

Prosodic Phrasing and the *That-Trace* Effect

We propose here a new PF-account of the *that*-trace effect. Adopting the recent phase-based theory of prosodic mapping and independent principles of prosodic restructuring, we propose that the complementizer *that* cannot form a prosodic phrase on its own for the purposes of prosodic phrasing. We show that this analysis straightforwardly derives the core paradigm surrounding the *that*-trace effect and its well-documented exceptions triggered by focus, adverbs, parentheticals, resumption, and right node raising.

Keywords: prosodic phrasing, phase, restructuring, *that*-trace effect, PF

1. Introduction

Since the advent of the Minimalist Program (Chomsky 1995), various phenomena once treated in exclusively syntactic terms have been subject to reanalysis with special reference to the syntax-phonology interface (An 2007; Bošković 2001, 2011; Kandybowicz 2006, 2009; Richards 2010). This paper investigates further consequences of the general interface approach to the *that*-trace effect (*that-t* effect), which has steadfastly resisted a purely syntactic explanation despite more than three decades of intensive generative research. Our analysis adopts the recent phase-based theory of prosodic mapping laid out in Dobashi (2003), Kahnemuyipour (2004), and Kratzer and Selkirk (2007), coupled with well-defined principles on prosodic restructuring (Kenesei and Vogel 1995; Nespore and Vogel 1986). We propose that the *that-t* effect is due to an ill-formed prosodic representation which violates the PF condition in (1) (see also Bruening 2009 for a similar proposal).

(1) Function words cannot form a prosodic phrase on their own.

(1) has its roots in Truckenbrodt's (1999) *Lexical Category Condition* and Selkirk's (1984, 1995) *Principle of the Categorical Invisibility of Function Words*, both of which state that function words are invisible to the syntax-prosody mapping (see also section 5).

The paper is structured as follows. In section 2, we outline a phase-based theory of default prosodic mapping proposed by Dobashi (2003). In sections 3–5, we demonstrate that (1) not only captures the core observations regarding the *that-t* effect, but also allows for a unified explanation for various mitigating circumstances (e.g., adverbs, parentheticals, resumption, and right node raising) which otherwise appear unrelated. In so doing, we compare our analysis with Kandybowicz's (2009) alternative PF-interface account of the *that-t* effect. Section 6 is the conclusion.

2. A Phase-Based Theory of the Default Prosodic Phrasing

Prosodic structure consists of hierarchically layered prosodic constituents shown in (2) (Selkirk 1978, 1984, 1986; Nespors and Vogel 1986).¹

(2) ()_U
()_I ()_I
()_φ ()_φ ()_φ
(ω ω)_C (ω)_C (ω)_C (ω ω)_C (ω)_C (ω)_C

A growing body of work within Phase Theory (Chomsky 2000) has argued for a minimal theory of the syntax-prosody mapping according to which the Spelled-Out domain of a

phase head (either C or ν) – TP and VP – is marked as a potential prosodic domain. Thus, Kahnemuyipour (2004) argues that nuclear stress falls on the highest constituent within the Spelled-Out domain or SPELLEE (see also Adger 2007, Kratzer and Selkirk 2007, and Sato 2012 for different formulations of the same rule within Phase Theory). Here, we outline Dobashi’s (2003) theory of ϕ -phrasing. When applied to the structure [_{CP} [_{TP} Subj T [_{VP} ν + V_i [_{VP} t_i Obj]]]], the phase-based theory would yield the ϕ -phrasing in (3), a result which has been shown to be empirically wrong (see below).

(3) (C) _{ϕ} (Subj T ν) _{ϕ} (V Obj) _{ϕ}

Dobashi assumes that Spell-Out sends a linearly ordered string to ϕ -formation except for the initial element in the string. The rationale behind this assumption is that the otherwise unsettled order between a pair of ϕ -phrases is defined by the shared element so that it is consistent with each local string. Under this assumption, when Spell-Out applies at the ν P, it yields the ϕ -phrase in (4a), because V escapes the mapping to remain accessible to the next Spell-Out for the purposes of linearization. Similarly, the subject escapes the mapping at the CP, adding another ϕ -phrase shown in (4b). Finally, when the rest of the derivation is Spelled-Out, the final ϕ -phrase shown in (4c) obtains. The resulting ϕ -phrasing corresponds precisely to Nespor and Vogel’s (1986) ϕ -structure, which has been amply supported in the literature on prosodic phonology (Nespor and Vogel 1986).

- (4) a. (Obj) _{ϕ}
 b. (T ν V) _{ϕ} (Obj) _{ϕ}
 c. (C Subj) _{ϕ} (T ν V) _{ϕ} (Obj) _{ϕ}

In this paper, we assume, following Kratzer and Selkirk (2007), that Spell-Out yields only a skeletal prosodic representation (call it a *pf*) for the purposes of prosodic phrasing. In other words, cumulative results of the successive applications of Spell-Out may be subject to further domain-specific adjustments to give rise to the complete phonological form (call it a *PF*) before it is externalized for use at the Articulatory-Perceptual (AP) System. This model of the syntax-phonology interface is schematically illustrated in (5).

(5) Phasal Spell-Out \implies *Pf*'s \implies PF \implies Externalization

In the next section, we show that the *that-t* effect and its well-known “exceptions” receive a unified account under this hybrid model, which combines key insights from Phase Theory and independently motivated post-syntactic prosodic adjustment rules.

3. Prosodic Phrasing and the *That-t* Effect

(6a) illustrates the *that-t* effect. Direct objects and adjuncts behave differently in this regard, as shown in (6b) and (6c), respectively.

- (6) a. Who_i do you think *t*'_i (***that**) *t*_i wrote the book?
 b. What_i do you think *t*'_i (**that**) Bill wrote *t*_i?
 c. When_i do you think *t*'_i (**that**) Bill wrote the book *t*_i?

This subject-non-subject asymmetry has been standardly assumed since the Government-and-Binding (GB) Theory to arise from the Empty Category Principle (ECP) to the effect that all traces must be properly governed. Leaving details aside (see Lasnik and Saito 1984, 1992), object traces and adjunct traces are always properly governed whereas subject traces

are not due to the intervention of the overt complementizer *that*. The ECP-based analysis is not formulable within the minimalist framework, which attempts to dispense with the notion of government. Our PF account correctly predicts the asymmetry in question without relying on government as its central analytical premise. Within our phase-based theory of prosodic mapping, the examples in (6a–c) are assigned the default ϕ -representations shown in (7a–c), respectively.

- (7) a. * Who_i do you think (**that t_i**) $_{\phi}$ (wrote) $_{\phi}$ (the book) $_{\phi}$?
 b. What_i do you think (**that Bill**) $_{\phi}$ (wrote) $_{\phi}$ t_i?
 c. When_i do you think (**that Bill**) $_{\phi}$ (wrote) $_{\phi}$ (the book) $_{\phi}$ t_i?

(7a) is ill-formed because the ϕ -phrase, (that t_i) $_{\phi}$, violates (1). This violation does not occur in (7b–c), where *that* forms a ϕ -phrase in construction with the lexical item *Bill*, which immediately follows it. Our account also correctly predicts that the *that-t* effect remains even when T or Neg heads are overly filled, as shown in (8a, b), because both heads are grouped within the intermediate ϕ -phrase under our current system.

- (8) a. Who_i do you think (**that t_i**) $_{\phi}$ (will/should/might/could write) $_{\phi}$ (a book) $_{\phi}$?
 b. Who_i do you think (**that t_i**) $_{\phi}$ (didn't write) $_{\phi}$ (a book) $_{\phi}$?

There is an important piece of independent evidence showing that the *that-t* effect occurs due to a PF-violation, as in (1), rather than the exclusive result of purely syntactic principles such as the ECP. Merchant (2001) (see also Ross 1969) proposes that sluicing, illustrated in (9), is derived through regular *wh*-movement, followed by TP-ellipsis at PF.

(9) Someone just left. – Guess who; ~~[TP *t_i* just left]~~.

Our present analysis thus predicts that the *that-t* effect should be mitigated once the offending ϕ -phrase in (7a) is removed by PF-ellipsis. This prediction is indeed borne out (Perlmutter 1971; Merchant 2001), as shown by the contrast in (10a, b).

- (10) a. * It's probable that a certain senator will resign, but [DP which senator]_i
[TP it's probable that *t_i* will resign] is still a secret.
- b. It's probable that a certain senator will resign, but [DP which senator]_i
~~[TP it's probable that *t_i* will resign]~~ is still a secret.

(Merchant 2001: 185)

If the *that-t* effect were syntactic in nature, we would wrongly predict no contrast in (10a, b) because an ECP-like violation is a strictly syntactic violation which cannot be repaired. The contrast therefore suggests that the relevant effect is a PF-interface phenomenon. See also Bruening (2009) and Postal (2004) for further evidence from *as*-parentheticals in favor of the observation that the effect in question is not due to subject extraction per se.

4. Prosodic Restructuring and the *That-t* Effect

It is well-known that the *that-t* effect is mitigated under several other contexts than ellipsis. This section shows that these facts receive a simple account under our current analysis.

4.1. *Adverbs, Parenthetical Expressions and Resumption Pronouns*

The best-known case among mitigating environments for the *that-t* effect is the so-called adverb effect (Bresnan 1977; Culicover 1993); the violation is somehow suspended when a sentential adverb is inserted between *that* and the subject trace, as in (11).

(11) Who_i do you think [_{CP} that after years and years of cheating death [_{TP} *t*_i finally died]]?

(Kandybowicz 2006: 222)

The effect is a straightforward consequence of (1). As Sobin (2000: 537) notes, the adverb allows *that* to be prosodically incorporated into the *I*-phrase to its right, as illustrated in (12), a pattern which is clearly indicated by the comma intonation superimposed on the first *I*-phrase.

(12) Who do you think (that after years and years of cheating death)_I (finally died)_I?

The prosodic incorporation of sentential adverbs suggested here is independently supported by coordination. Sobin (2000, 2002) observes that the *that*-adverb sequence can be coordinated, as illustrated in (13).

(13) The lawyer claimed (that on July 4)_I – and (that on July 5)_I – (Bill was in Rhyl)_I.

(Sobin 2002: 538)

One might suspect that this example could be dealt with by saying that the string *Bill was in Rhyl* undergoes right node raising (RNR). Sobin shows that this analysis is incorrect.

RNR may apply to a sentence when the conjoined sequences bear contrastive focus, as shown by the contrast between (14a) and (14b).

- (14) a. The lawyers claimed that on July 4, and Mary testified that on July 5, Bill was in Rhyl.
b. * The lawyers claimed that on July 4, and the lawyers claimed that on July 5, Bill was in Rhyl.

(Sobin 2002: 538)

(14b) shows that the contrast between the two temporal PPs is not sufficient to license the application of RNR. The grammaticality of (13), however, naturally falls out if the level of coordination is at the *I*-phrase which arises through the prosodic incorporation of the C.

Our current analysis makes another important prediction. Sobin (2000) observes that the adverb effect looks just like a parentheticalization in that a *that*-adverb sequence is prosodically set off as if it were not present in the syntactic derivation of the host clause. Our analysis then predicts that the *that-t* effect should also be lessened by parentheticals. As noted by Ackema (2011), Example (15) bears out this prediction.

- (15) Who_i do you think that, **according to the latest rumors**, *t_i* is quitting politics?

(Ackema 2011: 228)

Our native consultants indeed report that this example sounds best with parenthetical intonation, namely, phrase boundaries at the commas, and pitch lowering over the parenthetical phrase marked by a pitch accent on the first syllable of *rumors* and a L-H% rising boundary tone on its second syllable. Note that this observation provides further evidence against syntactic explanations of the *that-t* effect. Parentheticals are known to be

invisible to the syntactic well-formedness of the host structure (Espinal 1991: Haegeman 1988; Potts 2002). For example, *as*-parentheticals do not disrupt the adjacency requirement between a transitive verb and its direct object, as illustrated in (16a). This example is in direct contrast with (16b), which shows that the intervening VP-level adverb *passionately* disrupts the adjacent requirement.

- (16) a. Susan loves, **as we are all aware**, silly books.
 b. *Susan loves **passionately** silly books.

Given the invisibility of *as*-parentheticals to the syntactic derivation of the host clause, a purely syntactic approach to the *that-t* effect would leave it unexplained why the amelioration of the effect could ever be triggered by the parenthetical expression.

Our analysis also predicts that the *that-t* effect should be lessened as long as the offending ϕ -phrase is removed by intrusive material which would go between the C and the subject trace. Kandybowicz (2006, 2009) observes that in Nupe, a Niger-Congo language of West Africa, the relevant violation can be saved by resumption, as illustrated in (17a, b).

- (17) a. * Zě_i Gana gàn [gàná_n t_i du nakàn] o?
 who Gana say C cook meat FOC
 ‘*Who did Gana say that cooked the meat?’
 b. Zě_i Gana gàn [gàná_n u_i du nakàn] o?
 who Gana say C 3SG cook meat FOC
 ‘Who did Gana say that cooked the meat?’

(Kandybowicz 2009: 330, 333)

Turning to English, we indeed find that the resumptive pronoun in the position of the subject gap improves a *that-t* violation (see Swets and Ferreira 2003, Ferreira and Swets 2005, McDaniel and Cowart 1999 and many references cited therein; see also Chomsky 1982 and Sells 1984). This point is verified by (18a, b).²

(18) a. * That's the girl_i that I wonder when t_i met you.

b. ? That's the girl I wonder when **she** met you. (McDaniel and Cowart 1999: B16)

4.2. *Focus Restructuring and the That-t Effect*

Drury (1999) and Kandybowicz (2006) observe that the *that-t* violation is mitigated by contrastive focus stress on the subordinate verb. This observation is illustrated in (19a). Note that, as shown in (19b, c), the stress on any other element than the subordinate verb does not cause any improvement.

(19) a. (?) Who_i do you think that t_i WROTE *Barriers* (as opposed to say, *edited it*)?

b. * Who_i do you THINK that t_i wrote *Barriers* (as opposed to say, *know*)?

c. * Who_i do you think that t_i wrote *Barriers* YESTERDAY (as opposed to say *a year ago*)?

(Kandybowicz 2006: 222, 223)

This effect obtains falls out under our system from an independently motivated prosodic adjustment rule (Kenesei and Vogel 1995; Frascarelli 1997, 2002). Kenesei and Vogel argue that English has the leftward focus restructuring (LFR) in (20) which applies at ϕ -phrases.

(20) Leftward Focus Restructuring Rule: English (Kensei and Vogel 1995: 28)

If some word in a sentence bears focus, place a ϕ -phrase boundary at its right edge, and join the word to the ϕ -phrase on its left.

This rule receives empirical support from the curious effect on the Rhythmic Rule triggered by contrastive focus. Consider (21a, b):

(21) a. It's hard to outcláss Délaware's football team.

b. It's hard to óutclass DÉLAWARE'S football team. (Kensei and Vogel 1995, 19, 22)

The Rhythmic Rule is responsible for familiar stress shifts which avoid the clash of two adjacent primary word stresses. The application of this rule has been standardly assumed to be governed by the ϕ -phrase boundary (Selkirk 1978; Nespór and Vogel 1986). The rule does not apply in (21a) because the verb and its object are contained in two different ϕ -phrases (recall (4c)), as shown in (22a). However, when focus is placed on the first word of the direct object, the Rhythmic rule may occur, as shown in (21b). This pattern is correctly captured by the LFR in (20), which states that the left boundary of a ϕ -phrase which contains a focused word is removed so that the word is restructured into another ϕ -phrase to its left. The result of the application of the LFR to (21b) is shown in (22b).

(22) a. (It's hard) $_{\phi}$ (to outcláss) $_{\phi}$ (Délaware's) $_{\phi}$ (football team) $_{\phi}$.

b. (It's hard) $_{\phi}$ (to óutclass DÉLAWARE'S) $_{\phi}$ (football team) $_{\phi}$.

(adopted from Kensei and Vogel 1995: 31, with a slight modification)

Turning now to our original examples in (19a–c), our current analysis assigns to them the partial ϕ -phrase representations shown in (23a–c), respectively.

- (23) a. Who do you think (that WROTE) $_{\phi}$ (*Barriers*) $_{\phi}$?
b.* Who do you THINK (that) $_{\phi}$ (wrote) $_{\phi}$ (*Barriers*) $_{\phi}$?
c.* Who do you think (that) $_{\phi}$ (wrote) $_{\phi}$ (*Barriers* YESTERDAY) $_{\phi}$?

In (23a), *that* forms a ϕ -phrase with the subordinate verb thanks to the LFR, thereby evading the violation of the condition in (1). The foci on the matrix verb or the adverb do not change the phrasing to avoid this violation. Hence, (23b, c) are both ungrammatical.

Our analysis coupled with the LFR leads us to predict further that the *that-t* effect should also be mitigated in any other syntactic environments where focus is necessarily involved so that it creates a derived prosodic structure for *that* to evade the violation of (1). This prediction is borne out by the absence of such effect in focalization and RNR. Firstly, the *that-t* effect is known to be ameliorated by embedded focalization, as shown in (24).

- (24) Robin met the man who_i Leslie said (that to KIM t_i) $_{\phi}$ (had given) $_{\phi}$ (the money) $_{\phi}$.

(Culicover 1993: 98)

This observation receives the same account as that we offered for (19a); the focused PP is prosodically integrated into the same ϕ -phrase that contains *that*. Secondly, the elements which undergo RNR are obligatorily parsed as separate *I*-phrases; *I*-boundaries occur, on one hand, between the first and second conjuncts, and, on the other hand, between the second conjunct and the target of RNR, as shown in the *I*-phrasing in (25).

(25) (John could have planned)_I (and Mary could have hosted)_I (a huge party)_I.

As we saw in section 4.1, the expression in the first conjunct which immediately precedes the target of the RNR and its correspondent in the second conjunct must bear contrastive focus. Given this observation, we predict that the *that-t* effect should once again be suppressed when the C occurs at the right edge of the second *I*-phrase as the result of RNR. De Chene (1995, 2000, 2001) observes that the *I*-boundary created by RNR indeed ameliorates the *that-t* violation. Example (26) illustrates this amelioration.

(26) That's the guy_i ((Jim's)_φ (been)_φ (wondering **if**)_φ)_I (and (Tom's)_φ (been)_φ (saying **that**)_φ)_I ((really)_φ (likes)_φ (Sue)_φ)_I.

(adopted from De Chene 2000: 4, with prosodic phrasing added)

Here, the two Cs stand in contrastive focus relation. Given the LFR, this means that the second C is prosodically restructured into the *φ*-phrase which contains the verb *saying*.

4.3. Auxiliary Reduction and the That-t Effect

Kandybowicz (2006) points out that for many speakers, auxiliary reduction across the subject trace voids a *that-t* violation, as shown in (27).

(27) (?) Who do you suppose **that'll** leave early? (Kandybowicz 2006: 222)

This pattern also falls out from our system given the independently documented prosodic characteristics of reduced auxiliaries, namely, that they are morphosyntactically proclitic,

but phonologically enclitic. On one hand, an auxiliary cannot undergo reduction when it is immediately followed by a gap created by transformations or deletion (Bresnan 1971; King 1970; Lakoff 1970). (28a, b) illustrate this blocking effect.

- (28) a. I am wondering where_i {Mary is → *Mary's t_i}. (*wh*-movement)
 b. Zechy is taller than {Leslie is → * Leslie's Ø} (comparative deletion)

Bresnan argues that this blocking effect is accounted for if contracted auxiliaries are proclitic. On the other hand, Lakoff (1972) and Wood (1979) argue, on the basis of voicing assimilation, that phonologically, reduced auxiliaries behave as enclitic. Example (29) shows that the reduced auxiliary *-s* assimilates in voicing to the preceding, not the following, segment, just as the phonologically equivalent suffix *-s* does in the possessive and plural contexts.

(29)	reduced auxiliary	possessive	plural
[s]	Jack's boring.	Jack's book	The jacks bounced.
[z]	Ted's tall.	Ted's teacher	The Feds tried.
[ɪz]	Liz's tall.	Liz's teacher	The fezzes turned yellow.

(Lakoff 1972: 81)

We analyze (27) as follows. The reduced auxiliary first forms a ϕ -phrase with the verb they precede due to their morphosyntactically proclitic nature, as shown in (30a). Subsequently, the auxiliary's enclitic nature requires that the auxiliary-verb sequence attach to the

preceding C, as shown in (30b). Consequently, the C ends up in the same ϕ -phrase with the auxiliary-verb sequence, yielding the amelioration pattern, as desired.

- (30) a. (that) $_{\phi}$ ('ll-leave) $_{\phi}$ (procliticization of the reduced auxiliary to *leave*)
b. (that'll-leave) $_{\phi}$ (encliticization of the reduced auxiliary-verb sequence to C)

4.4. Section Summary

It is clear from the above that all the apparently disparate “exceptions” to the *that-t* effect can receive a unified explanation under our system as the result of some independently motivated prosodic readjustments applied to the phase-based default prosodic phrasing template, which happen to evade the violation of the interface condition in (1). Adverbs/parentheticals/resumptive pronouns work to prosodically incorporate the C into a newly created *I*-phrase to its right. Contrastive focus and RNR create a prosodic configuration where the C can form a ϕ -phrase with other lexical material due to the LFR. Finally, auxiliary reduction forces the prosodic integration of the contracted auxiliaries into the same ϕ -phrase with the C due to their enclitic character. In other words, the various environments discussed here are not “exceptions” to the *that-t* effect, as they might be so deemed in the exclusively syntactic approach which has dominated the field over the last 30 years or so within generative grammar. The fact that such a diverse range of circumstances to alleviate the *that-t* effect receives a simple, unified explanation under our system speaks strongly in favor of our interface-oriented approach to the phenomenon.

5. Kandybowicz' (2006, 2009) Anti-Adjacency Analysis of the *That-t* Effect

Kandybowicz (2006, 2009) pursues a PF-account of the *that-t* effect as an anti-adjacent requirement imposed at the syntax-phonology interface.³ His proposed filter is defined in (31):

(31) PF Anti-Adjacency Filter on Cs and Traces (Kandybowicz 2006: 223)

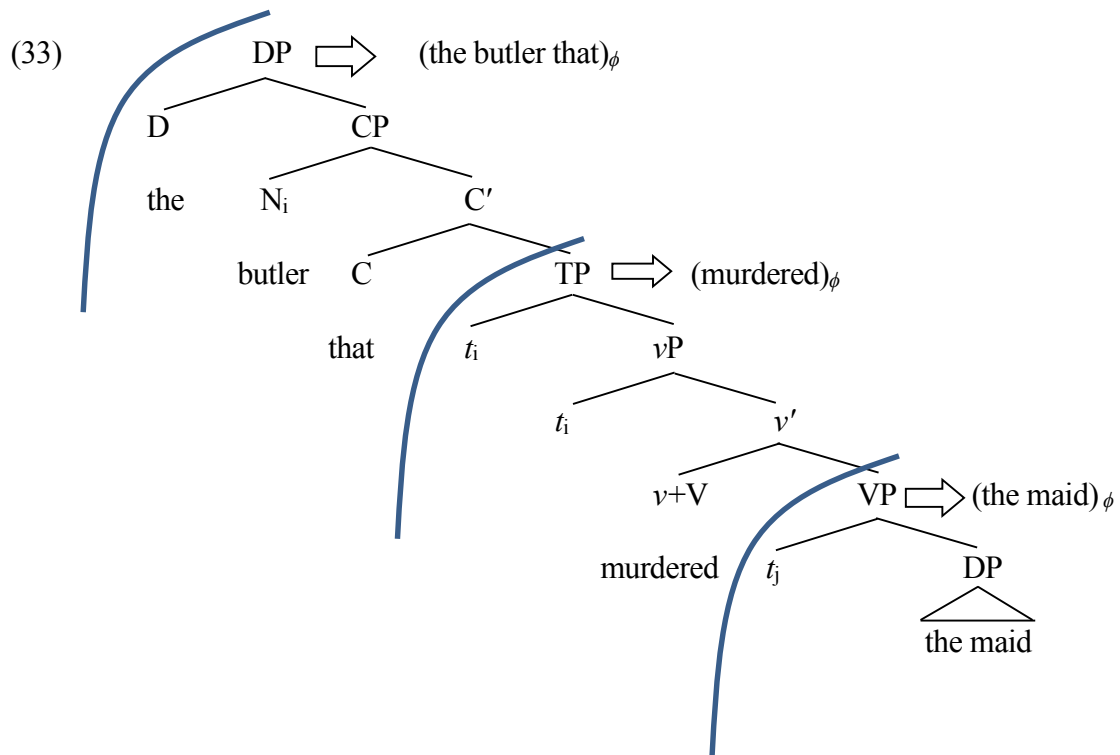
* $\langle C^0, t \rangle$ iff:

- i. C^0 & t are adjacent within a prosodic phrase AND
- ii. C^0 is aligned with a prosodic phrase boundary.

This constraint accounts for the facts discussed in section 4. Firstly, (6a) is out because that C and trace are adjacent within a single prosodic phrase. Secondly, (11) and (26) are fine because the two items are no longer within a same prosodic phrase due to adverbs and RNR. Thirdly, the *that-t* violation is suppressed in (19a) since focus on the subordinate verb disrupts the C-trace adjacency within the same prosodic phrase. Finally, (27) is fine because auxiliary reduction makes the *wh*-trace internal to C so that the two elements do not count as adjacent. The condition in (31ii) is to account for the lack of the *that-t* effect in matrix relativization, illustrated in (32), where the C is not aligned with any prosodic phrase boundary.

(32) [the butler that ____ murdered the maid]_I (Kandybowicz 2006: 220)

Our analysis also correctly predicts this result. Kayne (1994) proposes that the relative head originates from within the relative clause TP and moves into [Spec, CP]. Under this head-raising analysis, the relevant part of the derivation for (32) would be as in (33).



Within Dobashi's (2003) system of syntax-prosody mapping, this derivation yields three ϕ -phrases shown in (33): $((\text{the butler that})_\phi (\text{murdered})_\phi (\text{the maid})_\phi)_I$. This particular phrasing is independently supported by Selkirk's (2005) observation that a substantial pause is not necessary between the head and relative pronoun within a restrictive relative clause as in (34a). This is in direct contrast with a non-restrictive relative clause, as in (34b), which must obligatorily have a comma intonation imposed on the relative clause.

- (34) a. The Romans who arrived before one hundred AD found a land of wooded hills.
b. The Romans, who arrived before one hundred AD, found a land of wooded hills.

(Selkirk 2005: 14, 15)

Below, we present a number of arguments showing that our proposed analysis presents a further refinement of Kandybowicz's filter-based PF-analysis. First of all, as Kandybowicz (2006: 224) himself notes, the filter in (31) is itself "a descriptive generalization" which one ultimately wants to derive from independent principles of the syntax-prosody mapping. Our system developed thus far allows us to achieve precisely that. Let us assume that prosodic phrase boundaries are marked at the juncture between a pair of prosodic words (Nespor and Vogel 1986). Let us also assume Truckenbrodt's (1999) *Lexical Category Condition*, defined in (35) (see also Selkirk's (1984, 1995) *Principle of the Categorical Invisibility of Function Words*), which states that syntax-prosodic mapping can refer to lexical categories, but not to functional categories, including the C *that*. See also Nespor and Scorretti (1985), Nespor and Vogel (1986), and Borsley and Tallerman (1996) for further arguments in favor of the view that empty categories, including traces/copies, do not have any effect on the application of prosodic rules.

(35) Lexical Category Condition (Truckenbrodt 1999: 226)

Constraints relating syntactic and prosodic categories apply to lexical syntactic elements and their projections, but not to functional elements and their projections, or to empty syntactic elements and their projections.

Our condition in (1) directly falls out from these two assumptions; our phase-based prosodic mapping à la Dobashi (2003) yields the default ϕ -phrase (*that t*) $_{\phi}$, but this phrase remains undefined because there is no element in it which is visible to prosodic phrasing. As a result, this ϕ -phrase violates the fundamental well-formedness principle on prosodic mapping (Selkirk 1986) to the effect that all utterances must be exhaustively parsed into a sequence of prosodic categories at each level (see our related discussion in section 2). In this way, our present system provides a deeper explanation for why Kandybowicz’s PF-filter takes the form it does as in (31).

There is also an empirical problem with Kandybowicz’s analysis based on the *whether*-trace construction illustrated in (36a). Sobin (1987) conducts an experiment with a group of 42 undergraduate students, all native speakers of Standard English, at the University of Iowa. The results of his experiment show that *whether-e* constructions structurally identical to that in (36a) “had an average rejection rate of 97.6%.”

(36) a. * Who_i did you ask whether t_i kissed Harriet?

(Sobin 1987: 58, his questionnaire item 26)

b.? Who did you ask whether Bill kissed t_i ?

(Sobin 1987: 58, his questionnaire item 25)

One might think that (36a) is degraded independently due to the *wh*-island constraint, but there are three reasons to suspect that this cannot be the whole story. Firstly, Sobin’s experimental result (p. 58) shows that the rejection rate is critically different between (36a) and (36b); whereas (36a) had only 4.8% passive acceptance rate with 95.2% rejection, (36b) had 35.7% acceptance rate (4.8% for active acceptance and

30.9% for passive acceptance) with 64.3% rejection. Secondly, Bley-Vroman, Felix and Georgett (1988) observe that there are many native speakers who accept *whether*-islands despite the fact that other *wh*-phrases uniformly block similar extraction patterns (see also Chomsky 1981). Finally, there are languages such as Icelandic (Maling 1978: 84; Sobin 1987: 39) which do not prohibit extraction from *wh*-islands in some contexts but nonetheless exhibit the *whether*-trace violation. These considerations thus indicate that (36a) involves the violation of some other constraint in addition to the *wh*-island constraint.

Keeping this observation in mind, let us now consider the prosodic representation of (36a). Ha (2010: 125) points out that *whether* as its inherent lexical property creates a prosodic break left-aligned to it and tends to be separated from the prosodic phrase to its right so that the C itself constitutes an IntP, as shown in (37).

(37) * Who did you ask (**whether**)_I (kissed Harriet)_I ?

In (37), the C and the trace are not adjacent within the same prosodic phrase; recall that the trace is not contained within the first IntP, for Kandybowicz (p. 223) assumes that prosodic phrasing can only occur between two prosodic words (see also Nespor and Vogel 1986 and Schütze 1994) Accordingly, his analysis would predict that there should be no appreciable contrast in grammaticality between (36a) and (36b) because both examples would violate just the *wh*-island constraint, a prediction which is not borne out by Sobin's experimental result reported above. Our current analysis, on the other hand, correctly predicts this pattern because the prosodic representation in (37) is a straightforward violation of our condition in (1).

6. Conclusion

This article has presented an interface-oriented analysis of the *that-t* effect, which we take to be a further refinement of Kandybowicz's (2006, 2009) filter-based analysis. Adopting the recent phase-based model of prosodic mapping (Dobashi 2004; Kratzer and Selkirk 2007) coupled with independently motivated prosodic adjustment rules such as focus restructuring and prosodic incorporation (Kenese and Vogel 1995; Nespor and Vogel 1986; Sobin 2000, 2002), we have demonstrated that the core facts and exceptions regarding the *that-t* effect can be straightforwardly derived if function words cannot form a prosodic phrase on their own. We have further shown that this interface condition, in turn, is derived from certain well-formedness constraints governing the syntax-prosody mapping such as Truckenbrodt's (1999) Lexical Category Condition and Selkirk's (1986) Exhaustive Parsing Condition. We hope that our work serves as a case study proving the fruitfulness of an interface approach to what have long been deemed the exclusive terrain of generative syntactic research.

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¹ U = utterance phrase, I = intonational phrase, ϕ = phonological phrase, C = clitic group, and ω = phonological word.

² As a reviewer points out, subjection resumption/copy spell-out does not always work to save the *that-t* violation. This means that resumption, as well as other prosodic/semantic circumstances which we discuss below, does not have the teleological purpose to save the violation.

-
- (i) a. * Who_i do you think that **he**_i wrote the book?
b. * Who_i do you think that **who**_i wrote the book?

We can only suggest that a certain strategy can save the relevant violation only when it is independently available. For example, it is well known that resumptive pronouns may occur when the distance between the filler and the gap is sufficiently complex or crosses island boundaries (Chomsky 1982; Sells 1984). This observation thus independently excludes the example in (ia). A similar story might hold for the copy-spell-out case shown in (ib), though we leave this issue open for reasons of space.

³ Bošković (2011) presents another PF-based analysis of the *that-t* effect. Assuming that the effect involves a locality violation, he proposes that this violation is marked as * on the C when a subject *wh*-phrase moves to the embedded [Spec, CP] (cf. Merchant 2001). (i) is then ruled out because the * survives into the PF representation.

- (i) Who do you think [_{CP} ~~who~~ **that*** ~~who~~ wrote the book]?

This analysis suffers from many problems, only two of which we mention here for reasons of space. Firstly, as Stepanov (2012: 684) points out, the star-marking involved in this analysis not only violates the Inclusiveness Condition of Chomsky (1995), which prohibits the introduction of features absent in the numeration into the syntactic derivation, but also begs the question what decides the exact position of the marking. Secondly and more importantly, this analysis crucially assumes, in line with the vast majority of the generative work on the topic thus far (see section 2), that the *that-t* effect involves some violation internal to the syntactic derivation. Accordingly, the analysis

cannot account for many other prosodic circumstances discussed in this paper which we showed to ameliorate the relevant violation.