that are indicative of more formal contexts (e.g. *akan* 'will') than with those that are indicative of informal contexts (e.g. *bakal* 'will', *mau* 'want, will'). I take the relative unacceptability of ellipsis following e.g. *akan* (i) to be due to a style clash, rather than some strictly syntactic restriction on ellipsis following *akan*; this hypothesis is supported by the variability in judgments regarding the acceptability of *akan* with VPE.

(i) Guru   saya   menyuruh   saya   menulis   ulang   karangan   saya,
    teacher 1SG   ACT-order   1SG   ACT-write again   composition 1SG
    tapi   saya   tidak   √ mau   /?? akan   [$_{vP}$ menulis   ulang   karangan   saya].
    but   1SG   NEG   want /   FUT   [$_{vP}$ ACT -write   again   composition 1SG]
    'My teacher told me to rewrite my composition, but I won't (rewrite my composition).'

[7] Depiante (2000) argues that stripping (in Spanish and Italian) is, like sluicing, TP ellipsis which is preceded by movement of the remnant (i.e., the argument that remains pronounced) plus negation (if present) to a focus position (i).

(i)   Ali likes vegetables…
      a.   … [$_{CP}$ but [$_{FP}$ [not Siti] [$_{TP}$[$_{NegP}$ not [$_{vP}$ Siti [$_{vP}$ likes vegetables]]]]]]
      b.   … [$_{CP}$ but [$_{FP}$ [not Siti] [$_{TP}$[$_{NegP}$ not [$_{vP}$ Ali [$_{vP}$ like Siti]]]]]]

[8] For one recent analysis of the blocking effect created by *meng-*, see Fortin in press.

[9] Note that the problem with this example cannot be reduced to a lack of parallelism between the antecedent and elided vPs, since it is wellformed without the ellipsis.

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Verbal Tense and Agreement in Child Spanish-speakers with Specific Language Impairment

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1. Introduction
1.1 Overview
What is specific language impairment (SLI)? SLI is an impairment which appears to only affect linguistic cognition, leaving other domains of cognition intact. From five to seven percent of the population suffers from it (Tomblin 1996a, 1996b) and it is associated with dyslexia in school aged children (Catts, Fey, Zhang & Tomblin 2001). There are currently a variety of criteria used to identify children with SLI. Unfortunately, most of them are exclusive and not inclusive. The purpose of the exclusive criteria is to make sure that the child does not have language problems which stem from other causes:

- Nonverbal IQ above 85
- Normal hearing
- No recent episodes of otitis media with effusion
- Normal oral structure
- No frank neurolgical damage
- No social or physical problems which might impede the child's interactions with others (e.g. autism, epilepsy)

The only inclusive criterion is that the child have a score on a standardized language test of 1.25 standard deviations below the mean.

One of the reasons why improving diagnostic accuracy is important is that the US has a sorry history of tracking immigrants and language minority children into special education classes with language impariment diagnoses, when in reality they are simply passing through normal processes of second language acquisition (Baugh 1995, Pray 2003). It is consequently of social importance that tools be developed which are capable of distinguishing normal bilingual delay from language impairment to help both populations succeed.

1.2 Theoretical Background

It is argued that SLI manifests itself differently in different languages. In fact, there appear to be two putative classes of cross-linguistic variation. Gender marking on articles is especially problematic for Spanish-speaking children with SLI (Restrepo & Gutiérrez-Clellan 2001), but not in English because English has no gender marking. This is one kind of difference. But what about constructions that are common to multiple languages? It has been argued that tense marking, which is common to English and Spanish, is very problematic for child English-speakers (e.g. Rice & Wexler 1996), but that it is not problematic for child Spanish-speakers (e.g. Bedore & Leonard 2001, 2005; Bosch & Serra 1997). We will now review reasons why we think that the conclusion that tense marking in Spanish is unproblematic is likely to be unfounded. If we are correct, then tense marking is not an axis of cross-linguistic variation for the manifestation of SLI, but rather a fundamental grammatical dimension of SLI which we should expect to find instantiated cross-linguistically. Below we will attempt to show through a new experiment that, when measured appropriately, tense marking appears to be vulnerable in child Spanish-speakers with SLI in a way similar to child English SLI.

1.3 Root Nonfinite Verbs in Child Spanish

It has been shown in English (Rice & Wexler 1996), French (Jakubowicz & Roulet 2004), Dutch (Wexler, Schaeffer & Bol 2004) and other languages that tense marking is problematic for children with SLI.

1)   *He walk across the street.

2)   He walks across the street.

But these languages also show the optional use of nonfinite verbs in child language…what about Spanish? Studies of child Spanish (Grinstead 1994, Bel 2001) and related languages such as Catalan (Torrens 1992) & Italian (Guasti 1994) show few problems for typically-developing children with finiteness marking.
One of the underlying assumptions in these studies, however, is that root nonfinite forms will be morphological infinitives. As a consequence, researchers mostly looked for morphological infinitives or agreement errors between overt subjects and verbs - there were few of either. In contrast, an array of nonfinite forms have been found in child English (e.g. Vainikka 1993), thus we might expect there to be multiple nonfinite forms in child Spanish, too. A second problematic dimension to these studies is their exclusive reliance on spontaneous data. Because overt subjects only appear with verbs about 20% of

the time in adult Spanish (Silva-Corvalán 1977), spontaneous production offers few opportunities to find agreement errors. A third problem is the confusion of present indicative verbs, particularly when they occur without an overt subject, with potentially nonfinite bare stem forms. It is largely impossible to distinguish imperatives, 3rd singular indicative and nonfinite bare stems from one another, when one is limited to a transcript.

Bare Stem
3)   Habla.
        speak (root + "a" theme vowel)
        "Speak."

Imperative
4)   Habla.
        speak 2nd sg. fam. imperative
        "Speak."

3rd Singular Present Indicative
5)   Habla.
        speaks 3rd singular present (progressive or habitual)
        "He/she speaks." – "He/she is speaking"

A fourth problem is the widespread use by children of holophrastic, or "frozen form" utterances. These are words or phrases which do not appear to be productive, when studied over time, and do not contrast with other forms of their paradigm. For example, "Quiero eso." or "I want that." may occur in a transcript, but there are no other forms of the verb "querer" anywhere in the first transcript in which "Quiero eso." is found nor are they found for several months of the following recording sessions. Because these are not productive, the conservative assumption to adopt is that these forms do not tell us anything about productive morphosyntax.

A fifth problem stems from adults' discourse representations, computed on the basis of reading transcripts of children's utterances. In the same way that our adult phonological grammars are likely to "fill in the gaps" in phonological experiments which mask certain segmental features, the adult grammars of those analyzing transcripts are also likely to "fill in the gaps" as to what children mean when they use bare stem verbs with null subjects. That is, how do adults reading a transcript know what the children think is a salient antecedent, and consequently whether there is correct subject-verb agreement? Most studies argue that researchers are able to infer from context what children's intended subject referents are, but this is a very difficult task. At times, for example, children appear to be referring to themselves with bare stems, as in the following examples (from Grinstead 1998).

6)   Eduardo - 2;5.29
        No puede.
        Not can (root + "e" theme vowel)
        "Cannot."
        [Eduardo responds to the investigator's question of whether
        he can put two pieces of a puzzle together.]

7)   Graciela - 2;3.4
        No quiere.
        Not want (root + "e" theme vowel)
        "Does not want."
        [Graciela responds to mother asking her if she wants a
        band-aid.]

The likelihood that these utterances are bare stems with a first person singular referent is strengthened by the occasional occurrence of bare stems with first person singular pronouns, in the sense that bare stems with first person subject reference appears to be a grammatical option.

8)   Carlos - 2;1.08
        Va yo.
        go stem I-nom
        "I goes."

9)   Carlos - 3;3.28
        Yo va a buscar.
        I-nom go stem to look for-inf
        "I goes to look for."

10)   Graciela - 2;6.5
        Hace esto yo.
        do (root + "e" theme
        vowel) this I-nom
        "I does this."

11)   Graciela - 3;3.26
        Este, yo quiere.
        this, I-nom want (root + "e"
        theme vowel)
        "This, I wants."

Finally, there is some research on child Spanish-speakers using elicited production techniques, which can overcome some of the limitations posed by

spontaneous production data. Pérez-Pereira (1989) and Kernan & Blount (1966) carried out "Wug" test type studies in child Spanish with both real verbs and nonce verbs. Pérez-Pereira showed child Spanish speakers to be less than perfect (78% correct) up to 5-6 years old, as illustrated in Table 1.

	3 year-olds	4 year-olds	5 year-olds	6 year-olds
Preterite 3rd Sg.	48%	74%	73%	76%

Table 1 – Percentage Correct with Real Verbs in Pérez-Pereira (1989)

When the experimenters and not the child decide what the subject and verb are going to be (atenuating the frozen form option), Spanish-speaking children look much more like English-speaking children with respect to root infinitive production (cf. Berko-Gleason 1958, Derwing & Baker 1979; Rice, Wexler & Hershberger 1998).

In summary, in most studies of child Spanish, researchers have found themselves looking at transcripts with many bare stem verbs (including frequently repeated, non-productive forms) with mostly null subjects, trying to figure out whether there is correct agreement or not. This state of affairs is less than optimal and constitutes a weak empirical basis for the generalization that child Spanish speakers mark finiteness correctly. When elicited production data has been considered, child Spanish speakers' ability to mark finiteness looks similar to that of child English speakers.

1.4. Spanish SLI

One of the few studies of tense and agreement marking in Spanish SLI in a Spanish-speaking context is Bosch & Serra (1997). Using spontaneous production data, they studied multiple aspects of the language of 12 SLI children in Spain and concluded that there were very few problems with finiteness marking. However the average age of the children in their sample was 7;6, which is quite old, even for children with SLI, to be having problems marking tense and agreement. Another pair of studies, Bedore & Leonard (2001, 2005), studied 15 SLI children in the US with elicited and spontaneous production, respectively. They concluded that there were no serious problems marking tense and agreement. The children in Bedore & Leonard (2001) showed relatively high accuracy on elicited production tasks, as illustrated in the following table, compiled from their results.

	SLI	Language Controls	Age Controls
Percentage Correct	1085/1296 (84%)	1010/1186 (85%)	1455/1511 (96%)

Table 2 - Elicited Production Errors from Bedore & Leonard (2001, Table 5, pre-publication version)

Bedore & Leonard (2005) showed even higher accuracy in spontaneous production (above 91% for the SLI group), as we might expect.

The results in Bedore & Leonard (2001) show that the children make errors, which leads us to the questions of what kinds of errors they made and whether any of them might constitute non-finite forms. Of course without interpretation/comprehension results, we cannot know definitively, nonetheless there are plausible candidates. In Bedore & Leonard's (2001) elicited production study, there were three very common erroneous responses:

- The infinitive - Yo hablar.
- The Bare Stem - Yo habla.
- An Overgeneralized Agreement Form - Yo habló.

These were the three most common errors that children made. On the basis of these errors, we propose that the grammars of Spanish-speaking children include these nonfinite forms as acceptable, in spite of lacking tense and agreement. Our proposal leads us to the following 2 research questions.

1.5 Research Questions

- Can a receptive task overcome the obstacles posed by spontaneous production data for determining the pervasiveness of root nonfinite forms in child Spanish?

- If root nonfinite forms are pervasive, can they distinguish children with SLI from age and MLUw-matched control groups, and is finiteness consequently useful as a clinical marker of SLI in Spanish?

2. Methods
2.1 Participants

Twenty-seven monlingual Spanish-speaking children in Mexico City participated in our study. Nine were diagnosed with SLI. They had an average mean length of utterance, measured in words (MLUw) of 3.0. Their average age was 67 months (5 years, 7 months). Our age control group consisted of nine

typically-developing children of the same age as the SLI group (mean age = 67 months - 5 years, 7 months). Our language control group consisted of nine typically-developing children of the same language level with an MLUw of 3.0.
The SLI children met all of the inclusive and exclusive criteria for SLI. They all had scores of 1.25 standard deviations below the mean on the *Batería de evaluación de la lengua española* or BELE (Rangel et al 1988), which was normed in Mexico City. Nonverbal IQ was measured using the WIPSSI/WISC, Spanish translation. We included a phonological screen to exclude phonological disorder and we used the Restrepo (1998) family interview, which has been validated as an instrument for identifying Spanish-speaking children with SLI.The control group children also took the phonological screen and the standardized language test to eliminate outliers.

In order to understand the importance of our sample being from Mexico City and not from a Spanish-speaking community in the US, as in Bedore & Leonard's work, we hasten to point out that in previous studies we have found very different results with children in Mexico than have Bedore & Leonard. Such a difference is illustrated by the following two tables, which show the results of two methodologically very similar studies of noun-adjective agreement in Spanish-speaking 5 year-olds in the US and Mexico. While even the five year-old language control children studied in the US, shown in Table 3, show difficulty with agreement, both control groups of children studied in Mexico, shown in Table 4, performed at very high levels of accuracy. On this basis we conclude that the two populations have potentially very different levels of linguistic competence.

	Masc. Sing.	Fem. Sing.	Masc. Pl.	Fem. Pl.	**Total**
SLI	49/60 (82%)	43/60 (72%)	22/30 (73%)	16/45 (36%)	**130/195 (67%)**
Lang	51/60 (85%)	46/60 (77%)	27/30 (90%)	24/45 (53%)	**148/195 (76%)**
Age	57/60 (95%)	55/60 (92%)	30/30 (100%)	35/45 (78%)	**177/195 (91%)**

Table 3 - Noun-Adjective Agreement in Bedore & Leonard (2001) - 5 Year-old SLI Children in San Diego

	Masc. Sing.	Fem. Sing.	Masc. Pl.	Fem. Pl.	**Total**
SLI	35/36 (97%)	33/36 (92%)	33/38 (87%)	30/39 (77%)	**131/149 (88%)**
Lang	38/38 (100%)	37/37 (100%)	37/39 (95%)	32/35 (91%)	**144/149 (97%)**
Age	38/38 (100%)	38/40 (95%)	40/40 (100%)	38/40 (95%)	**150/154 (97%)**

Table 4 - Noun-Adjective Agreement Grinstead, Cantú & Flores (2007) - 5 Year-old SLI Children in Mexico City

2.2 Procedures

The investigator introduces two puppets to the children and explains that they are babies and consequently they do not know how to talk well yet. The child is asked to help the investigators help the puppets to learn to speak better by telling them which of the two produces the better sentence. The investigator then shows the child pictures in which the puppets are carrying out an activity. Upon seeing the pictures, each puppet utters a sentence with either an adult-like verb or with one of the nonfinite forms of the Spanish Tense Composite (hablar, habla, habló). There were 17 items in the present and 17 in the past, plus 10 fillers with errors of syntactic order to be sure that the child understood the experimental format:

12)   **Filler Items**
         Nosotros bailar en sala la.
         We dance in living room the.
                    vs.
         Nosotros bailamos en la sala.
         We dance in the living room.

Only children who could detect errors in at least 7 of 10 fillers were included.

3.0 Results

As we can see in the following table and figure, the children with SLI scored significantly lower than did the two control groups. A one-way ANOVA showed a main effect for group, $F_{(2, 24)} = 18.224$, $p < 0.0001$. Post-hoc tests of Least Significant Differences showed the scores of the SLI group to be significantly worse than those of the language control group (p. < 0.0001) and significantly worse than those of the age control group ($p < 0.0001$).

	Past	Present	Average	SD
SLI	51.39%	54.90%	53.15%	13.35%
MLU	72.92%	77.78%	75.35%	14.33%
AGE	84.01%	87.54%	85.78%	5.54%

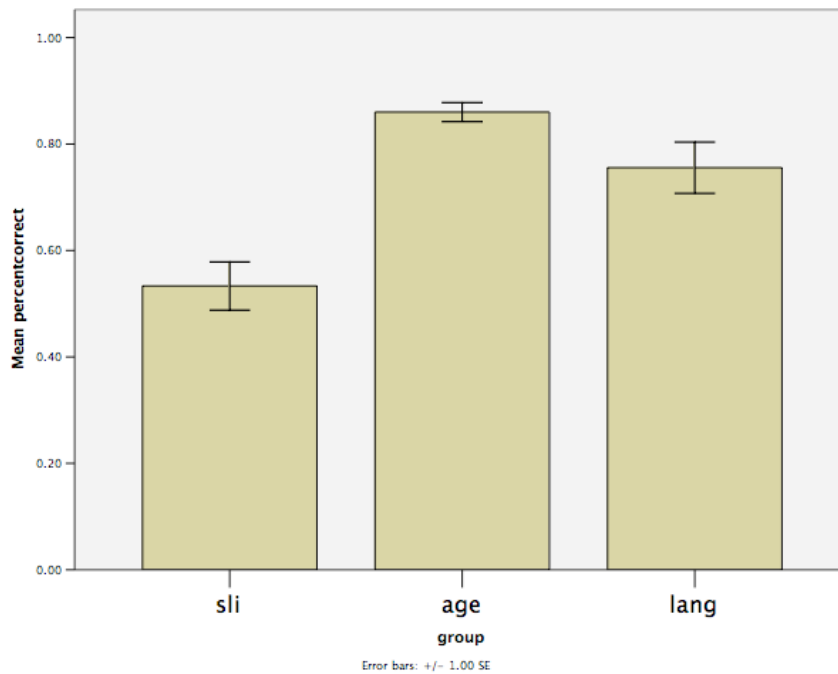Table 5 – Grammaticality Choice Task Results for Verb Finiteness

Figure 2 – Comparison of SLI and Control Group Scores

There was also a main effect of verb form type, with group as the between subjects variable, for infinitives (F [2, 24] = 11.680, p < 0.0001), overgeneralizations (F [2, 24] = 12.785, p < 0.0001) and bare stems (F [2, 24] = 18.642, p < 0.0001).

	Bare Stems	Overgeneralizations	Infinitives
SLI	4.33/10 (43%)	7.11/11 (65%)	5.56/12 (46%)
MLU	7.44/10 (74%)	8.22/11 (75%)	9.22/12 (77%)
Age	8.11/10 (81%)	10.44/11 (95%)	9.78/12 (81%)

Table 6 – Comparison of Verb Types Among SLI and Controls

4. Discussion

For children in the SLI group, there was no difference between the grammaticality of the adult forms and the forms of the Spanish Tense Composite. This difference in SLI children's grammatical representations is sufficient to distinguish them from unaffected children of the same age and from unaffected children of the same linguistic level. Our study constitutes a Spanish-language cross-validation of the argument of Rice & Wexler (1996) that at least one important dimension of the SLI disorder is a representational deficit rooted in grammatical tense. Methodologically, we take our results to serve as confirmation that techniques other than spontaneous production are called for when the grammatical properties of phonetically null constituents, such as the subject in Spanish, are a critical dimension of the research question. Finally, our results suggest that receptive measures of finiteness marking could be useful as a clinical marker of SLI.

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Swiping and Related Phenomena in English and Other Languages*

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1 Introduction -- Pied-Piping (P-P-ing) + PF Head Movement Analysis (Merchant (2002))

Sluicing is a form of ellipsis widely studied since Ross (1969):

(1) a. John bought something, but I don't know what.
  b. Someone called, but I can't tell who.   (Ross (1969))

In addition to Sluicing exemplified in (1), Ross (1969) also discussed a slightly different type of ellipsis, which Merchant (2002) called Swiping. Swiping leaves a preposition after the remaining *wh*-element associated with it as in (2):

(2) a. Lois was talking, but I don't know who to.
  b. They were arguing; God only knows what about.   (Merchant (2002))

  Merchant (2002) offers an account of Swiping where the remaining P is Pied-piped along with the moved *wh*-element. After *Wh*-movement and Sluicing, which is IP ellipsis at PF, the fronted *wh*-element is further moved and attached to the front of the preposition as shown in (3). (We will henceforth ignore intermediate landing sites unless relevant to discussion):

(3) Lois was talking, but I don't know…)
  a. [$_{CP}$ [$_{IP}$ she was talking [$_{PP}$ to who(m)]]]
       ↑_____| (*Wh*-movement+ P-P-ing)

b. $[_{CP} [_{PP} \text{ to who(m)}]_i [_{IP} \underline{\text{she was talking } t_i}]]$

↓

φ (Sluicing = IP ellipsis)

c. $\text{who}_j + \text{to} \quad t_j$

↑_____| (PF Head Movement)

Merchant claims that the final movement of the *wh*-element to the front of the preposition is PF Head Movement.

2 Alternative Analysis: Preposition Stranding (PS) + Remnant PP Extraposition (Rem-PP-Ex)

We propose that Swiping sentences are derived through *Wh*-movement stranding P (*Wh*-movement + PS), not through Pied Piping, followed by Extraposition of the remnant PP (henceforth **Rem-PP-Ex**) and Sluicing (or IP Ellipsis). The derivation of (2a) under our analysis is given in (4):

(4) (Lois was talking, but I don't know…)

a. $[_{CP} \quad [_{IP} \text{ she was talking } [_{PP} \text{ to } \underline{\text{who}}]]]$

↑_____| (*Wh*-movement + PS)

b. $[_{CP} \text{ who } [_{IP} \text{ she was talking } [_{PP} \underline{\text{to } t}]] \quad]$

|___↑ (**Rem-PP-Ex**)

c. $[_{CP} \text{ who } [_{IP} \underline{\text{she was talking}}] [_{PP} \text{ to } t]]$

↓

φ (Sluicing = IP ellipsis)

d. who to (*t*)

Here we will just assume Extraposition as a syntactic rightward movement, along the lines of Müller (1997, 1998).[1]   We will also assume along the lines of Müller (1997) that the landing site for the extraposed PP is CP.

2.1 Advantages of P-stranding (PS) + Rem-PP-Ex analysis

As discussed in Rosen (1976), most of the acceptable cases of Swiping are what

Chung, Ludsaw and McCloskey (1995) called "Sprouting," where there is no explicit antecedent for the remaining *wh*-element and the preposition, as in (5):

(5) a. John was talking with someone, but I don't know who (?*with).
     b. John was talking, but I don't know who with.

   One advantage of our PS + Rem-PP-Ex Analysis is that this "Sprouting" requirement might follow naturally from the property of Extraposition.   As argued in Huck and Na (1990) among others, extraposed elements must bear focus/stress in general.   If an explicit antecedent for the PP is already given, it would be impossible for the second PP to bear focus by Extraposition.   This "Sprouting" requirement of Swiping thus might follow from the requirement that the extraposed element must bear focus/stress in general.
   Another advantage of our PS + Rem-PP-Ex account is that Merchant's (2002) Sluicing Condition in (6) is no longer a problem:

(6) Sluicing Condition   (Merchant (2002))
        Swiping only occurs in Sluicing.

Under Merchant's Pied-Piping account, Sluicing (or IP Ellipsis) is a prerequisite for PF Head Movement.   In other words, a sentence like (7), where PF Head Movement has applied but not Sluicing, must be ruled out somehow.

(7) *Lois was talking, but I don't know [$_{PP}$ <u>who</u>$_i$ with t_i]$_j$ Lois was talking t_j.
                                    ↑_____|

As pointed out also by Lasnik (2005), Merchant (2002) does not offer a clear explanation for this condition.   Under our PS + Rem-PP-Ex account, this problem does not arise in the first place, because there is no possibility of deriving an ungrammatical sentence like (7).
   Now consider the paradigm in (8):

(8) Peter was talking, but…
        a. I don't know with whom/??who he was talking.   (P-P-ing)
        b. I don't know who/?whom with.   (Swiping)
        c. I don't know who/?whom he was talking with.   (PS)

(cf. Merchant (2002), Craenenbroeck (2004))

Swiping sentences like (8b) pattern with examples with stranded P like (8c) with respect to the preferred form of the *wh*-element *who* or *whom*, not with P-P-ing examples like (8a), as pointed out by Merchant (2002) himself.   This is quite natural under our PS analysis, but not under Merchant's P-P-ing analysis.[2]

  Swiping like (9) or (10) is potentially problematic for P-P-ing account:

(9)   A: Mary is talking.   (cf. Craenenbroeck (2004:105),
      B: Who do you think to?   cited by Lasnik (2005))
(10)   He wants us. -- What do you suppose for?   (Hartman (2007))

If we tentatively assume that a preposition moved to an intermediate landing site by P-P-ing can potentially be left behind by PS, the putative derivation of (9) would be as given in (9′):

(9′)   a.   (You think) [$_{CP}$ [$_{IP}$ Mary is talking [$_{PP}$ <u>to who(m)</u>]]]
                          ↑_____| (*Wh*-mov. + P-P-ing)

       b.   [$_{CP}$ [$_{IP}$ You think [$_{CP}$ [$_{PP}$ to <u>who(m)</u>]$_i$ [$_{IP}$ Mary is talking t_i]]]]
                    ↑_____| (*Wh*-mov. + PS)

       c.   [$_{CP}$ Who$_j$ do [$_{IP}$ you think [$_{CP}$ [$_{PP}$ to t_j]$_i$ [$_{IP}$ <u>Mary is talking t_i</u>]]]]
                                            ↓   (Sluicing
                                            φ   = IP ellipsis)
       d.   Who$_j$ do you think to t_j (cf. Craenenbroeck (2004:105))

Note that without Sluicing, this derivation would result in the ungrammatical sentence in (9′c), for which some independent explanation is required.[3]

  (9) has a natural derivation in our PS + Rem-PP-Ex account, as given in (11):

(11)   a.   (You think) [$_{CP}$ [$_{IP}$ Mary is talking [$_{PP}$ to <u>who</u>]]]
                             ↑_____| (*Wh*-mov.+PS)

       b.   [$_{CP}$ [$_{IP}$ you think [$_{CP}$ <u>who</u> [$_{IP}$ Mary is talking [$_{PP}$ <u>to</u> t]]   ]]]
                    ↑_____| (Rem-PP- Ex) |____↑

c. [_{CP} Who (do) [_{IP} you think [_{IP} <u>Mary is talking</u>] [_{PP} to *t*]]]

↓

φ (Sluicing = IP ellipsis)

d.   Who do you think to *t*

Our analysis does not have to assume a problematic derivation with a remaining P in an intermediate landing site. Without Sluicing, we would also get a well-formed sentence in (11c).

3   Cross-linguistic Considerations -- Rem-PP-Ex and "Crossing" effects

As pointed out by Merchant (2002), there are some languages other than English allow Swiping, namely, Danish and some dialects of Norwegian.   As stated in (12), all of these languages and dialects also allow PS.

(12)   Swiping available: English, Danish, (Some dialects of) Norwegian
→ all these languages (and dialects) allow PS

One important problem with Merchant's (2002) P-P-ing account is that it renders this correlation a mere accident.   Under our PS analysis this necessarily follows.

Some languages allow PS but not Swiping; for instance, Icelandic.   I suggest that some other factor, namely, the unavailability of Rem-PP-Ex, might be blocking Swiping in such a language.   This prediction is borne out in Icelandic; both Swiping and Rem-PP-Ex are impossible in Icelandic, as shown in (13):

(13)   a. *Lísa var að tala en ég veit ekki hvern við.
Lisa was talking but I know not who with
'Lisa was talking, but I don't know who with.'   (Icelandic)

b. *Ég veit ekki hvern Lísa talaði í gær við.
I know not who Lisa talked yesterday with
'I don't know who Lisa talked yesterday with.'   (Icelandic)

According to Merchant (2002), Swedish is another language that allows PS

but not Swiping. And for many Swedish speakers, both Swiping and Rem-PP-Ex are impossible, as indicated in (14):

(14) a. $^{??}$/*Lois pratade, men jag vet inte vem med.
         Lois talked   but   I know not who with
         'Lois talked, but I don't know who with.'   (Swedish)
     b. $^{??}$/*Jag vet inte vem Lois pratade igår med.
          I know not who Lois talked yesterday with
         'I don't know who Lois talked yesterday with.'   (Swedish)

However, some speakers of Swedish marginally accept Swiping in (14a).   And interestingly, the same speakers marginally accept (14b) with Rem-PP-Ex. This sort of correlation strongly supports our analysis of Swiping in terms of P-Stranding and Rem-PP-Ex.

   Now let us go back to English.   Since English allows Swiping, Rem-PP-Ex should also be possible under our analysis.   Consider (15a):

(15) a.   I don't know who/what Lois was talking yesterday with/about.
     b.   (Lois was talking yesterday, but) I don't know who with / what about.
                                         (cf. Huck and Na (1990))

Under our analysis, Swiping in (15b) is derived through Sluicing from (15a), to which Rem-PP-Ex has applied.

   According to Huck and Na (1990), sentences like (15a) are acceptable with stress on the stranded P.   Though some speakers find (15a) acceptable with this stress pattern, many speakers find (15a) unacceptable.[4]   There does not seem to be such a dialectal variation as to the acceptability of Swiping in (15b).

   Our claim is that for all English speakers who accept Swiping, Rem-PP-Ex is available.   If it were not available, Swiping structures could not be derived under our analysis.   Merchant (2002) observes that the remaining P in Swiping must bear stress, as indicated in (16):
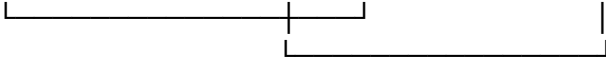
(16)   John was talking, but I don't know who WITH / *WHO with.
                                         (Merchant (2002))

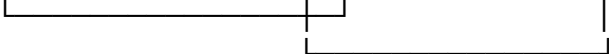For speakers who accept (15a), the sentence-final P must bear focus/stress,

which follows from the fact that an extraposed element must bear focus/stress in general. This is consistent with Merchant's observation in (16) that the sentence-final P bears stress in Swiping, and thus might support our analysis of Swiping based on Rem-PP-Ex.

Then why is (15a) unacceptable for some speakers? My suggestion is that there is another interfering factor involved here.

(15a) is reminiscent of the long-standing debate concerning the acceptability (or unacceptability) of a structure with an extraposed element containing an extraction site, which goes back to much earlier works like Chomsky (1977). Here we might adopt Lasnik and Saito's (1992) account of its (un)acceptability:

(17) ?*What$_1$ did you give t_2 to John [a book about t_1] $_2$?
(17′)   What did you give (a book about (what)) to John [a book about (what)]?

According to Lasnik and Saito (1992), (17) is rendered unacceptable because the two dependencies cross each other, under some definition of 'crossing.' I will take this "Crossing Constraint" to be a constraint on parsing/processing, along the lines of Fodor (1978). More specifically, I assume the process of undoing the derivation in the reverse order. First, the extraposed element is put back in its original position. In order to undo *Wh*-movement, the *wh*-element must cross the preposition already placed back into its original position, and this causes processing difficulties. We might suggest that there is variation among languages/dialects as to how robust the effect of this "Crossing Constraint" is, causing the dialectal variation in the acceptability of (15a) among speakers.

(15a′)   I don't know
         [$_{CP}$ who [$_{IP}$ Lois was talking (with (who)) yesterday] [$_{PP}$ with (who)]].

This "Crossing effect" is not attested in Swiping in (15b) because the crossing dependencies are "wiped out" by Sluicing, which elides the IP. This can be viewed as an instance of "island repair" effects discussed in Fox and Lasnik (2003) among others.

Danish is another language that allows Swiping, as indicated in (18a).   And my Danish informants rejected (18b), where Rem-PP-Ex has applied.

(18)   a.   Lois snakkede, men jeg ved ikke hvem med.
           Lois   talked   but   I know not   who with
           'Lois talked, but I don't know who with.'   (Danish)
       b. *Jeg ved ikke hvem Lois snakked igår med.
           I know not   who Lois talked yesterday with
           'I don't know who Lois talked yesterday with.'   (Danish)

Along the lines we just argued for (15a) in English, we suggest that (18b) is ruled out by the "Crossing Constraint."   The effect of this constraint seems robust at least for the Danish speakers I consulted with, but this "Crossing effect" is "wiped out" by Sluicing in (18a), again an instance of "island repair" effects discussed in Fox and Lasnik (2003) among others.

4 Some Problems with Merchant's Minimality Condition

Merchant (2002) claims that his P-P-ing + PF Head Movement analysis can account for the restriction that wh-elements that appear in Swiping seem to be limited to syntactic heads like *who*, *what*, and *where*, which he calls the Minimality Condition.   Merchant gives unacceptable examples of Swiping with complex wh-phrases like (19b) and (20b):

(19)   a.   He was shouting, but it was impossible to tell who to.
       b. *He was shouting to one of the Republican senators, but it was impossible to tell exactly which (one/senator) to.
(20)   a.   She's driving, but God knows where to.
       b. *She's driving, but God knows what town to.   (Merchant (2002))
(21)   Minimality Condition (Merchant (2002))
       Only 'minimal' wh-operators (=X^0s) occur in Swiping

According to Merchant (2002), this follows from his analysis in which the *wh*-element is moved to the front of the preposition by PF Head Movement.
   Merchant's (2002) PF Head Movement account of his Minimality Condition

has certain empirical coverage, but is not without problems.

   As for the unacceptability of (19b), we might not have to resort to Merchant's Minimality Condition, as pointed out by Howard Lasnik and Chris Tancredi (p.c.).   Since (19b) contains an antecedent PP, we might rule them out as a violation of "Sprouting" requirement we discussed with respect to (5).

   Hartman (2007) gives some exceptions to Merchant's Minimality Condition, namely, acceptable Swiping sentences with complex *wh*-phrases in (22):[5]

(22)   a.   He fought in the civil war, but I don't know which side for.
         b.   Pierre is an illegal immigrant. He's originally from France, but came here from Canada.   He'll definitely be deported, but it's not clear which country to.
         c.   A: He's one of the best players in the league. He plays shortstop.
              B: Which team for?
         d.   It appears to have been translated, but I can't tell what language from.
                                                                    (Hartman (2007))

All the acceptable examples in (22) with a complex *wh*-phrase do not have an explicit antecedent for the remaining P, as opposed to (19b), which confirms our account of ill-formedness of (19b) based on the Sprouting requirement.

   It should be pointed out that Merchant's (2002) PF Head Movement account of his Minimality Condition captures only a part of the restrictions on the remaining elements in Swiping structures.   Culicover (1999) and Culicover and Jackendoff (2005) point out that the combination of the *wh*-element and the preposition that can appear in Swiping is limited to certain restricted pairs. Swiping examples in (23) are impossible, and what makes these combinations wrong is the choice of P, not the choice of the *wh*-element.

(23)   *John made a speech during the session, but I can't remember who/what before/after.   (cf. Culicover (1999), Culicover and Jackendoff (2005))

   Note that (24), to which P-P-ing and Sluicing have applied (but not Merchant's "PF Head Movement"), is acceptable, even though (24) is supposed to be the source of the unacceptable Swiping in (23) under Merchant's account:

(24)   John made a speech during the session, but I can't remember before/after
       whom/what.

As opposed to P-P-ing + Sluicing in (24), the acceptability of Swiping is affected not only by the choice of the *wh*-element but also by the choice of P, as indicated in (23). Merchant's P-P-ing account of his Minimality Condition does not offer any explanation for this.

   A very interesting observation is made in Müller (1998) concerning the phonological length of P and the availability of Rem-PP-Ex in (25), which might be taken to support our account of Swiping based on Rem-PP-Ex:

(25)   a.   Da$_1$ hat keiner t_2 gestimmt [$_{PP}$ t_1 für/$^{??}$gegen] $_2$.
                 there has no-one   voted   for/against
       b.   Da$_1$ sind viele Leute t_2 gelaufen [$_{PP}$ t_1 auf/$^{??}$unter] $_2$.
                 there are many people   walked   on/under
              'Many people walked on/under it (e.g., the bridge)

                                             (German; Müller (1998: 175))

According to Müller (1998: 175), "All postpositions in (i) (= (25)) allow postposition stranding and PP Extraposition in isolation, but the combination of the two processes may or may not lead to reduced acceptability. Since the syntactic context is identical for the legitimate and illegitimate cases in (i-a) and (i-b) (= (25a) and (25b)), and semantic considerations do not suggest themselves here, one might speculate that phonological factors are relevant here, such that Extraposition of a bare P category is optimal with a monosyllabic P, and gets worse the longer P gets." We have seen in (23) that the acceptability of Swiping is affected by the phonological/morphological length of the remaining P. The correlation between the phonological length of the remaining P and the availability of the Rem-PP-Ex pointed out by Müller might be taken to suggest that our analysis of Swiping based on Rem-PP-Ex is on the right track.

5 Complex data in Norwegian and the interaction of various factors

Now let us turn to Norwegian. Swiping in (26) is acceptable to some speakers

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of Norwegian while unacceptable to others, as reported in Merchant (2002):

(26) a. $^{(?)/?}$*Lois snakket, men jeg vet ikke hvem til/med.
             Lois talked   but   I   know not who to/with
             'Lois talked, but I don't know who to/with.'
       b. $^{(?)/?}$*Lois snakket, men jeg vet ikke hva om.
             Lois talked   but   I   know not what about
             'Lois talked, but I don't know what about.'   (Norwegian)

(27) a. $^{(?)}$*Jeg vet ikke hvem Lois snakket i går med.
             I know not who Lois talked yesterday with
             'I don't know who Lois talked yesterday with.'
       b. $^{(?)}$*Jeg vet ikke hva Lois snakket i går om.
             I know not what Lois talked yesterday about
             'I don't know what Lois talked yesterday about.'   (Norwegian)

specifically, Swiping sentences like (26) are (marginally) acceptable to some
speakers of Tromsø/Bergen/Oslo/Øberbygd/Nordmøre/Trøndelag dialects,
while unacceptable to other speakers of Narvik/Trøndelag dialects. On the
other hand, (27), where Rem-PP-Ex has applied, were more or less rejected by
all the Norwegian speakers I could gather data from.

   If we take a closer look, however, the situation in Norwegian is even more
complex. If you change the intervening adverbial element from *i går*
('yesterday') to *på tirsdags morgen* ('on Tuesday morning'), the sentences with
Rem-PP-Ex become acceptable to some speakers, as shown in (28):

(28) a. $^{(?)/?}$*Jeg vet ikke hvem du snakket på tirsdags morgen med.
              I know not who you talked on Tuesday morning with
             'I don't know who you talked on Tuesday morning with.'
       b. $^{(?)/?}$*Jeg vet ikke hva du snakket på tirsdags morgen om.
             I know not what you talked on Tuesday morning about
             'I don't know what you talked on Tuesday morning about.'
                                                                    (Norwegian)

This shows that Rem-PP-Ex is potentially available at least for some speakers of
Norwegian in some cases. I suggest that some other factor, namely
phonologial/morphological/prosodic properties of the intervening adverbial

elements, might be affecting the availability of Rem-PP-Ex in Norwegian. More specifically, the intervening adverbial element like *i går* ('yesterday') might be preventing the formation of legitimate intonational phrasing, as suggested by Bruce Moren at the University of Tromsø (p.c.), but my lack of knowledge in this area prevents me from further elaboration. It should also be noted that while speakers who accept Swiping in (26) put stress on the final P, speakers who accept (28) do not put stress on the final P, even though Rem-PP-Ex requires stress on the final P in general. Bruce Moren (p.c.) points out that there is a semantic effect attained only by Extraposition in (28), in that it has a reading made available only by Extraposition here, namely, a reading where 'talk on Tuesday morning' is interpreted as an information unit. While with (27) the same sort of reading can be attained without Extraposition by putting stress on 'yesterday,' in (28) this reading can be attained only by means of PP Extraposition, because putting stress on any of the elements in the adverbial PP gives rise to a different, contrastive reading. We might speculate that for some speakers this otherwise unattainable semantic effect somehow exceptionally makes the Rem-PP-Ex possible even without stress on the final P.[6]

To sum up, there are Norwegian speakers who (i) (marginally) accept Swiping (in (26)) and (ii) reject Swiping (in (26)). And among them there are those who (a) reject sentences with Rem-PP-Ex ((27) - (28)) altogether and (b) accept some sentences with Rem-PP-Ex (like (28)). Norwegian speakers can be cross-classified into four types, (ia) - (iib), based on these two criteria.[7]

(ia) type speakers: (includes speakers of Tromsø/Bergen dialect)

▶ "Crossing" effect robust → (27) - (28) with Rem-PP-Ex ruled out

▶ "Crossing" effect "wiped away" by Swiping → Swiping in (26) acceptable

(ib) type speakers: (includes speakers of Oslo/Øverbygd/Trøndelag dialect)

▶ "Crossing" effect not robust → some sentences with Rem-PP-Ex acceptable

▶ (27) (with Rem-PP-Ex) ruled out because the intervening adverbial element (igår 'yesterday') creates an illegitimate phonological/prosodic pattern.

▶ (28) acceptable, perhaps due to a semantic effect attained only by Extraposition (as suggested by Bruce Moren (p.c.))

(iia) type speakers: (includes speakers of Oslo dialect)

▶ "Crossing" effect robust → (27) - (28) with Rem-PP-Ex ruled out

▶ P not eligible as the bearer of sentence-final stress

→ Swiping impossible, because it requires stress on the remaining P

(iib) type speakers: (includes speakers of Narvik/Trøndelag dialect)

► "Crossing" effect not robust → some sentences with Rem-PP-Ex
    acceptable

► P not eligible as the bearer of sentence-final stress

    → Swiping impossible, because it requires stress on the remaining P

► (27) (with Rem-PP-Ex) ruled out because the intervening adverbial element
    (i går 'yesterday') creates an illegitimate phonological/prosodic pattern.

► (28) acceptable perhaps due to a semantic effect attained only by
    Extraposition

Speakers of type (i) are divided into speakers of type (ia) and speakers of type (ib) depending on whether or not they accept (28) with Rem-PP-Ex. Interestingly, I was informed that while Tromsø and Bergen dialects (type (ia) speakers) share a similar intonation pattern, Oslo and Øverbygd dialects (type (ib) speakers) share a different intonation pattern. This seems to suggest that some phonological/prosodic/intonational factors might be at work in this division.

Idiolectal variation between type (ib) speakers and (iib) speakers might be reduced to idiolectal variation in the eligibility of P as the bearer of sentence-final stress. For a speaker of type (ib), Swiping is possible because P is eligible as the bearer of sentence-final stress. For a speaker of type (iib), Swiping is impossible because P is not eligible as the bearer of sentence-final stress. (Both speakers accept (28) because it is exceptionally acceptable without a stress on the final P due to its otherwise unattainable semantic effect.) Interestingly, one of the type (ib) speakers preferred preposition *med* ('with') to preposition *til* ('to') in Swiping in (26a). The existence of such a speaker suggests that the dialectal/idiolectal variation in the preference for P as the bearer of the sentence-final stress might be a plausible idea. There are speakers who accept many prepositions as the bearer of the sentence-final stress, and they accept Swiping with various prepositions. There are some speakers who prefer a particular P to another as the bearer of the sentence-final stress, and these speakers' judgments on Swiping vary according to the final P they contain. And there are speakers who reject all Ps as the bearer of the sentence-final stress, and they reject Swiping altogether.

6 Concluding Remarks

Swiping structures are derived through the interaction of fairly general syntactic operations such as *Wh*-movement (+ P-stranding) and Extraposition, and Sluicing (or IP Ellipsis), presumably a PF process. There are various factors related to parsing/processing, phonology/morphology/prosody, or information structure / discourse semantics that interfere with these general operations and processes to complicate the situation. However, Culicover (1999) and Culicover and Jackendoff (2005), who claim that children simply memorize pair-wise the *wh*-element and the preposition that appear in Swiping, are missing interesting generalizations argued for here. Swiping is a result of intricate interactions of factors that are universal, or specific to certain languages or dialects, or perhaps even idiolects, and we would like to leave further clarification of this very interestingly complex phenomena for future research.

Notes

[1] See also Kim (1997) and Nakao and Yoshida (2006) for different analyses of Swiping that also employ rightward movement of PP.

   (i) can potentially be a swiped form of the two sentences in (i′):

(i)   John believes that Mary was talking, but I don't know who to.

(i′) a.   John believes that Mary was talking, but I don't know who John believes that Mary was talking to.

   b.   John believes that Mary was talking, but I don't know who Mary was talking to.

(cf. Kim (1997), Craenenbroeck (2004))

According to my informants, (i) can only have the meaning which corresponds to (i′b).   This is consistent with the fact that Extraposition (as an instance of syntactic rightward movement) conforms to the so-called "Right Roof Constraint" and is syntactically clause-bounded.   (i) cannot be derived from (i′a), because the remnant PP cannot be moved across a clause boundary to a higher clause before Sluicing.   However, there are some cases where some speakers give different interpretations to Swiping sentences like (i).   See Kim (1997) and Craenenbroeck (2004) for related arguments.   It might be interesting to examine the possibility of reconsidering my proposals under Kaynean leftward movement analysis of so-called rightward movement phenomena (especially in light of an interesting view in Kayne (2005) of P as probes), or under PF movement analysis of Extraposition (cf. Göbbel (2006)), which I will leave for future research.

[2] The same point is made in Craenenbroeck (2004), even though his analysis is quite different from ours in that he employs BOTH P-P-ing AND PS within a split CP system to derive Swiping sentences.   See Sugisaki (2008) for interesting arguments based on language acquisition data that favor PS analyses of Swiping over P-P-ing analyses.

   Consider also (i):

(i)   a.   What did he do that for? ($\doteqdot$ Why did he do that?)

   b.   #For what did he do that?   (cf. Merchant (2002:314, fn13),

   c.   He did it, but I don't know what for.   Craenenbroeck (2004))

As pointed out by Merchant (2002) himself, the Swiping sentence in (ic) has the same idiomatic meaning as the sentence with the stranded P in (ia) for most speakers.   (One of the reviewers of WECOL does not get a reading like (ia) for Swiping in (ic), but I could not find any other similar

speakers.)　This again follows quite naturally from our account of Swiping based on PS.　The same point is also made in Craenenbroeck (2004).

[3] This sort of derivation is in fact suggested in Craenenbroeck (2004), where it is claimed that Sluicing must apply to void a violation of the ban on P-stranding in intermediate positions, which he tries to account for in terms of Chain Uniformity.　However, as suggested by Howard Lasnik (p.c.), this sort of derivation might be blocked by the A-over-A Principle, or by the "Relativized A-over-A Principle" discussed in Fukui (2006), as indicated in (i).　A similar point is made in Abels (2003):

(i)　　　PP [+wh]

　　　　　/

　↑　P　DP [+wh]

　└──X──┘

If so, the derivation in (9′) should not be available to begin with.　See also Hartman (2007) for an argument against the Chain Uniformity account in Craenenbroeck (2004).

[4] Jason Merchant, Tim Stowell, and Chris Tancredi accept (15a) (with stress on P) while Howard Lasnik and Peter Sells reject it.

[5] There are some speakers who do not accept Swiping examples in (22).　However, Merchant's Minimality condition in (21) derived from a condition on (PF) Head Movement that the moved element must strictly be X^0 (= a syntactic head) would incorrectly rule out the existence of speakers who accept Swiping with complex *wh*-elements like those in (22).　There seems to be a dialectal variation among speakers concerning constraints on phonological/morphological properties of the remaining elements (*wh*-element and P) in Swiping, and speakers who reject Swiping like (22) seem to have stricter phonological/morphological constraints on the remaining elements.

[6] Marcel den Dikken (p.c.) pointed out to me the English example in (i) attributed to Pesetsky's (1989) GLOW paper, which seems interesting in this respect:

(i)　Which door did he knock twice intentionally on?

Here also, "knock twice intentionally" is interpreted as an information unit, and the sentence is acceptable without stress on the final P.

[7] We do not intend to claim that this cross-classification of speakers necessarily coincide with geographic dialectal distinction of Norwegian.　The data is too limited to make such a claim, and there are some data which seem to suggest that this four-way classification does not coincide with geographic dialectal distinction at least in certain respects; for instance, speakers of both type (ib) and type (iib) were attested among speakers of Trøndelag dialect, and speakers of both type (ib) and type (iia) were attested among speakers of Oslo dialect.

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Discontinuous Antecedents and Radical Reconstruction*
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1   Introduction

It is a traditional assumption in generative grammar that sound and meaning are indirectly connected through the syntactic component. In the minimalist program (MP) proposed by Chomsky (1995) and further developed by, among others, Chomsky (2004; 2005; 2006), the syntactic component contains operations that transfer the syntactic object (SO) already constructed in the syntactic component to the interfaces, called Transfer operations, which apply at the phase level. PF-Transfer operations hand the SO to the phonological component, which maps to the sensory-motor (S-M) interface; LF-Transfer operations hand the SO to the semantic component, which maps to the conceptual-intentional (C-I) interface. There remains an unsettled question as to at what stage of a derivation PF-Transfer and LF-Transfer should apply. Chomsky (2004; 2005; 2006) claims that phases are the same for PF-Transfer and LF-Transfer and thus both of the Transfer operations apply simultaneously, more specifically when structure- building completes a phase, which is CP and vP in his system. Since PF- Transfer and LF-Transfer are independent operations, however, there is no a priori reason to assume that they should apply simultaneously in a derivation.   In fact, it has been suggested by, among others, Megerdoomian (2002), Cecchetto (2004), and Marušič (2005) that phases should not be the same for PF-Transfer and LF-Transfer, and that these two Transfer operations should apply at different stages of a derivation.

   This paper argues that phases are the same for both PF-Transfer and LF-Transfer, that is, CP and vP, as argued by Chomsky (2004; 2005; 2006), but there are cases where these two Transfer operations do not apply simultaneously. More specifically, I propose that PF-Transfer and LF-Transfer may apply separately within a phase once the phase becomes "saturated" in the sense of Collins (2002). According to Collins (2002:46), an item is "saturated" if it does not contain any probe/selector property that needs to be satisfied; an item that contains at least one probe or selector is "unsaturated," where the selector property includes a θ-property and a categorial selection property. This analysis leads to an argument/adjunct asymmetry with respect to timing of merger within

a phase. Merger of an argument is triggered by a selector; it must be merged before PF-Transfer and LF-Transfer within a phase. Merger of an adjunct, on the other hand, is not triggered by any probe or selector. Hence, an adjunct may be merged before or after PF/LF-Transfer if we essentially assume with, among others, Lebeaux (1988), Ishii (1997; 1998), and Stepanov (2001), that an adjunct may be merged postcyclically within each phase. This allows merger of an adjunct (not merger of an argument) to be interweaved with PF-Transfer and LF-Transfer within a phase.[i] As an illustration, let us consider (1):

(1)   John deliberately broke the rules.

During its derivation, we construct the *v*P phase. According to our analysis, the arguments *John* and *the rules*, whose merger is triggered by their selector, must be merged cyclically. On the other hand, the adjunct *deliberately*, whose merger is not triggered by any probe or selector, may be merged either cyclically or postcyclically. Suppose that the adjunct *deliberately* is merged postcyclically. Then, the derivation of the *v*P phase of (1) proceeds as shown in (2). It should be noted that this paper assumes that complements are sisters to the head X whereas adjuncts are adjoined to XP:

(2)   a.   [$_{v}$P John [$_v$ [$_V$P break the rules]]]
      b.   [$_{v}$P John [$_v$ [$_V$P **deliberately** [$_V$P break the rules]]]]

As shown in (2a), the arguments *John* and *the rules* are merged cyclically; the VP-adjunct *deliberately* is merged (more specifically, adjoined to VP) postcyclically, as shown in (2b). It should be noted that the *v*P phase has already become "saturated" at stage (2a). Hence, PF/LF-Transfer may apply either at stage (2a), *i.e.*, before postcyclic merger of *deliberately*, or stage (2b), *i.e.*, after postcyclic merger of *deliberately*. In the former case, merger of the adjunct *deliberately* is interweaved with PF/LF-Transfer within a phase. In this case, the interweave of Merge and Transfer does not have any effect. I will argue, however, that there are cases where the interweave of Merge and Transfer does have an effect. It is shown that our interweave analysis can account for hitherto unexplained puzzling PF-LF mismatch phenomena. This paper discusses two PF-LF mismatch phenomena, *i.e.*, *do so* and *one* anaphora and radical reconstruction with Japanese scrambling. I will argue that these two phenomena, which have been assumed to be totally unrelated to each other, can be given a unified account in a principled way.

   The organization of this paper is as follows. Section 2 investigates anaphoric expressions *do so* and *one*. It is first shown that contrary to the widely accepted view, the antecedents of *do so* and *one* are not necessarily continuous parts of sentences, which is one instance of PF-LF mismatch phenomena. I will then

explicate Culicover and Jackendoff's (2005) analysis of *do so* and *one* anaphora, and show that their analysis cannot account for argument/non-argument asymmetries regarding the antecedents of *do so* and *one*. I will argue that the interweave of Merge and Transfer within a phase gives us a principled account of *do so* and *one* anaphor facts. Section 3 is concerned with radical reconstruction phenomena with Japanese scrambling, which is another instance of PF-LF mismatch phenomena. It is shown that given that Japanese scrambling is an optional movement, as argued by, among others, Fukui (1993) and Saito and Fukui (1998), the interweave of Merge and Transfer within a phase can account for radical reconstruction phenomena.

2   *Do So* and *One* Anaphora

2.1   Culicover and Jackendoff's (2005) Analysis

There are a number of traditional diagnostics of constituent structure, one of which relates to phenomena of substitution. The basic assumption behind substitution tests is that a particular string of words must be a constituent if it can be substituted (replaced) by something else. This paper is concerned with the anaphoric expressions *do so* and *one*, which have been used as diagnostics of constituent structure. More specifically, it has been widely assumed that *do so* substitutes a VP constituent, functioning as a VP anaphor.   Following Fromkin et. al. (2000) and Hornstein, Nunes, and Grohmann (2005), this paper assumes for expository purposes that what *one* replaces is an NP constituent, and thus *one* is an NP anaphor. Let us explicate a traditional analysis of *do so* and *one*, taking (3, 4) as examples:

(3)   a.   John <u>bought bread</u> in the supermarket, and Bill **did so** in the corner shop.   [*do so* = buy bread]
       b.   John <u>bought bread in the supermarket</u>, and Bill **did so** too.
            [*do so* = buy bread in the supermarket]

(4)   John likes the Italian <u>student of English</u>, but not the Spanish **one**.
       [*one* = student of English]

The structures of *buy bread in the supermarket* and *the Italian student of English* are as follows:

(5)   [$_{VP}$ [$_{VP}$ buy bread] [in the supermarket]]
(6)   [$_{DP}$ the [$_{NP}$ Italian [$_{NP}$ student of English]]]

In (5), the complement *bread* is the sister to the verb *buy*; the adjunct *in the supermarket* is adjoined to VP. The VP anaphor *do so* can replace either *buy bread* or *buy bread in the supermarket*, both of which are VPs. In (6), the complement *of English* is the sister to the noun *student*; the adjunct *Italian* is adjoined to NP. In (4), the NP anaphor *one* replaces the NP *student of English*.

It has been pointed out by Radford (1981) and Culicover and Jackendoff (2005) (C&J), however, that the antecedents of *do so* and *one* are not necessarily continuous parts of sentences, as shown below:

(7) a. Robin <u>slept</u> for twelve hours <u>in the bunkbed</u>, and Leslie **did so** for eight hours. [*do so* = sleep ... in the bunkbed]

  b. Robin <u>cooked Peking duck</u> on Thursday <u>in order to impress Ozzie</u>, and Leslie **did so** on Friday.
  [*do so* = cook Peking duck ... in order to impress Ozzie]
  (Culicover and Jackendoff 2005: 285)

(8) a. I put that silly <u>picture of Robin</u> from Mary <u>that was on the table</u> next to this artful **one** from Susan.
  [*one* = picture of Robin ... that was on the table]

  b. I put that <u>silly picture of Robin</u> from Mary <u>that was on the table</u> next to this **one** from Susan.
  [*one* = silly picture of Robin ... that was on the table]
  (Culicover and Jackendoff 2005: 137)

  c. Jane has a <u>big</u> black <u>dog</u>, and Jean has a brown **one**.
  [*one* = big ... dog] (Radford 1981: 117)

In (7a, b), the antecedents of *do so* are *sleep in the bunkbed* and *cook Peking duck in order to impress Ozzie*, respectively. However, they are not continuous parts of the sentences. Similarly, in (8a-c), the antecedents of *one* are *picture of Robin that was on the table*, *silly picture of Robin that was on the table*, and *big dog*, respectively; they are not continuous parts of the sentences, either.

Based on these facts, C&J claim that the *do so* and *one* substitution operations do not count as constituency tests or provide any evidence for the internal structures of VP and DP. They claim that syntactic structures are "flat" in the sense that there is no hierarchical distinction within VP and DP (more generally, XP). Under their analysis, the antecedents of *do so* and *one* are not determined by structural conditions, but rather by what they call indirect licensing (IL). The indirectly licensed constituent is taken as anaphoric to the antecedent in that its interpretation is constructed on the basis of that of the antecedent. Their formulations of *do so* anaphora and *one*-anaphora are given below (Culicover and Jackendoff 2005: 289, 292):

(9)   *Do so* anaphora
      Syntax: [$_{VP}$ [$_V$ do][$_?$ so] < YP$_i^{ORPH}$>]^{IL}
      CS: [$_{Action}$ F (...); ... <Y$_i$> ...]

(10) *One*-anaphora
      Syntax: [$_{DP}$ <Det/NP$_i^{ORPH1}$> < YP$_j^{ORPH2}$> one < ZP$_k^{ORPH3}$>]^{IL}
      CS: [F (...); ... <X$_i$> <Y$_j$> <Z$_k$>...]

Putting the details aside, what (9) says is that in Syntax, a VP consisting of *do so* and an optional orphan YP (abbreviated as YP with superscript ORPH) is connected to an antecedent by IL. IL also connects the orphan YP to a target within the antecedent. After we establish the antecedent, the function F in the Conceptual Structure (CS) is constructed by reference to the antecedent. Let us consider (3a) (repeated here as (11)) as an example:

(11) John <u>bought bread</u> in the supermarket, and Bill **did so** in the corner shop.

According to (9), IL connects the VP *do so in the corner shop* to its antecedent *buy bread in the supermarket*, and the orphan *in the corner shop* to its target *in the supermarket* within the antecedent. The content of the function F can be copied from the CS of the antecedent, except that the target *in the supermarket* in the antecedent is substituted by the orphan *in the corner shop*. This provides the correct interpretation, *i.e.*, *buy bread in the corner shop*, for the VP *do so in the corner shop*. Similarly, what (10) says is that a DP consisting of *one* and optional orphans Det/NP, YP, and ZP are connected to an antecedent by IL. Let us consider (4) (repeated here as (12)) as an example:

(12) John likes the Italian <u>student of English</u>, but not the Spanish **one**.

According to (10), IL connects the DP *the Spanish one* to its antecedent *the Italian student of English*, and the orphans *the* and *Spanish* to their targets *the* and *Italian*. The function F can be constructed by reference to the antecedent. This provides the correct interpretation, *i.e.*, *the Spanish student of English*, for the DP *the Spanish one*. It should be noted that since their analysis does not refer to any structural notions, it can also accommodate cases like (7) and (8), where the antecedents of *do so* and *one* are not continuous parts of the sentences.

   C&J's analysis, however, cannot provide a principled account for well-known argument/non-argument asymmetries with respect to orphans. As shown in (3a) and (4), *do so* and *one* allow non-arguments to be their orphans; *in the corner shop* in (3a) and *the Spanish* in (4). On the other hand, *do so* and *one* do not allow arguments to be their orphans, as shown in (13) and (14):

(13) *John bought bread in the supermarket, and Bill **did so** <u>milk</u> in the corner shop.

(14) *John likes the Italian student of English, but not the Spanish **one** <u>of French</u>.

In (13, 14), the orphans include the arguments, *milk* and *of French*; the result is deviant. In order to accommodate this asymmetry, their analysis has to designate the orphan as a non-argument rather than an argument in CS. Under their notation of CS, arguments are placed in parentheses while non-arguments are separated off by a semicolon. In the CSs of (9, 10), the orphans are separated off by a semicolon, and therefore they are restricted to non-arguments. Although this notation makes the distinction between arguments and non-arguments, it only provides a stipulation, not an explanation, for this asymmetry.

Contrary to C&J's analysis, this paper argues that the traditional assumption is correct in claiming that *do so* and *one* can only substitute constituents. I will argue that apparent counterexamples like (7, 8) straightforwardly follow from the interweave of Merge and Transfer within a phase.

2.2   A Proposal

Section 2.1 has pointed out the puzzling fact that the antecedents of *do so* and *one* are not necessarily continuous parts of sentences. In this section, I will argue that the traditional observation that only constituents can function as the antecedents of *do so* and *one* anaphora is correct, and that the puzzling fact can be accounted for by the interweave of Merge and Transfer within a phase.

Let us consider (7a) and (8c) (repeated here as (15) and (16)) as examples:

(15)   Robin <u>slept</u> for twelve hours <u>in the bunkbed</u>, and Leslie **did so** for eight hours.

(16)   Jane has a <u>big</u> black <u>dog</u>, and Jean has a brown **one**.

This paper assumes that the interpretations of *do so* and *one* anaphora should be determined at LF by copying their antecedent. Let us first consider *do so*, taking (15) as an example. During the derivation of its first conjunct *Robin slept for twelve hours in the bunkbed*, we construct the following *v*P structure, where the argument *Robin* is merged cyclically:

(17) [$_{vP}$ Robin [*v* [$_{VP}$ sleep]]]

It should be noted that this *v*P is "saturated," since it does not contain any probe or selector that needs to be satisfied. Hence, we may apply Transfer at stage (17) or later within the *v*P phase. Suppose that before we apply Transfer, we merge an

adjunct. Since there is no ordering restriction on applications of postcyclic merger of adjuncts, we merge either *for twelve hours* or *in the bunkbed* at this stage. Suppose that we merge *in the bunkbed* first, which yields structure (18):

(18) [$_v$P Robin [v [$_{VP}$ [$_{VP}$ sleep] **[in the bunkbed]**]]]

At this stage, we apply LF-Transfer in the *v*P phase. Let us assume with Chomsky (2004; 2005; 2006) that PF/LF-Transfer sends the complement of a phase head to the PF/LF component. In the present case, LF-Transfer sends the complement of the phase head *v*, *i.e.* the larger VP *sleep in the bunkbed* to the LF-component, as depicted below:

(19) [$_v$P Robin [v **[$_{VP}$ [$_{VP}$ sleep] [in the bunkbed]]**]]
$$\Downarrow$$
LF-Transfer

The VP anaphor *do so* in the second conjunct copies this LF-transferred VP in the first conjunct, which yields the interpretation that the antecedent of *do so* is *sleep in the bunkbed*. We then adjoin *for twelve hours* to the smaller VP postcyclically, yielding (20):

(20) [$_v$P Robin [v [$_{VP}$ [$_{VP}$ [$_{VP}$ sleep] **[for twelve hours]**] [in the bunkbed]]]]

At this stage, we apply PF-Transfer in the *v*P phase, which sends the complement of the phase head *v*, *i.e.* the largest VP *sleep for twelve hours in the bunkbed*, to the PF-component:

(21) [$_v$P Robin [v **[$_{VP}$ [$_{VP}$ [$_{VP}$ sleep] [for twelve hours]] [in the bunkbed]]**]]
$$\Downarrow$$
PF-Transfer

This PF-Transferred VP is subject to linearization in the PF-component.[ii] Let us consider how to linearize this PF-Transferred VP, especially the two rightward (right-adjoined) adjuncts.

   This paper basically adopts Kayne's (1994) antisymmetric theory of phrase structure, which is based on the hypothesis that what is structurally higher necessarily precedes what is lower (*i.e.*, the Linear Correspondence Axiom). Following Takano (2003), however, I assume that Kayne's antisymmetric view should be weakened. More specifically, rightward merger (rightward adjunction), which should not be allowed in the antisymmetric hypothesis, is needed to account for rightward adjuncts like *for twelve hours* and *in the bunkbed* in (21); such adjuncts are not subject to the antisymmetric hypothesis. Takano's

argument for positing rightward merger and thus weakening the antisymmetric hypothesis is made on the basis of the following facts (Branigan 1992: 45):

(22) a.   John paints pictures **at all** well <u>only rarely</u>.
    b.   John tells jokes **with any gusto** <u>only occasionally</u>.

In (22), the adjunct Negative Polarity Items (NPIs) *at all* and *with any gusto* are licensed by the rightmost adjuncts *only rarely* and *only occasionally*, respectively, which indicates that the rightmost adjuncts are located structurally higher than the preceding adjunct NPIs. This has led Takano to conclude that in the case of rightward adjuncts, what is structurally lower precedes what is higher. One might argue that rightward merger is not the only way to derive (22); there is a way of deriving (22) in accordance with the antisymmetric hypothesis. (22a), for example, could be derived by generating the licensing rightmost adjunct *only rarely* in a structurally higher position than the phrase containing the NPI *paints pictures at all well*, and moving *paints pictures at all well* over *only rarely*, as shown in (23). It should be noted that this analysis requires that the NPI *at all* should be licensed by *only rarely* under reconstruction:

(23) a.   John only rarely [paints pictures at all well].
    b.   John [$_\alpha$ paints pictures at all well] only rarely t_α.

Takano points out, however, that this antisymmetric analysis is untenable, since NPIs cannot be licensed under reconstruction, as observed by, among others, Laka (1990) and Phillips (1996):

(24) a.   *[Buy **any records**]$_i$ she did<u>n't</u> t_i.   (Laka 1990: 195)
    b.   *[Whose theory about **anything**]$_i$ does John <u>not</u> like t_i?
                                                (Phillips 1996: 53)

Given this property of NPIs, (22a) cannot involve derivation (23). Hence, the rightmost licensing adjuncts in (22) must be merged rightward (right-adjoined to VP) in a structurally higher position than the preceding NPIs. According to this "weakly antisymmetric" hypothesis, the PF-Transferred VP, *i.e.*, the largest VP, in (21) is correctly assigned the linear order *sleep for twelve hours in the bunkbed*. Hence, the interweave of Merge and Transfer within a phase enables us to account for (15), where the antecedent of *do so* is *sleep in the bunkbed*, which is a discontinuous part of the sentence.

    Let us next consider *one*, taking (16) as an example. Let us assume with, among others, Chomsky (2006) that in addition to CP and *v*P, DP also counts as a phase. During the derivation of its first conjunct *Jane has a big black dog*, we construct the following DP structure, where *a* and *dog* are merged cyclically:

(25) [DP a [NP dog]]

It should be noted that this DP is "saturated," since it does not contain any probe or selector that needs to be satisfied. Hence, we may apply Transfer at stage (25) or later within the DP phase. Suppose that we merge an adjunct before we apply Transfer. We may merge either *big* or *black* postcyclically at this stage. Suppose that we first merge *big*, as shown in (26). At this stage, we apply LF-Transfer to this DP phase, sending the complement of the phase head D, *i.e.* the larger NP *big dog*, to the LF-component:

(26) [DP a **[NP big [NP dog]]**]   (LF-Transfer)

Then, the NP anaphor *one* copies this LF-transferred NP *big dog* in the first conjunct, which results in the interpretation that the antecedent of *one* is *big dog*. We then merge (adjoin) *black* to the smaller NP postcyclically, yielding (27). At this stage, we apply PF-Transfer, sending the complement of D, *i.e.* the largest NP *big black dog*, to the PF-component:

(27) [DP a **[NP big [NP black [NP dog]]]**]   (PF-Transfer)

Linearization applies to this PF-Transferred NP, yielding the linear order *big black dog*.[iii] Hence, we can account for (16), where the antecedent of *one* is *big dog*, a discontinuous part of the sentence.

   Our analysis can also account for the argument/non-argument asymmetry with respect to *do so* and *one* anaphora, which C&J cannot account for in a principled way. Recall that although *do so* and *one* can co-occur with non-arguments, they cannot co-occur with arguments, as shown in (13) and (14) (repeated here as (28) and (29)):

(28) *John bought bread in the supermarket, and Bill **did so** <u>milk</u> in the corner shop.
(29) *John likes the Italian student of English, but not the Spanish **one** <u>of French</u>.

Let us consider (28) as an example. Under our analysis, the adjunct *in the supermarket* in the first conjunct may be merged before or after PF/LF-Transfer in the *v*P phase. Suppose that it is merged after PF-Transfer and LF-Transfer. The argument *bread*, on the other hand, must be merged cyclically, *i.e.*, before PF-Transfer and LF-Transfer, in the *v*P phase, as shown (30). At this stage, we apply PF-Transfer and LF-Transfer, sending the complement of *v* to the PF- and LF-components:

(30) [$_v$P John [v **[VP buy bread]**]]   (PF-Transfer and LF-Transfer)

The argument *bread*, therefore, must be part of the LF-Transferred VP. This LF-Transferred VP is copied by *do so* in the second conjunct, which yields (31):

(31) ..., Bill Tense **buy bread** milk in the corner shop.

In (31), the verb *buy* would have two objects at LF, *i.e.*, *bread* and *milk*, which violates the θ-criterion; the deviance of (28) follows. (29) can be accounted for in the same way.

2.3   Against "Hidden" Movement Analyses

One might argue that examples like (7) and (8), where the antecedents of *do so* and *one* are not continuous parts of sentences, could be accounted for without recourse to the interweave of Merge and Transfer if we assume "hidden" movement operations. Under "hidden" movement analyses, there would be a stage of derivation where the discontinuous parts are constituents. Let us consider (15) (repeated here as (32)) again as an example:

(32) Robin <u>slept</u> for twelve hours <u>in the bunkbed</u>, and Leslie **did so** for eight hours.

We would first generate underlying structure (33):

(33) [VP **[VP [VP sleep] [in the bunkbed]]** [for twelve hours]]

The VP-anaphor *do so* would substitute the intermediate VP *sleep in the bunkbed*, which would be a constituent at this stage. In order to derive the surface order, we would either move *in the bunkbed* rightward over *for twelve hours*, as shown in (34), or move *in the bunkbed* leftward followed by remnant movement of the VP, as shown in (35):

(34) [VP [VP [VP [VP sleep] $t\alpha$] [for twelve hours]] [α in the bunkbed]]
(35) [VP sleep $t\alpha$ for twelve hours] [α in the bunkbed] t_{VP}

The "hidden" movement analysis is implausible, however, since the "hidden" movement operations involved here are not motivated by any principles, but stipulated simply for the purpose of making the discontinuous parts function as antecedents and yielding the correct surface order. Furthermore, as argued by C&J, there is evidence to cast doubt on the "hidden" movement analysis; there is

a fixed order among modifying adjuncts (C&J 2005: 138; cf. Jackendoff 1977)

(36) a.   the man arrested in the park who was carrying a rifle
    b. *the man who was carrying a rifle arrested in the park

As shown in (36), when the two adjuncts *arrested in the park* and *who was carrying a rifle* modify the same NP *man*, the former must precede the latter. Let us then consider the following example:

(37) the <u>man</u> arrested in the park <u>who was carrying a rifle</u> and the **one** found
    hiding in the gazebo   [*one* = man who was carrying a rifle]
                      (Culicover and Jackendoff 2005: 138)

In (37), the antecedent of *one* is a discontinuous part of the sentence, *i.e.*, *man who was carrying a rifle*. Under the "hidden" movement analysis, the underlying structure of (37) would be as follows:

(38) [$_{DP}$ the [$_{NP}$ [$_{NP}$ [$_{NP}$ man] [who was carrying a rifle]] [arrested in the park]]]

The NP anaphor *one* would substitute the intermediate NP *man who was carrying a rifle*. We would then either move *who was carrying a rifle* rightward over *arrested in the park* or move *who was carrying a rifle* leftward followed by remnant movement of the NP; this would yield the correct surface order. Although it is mechanically possible for the "hidden" movement analysis to arrange a derivation that creates the antecedent *man who was carrying a rifle* for the purpose of the NP anaphora *one*, it would have to assume underlying structure (38), which cannot exist on the surface, as shown by the deviance of (36b). This casts serious doubt on the "hidden" movement analysis. Our analysis, on the other hand, can account for (37) without positing any non-existent structure throughout its derivation, as shown below:

(39) a.   [$_{DP}$ the [$_{NP}$ man]]
    b.   [$_{DP}$ the **[$_{NP}$ [$_{NP}$ man] [who was carrying a rifle]]**]   (LF-Transfer)
    c.   [$_{DP}$ the **[$_{NP}$ [$_{NP}$ [$_{NP}$ man] [arrested in the park]] [who was carrying a rifle]]**]   (PF-Transfer)

First, as shown in (39a), *the* and *man* are merged cyclically. We then merge the adjunct *who was carrying a rifle* to the NP, as shown in (39b). At this stage, we apply LF-Transfer, sending the complement of D, *i.e.*, the larger NP *man who was carrying a rifle*, to the LF-component. The NP anaphor *one* in the second conjunct copies this LF-transferred NP in the first conjunct, which correctly

yields the interpretation that the antecedent of *one* is *man who was carrying a rifle*. We then merge the other adjunct *arrested in the park* to the lower NP postcyclically, as shown in (39c). We apply PF-Transfer to (39c), correctly yielding the linear order *man arrested in the park who was carrying a rifle*. It should be noted that under our analysis, at no stage of this derivation do we have to posit structure (38), which cannot exist on the surface.

This section was concerned with the PF-LF mismatch phenomena regarding anaphoric expressions *do so* and *one*. I have argued that the interweave of Merge and Transfer within a phase enables us to account for the *do so* and *one* anaphor facts in a principled way. In the next section, I will argue that the interweave of Merge and Transfer can also account for radical reconstruction phenomena with Japanese scrambling, another instance of PF-LF mismatch phenomena.

3   Radical Reconstruction with Japanese Scrambling

Let us first consider the following examples (Saito 1989: 190):

(40) a.   [John-ga   Mary-ni [**dare-ga**   kuru **ka**] osieta] (koto)
              -Nom   -Dat **who-Nom** come **Q** taught (fact)
         'John told Mary Q who is coming.'
   b.   *[John-ga   **dare-ni** [Mary-ga   kuru **ka**] osieta] (koto)
              -Nom **who-Dat**   -Nom come **Q**   taught (fact)
         'John told who Q Mary is coming.'

In (40), only the embedded clause, which is marked by the Q-morpheme *ka*, is an interrogative. While the *wh*-phrase *dare-ga* 'who' is contained within the embedded clause in (40a), the *wh*-phrase *dare-ni* 'who-Dat' is not in (40b).   The contrast between (40a) and (40b) indicates that a *wh*-phrase must be contained within an interrogative clause. Let us next look at the following example:

(41) a.   [Mary-ga [John-ga   **dono hon-o**   tosyokan-kara karidasita
                 -Nom   -Nom **which book-Acc** library-from   checked-out
         ka] siritagatteiru] (koto)
         Q   want-to-know (fact)
         'Mary wants to know which book John checked out from the library.'
   b.   ?[**dono hon-o** [Mary-ga [John-ga *t* tosyokan-kara karidasita **ka**]
         siritagatteiru]](koto)   (Saito 1989: 191-192)

(41b) is derived from (41a) by scrambling of the *wh*-phrase *dono hon-o* 'which book-Acc' to the matrix clause. Although the *wh*-phrase is not contained within the embedded interrogative clause, it can still take embedded scope. Based on

this fact, Saito (1989) argues that scrambling can be undone, *i.e.*, the scrambled phrase can be totally reconstructed, in the LF-component. In (41b), the scrambled phrase is totally reconstructed in the LF-component, and contained within the interrogative clause; this satisfies the licensing condition on *wh*-phrases. It remains an unsettled question, however, why scrambling can be undone. I argue that this property of scrambling straightforwardly follows from the interweave of Merge and Transfer within a phase together with the assumption that scrambling is an optional movement (see, among others, Fukui 1993 and Saito and Fukui 1998). Given that scrambling is an optional movement and thus not triggered by any probe or selector, it should be treated on a par with merger of an adjunct. This allows scrambling to be interweaved with PF-Transfer and LF-Transfer within a phase.

Let us consider (41b). During its derivation, we construct the following *v*P structure cyclically[iv]:

(42) [$_{v}$P John-ga [[$_{VP}$ dono hon-o tosyokan-kara karidasu] *v*]]
         -Nom   which book-Acc library-from   check-out

At this stage, we apply LF-Transfer to (42) in the *v*P phase, sending the complement of the phase head *v*, *i.e.* the VP *dono hon-o tosyokan-kara karidasu* 'which book-Acc library-from check-out' to the LF-component:

(43) [$_{v}$P John-ga [**[$_{VP}$ dono hon-o   tosyokan-kara karidasu] *v*]]**
         -Nom   **which book-Acc library-from   check-out**

It should be noted that the *wh*-phrase *dono hon-o* 'which book-Acc' is interpreted in-situ at LF before undergoing scrambling. Since it is contained within the embedded interrogative clause, it satisfies the licensing condition on *wh*-phrases. The *wh*-phrase *dono hon-o* 'which book-Acc' gets devoid of its LF-content at this stage. We then apply scrambling to *dono hon-o* 'which book-Acc', which only has its PF-content, and merge it with *v*P postcyclically, yielding (44). We apply PF-Transfer to (44) in the *v*P phase, sending the complement of *v*, *i.e.* the VP *t$_i$ tosyokan-kara karidasu* '*t$_i$* library-from check-out' to the PF-component:

(44) [$_{v}$P dono hon-o$_i$ [$_{v}$P John-ga [**[$_{VP}$ *t$_i$* tosyokan-kara karidasu] *v*]]]**
         which book-Acc   -Nom   **library-from   check-out**

Linearization applies to this PF-transferred VP, yielding the linear order *tosyokan-kara karidasu* 'library-from check out'. It should be noted that the copy/trace left by scrambling is immune from linearization. The *wh*-phrase *dono hon-o* 'which book-Acc' undergoes successive cyclic movement to its final landing site, *i.e.*, the matrix TP-adjoined position, as shown in (45):

(45) [$_{CP}$ [$_{TP}$ **dono hon-o$_i$**   [$_{TP}$ **Mary-ga**   [**John-ga ...**
          which book-Acc   **-Nom**   **-Nom**

We apply PF-Transfer as well as LF-Transfer in the matrix CP phase, sending the complement of the phase head C, *i.e.* the larger matrix TP, to the PF- and LF-components. It is important to note that the scrambled phrase *dono hon-o* 'which book-Acc', which has already been transferred to the LF-component in the embedded *v*P phase, is transferred to the PF-component and hence assigned its linear order at this stage. The *wh*-phrase *dono hon-o* 'which book-Acc' receives its LF interpretation in-situ in the embedded *v*P phase (43), and then receives its PF-interpretation at the matrix TP-adjoined position in the matrix CP phase (45). Hence, our analysis can account for the radical reconstruction property of Japanese scrambling.[v]

4. Conclusion

In this paper, I have proposed that merger of an adjunct, but not merger of an argument, may be interweaved with PF-Transfer and LF-Transfer within a phase. It is shown that our analysis gives us a unified account of the two puzzling PF-LF mismatch phenomena which have been assumed to be totally unrelated to each other, *i.e. do so* and *one* anaphora and the radical reconstruction property of Japanese scrambling.

Notes

[i] Assuming the previous minimalist model, Nissenbaum (2000) argues that Spell-Out (PF-Transfer in the present term) may apply before merger of an adjunct and thus merger of an adjunct may be interweaved with PF-Transfer within a phase. Our analysis differs from Nissenbaum's in that not only PF-Transfer but also LF-Transfer may be interweaved with merger of an adjunct within a phase, which enables us to account for PF-LF mismatch phenomena which are to be presented below.
[ii] I argue that the adjunct *for twelve hours*, which has not been transferred to the LF-component in this *v*P phase, undergoes LF-Transfer in the next CP phase. A question arises how the adjunct, which is within VP, is still accessible in the next CP phase. Given the definition of domination based on the category/segment distinction proposed by May (1985), the adjunct *for twelve hours* is not dominated by VP. I argue that those elements like the VP adjunct *for twelve hours* which are not dominated by the transferred domain are still "accessible" and thus may undergo Transfer in the next phase.
[iii] Note that the adjunct *black* undergoes LF-Transfer at the next *v*P phase.
[iv] In what follows, I assume for expository purposes that Japanese is right-headed in its base structure, which is contrary to Kayne's (1994) universal Specifier-Head-Complement word order hypothesis. It should be noted that discussions to follow hold irrespectively of whether Japanese is right-headed or left-headed in its base structure.
[v] Sauerland and Elbourne (2002) claim that scrambling is a PF-movement, which accounts for its radical reconstruction property. Their analysis, however, cannot account for binding facts; there are

cases where scrambled phrases function as antecedents for anaphors and thus have effects on LF. In (i), for example, the scrambled phrase *karera-o* 'they-Acc' functions as an antecedent for the reciprocal *otagai* 'each other'. (Saito 2003: 485):

(i) ?**Karera-o** [[otagai-no sensei]-ga   *t* hihansita] (koto)
    they-Acc   each other-Gen teacher-Nom   criticized (fact)
    'Each other's teacher criticized them.'

For further discussion of binding facts under the analysis proposed here, see Ishii (2007).

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Effects of Post-Pronominal Information on Pronoun Resolution

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1. Introduction[*]

It is widely assumed that a pronoun is preferentially interpreted as referring to whatever referent is most salient when the pronoun is encountered. On this view, information that precedes the pronoun plays a central role in guiding pronoun interpretation. For example, according to the widespread view that subjects are by default more salient than objects, the subject pronoun in the second sentence of ex.(1) is predicted to be more likely to refer to the preceding subject (Bob) than to the object (Jim).

(1) Bob kicked Jim. He...

In this paper, I investigate effects of information not available to the processing system until after the pronoun has been encountered. It has been observed in previous work (e.g., Winograd 1972, Grosz, Joshi & Weinstein 1995, Kehler 2002) that information available after the pronoun (e.g. verb semantics) may influence reference resolution, but there has been little systematic psycholinguistic investigation of what kinds of post-pronominal factors have an impact. Most existing psycholinguistic research tends to focus on the effect of information available before the pronoun.

This paper aims to contribute to our understanding of how post-pronominal information impacts reference resolution by testing whether the interpretation of sentence-initial ambiguous pronouns is influenced by the referential properties of the remainder of the sentence. This research builds on predictions derived from work by Grosz et al. (1995)'s Centering Theory, and aims to provide experimental results that can be used to enrich existing theories of reference resolution (see also Kaiser (to appear) for related work).

The structure of the paper is as follows. In Section 1.1, I review existing work on how pronoun interpretation is affected by information that precedes the pronoun. In Section 2, I turn to the role of post-pronominal information, and

consider whether post-pronominal referential properties, in particular the presence vs. absence of another argument, influence interpretation of pronouns in subject position. Experiment 1 (Section 3) shows that the presence of post-pronominal arguments is correlated with an increased likelihood of subject interpretations. Experiment 2 (Section 4) shows that the result obtained in the first study cannot be attributed to unaccusativity. In Section 5, I sketch out a possible way of explaining the referential effects found in Experiments 1 and 2.

1.1 Role of information that precedes the pronoun

Research on pronoun resolution often ascribes to the view that pronouns refer to entities that are highly salient when the pronoun is encountered (e.g., Ariel 1990, Gundel et al. 1993). The important question of what makes entities highly salient has received a lot of attention, and a range of salience-influencing factors have been posited in the literature. In the remainder of this section, I review three factors that are relevant to the experiments discussed in this paper.

Perhaps the most robustly-supported factor is grammatical role, specifically the idea that subjects are more salient than objects (e.g., Chafe 1976, Brennan, Friedman & Pollard 1987, Crawley & Stevenson 1990, see also Gordon, Grosz & Gilliom 1993). However, it has been argued that a subject preference could also be attributed to parallelism, i.e., the observation that pronouns in particular syntactic positions prefer antecedents that are in the same syntactic position (e.g. Sheldon 1974, Smyth 1994). However, what about pronouns in object position? According to parallelism, a pronoun in object position will prefer an antecedent in object position, as observed in experimental outcomes (e.g. Smyth 1994).

Another factor that has been argued to influence pronoun resolution is the nature of the relation between the two clauses. This relation can be implicit, or it can be signaled overtly by connectives such as 'and as a result' or 'and similarly.' Existing research has shown that *result* connectives redirect attention to objects (e.g., Stevenson et al. 2000, for coherence-based accounts see Kehler 2002, Wolf et al 2004). Thus, on the basis of existing research we predict that the ambiguous subject pronoun in (2) is more likely to be interpreted as referring to the preceding object (Jim) with *as a result* than with *then*.

(2) Bob tickled Jim and {then/as a result} he…

2. Post-Pronominal Information

Having reviewed some of the pre-pronominal factors that have been argued to influence reference resolution, in this section I turn to research on the effects of information that is not available to the processing system until after the pronoun has been encountered. Post-pronominal factors have not received much attention in the psycholinguistic research on pronoun interpretation, but have been

acknowledged more explicitly in computational linguistics work (e.g. Winograd 1972, Grosz et al. 1995, Kehler 2002).

2.1 Effects of post-pronominal referential information

This paper focuses on a particular kind of post-pronominal information, namely the referential properties of the remainder of the clause – specifically the question of whether mention of other referents in the remainder of the sentence has an effect on how we interpret a pronoun in subject position.

The idea that the interpretation of a subject pronoun is influenced by whether another referent is mentioned subsequently is discussed in Centering Theory, a computationally-based model of the local-level component of attentional state in discourse. Centering Theory is based on extensive corpus work, and makes predictions regarding the connections between focus of attention, choice of referring expression and local coherence (Grosz, Joshi & Weinstein 1995). In Centering Theory, the entities mentioned in an utterance ('centers') are ranked in terms of how salient ('central') they are. In English the centers are commonly assumed to be ranked by grammatical role, with subjects ranked above objects.

According to Centering Theory, sequences of utterances can be more or less coherent and therefore carry varying amounts of processing load. The coherence of the transition from one utterance to the next depends on (a) whether, (b) in what position and (c) with what form the most central entity from one sentence is mentioned in the next sentence. For example, using a subject pronoun in Utterance 2 to refer to the most central entity mentioned in Utterance 1 makes for a more coherent transition than use of an object pronoun in Utterance 2 to refer to the most central entity in Utterance 1. Centering Theory posits four transition types, of differing levels of coherence and processing load. Due to space limitations, I cannot provide a full overview of Centering Theory or the transition types here. The reader is referred to Grosz, Joshi & Weinstein (1995) and Walker, Joshi & Prince (1998) and the references cited therein for details.

2.2 Predictions for different sentence frames

Let us now take a closer look at the predictions that can be derived from Centering Theory regarding the effects of post-pronominal referential information, and compare them to the predictions of a subjecthood-based account and a parallelism-based account. It is important to note that the original Centering Theoretic work by Grosz, Joshi & Weinstein (1995 and earlier versions) is not a pronoun resolution algorithm, but a Centering-based algorithm for pronoun interpretation was proposed by Brennan, Friedman & Pollard (1987, BFP). The BFP algorithm assumes that more coherent transitions are preferred over less coherent transitions and assigns pronominal reference accordingly (see also Poesio et al. 2004).

To illustrate how the interpretation of a subject pronoun is influenced by subsequent mentions of other entities in the BFP algorithm, let us consider example (3). Here, as in the experiments discussed later in this paper, I consider (i) three sentence frames (intransitive, transitive+full NP, transitive+pronoun) and (ii) two connectives (*as a result* and *then*). Nonsense verbs and nouns are used to eliminate potential effects of lexical semantics.

(3) Linda tulvered Barbara and {as a result/then}
(a) …she sprelled.   [intransitive]
(b) …she sprelled the jeg.   [transitive+full NP]
(c) …she sprelled her.   [transitive+pronoun]

Let us start by considering the effect of sentence frame and then turn to the connectives. First, let's consider the intransitive frame in (3a) and the transitive+full NP frame in (3b). According to Centering Theory, interpreting the subject pronoun 'she' in (3a) and (3b) as referring to Linda results in as coherent a transition as interpreting 'she' as referring to Barbara.[i] In other words, in a situation where both Barbara and Linda are new information in the first clause (i.e., the clause has no backward-looking center, in Centering terms) and only Barbara or Linda is mentioned in the second clause,[ii] the pronoun can refer equally felicitously to either the subject or the object. In this regard, the predictions of Centering Theory differ from the predictions of a simple 'subject preference' account, which would predict an overall subject preference for 'she' in both (3a) and (3b). Parallelism presumably also predicts a preference for the preceding subject over the preceding object in both cases, since we are dealing with a pronoun in subject position.

Let us now turn to the transitive+pronoun frame in (3c). Centering Theory predicts that if the second clause mentions both referents from the preceding clause, there should be a preference for the interpretation in which the subject pronoun 'she' refers to Linda (preceding subject) and the object pronoun 'her' refers to Barbara (preceding object).[iii] In other words, according to Centering there should be a stronger preference for 'she' to refer to the preceding subject in the transitive+pronoun frame in (3c) than in the intransitive frame in (3a) or the transitive+full NP frame in (3b). This prediction does not follow from a simple 'subject preference' account, which would presumably predict equally strong subject preferences in all three sentence frames. According to a parallelism-based account, one might expect the subject preference of 'she' to be stronger in (3c) than in (3a) and (3b), due to the presence of the object pronoun 'her' in (3c) exerting its own parallelism preference. However, in all three conditions a parallelism-based account presumably nevertheless predicts a preference for the subject over the object.

What about the effects of the connectives *as a result* and *then*? The core versions of Centering, parallelism and subjecthood-based accounts do not make

specific predictions regarding the effects of discourse connectives. However, on the basis of preceding research we expect to see more subject interpretations of 'she' with *then* than with *as result*. Furthermore, given that existing work has shown that the nature of the inter-clausal relation influences pronoun resolution, I included the connective manipulation in the experiments in order to control what kind of relation participants posit to hold between the two clauses. Not specifying a particular connective would have led to considerable ambiguity and would have made the data harder to interpret and potentially 'noisier.'

3. Experiment 1

Experiment 1 aimed to test whether the referential properties of the pronoun-containing clause influence the interpretation of an ambiguous pronoun in subject position. In particular, I wanted to find out how the three sentence frames (intransitive, transitive+full NP and transitive+pronoun) impact pronoun interpretation and whether they pattern as predicted by Centering Theory.

In this experiment, native English speakers (n=18) listened to the stimuli (an example is shown in (4a-c), repeated from (3)), presented over headphones. The sentences were spoken with neutral intonation. After each sentence, a question appeared on the computer screen (e.g. 'Who did the sprelling?'), followed by two answer choices (in critical items, these were the two names from the preceding sentence, e.g. Linda and Barbara). Participants pressed a button to indicate their answer. There were 36 target items and 36 fillers. The experiment also included some memory questions about the nonsense words. The experiment had a 2x3 design, and crossed discourse connective type (*then/as a result*) with sentence frame (intransitive, transitive+full NP, transitive+pronoun). Nonsense words were used in place of verbs and nouns in order to factor out any effects of lexical semantics in order to focus on the effects of argument frames.

(4) Linda tulvered Barbara and {as a result/then}
(a) …she sprelled.   [intransitive]
(b) …she sprelled the jeg.   [transitive+full NP]
(c) …she sprelled her.   [transitive+pronoun]

As discussed above, existing work on connectives leads to the expectation that there will be more subject interpretations with *then* than with *as a result*. Furthermore, if both connective type and post-pronominal information guide reference resolution in the manner predicted by Centering Theory, we expect to see a more subject interpretations in the transitive+pronoun conditions than in the intransitive conditions or in the transitive+full NP conditions. However, if post-pronominal information is not taken into account (e.g., if interpretation of

subject-position pronouns is guided only by a preference for preceding subject), an equal number of subject choices is expected for all three sentence frames.

3.1 Results and discussion

Let us first consider the effects of connective type. Participants' responses to the critical questions show that their interpretation of the subject pronoun is influenced by the nature of the connective between the two clauses. As predicted on the basis of previous work, there is a significant effect of connective type. The subject pronoun is more likely to be interpreted as referring to the preceding object with *as a result* than *then*: In the *result* conditions, participants produced an average of approx. 36% subject choices, whereas in the *then* conditions there were over 80% subject choices on average.
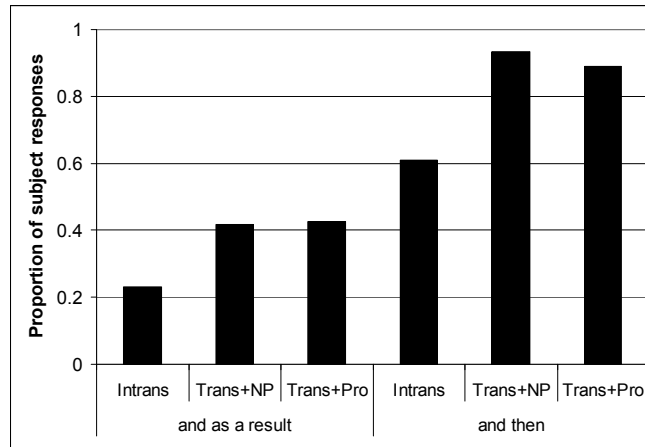

Figure 1. Proportion of subject choices in Experiment 1

Crucially, as Figure 1 shows, the nature of the sentence frame also has an effect, but not quite in the way that one might have expected: Within the *then* and the *result* conditions, there are significantly more subject-interpretations with transitive frames (transitive+full NP and transitive+pronoun) than with intransitives, as shown in Figure 1. Strikingly, the two types of transitives (pronominal object, (4b), and NP object, (4c)) show similar choice patterns and do not differ significantly from each other.

Thus, although there is an effect of sentence frame, it does not pattern quite as predicted by Centering Theory. Recall that we expected to see more subject choices in the transitive+pronoun conditions than in the intransitive and transitive+full NP conditions. The results show that while there were indeed more subject choices in the transitive+pronoun conditions than in the intransitive conditions, the transitive+full NP conditions pattern like the transitive+pronoun

conditions.[iv] This suggests that a transitive sentence, regardless of whether the object is a pronoun referring to an argument in the preceding clause or a previously-unmentioned full NP, increases likelihood of subject interpretation.

In sum, the outcome of Experiment 1 does not seem to be predicted directly by Centering or a subjecthood-based account. A basic version of parallelism also seems to predict a different outcome from the one in Figure 1.[v] However, perhaps the transitivity effect observed in this experiment is due to intransitive sentence frames being interpreted as involving non-agentive subjects. Specifically, were participants interpreting some of the intransitives as unaccusatives with non-agentive subjects (e.g. *she arrived*) rather than unergatives with agentive subjects (e.g. *she ran*)? If so, perhaps the increased number of object interpretations with intransitives stems from a type of thematic role matching, a bias to interpret the non-agentive subject of the unaccusative verb as coreferential with the preceding non-agent (the *object* of the initial transitive clause). Experiment 2 investigates this possibility.

4. Experiment 2

Experiment 2 probed whether the relatively higher number of object responses with intransitives than transitives in Experiment 1 was due to participants treating the intransitives as unaccusatives. Experiment 2 used real verbs in the second clause, including intransitive verbs with agentive subjects (unergatives, e.g. swam, walked) and intransitive verbs with non-agentive subjects (unaccusatives, e.g., arrived, fell). A new set of native English speaking participants (n=18) heard two-sentence sequences and responded to visually-displayed questions about them, similar to Experiment 1.

If the relative object bias observed with intransitives in Experiment 1 is due to intransitive nonsense verbs being interpreted as unaccusatives, we should see more object responses with unaccusatives than unergatives in Experiment 2.

4.1 Results and discussion

An analysis of intransitive sentence frames with unergative and unaccusative verbs, connected to the preceding clause with *then* or *as a result,* argues against the unaccusative/'thematic role matching' analysis. Similar to Experiment 1, there are more subject interpretations following *then* (over 60%) than *as a result* (23%). However, unergative and unaccusative verbs do not differ significantly from each other. With the connective *then*, unergatives result in 23% subject choices and unaccusatives also result in 23% subject choices. With the connective *as a result*, unergatives result in 71% subject choices and unaccusatives in 61% subject choices. The lack of a significant difference

between the two verb types suggests that the transitivity effect is not due to a thematic-role matching strategy or non-agentive subject interpretations.

5. Conclusions and Further Research

Our findings highlight the importance of including the impact of post-pronominal information in psycholinguistic theories of reference resolution (see also Kaiser (to appear) for related evidence from a different experiment). Taken as a whole, the results discussed here show that the interpretation of a subject pronoun is influenced by the sentence frame in which it occurs, such that a subject pronoun is more likely to be interpreted as coreferential with the preceding subject when another referent is mentioned later in the pronoun-containing sentence. Or, put differently, a subject pronoun is more likely to be interpreted as referring to the preceding object when the pronoun is the subject of an intransitive verb (i.e., no further referents are mentioned) than when it is the subject of a transitive verb. In this section I explore a possible way of explaining this finding, building on what is known about the nature of human sentence processing system. However, it is important to emphasize that these ideas are only speculative and further research is needed to assess their validity.

5.1 Effects of processing load

Let us start with two findings from previous research: (i) Referential processing imposes demands on the resources available to the human sentence processing mechanism (e.g., Warren & Gibson 2002 and references cited therein), and (ii) the human sentence processing mechanism has limited cognitive resources and prefers to minimize processing load if possible (i.e., when context and other factors do not bias against the consequences of the minimization).

On the basis of (i), it seems possible to hypothesize that an intransitive sentence (one argument requiring resolution) carries less processing load than a transitive sentence (two arguments need to be resolved). If we combine this idea with (ii), we can formulate the *Processing Cost Hypothesis* which predicts that the presence/absence of subsequent referents influences whether an ambiguous subject pronoun is interpreted as referring to the preceding clause's subject or object, with object interpretations being more likely if no further referents are mentioned in the pronoun-containing clause. This prediction is derived from the idea that the sentence processing mechanism strives to minimize processing cost if possible (i.e., if other factors do not bias against minimization).

The specific prediction regarding the proportion of subject and object interpretations is generated as follows. Let us assume that, upon encountering an ambiguous pronoun, the human sentence processing mechanism activates both the preceding subject and object as possible antecedents, but gives more

consideration to the subject (in light of the common observation that subjects tend to be the default antecedents for pronouns). The default subject preference is presumably modulated by the connective, such that *then* further boosts consideration of the subject, whereas *as a result* increases the object's activation and may even result in it being more activated than the subject.

What happens when another argument is encountered later in the pronoun-containing clause? In light of results indicating that referential processing imposes demands on the human sentence processing mechanism, one might expect the presence of another referential entity in the sentence to increase processing load. Perhaps, to lower processing load, the human sentence processing mechanism then gives more consideration to the default ('easy') interpretation, namely the preceding subject. To put it another way, the dispreferred object interpretation, presumably more costly to maintain than the subject interpretation, receives less consideration when other factors impose demands on the limited resources of the human sentence processing mechanism.

This account predicts that ambiguous pronouns (in subject position) in transitive and intransitive clauses will show different degrees of preference for the subject and the object of the preceding clause. Specifically, due to the human sentence processing mechanism striving to minimize processing load, there should be more subject interpretations in transitives than intransitives, and more object interpretations with intransitives than transitives. As we saw in sections 3 and 4, this is indeed what was observed in Experiments 1 and 2. Thus, if the Processing Load Hypothesis turns out to be on the right track, it may offer a promising way of capturing the results described here.

However, it is clear that many questions remain open and further work is needed in order to determine whether the transitivity effects observed in Experiments 1 and 2 are actually due to effects of processing load. For example, questions arise regarding the effects of non-referential linguistic material. Existing psycholinguistic research suggests that referential processing is costly, which raises the question of whether linguistic material that does not refer to discourse entities would also result in an increase in processing load. For example, consider a sentence with post-verbal adverbials like 'Linda tulvered Barbara and then she sprelled quickly and carefully.' If referential entities increase processing cost but non-referential ones do not, we would presumably expect sentences of this type to pattern with intransitives. Another question concerns entities realized in non-argument positions. So far I have only investigated the effects of entities that were clearly in argument position (direct objects). Would post-verbal referents in non-argument positions have the same effect, e.g., instrument phrases in sentences like 'Linda tulvered Barbara and she sprelled with the jeg'? If non-argument referents increase processing load, we would expect these kinds of sentences to pattern like the transitive frames.

In sum, given the range of open issues, the Processing Cost Hypothesis is best regarded as a possible but speculative approach to capturing the transitivity

effects observed in Experiments 1 and 2. Further work is needed to determine whether the transitivity effects are due to processing load effects.

5.2 Implications for real-time processing

In closing, I would like to emphasize that – regardless of what turns out to be the best way of explaining the effects of post-pronominal information observed in Experiments 1 and 2 – the results presented here support the idea that sentence-initial pronouns do not receive their final interpretation at the point at which the pronoun itself is encountered. Although the data presented here are off-line data and we cannot tell when exactly the effect of sentence frame 'kicks in', it seems safe to assume that the effect cannot be triggered until after the sentence-initial pronoun, especially since the pronoun and the following nonsense verb are identical in all conditions. In other words, post-pronominal referential information has an effect on pronoun interpretation (see also Kaiser (to appear) for related results from another experiment). This idea has been incorporated into computationally-oriented work such as Centering Theory, but has not received as much attention in psycholinguistics – although it potentially has implications for our view of real-time language processing.

In particular, let us consider how the effects of post-pronominal information fit with existing research showing that the human language processing mechanism begins to interpret pronouns right away, without waiting for subsequent information. For example, Arnold et al. (2000) conducted an eye-tracking experiment showing that participants began to launch eye-movements towards a (predicted) referent of the pronoun starting at 400ms after pronoun onset, i.e., without waiting to see what other referents are mentioned in the sentence.[vi] How can we reconcile this with the results described here and with the claims of the BFP algorithm/Centering which argue in favor of post-pronominal information guiding pronoun interpretation (see Kehler 1997 for related discussion)?

Existing psycholinguistic research indicates that incremental processing is not incompatible with effects of post-pronominal information. A sizeable body of psycholinguistic research suggests that the human language processing system is capable of considering different interpretations or structures in parallel (e.g. Tanenhaus & Trueswell 1995 for an overview). This allows for the possibility that upon encountering a pronoun, the language comprehension process does not pick a single antecedent but rather considers multiple alternative antecedents (see e.g. Arnold et al. 2000). In this case, the system can interpret pronouns incrementally (or rather, activate a number of potential antecedents incrementally or create an initial ranking of possible referents incrementally) and at the same time be capable of changing the ranking or activation of the alternatives based on what comes later in the sentence (see also Arnold et al. 2000).

In sum, the findings presented in this paper indicate that the referential properties of the remainder of the clause have an effect on the final

interpretation assigned to subject position pronouns, possibly due to processing cost considerations. More generally, these results emphasize the importance of enriching current psycholinguistic theories of pronoun resolution with information regarding the effects of post-pronominal referential information.

Notes

[i] According to Centering Theory, she=Barbara and she=Linda are both Continue transitions, and therefore equally coherent (e.g. Walker et al. 1998). Centering Theory also makes claims regarding the referential form used to refer to the preceding referent (Rule 1), but since in this paper I only consider cases where pronouns are used to refer back to preceding referents, I do not discuss Rule 1.

[ii] One might wonder whether the full NP in the transitive+full NP frame (ex.(3b)) could be interpreted as referring back to one of the referents in the preceding clause. For example, could participants interpret 'the jeg' as an epithet, meaning something like 'the fool' or 'the bastard'? Such an interpretation is unlikely for at least two reasons. First, the nonsense noun used in the full NP condition was different for each item. The large number of different nonsense words used in this frame is likely to bias participants against an epithet-type interpretation, given that English only has a limited number of commonly-used epithets. Second, some filler items used other nonsense nouns in contexts that were semantically richer and indicated that the nonsense nouns referred to plants or animals. It is thus likely that when faced with a nonsense noun in the transitive+full NP frame, participants would also assume that it refers to something similar.

[iii] According to Centering, a situation in which 'she' refers to the preceding subject Linda and 'her' refers to the preceding object Barbara results in a Continue transition, whereas interpreting 'she' as referring to the object Barbara and 'her' as referring to the subject Linda results in a Retain transition. Retain transitions are less coherent than Continue transitions (see e.g. Walker et al. 1998), and thus according to the BFP algorithm, Continues are preferred.

[iv] See also note (ii).

[v] One could perhaps start to derive the transitivity effect from a parallelism preference which states that a subject position pronoun has a stronger preference for the preceding subject when the overall structure of the two clauses is more parallel. However, it is not clear whether the results of Smyth (1994) would be compatible with this type of approach, as he finds that subject pronouns are less sensitive to certain kinds of parallelism mismatches than object pronouns.

[vi] Arnold et al. (2000) do not argue against the effects of post-pronominal information; their focus is on the real-time use of gender and accessibility cues. I mention their work here as an illustration of how quickly the human language processing mechanism begins to interpret pronouns.

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Event Reference and Semantic Transparency

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1. Background

In this paper we consider the *do so* construction, exemplified in (1):

(1) As an imperial statute the British North America Act could be amended only by the British Parliament, which *did so* on several occasions. [= amended an imperial statute] (Groliers Encyclopedia)

Previous accounts of this construction have noted its seemingly idiosyncratic syntactic and anaphoric properties (Lakoff and Ross 1966, Anderson 1968, Bouton 1970, Halliday and Hasan 1976, Hankamer and Sag 1976, Sag and Hankamer 1984, Miller 1990, Ward, Sproat, and McKoon 1991, Cornish 1992, Fu and Roeper 1993, Dechaine 1994, Kehler and Ward 1995, Kehler and Ward 1999, Fu, Roeper, and Borer 2001, Ward and Kehler 2005, inter alia). Our focus in this paper is on the anaphoric properties of *do so*, which have confounded previous attempts to answer even the most basic questions regarding its interpretation, such as the level of representation at which its meaning is resolved. On the one hand, for instance, *do so* requires linguistic evocation, per Hankamer and Sag's (1976) treatment of it as a SURFACE ANAPHOR, and thus it resists pragmatic control:

(2)   [Andy is holding a newborn baby with one hand behind his head, and shows Gregory]

   a. Andy: By *doing this*, you add support to his developing neck muscles.

   b. Andy: # By *doing so/so doing*, you add support to his developing neck muscles.

On the other hand, we have previously argued (Kehler and Ward 1995, Kehler and Ward 1999, Ward and Kehler 2005) that *do so* does not satisfy the other criterion of surface anaphora, in that it imposes no requirement for a syntactically-matching antecedent (note the syntactic mismatch in (1), for instance). In that work we argued for an anaphoric theory that captured the requirement for linguistic evocation (see these papers for further details).

In contrast to our analysis, Fu, Roeper, and Borer (2001, henceforth FRB) assume that *do so* categorically requires a syntactic VP antecedent. Further, in light of felicitous examples of *do so* with nominalized antecedents (see Section 2.3), they use this assumption to argue that process nominals must contain a VP in their underlying syntactic representations.

In the next section, we review some of the data that support an anaphoric theory of *do so*, comparing it to Fu et al.'s proposal and their arguments against the conclusions drawn in Kehler and Ward (1995). In Section 3 we argue that *do so* patterns with other anaphors in being sensitive to the degree of SEMANTIC TRANSPARENCY between the antecedent expression and the referent. Finally, in Section 4 we report on a corpus study of cases in which role nominalizations serve as antecedents for *do so* that supports this conclusion.

2. Anaphora versus Syntax

2.1 Syntactically-mismatched antecedents

A variety of data has previously been offered to show that *do so* does not require a syntactically-matched antecedent (see Ward and Kehler (2005) and references therein). For instance, examples (3–4) involve voice mismatches: Whereas the clause containing *do so* is in the active voice, the antecedent clause is in the passive, and hence a matching antecedent VP as required by syntactic treatments does not exist:

(3) As an imperial statute the British North America Act could be amended only by the British Parliament, which *did so* on several occasions [= amended an imperial statute]. (=1)

(4) Section 1 provides the examples to be derived by Gapping, and a formulation of Gapping capable of *doing so*. [= deriving the examples] (text of Neijt 1981)

Although problematic for a syntactic analysis, these data are predicted on an anaphoric one.

Fu et al. briefly discuss example (3), and state:

it is not clear that it seriously jeopardizes the claim that *do so* requires a VP/V' antecedent...That in the first conjunct the direct object is occupied by a trace, rather than a full NP may very well turn out to be immaterial for the licensing of the anaphor *do so*. (pp. 572–573)

However, they do not pursue this idea, and thus do not provide the details necessary to evaluate it. Indeed, they never state their assumptions about how *do so* is

interpreted nor why it would require a syntactic antecedent. On many syntactic theories of VP-ellipsis, the need for syntactic parallelism stems from the fact that a VP needs to be reconstructed at the ellipsis site. This logic does not extend to *do so*, since it is not associated with an ellipsis site.

Indeed, such details would be required to address a range of other types of attested syntactic mismatch discussed by Kehler and Ward (1995) but not addressed by Fu et al.:

(5) There was a lot more negativity to dwell on, if anyone wished to *do so*. [= dwell on more negativity]

(6) With or without the celebration, Belcourt is well worth seeing, and you can *do so* year round. [= see Belcourt]

(7) ... He went on to claim that the allegedly high-spending Labour authorities had, by *so doing*, damaged industry and lost jobs. [= spent highly] (Cornish 1992)

However, FRB do contrast cases like (3) with cases involving adjectivals, which are presumably worse because they do not involve a trace:

(8) ?? This act turned out to be amendable, and the British Parliament *did so* in its last session. [= amend the act]

However, a considerably more acceptable variant can be readily constructed, seemingly ruling out a purely syntactic explanation:

(9) After the British Parliament found out that the act was amendable, they elected to *do so* at their very first opportunity. [= amend the act]

All of these data are thus compatible with an anaphoric theory, but need to be explained on a surface-anaphoric approach.

2.2 Split antecedents

Another type of example discussed by Kehler and Ward (1995) but not addressed by FRB involves split antecedents. It is well-known that pronominal reference is compatible with referents that have antecedents that are 'split' across the discourse:

(10) The first person to die each year is usually listed in the newspaper, as is the first couple to file for divorce. In a rare show of respect, this year *their* names were kept private.

As pointed out by Dalrymple et al. (1991), *do so* is felicitous with split antecedents as well, as illustrated by example (11):

(11) Fortunately, the first person to die in 1990 and the first couple to file for divorce in 1990 were allowed to *do so* anonymously. [= die / file for divorce] (text of Roeper (1990), cited by James McCawley's "1990 Linguistic Flea Circus")

Again, this is exactly what we would expect on an anaphoric theory, but is problematic for a syntactic theory since no suitable VP antecedent exists in the discourse.

2.3 Process nominalizations

One area of agreement for the two analyses is the potential felicity of *do so* with nominalized antecedents:

(12) The defection of the seven moderates, who knew they were incurring the wrath of many colleagues in *doing so*, signaled that it may be harder to sell the GOP message on the crime bill than it was on the stimulus package. [= defecting] (*Washington Post*)

(13) Even though an Israeli response is justified, I don't think it was in their best interests to *do so* right now. [= respond] (token provided by Dan Hardt)

The two analyses draw very different conclusions, however. For our anaphoric analysis, these simply constitute further support. For FRB, on the other hand, these show that process nominalizations must have a VP in their syntactic representations, in light of their assumed requirement that *do so* have a syntactic VP antecedent.

For their conclusion, FRB cite the contrast between (14–15) as evidence:

(14) His removal of the garbage in the morning and Sam's *doing so* in the afternoon were surprising. (= their 42b)

(15) * Kim's accident in the morning and Sue's *doing so* in the evening were not coincidences. (= their 43b)

That is, whereas the nominalization *removal* can antecede *do so* in (14), the non-nominalized event-denoting noun *accident* cannot in (15). The question then is why event-denoting nouns cannot antecede *do so* on an anaphoric theory.

Whereas FRB are correct in stating that this contrast ultimately needs to be explained, it does not provide evidence for their particular explanation. The problem is that the judgments do not significantly change when *do so* is replaced by an anaphor such as *do it*:

(16) His removal of the garbage in the morning and Sam's *doing it* in the afternoon were surprising.

(17) # Kim's accident in the morning and Sue's *doing it* in the evening were not coincidences.

Since *do it* is widely agreed to place no formal restriction on its antecedent (i.e., it is uncontroversially a form of DEEP ANAPHORA per Hankamer and Sag (1976)), the contrast between (14–15) cannot be attributed to a syntactic requirement on *do so*, and in turn does not provide any evidence that nominalizations have a VP within their syntactic representations.

2.4 Non-process nominalizations

Finally, FRB's analysis as described in the last section applies only to process nominalizations; they make no claims to the effect that other types of nominalizations similarly incorporate a VP in their syntax. However, felicitous, naturally-occurring examples of *do so* with other types of nominalizations as antecedents, e.g. role nominalizations, are readily found (the following examples were collected from various internet webpages):[1]

(18) One study suggests that almost half of young female smokers *do so* in order to lose weight. [= smoke]

(19) The majority of horse riders *do so* purely for leisure and pleasure. [= ride horses]

(20) AmericaNet.Com, its officers, directors or employees are not responsible for the content or integrity of any ad. Sellers/buyers/subscribers/investors *do so* at their own risk. [= sell/buy/subscribe/invest]

(21) Data from the Retirement Survey reveals that 5% of early retirees *do so* because of the ill health of others. [= retire early]

An obvious way to maintain FRB's analysis would be to claim that role nominalizations also incorporate VPs in their syntax. The problem is that this move would overgenerate, allowing many cases that remain unacceptable:

(22) # Most professors will *do so* for hours even when no one is listening.
[= profess]

(23) # In my opinion, our governor *does so* better than the last one did.
[= govern]

We know of no independent evidence that some role nominals incorporate VP syntax and others do not, nor do we anticipate that such evidence exists.[2] What is instead apparent from the contrast between (18-21) and (22-23) is that role nominalizations display gradience with respect to compositionality: Whereas a smoker is someone who smokes and horse rider is someone who rides horses, a professor is not merely one who professes, nor is a governor merely one who governs. We argue that it is the degree of semantic transparency between the nominalization and the verb that it nominalizes that determines the extent to which the nominalization makes the event denoted by the verb accessible for subsequent reference.

3. Anaphoric Islands

Indeed, the distinction between (18–21) and (22–23) mirrors an analogous distinction at the nominal level with respect to *outbound anaphora*, a type of reference that Postal (1969) characterizes as involving so-called 'anaphoric islands'. Standard examples that demonstrate the infelicity of such anaphora involve semantically non-transparent relationships (examples from Ward et al. (1991)):

(24) Fritz is a cowboy. # He says *they* can be difficult to look after. [= cow]

(25) Dom's clothes are absolutely elephantine. # Indeed, you could almost lose *one* in them. [= an elephant]

On Postal's analysis, reference fails in these cases because it involves 'word internal' reference: *they* cannot have *cow* in *cowboys* as its antecedent in (24), and similarly for *elephant* and *elephantine* in (25).

However, Ward et al. offer an alternative interpretation:

> ...we shall argue that the degree to which outbound anaphora is felicitous is determined by the relative accessibility of the discourse entities evoked by word-internal lexical elements, and not by any principle of syntax or morphology. (p. 449)

This characterization predicts that felicitous examples that are similar to (24–25) should occur, as long as a sufficient degree of semantic transparency holds between the antecedent expression and its word-internal counterpart. This is in fact the case (examples again from Ward et al. (1991)):

(26) Do parental reactions affect *their* children? [=parents]

(27) I think if I were a Peruvian I wouldn't want to live *there* for the next couple of years. [= Peru]

(28) It's awfully foggy tonight so you people out there driving better watch out for *it*. [= fog]

(29) Very well. But I warn you that if you continue in such foolishness you'll be the last paleontologist alive by the time you retire. There's no future in *it*. [= paleontology]

Such examples should be as bad as (24–25) on a purely syntactic account.

Therefore, the facts regarding pronominal anaphora appear to mirror those for *do so* anaphora that we discussed at the end of the last section. Ironically, however, Ward et al. drew the opposite conclusion about *do so*, citing example (30) in support of their idea that it is a surface anaphor:

(30)   Mary is a heavy smoker – even though her doctor told her not to

   a. # *do so*.   (judgment theirs)

   b. *do it*.

However, we have already seen a felicitous case of *do so* with *smoker* as its antecedent in (18). Example (31) is another:

(31) In some cases removing triggers from your home is as simple as asking smokers to *do so* outside, removing pets from the house, and vacuuming rugs and washing ...

We therefore conclude that the key difference between (18–21) and (22–23) lies in precisely the sort of semantic transparency and activation factors that Ward et al. cited in arguing against the existence of grammatical anaphoric island constraints.

4. Corpus Study

This conclusion predicts that felicitous uses of *do so* should occur only with those role nominalizations that have a highly transparent semantic relationship with the verb they nominalize. To test this prediction, we conducted a simple corpus study. We first collected the *-er/-or* agent nominalizations that occur at least 2000 times in the British National Corpus. This resulted in a list of 42 nominalizations. For each nominalization (N), a search of the form N*s do so* (e.g., *drivers do so*) was performed using Google, and the results carefully filtered and analyzed. Cases in which there was any ambiguity about the identity of the antecedent were set aside. For 29 of the 42 nominalizations, felicitous examples of *do so* in which the nominalization unambiguously serves as antecedent were found.

An approximate measure of the degree of semantic transparency between each role nominalization and the verb it nominalizes was then computed. For this purpose we used the Latent Semantic Analysis (LSA) vector cosine value[3], as such

values have been claimed to correlate well with human semantic similarity judgments (Landauer, Foltz, and Laham 1998). The idea is that the more transparent the relationship between a role nominalization and the verb it nominalizes, the more likely they will be found in similar contexts within a large corpus. For instance, *smoke* and *smoker* receive a 0.82 score, which is indicative of a high degree of relatedness (1 represents perfect contextual overlap). On the other hand, *profess* and *professor* receive a 0.06 score, which indicates a degree of relatedness close to chance (0 represents chance).[4]

The average LSA value for the 29 nominalizations for which our searches revealed felicitous naturally-occurring examples of *do so* was 0.491. In contrast, the average LSA value for the remaining 13 cases not found in the corpus search was only 0.264. By a one-tailed t-test, these two means are significantly different (p=.004).

Whereas this informal study cannot be considered definitive – LSA values are no doubt a fairly crude approximation of semantic transparency and not all possible felicitous cases will be necessarily found on the web – the results nonetheless strongly point to the idea that degree of semantic transparency between a role nominalization and the verb it nominalizes is a significant factor in determining when felicitous reference with *do so* is possible. Indeed, a post-hoc examination suggests that the effect might be even stronger than the results summarized above suggest. It turns out that no examples were found for two of the highest-scoring nominalizations of the 42: *farmer* at 0.81, and *developer* at 0.77. The reasons for this appear to be idiosyncratic given that, unlike many of the other unattested cases, felicitous examples can be readily constructed. Example (32) is a constructed case with *marijuana farmers* as the antecedent of *do so*.

(32) Many marijuana farmers *do so* with a sincere sense that they are doing nothing wrong, and not out of greed without regard for the law.

Furthermore, example (33) is an attested case with *developers of free software* as the antecedent:

(33) Whatever approach you use, it helps to have determination and adopt an ethical perspective, as we do in the Free Software Movement. To treat the public ethically, the software should be free – as in freedom – for the whole public.

Many developers of free software profess narrowly practical reasons for *doing so*: they advocate allowing others to share and change software as an expedient for making software powerful and reliable.
(http://www.gnu.org/philosophy/university.html)

This example was not found during our corpus search because the searches we used – of the form N*s do so* – only find examples in which *do so* is adjacent to

the nominalization. Example (33) shows nonetheless that *developers* can antecede *do so*. Setting these aside, the other 11 verb-nominalization pairs had an average 0.168 transparency score.

5. Conclusions

Our investigation of *do so* has revealed that it is governed by the same pragmatic principles that apply to other forms of anaphoric reference. In concert with other well-known factors (e.g., topicality, recency of mention), semantic transparency influences accessibility: The more transparent the semantic relationship between a nominalization and the verb it nominalizes, the more accessible the event evoked by the nominalization will be.

We therefore find that *do so* does not directly impose purely syntactic restrictions on its antecedent, and hence it provides no evidence that process nominals incorporate a syntactic VP. On the other hand, there is an indirect connection between syntactic form and felicity of *do so*, in the sense that choice of syntactic form influences discourse accessibility, and discourse accessibility in turn influences the felicity of reference with *do so*.

Acknowledgments

Notes

[1]Our corpus contains felicitous naturally-occurring cases of *do so* with role nominalizations as antecedents for over sixty different verbs.

[2]FRB offer a second type of evidence that process nominalization incorporate VP syntax, based on a purported co-occurence with adverbs:

(34) A presentation of the awards separately (was attended by parents).

(35) His removal of the evidence deliberately (resulted in obscuring the case).

Here we simply disagree with the judgments: We find such data to be ungrammatical on the relevant syntactic modification relationships. We are thus not persuaded by this evidence. Note, however, that even if we were to defer to their judgments on such data, a move to extend FRB's analysis to role nominalizations would generate the prediction that adverbs should be able to modify those as well. In that case, the subject of (36) should be a grammatically-acceptable way of referring to the person who presented the awards separately, and (33) should be a grammatically-acceptable way of referring to the people who developed the software quickly:

(36) * The presenter of the awards separately (was pleasing to the group of parents).

(37) * The developers of the software quickly (are the ones that I would recommend).

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We find such examples to be strongly ungrammatical on these interpretations.

[3]Computed at lsa.colorado.edu using Matrix Comparison over the *General Reading up to 1st year college* corpus.

[4]LSA failed to produce a value for one of the otherwise qualifying nominalizations, *vendor*, when paired with its corresponding verb *vend*. This case was therefore not included in the aforementioned list of 42.

Appendix

The following list includes an example of *do so* anaphora for each of the qualifying role nominalizations in the BNC for which felicitous cases were found. They were all collected from various webpages in June, 2007. All were carefully analyzed to ensure that the role nominalization was the intended antecedent. For many of the nominalizations, multiple examples were found.

(38) Gulden ignored a race official and jumped the tape marking the finish area to shake hands with his runners. He was the only coach in the shutes, a coach whose instincts have always told him this moment is important. After 25 years, he is remarkably more tenacious than ever. Other coaches show up at meets in jacket and tie, assigning their assistants to points on the course. Gulden shows up in sweats and puts in a few thousand meters himself, running from point to point. The greatest teachers do so by example.

(39) Most evening and night shift workers do so not because they choose to, but because they have to. [= work evening and night shifts]

(40) Successful leaders can be made as well as born. They must be themselves so that others trust them and devote their energy to their work. They are grounded, comfortable with their own strengths and weaknesses and can be appropriately open. The finest leaders do so by example, with integrity, and by knowing every person well in order to encourage other leaders.

(41) Injuries incurred during lunchtime volleyball are NOT covered by W.C.B. Players do so at their own risk.

(42) This site is provided AS-IS and users of this site do so at their own risk.

(43) We have a 100 Club at the school with a guest speaker once a month or so. We have had Joost van der Westhuizen, Bruce Grobbelaar, Dick Muir etc. All speakers do so for free gratis and money raised goes to the school. Usually a large pissup follows. Bruce Grobbelaar left at 2 o'clock.

(44) Avid readers do so as a hobby because they find pleasure in the activity!

(45) DUI is a problem that goes way beyond accidents or simple bad choices, although many who get arrested for DWI fall into one or both of the above categories. Many drunk drivers do so not by choice or stupidity, but because they have a drinking problem.

(46) ...harm to computer systems. Many of these Virus writers do so simply because they can, or because they are bored. Un-wiling, or just...

(47) In France, 22% of consumers think their tap water is too hard and another 22% fear health or sanitary hazards or contamination by toxic substances: this rate is rather low, but it has doubled between 1989 and 2000 (IFEN, 2000). Concern for sanitary water situation is much higher in the United States, where nearly half of bottled water consumers do so out of health and safety reasons.

(48) Every time you raise a site's profile and rankings, you are pushing others down. SEO is a zero sum game - winners do so at the expense of losers.

(49) Why is the traditional MTS approach often considered less desirable?

Most traditional Make-to-Stock manufacturers do so according to some kind of forecast. In our experience, there are only two kinds of forecasts – wrong and really wrong.

(50) The latest public opinion poll suggest that about 64% of supporters of capital punishment do not believe it is a deterrent. Most supporters do so because they believe in revenge or retribution (not the same thing).

(51) I heard an interesting statistic recently. 80% of Corvette buyers do so for looks, not performance.

(52) The issue of what constitutes small quantities of primary products is particularly important to this sector as many artisan poultry and egg producers do so on a very small scale as a supplement to farm income.

(53) Every time you raise a sitetake a lot of pride in their genealogy. There are many Luo whose works have roots in Sudan. The researchers do so with great pride. Mr Paul Mboya and Tom Ojienda, both my friends, have completed an exhausting genealogy covering hundreds of years.

(54) How does a scholar develop a publishing strategy?

Although some people including even some very successful publishers do so without a strategy, for many people it is helpful to have an overall plan for publications.

(55) Bollocks. I have found that most Linux lovers do so because they actually enjoy using software that works (I have had less than a dozen major Linux crashes, etc. - they were all either massive H/W failure or my fault).

(56) I am a big fan of the double count method. I have been told that it isn't done much here in the U.S. Most active observers do so singly. Our group did some simultaneous observing and encoded our sighting by generating a sound tone on audio tape.

(57) The survey also discovered that 50% of "uber affluent" travellers do so with their families in tow.

(58) Organized real estate has evolved to meet that goal. 95% of homesellers come to that conclusion. Most private sellers do so to save the commission and net more money but in most cases a buyer will not let the homeowner save the commission.

(59) A recent survey conducted for Microsoft reveals that 85% of new home computer purchasers do so for access to the World Wide Web.

(60) slimepuppy's mostly right though there are short-film creators that work exclusively in that market and don't want to move to features.

Many short makers do so with their own money (and own equipment which means less money) and many also do it with grants from government and cultural entities.

(61) Lanny, you are 100% correct. There are 300 plus million people in this country counting children. Usually less than half of the "Could-be" voters do so.

(62) I was just trying to point out that in almost all cases afk miners do so naked with minimal skills beyond the focus of the script. and manual miners are often more balanced chars.

(63) It is important that all visitors to our sites understand that they do so at their own risk.

(64) I would ask the writers of Movie and TV show articles if being a fan of something is a valid reason to want to improve it. I am sure 95% of article editors do so because they are a fan or have an interest in the topic they wrote about.

(65) The majority of mutual fund investors do so through employer-sponsored plans, such as 401(k)s. So, what's the allure of mutual funds and what has made them so popular?

(66) The industries represented by Noosa Home-based businesses (HBBs) tend to be more diverse than in other locations (e.g. the Sunshine Coast or in NSW/ACT).

Noosa HBB operators do so primarily because they do not need a shopfront, want flexible hours, lower overheads and for lifestyle reasons.

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English Existential Construction as Locative Inversion: Evidence from Acquisitional Data

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1. Introduction

In this paper, I present the results of a child language corpus study to help decide between "pure expletive" and "locative" approaches to the English existential construction. According to the former approach, the existential construction results from expletive replacement, a process that may be driven by the case properties of *there* and its associate. This point of view seems to be widely accepted in the current literature, and can be found in the Move-F analysis of Chomsky (1995), the LF-affix analysis of Lasnik (1999), and the affix-hopping analysis of Bošković (1997). Though there are differences in the details, the shared idea is that *there* is an expletive, directly inserted into Spec IP. The locative approach considers the existential construction to be a case of locative inversion, as discussed in Hoekstra & Mulder (1990), Freeze (1992), Bresnan (1994), and Moro (1997). In this approach, *there* is a real locative lexical item, and it is inverted from the predicate to the subject position. My acquisitional findings lead to a strong preference for the latter approach. That is, the existential construction may have something to do with locative inversion.

2. The Agreement Phenomenon

The acquisition study that I conducted was motivated by an agreement similarity between Presentational Locative Inversion (PLI) and the Existential Construction (Expl). First, notice that when compared to the predicate locative sentences in (1), the sentences in (2) seem to have their locative phrases inverted to the sentence initial position. Because of this property, these sentences exemplify what I refer to as Presentational Locative Inversion.

(1) Predicate Locative

a. A book is here/there.
b. The book is here/there.

(2) Presentational Locative Inversion
a. Here/there is a book.
b. Here/there is the book.

As one can see, if we compare PLI's in (2) to the existential construction, we find a very interesting paradigm: the copulas in both constructions have to agree with the postverbal subject, shown in (3) and (4) respectively. This is the so-called standard agreement between the copula and the postverbal subject: the copula changes with the number of the postverbal subject.

(3) Standard Agreement in Presentational Locative Inversion
a. There/Here is a/the book.
b. There/Here are some/these books.

(4) Standard Agreement in Expletive construction
a. There is a book on the desk.
b. There are some books on the desk.

However, there is also the so-called nonstandard agreement observed in adults' utterances. That is, when the copula is in the contracted form, it does not have to agree with the postverbal subject no matter whether the postverbal subject is singular or plural.

(5) Nonstandard agreement in PLI
a. There's/Here's a/the book.
b. There's/Here/s some/the books.

(6) Nonstandard agreement in Expletive construction
a. There's a book on the desk.
b. There's some books on the desk.

While the above paradigm is observed among adult English speakers, the question arises whether it will be observed in children's spontaneous utterances as well. Interestingly, this appears to be the case. For example, the child Becky taken from the Manchester section in the CHILDES corpora does produce the full paradigm shown above.

(7) PLI types in Becky's utterances
a. Here/There + (verb) + singular noun
Ex: here is another big saucepan   (Becky: 2;3.20)

b. Here's /There's + singular/plural noun
   Ex: here's a fork.   (Becky: 2;3.06)
   Ex: but here's some plums.   (Becky: 2;8.30)
c. Here/There + (verb) + plural noun
   Ex: Here are eggs.   (Becky: 2;5.29)
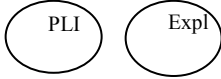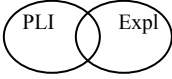
(8) Expl type in Becky's utterances
   a. There is + singular N + Locative
      Ex: there is more (penny) there   (Becky: 2;2.30)
   b. There's + singular/plural N
      Ex: there's no Daddy horsie anywhere   (Becky: 2;6.05)
      Ex: there's some dots there   (Becky: 2;4.28)
   c. There are + plural N + Locative
      Ex: are there eggs in there   (Becky: 2;5.01)
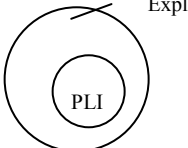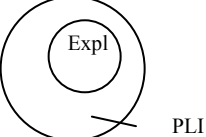
  Thus it seems that there is something interesting going (perhaps some grammatical connection) between PLI and Expl.

2. Four Logical Possibilities

This similarity between PLI and Expl led me to hypothesize a grammatical connection between these two constructions. Call this shared grammatical knowledge 'property A', a property that yields the agreement between the copula and postverbal subject. This property A should be one of the acquisitional pre-requisites for both PLI and Expl. If we keep this generalization more general, logically there should be four possibilities when we examine the acquisition data for PLI and Expl. These four possibilities are illustrated in Table 1.

Table 1

Scenario 1	Scenario 2	Scenario 3	Scenario 4
PLI Expl	PLI Expl	Expl / PLI	Expl / PLI
No correlation/ordering effect	Possible correlation	Ordering effect	Ordering effect

First, the supposed grammatical relation might not exist at all between these two constructions. In that case, we would not expect any correlation or ordering effect in the ages when the two constructions are acquired. The second possibility is that the shared grammatical knowledge overlaps between these two constructions. Under this scenario, there may be a correlation between PLI and Expl. However, since at the same time both constructions have other pre-requisites, these sources of 'noise' may intervene and the correlation may fail to reach significance. The more interesting possibilities are Scenarios 3 and 4. Now the shared grammatical knowledge is part of a subset/superset relationship. Taking Scenario 3, for example, suppose that the prerequisites of PLI are a subset of those for Expl. If children start from the inner circle (which contains the shared grammatical knowledge) to the outer circle, we would expect children to acquire PLI earlier than Expl. Or children could start from the portion of the outer circle that doesn't contain the shared grammatical knowledge. Then we would expect children to acquire PLI and Expl at the same time, once they reach the inner circle. Under this scenario, we would never expect children to acquire Expl earlier than PLI, since the pre-requisites of PLI are a subset of those for Expl here. (With Scenario 4, the expectations would be the reverse of those for Scenario 3.) To be more specific, Scenario 3 would create the following expectations:

(9) Expectations under Scenario 3:
   a. Some children will show PLI significantly earlier than the expletive construction.
   b. Other children will show no significant difference between PLI and the expletive construction.
   c. No child will have the expletive construction appear significantly earlier than PLI.
   d. When we look at the ages for the whole group of children with the paired t-test, a significant difference (PLI ≤ Expl) may be found.

3. The Study

To test which scenario is the correct one, I chose both 12 British-English speaking children (from the Manchester Section of the CHILDES database) and 7 American-English speaking children, including the Brown children (Brown (1973)), Adam, Eve, and Sarah; Naomi by Sachs (1983); Nina by Suppes (1974); Peter by Bloom, Hood & Lightbown (1974); and Shem by Clark (1978). The procedure for the study was as follows: I counted the appearance of both PLI and Expl in children's utterances. The utterance types of these two constructions are shown in (10). Notice that when counting PLI, I required a minimum of

three words and ignored two-word cases. This was to minimize the problem of different length between PLI and Expl.

(10) Types of Utterances
    a.   Here + (verb) + (determiner) + N
    b.   There + (verb) + (determiner) + N + locative

The first PLI and Expl of each child are noted in the following table.

Table 2

Name	First PLI	First Expl
Anne	1;11.18	2;2.10
Aran	2;1.21	2;3.02
Becky	2;2.30	2;2.30
Carl	1;11.03	1;9.13
Dominic	2;5.08	2;7.03
Gail	2;3.17	2;4.28
Joel	2;2.14	2;0.12
John	1;11.15	1;11.29
Liz	2;0.14	2;3.13
Nicole	N/A[1]	2;10.08
Ruth	2;3.25	1;11.15
Warren	1;11.04	1;10.06
Adam	2;4.15	3;2.09
Eve	1;7	1;9
Sarah	2;4.19	3;1.17
Naomi	1;11.11	2;4.30
Peter	1;10.11	2;1
Nina	1;11.16	2;1.15
Shem	2;2.16	2;2.16

As is evident, among the nineteen children, fifteen have their first PLI appearing earlier than their first Expl. On the other hand, the four children who are shaded have their first Expl appearing earlier than their first PLI. Though most of the subjects do follow the prediction of Scenario 3, we need a more reliable way to confirm that the appearance time between PLI and Expl is significant, and that the earlier appearance of PLI is not there just by accident. In order to show this, I ran a Binominal Test to check the significance. The result is shown in Table 3.

Table 3

Name	*p*-value of the Binomial Test

Anne	.734
Aran	.073
Becky	.390
Carl	.07
Dominic	.016
Gail	.006
Joel	.6
John	.308
Liz	.054
Nicole	N/A
Ruth	.448
Warren	.25
Adam	<.001
Eve	.36
Sarah	<.001
Naomi	<.001
Peter	<.001
Nina	<.001
Shem	.528

I categorize the results in Table 3 as follows. For the group of children who have their first PLI appearing earlier than Expl, we find both non-significant and significant results. However, this is consistent with expectations, since for the non-significant subgroup (11b), this means that the children may just acquire the PLI and Expl at the same time.

(11) PLI < Expl:
   a. Not available: Nicole
   b. Not significant: Anne, Becky, John, Eve, and Shem
   c. Marginally significant: Aran, and Liz
   d. Significant: Dominic, Gail, Adam, Sarah, Naomi, Peter and Nina

The most interesting result is in (12): the group of children who have their first Expl appearing earlier than their first PLI. As one can see, the results of all these four children are not significant.

(12) Expl < PLI:
   Not significant: Carl, Joel, Ruth, and Warren

The above results can be further strengthened by the paired *t*-test, shown in (13). The result is again significant.

(13) Result of paired *t*-test:
    $p = .043$ (two tailed, significant)

  The results of the statistical tests confirm the prediction of Scenario 3. The whole picture is summarized in (14).

(14) Final Results:
    a.   Scenario 3 predicts an ordering effect of PLI ≤ Expl.
    b.   None of the children got Expl significantly earlier than PLI by Binomial Test, despite the fact that the two constructions are acquired very close together and despite the fact that several of the children got PLI significantly earlier than Expl.
    c.   The ordering of first use of PLI prior to first use of Expl was significant by two-tailed, paired *t*-test. ($p = .043$).

  The findings in this study favor the stand that there is a grammatical connection between PLI and Expl. And this connection is shown by the ordering of PLI ≤ Expl, which supports Scenario 3. In other words, the grammatical pre-requisites for PLI are plausibly a proper subset of those for Expl.

4. Case Study

A concern might be raised about the influence of utterance length on the ordering effect observed above. When I counted the PLI's, I limited the search to PLI's of no less than three words. However, the length of the Expl's is still generally longer than that of the PLI's. Thus it could be possible that the ordering effect is caused by different length between PLI and Expl.
  In order to eliminate this concern, I would like to present a case study here. The subject is the child Adam, who produced PLI's of more than five words.[2] Now the length between Expl and PLI is quite similar. The result of a binominal test run on Adam's data is as follows:

(15) Binominal test of Adam:

PLI:4   E:2   PLI: 4

01   24   33
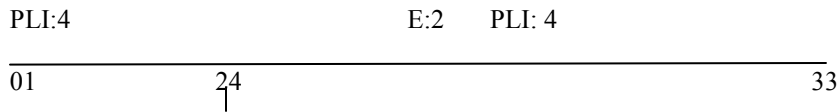
             First existential appears

$p = (4/6)4 = .0030864……$

As is evident, in the case of Adam, the length between PLI and Expl is almost the same, but PLI still appears significantly earlier than Expl. Furthermore, if we do a detailed counting of the PLI's and Expl's in the above test, we in fact find that all Adam's PLI's are longer than his Expl's. This is shown in (16).

(16) Adam's PLI and Expl word count:
    a.   Four PLI before first Expl: 11/6/5/5, mean = 6.75
    b.   Four PLI after first Expl: 5/7/5/6, mean = 5.75
    c.   Two Expl: 5/6, mean = 5.5

Even in this situation where every one of Adam's PLI's is longer than his Expl's, there is still a significant gap between them. That is, Adam's PLI appears earlier than his Expl. Thus, we can conclude that the ordering effect here cannot be just due to a MLU difference between PLI and Expl.

5. Discussion and Conclusions

The above acquisitional findings lead to the following interesting implications: First, *there* in Expl is arguably a locative/deictic *there*, as is the one in PLI. (Note that the lexical item *there* in PLI can reasonably be considered a locative/deictic *there*, since in English one distinguishes between "Here is the book" and "There is the book.) Second, for syntactic theories of the English existential construction, my findings support the 'locative' approach. For example, Freeze's (1992) cross-linguistic account of existential constructions claims that existentials are derived through locative inversion. This can be illustrated in the following Chamorro examples.

(17) a. Baige gi gima' si   Juan.   (V Locative Theme)
      Be   P house UNM John
      'John is in the house.'
    b. guäha lahi gi gima.   (V Theme Locative)
       be   man P house
       'There is a man in the house.'

According to Freeze, children need to acquire locative inversion in order to produce an existential construction. If we analyze PLI as a case of locative inversion, following Freeze's analysis, we will expect PLI to be acquired either earlier than, or at the same time as, Expl. And this is again what I have found in the above study.

Notes

[1] The child Nicole doesn't have any three-word PLI's. However, her first two-word PLI appears at 2;4.18, which is still earlier than her first Expl

[2] In Kuo (in review), I show that he average of the length of the first Expl of the nineteen children is 4. 44. I use this as a standard to find the PLIs.

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Bridging the Gap: MiniCorp Analyses of Mandarin Phonotactics

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1 Introduction

Despite skepticism about corpus data going back to the beginnings of generative linguistics (Chomsky 1957), most phonological research is actually a form of informal corpus linguistics. That is, unlike syntacticians, phonologists do not rely primarily on elicited native-speaker judgments of novel forms, but rather on collections of preexisting lexical items (e.g. dictionaries).

Corpus data are limited in what they can say about phonological knowledge, as has often been pointed out (e.g. Ohala 1986), and there has been growing interest among phonologists in testing hypotheses with native-speaker judgments (e.g. Coetzee to appear), phonetic measurements (e.g. Morén and Zsiga to appear), and other types of experimentally collected data (e.g. Moreton to appear). Nevertheless, the continued use of dictionary data in phonology is justifiable. The most important reason is that like acceptability judgments, a lexicon represents the output of processes that arguably include grammatical knowledge as a component (Blevins 2004 presents a contrary view, but see Kiparsky 2006, Zuraw 2007, Moreton to appear for responses). Moreover, dictionary analyses have provided key evidence for the most empirically robust concepts in phonological theory, from phonemes to constraints and beyond.

Though the corpus analyses in theoretical phonology typically do not use sophisticated quantitative methods (cf. Frisch et al. 2004, Uffmann 2006), they do rely on the implicitly quantitative assumption that type frequency is informative about grammatical status. Not only are exceptions dismissed if their type frequency is sufficiently low, but the distinction between systematic and accidental gaps depends on whether the gaps are rarer than would be expected by chance. Note that the logic here runs from the grammar to the corpus, not the other way around; type frequency does not directly indicate grammatical status any more than acceptability is identical to grammaticality in syntax. Instead, in phonological argumentation, type frequency is cited to support or challenge a grammar that has been motivated at least partly by a priori considerations.

This paper introduces a software tool, MiniCorp (Myers 2008a), that attempts to bridge the gap between this traditional logic (as applied in the Optimality-Theoretic framework) and truly quantitative corpus analysis. Virtually unique among OT software, MiniCorp is not an automatic grammar learner, but rather it follows the traditional logic in testing a proposed OT grammar against dictionary data. Specifically, MiniCorp tests whether the proposed constraints are obeyed more reliably than chance and whether the relative strengths of competing constraints are sufficiently different to support the proposed constraint ranking. Not only is MiniCorp the only program that tests OT grammars for statistical significance, but it also includes special tools to simplify the annotation of corpus items. It is also both freely available (www.ccunix.ccu.edu.tw/~lngproc/MiniCorp.htm) and open-source (the current version is written in JavaScript, with statistics handled by R, the free, open-source statistics program: R Development Core Team 2008).

The remainder of this paper describes the application of MiniCorp to the analysis of a phonotactic pattern in Mandarin. The grammatical proposal is introduced in section 2. Section 3 gives a step-by-step overview of how MiniCorp was used to test it, from corpus annotation to the output of the statistical analyses. Section 4 explains the algorithm behind MiniCorp's output report. Section 5 sums up and looks to the future.

2 Tone and voicing in Mandarin

The four lexical tones in Mandarin are often illustrated with the set of words shown in (1).

(1) Tone 1 (high): ma^{55} "mother"
     Tone 2 (rising): ma^{35} "hemp"
     Tone 3 (low): ma^{214} "horse"
     Tone 4 (falling): ma^{51} "scold"

This set is misleading, however, since it is not typical for high tone to appear in syllables with voiced onsets like /m/. This is demonstrated in (2) below, which shows the number of morphemes with different combinations of onset and tone (Mandarin morphemes are almost always monosyllabic). Note that morpheme counts are relatively low when high Tone 1 appears with a voiced onset.

Tone-voicing cooccurrence restrictions are not typologically unusual, as shown by tone split (Hombert et al. 1979) and depressor consonants in Bantu languages (Laughren 1984). The apparent depressors in Mandarin are somewhat unusual in being sonorants (including the voiced retroflex-like fricative; see Wang 1993:113), but depressor sonorants are also found in other language families (Bradshaw 1999). Note also that the high level tone (i.e. H) is affected

(becoming LH) while the high-initial falling tone (HL) is not, consistent with the well-known tendency of Asian contour tones to act as if unitary (Yip 1995).

(2) Morpheme type counts in Mandarin (data from Li et al. 1997 and Tsai 2000)

	Onset	High	Rising	Low	Falling	Toneless
[-voice]	p	167	73	105	243	3
	p^h	105	182	45	89	0
	f	108	146	62	102	0
	t	154	114	93	267	2
	t^h	103	290	87	117	1
	k	223	44	144	129	2
	k^h	122	26	82	136	0
	x	116	283	56	255	1
	ts	122	43	72	79	1
	ts^h	68	69	33	92	0
	s	126	4	49	132	0
	tɕ	339	240	176	328	0
	tɕ^h	197	272	63	123	0
	ɕ	329	193	87	259	0
	tʃ	268	129	124	258	0
	tʃ^h	142	241	89	130	0
	ʂ	180	57	72	206	0
[+voice]	m	13	210	113	171	4
	n	7	101	78	99	0
	l	23	440	161	329	1
	ʐ	1	103	47	60	0
	Onsetless	384	561	388	644	0

We thus have reason to hypothesize that the Mandarin pattern is consistent with the universal markedness constraint in (3). According to the view expressed earlier, whereby a lexicon is only partially predicted by a grammar, we may interpret violations of this constraint in Mandarin as simply ungrammatical, since speakers can memorize them using extra-grammatical components of the speech processing system.

(3) *Voice/H

Setting the exceptions aside enables us to propose a simple grammatical analysis. *Voice/H potentially competes with faithfulness constraints protecting either voicing or tone. Since Mandarin does not use voicing phonologically (in lexical contrasts or in alternations), but does contrast and manipulate tone (in tone sandhi), we have some justification for the ranking shown in (4). Note that this ranking further permits us to assume that in voiced-initial morphemes that surface with the rising Tone 2, the underlying tone may be high level Tone 1.

(4) Ident(Voice) >> *Voice/H >> Ident(H)

One may criticize some of the a priori assumptions motivating this grammar, in particular the synchronic derivation of rising tones from high tones, given that Lexicon Optimization (Prince and Smolensky 2004) should have made them underlyingly rising. However, such criticisms rely on a priori assumptions themselves. A more objective test of the proposed grammar would be to see how well it describes the data set.

Here quantification becomes crucial. *Voice/H is proposed to account for the rarity of voiced-initial high-toned morphemes, but there are still 44 of them. Is that really rare enough to ignore? Ident(H) is claimed to be ranked low, but the more lowly ranked a constraint, the fewer items will obey it in a corpus. Doesn't this weaken any language-internal evidence for it? Finally, (4) claims not only that Ident(Voice) is undominated, but that it can override the effects of both of the lower-ranked constraints put together. Does Ident(Voice) really provide such an overwhelmingly robust a description of the corpus?

In short, the question here is whether the proposed grammar describes the corpus better than chance. This is consistent with the implicit logic of traditional phonological argumentation, where the degree of empirical coverage (rarity of exceptions and accidental gaps) is a crucial factor in convincing skeptics of the validity of an analysis. MiniCorp automates the steps needed to make this kind of argument statistically sound, even in corpora too large to analyze by hand.

3 Using MiniCorp

A MiniCorp session starts with an electronic dictionary and ends with a statistical analysis testing the reliability of each proposed OT constraint and their proposed ranking. Currently the only version of MiniCorp is MiniCorpJS, written in JavaScript and run in the user's web browser (it's been tested in Firefox, Internet Explorer, Safari, and Opera).

In the present case study, the corpus was a file listing the 13,607 Mandarin monosyllabic morphemes described in (2), transcribed in IPA, except that the

four lexical tones were transcribed 1-4 as in (1). The choice of transcription system is up to the researcher, as is the choice of corpus. Such choices may affect the analysis, as well they should, since a transcription represents a hypothesis about phonological representation, and different corpora represent different levels of the grammatical system (e.g. a morpheme inventory, as is analyzed here, as opposed to a syllable inventory, conflating all homophones).

The next step is to tag (i.e. annotate) the corpus for the theoretically relevant aspects. All we care about these Mandarin morphemes is which of the proposed OT constraints are violated by them. As first pointed out by Golston (1996), tagging a word for its constraint violations serves as a sort of representational system. For example, marking the morpheme [ma1] "mother" as violating *Voice/H is equivalent to saying that it is a voiced-initial high-toned syllable.

This link between constraint violations and representations is convenient because it offers a way to tag corpus items automatically (tagging 13,607 items by hand would not only be time-consuming, but error-prone as well). In order to tag all violations of some constraint, we merely have to encode this constraint in terms of the class of character strings that violate it. Fortunately, as Karttunen (1998) realized, there is already a well-established mathematical tool for transcribing classes of character strings, called regular expressions. The most familiar element of regular expression notation is the "wildcard" symbol offered by many search systems, but it goes far beyond this, with symbols marking the starts and ends of strings, repetition, and set union, among other things.

For example, (5) gives regular expressions that encode violations of the three constraints in (4). The faithfulness constraint Ident(Voice) is, by hypothesis, never violated, so it requires no encoding. The markedness constraint *Voice/H is violated by syllables with any of the four voiced onsets and the high tone, transcribed as 1 in the corpus (for Tone 1). The set union of the different onsets is indicated by placing them inside square brackets, and restriction to onset position is indicated by the caret (/n/ also appears in coda position, where it doesn't interact with tone). The dot is a wildcard symbol, and the star after it indicates repetition. Thus the expression in (5b) picks out items containing both voiced onsets and Tone 1. Finally, the faithfulness constraint Ident(H) is encoded with a regular expression indicating all voiced-onset syllables with rising tone (Tone 2), based on the simplifying assumption that all such syllables underlyingly have high Tone 1. This assumption helps because faithfulness violations involve representations that are not available in the corpus (e.g. inputs) (Golston 1996 actually rejects the very notion of faithfulness).

(5)   a. Ident(Voice):   {not applicable: no violations}

       b. *Voice/H: ^[lmnz̩].*1

       c. Ident(H):   ^[lmnz̩].*2

After entering the corpus and automatically tagging the items, the MiniCorp

user is able to scroll around and sort the tagged corpus, making it easier to find any mistagged items. This is done via the tabular display in (6). Constraint names are modified to serve as legal variable names for the statistical analysis.

(6) MiniCorp tagging table

The user then defines the grammar in terms of a ranking of the constraints, and MiniCorp generates analysis code to run in R, the free statistics program rapidly becoming a standard tool in quantitative linguistics (Baayen 2008, Johnson 2008). The R code runs two types of tests, one for the contribution of each constraint to the description of the corpus data, and one for the ranking. The two sets of results for the present analysis are shown in (7) and (8) below.

(7) Constraint test:

Constraints	Weights	p	
IdentVoice	-8.1321	0	*
xVoiceH	-5.6651	0	*
IdentH	-2.7002	0	*
(* significant constraint)			

The significant results ($p < .05$) in (7) show that each of the constraints does better than chance, independently of the others, at describing the data. The constraint weights are also all negative, as they should be if the constraints are obeyed more often than violated (as described in the next section, the statistical analysis is attempting to predict type frequencies from constraint violations).

(8) Ranking test:

```
Constraints   p
 IdentVoice   0.6654
   xVoiceH    0              *
 (* significant ranking)
```

The ranking tests examine the partial rankings in (9), implied by the grammar in (4), where the ranking in (9a) indicates that the topmost constraint strictly outranks all of the others. In general, MiniCorp encodes the ranking hierarchy of a grammar with *n* constraints in terms of the *n*-1 non-terminal constraints. According to the report in (8), then, the ranking in (9b) describes the corpus data better than chance, but the ranking in (9a) fails to reach statistical significance.

(9)   a. Ident(Voice) >> {*Voice/H, Ident(H)}
        b. *Voice/H >> Ident(H)

Putting these results together, the constraints do seem to describe genuine patterns in the observed data, and part of the constraint ranking is supported as well, namely *Voice/H >> Ident(H). However, Ident(Voice) does not provide such a robust description of the data to rank it confidently above both of the other constraints. This calls into question the assumption that potential *Voice/H violations are avoided at the expense of tone rather than voicing.

As this example shows, MiniCorp formalizes and automates aspects of traditional phonological argumentation, even with large data sets.

4 How MiniCorp works

The validity of the above conclusions depends on the validity of the algorithm used to generate them. As it happens, this algorithm not only builds on well-established statistical techniques, but is also reasonably easy to understand, even without much statistical background.

The first insight exploited by the algorithm is that an OT grammar is a species of harmonic grammar (HG), in which constraints are weighted rather than strictly ranked (Prince and Smolensky 2004). Strict ranking emerges when weights are chosen such that the weight of each constraint is greater than the sum of the weights of all lower-ranked constraints (Prince 2007).

The second insight is that constraint weights of the HG type can be set automatically from corpus data through a technique called loglinear modeling (Goldwater and Johnson 2003, Hayes and Wilson to appear; Pater et al. 2007 use a related approach). In the case of HG, the loglinear model is an equation relating constraint violations to type frequencies, where the weights are equation

coefficients. All else being equal, the larger the magnitude of a weight, the better the associated constraint is at predicting the type frequencies.

As the above-cited works show, the relationship between HG and loglinear modeling makes it possible to create an automatic HG learner. However, the purpose of MiniCorp is not to learn an HG grammar, but to test an OT grammar. Thus MiniCorp uses loglinear modeling to compute the chance probabilities (p) that constraint weights differ from zero (i.e. help describe the data) and that constraint weights differ from each other (i.e. are ranked).

More precisely, MiniCorp converts the information in a tagging table like (6) into a type frequency table like (10), where each category is defined by a different combination of constraint violations. It then runs a standard sort of loglinear model called Poisson regression (Agresti 2002) to model the fit between the type frequencies and the constraints attempting to predict them.[1] This is how the weights and p values in (7) were computed.

(10) Type frequency table

Count	Ident(Voice)	*Voice/H	Ident(H)
12709	0	0	0
854	0	0	1
44	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1

To see how the p values in (8) were computed, note first that the weights in (7) are partially consistent with the claimed ranking, with the weight magnitude of *Voice/H (-5.67) greater than that of Ident(H) (-2.70). However, the weight magnitude of Ident(Voice) (-8.13) is not greater than the sum of the other two (-8.37), conflicting with the claim that it outranks both of them put together. To test hypothesized rankings for statistical significance, MiniCorp uses likelihood ratio tests to compare the data fit of the model in (11a), where the constraint weights for *Voice/H and Ident(H) are identical, with the model in (11b), where they need not be. Similarly, the ranking of Ident(Voice) over both of the other constraints is tested by comparing the models in (12).[2]

(11) a. Counts $\sim w_1$xVoiceH + w_1IdentH
       b. Counts $\sim w_1$xVoiceH + w_2IdentH

(12) a. Counts $\sim (w_1 + w_2)$IdentH + w_1xVoiceH + w_2IdentH
       b. Counts $\sim w_1$IdentH + w_2xVoiceH + w_3IdentH

All of these statistical techniques are well-established. The unique contribution of MiniCorp is to automate them in a user-friendly package designed for OT grammars assuming strict constraint ranking.

5 Conclusions

Phonological argumentation traditionally relies on comparing type frequencies in dictionary corpora. MiniCorp expands on and automates this idea so that it can be applied to large and complex data sets. In the case of the hypothesized grammar tested in this paper, MiniCorp was able to confirm some aspects (e.g. the role of *Voice/H) while calling other aspects into question (e.g. the undominated ranking of Ident(Voice).

MiniCorp isn't restricted to phonotactics; if a grammatical proposal can be expressed as a fixed ranking of constraints, MiniCorp can test it. It does have some limitations, however. One that should be overcome soon is that it assumes that each item violates each constraint at most once; extending the algorithm to allow any number of constraint violations merely requires a bit more algebra. Other planned extensions include techniques for testing variable grammars (e.g. Boersma and Hayes 2001) and grammars incorporating derivational ordering (e.g. Kiparsky 2000). One extension that has already been implemented is a tool for computing neighborhood density (i.e. number of similar lexical items of a target), known to influence acceptability judgments (Bailey and Hahn 2001). These values can then be used in the analysis of judgments collected with the help of MiniCorp's sister program MiniJudge, a tool for designing, running, and analyzing acceptability judgment experiments (Myers 2007, 2008b).

MiniCorp is intended to help bridge the gap between traditional phonological argumentation and truly quantitative corpus analysis. While already useful and reasonably user-friendly, MiniCorp is always in need of further improvement. Collaborators and competitors are both most welcome!

Notes

[1] Note that the top-ranked constraint is almost perfectly correlated with the output; that is, it is (by definition) never violated, so input 1 values are always associated with output counts of zero. Since (near) perfect correlations cause the weight estimation algorithm used in Poisson to crash (Agresti 2002), MiniCorp replaces each 0 count with 1 before running the analyses.

[2] Model equations can only be compared like this if one is contained within the other (e.g. $y \sim x$ vs. $y \sim x + z$), which algebraic manipulation shows to be true of the equations in (11ab) and (12ab).

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Types of Numeral-Classifiers and their Flexibility[*]

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1 Two Types of Prenominal Numeral-Classifiers

This paper discusses the distribution of the Japanese nominal phrases containing a numeral-classifier (NC) pair. As shown in (1), Japanese has a variety of patterns in the NC constructions in relation to a head noun and a Case particle.[1]

(1) a. Taro-wa hon san-satu-o katta.   *Pattern (a)*
   T-TOP book 3-CL-ACC bought *'NP NC Case'*
   'Taro bought three books.'
  b. Taro-wa san-satu-no hon-o katta.   *Pattern (b)*
   T-TOP 3-CL-GEN book-ACC bought *'NC GEN NP Case'*
  c. Taro-wa hon-o san-satu katta.   *Pattern (c)*
   T-TOP book-ACC 3-CL bought *'NP Case NC'*

 Pattern (b) shows a different behavior from the other types. In (2), only (2b) has an ambiguous reading, one of which cannot be obtained in the other cases.

(2) a. Bill-wa kabocha hyaku-pondo-o hakonda. *Pattern (a)*
   B-TOP pumpkin 100-CL-ACC carried
   'Bill carried 100 pounds of pumpkins'
  b. Bill-wa hyaku-pondo-no kabocha-o hakonda. *Pattern (b)*
   B-TOP 100-CL-GEN pumpkin-ACC carried
   'Bill carried 100 pounds of pumpkins.' OR 'Bill carried a
   100-pound pumpkin.'
  c. Bill-wa kabocha-o hyaku-pondo hakonda. *Pattern (c)*
   Bill-TOP pumpkin-ACC 100-CL carried
   'Bill carried 100 pounds of pumpkins.'

I assume that prenominal NCs are divided into two classes regarding how they form a modification relation with the head noun. In (2b), a NC pair shows the

amount of pumpkins that Bill carried, a reading which the other patterns can provide as well. Also, the prenominal NC, in contrast to the others, can function as a part of a compound noun, regardless of the amount of pumpkins Bill carried. This paper calls each NC Q(uantity)NC and P(roperty)NC. A similar case is given in (3).

(3) a. Bill-wa san-painto-no biiru-o nonda.
        Bill-TOP 3-CL-GEN beer-ACC drank
     b. Bill drank a 3-pint (bottle of) beer.   [*san-painto:* **PNC**]
     c. Bill drank 3 pints of beer.   [*san-painto:* **QNC**]

   Let us consider (4), in which there are two prenominal NCs. What is important is that the dichotomy of PNC and QNC brings about an ambiguous interpretation. Given that the former NC is always construed as QNC, the inner NC can be construed as either PNC or QNC, as in (4b) and (4c) respectively.

(4) a. Bill-wa san-ko-no hyaku-pondo-no kabocha-o hakonda.
        B-TOP   3-CL GEN 100-CL GEN pumpkin-ACC carried
     b. Bill carried three pumpkins each of which weighed 100 pounds.
        [*hyaku-pondo*: **PNC**]   100lb. 100lb. 100lb. [Total : 300 pounds]
     c. Bill carried three pumpkins which weighed 100 pounds in total.
        [*hyaku-pondo*: **QNC**]   20lb. 50lb. 30lb.   [Total : 100 pounds]

It is interesting to mention that there is an ordering restriction between PNC and QNC. The PNC must follow the QNC, which is demonstrated in (5).

(5) Bill-wa hyaku-pondo-no san-ko-no kabocha-o hakonda.
     B-TOP   100-CL GEN 3-CL GEN pumpkin-ACC carried
   [the interpretation of (4b) : impossible ; the interpretation of (4c) : possible]

In (5), the NC *hyaku-pondo* precedes another NC *san-ko* which functions as QNC. In this case, the interpretation is not allowed in which the outer NC *hyaku-pondo* is treated as PNC. This ordering restriction indicates that PNC should be located closer to the head noun than QNC.[2]

2 Watanabe's (2006) Analysis on Nominal Structures

Wanatabe (2006) attempts to account for the data of Japanese nominals. Specifically, his theory argues that Japanese nominals have three functional categories between NP and DP: #P, CaseP, and QP, as in (6) (cf. Cheng and Sybesma 1999, Muromatsu 1998, Borer 2005).

(6) $[_{DP} [_{QP} [_{CaseP} [_{\#P} [_{NP} N^0] \#^0] Case^0] Q^0] D^0]$

A point of departure in Watanabe's analysis is to give a unified account of the structure and derivation of three nominal patterns in Japanese, as in repeated (1).

(1)   a.   Taro-wa <u>hon</u> san-satu-o katta.   *Pattern (a)*
           T-TOP   book 3-CL-ACC   bought
           'Taro bought three books.'
      b.   Taro-wa san-satu-no <u>hon</u>-o katta.   *Pattern (b)*
           T-TOP   3-CL-GEN   book-ACC bought
      c.   Taro-wa <u>hon-o</u> san-satu katta.   *Pattern (c)*
           T-TOP   book-ACC 3-CL bought

   Let us look at the account in which the three patterns in (1a-c) are related to the common base structure outlined by Watanabe. As shown in (6), the functional category immediately above NP is #P, which is headed by the classifier and has the following internal structure.

(7) $[_{\#P}$ san $[_{\#'} [_{NP}$ hon $]$ satu$]]$

It is suggested in (7) that numerals are placed in Spec of #P. Assuming the existence of an EPP feature in the $\#^0$ and $Case^0$, NP obligatorily moves to another Spec of #P and then to Spec of CaseP, which gets us Pattern (a) (see (8a)). It should be noted that two movements result in Number agreement of the head noun with the $\#^0$ and Case agreement of the head noun with the $Case^0$, respectively. Next, when Q^0 is merged, an optional movement of #P to Spec of QP takes place, as illustrated in (8b).[3] The genitive case-morpheme *no* is assumed to be attached to #P at the PF branch, resulting in Pattern (b). The derivation proceeds to the DP domain. When D^0 is merged, CaseP is optionally raised to Spec of DP, as in (8c). That obtains Pattern (c).[4]

(8)   a. $[_{CaseP} [_{NP}$ hon$] [_{Case'} [_{\#P} t_i [_{\#'}$ san t_{NP} satu$]]]$ o$]$
      b. $[_{QP} [_{\#P}$ san-satu$] [_{Q'} [_{CaseP} [_{NP}$ hon$] [_{Case'} t_{\#P}$ o$]] Q^0]]$
      c. $[_{DP} [_{CaseP}$ hon-o$] [_{D'} [_{QP} [_{\#P}$ san-satu$] [_{Q'} t_{CaseP} Q^0] D^0]]$

   Although the unified analysis in Watanabe (2006) looks tenable as far as Japanese is concerned, several questionable cases emerge when applying Watanabe's theory to Chinese. In contrast to Japanese, head-initial Chinese nominals do not allow various patterns; 'Num-CL-NP' is the canonical word sequence. Let us consider (9a) and (9b).

(9)   a.   Wo mai [san ben   shu] qu le.   *'Num CL NP'*

I buy 3 CL book go SFP

'I went to buy three books'

  b.   ?*Wo mai [<u>shu</u> <u>san ben</u>] qu le.   *'NP Num CL'*

     I   buy book 3 CL   go SFP

The structure of (9a) would be analyzed as in (10) under the Watanabe's theory.[5]

(10) $[_{XP}$ X^0 $[_{QP}$ $[_{\#P}$ t'_{NP} san ben $t_{NP}]$ $[_{Q'}$ Q^0 $[_{CaseP}$ $[_{NP}$ shu$]$ Case^0 $t_{\#P}]]]]$

The structure in (10) results from an obligatory phrasal movement of NP to Spec of CaseP and a subsequent phrasal movement of #P to QP.

    At this point, there are two problems with Watanabe's analysis. First, since #P movement to QP is claimed to be optional, an additional structure should also be derived in which that optional #P movement to QP does not occur, as in (11).

(11) $[_{CaseP}$ $[_{NP}$ shu$]$ $[_{Case'}$ Case^0 $[_{\#P}$ t'_{NP} san ben $t_{NP}]]]$

The structure in (11) is an equivalent linear string of a nominal phrase to (9b), *shu san ben* 'NP-Num-CL', which is unacceptable. It is a halfway structure to derive (10), which is equivalent to the canonical 'Num-CL-NP' sequence in Chinese. Thus, Watanabe's theory predicts that languages admitting the structure, as in (10), are always allowed to spell-out the structure like (11), which turns out to be incorrect due to the ill-formed Chinese data like (9b).

    The other potential problem regarding structure (10) has to do with the treatment of CaseP in Chinese. It is a controversial topic whether or not CaseP exists in Chinese in the first place, since any overt Case particles are not observed in the language (cf. Cheng and Sybesma 1999). Watanabe's theory falls into a serious difficulty unless one can corroborate the argument for the presence of CaseP in Chinese. Let us examine the following structure, which is the same as (10) except that CaseP is excluded.

(12) $[_{XP}$ X^0 $[_{QP}$ $[_{\#P}$ $[_{NP}$ shu$]$ san ben $t_{NP}]$ $[_{Q'}$ Q^0 $t_{\#P}]]]$

As shown in (12), the CaseP-less structure in Chinese nominals induces a result in which the canonical 'Num-CL-NP' linear order cannot be obtained at any timing of the derivation except where all the lexical items are base-generated. One might consider that assuming that lexical items in Chinese nominal phrases do not undergo any movement operations, the merge order 'Num-CL-NP' is successfully obtained. However, the possibility would never be accepted under Watanabe's analysis, because NPs necessarily get raised due to the obligatory movement for Number agreement. In sum, the Watanabe-style analysis leads to serious drawbacks when taking into account the comparison between head-initial and head-final CL languages.

3 Alternative Analysis

This section offers an alternative analysis regarding nominal structures. Before that, I list the main differences between Watanabe's and my view in (13).

(13)	Watanabe	Nagasue
a. Pattern (a) & (b)	identical base structure	different base structures
b. NP movement	Number agreement	Presentational focus
c. Pattern (c) [Stranding Analysis]	NC & weak quantifier	NC

I propose that Japanese nominals have the two base structures as follows.

(14) a. $[_{DP} [_{QP} [_{\#P}$ san $[_{NP}$ hon$]$ satu$]$ $Q^0]$ o$]$ *Pattern (a)*
    b. $[_{DP} [_{QP} [_{\#P1}$ san-satu$]$ $[_{Q'} [_{\#P2}$ hon$]$ $Q^0]]$ o$]$ *Pattern (b)*

While the NC and the head NP occur in the same #P in Pattern (a), the NC cluster is placed in Spec of QP and modifies a separate #P in Pattern (b).

3.1 NP movement

Focusing on Pattern (a), let us consider the NP movement that is in question. As mentioned above, Watanabe (2006) assumes that NP has to move to enter the Spec-Head relation for Number agreement of $\#^0$ even when a CL is overtly used. However, my view is that when the CL overtly appears, Number agreement of $\#^0$ is satisfied without the NP movement which Watanabe maintains. This paper claims that a CL is originally a noun with a [+count] feature and it makes a Number agreement with $\#^0$ through base-adjunction to the same $\#^0$ position. The proposed view is compatible with the behavior of CLs in the sense that they can directly combine with nouns with a [+count] feature, namely count nouns. This is a convincing account, because the classifier in itself has a [+count] feature.

This being the case, there is no need to postulate any movement as to the agreement relation of $\#^0$ in CL languages since a CL enters into a numeration. The CL valued as a [+count] feature incorporates into $\#^0$ and Agree undergoes valuing [+count] features on $\#^0$. Note that since under the present theory, neither CLs nor NPs in Chinese do not have to get raised for Number agreement, the linear order of 'Num-CL-NP' is the same as each item is base-generated (= (9a)) and the correct order is obtained, in contrast to Watanabe (2006).

Although I claim that Number agreement does not derive NP movement, NP is still considered to be raised for some other reason in (14a); if nothing is done later in the derivation, the ill-formed word order *san hon satu* 'Num-NP-CL' is spelled out. What needs to be done is to examine if there is any plausible motivation for this phrasal movement of NP. Therefore, several cases in which

similar phrasal movement is observed are provided in (15) from Thai.

(15) a. <u>dek naa-rak</u> soong khon
child lovable 2 CL
'two cute children' (Simpson 2005)

b. [NP <u>dek naa-rak</u>]i [#P soong [# khon] ti]

Thai is a head-initial CL language similar to Chinese. In (15a), a head noun *dek* 'child' precedes a NC sequence *soong khon* '2-CL', which is distinct from Chinese canonical 'Num-CL-NP' order. The sequence of the head noun preceding a NC combination is appropriately accounted for when adopting the phrasal movement of NPs over the NC combination claimed here. If so, the Thai example in (15a) can be construed as in (15b).

Simpson (2005) argues that a striking comparative point concerns Nung, which is a northern Tai language. What is an intriguing observation is that the head noun follows a NC combination in this language, which is distinct from Thai. The following (16) illustrates the contrast between the two languages which belong to the same language family, Tai.

(16) a. Nung (northern Tai): Num CL NP
b. Thai (southern Tai): NP Num CL

It can be suggested under the proposed analysis that, in contrast to Thai, Nung has an underlying structure of nominal phrases, where NPs get raised to the position preceding a NC. Another head-initial CL language, Indonesian, lends support for the purported NP movement. In Indonesian, while the sequence of the head noun following a NC pair is common (see (17a)), the word order can be converted into one with the head noun preceding the NC pair (see (17b)).

(17) a. tiga buah <u>buku</u>
3 CL book
'three books'

b. maka adapum mengerjakan [<u>lobang</u> sa buah itu] sampai lima enam hari
and indeed make hole one CL that tool 5 6 day
'Indeed it took 5 or 6 days just to dig that one hole.' (Simpson 2005)

It is observed that there are cases in which NP movement occurs over the NC pair. Let us consider briefly what motivates this movement. Following Simpson (2005), this paper claims that it is presentational focus that has to do with the NP movement. Apart from the detailed investigation, if this is a legitimate view, it can be suggested that the DP-internal movement is simply compulsory in some languages such as Japanese and Thai, while such a movement is obviously more restricted in other languages such as Chinese. In Japanese when adopting the

phrasal movement of NP to Spec of QP, which is on top of #P, Pattern (a) *hon san-satu o* is appropriately derived as in (18).[6]

(18) $[_{DP} [_{QP} [_{NP}$ hon] $[_{Q'} [_{\#P}$ san t_{NP} satu] $Q^0]$ o]

3.2 Pattern (b)

Let us turn attention to Pattern (b). As stated above, a NC combination is base-generated in Spec of QP in this case. This is also applicable to some quantifiers such as Japanese *takusan* 'many' and *ikutuka* 'several'. After Q^0 and a quantifier are merged with #P, the following structure is obtained.[7]

(19) $[_{QP} \{$*san-satu/takusan/ikutuka*$\} [_{Q'} [_{\#P} [_{NP}$ hon] $[_{\#'} t_{NP} \#^0]] Q^0]]$

Insertion of genitive-like *no* takes place after a NC pair or a quantifier, which is assumed to be a matter of morphology. Positing some quantifier directly in Spec of QP is based on the following contrasting observation.

(20) a. *Taro-wa hon takusan/ikutuka-o katta.   *Pattern (a)*
          T-TOP   book many/several-ACC bought
          (intended.) 'Taro bought many books.'
     b. Taro-wa takusan/ikutuka-no hon-o katta.   *Pattern (b)*
          T-TOP   many/several-GEN book-ACC bought

Before ending this section, let us mention one issue relevant to the head-parameter among CL languages. Given that head-final Japanese has the option for the lexical insertion of the NC pair directly in Spec of QP, it is obvious that one might consider that this option also holds for a head-initial CL language, Chinese for instance. It is widely accepted that in head-final CL languages, such as Japanese and Korean, more than one pattern of the NC constructions can be found under normal circumstances, whereas only the 'Num-CL-NP' pattern is observed in Chinese. In the former languages, positing 'Num-CL' in Spec of QP results in the sequence of 'Num-CL-(GEN)-NP', in addition to the ordinary 'NP-Num-CL' order. What is interesting in head-initial CL languages such as Chinese is that the direct lexical insertion of 'Num-CL' in Spec of QP does not affect the word order. Consider (21).

(21) a. san ben shu
           3   CL book
          'three books'
     b. $[_{QP} Q^0 [_{\#P}$ san ben $[_{NP}$ shu]]]   *Pattern (a)*
     c. $[_{QP}$ san ben $[_{Q'} Q^0 [_{\#P} [_{NP}$ shu] $\#^0 t_{NP}]]]$ *Pattern (b)*

In head-initial CL languages, whichever option as to the placement of the NC pair is taken (if any), the resulting word order is the same 'Num-CL-NP'. This fact may be extended to suggest that the possibility of multiple patterns in the NC construction has to do with the parametric variation of head-directionality among CL languages, which will be a future area of research.

3.3 Pattern (c)

3.3.1 #P Extraposition
Finally, I give an explanation regarding Pattern (c), connecting with Pattern (a).

(22) a. Taro-wa hon san-satu-o katta.   *Pattern (a)*
          T-TOP   book 3-CL-ACC   bought
          'Taro bought three books.'
      b. Taro-wa hon-o san-satu katta.   *Pattern (c)*
          T-TOP   book-ACC 3-CL bought

Pattern (c) in Japanese is often called a 'floating' quantifier construction and there are two major approaches to this phenomenon; the adverbial analysis (Terada 1990, Kobuchi-Philip 2003) and the stranding analysis (Sportiche 1988, Kawashima 1998). It appears that although there are cases where this pattern is adequately analyzed by the adverbial analysis, the stranding analysis is also necessary. Specifically, the stranding analysis can be adopted only when a nominal phrase contains a NC, but not a weak quantifier. It is claimed that there are cases where Pattern (c) is derived from Pattern (a), which is shown in (23).

(23) a. $[_{DP} [_{QP} [_{NP} \text{hon}] [_{Q'} [_{\#P} \text{san } t_{NP} \text{ satu}] Q^0]] \text{ o}]$ *Pattern (a)*
      b. $[_{DP} [_{DP} [_{QP} [_{NP} \text{hon}] [_{Q'} t_{\#P} Q^0]] \text{ o}] [_{\#P} \text{san } t_{NP} \text{ satu}]]$ *Pattern (c)*
          $| \underline{\hspace{2cm}} \uparrow$

Following Kim (2005), it is assumed that the #P extraposition in (23b) obeys the Specificity Condition (Fiengo and Higginbotham 1981), in which movement out of specific DPs leads to a deviant result, as exemplified in (24).

(24) a. ?*Who$_i$ did you see [*the* picture of t_i]?
      b. ?*Who$_i$ did you see [*John's* picture of t_i]?
      (cf. Who$_i$ did you see [*a/three* picture(s) of t_i]?

Based on the above data, I argue that this derived Pattern (c) necessarily has a non-specific interpretation, which has been observed since Kamio (1977). It is argued that individual-level predicates cannot license a non-specific indefinite noun as a subject (Diesing 1992). Given that the derived Pattern (c) is required for a non-specific reading, it is predicted that it is incompatible with these types

of predicates in contrast to stage-level predicates, which is borne out as follows.

(25) a. *?<u>Gakusei</u>-ga go-nin nihongo-ga *umai*. *Individual-level predicate*
            student-NOM 5-CL   Japanese-NOM good
            'Five students are good at Japanese.'
      b. <u>Gakusei</u>-ga go-nin nihongo-o *hanasita*. *Stage-level predicate*
            student-NOM 5-CL   Japanese-ACC spoke
            'Five students spoke Japanese.'

Japanese DP possessive containing the Case-medial order (Pattern (c)) is unavailable with obtaining a specific/definite interpretation, as in (26b).

(26) a. John-wa [<u>Bill-no tomodati</u> san-nin-o] yobidasita. *Pattern (a)*
            J-TOP   B-GEN   friends   3-CL-ACC called.out
            'John called Bill's three friends.'   (definite description)
            'John called, (as for) Bill's friends, three of them.'(partitive reading)
      b. John-wa [<u>Bill-no tomodati</u>-o san-nin] yobidasita. *Pattern (c)*
            J-TOP   B-GEN   friends-ACC 3-CL   called.out
            #'John called Bill's three friends.'   (definite description)
            'John called, (as for) Bill's friends, three of them.'(partitive reading)

3.3.2 Stranding analysis or adverbial analysis?
At this point, one might consider that Pattern (c) is always construed as the stranding analysis through the #P extraposition. The present analysis provides an intriguing contrastive behavior between a NC pair and a weak quantifier with regard to the treatment of this pattern. As in (23b), it is #P that dislocation and right-adjunction to DP apply to. Under the present analysis, while a numeral occupies Spec of #P, (weak) quantifiers appear in Spec of QP, outside of #P. This indicates that a quantifier has nothing to do with the #P dislocation. Thus, it is claimed that weak quantifiers in Pattern (c) are always adverbials.

The use of single-event predicates such as Japanese *korosu* 'kill' helps to distinguish the stranding analysis and the adverbial analysis for Pattern (c). For instance, (27) shows that Pattern (c) containing a weak quantifier is incompatible with a single-event predicate.

(27) a. ?*<u>gakusei</u>-ga takusan John-o *korosita*.
             student-NOM many   J-ACC killed
             (intended.) 'Many students killed John.'
      b. <u>gakusei</u>-ga takusan John-o *suisensita*.
            student-NOM many   J-ACC recommended
            'Many students recommended John.'

Since it is assumed the quantifiers in (27) are treated as adverbials, this suggests

that the adverbial analysis cannot bring about a collective reading. Turning to NCs, they permit both collective and distributive readings in Pattern (a).

(28) a. gakusei go-nin-ga John-o *korosita*.
     student 5-CL-NOM   J-ACC killed
     'Five students killed John.'
  b. gakusei go-nin-ga John-o *suisensita*.
     student 5-CL-NOM   J-ACC recommended
     'Five students recommended John.'

   The observation in (28) indicates that if a NC is originally within a nominal phrase, it can co-occur with a single-event predicate. Importantly, in contrast to (27), Pattern (c) with a NC pair allows both types of event readings, as in (29).

(29) a. gakusei-ga go-nin John-o *korosita*.
     student-NOM-5-CL   J-ACC killed
     'Five students killed John.'
  b. gakusei-ga go-nin John-o *suisensita*.
     student-NOM-5-CL   J-ACC   recommended
     'Five students recommended John.'

The present analysis suggests that the single-event reading is available in (29a) only when the NC pair is originally part of a nominal phrase and that the nominal order is derived by the #P extraposition, namely the stranding analysis.
   This being the case, it can be accounted for the reason why (27a) is unacceptable; a quantifier *takusan* 'many' has no option but to be construed as an adverbial in the Case-medial sequence, which is demonstrated by the fact that a quantifier is not allowed to appear in Pattern (a), as shown in (30).

(30) a. *gakusei takusan-ga John-o   *korosita*.
      student many-NOM   J-ACC   killed
     (intended.) 'Many students killed John.'
  b. *gakusei takusan-ga John-o *suisensita*.
     student many-NOM   J-ACC   recommended
     (intended.) 'Many students recommended John.'

The present view is further corroborated by the following observation.

(31) a. ?*gakusei-ga   kinoo   go-nin John-o *korosita*.
      student-NOM yesterday 5-CL   J-ACC killed
     (intended.) 'Five students killed John yesterday.'
  b. gakusei-ga   kinoo   go-nin John-o *suisensita*.
     student-NOM yesterday 5-CL   J-ACC   recommended

'Five students recommended John yesterday.'

It is natural to maintain that when an adverbial intervenes between 'NP-Case' and a NC combination, the NC is necessarily interpreted as an adverbial as well, but not part of the nominal phrase. It leads to the conclusion that Pattern (c) forces a multiple- event reading if a NC is construed as an adverbial, whereas the pattern can have a single-event reading if it is generated as part of a nominal phrase and is extraposed to the right-adjoined DP position such as (23b).

4 Concluding Remarks

This paper has discussed the distribution of Japanese nominal phrases, focusing on the cases containing a NC pair. It has been observed that there are two types of prenominal NCs, namely PNC and QNC, and that they show a positional contrast in relation to the head noun. Compared with Watanabe's (2006) analysis, an alternative analysis is provided of nominal phrases in which there are different base structures for Pattern (a) and Pattern (b), accounting for the contrastive behavior between Japanese and Chinese regarding distributional patterns of the NC construction. As to Pattern (c), NCs can extrapose to the DP-adjoined position from the underlying structure of Pattern (a). The proposed analysis has demonstrated that such a stranding analysis is limited to NCs. That is, 'floating' quantifiers are uniformly treated under the adverbial approach, whereas there are cases in which 'floating' NCs are dealt with by the stranding approach.

Notes

[1] Japanese has another type of NC construction as in (i); I do not discuss this pattern because of limitations of space. See Ishii (1999) on this matter.

(i)	Taro-wa san-satu hon-o katta.
	T-TOP 3-CL book-ACC bought
	'Taro bought three books.'

[2] Larson (2000) discusses other positional contrasts of nominal modifiers.

[3] It is suggested in Watanabe (2006) that this optional movement is mediated by the Agree relation between Q^0 and #P.

[4] Note that under this theory, not only NCs but also quantifiers can be licensed as 'floating' quantifiers that occur in the nominal context. I will demonstrate a different view in this regard later.

[5] XP in (10) is not DP. Watanabe (2006) does not posit DP for Chinese.

[6] The NP movement in question might occur following some adjacency requirement of a NC. Note that a numeral and a classifier are generally next to each other in CL languages. I will leave this issue to another occasion.

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[7] Note that as shown in (19), the NP movement does take place for Number agreement in this case, although it does not affect word order. Also note that in these cases, I speculate that no further NP movement to Spec of QP occurs, compared with Pattern (a) (cf. (18)). While the head NP is assumed to undergo phrasal movement due to presentational focus to the position structurally higher than the #P when a NC pair is overtly present, such movement is unnecessary when a NC pair is absent just because there is no comparable element with the head noun within the same #P.

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Paradigm Gaps and Periphrases in the Japanese Conjugation System

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1 Introduction

This paper investigates the Japanese verb inflectional morphology and addresses issues of non-existing forms in the primary synthetic verb inflection. A careful observation of the overall inflectional patterns reveals that Japanese has three distinct, but related, lexemes and each of them complements missing cells in other lexemes' paradigms. I shall show that one of those lexemes exhibits properties of genuine periphrases despite the surface similarity to circumlocutional copula construction. The lexemic relations are defined in terms of derivations driven by syntactic features and inflectional patters are analyzed in the framework of Paradigm Function Morphology (Stump 2001).

   The paper is organized as follows. In section 2, the basic set of data is introduced by pointing out problematic non-existing forms. Section 3 shows that Japanese has circumlocutions constructed by a copulative polite verb, but there is a special periphrastic construction involving the same copulative verb. A word-and-paradigm analysis is given in section 4, in which the formulation of lexemic relations and a set of realization rules are presented. The paper is concluded in section 5.

2 Synthetic Inflection

Verbs in Japanese inflect for mood and polarity. The mood includes indicative, tentative, hortative, imperative, conjunctive, two conditionals, disjunctive, and representative, where past and non-past tense distinction is found only in the indicative. The polarity is either affirmative or negative. Hence, a verb, *kak* 'write', constitutes the following inflection paradigm:

		Affirmative	Negative
Indicative	Non-past	*kaku*	*kakanu*
	Past	*kaita*	—
Tentative		*kakoo*	*kakumai*
Hortative		*kakoo*	*kakumai*
Imperative		*kake*	*kakuna*
Conjunctive		*kaite*	*kakanaide*
Conditional I		*kakeba*	*kakaneba*
Conditional II		*kaitara*	—
Disjunctive		*kaitatte*	—
Representative		*kaitari*	—

Table 1. The forms of the plain verb, *kak* 'write'

The politeness status can further be encoded by suffixation of *-mas* to the infinitival form. For instance, the plain verb, *kak* 'write', becomes *kakimas* when the speaker makes the statement polite. Thus, the following polite verb paradigm can be obtained:

		Affirmative	Negative
Indicative	Non-past	*kakimasu*	*kakimasen*
	Past	*kakimasita*	—
Tentative		*kakimasyoo*	*kakimasumai*
Hortative		*kakimasyoo*	*kakimasumai*
Imperative		*kakimase*	*kakimasuna*
Conjunctive		*kakimasite*	*kakimasende*
Conditional I		*kakimaseba*	*kakimaseneba*
Conditional II		*kakimasitara*	—
Disjunctive		*kakimasitatte*	—
Representative		*kakimasitari*	—

Table 2. The forms of the polite verb, *kakimas* 'write'

One crucial aspect about the verb paradigms in Table 1 and 2 is missing forms in the indicative past, conditional II, disjunctive and representative of the negative. With respect to the plain status, Japanese has a derived negative verb to complement the gaps in Table 1. The derived negative verb is formed by suffixation of *-nai* to the root (*a* is inserted for the root ending in a consonant); for instance, *kakanai* 'not write' is derived from *kak* 'write'. This derived negative verb is morphologically an adjective, i.e., it inflects exactly like an adjective as shown in Table 3 — the hortative and imperative mood is not available in the adjective inflection.

		Derived negative	Adjective
Indicative	Non-past	*kakanai*	*hayai*
	Past	*kakanakatta*	*hayakatta*
Tentative		*kakanakaroo*	*hayakaroo*
Conjunctive		*kakanakute*	*hayakute*
Conditional I		*kakanakereba*	*hayakereba*
Conditional II		*kakanakattara*	*hayakattara*
Disjunctive		*kakanakutatte*	*hayakutatte*
Representative		*kakanakattari*	*hayakattari*

Table 3. The forms of *kaknai* 'not write' and *hayai* 'fast, early'

Note that the inflectional endings of the derived negative verb are identical to those of ordinary adjectives. Further note that the indicative past, conditional, disjunctive and representative are all filled in the paradigm of the derived negative, so that the missing forms in the Table 1 are complemented.

The gaps in Table 2, on the other hand, cannot be complemented by the same strategy. This is due to the unavailability of derived polite negative verbs. As mentioned, the politeness status is encoded by suffixation of *-mas* to the infinitival form, while a negative verb is formed by suffixation of *-nai* to the root. The suffixation of *-mas*, however, is subject to two restrictions. Firstly, it can only attach to a verb. Since a derived negative verb formed by suffixation of *-nai* is morphologically an adjective, *-mas* cannot follow it to add the politeness status, namely **kakanaimas* is ill-formed due to this restriction. Secondly, *-mas* can only appear at the word-final position, which prohibits creating a derived negative verb from a polite form, that is **kakimasanai* is not available as *-mas* is followed by another suffix, *-nai*.

The unavailability of polite negative verbs leaves the gaps in Table 2 unfilled. This means that certain combinations of features are unexpressible synthetically in the Japanese conjugation system. I shall argue that those combinations are expressed periphrastically.

3 Circumlocution to Periphrasis

3.1 *No des* construction

Japanese has a copulative verb, *des*, which encodes the polite status to the sentence by following a noun in predicative use:[1]

(1) Yamada-san wa   sensei desu.
     Yamada-Mr   TOP teacher COP.POL
     'Mr Yamada is a teacher.'

In (1), *sensei* 'teacher' is used as a predicate. The copulative verb, *des*, follows this predicative noun to make the statement polite. This copulative verb can also occur with other types of predicates. For example, it follows an adjectival predicate, *utukusii* 'pretty', in (2a) and a verbal predicate, *kaita* 'wrote', in (2b):

(2) a. Tanaka-san   wa   utukusii (no)   desu.
         Tanaka-Ms   TOP pretty NOMINAL   COP.POL
         'Ms Tanaka is pretty.'
     b. Abe-san   ga   sono hon o   kaita   no   desu.
         Abe-Mr   NOM that book ACC wrote   NOMINAL   COP.POL
         'Mr Abe wrote that book.'

Since the copula occurs with both verbal and adjectival predicates, synthetic negative forms of a verb and a derived negative verb can appear in this construction as shown in (3):

(3) a. Abe-san wa   son'na hon wa   kakanu   no   desu.
         Abe-Mr TOP such   book TOP write.NEG NOMINAL   COP.POL
         'Mr Abe never writes such a book.'
     b. Abe-san wa   son'na hon wa   kakanai (no)   desu.
         Abe-Mr TOP such   book TOP not write NOMINAL   COP.POL
         'Mr Abe doesn't write such a book.'

(3a) illustrates that the indicative non-past tense verb, *kakanu*, is used with the copula (cf. Table 1), while (3b) shows that the indicative non-past form of a derived negative verb, which is morphologically an adjective, is used (cf. Table 3). Although (3a) sounds slightly more emphatic and formal than (3b), the two utterances convey the same semantic information.

When the polite copulative verb occurs with adjectival or verbal predicates, two properties are observed. Firstly, the nominalizer, *no*, intervenes between the predicate and the copula.[2] This indicates that the copula takes a nominal complement. Secondly, when the predicates are in the indicative form, the tense contrast is observed. The adjective predicate in (2a) is in the non-past form, whose past tense counterpart is *utukusikatta* (*no*) *desu* (cf. Table 3). Similarly, the verbal predicate is in the past tense form in (2b) whose non-past counterpart is *kaku no desu*. Those two properties clearly suggest that this construction is not a genuine periphrasis as a product of the inflectional morphology, but a circumlocutional expression adding politeness status syntactically with the copula taking a nominal complement.

3.2 Polite negative periphrasis

As shown above, the polite copula occurs with noun, verb and adjective

predicates. But it cannot follow an affirmative polite form of a verb exemplified in Table 2. Hence, neither of the following sentences are acceptable:

(4) a. *Abe-san wa   sono hon o   kakimasu   no   desu.
        Abe-Mr TOP that book ACC write.POL   NOMINAL   COP.POL
        'Mr Abe doesn't write that book.'
     b. *Abe-san wa   sono hon o   kakimasita no   desu.
        Abe-Mr TOP that book ACC wrote.POL   NOMINAL   COP.POL
        'Mr Abe didn't write that book.'

The predicates in (4a) and (4b) are in the polite non-past tense form and the polite past tense form respectively. The unacceptability of those forms may be explained by the doubly marked politeness, namely both on the verb predicate and the copula.

   Intriguingly, however, the doubly politeness marking is allowed when the predicate is in the polite negative:

(5) Abe-san wa   sono hon o   kakimasen   desita.
     Abe-Mr TOP that book ACC write.POL.NEG COP.PST.POL
     'Mr Abe didn't write that book.'

In (5), the verb predicate is an indicative non-past polite negative form of a verb, *kakimasen* (cf. Table. 2). The past tense form of the copula follows it, which results in encoding the politeness status twice.

   There are at least two striking features of the combination of an indicative polite negative and the copula. Firstly, the nominalizer, *no*, must not intervene between the predicate and the copula. Thus, the following sentence is not acceptable:

(6) *Abe-san wa   sono hon o   kakimasen   no   desita.
      Abe-Mr TOP that book ACC write.POL.NEG NOMINAL COP.PST.POL
      'Mr Abe didn't write that book.'

   Another feature involved in this construction is that the indicative non-past form of the copula cannot be used as shown in (7):

(7) *Abe-san wa   sono hon o   kakimasen   desu.
      Abe-Mr TOP that book ACC write.POL.NEG COP.N-PST.POL
      'Mr Abe didn't write that book.'

Unlike (5), the copula is in the non-past tense form in (7), which makes this sentence ill-formed.

   The doubly marked politeness, the prohibition of the nominalizer and the

non-existence of the indicative non-past all suggest that this construction involving the polite negative is not a mere circumlocution, but a periphrastic form as a product of the inflectional morphology. This point can be addressed by looking at the paradigm of this construction with the synthetic verb paradigm:

		Synthetic	Periphrastic
Indicative	Non-past	*kakimasen*	—
	Past	—	*kakimasen desita*
Tentative		*kakimasumai*	*kakimasen desyoo*
Conjunctive		*kakimasende*	*kakimasen desite*
Conditional I		*kakimaseneba*	*kakimasen desitara*
Conditional II		—	*kakimasen desitara*
Disjunctive		—	*kakimasen desitatte*
Representative		—	*kakimasen desitari*

Table 4. The forms of synthetic and periphrastic polite negative

By inspecting Table 4, the non-existence of a periphrastic indicative non-past can be accounted for by the existence of the synthetic form for the same combination of morphosyntactic properties. The table clearly shows that missing forms in the synthetic verb paradigm are resolved by the periphrastic forms. Similar to the relationship between the plain negative paradigm and the derived negative paradigm (cf. Table 1 and 3), the competing forms are observed in the tentative, conjunctive and conditionals. But the periphrastic forms are dominantly used for the tentative and conditionals, and the opposite is true for the conjunctive.

4 Theoretical Analysis

4.1 Multiple paradigm structures

In some languages, it is argued that periphrastic forms fill some cells in the synthetic paradigm (e.g., Börjars et al. (1997) and Sadler and Spencer (2001) for the Latin deponent verbs, and Ackerman and Stump (2004) for Mari and Udmurt). Spencer (2003) offers a similar argument for the Japanese verb paradigm, namely, the synthetic paradigm is filled by a periphrastic form only in the past polite negative. However, a careful observation made in the previous section reveals that this is not the case; instead, the situation is best described as the three distinct, but related, paradigms, one of which is periphrastic, exist and complement the missing forms of the primary synthetic paradigm. That is, the missing forms of the plain negative in Table 1 are resolved by derived negative verb forms in Table 3; and those of the polite negative are resolved by periphrastic forms in Table 4.

Stump (2001: 257) argues that derivational morphology can be established by Paradigm Function (PF) in the framework of Paradigm Function Morphology (PFM). PFM is originally proposed as an inferential realizational theory of inflectional morphology, in which a pair of root (X) and a complete set of morphosyntactic properties (σ) for a given lexeme L is mapped onto a cell in L's paradigm by PF (Stump 2001: 43). This operation is formulated as follows:

(8) $PF(\langle X, \sigma \rangle) = \langle Y, \sigma \rangle$

Roughly speaking, (8) states that the function PF yields an output form, Y, from the root, X, according to a set of morphosyntactic properties, σ. A very simple English example is given as in (9) where the suffixation of -s to the root, *look*, is done by PF:[3]

(9)   Where $\sigma = \{AGR:\{PERS:3, NUM:sg\}, TNS:pres\}$,
        $PF(\langle look, \sigma \rangle) = \langle looks, \sigma \rangle$

Morphological operations that enables PF to yield a correct output are defined by successive applications of realization rules (RRs). Stump formulates a RR as in (10):

(10) $RR_{n, \tau, C}(\langle X, \sigma \rangle) =_{def} \langle Y', \sigma \rangle$, where n is a block index, C is an inflectional class index, and τ is a property set index.

RRs are organized as rule blocks, so that one rule applies per rule block. In (10), n specifies which rule block a given RR belongs to. A rule is applied for a certain set of morphosyntactic properties, so τ is a statement of such properties. Finally, morphological rules are sensitive to a class category of a lexeme, which is specified by C. In the English verb inflectional morphology, (11) is included in the block I for the suffixation of -s with the 3rd person singular agreement in the present tense:

(11) $RR_{I, \{AGR:\{PER:3, NUM:sg\}, TNS:pres\}, V}(\langle X, \sigma \rangle) =_{def} \langle Xs, \sigma \rangle$

An application of PF can be stretched to derivational morphology. Stump (2001: 257) allows PF to take a pair of $\langle X, \delta \rangle$ where δ is some syntacticosemantic category. Hence, the following morphological derivation can be carried out by PF, for instance:

(12) $PF(\langle friend, \text{privative adjective} \rangle) = \langle friendless, \text{privative adjective} \rangle$

Instead of taking a set of morphosyntactic properties, PF takes a syntacticosemantic property, 'privative adjective'. According to this feature, a

derivational suffix, -*less*, is added to the stem, which results in the derived adjective, *friendless*.

In a similar spirit, I propose that PF yields derived forms according to syntactic properties in order to establish lexemic relations for the three distinct lexemes in Japanese. Specifically, the following two lexemes are constructed from a primary verb root, *kak* 'write':

(13) a. PF(⟨*kak*, {NEG: +}⟩) = ⟨*kakana*, {NEG: +}⟩
       b. PF(⟨*kak*, {NEG: +, POLITE: +}⟩) = ⟨*kakimasen des*, {NEG: +, POLITE: +}⟩

(13a) illustrates that PF yields the output form, *kakana*, from a pair of the root and a syntactic feature{NEG: +}, so that this form becomes an input to the syntax with this feature. Similarly, the periphrastic form, *kakimasen des*, is produced by the PF in (13b) and the syntactic features,{NEG: +} and {POLITE: +}, are associated with this form. Unlike morphological features, {POL: neg} or {STATUS: polite}, those syntactic features play no roles in the inflectional morphology, namely, *kakana* does not inflect for polarity morphologically, even though it is a negative verb in the syntax; in the same way, *kakimasen des* does not inflect for polarity or status in the inflectional morphology despite its negative polite function in the syntax.[4]

4.2 Inflectional rules

4.2.1 Verb lexeme inflection
A primary verb and the polite copula follow the verb inflectional patterns. In PFM, morphosyntactic properties are defined as features and permissible values. For the Japanese verb inflection, (14) can be proposed:

(14) FEATURES   PERMISSIBLE VALUES
      MOOD   indic, tent, hort, imper, conj, cond I, cond II, disj, repr
      TNS   past, n-past
      POL   aff, neg
      STATUS   plain, polite
      COPULA   yes, no
      AUX   yes, no

MOOD, TNS, POL and STATUS and their permissible values are straightforward. COPULA and AUX are only used for property co-occurrence restrictions in (15), which define a well-formed set of morphosyntactic properties for Japanese verbs:

(15) A set τ of morphosyntactic properties of a lexeme of category V is well-formed only if τ has a well-formed extension of σ such that

    a. for any permissible α, σ is an extension of {TNS: α} iff σ is an extension of {MOOD: indic};

    b. if σ is an extension of {POL: neg}, then σ is not an extension of {MOOD: cond II}, {MOOD: repr}, or {TNS: past};

    c. if σ is an extension of {COPULA: yes}, then σ is not an extension of {POL: neg}, or {MOOD: hort}, or of {MOOD: imper};

    d. if σ is an extension of {AUX: yes}, then σ is not an extension of {TNS: n-past}.

'Extension' is a technical term of PFM and can be understood as 'subsumption' in more general terms. Thus, (15a) states that TNS feature is available only when {MOOD: indic} is a member of σ. (15b–d) are about non-existing forms. For instance, when σ includes {POL: neg}, {MOOD: cond II}, {MOOD: repr} or {TNS: past} is not available, so that those feature combinations are simply excluded from the system ((15b)). Since the copulative verb lacks negative forms and the hortative or imperative forms, COPULA is introduced, namely (15c) states that the copulative verb does not inflect for {POL: neg}, {MOOD: hort} or {MOOD: imper}. When the copula is a part of periphrastic polite negative, a tense distinction disappears. This is regulated by AUX feature, which encodes that a given verb is a part of periphrases, as in (15d).

    Two rules block are proposed for verbs in Japanese. Block I contains only one RR that defines the suffixation of *-mas* as in (16a). Block II includes 16 rules defined over various values of MOOD, TNS, POL and STATUS as in (16b):

(16) a. **Block I**

      i. $RR_{\text{I, \{STATUS:polite\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xmas, \sigma \rangle$

  b. **Block II**

      i. $RR_{\text{II, \{MOOD:indic, TNS:n-past, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xu, \sigma \rangle$

      ii. $RR_{\text{II, \{MOOD:indic, TNS:past, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xta, \sigma \rangle$

      iii. $RR_{\text{II, \{MOOD:tent, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xoo, \sigma \rangle$

      iv. $RR_{\text{II, \{MOOD:imper, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xe, \sigma \rangle$

      v. $RR_{\text{II, \{MOOD:conj, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xte, \sigma \rangle$

      vi. $RR_{\text{II, \{MOOD:cond I, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xeba, \sigma \rangle$

      vii. $RR_{\text{II, \{MOOD:cond II, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xtara, \sigma \rangle$

      viii. $RR_{\text{II, \{MOOD:disj, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xtatte, \sigma \rangle$

      ix. $RR_{\text{II, \{MOOD:repr, POL:aff\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xtari, \sigma \rangle$

      x. $RR_{\text{II, \{MOOD:indic, TNS:n-past, POL:neg\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xn, \sigma \rangle$

      xi. $RR_{\text{II, \{MOOD:tent, POL:neg\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xmai, \sigma \rangle$

      xii. $RR_{\text{II, \{MOOD:imper, POL:neg\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xna, \sigma \rangle$

      xiii. $RR_{\text{II, \{MOOD:conj, POL:neg, STATUS:plain\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xnaide, \sigma \rangle$

      xiv. $RR_{\text{II, \{MOOD:conj, POL:neg, STATUS:polite\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xnde, \sigma \rangle$

      xv. $RR_{\text{II, \{MOOD:cond I, POL:neg\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xmai, \sigma \rangle$

xvi. $\text{RR}_{\text{II, \{MOOD:cond II, POL:neg\}, V}}(\langle X, \sigma \rangle) =_{def} \langle Xneba, \sigma \rangle$

Finally, the hortative mood forms are always identical to the tentative mood forms. Such syncretism is resolved by rule of referral in PFM as in (17) — a formulation is given in parentheses (see Stump (2001) for details):

(17) **Rule of referral**
In the hortative mood, a verb's forms are inflected however its tentative mood forms are inflected.
(Where τ is any complete extension of {MOOD: hort}, n is any of rule blocks I to II, and $\sigma' = \sigma/\{\text{MOOD: tent}\}$, $\text{RR}_{n,\ \tau,\ V}(\langle X, \sigma \rangle) =_{def} \langle Y, \sigma \rangle$, where $\text{Nar}_n(\langle X', \sigma \rangle) = \langle Y, \sigma \rangle$.)

4.2.2 Derived negative lexeme inflection
Since derived negative verbs are morphologically adjectives, different rule applications are posited. Adjectives inflect only for mood and tense and lack hortative and imperative forms. Therefore, (18) is postulated:

(18) FEATURE   PERMISSIBLE VALUES
      MOOD   indic, tent, conj, cond I, cond II, disj, repr
      TNS   past, n-past

The property co-occurrence restriction (19) allows TNS feature to appear only with {MOOD: indic}:

(19) A set τ of morphosyntactic properties for a lexeme of category A is well-formed only if τ has a well-formed extension of σ such that for any permissible α, σ is an extension of {TNS: α} iff σ is an extension of {MOOD: indic}.

Only one rule block is proposed for the adjective inflection as follows:

(20) **Block I**
      i. $\text{RR}_{\text{I, \{MOOD:indic, TNS:n-past\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xi, \sigma \rangle$
      ii. $\text{RR}_{\text{I, \{MOOD:indic, TNS:past\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkatta, \sigma \rangle$
      iii. $\text{RR}_{\text{I, \{MOOD:tent\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkaroo, \sigma \rangle$
      iv. $\text{RR}_{\text{I, \{MOOD:conj\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkute, \sigma \rangle$
      v. $\text{RR}_{\text{I, \{MOOD:cond I\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkereba, \sigma \rangle$
      vi. $\text{RR}_{\text{I, \{MOOD:cond II\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkattara, \sigma \rangle$
      vii. $\text{RR}_{\text{I, \{MOOD:disj\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkutatte, \sigma \rangle$
      viii. $\text{RR}_{\text{I, \{MOOD:repr\}, A}}(\langle X, \sigma \rangle) =_{def} \langle Xkattari, \sigma \rangle$

4.2.3 Applications

To see how RRs are successively applied to a pair of root and σ to yield a correct output form, I illustrate three cases, *kakimasu* (the polite affirmative indicative non-past in Table 2), *kakanakatta* (the plain negative indicative past in Table 3) and *kakimasen desitatte* (the polite negative disjunctive in Table 4).

Firstly, the formation of *kakimasu* is given in (21) in which two RRs, (16a-i) and (16b-i), are applied to a pair of the root, *kak*, and a set of morphosyntactic properties σ:[5]

(21)　σ = {MOOD:indic, TNS:n-past, POL:neg, STATUS:polite, COPULA:no, AUX:no}
　　　PF($\langle kak,\ \sigma \rangle$)
　　　= RR$_{(16b\text{-}i)}$(RR$_{(16a\text{-}i)}$($\langle kak,\ \sigma \rangle$))
　　　= RR$_{(16b\text{-}i)}$($\langle kakimas,\ \sigma \rangle$)
　　　= $\langle kakmasu,\ \sigma \rangle$

(22) shows the inflection of a derived negative verb. Note that although it is a negative verb, {POL: neg} is not a member of σ. As shown in (13), the negative property associated with this lexeme is syntactic {NEG: +} feature. In terms of the morphology, therefore, this adjectival negative does not inflect for polarity.

(22)　σ = {MOOD:indic, TNS:past}
　　　PF($\langle kakana,\ \sigma \rangle$)
　　　= RR$_{(20\text{-}ii)}$($\langle kakana,\ \sigma \rangle$)
　　　= $\langle kakanakatta,\ \sigma \rangle$

Finally, (23) illustrates a RR applies to the polite copula that is a part of periphrasis. This periphrastic status is encoded by markedness features, COPULA and AUX:

(23)　σ = {MOOD:disj, POL:aff, COPULA:yes, AUX:yes}
　　　PF($\langle kakimasen\ des,\ \sigma \rangle$)
　　　= RR$_{(16b\text{-}viii)}$($\langle kakimasen\ des,\ \sigma \rangle$)
　　　= $\langle kakmasen\ desitatte,\ \sigma \rangle$

5 Conclusion

This paper starts by looking at the Japanese verb inflectional morphology from a different perspective, focusing on missing forms in the synthetic paradigm. If we stretch the domain of investigation to the expressions with the copula, the existence of polite negative periphrases is revealed. Such a careful observation

of the data shed light on a possibility that the Japanese verb inflection is completed by three related lexemes, one of which is periphrastic. Finally, this paper shows that this kind of complicated set of data can be captured by PFM with a new proposal on PF derivations whose relations are established by syntactic features.

Notes

* I would like to express my gratitude to Andrew Spencer for discussion. I would also like to thank the audience at WECOL 2007, particularly Farrell Ackerman for comments.
1 The following abbreviations are used for the examples: ACC = accusative, AGR = agreement, COP = copula, NEG = negative, NOM = nominative, NOMINAL = nominalizer, POL = polite, PST = past, TOP = topic.
2 As indicated by the parentheses in the example, the nominalizer is omissible depending on the forms of the copula, particularly in colloquial speech. In my judgement, it can be omitted when the copula is in the indicative non-past or the tentative with adjectival predicates, and in the conjunctive with verbal predicates.
3 The following abbreviations are used for the morphosyntactic features and values: aff = affirmative, AGR = agreement, AUX = auxiliary, cond = conditional, conj = conjunctive, disj = disjunctive, hort = hortative, imper = imperative, indic = indicative, neg = negative, n-past = non-past, NUM = number, PERS = person, POL = polarity, pres = present, repr = representative, sg = singular, tent = tentative, TNS = tense.
4. The way syntactic features are processed varies depending on syntactic theories. In Lexical Functional Grammar (Kaplan and Bresnan 1982, Bresnan 2001), for instance, a derived negative verb has (↑ NEG) = +. See Sadler and Spencer (2001), Sadler and Nordlinger (2004) and Otoguro (2006) for discussion about morphological features and syntactic features in LFG.
5. An epenthesis is inserted between *kak* and *mas*. This is due to the following rule: 'If *X* ends in a consonant and the suffix defined by R is *ta*, *te*, *tara*, *tatte*, *tari* or *mas*, insert *i* between *X* and the suffix. In PFM, this kind of alternation is captured by means of morphophonological metageneralization (Stump 2001: 179ff).

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Polish Clitics: Consequences for the Analysis of Optionality in OT*

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1. Variation Pattern

For present purposes, variation (or optionality) can be defined as a situation in which one input corresponds to more than one output. The Polish monoconsonantal proclitic /z/ is involved in two types of variation. Whenever it attaches to a stem that begins with an alveolo-palatal or a postalveolar/retroflex fricative (i.e., [ʑ], [ɕ], [z̪], or [ʂ]) followed by a vowel, or an alveolo-palatal or a postalveolar affricate (i.e., [d͡ʑ], [t͡ɕ], [d͡z̪], or [t͡ʂ]), /z/ undergoes optional coronal place assimilation (CPA) (1a). On the other hand, when the stem begins with an alveolo-palatal or a postalveolar fricative followed by a consonant, CPA is blocked and /z/ can optionally surface with an epenthetic vowel (1b).

(1) *Variation pattern of the proclitic /z/*
    a. *CPA ~ no CPA*
       when the stem begins with {ʑ, ɕ, z̪, ʂ}V *or* {d͡ʑ, t͡ɕ, d͡z̪, t͡ʂ}

CPA		no CPA	*epenthesis	
ʑ+ʑɛmi	~	z+ʑɛmi	*zɛ+ʑɛmi	'from the ground'
ɕ+t͡ɕpʊnɛm	~	s+t͡ɕpʊnɛm	*zɛ+t͡ɕpʊnɛm	'with a junkie'
z̪+d͡z̪ɛmɛm	~	z+d͡z̪ɛmɛm	*zɛ+d͡z̪ɛmɛm	'with jam'
ʂ+ʂɔkʊ	~	s+ʂɔkʊ	*zɛ+ʂɔkʊ	'from shock'

    b. *Epenthesis ~ no CPA*
       when the stem begins with {ʑ, ɕ, z̪, ʂ}C

epenthesis		no CPA	*CPA	
zɛ+ʑrʊdwɑ	~	z+ʑrʊdwɑ	*ʑ+ʑrʊdwɑ	'from a spring'
zɛ+ɕfitɛm	~	s+ɕfitɛm	*ɕ+ɕfitɛm	'with dawn'
zɛ+z̪virʊ	~	z+z̪virʊ	*z̪+z̪virʊ	'from gravel'
zɛ+ʂpilkɔ̃	~	s+ʂpilkɔ̃	*ʂ+ʂpilkɔ̃	'with a pin'

In this section I discuss in more detail the behavior of the clitic /z/, and show how the variation pattern in (1b) results from the interaction between two processes: obligatory epenthesis and optional CPA.

1.1 Obligatory processes

Polish has an obligatory process of regressive voicing assimilation that applies to obstruent clusters (e.g., Bethin 1992). The application of this process to the clitic /z/ is illustrated in (2).

(2) *Polish clitic /z/: voicing assimilation*

z+ɲaɲɔ̃	'with a nanny'	s+kfasɛm	'with acid'
z+bʑikɔvatɕ͡	'to become crazy'	s+plɛɕtɕ͡	'to entwine together'
z+zɛgarka	'from a watch'	s+sʊnɔ̃tɕ͡	'to slip down'

In Optimality Theory (OT) (Prince & Smolensky 1993/2004), it can be assumed that assimilation is triggered by the markedness constraint AGREE[voi], which penalizes adjacent obstruents that disagree in [±voice]. Accordingly, obstruents that change their voicing from input to output (in order to satisfy AGREE[voi]) violate the faithfulness constraint IDENT[voi]. Informal definitions of these constraints are provided in (3).

(3) *Informal definitions of constraints responsible for voicing assimilation*

AGREE[voi]   Adjacent obstruents must have the same value for voicing
IDENT[voi]   Correspondent consonants must have the same value for voicing

Voicing assimilation can only be enforced in a language by ranking AGREE[voi] above IDENT[voi], as illustrated in the tableau in (4).

(4) *Voicing assimilation*

/z+kfasɛm/	AGREE[voi]	IDENT[voi]
a. z+kfasɛm	*!	
b. → s+kfasɛm		*

In certain contexts the clitic /z/ surfaces with an epenthetic vowel, as in (5).

(5) *Polish clitic /z/: obligatory vowel epenthesis*
   when the stem begins with {z, s}C

/z+zvʲɛzɛ̃tɕitɕ͡+ɕɛ̃)/[1]	→	zɛ+zvʲɛzɛ̃tɕitɕ͡+ɕɛ̃	'to become animal-like'
/z+znakʲɛm/	→	zɛ+znakʲɛm	'with a sign'
/z+stazɛ̝tɕ͡+ɕɛ̃/	→	zɛ+stazɛ̝tɕ͡+ɕɛ̃	'to become old'
/z+skawɔ̃/	→	zɛ+skawɔ̃	'with a rock'

It has been observed by many authors (e.g., Steele 1973, Laskowski 1975, Rubach 1977, Bethin 1992, Gussmann 2007) that this vowel insertion is conditioned phonologically. Epenthesis applies whenever /z/ attaches to a stem that begins with a 'similar' segment (i.e., [z] or [s], which differ from the clitic /z/ at most in voicing) followed by another consonant. A straightforward analysis of this pattern (following Baković 2005) is to say that epenthesis applies whenever – due to the independently motivated process of voicing assimilation – the result would otherwise be a sequence of completely identical segments (or geminates) followed by another consonant, as shown in (6).

(6) *Avoidance of identical consonants that begin a cluster: obligatory epenthesis*

/z+znɑkʲɛm/   ⟶╫⟶   *z+znɑkʲɛm   'with a sign'
                              zɛ+znɑkʲɛm

/z+stɑzɛ͡tɕ+ɕɛ̃/   ⟶╫⟶   *s+stɑzɛ͡tɕ+ɕɛ̃   'to become old'
                              zɛ+stɑzɛ͡tɕ+ɕɛ̃)

In an OT analysis, three crucial constraints need to interact in order to yield the desired result: DEP(V) (which penalizes vowel epenthesis), NOGEM+C (which is violated by adjacent indentical segments, or geminates, followed by another consonant),[2] and AGREE[voi]. The informal definitions of the first two constraints are provided in (7).

(7) *Informal definitions of constraints responsible for vowel epenthesis*

NOGEM+C   No adjacent identical consonants (geminate) in a cluster
DEP(V)   No vowel epenthesis

The candidate with epenthesis surfaces in order to avoid geminates followed by another consonant that would otherwise arise due to the operation of voicing assimilation, which is independently active in the language. Therefore, DEP(V) is violated in an attempt to jointly satisfy the higher-ranked constraints NOGEM+C and AGREE[voi]. This leads to the following ranking: DEP(V) has to be dominated by both NOGEM+C and AGREE[voi]. The tableaux in (8) illustrate how this ranking yields the correct results. In both cases, the candidates assimilated in voicing (a) are eliminated by NOGEM+C, whereas the candidates that satisfy NOGEM+C by virtue of disagreeing in voicing (b) are eliminated by AGREE[voi]. The candidates with epenthesis (c), which violate DEP(V), surface in this situation as optimal assuring that neither NOGEM+C nor AGREE[voi] are violated.

(8) *Vowel epenthesis*

/z+znɑkʲɛm/		NOGEM+C	AGREE[voi]	DEP(V)
a.	[z+znɑkʲɛm]	*!		
b.	[s+znɑkʲɛm]		*!	
c. →	[zɛ+znɑkʲɛm]			*

/z+stɑzɛ͡tɕ/		NOGEM+C	AGREE[voi]	DEP(V)
a.	[s+stɑzɛ͡tɕ]	*!		
b.	[z+stɑzɛ͡tɕ]		*!	
c. →	[zɛ+stɑzɛ͡tɕ]			*

Another ranking is essential for the present analysis. Namely, the faithfulness constraint IDENT[voi] needs to be ranked below DEP(V) so that the candidate with epenthesis is eliminated in contexts where NOGEM+C is not at stake. This is illustrated in the tableaux in (9). Note that the motivation for this ranking comes from the second tableau only, where the clitic /z/ needs to change its

underlying voicing in order to satisfy AGREE[voi] (a). In the first tableau, the candidate assimilated in voicing (a) does not violate any of the constraints.

(9) *No epenthesis*

/z+zɛɡarka/	NOGEM+C	AGREE[voi]	DEP(V)	IDENT[voi]
a. → [z+zɛɡarka]				
b. [s+zɛɡarka]		*!		*
c. [zɛ+zɛɡarka]			*!	

/z+kfasɛm/	NOGEM+C	AGREE[voi]	DEP(V)	IDENT[voi]
a. → [s+kfasɛm]				*
b. [z+kfasɛm]		*!		
c. [zɛ+kfasɛm]			*!	

Therefore, the complete ranking of constraints required for this analysis is the following: NOGEM+C, AGREE[voi] >> DEP(V) >> IDENT[voi].

1.2 Optional processes

Polish has an optional process of regressive coronal place assimilation (CPA) (e.g., Rowicka 1994), which requires that adjacent coronal consonants agree in subcoronal place of articulation (i.e., the feature(s) distinguishing alveolars, alveolo-palatals, and postalveolars; henceforth [COR-place] or simply [COR]).[3] The examples in (10) show the application of CPA to the clitic /z/.

(10) *Polish clitic /z/: optional CPA*

z+d͡ʑivit͡ɕ	~ ʑ+d͡ʑivit͡ɕ	'to surprise'
s+ɕanɛm	~ ɕ+ɕanɛm	'with hay'
z+z�envab̃	~ z�+z̝ab̃	'with a frog'
s+t͡ʂkafki	~ ʂ+t͡ʂkafki	'from hiccups'

In certain contexts vowel epenthesis applies to the clitic /z/ optionally (Rubach 1977: 119), and CPA is always blocked, as shown in (11). This happens whenever /z/ attaches to a word that begins with an alveolo-palatal or a postalveolar segment followed by another consonant.

(11) *Optional epenthesis*

when the stem begins with {ʐ, ɕ, z̝, ʂ}C

/z+ʐrɛbakʲɛm/	→ z+ʐrɛbakʲɛm	~ zɛ+ʐrɛbakʲɛm	'with a colt'
/z+ɕfʲatɛm/	→ s+ɕfʲatɛm	~ zɛ+ɕfʲatɛm	'with the world'
/z+z̝virʊ/	→ z+z̝virʊ	~ zɛ+z̝virʊ	'from gravel'
/z+ʂfɛt͡sʲi/	→ s+ʂfɛt͡sʲi	~ zɛ+ʂfɛt͡sʲi	'from Sweden'

This pattern can be accounted for by building on Baković's (2005) work on other languages. Note that the input forms in (11) should be in principle able to undergo CPA. Being optional, CPA can either apply (12a) or not (12c).

Crucially, however, if it applies (together with obligatory voicing assimilation), the result is a sequence of two identical segments followed by another consonant. As discussed in §1.1, such sequences are strictly forbidden in Polish and are obligatorily repaired by vowel epenthesis (12b). That is, epenthesis in (11) is not optional, but crucially *contingent* on the optionality of CPA (Baković & Pająk 2008). Epenthesis applies obligatorily whenever – due to the independently motivated processes of CPA and voicing assimilation – the result would otherwise be a sequence of a geminate that begins a cluster. The form not assimilated in coronal place, on the other hand, does not contain disallowed sequences, and thus remains available as another option.

(12) *Avoidance of identical consonants that begin a cluster: optional CPA*

	*ʑ+ʑrɛbɑkʲɛm (a)	
/z+ʑrɛbɑkʲɛm/	z+ʑrɛbɑkʲɛm (b)	'with a colt'
	zɛ+ʑrɛbɑkʲɛm (c)	
	*ʂ+ʂfɛts͡ʲi (a)	
/z+ʂfɛts͡ʲi/	zɛ+ʂfɛts͡ʲi (b)	'from Sweden'
	s+ʂfɛts͡ʲi (c)	
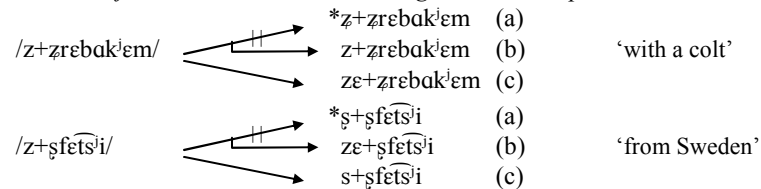
In my OT analysis I assume that CPA is triggered by the markedness constraint AGREE[cor], which penalizes sequences of coronal stridents that do not agree in subcoronal place of articulation. Underlying coronal segments that surface with a different place of articulation violate the faithfulness constraint IDENT[cor]. Note that this constraint is violated when a coronal segment changes its place to either another coronal (e.g., alveolar to alveolo-palatal) or a non-coronal (e.g., alveolar to dorsal). That is, IDENT[cor] requires that a coronal in the input remain the same type of coronal in the output. Informal definitions of these constraints are shown in (13).

(13) *Informal definitions of constraints responsible for CPA*
    AGREE[cor]   Adjacent coronal consonants must have the same value for subcoronal place of articulation
    IDENT[cor]   Correspondent consonants must have the same value for subcoronal place of articulation

In §2 I discuss possible ways in which the complete variation pattern of the clitic /z/ can be accounted for in OT.[4]

2. Accounting for Optionality

2.1 Ranking paradox

A common way of accounting for optionality in OT is by using the concept of 'ties' (see Müller 1999 for a review of different approaches to optionality in

OT). Under this approach, two (or more) candidates can surface as optimal when the constraints that distinguish between them are tied, that is, crucially unranked with respect to each other.

Recall from §1.2 that the clitic /z/ is involved in two types of variation, as shown in (14).

(14) *Variation pattern of the proclitic /z/*

CPA		no CPA		*epenthesis	
z̪+d͡z�...					

	CPA	no CPA	*epenthesis	
	z̪+d͡ʑɛmɛm	~ z+d͡ʑɛmɛm	*zɛ+d͡ʑɛmɛm	'with jam'
	epenthesis	*no CPA*	*CPA	
	zɛ+ʑrʊdwɑ	~ z+ʑrʊdwɑ	*ʑ+ʑrʊdwɑ	'from a spring'

Applying ties to this variation pattern leads to a ranking paradox. Consider first the tableaux in (15). In order to account for the variation between the 'CPA' and 'no CPA' forms, the constraints AGREE[cor] and IDENT[cor] need to be tied (i). Note that DEP(V) must be ranked higher so that the candidate with epenthesis (i-c) is eliminated. However, this arrangement of constraints predicts only one optimal candidate in the second type of variation (between the 'epenthesis' and 'no CPA' forms) (ii). Crucially, the candidate with epenthesis in (ii-c) is eliminated due to the ranking DEP(V) >> AGREE[cor].

(15) *Tie between AGREE[cor] and IDENT[cor]*

i. *CPA ~ no CPA*

/z+d͡ʑɛmɛm/	NOGEM+C	DEP(V)	AGREE[cor]	IDENT[cor]
a. → [z+d͡ʑɛmɛm]			*	
b. → [ʑ+d͡ʑɛmɛm]				*
c. [zɛ+d͡ʑɛmɛm]		*!		

ii. *Epenthesis ~ no CPA*

/z+ʑrʊdwɑ/	NOGEM+C	DEP(V)	AGREE[cor]	IDENT[cor]
a. → [z+ʑrʊdwɑ]			*	
b. [ʑ+ʑrʊdwɑ]	*!			*
c. !!! [zɛ+ʑrʊdwɑ]		*!		

This problem might be thought to be solvable by assuming that the constraints DEP(V) and AGREE[cor] are also tied, as in the tableaux in (16). Now, two optimal candidates are correctly predicted for the second type of variation (ii). However, this solution leads to an incorrect result in the first tableau (i), where the candidate with epenthesis is now predicted as a possible option, when in fact it should be eliminated.

(16) *Tie between DEP(V) and AGREE[cor]*

    i. *CPA ~ no CPA*

/z+d͡ʑɛmɛm/	NOGEM+C	DEP(V)	AGREE[cor]	IDENT[cor]
a. → [z+d͡ʑɛmɛm]			*	
b. → [z̻+d͡ʑɛmɛm]				*
c.!!!→ [zɛ+d͡ʑɛmɛm]		*		

    ii. *Epenthesis ~ no CPA*

/z+ʐrʊdwɑ/	NOGEM+C	DEP(V)	AGREE[cor]	IDENT[cor]
a. → [z+ʐrʊdwɑ]			*	
b. [z̻+ʐrʊdwɑ]	*!			*
c. → [zɛ+ʐrʊdwɑ]		*		

Therefore, the tied-constraint approach induces a paradox because the constraints DEP(V) and AGREE[cor] must be simultaneously ranked and crucially unranked with respect to each other in order to account for the two types of variation.

2.2 Partially Ordered Grammars (POG)

More complex models can be employed to account for variation in OT. The model of POG (Anttila 1997, 2002) allows for the constraints to be crucially unranked with respect to each other. The basic claim is that a grammar can be defined as a set of ordered pairs of constraints. Variation arises within grammars whose constraints are only partially ordered (unless the unordered constraints do not interact).

In order to account for the variation pattern of the clitic /z/, it could be first assumed that there is no order between the three crucial constraints, DEP(V), AGREE[cor], and IDENT[cor] (assuming that the constraint NOGEM+C is always higher-ranked). As shown in (17), this would yield six possible rankings, each selecting different output forms for the two variation types. However, this grammar needs to be restricted in order to disallow unattested outputs (circled).

(17) *No ordered pairs and the predicted outputs of the clitic /z/*

RANKING	INPUT-OUTPUT MAPPING	
	/z+d͡ʒɛmɛm/	/z+ʐrʊdwɑ/
i. DEP(V) >> AGREE[c] >> IDENT[c]	CPA	no CPA
ii. DEP(V) >> IDENT[c] >> AGREE[c]	no CPA	no CPA
iii. AGREE[c] >> DEP(V) >> IDENT[c]	CPA	epenthesis
iv. IDENT[c] >> DEP(V) >> AGREE[c]	no CPA	no CPA
v. AGREE[c] >> IDENT[c] >> DEP(V)	epenthesis	epenthesis
vi. IDENT[c] >> AGREE[c] >> DEP(V)	epenthesis	epenthesis

There is one ordered pair of constraints that, if added to the grammar, eliminates the unattested outputs and predicts all the attested forms: DEP(V) >>

IDENT[cor]. As shown in (18), adding this ordered pair reduces the number of possible rankings to three, and yields outputs that are all attested in Polish. The tableaux with the three rankings and their corresponding outputs are provided in (19). Therefore, POG correctly captures the data under discussion.

(18) *A partially ordered grammar and the correctly predicted outputs of the clitic /z/*

Ordered pair: DEP(V) >> IDENT[cor]	INPUT-OUTPUT MAPPING	
RANKING	/z+d͡ʒɛmɛm/	/z+ʐrʊdwɑ/
i. DEP(V) >> AGREE[c] >> IDENT[c]	CPA	no CPA
ii. DEP(V) >> IDENT[c] >> AGREE[c]	no CPA	no CPA
iii. AGREE[c] >> DEP(V) >> IDENT[c]	CPA	epenthesis

(19) *Three possible rankings and their outputs*

i. DEP(V) >> AGREE[cor] >> IDENT[cor]

/z+d͡ʒɛmɛm/	NoGEM+C	DEP(V)	AGREE[cor]	IDENT[cor]
a. [z+d͡ʒɛmɛm]			*!	
b. → [z�+d͡ʒɛmɛm]				*
c. [zɛ+d͡ʒɛmɛm]		*!		

/z+ʐrʊdwɑ/	NoGEM+C	DEP(V)	AGREE[cor]	IDENT[cor]
a. → [z+ʐrʊdwɑ]			*	
b. [ʐ+ʐrʊdwɑ]	*!			*
c. [zɛ+ʐrʊdwɑ]		*!		

ii. DEP(V) >> IDENT[cor] >> AGREE[cor]

/z+d͡ʒɛmɛm/	NoGEM+C	DEP(V)	IDENT[cor]	AGREE[cor]
a. → [z+d͡ʒɛmɛm]				*
b. [z̺+d͡ʒɛmɛm]			*!	
c. [zɛ+d͡ʒɛmɛm]		*!		

/z+ʐrʊdwɑ/	NoGEM+C	DEP(V)	IDENT[cor]	AGREE[cor]
a. → [z+ʐrʊdwɑ]				*
b. [ʐ+ʐrʊdwɑ]	*!		*	
c. [zɛ+ʐrʊdwɑ]		*!		

iii. AGREE[cor] >> DEP(V) >> IDENT[cor]

/z+d͡ʒɛmɛm/	NoGEM+C	AGREE[cor]	DEP(V)	IDENT[cor]
a. [z+d͡ʒɛmɛm]		*!		
b. → [z̺+d͡ʒɛmɛm]				*
c. [zɛ+d͡ʒɛmɛm]			*!	

/z+ʐrʊdwɑ/	NoGEM+C	AGREE[cor]	DEP(V)	IDENT[cor]
a. [z+ʐrʊdwɑ]		*!		
b. [ʐ+ʐrʊdwɑ]	*!			*
c. → [zɛ+ʐrʊdwɑ]			*	

2.3 Stochastic OT

Another model that can account for variation is Stochastic OT (Boersma 1998, Boersma and Hayes 2001). In this model it is assumed that all the constraints are situated on a continuum, and each constraint is associated with a fixed numeric value ('ranking value'), as shown in (20). The numbers are completely arbitrary; what is important is the relative distance between the constraints. In each speaking event, a so called 'stochastic candidate evaluation' takes place. At the moment of this evaluation some 'noise' is temporarily added to the ranking value of each constraint. 'Noise' is just a random numeric value that is normally distributed with mean zero (i.e., zero is the most probable value of noise). The result of adding noise to the ranking values is called 'selection points.' Selection points determine the ranking of constraints used in a particular speaking event.

(20) *Continuous ranking scale and stochastic candidate evaluation*
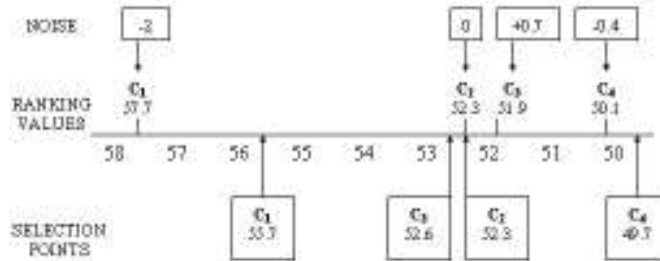
Note that if the constraints are close to each other on the continuum, as the constraints C_2 and C_3 are in (20), then even a small amount of noise may reverse their original ranking. Such changes in the ranking of constraints constitute the source of variation in Stochastic OT.

In order to account for the variation pattern of the Polish clitic /z/, the constraints used in the analysis must be arranged on the continuum in a very particular way. Note that for each type of variation there are two different conditions on the constraint ranking. For the variation between the 'CPA' and 'no CPA' forms (as shown in (14)), DEP(V) must dominate either IDENT[cor] or AGREE[cor] (21a-i), so that the candidate with epenthesis is always eliminated. Additionally, AGREE[cor] and IDENT[cor] need to overlap significantly (21a-ii) to enable the optional application of CPA. That is, they must be sufficiently close to each other on the continuous ranking scale to allow for their variable ranking from one speaking event to another due to the application of noise. This is illustrated in (21a). Each constraint is associated with a distribution of selection points, which determine its position in the ranking. Due to the fact that the distributions of AGREE[cor] and IDENT[cor] overlap, either of these constraints might precede the other in a given speaking event.

There are two different conditions that need to be fulfilled in order to account for the variation between the 'epenthesis' and 'no CPA' forms. NOGEM+C must be ranked higher than DEP(V) (21b-i), so that the candidates with a geminate in a cluster can be repaired by vowel epenthesis. Moreover, there needs to be a significant overlap between DEP(V) and AGREE[cor] (21b-ii) in order to enable the variation. This is shown in (21b). Again, since the distributions of DEP(V) and AGREE[cor] overlap, the ranking between these constraints varies from one speaking event to another.

(21) *Conditions on the arrangement of constraints*
    a. *CPA ~ no CPA*
        Conditions: (i)   DEP(V) >> IDENT[cor] / AGREE[cor]
                         (ii) AGREE[cor] ~ IDENT[cor]

Distribution (normal) of the selection point

    DEP(V)   AGREE[cor]   IDENT[cor]
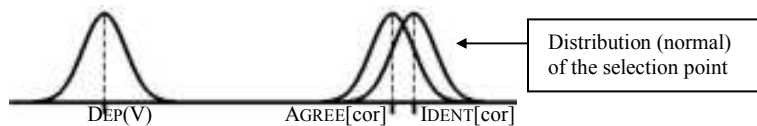
    b. *Epenthesis ~ no CPA*
        Conditions: (i)   NOGEM+C >> DEP(V)
                         (ii) DEP(V) ~ AGREE[cor]


    NOGEM+C   DEP(V)   AGREE[cor]

When the conditions for both types of variation are considered together, as shown in (22), it follows that AGREE[cor] has to overlap with both DEP(V) and IDENT[cor] (22a), but, crucially, DEP(V) and IDENT[cor] cannot overlap (22b).

(22) *Conditions on the arrangement of constraints*
    a. AGREE[cor] ~ IDENT[cor]   (22a-ii)
        AGREE[cor] ~ DEP(V)   (22b-ii)
    b. DEP(V) >> IDENT[cor] / AGREE[cor] (22a-ii)⎤
        DEP(V) ~ AGREE[cor]   (22b-ii)⎦ DEP(V) >> IDENT[cor]

This can only be achieved by arranging the constraints in the way illustrated in (23). The three critical constraints, DEP(V), AGREE[cor] and IDENT[cor], must be placed sufficiently close to each other to allow for the required overlaps between AGREE[cor] and DEP(V), and between AGREE[cor] and IDENT[cor], but at the same time sufficiently far apart to minimize the overlap between DEP(V) and IDENT[cor].

(23) *Arrangement of constraints on the continuous ranking scale*
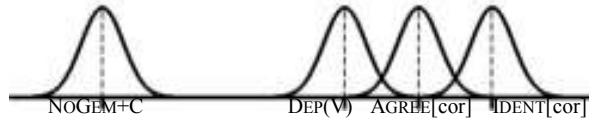
Arranging the constraints as in (23) results in three possible rankings, shown in (24) (the higher-ranked constraint NOGEM+C is omitted). The ranking in (24a) is chosen whenever the value of noise is relatively small, and the original order of constraints is preserved. In cases when noise is larger and the selection points of both AGREE[cor] and DEP(V), or AGREE[cor] and IDENT[cor] fall within their overlap region, there is a chance of their switching places, which in turn results in using the ranking in (24b) (when AGREE[cor] and IDENT[cor] change places) or in (24c) (when AGREE[cor] and DEP(V) change places).

(24) *Three possible rankings and the correctly predicted outputs of the clitic /z/*

RANKING	INPUT-OUTPUT MAPPING	
	/z+d͡ʒɛmɛm/	/z+ʐrʊdwɑ/
a. DEP(V) >> AGREE[c] >> IDENT[c]	CPA	no CPA
b. DEP(V) >> IDENT[c] >> AGREE[c]	no CPA	no CPA
c. AGREE[c] >> DEP(V) >> IDENT[c]	CPA	epenthesis

Note that the three rankings in (24) are exactly the rankings predicted by POG, as discussed in §2.2. Therefore, similarly to POG, Stochastic OT resolves the ranking paradox induced by the tied-constraint approach, and correctly accounts for the data under discussion.

3. Predicting Probabilities

In addition to accounting for variation, both POG and Stochastic OT are claimed to predict the probabilities of the varying forms. In this section I show that this claim is in fact problematic.

In POG, the probability of a given candidate is equal to the number of tableux in which this candidate wins divided by the total number of possible tableaux (i.e., total rankings consistent with specified ordered pairs). This means that the predicted probabilities are sensitive to the exact number of intervening constraints (a problem originally noted by Smolensky 2007). Since the complete set of constraints is far from being well-understood, I simply assume that POG cannot at this point make any conclusive predictions regarding the probabilities of the varying forms.[5]

Stochastic OT can account for variation due to the assumption that random 'noise' interferes with the constraint ranking. However, not all values of noise are equally probable. Rather, the assumption is that noise is normally distributed with mean zero, which means that most of the time the value of noise falls

exactly on zero or within a close range around zero. As a consequence, selection points generally oscillate around the ranking values of each constraint, and therefore, the ranking that arranges the constraints exactly according to their ranking values has the highest probability of being used.

As discussed in §2.3, in order to account for the variation pattern of the Polish proclitic /z/, the crucial constraints have to be arranged on the continuous ranking scale in a particular order, as in (23). Since the overlap between the constraints is very small, clearly the ranking with the highest probability is just the one consistent with the order of the constraints, as in (25a). Yet, since there is some overlap between some of the constraints, there are two other relevant rankings with lower probability, where AGREE[cor] switches places with either IDENT[cor] (25b) or DEP(V) (25c).

(25) *Probabilities of the rankings and their predicted outputs*

RANKING	INPUT-OUTPUT MAPPING	
	/z+d͡ʒɛmɛm/	/z+ʐrʊdwɑ/
Ranking with the highest probability		
a. DEP(V) >> AGREE[c] >> IDENT[c]	CPA	no CPA
Rankings with lower probability		
b. DEP(V) >> IDENT[c] >> AGREE[c]	no CPA	no CPA
c. AGREE[c] >> DEP(V) >> IDENT[c]	CPA	epenthesis

Since rankings are associated with certain probabilities, it is possible to estimate the probabilities of the outputs they select as optimal. In the ranking in (25a), the winning outputs are [z̩+d͡ʑɛmɛm] (CPA) and [z+ʐrʊdwɑ] (no CPA). Therefore, these are the forms that are predicted to be the most frequent in the language. Note that this claim is made even stronger by the fact that one of the rankings with lower probability also selects these outputs as optimal.

More precise predictions regarding the probabilities can also be made by using the Gradual Learning Algorithm (GLA) (Boersma 1998, Boersma & Hayes 2001) as implemented in OTSoft (Hayes, Tesar & Zuraw 2003). When provided with the data that simply specify the optimal outputs (without making any reference to their actual frequencies), the GLA learns the pattern and returns the predicted probability of each output form. The result of this learning problem is shown in (26). As can be seen, the forms [z̩+d͡ʑɛmɛm] and [z+ʐrʊdwɑ] are indeed predicted to have the highest probabilities of occurrence.[6] However, a comparison with the actual relative frequencies of these forms (in (27)) reveals that this prediction is incorrect. In reality, the forms [z+d͡ʑɛmɛm] (no CPA) and [zɛ+ʐrʊdwɑ] (epenthesis) are the most frequent ones.[7]

(26) *Mean probabilities predicted by GLA (computed over 30 runs)*

/z+d͡ʑɛmɛm/		/z+ʐrʊdwɑ/	
output	*mean probability*	*output*	*mean probability*
z̢+d͡ʑɛmɛm (CPA)	**0.50** *sd=.048*	**z+ʐrʊdwɑ (no CPA)**	**0.65** *sd=.046*
z+d͡ʑɛmɛm (no CPA)	0.34 *sd=.046*	zɛ+ʐrʊdwɑ (epenthesis)	0.35 *sd=.046*
*ze+d͡ʑɛmɛm (epenthesis)	0.16 *sd=.029*	*ʐ̢+ʐrʊdwɑ (CPA)	0.00 *sd=.000*

(27) *Actual relative frequencies*

/z+d͡ʑɛmɛm/		/z+ʐrʊdwɑ/	
output	*frequency*	*output*	*frequency*
z̢+d͡ʑɛmɛm (CPA)	36%	z+ʐrʊdwɑ (no CPA)	1%
z+d͡ʑɛmɛm (no CPA)	**64%**	**zɛ+ʐrʊdwɑ (epenthesis)**	**99%**

   In conclusion, while Stochastic OT seems to be able to predict the correct output forms in the variation pattern of the clitic /z/ (even disregarding the GLA's difficulty in assigning zero probability to the epenthetic candidate in the first type of variation), it clearly fails to predict the correct probabilities of the varying forms. The problem cannot be easily solved because it impinges on the fact that epenthesis must be eliminated in one context, but remain optimal in another context.

   There are two possible reactions to this result that I plan to explore in future research. The first is to abandon the claim that grammar is in fact responsible for predicting the absolute probabilities of the varying forms. This has already been suggested by Coetzee (2004), who claims that grammar only dictates which variant is more probable than another, but does not calculate the exact proportion in which they should occur in the language. However, even this moderated claim does not solve the problem of predicting the probabilities of the variants of the clitic /z/ because the predicted proportions are the opposite of what is actually observed in the language. Therefore, one would have to take a more radical step by saying that grammar only predicts possible output forms, but does not say anything about their probabilities, which are determined by extragrammatical factors (e.g., morpheme perceptibility; an idea originally due to Matt Goldrick, p.c.).

   Another reaction is to assume that the analysis itself is deficient in some way. In fact, the problem can be solved by adding just one constraint to the analysis. The ranking paradox is avoided if there is some additional constraint X that is violated by the 'no CPA' candidate in the 'epenthesis' ~ 'no CPA' variation, but, crucially, it is not violated by the 'no CPA' candidate in the 'CPA' ~ 'no CPA' variation.[8] In this way each type of variation is accounted for by a separate pair of overlapping constraints: IDENT[cor] ~ AGREE[cor], and X ~ DEP(V).[9] I

leave for further research determining whether there is in fact independent motivation for such a constraint in the language.

4. Conclusion

In this paper I discussed a unique variation pattern of vowel epenthesis in the Polish proclitic /z/, which relies on the interaction between obligatory and optional processes. While on the surface vowel epenthesis might seem to be optional in some contexts, I argued that it is in fact always obligatory, and its apparent optionality arises from it being contingent on the optionality of another process. Furthermore, I discussed different approaches to optionality and concluded that POG and Stochastic OT are able to capture the data correctly, but they cannot predict the correct probabilities of the varying forms. I outlined the implications of this result that might be explored in future research.

Notes

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[1] Here and throughout the paper the forms enclosed in slashes are simplified underlying representations in that they only reliably show the underlying forms of segments that are relevant for discussion.

[2] For more elaboration on the definition of this constraint see Pająk (2008).

[3] I adopt the term coronal place assimilation (CPA) to describe assimilatory processes that affect coronal clusters. In previous literature the same processes have also been referred to as 'palatal assimilation' (e.g., Rowicka 1994) or 'strident assimilation' (e.g., Rubach 1984).

[4] See Baković & Pająk (2008) for a discussion on how this pattern is problematic for a rule-based analysis.

[5] See Pająk (2008) for a more elaborate discussion on how POG makes inconsistent predictions in this respect.

[6] Note that the GLA also gives some probability to the unattested form *[zɛ+d͡ʑɛmɛm] (as shown in (26)), even though the data submitted to the program did not allow it as a possible output. The result does not improve with increasing the number of learning trials (e.g., from 1,000,000 to 4,000,000). This problem is due to the necessary proximity of the constraints DEP(V) and IDENT[cor] on the ranking scale, which allows them to switch places (though relatively rarely).

[7] The relative frequencies of the 'CPA' and 'no CPA' forms are based on a production study by Osowicka-Kondratowicz (2004) on 90 subjects. In general, non-application of CPA was found more common than its application. The clitic /z/ (9 tokens) underwent CPA with an average frequency of 36%. The relative frequencies of the 'epenthesis' and 'no epenthesis' forms are based on a search through a written corpus, the IPI PAN Corpus of Polish (available at http://korpus.pl), containing over 250 million words and about 44,000 occurrences of the clitic /z/ in the context that triggers optional epenthesis, of which the non-epenthetic forms constitute less than 1%. Note that this proportion might be different in spoken language. However, the magnitude of the obtained result suggests that the frequency of the epenthetic form in speech is still higher than the frequency of the non-epenthetic form. This is confirmed by consultations with native speakers of Polish, who

generally show higher preference for the form with epenthesis. While the exact frequencies might not be accurate, the arguments presented in this section rely on the *relative* frequencies of the forms. That is, they point to the fact that the epenthetic form of the clitic is always more frequent than the non-epenthetic form. Therefore, the same would be true if the actual frequencies were, for instance, 60% (epenthesis) and 40% (no epenthesis).

[8] I am indebted to Lucien Carroll (p.c.) for this idea.

[9] In Pająk (2008) I show in more detail how adding such a constraint solves the ranking paradox, and discuss a possible definition of the constraint X.

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Relative Clauses without CPs in Luganda[1]

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1   Introduction

It is typically assumed that relative clauses (RCs) are 'full clauses,' involving Ā-movement of a relative pronoun or null operator to the clause-peripheral position Spec,CP (Chomsky 1977, etc.). This assumption is consistent with several key properties of English RCs, including: (i) the fact that the relative pronoun (when overt) *precedes* the RC subject (1a); (ii) the fact that the complementizer *that* (when overt) also appears in the expected position before the RC subject (1b); and (iii) the fact that RC extraction has the usual properties of Ā-movement: leaves a gap, allows cyclic cross-clausal movement (1c), obeys island constraints (1d), and allows movement across an intervening noun phrase (*Mary* in (1e)), unlike in e.g. passivization.

(1)   a.   the cornbread $_{CP}$[**which**$_i$ $_C$[Ø] $_{TP}$[**Mary** ate t_i]]]
       b.   the cornbread $_{CP}$[*Op*$_i$ $_C$[**that**] $_{TP}$[**Mary** ate t_i]]]
       c.   the cornbread that John thinks that Mary ate
       d.   *the cornbread that John met the woman who ate
       e.   the cornbread *Op*$_i$ that John fed **Mary** t_i
             cf. A-movement: *the cornbread$_i$ was fed **Mary** t_i

The idea that English RCs are full CPs on the one hand and Ā-movement structures on the other is not controversial. What I will be questioning here, however, is whether Ā-movement – specifically relativization – cross-linguistically *entails* a full clause structure. In other words, does relativization by definition require a licensing CP projection, or could it in principle be driven by a lower head, e.g. T or v, and thus occur in a reduced, sub-clausal structure? Since the CP label is not required for the purposes of semantic computation (as long as there is a relative pronoun at the top of the structure and a trace below (Heim and Kratzer 1998:89)), we can at least entertain the possibility that RCs come in different sizes. More broadly, the idea that Ā-movement can be licensed without a CP projection could be extended to e.g. operator movement in English

tough-infinitives and purpose infinitives, which appear to be Ā-movement structures but are restricted in ways that full finite clauses are not (viz. restrictions on cyclic cross-clausal movement).

This paper looks closely at relativization in Luganda, a Bantu language spoken in Uganda. Based primarily on phonological evidence – namely, the fact that tone-spread freely crosses the boundary between a RC and a main clause even though it is systematically blocked across 'other' clause boundaries – I argue for the hypothesis in (2):

(2) **Reduced-clause hypothesis for Luganda RCs:** Luganda RCs are reduced, sub-CP structures, involving Ā-movement to a position lower than CP.

The hypothesis in (2) is consistent with Luganda RC word order, which is typologically unusual insofar as the subject *precedes* the relative-marker (§2), and is corroborated by syntactic evidence as well (§5). Implications and alternative proposals are considered in §§4–6.

2 Background on Luganda RCs

Luganda RCs are distinguished by the obligatory presence of a relative marker – a segmental piece at the left edge of the verb – as well as, in some tenses, an additional H tone on the verb. (The relative marker is glossed as 'rel' in the examples here and is represented as a verbal prefix, although nothing hinges on this assumption; see Hyman and Katamba 2006 for discussion.) The form of the relative marker depends on the type of RC: if the subject is extracted, the relative marker is simply an 'initial vowel' (*e-, a-*, or *o-*) that harmonizes with the following mora; if the object is extracted, the relative marker is a noun-class concord piece (agreeing with the RC head) followed by the vowel /e/.

(3) a. Non-relativized declarative:
    abawala   ba-a-luka emikeeka
    2.girl   2-pst-plait   4.mat
    'The girls plaited the mats.'
  b. Subject RC:
    n-daba   abawala   **a**-ba-a-luka   emikeeka
    1s-see   2.girl   **rel**-2-pst-plait   4.mat
    'I see the girls who plaited the mats.'
  c. Object RC:
    emikeeka abawala **gye**-ba-a-luka   te-gi-gasa
    4.mat   2.girl   **4.rel**-2-pst-plait   neg-4-be.of.use
    'The mats the girls plaited are unsuitable.' (Ashton et al. 1954:144)

Unlike English, Luganda does not allow an option of pronouncing a complementizer (e.g. *nti, nga*) within a RC.

Notice that when the RC contains its own overt subject (e.g. (3)c)), the relative marker *follows* the subject. This pattern is also found in the Bantu languages Ikalanga (Letsholo 2002) and Zulu (Cheng and Downing 2007), but it is fairly unusual both cross-linguistically and within Bantu; in the more familiar Bantu cases described in Demuth and Harford (1999) and others, either the relative marker is an 'independent word' *preceding* the subject, or the relative marker is a prefix on the verb and there is subject-verb inversion. What crucially distinguishes Luganda, Zulu, and Ikalanga from other Bantu languages is that there is *never* any overt functional material above the subject within a RC – i.e., consistent with (2), there is no evidence from the word order that RCs are CPs.

RC verbs are distinguished from main-clause verbs not only by the appearance of the relative marker but also by the expression of negation. As shown in (4)a, main-clause negation is done with a 'peripheral *te-*' prefix that appears at the leftmost edge of the verb (before subject-agreement). In RCs, however, peripheral *te-* is unavailable and negation is expressed instead with a prefix *-ta-*, which *follows* subject-agreement (4)b-(4)c (Ashton et al. 1954:144).

(4)   a.   abasajja **te**-ba-a-leeta   emigugu jjo
              2.man   **neg**-2-pst-bring 4.bundle yesterday
              'The men didn't bring the bundles yesterday.'
      b.   abasajja   a-ba-**ta**-a-leeta   migugu jjo
              2.man   rel-2-**neg**-pst-bring 4.bundle yesterday
              'the men who didn't bring bundles yesterday'
      c.   emigugu abasajja gye-ba-**ta**-a-leeta   jjo
              4.bundle 2.man   4.rel-2-**neg**-pst-bring yesterday
              'the bundles that the men didn't bring yesterday'

Interestingly, peripheral *te-* is also unavailable in infinitives (which require *-ta-*, like RC verbs) and subjunctives (which require periphrastic negation with *kulema* 'to fail to'). This basic split between negation in main clauses on the one hand, and negation in infinitives, subjunctives, and RCs on the other, is a recurring pattern in Bantu (see e.g. Güldemann 1999). I provisionally assume that there are two positions for sentential negation in the clause (as proposed in Ngonyani 2002 and Letsholo 2002), and that infinitives, subjunctives, and RCs are alike in that the higher NegP is unavailable – perhaps because these kinds of 'clauses' are missing the topmost levels of functional structure (2). In the next section we will see some further evidence that RCs pattern with infinitives and subjunctives, and are unlike main clauses, in terms of apparent clause size.

3   Phonological Evidence for the Non-CP Hypothesis

So far I have shown that the word order and morphology of Luganda RCs make the reduced-clause hypothesis in (2) at least feasible; in this section I provide evidence from the phrasal phonology that (2) is in fact correct. As we will see, H tones freely spread across RC-main clause junctures even though they are systematically blocked from spreading across 'other' clause boundaries. The reduced-clause hypothesis in (2) accounts for this pattern naturally while maintaining a restrictive, transparent view of the syntax-phonology interface (§4), and is moreover corroborated by syntactic evidence (§5).

3.1   Tone spread: the basic pattern

On the surface, Luganda syllables are H, L or HL. The distribution of surface tones is largely predictable if it is assumed that (i) each mora is underlyingly either H or Ø (toneless), and (ii) the full range of H, L and HL tones is derived by a series of *word-internal* and *phrasal* tone-assignment rules (Hyman 1982; Hyman and Katamba 1990/1991, 1993). For current purposes, the important point is that some words are composed entirely of toneless morphemes and thus get their surface tones at the phrasal level. The phrasal tone rule we will be focusing on here is:

(5)   **High Tone Anticipation (HTA):** A word-level H tone (underlined in examples) spreads *leftward* through toneless moras onto preceding words within the domain, stopping short of the first mora of the domain.

Syllables that are still toneless after HTA and other phrase-level rules apply get default L.

   Consider first the examples in (6), which show HTA application within a single clause. The only underlying H tone in these utterances is on the first mora of *kaawa* 'coffee' (underlined); *Mukasa, omulenzi*, and *a(mu)gulira* are all underlyingly toneless. In (6)a, the H on *kaawa* spreads leftward through the indirect object *omulenzi* onto the verb, but the preverbal subject *Mukasa* surfaces with all L tones, indicating that it is in a separate HTA domain. In (6)b, where the indirect object *omulenzi* is left-dislocated (and associated with an obligatory object prefix on the verb), both the indirect object and the subject form their own HTA domains and surface with L tones.[2]

(6)   a.   (Mùkàsà) (à-gúl-ír-á   ómúlénzí kááwà)
             1.Mukasa sbj1-buy-appl-fv 1.boy   1a.coffee
             'Mukasa is buying the boy coffee.'

b. (Mùkàsà) (òmùlènzì) (à-mú-gúl-ír-á   ká̱áwà)
    1.Mukasa 1.boy   sbj1-obj1-buy-appl-fv coffee
    'Mukasa is buying the boy some coffee.'

(In (6) and subsequent examples, HTA domains are demarcated with parentheses and the 'source' underlying H tone is underlined.)

   As demonstrated by (6) and as pointed out by Hyman (1982, 1990), the basic pattern found in utterances containing a single clause is as follows:

(7) In utterances containing a single clause:
     a. items preceding the verb – preverbal subjects, left-dislocated objects, and topic adverbials – each form their own HTA domain;
     b. the verb groups together with any following objects/modifiers into a single HTA domain.

3.2   Tone spread in multi-clausal structures

If an utterance contains more than one verb, there are two basic possibilities – either each verb heads a clause that individually follows the pattern in (7) ('phonological independence'), or the two verbs group together for the purposes of HTA, along with any arguments or modifiers that follow them ('phonological dependence'). The first pattern is found when both clauses are (by hypothesis) full CPs, in either a complementation or adjunct structure.

(8) a. (òmùlènzì) (à-gàmbà) (ntì)   (Mùkàsà) (y-à-gé̱è̱ndà)
         1.boy   sbj1-say comp 1.Mukasa sbj1-pst-go
         'The boy says that Mukasa went.'
     b. (Wàlúsìmbì) (à-lòwòòzà) (à-yîmbà)
         1.Walusimbi sbj1-think   sbj1-sing
         'Walusimbi thinks s/he's singing.'
     c. (ò-léká) (Mùkàsà) (à-ká̱àba)
         2s-leave Mukasa   sbj1-cry
         'You leave as Mukasa cries.'/ 'You leave with Mukasa crying.'
     d. (òmùlènzì) (à-ná̱á̱-sèká)   (òmùlìmì) (bw'-à-yîmbà)
         1.boy   sbj1-fut-laugh 1.farmer cond-sbj1-sing
         'The boy will laugh if the farmer sings.'

(8)a-(8)b show clausal complements of the verbs 'say' and 'think.' The embedded verb in 'say/think' complements is morphologically identical to a main-clause verb – it is fully tensed and takes peripheral *te-* negation (not indicated here). The embedded clause correspondingly forms its own domain for the purposes of HTA – even if it consists of only a single word, as in (8)b.

Examples (8)c-(8)d show that the 'phonological independence' pattern also occurs in certain kinds of adjunct structures: although the secondary predicate in (8)c and the *if*-clause in (8)d each contain their own subject, the underlying H tone on the verb does not spread leftward, indicating that the verb has formed its own HTA domain.

The basic generalization so far is that Luganda HTA domains are sensitive to two kinds of syntactic boundaries: (i) boundaries between clauses, and (ii) boundaries between items at the left *edge* of each clause. A similar pattern has been reported for phonological rules in Kinande (Hyman 1990), Tohono O'odham (Hale and Selkirk 1987, Phillips 1996), Slave (Rice 1987), and San Mateo Huave (Pak 2007), and can be accounted for straightforwardly under the direct spellout-based proposal in (9):

(9)   **Direct spellout-based proposal for Luganda HTA:**
    a.   Syntactic structures are built up and spelled out in phases, or designated subparts, rather than all at once.
    b.   Full spellout is triggered at each CP; material at the CP *edge* (C and Spec,CP) is spelled out on a separate cycle.
    c.   Luganda HTA applies directly to the fully spelled-out, linearized output of each CP phase.[3]

Main-clause preverbal subjects and left-dislocated objects are assumed to be in Spec,CP (see Letsholo 2002 for arguments in favor of this analysis); and sentences with multiple preverbal constituents are assumed to have multiple recursive CPs, each of which is therefore spelled out separately.

(10)   (Mùkàsà) (òmùlènzì) (à-mú-gúl-ír-á ká̱áwà)
      1.Mukasa 1.boy   sbj1-obj1-buy-appl-fv coffee
      'Mukasa is buying the boy some coffee.'   *(repeated from (6)b)*
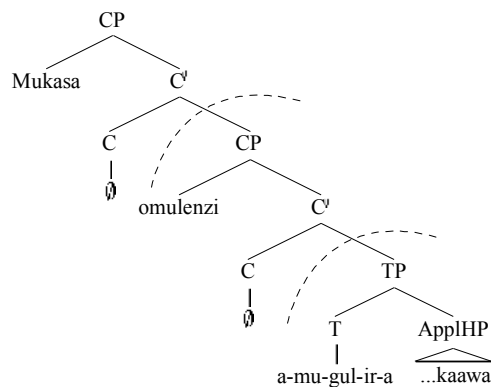
As noted at the beginning of this section, there are some structures in which two verbs group together for the purposes of HTA, instead of forming separate domains (the 'phonological dependence' pattern). The embedded 'clause' in these cases, however, can be plausibly argued to be a *reduced*, sub-CP structure which, in accordance with (9), automatically undergoes spellout with the next-higher CP instead of by itself. Phonological dependence is typically observed in infinitival and subjunctive complements of 'want' and 'going to' – core members of the class of restructuring predicates cross-linguistically (Cinque 2000, Wurmbrand 2001):

(11)   a.   (à-yágál' ókú-yîmbà)
            sbj1-want inf-sing
            'S/he wants to sing.'
       b.   (Wàlúsìmbì) (à-jjá   kú-kwâtà lwèwùnzìkâ)
            1.Walusimbi sbj1-come inf-hold 1a.bananas
            'Walusimbi is going to hold the bananas.'
       c.   (nj-ágál' ómúlénzí á-wándík-ér-ê   Mùkàsà èbbàlúwà
            1s-want sbj1-boy sbj1-write-appl-subj 1.Mukasa 5.letter
            'I want the boy to write Mukasa a letter.'

3.3   Tone spread in RCs

Somewhat surprisingly, the 'phonological dependence' pattern is also found with RCs in Luganda. As demonstrated in (12), however, restrictive RCs regularly group together with the main clause for HTA. This is true even if the RC contains its own subject (e.g. (12)a, b, d) – the H tone on the RC verb spreads leftward through the RC subject and the head NP, all the way up to the main-clause verb:

(12)   a.   (nj-ágál' ékítábó   ómúlénzí kyé-y-á-lábà)
            1s-like 7.book   1.boy   7.rel-sbj1-pst-see
            'I like the book that the boy saw.'
       b.   (Wàlúsìmbì) (à-gúlá   lúmóóndé Múkásá gw'-á-géndà òkù-wá
            1.Walusimbi   sbj1-buy 1a.potato 1.Mukasa 1.rel-sbj1-go inf-give
            àbálénzí)
            2.boy
            'W. is buying the potatoes that Mukasa is going to give the boys.'
       c.   (Bàbíryè) (à-yágál' ómúntú é-y-á-wá   Wálúsìmbì nnàwólòvù)
            1.Babirye sbj1-like 1.person rel-sbj1-pst-give 1.W.   1.chameleon
            'Babirye likes the person who gave Walusimbi a chameleon.'
       d.   (nj-ógérá kú-mbátá   ómúlímí zé-y-á-n-dágà)
            1s-talk   loc-10.duck 1.farmer 10.rel-sbj1-pst-1s-show
            'I'm talking about the ducks that the farmer showed me.'

If the proposal in (9) is on the right track, then the pattern in (12) must be taken as an indication that Luganda RCs, like infinitival and subjunctive complements of restructuring predicates, are *smaller than CPs* and thus do not get spelled out independently. I provisionally assume that Luganda RCs have the structure in (13), where the T(ense) head drives Ā-movement of a null operator to an outer Spec,TP and the relative-marker is a piece of agreement inflection inserted on the verb. Other structures – e.g. a Kaynean or 'head-raising' structure – would work equally well for our purposes, as long as the RC is assumed to be smaller than a CP.

(13)   emikeeka   abawala   gye-ba-a-luka
    4.mat   2.girl   4.rel-2-pst-plait
       'the mats that the girls plaited'
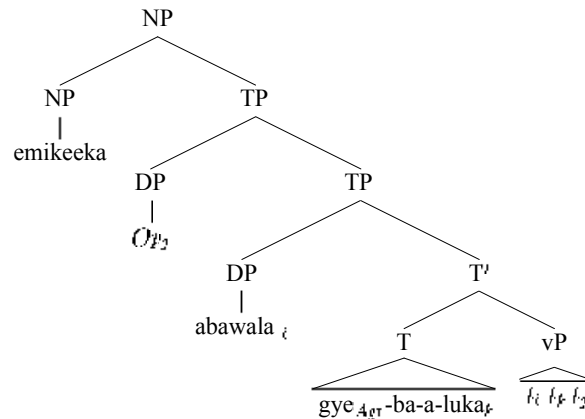
In §4 I consider and reject two alternative proposals, and in §5 I show that the current proposal has independent syntactic support.

4   Alternative Proposals

4.1   Are Luganda RCs really Ā-movement structures?

One possibility we might consider at this point is that Luganda RCs do not involve Ā-movement, but rather some other kind of displacement mechanism. For example, we could hypothesize that Luganda RCs involve A-movement (cf. Bhatt's (1999) analysis of English subject infinitival relatives as AspPs, in which the subject undergoes local, string-vacuous raising) – and thus maintain the idea that 'true' (i.e. A-bar) relativization cross-linguistically requires a CP.

It turns out, however, that Luganda RCs do have the classic properties of Ā-movement. First, unlike in passivization, no relativized-minimality violation is incurred if the moved phrase 'crosses' multiple NP interveners; i.e., it is not the case that only the closest c-commanded argument can be extracted (cf. Rizzi 1990). Notice the grammaticality contrast between the RC in (15) and the passive in (16)a, where intervening noun phrases are boldfaced:

(14)   n-a-lis-iza ekijiiko omwaana obutungulu
       1s-pst-feed-appl 7.spoon 1.child   14.onion
       'I fed the child onions with a spoon.'

(15)   Mukasa y-a-gul'   obutungulu *Op*ᵢ bwe-n-a-lis-iza **ekijiiko omwaana** *t*ᵢ
       Mukasa sbj1-pst-buy 14.onion   14.rel-1s-pst-feed-appl 7.spoon 1.child
       'Mukasa bought the onions that I fed to the child with a spoon.'

(16)   a.   *obutunguluᵢ bw-a-lis-iz-ibwa   **ekijiiko   omwaana** *t*ᵢ
             14.onion   14-pst-feed-appl-pass 7.sppon   1.child
             'Onions were fed to the child with a spoon.'
       b.   cf. (ok) ekijiikoᵢ ky-a-lis-iz-ibwa   *t*ᵢ omwaana obutungulu
                     7.spoon 7-pst-feed-appl-pass   1.child   14.onion
                     'A spoon was used to feed the child onions.'

Furthermore, unlike e.g. left-dislocation, Luganda relativization (i) leaves a gap and (ii) is subjected to island constraints – two well-known diagnostics for Ā-movement (Chomsky 1977). The RCs in the (b) examples below are ungrammatical (see also Walusimbi 1996) – whether or not the object marker is inserted as an attempted resumption strategy – but the left-dislocation sentences in the (c) examples (which require a co-indexed object marker) are fine.[4] The puzzle remains: Luganda RCs are Ā-movement structures that behave phonologically like sub-CPs.

(17)   a.   omulenzi y-ebaka   bwe n-a-mu-som-er-a   ekitabo
             1.boy   sbj1-sleep when 1s-pst-obj1-read-appl-fv 7.book
             'The boy fell asleep when I read him the book.'
       b.   * nj-ogera ku-kitabo omulenzi kye-y-ebaka bwe n-a-(ki)-mu-som-era
             1s-talk   loc-7.book 1.boy   7.rel-sbj1-sleep when 1s-pst-7-obj1-read-appl
             Lit: 'I'm talking about the book that the boy fell asleep when I read (it) to him.'
       c.   ekitabo kino, omulenzi y-ebaka   bwe n-a-ki-mu-som-era
             7.book 7.dem 1.boy   sbj1-sleep when 1s-pst-obj1-read-appl
             'This book, the boy fell asleep when I read it to him.'

(18) a.   n-a-sanga   omusomesa   gwe-tw-a-wa   ebimuli
            1s-pst-meet 1.teacher   1.rel-1p-pst-give 8.flower
            'I met the teacher we gave flowers to.'

      b. * Walusimbi y-a-gula   ebimuli be-n-a-sanga   omusomesa
            Walusimbi sbj1-pst-buy 8.flower 8.rel-1s-pst-meet 1.teacher
            gwe-tw-a-(bi)-wa
            1.rel-1p-pst-8-give
            Lit: 'W. bought the flowers I met the teacher we gave (them to).'

      c.   ebimuli bino, n-a-sanga   omusomesa   gwe-tw-a-bi-wa
            8.flower 8.dem 1s-pst-meet 1.teacher   1.rel-1p-pst-8-give
            'These flowers, I met the teacher we gave (them to).'

4.2   Modeling the syntax-phonology interface

Under the proposal in (9) – and indeed within any model of the syntax-phonology interface where phonological domains are closely related to syntactic structures (e.g. most versions of prosodic hierarchy theory (Selkirk 1986, Nespor and Vogel 1986, etc.)) – the tone-spread patterns reported in §3 are taken as a strong indicator that Luganda RCs are reduced, sub-CP structures. More explicitly:

(19) **Proposal for Luganda RC spellout:**
      a.   Unlike main clauses, Luganda RCs do not contain a CP layer of structure. (RC subjects correspondingly move only to Spec,TP.)
      b.   Spellout is triggered at each CP. Since a Luganda RC does not have a CP, it does not get spelled out until the next-higher CP is reached.
      c.   HTA applies directly to the fully spelled-out contents of each phase; thus, RCs automatically group together phonologically with the next-higher clause.

It is quite difficult to see how the phonological facts reported here could be explained without the reduced-clause hypothesis. If we wanted to maintain the idea that Luganda RCs were CPs, we might argue that RCs have a distinguishing feature (e.g. [+rel]) in C, and that there is a special provision that Luganda spellout ignore any [+rel] CP. However, this kind of provision would represent a major departure from the idea that the phrasal phonology does not distinguish among particular morphosyntactic features like [+rel], [+def], etc. – a central idea in the prosodic hierarchy theory literature (see e.g. Inkelas and Zec 1995:536–537) and also a basic assumption in phase theory. If we allowed the phrasal phonology to ignore [+rel] CPs, we would open the door for similar cases of feature-sensitivity that are never actually attested – e.g., phonological rules that are blocked *only* at [-fin] CPs/TPs and nowhere else, or rules that

distinguish verbs with a particular kind of gender-agreement prefix (see Pak 2007, forthcoming for further discussion).

It should also be pointed out that RCs are not phonologically dependent cross-lingusitically: as noted above, Huave (Pak 2007), Kinande (Hyman 1990), and Tohono O'odham (Hale and Selkirk 1987) have phrasal tone rules whose domains look much like Luganda HTA domains, but RCs in these languages *do* phrase separately. The idea that the phonological dependence of Luganda RCs can be attributed to the syntax-phonology mapping, rather than to the size of the RC, will therefore not be considered further here.

4   Prediction: No Position for Spec,CP Items within a RC

If it is true that Luganda RC subjects are in Spec,TP and that there is no CP projection above it, then we make the following prediction: any material that can *only* be in Spec,CP will not be able occur within a Luganda RC. This prediction appears to be borne out. Certain topic adverbs cannot precede the subject within a RC – supporting the idea that the Spec,CP position is simply absent:

(20) a.   Mukasa   a-lowooza nti   **mpozzi** omulenzi y-a-bba   olulagala
           1.Mukasa sbj1-think comp maybe   1.boy   sbj1-pst-steal 11.leaf
           'Mukasa thinks that maybe the boy stole the banana leaf.'
     b.   nj-ogera ku-lulagala   (***mpozzi**) omulenzi lwe-y-a-bba
           1s-talk   loc-11.banana.leaf   maybe   1.boy   11.rel-3s-pst-steal
           'I'm talking about the banana leaf that (maybe) the boy stole.'

(21) a.   **oku-mala essaw' emu** Musoke y-a-kwata omulenzi
           inf-finish 9.hour 9.two 1.Musoke sbj1-pst-hold 1.boy
           'For two hours Musoke held the boy.'
     b.   nj-agal' omulenzi (***oku-mala essaw' emu**) Musoke gwe-y-a-kwata
           1s-like   1.boy   inf-finish 9.hour 9.two Musoke 1.rel-sbj1-pst-hold
           'I like the boy that (for two hours) Musoke held.'

Similarly, some speakers reject object-fronting internal to a RC (22), even though the (18)c counterpart, where the fronted object appears in *matrix* Spec,CP, is uniformly accepted. This contrast is exactly what we expect under the assumption that (i) fronted/left-dislocated objects are in Spec,CP, and (ii) Luganda RCs are smaller than CPs.[5]

(22) ?? n-a-sanga   omusomesa **ebimuli bino**   gwe-tw-a-bi-wa
           1s-pst-meet 1.teacher   8.flower 8.dem   1.rel-1p-pst-8-give
           Lit: 'I met the teacher who these flowers, we gave (them to).'

5   Conclusion

The hypothesis explored here is that the confluence of word-order and morphosyntactic (negation) factors in Luganda RCs may allow speakers to analyze Luganda RCs as reduced, non-CP structures, much like restructured complement infinitives. The tone-spread data presented in §3 were taken as a confirmation of the reduced-RC hypothesis. An important implication of this finding is that Ā-movement can be driven by syntactic heads that do *not* also trigger phonological spellout (cf. Chomsky 2004). An alternative analysis of the findings reported here – one where [+rel] CPs are stipulated to 'supress' spellout in Luganda – was considered and rejected. The advantage of the current analysis is that it allows us to maintain a view of the syntax-phonology interface where constituent size and constituent structure are the main factors in determining how utterances are spelled out, without requiring any special provisions for particular morphosyntactic features.

Notes

[1] For helpful comments and discussion I am indebted to Rajesh Bhatt, David Embick, Larry Hyman, Tony Kroch, Rolf Noyer, and participants in the Fall 2007 syntax reading group at Penn and the 2007 Syntax- Phonology Interface in the Northeast (SPINE-3) workshop at Cornell. I would also like to thank Sanyu Kakoma, Sara Mukasa, and Rosemary Vonjo for their extensive contributions as linguistic informants. All errors are of course my own.

[2] Left-dislocated objects can either precede or follow a preverbal subject. In either case, the subject and the left-dislocated object form their own HTA domain.

[3] For a comparison between the direct spellout-based approach used here and a prosodic-hierarchy based approach, where Luganda HTA would apply to a prosodic constituent like the Phonological Phrase or Intonational Phrase rather than directly to the output of spellout, see Pak (forthcoming) and Rice (1987).

[4] Wh-questions, another potential displacement structure, are done either with the wh-word in situ (*walaba ani*? (you-saw who?)) or with a clause-initial wh-word followed by a RC (probably a cleft or pseudocleft, e.g. *ani gwe-walaba*? (who I.REL-you.saw `Who is it you saw?')). The latter structure appears to pattern with RCs with respect to Ā -movement diagnostics.

[5] One of my consultants has accepted examples like (22). I assume that for this speaker, and possibly for all speakers under certain discourse conditions that remain to be specified, fronted objects can be pronounced in Spec,TP as well as Spec,CP. Independent diagnostics for the two positions remain to be explored.

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Effects on Deaccenting in Two Speech Styles of Barcelona Spanish

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1. Introduction

While the vast majority of previous work on Spanish intonation has been conducted using a laboratory approach with scripted speech, Face (2003) encourages work on the more natural, and understudied, spontaneous speech (SS). One of the main differences between lab speech and SS that he notes is the higher presence of deaccenting, or the lack of fundamental frequency (F0) movement through stressed syllables, in the latter style. Inspired by this idea, the present study's goal is to investigate eight potential variables that influence this lack of tonal movement in Barcelona Spanish. Data from SS as well as a map task (MT), which approaches natural speech, are examined with regard to deaccenting and what affects it.[1] Though a definition of deaccenting has been established, very little work has uncovered what factors significantly contribute to its occurrence. By focusing on a somewhat mysterious aspect of intonation in speech styles and a dialect that are understudied, this paper aims to address research gaps. The major findings reveal that the following characteristics of a word significantly increase its odds of deaccenting: having fewer syllables (in both speech styles), being an adverb or a verb (in SS), being frequent at a global level (in SS), being recently repeated in discourse (in SS), and being located in initial or medial positions of the phonological phrase (PPH) (in both styles).

1.1 Stress and accent

Ladd (1996) says that *stress* concerns perceived prominence of lexical items in an utterance, whereas *accent* refers specifically to intonational F0 movement, which serves as one possible phonetic cue to the location of perceived prominence. These ideas are also relevant to the Autosegmental-Metrical model (beginning with Pierrehumbert 1980), in which F0 contours are seen as the result of phonetic interpolation between *pitch accents*, which are tonal events

that are phonologically specified and associated with lexically stressed syllables (Hualde 2003).

Previous lab speech work on Spanish intonation has informed us that lexical stress can be expressed acoustically in syllables via increases in intensity, duration, and F0. Work in the last two decades, such as Quilis (1993), claims that F0 is the principle acoustic expression of stress and that intensity and duration have a reduced role. In terms of tonal movement, Garrido et al. (1993) and Garrido (1996) posit that a rise in F0, as opposed to its peak, is the most important phonetic signal to a stressed syllable. However, some pitch accents, especially those in nuclear position of declaratives, may show a decrease in F0 through the stressed syllable. Therefore, for the purposes of this study, a stressed lexical item is considered as deaccented when any type of F0 movement is absent from its stressed syllable.[2] An example from the present data of a lack of accent is provided below in Figure 1. In this case, the stressed word, *color* ('color'), in *el mundo es de color de rosas* ('the world is the color of roses'), does not possess any change in F0 and is thus deaccented. In contrast, the other stressed words, *mundo* ('world'), *es* ('is'), and *rosas* ('roses) all demonstrate accent via some degree of F0 movement through stressed syllables.
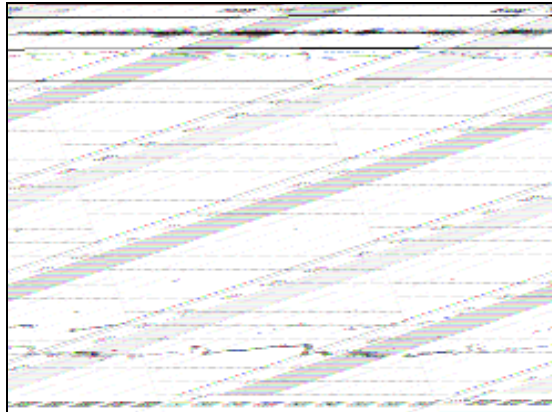

Figure 1: Deaccenting of the word *color* ('color'), belonging to *el mundo es de color de rosas* ('the world is the color of roses').

1.2 Previous studies

The investigation of Face (2003) is among few that have focused on SS in Spanish. In terms of F0 movement through stressed syllables, Face finds that 30% of accentable words in SS in prenuclear position do not have a pitch accent. Of all the deaccented words in this study, the majority are verbs, adverbs, and syntactic determiners. The verbs that are more inclined to deaccent, such as *ser* ('to be'), *haber* ('to have,' 'to have to'), and *estar* ('to be') seem to share the

feature of being commonly used. Additionally, Rao's (2006) follow-up to Face reveals that deaccenting is pragmatically associated with low levels of emotion.

  Some work on deaccenting in Romance seeks to discover if its occurrence is tied to information structure. Cruttenden (1993) finds that unlike Germanic languages such as English (see Hirschberg 1993; among others), Spanish resists deaccenting of old information. Similarly, Ladd (1996) claims that low levels of deaccenting extend to other Romance languages such as Romanian and Italian. The studies by Avesani and Vayra (2005) and Bard and Aylett (1999), who analyze deaccenting of repeated structures in Italian through dialogue tasks, arrive at a conclusion reflecting that of Ladd. Gussenhoven (2004) echoes this tendency against deaccenting in French as well.

  In terms of contexts in which words are more prone to demonstrate deaccenting, de la Mota (1995), Face (2001, 2002), and Prieto et al. (1995, 1996), among others, have shown that it often occurs in cases of pitch reduction, such as final lowering or post-focal situations. Final lowering is often present at the conclusion of ideas. On the other hand, the preference for accenting words to cue stress in nuclear position of the PPH is supported by the fact that this position is the strongest stress position in languages such as Catalan, Italian, and Spanish (see Frascarelli 2000; Prieto 2005; among others). This strength is seen in F0 rises in nuclear position of the PPH that indicate the continuation of ideas.

1.3 Variables of interest

The current study examines the effects of eight independent variables on deaccenting of words in SS and MT data in Barcelona Spanish. The eight variables are shown in (2). Variables (2a), (2b), (2e), (2g) and (2h) are inspired by previous studies, while the remaining three are based on intuition.

(2) Eight independent variables in this study
     a. Repetition in discourse
     b. Recent repetition in discourse
     c. Number of syllables
     d. Stress pattern
     e. Grammatical category
     f. Global high frequency (i.e. generally frequent in Spanish)
     g. Position in the PPH
     h. Position in the IP

  The phrase types in (2g) and (2h) derive from Prosodic Phonology (Nespor and Vogel 1986; Selkirk 1984, 1986), which hierarchically organizes constituents in the fashion shown in (3).[3] The top two levels represent ways in which prosody is used to chunk information into units with definite size and internal structure (D'Imperio et al. 2005).

(3) Prosodic Hierarchy (from Selkirk 1984)

IP	Intonational Phrase (Major Phrase)
PPH	Phonological Phrase (Minor Phrase)
PW	Prosodic Word
F	Foot
σ	Syllable

The top three levels are the most relevant to this paper. An IP is a unit that corresponds with a portion of a sentence associated with a characteristic intonational contour or melody. In Spanish, the conclusion of an IP is signaled by a final high (H) or low (L) boundary tone (%) or by a clear pause. A PPH denotes any level of prosodic constituent structure that may include one or more major category words (i.e. Noun, Verb, Adjective, and Adverb). The boundaries of such constituents can be located in Spanish by using cues such as F0 continuation rises ending in the final syllable of a word, final lengthening, large pitch range increases or decreases, and pauses (D'Imperio et al. 2005; Hualde 2003; Prieto 2006; among others). According to Truckenbrodt (1999), the PPH and IP differ in that the former refers specifically to syntactic phrases (XPs), while the latter deals with larger syntactic clauses. A PW is a phonologically relevant idea that plays a metrical role in describing main word stress. Based on the discussion of stress and accent, it is assumed that PWs are prosodically accented, meaning they contain tonal movement through the stressed syllable.[4]

  The rest of this paper addresses how the variables in (2) affect deaccenting in the aforementioned speech styles. Specifically, the results of statistical tests will reveal the following: i. which of the variables have significant effects on deaccenting; ii. how the significant variables affect the odds of deaccenting; iii. the interactions among variables; iv. the implications of interactions for deaccenting. Section 2 details data collection and analysis procedures, Section 3 tabulates statistical results and explores their implications, and Section 4 sums up the main findings and suggests avenues for future research.

2. Methods

2.1 Data collection

SS and MT data were collected in Barcelona, Spain, at the *Universitat Autònoma de Barcelona* in a phonetics laboratory. Since Barcelona is a city of constant language contact between Spanish and Catalan, a language history questionnaire helped screen for participants. The data comes from a total of 17 participants; 12 females and 5 males, all between the ages of 19 and 28. For SS, each participant conversed with the investigator about various topics ranging from his/her daily routine to the political situation in Spain. The speakers each

produced a total of nine to ten minutes of SS data. The MT was done in pairs. Each speaker had a map of the same city, and each map had numbers of sites to find. The locations of the missing places on one map were given on the other map. The task of each speaker was to ask their partner for directions to six locations. The data comes from the direction-givers.

The collection and analysis of data were done using the PitchWorks software package, a laptop computer, and a head-mounted microphone. In order to minimize the participants' awareness of the microphone, they performed ten to fifteen minutes of other recorded activities prior to the tasks described here.

2.2 Coding scheme for the eight variables

Upon completion of the collection process, the data for both types of speech were transcribed. Since deaccenting applies to words that are stressed, the data sets had to be coded to separate stressed and unstressed words (with the help of Quilis 1993).[5] Each stressed word (henceforth, simply 'word,') was examined for tonal movement through the stressed syllable. Once it was clear which words were deaccented, these items, along with all other stressed words, were further coded in preparation for evaluating the contribution of the variables listed in (2).

It is crucial to clarify how the variables are defined and how words are classified based on different categories of outcomes for each variable. The current method incorporating 'general repetition' in addition to 'recency' was motivated by the fact that previous investigations do not seem to include or specifically define the importance of both of these factors in completely accounting for the relationship between repetition and deaccenting. The definitions of 'general repetition' and 'recent repetition' emerged from the data. Five commonly deaccented words were chosen. For each of these words, the data of each speaker was examined to see how many times the word occurred before it was deaccented, and also how spread apart a deaccented articulation of the word was from its previous iteration. Averaging the results across speakers determined that a word would be classified as 'repeated' if there is one previous occurrence, and as 'recently repeated' if its previous appearance is within the preceding ten PWs.[6] For these variables, words are classified as 'yes' or 'no.'

The remaining variables that do not refer to prosodic constituents were coded in a straightforward manner. Counting the number of syllables in all words led to forming the categories '1,' '2,' and '3+' for SS and '1,' '2,' '3,' and '4' for the MT. The final category for SS collapses all words of more than three syllables in order to facilitate the statistics involved. In terms of stress pattern, words were distinguished as 'oxytone,' 'paroxytone,' and 'proparoxytone.' Words were also grammatically categorized as 'verbs,' 'adverbs,' 'nouns,' 'stressed pronouns,' 'adjectives,' and 'stressed conjunctions.' Furthermore, the value for 'global high frequency' derived from Fuller Medina's (2005) study on verbs, in which this label refers to having at least 2,000 hits in the 20th century in

the *Corpus del Español* (Davies 2002).[7] This measure is also a categorical distinction between 'yes' or 'no.'

  The final two variables deal with phrasal position of deaccented items, which required dividing the data into PPHs and IPs. Locating each type of phrase boundary was realized by searching for previously mentioned phonetic cues. For PPHs, words were positionally marked as 'initial,' 'medial,' 'final,' or 'single' (a word that is individually phrased in a PPH). At the IP level, words were labeled in the same way. However, in this case, the positional category of each word depends on the location of its PPH within an IP. A representation of this coding scheme is displayed in (4) through a general example. All Ws refer to possible PWs that may or may not be accented.

(4) Coding of the variables 'position in the PPH' and 'position in the IP'
        Note: i = initial, m = medial, f = final, s = single, Φ = PPH boundary
                [(W   W   W)Φ(W)Φ(W   W)Φ(W   W   W   W)Φ]IP
        PPH category   i   m   f   s   i   f   i   m   m   f
        IP category   i   i   i   m   m   m   f   f   f   f

2.3 Statistical procedure[8]

The distribution of words was described by calculating their frequencies across the categories just mentioned of each of the eight variables. Next, a logistic regression with main effects and two-way interactions was carried out. The model was then fit using a generalized linear mixed model with a random effect for subject and a binomial distribution for accenting/deaccenting. The model initially informs us which variables contribute to the probability of deaccenting at significant levels. Finally, odds ratios (or odds multipliers) were generated, indicating the effect of each covariate (i.e. potential influences on deaccenting here) on the odds of deaccenting, with all other things being equal (see Agresti 1996 for details on this type of model). The relationship between odds and probability is shown in the following manner: odds = probability/1-probability.

3. Results

3.1 Spontaneous speech

The process of coding to separate stressed and unstressed words reveals that there are 2,609 stressed words in the SS data.[9] The frequency of deaccented items, 23%, falls in the vicinity of the value documented by Face (2003), 30%. The tables that follow illustrate which variables significantly affect deaccenting, how different categories of the significant variables show effects, and what significant interactions exist between the eight variables.

3.1.1 Are there effects on deaccenting?
The probability that is modeled accounts for the words falling in the 'yes' category of the binary distinction between accented and deaccented words. Table 1 provides the variables and interactions that have a statistically significant effect on deaccenting in SS. Five of the eight variables in question individually have a significant influence: high frequency, number of syllables, grammatical category, recency, and position in the PPH. 'Grammatical category' makes an additional contribution by interacting with both 'high frequency' and 'number of syllables.' This means that one or more of the categories belonging to each of these variables join forces in affecting the odds of deaccenting.

Analysis of Fixed Effects	
Effect	P
High Frequency	.0005
Syllables	<.0001
Category	.0350
High Frequency*Category	.0074
Syllables*Category	.0059
Recency	.0083
Position in PPH	<.0001

Table 1: Analysis of effects (p<.05) in SS. Only statistically significant p-values are included.

Table 1 only tells us which variables have some sort of effect on deaccenting. In order to gain a clearer understanding of what is occurring, it was necessary to analyze the effects of each category belonging to the variables in Table 1.

3.1.2 What are the effects?[10]
Describing specific effects is done by obtaining odds ratios that explain these effects in terms of multipliers indicating an increase or decrease in the odds of deaccenting with respect to categories of each variable. In Tables 2-5, the right 'category' column is the reference group while the left column contains an alternate outcome for each variable that either increases or decreases the odds of deaccenting. The repeated columns for 'high frequency' and 'syllables' in Tables 6 and 7, respectively, are interpreted in the same manner, with the right column being the baseline and the left being a substituted outcome.

Table 2 reports how the odds of deaccenting are affected by 'recency' when a word is 'yes' instead of 'no.' From the odds ratio, it is clear that the odds increase when a word is repeated within a ten PW timeframe in that they are multiplied by a value of 1.42. This demonstrates the importance of incorporating the 'recency' component into the more general variable of 'repeated' information, as the former is found to have significant effects, while the latter does not. Since recent repetitions are found to increase the odds of lacking accent, one can posit that they are less prominent and less communicatively important, as they often fail to contain the most common cue to stress in Spanish.

Recency		
Category		Odds Ratio
Yes	No	1.42

Table 2: Effect of recent words on the odds of deaccenting. A recently repeated word increases the odds of deaccenting.

Concerning effects of word length, it is necessary to explain the inability to produce odds ratios associated with the '3+' category. This is caused by zeros in the data structure. Due to the interactions between the 'high frequency,' 'syllables,' and 'grammatical category' variables, the analysis of the former two was broken out by grammatical category. However, 'pronoun' did not yield any words that are longer than two syllables in length, and therefore the '3+' category for the 'syllables' variable has values of zero for the aforementioned grammatical category. Although this problem arose, we can still show the effect of having words of one syllable in length as opposed to two. The comparison in Table 3 demonstrates that when words have one syllable rather than two, the odds of deaccenting increase by a factor of 1.61. Therefore, it appears that shorter words increase the likelihood of deaccenting based on odds. The short length decreases the possible duration for F0 movement to occur, which increases susceptibility to not include a pitch accent. This is especially true in SS, where speech rates are increased when compared to scripted speech styles.

Number of Syllables		
Category		Odds Ratio
1	2	1.61

Table 3: Effect of number of syllables on the odds of deaccenting. Shorter words seem to increase the effects on deaccenting.

In Table 4, it becomes clear that the hierarchy of increased odds of deaccenting based on grammatical category is as follows: verb >> adverb >> adjective >> noun.[11] The first row reveals that an adverb as opposed to an adjective increases the odds of deaccenting while the second reveals that when adjectives are present instead of nouns, the odds increase as well. Therefore, by transitivity, we expect an increase in odds when adverbs are present rather than nouns as well. The fourth row of the table shows just that, as the odds increase in adverb versus noun cases by a multiplier of 1.19. Finally, the third, fifth, and sixth rows of the table point to an increase in the odds when verbs are present instead of any of the other three categories just mentioned. Overall, the findings for verbs and adverbs support Face (2003).

Category of Word		
Category		Odds Ratio
Adverb	Adjective	1.14
Adjective	Noun	1.05
Verb	Adjective	1.33
Adverb	Noun	1.19
Verb	Adverb	1.17
Verb	Noun	1.39

Table 4: Effects of different grammatical categories on the odds of deaccenting. Verbs and adverbs have the strongest effects.

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  Table 5 suggests a hierarchy of positions in the PPH with respect to effects on the odds of deaccenting. Upon evaluating each row of the table, the ranking that emerges is: medial >> initial >> final >> single. When looking at a word in initial or medial position of the PPH instead of a word that is phrased in its own PPH, the odds in the former two positions increase by immense multipliers over 20. The comparison 'final' versus 'single' also reveals that the former category increases the odds of deaccenting by a considerable factor of 4.80. This propensity to accent words that are individually phrased seems to make sense for two reasons: i. a PPH should contain at least one PW; ii. Face (2002) states that placing PWs in their own PPHs is a strategy of conveying narrow focus, which is definitely not a condition conducive to the absence of a pitch accent. Furthermore, in rows one and two, we observe that a word in initial or medial position rather than final position leads to odds increases by factors of over four in both cases. The preference for accenting words in final position of the PPH supports the claim that this position is the strongest stress position in many Romance languages. Finally, the fourth row conveys that when a word is medial rather than initial, the odds of deaccenting increase by a factor of 1.16. The ratio close to one indicates that the effects are fairly close to equal.

Position in PPH		
Category		Odds Ratio
Initial	Final	4.18
Medial	Final	4.85
Final	Single	4.80
Medial	Initial	1.16
Initial	Single	20.11
Medial	Single	23.31

Table 5: Effects of different positions in the PPH on the odds of deaccenting. Initial and medial positions show the strongest increase in odds.

3.1.3 Effects with interactions

When breaking out 'high frequency' by 'grammatical category' we see that the former variable significantly affects adverbs (p=.0108) and verbs (p=.0009). This is not surprising, as these two grammatical categories possess ratios in Table 4 that establish that they increase the odds when replacing adjectives and nouns. In order to discover the effects of 'high frequency' in this interaction we must obtain odds ratios.

  Table 6 provides the odds ratios for significant effects on grammatical categories when a word is 'yes' instead of 'no' with regard to the 'high frequency' variable.[12] The results for adverbs show that when a word is frequent rather than not, the odds of deaccenting increase by a large multiplier of almost 7. Furthermore, when a verb fits in the 'yes' category as opposed to 'no,' the odds increase considerably, by a factor of 2.65. Therefore, the interaction of adverbs and verbs with 'high frequency' produces higher odds ratios than observed in the previous section for these word types. The increased odds of

deaccenting caused by global high frequency could be due to speakers failing to signal stress on such words that do not fulfill a communicatively crucial role.

Simple Effect Comparisons of High Frequency*Category by Category			
Category	High Frequency	High Frequency	Odds Ratio
Adverb	Yes	No	6.99
Verb	Yes	No	2.65

Table 6: The effects of 'high frequency' on the odds of deaccenting of words belonging to different grammatical categories. The results for adverbs and verbs are significant. Frequent words increase the odds in both cases.

The second significant interaction is between a word's number of syllables and its grammatical label. The results in Table 7 indicate that deaccenting of adverbs (p<.0001), nouns (p=.0232), and verbs (p=.0002) is significantly affected by the number of syllables in each type of word. Now that we know the domain of significant effects, we will once again employ odds ratios to explain them.

Even though there are overall significant effects of number of syllables on adverbs, verbs, and nouns, there are some cases within each category of word in which the effects are not statistically significant. Only those odds ratios associated with significant effects are illustrated in Table 7. Based on this table, it is apparent that shorter words increase the odds of deaccenting when compared to longer words. For example, when replacing an adverb of two syllables with a word of the same class containing one syllable, the odds increase by a factor of 3.64. When considering two syllable adverbs versus those with three or more, the odds increase by a similar factor of 3.45. The second row, which takes one syllable adverbs instead of those with more than three syllables, reveals that the odds greatly increase by a multiplier of 12.53 (as predicted by transitivity). The increase in odds shown for nouns, in the fourth row of Table 7, provides further support for the idea that shorter words are more likely to deaccent. In this instance the odds increase by a factor of 2.14. When a verb of one syllable in length is present instead of a verb with three or more syllables, the odds increase by around 3. Finally, when a verb with two syllables is produced instead of one with three or more syllables, the odds increase by a factor of 2.28. Overall, due to the results in Table 7, we can posit that shorter, deaccented words may not be perceived as being as informationally salient as longer words with much lower odds of deaccenting.

Simple Effect Comparisons of Syllable*Category by Category			
Category	Syllable(s)	Syllable(s)	Odds Ratio
Adverb	1	2	3.64
Adverb	1	3+	12.53
Adverb	2	3+	3.45
Noun	2	3+	2.14
Verb	1	3+	2.90
Verb	2	3+	2.28

Table 7: The effects of 'number of syllables' on the odds of deaccenting words belonging to different grammatical categories. Shorter words increase the odds across significant grammatical categories.

3.2 Map task

Once the MT data was coded, it was determined that 24% of the 1,340 stressed words are deaccented. This value is almost identical to the frequency for SS, which supports the position that production in MTs much more closely resembles SS than lab speech. The following tables illustrate which variables have significant effects on deaccenting and what those effects are in the MT.

3.2.1 Are there effects on deaccenting?

Table 8 provides the significant effects on deaccenting in the MT data. When comparing this table to Table 1, we notice that the effects here are less complex with fewer variables involved.[13] The picture is further simplified when we see that there are no significant interactions to report. As was the case in SS, the number of syllables and the position in the PPH significantly influence deaccenting in some way. In order to view the exact effects, we must look at odds ratios comparing categories belonging to each variable.

Analysis of Fixed Effects	
Effect	P
Syllables	<.0001
Position in the PPH	.0002

Table 8: Analysis of effects (p<.05) for MT data. Only significant outcomes are given.

3.2.2 What are the effects?

With regard to the overall odds ratios in Table 9, we see that the findings support those of SS in that fewer syllables seem to make a word more prone to an absence of accent. The one curious outcome that goes against this trend is found in the first row of the table, when considering cases of one instead of two syllables. However, this should not be too alarming, since the odds ratio is close to one, meaning these two word lengths more or less equally affect deaccenting. In all other rows of the table, when we have fewer syllables rather than more, the odds of deaccenting increase. It is interesting to note that odds ratios are the highest in rows three, five, and six, when comparing four syllable words to those with fewer syllables. This allows for the claim that longer words clearly decrease the odds of deaccenting, possibly because such words are generally important to the content of an utterance.

Number of Syllables		
Category		Odds Ratio
1	2	.88
1	3	1.52
1	4	3.30
2	3	1.72
2	4	3.73
3	4	2.17

Table 9: Effects of number of syllables. In general, shorter words increase the odds of deaccenting.

In terms of position in the PPH, the MT results are similar to those found for SS. After focusing on each row of Table 10, the order of effects on deaccenting that develops is the same as we had for SS: medial >> initial >> final >> single. However, a distinction is made in the MT data, in that medial position separates itself from initial position. When taking medial position instead of any other, as seen in rows two, four, and six of Table 10, the odds of deaccenting increase by about two or more. The ratio in row one, which is very close to one, indicates that initial and final positions almost equally affect deaccenting, which was not the case in SS, where the former much more clearly increased the odds than the latter. Finally, words housed in their own PPHs decrease the odds of deaccenting, as one would expect based on the rationale from the SS data. The strong effect of medial position is further advanced when comparing rows three, five and six. When compared to the 'single' category, medial position increases the odds by a multiplier two times as large as that of the other positions. In sum, the hierarchy of increasing the odds is the same in both speech styles, but here medial position is on the top tier, initial and final positions on the middle tier, and single on the bottom. The fact that final position decreases the odds when compared to initial and medial positions still supports the idea that nuclear position is the most salient in PPHs. However, the results hint that initial and final positions could be more closely related than we previously thought.

Position in PPH		
Category		Odds Ratio
Initial	Final	1.07
Medial	Final	2.10
Final	Single	3.07
Medial	Initial	1.95
Initial	Single	3.30
Medial	Single	6.44

Table 10: Effects of different positions in the PPH on the odds of deaccenting. Medial position shows the strongest increase in odds.

4. Conclusion

This paper discussed a detailed empirical study of deaccenting in Barcelona Spanish in SS and a MT. Based on the overall results, we can posit that the following are characteristics of words that significantly increase the odds of deaccenting: having fewer syllables, being adverbs or verbs, being frequent at a global level, being recently repeated in discourse, and occupying initial or medial positions of PPHs. Overall, more factors significantly contribute to the odds of deaccenting in SS than in the MT. Therefore, as we approach SS from other speech styles, the effects on deaccenting become more intricate.

The statistically significant variables point to the fact that a lack of accent occurs more in words that are not central to the meaning of an utterance. This finding is noteworthy because it suggests that there is a communicative function

present when speakers do not include accent. That is, through deaccenting words, speakers decrease perceptive salience, thus further distinguishing informationally important words from those that are not.

In future research, we must attempt to answer the following questions regarding the status of deaccenting: Is it the case that a pitch accent corresponding with tonal targets is present and then removed by some phonological process? Or, on the other hand, is a lack of F0 movement in pitch contours only a phonetic correlate to stress? Also, since dialectal variation is common across languages, it would be fruitful to carry out related studies based on Latin American Spanish. Finally, another important covariate to consider in relation to deaccenting is distance between neighboring stresses, which comes to mind based on research on Catalan (Prieto et al. 2001).

In sum, this study contributes to the field of Spanish intonation by reporting new findings on factors that lead to deaccenting in speech styles that have not received much previous attention. Hopefully it will serve as a point of departure for further investigations of accent in Spanish and other languages.

Notes

[1] Face (2003) believes that when compared to other types of data elicitation tasks such as story retelling and dialogue games, MT data most closely resembles SS.

[2] 7 Hz (similar to O'Rourke 2006) was used as a threshold value for tonal movement as a cue to stress. However, as Willis (2002) mentions, stress can be conveyed via intensity and duration (which are not of interest here). In fact, a recent study by Ortega-Llebaria and Prieto (2007) on Castilian Spanish and Catalan finds that speakers rely on duration and intensity to perceive stress.

[3] Early work using this hierarchy also included a Clitic Group level between the PW and PPH. This level has been excluded from the hierarchy in more recent studies.

[4] Quilis (1993) provides an extensive list of types of stressed and unstressed words in Spanish.

[5] Factors such as emphasis and changes in speech rate, which are characteristic of spontaneous speech, can result in pitch accents associated with normally unstressed words. This only occurred a few times in the present study. A couple examples are *pero* ('but') and *porque* ('because').

[6] For repetition, recent repetition, and global high frequency, all conjugations of verbs were classified based on their infinitive form. Thus, if *soy* ('I am') appears five PWs before *somos* ('we are'), the second of these words is considered recently repeated because both come from *ser* ('to be').

[7] We have intuitions about 'high frequency words,' but in order to statistically incorporate such a category, it is necessary to provide a precise definition that can be implemented in a coding scheme. However, Fuller Medina (2005) does not explain why she chose 2,000 as her threshold value.

[8] Thanks to Jerome Braun of the UC Davis Statistics Lab for his help with the statistical analysis.

[9] The frequencies at which words belong to the categories described for each of the eight variables are not given here due to length restrictions.

[10] The fact that pronouns were all found to be 'high frequency' turned out to be a problematic issue because it resulted in zeros in the data structure, since there were no pronouns belonging to the 'no' category of this frequency variable. This was discovered after the first part of the logistic regression was carried out and unfortunately prevented obtaining odds ratios for the 'high frequency' variable. On the other hand, nothing impedes an analysis of the interaction between 'high frequency' and 'grammatical category,' since pronouns were discarded before the final phase of the statistical test.

[11] Many deaccented verbs here are presentational verbs such as *ser* ('to be') and *estar* ('to be'). Blake (p.c.) notes that this makes sense intuitively since such copula are not present in some languages.

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[12] This analysis is done using *least squares means*, which estimate the marginal means of specific factors of interest. A mean is considered *marginal* when it concerns only the factor of interest.
[13] Based on intuition and the documented process of final lowering, a variable called 'IP-final' was incorporated in the MT analysis. Results, in the form of large odds ratios, show that this position powerfully influences deaccenting, as one would expect.

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Contrast Preservation in the Yupik Languages

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1 Introduction

The Yupik language family consists of several languages and dialects spoken in parts of Alaska and Siberia. The stress and weight system of these polysynthetic languages is complex and of theoretical interest as there are certain quantitative adjustments made to words that happen independently of rhythmic and metrical principles, as it will be shown. This paper presents an analysis of the weight system in three Yupik dialects cast within Contrast Preservation Theory (Lubowicz 2003). Broadly, it makes the claim that the moraic structure of certain dialects of Yupik is manipulated to maintain contrast, an independent principle in the grammar. The contrast between underlying (or lexical) forms would be neutralized if the moraic structure of words were only sensitive to rhythmic principles. For example, iambic lengthening is a rhythmic principle operating in Yupik, mandating that iambs be uneven (Hayes 1995): the second syllable in a CVCV sequence, when footed into an iamb, lengthens to become CVCV⌉. If a similar sequence containing an *underlying* long vowel in the second syllable is also footed into an iamb, then these two forms would merge: both forms would have the output shape of CVCV⌉, and underlying contrast would be lost. The paper makes a contribution to the body of literature in phonology on contrast (cf. Fleming 1995, Padgett 1997, etc.) by arguing for the expansion of Contrast Preservation Theory (CPT) to include constraints on the preservation of contrast in the moraic structure of words. I argue that it is these constraints that force Yupik to alter the moraic structure of words, e.g. forcing an underlying CVCV⌉ to surface unfaithfully as CVCV⌉⌉.

The basic stress pattern of the Yupik languages is a left-to-right iambic system (Hayes 1995). Previous analyses of the stress and weight system of the Yupik languages include the derivational analysis presented by Hayes (1995), and an analysis presented by Bakovic (1996) framed within Optimality Theory (OT: Prince and Smolensky 1993). CPT, as argued in this paper, brings a critical insight to the stress and weight system of Yupik as it accounts for certain

quantitative adjustments that occur in the dialects by the independently motivated and cross-linguistically validated principle of contrast.

The paper is organized as follows: Section 2 presents facts about the weight system of Yupik and demonstrates some data that are problematic. In this section, I show forms across different dialects of Yupik that violate Faithfulness constraints in a manner that is seemingly unforced by Markedness. In Section 3, I outline the proposal argued for in this paper, which remedies the data in the previous section as unproblematic. Section 4 applies the proposal to lengthening processes and other quantitative adjustments in three dialects of Yupik. Section 5 provides a conclusion of the paper and gives a summary of the factorial typology developed in the paper.

2 The Data

All of the Yupik languages have a left-to-right iambic stress pattern (Hayes 1995). The varieties of Yupik discussed in this paper all have a four vowel inventory consisting of the vowels [i], [e], [a], and [u]. These vowels can be long or short (underlyingly). This distinction in long versus short vowels can be translated to moraic structure: short vowels contain one mora, while long vowels contain two. I assume that Yupik does not allow syllabic consonants, as I have not seen any in my research on the languages. Thus, the moraic structure that exists in the vowel inventory plays a crucial role in the syllable structure of Yupik words. Syllables of the type CV are light (mono-moraic) and syllables of the type CV⌉ are heavy (bi-moraic). Some dialects of Yupik allow for superheavy (tri-moraic) syllables of the type CV⌉⌉. It should be noted that these superheavy syllables are all derived from heavy syllables, as lexical forms only contrast in light versus heavy. Syllables of the type CVC are generally specified as light (although they can sometimes be heavy, as will be discussed below).

Many (if not all) of the dialects of Yupik have a process of iambic lengthening. Iambic lengthening causes an underlying short vowel to become long in order to achieve the canonical iamb, which consists of two syllables of uneven (unequal) weights, the first of which is a light syllable, and the second is a heavy syllable, as represented by (L H). So if two light syllables are footed into an iamb, the second of which undergoes lengthening, then (L L) becomes (L H). Additionally, a single heavy syllable may be footed by itself as (H), forming an acceptable iamb (Hayes 1995). An underlying long vowel in Yupik, when syllabified, either heads a (L H) foot, or exists by itself in a mono-syllabic foot (H), depending on what comes before it in the word (as iambs are formed left-to-right).

In Yupik, the Stress-to-Weight principle (Prince 1992) is generally not violated: Heavy (and superheavy) syllables always receive stress (and conversely, light syllables are generally unstressed). The data in this paper does

not show where stressed is placed for two reasons: primarily because it is predictable based on weight, and secondarily for ease of exposition and viewing of the data.

   The following illustration of iambic lengthening is taken from the St. Lawrence Island dialect of Yupik, but the same process (and for that matter, identical lexical items) are present in other dialects.

(1) Iambic lengthening (Hayes 1995: 241, Krauss 1985: 21, 29, 33)
   (a) /qaj**a**ni/ → [(qaj**a**⌉)ni]   'his own kayak'
   (b) /qaj**a**pixk**a**ni/ → [(qaj**a**⌉)(pixk**a**⌉)ni]   'in his own future authentic kayak'
   (c) /suj**u**qa⌉ni/ → [(suj**u**⌉)(qa⌉)ni]   'in his (another's) drum
   (d) /aNjani/ → [(aNj**a**⌉)ni]   'his own boat'

   In some dialects of Yupik, there is a process dubbed overlengthening (OL: Hayes 1995, Bakovic 1996). A long vowel in the underlying representation (input) becomes a superlong, tri-moraic vowel in the surface representation (output):

(2) Overlengthening in St. Lawrence Island Yupik (Jakobson 1985: 28)
   (a) /qaj**a:**ni/ → [(qaj**a**⌉⌉)ni]   'in his (another's) kayak'
   (b) /qajapixk**a**⌉ni/ → [(qaja:)(pixk**a**⌉⌉)ni]   'in his (another's) fut. auth kayak'
   (c) /ku⌉vel**e**⌉quq/ → [(ku⌉)(vel**e**⌉⌉)quq] 'it will spill'

Even more interestingly, in some dialects (notably Norton Sound, which will be discussed below), there is a process of pre-long strengthening (PLS), that takes the place of overlengthening (i.e. in the PLS dialects, PLS occurs in the same environment as overlengthening, and overlengthening does not occur. Note: these dialects still have iambic lengthening). In PLS, a mora is added to the syllable that *precedes* the underlying long vowel. This mora is realized ideally as a moraic coda consonant; if no coda consonant exists underlyingly, one is created through gemination. The following data from the Norton Sound dialect shows this:

(3) Pre-long strengthening in Norton Sound (Miyaoki 1985: 62)
   (a) /qaj**a**⌉ni/ → [(**qaj**)(ja⌉)ni]   'in his (another's) kayak'
   (b) /qajapixk**a**⌉ni/ → [(qaja⌉)(**pix**)(ka⌉)ni]   'in his (another's) fut. auth. kayak'
   (c)/taNer**cet**ela⌉rtuq/
         → [(taNe⌉x)(**cet**)(la⌉x)tuq][1]   'he usually lets himself be seen'

The added mora allows an acceptable (H) foot to be formed.

There is an important thing to note here: the overlengthened forms that occur in St. Lawrence Island in (1), for example, [(qaja꞉)ni] and [(qaja꞉)(pixka꞉)ni)], are ill-formed in Norton Sound Yupik; in Optimality Theoretic terms, they are losing candidates.

These data can be viewed as problematic because there is seemingly no motivation for overlengthening or pre-long strengthening, at least in metric or rhythmical terms. In other words, iambic lengthening is easy to obtain as it is compelled by Foot-Harmony, expressed by the constraint in (4), but OL and PLS are not predicted given the standard formulations of well-formedness constraints.

 (4) FTHARM (Foot-Harmony)
  Iambs: * Ĺ)
  A stressed light syllable at the end of a foot is prohibited.

FTHARM is defined in such a way for a few reasons. First, it allows (L H) to be the canonical iamb. Positing (L H) as the canonical iamb is based on the notion of Foot-Harmony in Hayes (1995). According to Hayes, (L H) iambs are a part of the universal foot inventory following the Iambic/Trochaic Law (Hayes 1995: 81). However, many iambic languages (including Yupik) also allow feet consisting of a single heavy syllable, (H). Iambs of the type (H) must therefore also be harmonic. Defining FTHARM as it is in (4) allows this to be achieved. Another thing should be noted in regards to this definition. The Stress-to-Weight (SWP) principle does basically the same thing, prohibiting light syllables that receive stress. However, prohibiting stressed light syllables at the end of feet, as in (4), creates iambs rather than trochees, which is crucial for the present analysis; SWP makes no distinction between iambs and trochees. Additionally, the definition in (4) essentially achieves the same result as Kager's (1999) RH-CONTOUR constraint, which mandates that feet end in a strong-weak contour of microbeats. However, if this constraint were to replace FTHARM, then overlengthened iambs of the type (L S) would be prohibited. This is because it is assumed that the first mora in a syllable is strong. Given that (micro-) beats must alternate, then, the foot would end in a weak-strong contour, thus violating RH-CONTOUR. The definition of FTHARM given in (4) is thus necessary to capture the full range of acceptable iambs in Yupik (and perhaps in other languages as well).

The problematic nature of OL and PLS, as discussed in the above paragraph, is shown in the following two tableaux: all of these processes add a mora that was non-existent in the input - thus a violation of DEP-μ.

(5) Iambic lengthening

	/qajani/	FTHARM	DEP-µ
a. ☞ (qaja:)ni			*
b. (qaja)ni		*!	

(6) Overlengthening

	/qaja⌐ni/	FTHARM	DEP-µ
a. ☞ (qaja⌐⌐)ni			*¡
b. ☜ (qaja⌐)ni			

(7) Pre-Long Strengthening

	/qaja⌐ni/	FTHARM	DEP-µ
a. ☜ (qaja⌐)ni			
b. ☞ (qaj)(ja⌐)ni			*¡

The tableau in (5) shows that iambic lengthening is fairly easy to achieve by ranking FTHARM over DEP-µ. The process of iambic lengthening is necessary in the Yupik languages in order to establish a canonical iamb.

The problem here occurs in the overlengthening case (the problem is identical for PLS). Foot-Harmony prohibits the (L L) iamb, so DEP-µ is violated to achieve the desired (L H) foot. However, Foot-Harmony is not at stake in the overlengthening case, yet DEP-µ is violated without a higher ranking constraint to force its violation. The problem, in short, is that there is a seemingly unwarranted violation of DEP-µ.

3 The Proposal

In this paper I propose to account for this unmotivated violation of faithfulness by employing Contrast Preservation Theory (Lubowicz 2003). In both rule-based phonology and standard OT, the preservation of contrast is achieved epiphenomenally: the preservation of contrast in rule-based phonology occurs due to rule application, and likewise occurs in standard OT due to the interaction of Markedness and Faithfulness constraints which do not refer to contrasts in grammar. In CPT, however, "…contrast preservation exists as an independent principle in the grammar, which in the framework of Optimality Theory is formulated as a family of rankable and violable constraints on preserving contrasts" (Lubowicz 2003: 5). CPT additionally deviates from standard OT in that phonological mappings (e.g., the mapping of an input to an output) are not evaluated in isolation: mappings are evaluated together as a system. Candidates in CPT are thus sets of mappings, known as *scenarios*. Constraint rankings

determine which scenario is optimal. CPT additionally adds a crucial dimension to OT by positing a third type of constraint, different than Markedness and Faithfulness constraints. This third type of constraint is known as a Preserve Contrast (PC) constraint, assigning violations to scenarios that merge contrasts.

The key idea argued for in this paper is that there is a PC constraint on the preservation of contrast of underlying weight in the language. Overlengthening and Pre-Long Strengthening occur to satisfy this constraint at the cost of violating DEP-μ. For example, in St. Lawrence Island Yupik, FTHARM forces the violation of DEP-μ to achieve iambic lengthening: /qajani/ → [(qajaˑ)ni] 'his own kayak.' The underlying form for 'in his kayak' is /qajaˑni/, and if this maps faithfully to [(qajaˑ)ni], the contrast between the input forms /qajani/ and /qajaˑni/ would be neutralized: both forms would be pronounced the same way, as [(qajaˑ)ni]. The PC constraint on the preservation of the weight contrast (long vs. short vowel) forces the additional violation of DEP-μ, resulting in OL and PLS. The contrast preserving nature of OL and PLS was originally observed by Bruce Hayes (1995). However, no formal account of OL and PLS in Yupik as contrast-preserving phenomena has been developed, in either rule-based phonology or OT. This work provides such an account.

The proposed constraint on the preservation of weight distinctions is introduced and formalized in (8). The definition and formalization of this constraint is adapted from other PC constraints introduced in Lubowicz's (2003) dissertation:

(8) PC$_{IN}$(WEIGHT)

   For each pair of inputs, contrasting in μ/∅ where in$_1$ has μ and in$_2$ lacks μ in the same position in a string, that map onto the same output, assign a violation mark.

   "Words that differ underlyingly in the presence/absence of a mora must be distinct on the surface."

Like other PC constraints, this constraint is evaluated by comparing sets of mappings. For example, if a set of two inputs, one of which has a mora in position x, but another of which lacks a mora in position x, maps into identical outputs (either having or lacking moras in position x), then a violation mark is assigned. This is shown schematically in the following diagram:

(9) The evaluation of PC$_{IN}$(WEIGHT)

Scenarios	Mappings	PC$_{IN}$(WEIGHT)
a..Contrast Preserving	μ　　　μ |　　　| CV → CV μμ　　μμ |　　| CV⌉ → CV⌉	√
b. Contrast Neutralizing	μ　　μμ |　　| CV → CV⌉ μμ　　μμ |　　| CV⌉ → CV⌉	*

In this diagram, the mappings in (b) contain two different inputs: one of which has a second mora associated with the vowel, and the other of which lacks this second mora (it is mono-moraic). These are mapped onto identical outputs having a second mora associated with the vowel. This scenario thus violates PC$_{IN}$(WEIGHT). The mappings in (a), however, satisfy PC$_{IN}$(WEIGHT). This is because the difference (or contrast) in the input forms is also reflected in the output forms: for both forms, where a mora exists in the input, it exists in the output, and where a mora was lacking in the input, it is lacking in the output.

　Consider a different mapping, shown schematically in (10):

(10) The evaluation of PC$_{IN}$(WEIGHT)

Scenarios	Mappings	PC$_{IN}$(WEIGHT)
a. Contrast Preserving	μ　　μμ |　　| CV → CV⌉ μμ　　μμμ |　　| CV⌉ → CV⌉⌉	√

　This scenario also satisfies PC$_{IN}$(WEIGHT): The first input lacks a second mora in the vowel, and the second input has a second mora in the vowel, and these map onto *different* outputs. It satisfies PC$_{IN}$(WEIGHT) even though it is highly unfaithful, containing multiple moras in the output that were not in the input. This is quite similar to what happens in Yupik, as will be shown in the following sections.

　The PC$_{IN}$(WEIGHT) constraint, as with other constraints in OT, is rankable and violable; it interacts with other markedness and faithfulness constraints. The

following sections show how this constraint plays a role in the grammar of four Yupik dialects.

4 Application: lengthening processes

The proposal argued for here can be applied to various dialects of the Yupik languages. It can be used to account for overlengthening phenomena in St. Lawrence Island Yupik, and pre-long strengthening in the Norton Sound dialect of Yupik.

4.1 Overlengthening in St. Lawrence Island Yupik

Recall from above that the Yupik languages have a process of iambic lengthening. This happens in order to achieve the canonical (L H) iamb (Hayes 1995). The assumption that a foot-harmony constraint drives this process is thus warranted.

(11) FTHARM
    Iambs: * Ĺ)
    A stressed light syllable at the end of a foot is prohibited.

The process of iambic lengthening adds a mora to the output – this mora was not in the input, thus violating the faithfulness constraint DEP-μ.

(12) DEP-μ
    Informally: output moras with no input correspondent are prohibited.

As was shown in tableau (5), iambic lengthening can be achieved by the ranking of FTHARM over DEP-μ.

  In (2), the process of overlengthening in the St. Lawrence Island dialect of Yupik was exhibited: a (L H) sequence becomes (L S), where S is superheavy. It should be reinforced that vowel length is contrastive in these languages. Take the following underlying forms as an example: /qajani/ 'his own kayak', /qajaˀni/ 'in his (another's) kayak' – the only difference between these two lexical items is the presence of the long versus short vowel. It may thus be assumed that vowel length is contrastive in the Yupik dialects considered here in this paper.

  The process of overlengthening results in a tri-moraic vowel (also a tri-moraic syllable). Tri-moraic vowels/syllables are cross-linguistically marked (and are actually strictly prohibited in some Yupik dialects). Thus a constraint against these superheavy constructions is needed.

(13) *μμμ]$_\sigma$
   Tri-moraic syllables are prohibited.

This constraint is adapted from a similar constraint used by Blevins and Sheldon (1999). The constraint used in this paper is called *V⊓, positing simply that vowels with three moras associated with them are prohibited. The constraint is broadened in this paper to the syllabic level because Yupik has underlying bimoraic vowels and (sometimes) moraic coda consonants, which can potentially combine into a tri-moraic syllable.

Using the four constraints introduced thus far, the correct result can be achieved. The crucial ranking involves the domination of FTHARM and PCIN(WEIGHT) over *μμμ and DEP-μ. That is, FTHARM, PCIN(WEIGHT) >>*μμμ, DEP-μ. This is demonstrated graphically in tableau (14).

(14) St. Lawrence Island Yupik (moras added to the output are bolded)

Scenario	Mappings	PC(WGHT)	FTHARM	*μμμ	DEP-μ
a.☞Contrast Preserving	Input Output μ μ μ μ**μ** | | | || qajani → (qaja⌐)ni μ μμ μ μμ**μ** | || | ||| qaja⌐ni → (qaja⌐⊓)ni			*	* *
b.Contrast Neutralizing	μ μ μ μ**μ** | | | || qajani → (qaja⌐)ni μ μμ μ μμ | || | || qaja⌐ni → (qaja⌐)ni	*!			*
c.No Lengthening	μ μ μ μ | | | | qajani → (qaja)ni μ μμ μ μμ | || | || qaja⌐ni → (qaja⌐)ni		*!		

Scenario (c) fails to achieve iambic lengthening, resulting in a marked (L L) iamb in one of the mappings. High-ranking FTHARM rules this scenario out. In scenario (b), canonical iambs are achieved, yet the weight distinctions in underlying forms map onto the same outputs, thus failing to achieve the preservation of contrast. The PC constraint that mandates that contrast be preserved is why scenario (b) loses. Scenario (a), the contrast preserving scenario, thus wins, even though it contains a tri-moraic vowel and two added moras. This shows that in the St. Lawrence Island dialect of Yupik, the preservation of contrast is important, and forms that neutralize contrast are

prohibited. Contrast Preservation Theory (CPT) is thus able to neatly capture the distribution of lengthening in this dialect.

4.1.1 Contrast neutralization in the Chaplinski dialect

A valuable asset of OT is that it allows constraints to be permuted, i.e. constraint rankings may be rearranged, and this permutation of constraints results in either possible or attested languages. The permutation of the four constraints discussed above not only yields different possible languages (in theory), but one such permutation yields an actual Yupik language. This language is the Chaplinski dialect of Yupik (Bakovic 1996). This form of Yupik is a contrast neutralizing dialect: iambic lengthening happens as usual, but overlengthening (nor PLS) does not happen.

  (15) Lengthening in Chaplinski (Bakovic 1996: 4)
      a. iambic lengthening
        /qajani/ → [(qaja⌐)ni]   'his own kayak'
      b. no overlengthening
        /qaja:ni/ → [(qaφa⌐)ni]   'in his (another's) kayak'

  A comparison of (16a) and (16b) reveals that contrast is neutralized: an underlying weight distinction is no longer present in the output. The grammar of this language thus chooses to violate the proposed constraint above, that is PC_{IN}(WEIGHT). This constraint is sacrificed in order to avoid a tri-moraic vowel: *μμμ thus dominates the PC constraint. Ranking this markedness constraint and FTHARM above the contrast preservation constraint achieves the correct result.

(16) Chaplinski Yupik

Scenarios	Mappings	*μμμ	FTHARM	PC(WGHT)	DEP-μ
a.Contrast Preserving	**Input Output** μ μ μ μ**μ** | | | ‖ qajani → (qaja⌉)ni μ μμ μ μμ**μ** | ‖ | ‖‖ qaja⌉ni→ (qaja⌉⌉)ni	*!			* *
b.☞Contrast Neutralizing	μ μ μ μ**μ** | | | ‖ qajani → (qaja⌉)ni μ μμ μ μμ | ‖ | ‖ qaja⌉ni → (qaja⌉)ni			*	*
c.No Lengthening	μ μ μ μ | | | | qajani → (qaja)ni μ μμ μ μμ | ‖ | ‖ qaja⌉ni → (qaja⌉)ni		*!		

In this dialect of Yupik, the contrast neutralizing scenario wins. The scenario that lacks lengthening loses because of a sub-harmonic foot (i.e., /qajani/ mapping to *[(qaja)ni]). The scenario that is able to preserve the underlying contrast (scenario (a)) – the winning scenario in St. Lawrence Island - loses because it contains a tri-moraic vowel. Scenario (b), the contrast neutralization scenario, thus wins. The constraint ranking of this language prefers to avoid tri-moraic vowels at the cost of neutralizing contrast.

4.2 Pre-long strengthening in Norton Sound Yupik

The process of pre-long strengthening was discussed above. In this process, a mora is added to the syllable *preceding* an underlying long vowel. Crucially, this process subsumes the role of overlengthening; in the PLS dialects, OL does not happen. One such PLS dialect is the Norton Sound dialect of Yupik. The lengthening processes of this language are shown in (17) (repeated from above):

(17) Lengthening in Norton Sound (Hayes 1995, Bakovic 1996)
    a. iambic lengthening
        /qajani/ → [(qaja⌉)ni]   'his own kayak'
        /qajapixk**a**ni/ → [(qaja⌉)(pixk**a**⌉)ni]   'in   his   own   future authentic kayak'
    b. pre-long strengthening

/qaja⌐ni/ → [(**qaj**)(ja⌐)ni]   'in his (another's) kayak'
/qajapixk**a**⌐ni/   → [(qaja⌐)(**pix**)(ka⌐)ni]   'in his fut. auth. kayak'

Overlengthening does not take place; there is thus a crucial distinction between how this dialect and the St. Lawrence dialect treat lexical items containing underlying long vowels. The following diagram compares the two dialects graphically:

(18) Comparison diagram

St. Lawrence Island		Norton Sound	
	μ μμ μ		μ μμ μ
Input:	| || |		| || |
	qaja⌐ni		qaja⌐ni
	μ μμ**μ** μ		μ **μ** μμ μ
Output:	| ||| |		|| || |
	(qaja⌐⌐)ni		(qaj)(ja⌐)ni

In both dialects, a mora is added to the output that was absent in the input: four-mora inputs become five-mora outputs. The difference between these two dialects is the location where this mora is added. In St. Lawrence Island, it is added to the same syllable as the underlying bi-moraic vowel; in Norton Sound, it is added to the syllable *preceding* the bi-moraic vowel. These two dialects are thus quite similar, only differing in the placement of this mora[2]. And recall, this mora is added to preserve contrast between underlying (lexical) forms.

  Again, Norton Sound adds a mora to the preceding syllable: it does not create an over-long (tri-moraic) vowel. This can be captured by assuming that *μμμ is undominated in Norton Sound. The following tableau shows this ranking.

(19) Norton Sound Yupik

Scenarios	Mappings	*μμμ	FTHARM	PC(WGHT)	DEP-μ
a. PLS ☞	**Input** **Output** μ μ μ μ**μ** | | | ‖ qajani → (qaja˥)ni μ μμ μ**μ** μμ | ‖ ‖ ‖ qaja˥ni→ (qaj)(ja˥)ni				* *
b. OL	μ μ μ μ**μ** | | | ‖ qajani → (qaja˥)ni μ μμ μ μμ**μ** | ‖ | ‖‖ qaja˥ni → (qaja˥˥)ni	*!			* *
c. Contrast neutralizing	μ μ μ μ**μ** | | | ‖ qajani → (qaja˥)ni μ μμ μ μμ | ‖ | ‖ qaja˥ni → (qaja˥)ni			*!	*
d. Fully faithful scenario; no lengthening	μ μ μ μ | | | | qajani → (qaja)ni μ μμ μ μμ | ‖ | ‖ qaja˥ni → (qaja˥)ni		*!		

What is important to note here is that the St. Lawrence Island scenario, that is, the overlengthening scenario, loses because it contains a tri-moraic vowel. The other constraints act in the same way they did in St. Lawrence Island, and the scenario that preserves contrast (PLS) *and* avoids a tri-moraic vowel and is chosen as the winner.

4.2.1 St. Lawrence Island revisited

There is, however, an issue that arises at this point. Using only the constraints we have so far, and considering the Norton Sound scenario in a St. Lawrence Island constraint ranking, the wrong result is predicted. In other words, something is needed additionally to address the sub-optimality of PLS scenario in the St. Lawrence Island dialect. This problem is shown in tableau (21):

(20) St. Lawrence Island with additional scenario: wrong result.

Scenarios	Mappings	PC(WGHT)	FTHARM	*μμμ	DEP-μ
a. PLS ☞	Input Output μ μ μ μ**μ** | | | ‖ qajani → (qaja ⌐)ni μ μμ μ**μ** μμ | ‖ ‖ ‖ qaja ⌐ni→ (qaj)(ja⌐)ni				* *
b. OL ☞	μ μ μ μ**μ** | | | ‖ qajani → (qaja ⌐)ni μ μμ μ μμ**μ** | ‖ | ‖‖ qaja ⌐ni → (qaja ⌐⌐)ni			*!	* *
c. Contrast Neutralizing	μ μ μ μ**μ** | | | ‖ qajani → (qaja ⌐)ni μ μμ μ μμ | ‖ | ‖ qaja ⌐ni → (qaja ⌐)ni	*!			*
d. FFS; no lengthening	μ μ μ μ | | | | qajani → (qaja)ni μ μμ μ μμ | ‖ | ‖ qaja ⌐ni → (qaja ⌐)ni		*!		

    This was the ranking that was established for St. Lawrence Island Yupik, yet with the additional scenario considered, it does not work. Scenario (b), the actual winning scenario in the language, should lose to scenario (a) in this tableau, but in reality it does not. Another constraint is therefore needed to make the ranking work once again. The constraint that solves the problem here is an alignment constraint:

    (21) ALL-FEET-L
        The left edge of every foot must be aligned with the left edge of a PrWd

This constraint effectively solves the problem[3]. It solves the problem (albeit epiphenomenally) by minimizing the number of feet contained in a Prosodic Word: the more feet there are in the PrWd, the more violations of this constraint there will be. This constraint prefers words with one foot rather than two. And it is this constraint that distinguishes between winners and losers in St. Lawrence Island Yupik:

(22) The correct result for St. Lawrence Island

Scenario	Mappings	PC	FTHARM	ALL-FT-L	*μμμ	DEP
a. PLS	**Input**　　**Output** μ μ　　　μ μ**μ** | |　　　　| || qajani → (qaja˺)ni μ μμ　　　μ**μ** μμ | ||　　　|| || qaja˺ni → (qaj)(ja˺)ni			*!		* *
b.OL ☞	μ μ　　　μ μ**μ** | |　　　| || qajani → (qaja˺)ni μ μμ　　　μ μμ**μ** | ||　　　| ||| qaja˺ni → (qaja˺˺)ni				 *	* *
c.Cont. Neutral.	μ μ　　　μ μ**μ** | |　　　| || qajani → (qaja˺)ni μ μμ　　　μ μμ | ||　　　| || qaja˺ni → (qaja˺)ni	*!				*
d.No length.	μ μ　　　μ μ | |　　　| | qajani → (qaja)ni μ μμ　　　μ μμ | ||　　　| || qaja˺ni → (qaja˺)ni		*!			

   What is crucial here is that the alignment constraint dominates *μμμ. It is this ranking that achieves the correct result. Scenario (b), the overlengthening scenario, can now be chosen as the correct winner over scenario (a), the PLS scenario. The PLS scenario contains two feet, one of which is not aligned to the left edge of the PrWd: ranking ALL-FEET-L over *μμμ makes this violation more costly than a tri-moraic vowel, and thus the overlengthening scenario is the winner.

   It should be noted that this constraint ranking generalizes over all forms in the language. Tri-syllabic /qajani/ and its parallels were only considered here, yet it also works for the multi-syllabic forms in the language. For example, St. Lawrence Island chooses a mapping of /qajapixka˺ni/ → [(qaja˺)(pixka˺˺)ni] to /qajapixk˺:ni/ → *[(qaja˺)(pix)(ka˺)ni] because there is an extra violation of ALL-FEET-L in the latter. The same constraint rankings also generalize over all forms in Norton Sound.

4.2.2 Norton Sound revisited

Recall that tri-moraic vowels do not occur in the Norton Sound dialect of Yupik. *μμμ must therefore be undominated. In fact, with respect to the phenomena under focus, it need only be ranked higher than ALL-FEET-L and DEP-μ. Further, the only thing required to achieve the difference between Norton Sound and St. Lawrence Island is to flip the ranking of ALL-FEET-L AND *μμμ. The following tableau shows this: It is nearly identical to the tableau for St. Lawrence Island, save for the ranking between the just-mentioned alignment constraint and markedness constraint.

(23) The correct result for Norton Sound

Scenario	Mappings	PC	FTHARM	*μμμ	ALL-FT-L	DEP
a. PLS ☞	Input → Output (qajani → (qaja)ni); (qaja ni → (qaj)(ja)ni)				*	* / *
b. OL	qajani → (qaja)ni; qaja ni → (qaja)ni			*!		* / *
c. Cont. Neutral.	qajani → (qaja)ni; qaja ni → (qaja)ni	*!				*
d. No length.	qajani → (qaja)ni; qaja ni → (qaja)ni		*!			

Of course, scenarios (c) and (d) are losers: they violate contrast preservation and foot-harmony, respectively. What is interesting is the choice of scenario (a), the pre-long strengthening scenario, over scenario (b), the overlengthening scenario. The OL scenario violates *μμμ, which dominates ALL-FEET-L. The PLS scenario thus wins because it has only a violation of ALL-FEET-L (and Dep-μ), the violation of which is tolerated by the grammar to avoid a tri-moraic vowel.

The difference between St. Lawrence Island Yupik and Norton Sound Yupik can thus be quite parsimoniously reduced to the ranking of *μμμ and All-Feet-

L. Permute these rankings, and you obtain the difference between the two languages.

5 Conclusion

A factorial typology for three dialects of Yupik has been developed in this paper. It is argued that the differences between the three dialects rest only on the relative ranking of the proposed PC constraint with other constraints. This factorial typology is summarized below.

(24) Factorial typology of Yupik

Dialect	Scenario	Ranking
St. Lawrence Island	Overlengthening	PC, FTHARM, ALL-FT-L >> *μμμ, DEP-μ
Chaplinski	Contrast neutralizing	FTHARM, ALL-FT-L, *μμμ >> PC, DEP-μ
Norton Sound	Pre-long strengthening	PC, FTHARM, *μμμ >> ALL-FT-L, DEP-μ

Acknowledgements

Notes

1. Segmental processes (e.g. [r] → [x]) happen for independent reasons – these are unimportant to the analysis of quantitative processes at hand.
2. The nomenclature distinction between OL and PLS may thus be trivial: I argue that OL and PLS involve the same process that yields different results depending on the ranking of other active constraints in the languages.
3. The reader may have noted that the same problem exists for the Chaplinski dialect. However, this problem can be remedied for Chaplinski by ranking ALL-FEET-L and *μμμ over PC(WEIGHT).

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The Distribution of the Active Voice

Morphology in Javanese and *v*P Phases[*]

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1. Introduction

This paper proposes an analysis of the distribution of the active voice (AV) morphology in two Javanic languages within the Phase Theory (Chomsky 2004). Cole and Hermon (1998) propose that the movement of an NP cannot cross the verb marked with the AV in Indonesian. I show that this generalization also holds for Javanese. Following Kayne's (1989) analysis of French participial agreement, I propose that the deletion of the AV morphology in the two languages is a PF reflex of the Spec-Head D-feature checking relation between the moved NP and its local *v*. The phenomenon investigated here provides syntax-external support for the phase-based implementation of successive cyclicity in terms of *v*P phases. I further situate the proposed analysis within the broader context of Austronesian by bringing in data from Chamorro and develop a micro-parametric account of the common Austronesian grammatical design concerning the syntax-morphology interface.

2. The Distribution of the Active Voice Morphology

Cole and Hermon (1998) establish a generalization (see also Chung 1976 and Saddy 1991) that, in Malay/Indonesian, the obligatory omission of the AV prefix *meN-* with verbs that would otherwise permit it indicates the movement of an NP argument over the *meN* + verb. Examples in (1-3) illustrate this generalization.

(1) a. Siapa$_i$ Bill ***mem**-beritahu ibu-nya [yang t_i **men**-cintai Fatimah]?
    who Bill AV-tell mother-his that AV-love Fatimah
    'Who does Bill tell his mother that loves Fatimah?'

  b. Ali **mem**-beritahu kamu tadi [apa$_i$ yang Fatimah ***mem**-baca t_i]?
    Ali AV-tell you just now what that Fatimah AV-read
    'What did Ali tell you just now that Fatimah was reading?'

  c. Ali **mem**-beri Fatimah apa?
    Ali AV-give Fatimah what
    'What did Ali give Fatimah?' (slightly modified from Cole and Hermon 1998: 232, 233, 237)

(2) Buku itu$_i$ adik saya ***mem**-beli t_i.
    book that brother my AV-buy
    'My brother bought that book./That book was bought by my brother.'
                      (slightly modified from Cole and Hermon 1998: 232)

(3) a. Kenapa$_i$ Mary **mem**-beli buku itu t_i?
    why Mary AV-buy book that
    'Why did Mary buy that book?'

  b. Kepada siapa$_i$ Mary **mem**-beli buku t_i?
    to who Mary AV-buy book
    'To whom did Mary give a book?' (Cole and Hermon 1998: 231, 232)

(1a-c) show that Indonesian has three ways to form *wh*-questions: overt movement into the matrix [Spec, CP] (1a), partial movement into a non-scopal [Spec, CP] (1b), and in-situ (1c). In (1a), only the higher verb has its AV affix deleted because the movement of *siapa* 'who' crosses this verb, not the lower verb, on its way to the final landing site. In (1b), AV omission happens only with the lower verb because the movement of *apa* 'what' crosses only this verb. No AV deletion is observed in (1c) because there is no movement of an NP that crosses the verb. (2) shows that *meN*-deletion is also caused by A-movement such as object preposing; see Chung (1976) for evidence based on the interaction of object preposing and Equi NP deletion that object preposing in Indonesian is an instance of A-movement. (3a, b) show that movement of non-nominal phrases such as *kenapa* 'why' and *kepada siapa* 'to whom' does not cause AV deletion.

Cole and Hermon's (1998) generalization also holds for Javanese, a closely related Malayo-Polynesian language spoken in Indonesia. Consider (4-6).

(4) a. [Sapa$_i$ sing Iwan ***ng**-ira [Esti ***nge**-sun t_i]]?
    who that Iwan AV-think Esti AV-kiss
    'Who does Iwan think that Esti kissed?'

  b. [Iwan **ng**-ira [sapa$_i$ sing Esti ***nge**-sun t_i]]?
    Iwan AV-think who that Esti AV-kiss
    'Who does Iwan think that Esti kissed?'

  c. [Iwan **ng**-ira [Esti **nge**-sun sapa]]?
    Iwan AV-think Esti AV-kiss who
    'Who does Iwan think Esti kissed?'

(5) Wong kuwi$_i$ Esti ***nge**-sun t_i.
    person this Esti AV-kiss
    'Esti kissed this person./This person was kissed by Esti.'

(6) a. Nangapa_i Esti **nge**-sun Fernando t_i?

      why   Esti AV-kiss Fernando

      'Why did Esti kiss Fernando?'

  b. Ning sapa_i Esti **ng**-irim paket t_i?

      to   whom Esti AV-send package

      'To whom did Esti send a package?'

In (4a), the nasal AV prefix must be deleted from both the matrix and embedded verbs since the movement of *sapa* 'who' crosses these verbs on its way to the final landing site. Only the lower verb undergoes AV deletion in (4b) because the partial movement does not cross the matrix verb. There is no AV deletion in (4c) due to the lack of movement across any verb. (5) shows that AV deletion obtains when A-movement such as object preposing occurs across a verb. Finally, movement of non-nominal phrases does not cause this deletion, as in (6a, b).

    Thus, Cole and Hermon's generalization holds for Indonesian and Javanese. Davies (2003) shows that this generalization also characterizes the distribution of the AV morphology in Madurese, another Javanic language spoken on the Madura Island of Indonesia. One question left unresolved in Cole and Hermon (1998) is why this generalization holds in these languages. This is the topic of the next section.

3. Successive Cyclicity and Phase Theory

I propose that the obligatory AV deletion is a morphophonological reflex of the Spec-Head D-feature checking relation between the moved NP and its local v at the vP phase. The core idea behind this proposal, namely, that overt syntactic movement affects the form of verbs within its path is not a new idea but has been around in the

syntactic literature. In this light, Kayne's (1989) analysis of participle agreement in French is informative. Consider (7a-c) from Kayne (1989: 85, 86, 91).

(7) a. Paul   a   **repeint/*repeintes**   les   chaises.
     Paul   has   repainted   the   chairs
     'Paul has repainted the chairs.'

     b. Je me demande [$_{DP}$ combine   de tables]$_i$ Paul a   **repeintes** t_i.
        I   wonder   how-many of tables   Paul   has   repainted
        'I wonder how many tables Paul has repainted.'

     c. Je me demande [$_{DP}$ combine   de chaises]$_i$ il   sera ***repeint/*repeintes*** cette année.
        I   wonder   how-many of chairs   Imp are   repainted   this   year
        'I wonder how many tables will be repainted this year.'

French does not show agreement between the participle and the post-verbal DP, as in (7a). However, when the DP undergoes movement as in (7b), agreement obtains between the two elements. Kayne argues (see also Chomsky 1995: chapter 2) that the agreement is contingent on the Spec-Head relation between the moved NP and the AgrO, in the manner seen in (8) for the sentence in (7b).

(8)   [$_{CP}$ combine de tables$_i$ [$_{TP}$ Paul ... [$_{AgrOP}$ t_i [$_{AgrO'}$ Agr [$_{VP}$ repeint***es*** t_i]]]]]]

In this structure, the Spec-Head agreement between the moved *wh*-phrase and AgrO results in the visible agreement on the participle. This analysis also correctly predicts that there is no such agreement under impersonal constructions as in (7c). The agreement is impossible here because expletive replacement, a case of A-movement, would involve improper movement (namely, A′-A movement) if the *wh*-phrase undergoes prior A′-movement into [Spec, AgrOP]. The grammaticality of the

example in (7c) without participal agreement is expected if the *wh*-phrase does not stop in [Spec, AgrOP] when the participle does not show agreement.

I propose that the distribution of the AV morphology in Indonesian/Javanese discussed in the previous section can be analyzed in the same way. Specifically, the deletion is a PF reflex of the Spec-Head D-feature checking relation between the moved NP and its local *v*. For illustration, consider the Javanese example in (4b). The derivation for the embedded part of this sentence is given in (9).

(9) [$_{CP}$ sapa$_i$ sing [$_{TP}$ Esti… [$_{vP}$ t_{Esti} [$_{v'}$ t_{sapa} [$_{v'}$ ~~nge~~-v [$_{VP}$ sun t_i]]]]]]
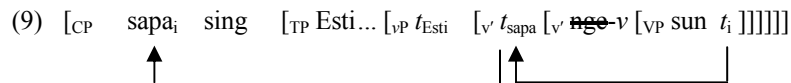
The *wh*-word *sapa* 'who' enters into the D-feature checking relation with the *v* head. This syntactic relation is read at the phonological component as the deletion/dephoneticization of the AV prefix. Movement of non-nominal phrases does not cause this deletion because they lack D-features. Note that this derivation is the only possible derivation within the phase-based system outlined in Chomsky (2004). Chomsky proposes that syntactic computation sends mid-derivational material headed by *v*P and CP to the interpretive components in a piecemeal fashion. This derivation yields the so-called *Phase Impenetrability Condition* to the effect that VP-internal elements that are to move to CPs must first move to the edge/specifier of [Spec, *v*P] to be accessible to operations at the CP phase. Therefore, to the extent that the proposed analysis is correct, the distribution of the AV morphology provides syntax-external support for *v*P phases.

One question to be addressed at this point is what is the nature of the formal feature checked against *v*. The proposed analysis claims that the relevant feature is (categorial) D-feature. An alternative possibility, which has been proposed in the literature on the related phenomena in other Austronesian languages (see section 4), is that Case is the relevant feature. Two considerations suggest that this alternative cannot

be upheld for Indonesian and Javanese. First, in multi-clausal environments, the Case-based analysis predicts that a single NP should receive multiple Cases on its way to the final landing site. However, this is an undesirable outcome as no languages have been reported in the literature where a single NP receives more than two structural cases in a particular construction. Second, the alleged Case-driven movement would violate the Last Resort Condition (Chomsky 1995: chapter 4), which effectively blocks movement from a Case position to another Case position: compare *John$_i$ seems t$_i$ to be ill* vs. **John$_i$ seems that t$_i$ is ill*. Thus, I maintain that the relevant feature checked between the moved NP and its local *v* is D-feature. I return to this question in the next section.

4. In Search of the Pan-Austronesian Grammatical Design

Other Austronesian languages such as Chamorro, Palauan, and Tagalog have been reported in the literature to exhibit a phenomenon similar to that observed in Indonesian and Javanese in which the morphology of a verb is affected by syntactic movement over it. The purpose of this section is to identify similarities and differences between those phenomena and to propose a micro-parametric account for them. For reasons of space, I limit my discussion to the comparison between WH-agreement in Chamorro and AV deletion in Indonesian and Javanese. See Sato (forthcoming: chapter 2) for discussion on the realis/irrealis alternation in Palauan (Georgopoulos 1985) and the voice-agreement in Tagalog (Rackowski and Richards 2005) as well as their structural similarities to the AV deletion discussed in this work.

In a series of work on WH-agreement in Chamorro, Chung (1982, 1994, 1998) proposes the generalization in (10); see Chung (1998: 236, 237) for the morphological effects of this agreement.

(10) WH-Agreement (holds at S-structure)

I^0 and an A-bar-bound trace that is free within I^0's minimal m-command

domain must have compatible values for [Case]. (Chung 1998: 257)

(10) states that a) the [+V] predicate on the lowest clause agrees with the Case of the initial *wh*-trace and that b) higher [+V] predicates agree with the Case of the intermediate CP out of which extraction has most recently occurred. Consider (11a, b).

(11) a. Hayi$_i$ ch*um*ätgi-n   mämaisa   gui' t_i?

      who?   WH[nom].laugh.at-L   self.Prog   him

      'Who was laughing at himself?'

   b. Hayi$_i$ si Manuel h*in*assóso- nn☐a   [t'_i ch*um*uli' t_i i salappi']?

      who?   Manuel WH[obj].think.Prog-Agr   WH[nom].take the money

      'Who does Manuel think has taken the money?'

                                              (Chung 1998: 237, 250)

In (11a), the verb is inflected for nominative because the extracted *wh*-phrase *hayi* 'who' carries nominative Case. In (11b), however, the higher verb is inflected for accusative because it agrees in Case with its complement CP out of which extraction has taken place, not with the initial *wh*-trace. Georgopoulos (1985) and Rackowski and Richards (2005) extend essentially the same account to Palauan and Tagalog, arguing that the same condition as in Chamorro WH-agreement governs the realis/irrealis alternation in Palauan and the voice-agreement in Tagalog, respectively.

It is clear from the above discussion that WH-agreement in Chamorro and the AV deletion in Indonesian and Javanese share a fundamental structural similarity: both phenomena exhibit the change in the morphology of verbs caused by syntactic movement across them. This indicates that the phase-based analysis of the AV morphology is naturally extended to Chamorro WH-agreement. At the same time,

however, Chung's Case-based analysis is uniquely designed for Chamorro, hence does not seem to be directly transportable to Indonesian/Javanese (recall our discussion at the end of section 3). For example, there is no visible agreement in Indonesian/Javanese between the moved NP and the CP out of which movement has most immediately occurred as in Chamorro (and Palauan and Tagalog, for that matter; see Georgopoulos 1985 and Rackowski and Richards 2005 for data to illustrate this point). Furthermore, Chung (1994) shows that intermediate agreement on CP arguments in Chamorro is sensitive to the referentiality of the moved DP in the sense of Cinque (1990) and argues that referential DPs can undergo non-successive cyclic movement. However, no such correlate is found in long distance extraction in Indonesian or Javanese, and all types of nominal elements, referential or not, cause AV deletion from the verbs that their movement crosses. Therefore, though WH-agreement in Chamorro and AV deletion in Indonesian/Javanese can both be captured as the PF reflex of the Spec-Head Agreement between the moved element and its local *v*, there remains an ineliminable micro-parametric difference between the two languages in terms of the feature checked under this configuration. This micro-parameter yields two distinct derivations in (12) and (13).

(12) Indonesian/Javanese   (13) Chamorro (cf. Chung 1998: 252)
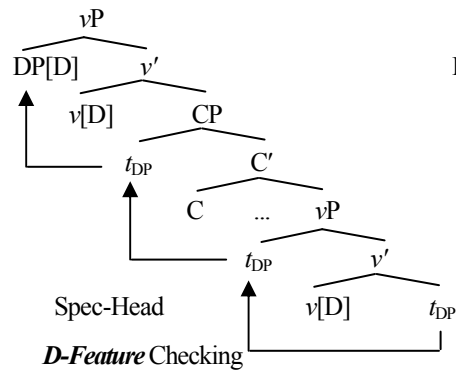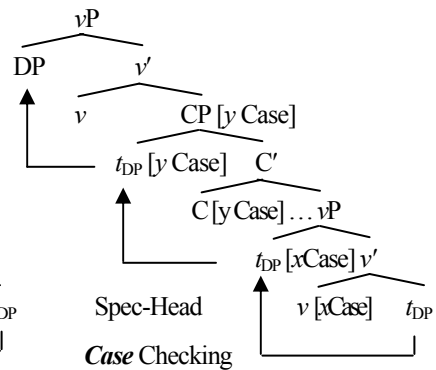
Why do Javanic languages behave differently from other Austronesian languages in this respect? I provide one possible analysis here; see Sato (forthcoming: chapter 2) for details. Travis (in press) recently proposed the idea of "domain-specific parameters" with a case study in Indonesian, whereby a single language can choose different values of a parameter within different structural domains. Adopting this idea, one might be able to show that Indonesian and Javanese select the Austronesian-type parameter within the vP phase domain but select the English-type parameter within the CP phase domain, as shown in (14).

(14)   Domain-Specific Parameters in Javanic Languages

vP-phase domain: Austronesian	CP-phase domain: English
⇨ agreement between the v and the moved NP	⇨ Case Resistance of CP
⇨ residue of the Philippine-type voice system	⇨ SVO word order

Similarities and differences between Indonesian/Javanese and Chamorro/Palauan/Tagalog directly fall out from the present analysis. First, we have seen earlier that, in Indonesian or Javanese, there is no agreement between the v head and its CP argument out of which movement of an NP has taken place as in Chamorro. This property follows if these languages behave like English in that their CPs resist structural Case in Stowell's (1981) sense; see the above-mentioned work for evidence that CP needs Case in Chamorro/Palauan/Tagalog. Second, Indonesian and Javanese are different from Chamorro/Palauan/Tagalog in that their basic word order is SVO. This rather unusual property among Austronesian languages is also naturally expected if T in these languages attracts the closest external argument without VP fronting, as in English: see Chung (in press) for arguments for this English-type derivation for the Indonesian SVO order. The present analysis also correctly accounts for similarities between the two types of Austronesian languages. Most importantly, I have demonstrated above that Indonesian and Javanese exhibit the syntax-morphology interaction at the vP phase, as does WH-

agreement in Chamorro. This is exactly what the present analysis predicts because Indonesian/Javanese select the "Austronesian" value for the vP-phase domain. This analysis is also in keeping with Cole and Hermon's (in press) claim that Indonesian exhibits the Philippine-type voice system in an impoverished form, by the alternation of *meN-* and its null counterpart Ø*meN-*.

5. Conclusions

This paper has proposed an analysis of the distribution of the AV morphology in Indonesian and Javanese within the phase-based theory of syntax. I have argued that the obligatory deletion of the AV marker is a PF reflex of the Spec-Head D-feature checking relation between the moved NP and its local *v*. To the extent that this analysis is correct, the current investigation lends support to the notion of vP phase. I have also situated this analysis within the larger context of Austronesian and have shown that similarities and differences between the AV-deletion in these languages and WH-agreement in Chamorro can be derived by a micro-parametric difference in terms of the feature that is checked under the relevant configuration.

Notes

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