

A Generalization on the Complementizer-Trace Effect from the Intonational Perspective*

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Abstract

This paper presents a generalization on the *Complementizer-trace* effect from the intonational perspective on the basis of a comparative investigation collecting phonetic data from English and Finnish, in both of which the C-t context is acceptable to some speakers but unacceptable to others, as well as from Italian, Finland-Swedish and Dutch, in which the presence of an overt complementizer is either optional (Ita.), preferable (Fin.-Swe.) or obligatory (Dut.). The generalization on the C-t effect based on the data from English and Finnish is as follows: in the pitch gesture of the speaker who shows the C-t effect, the pitch is reset on the overt complementizer and the final pitch accent occurs within the complementizer clause. This generalization applies to an individual speaker, not to an individual language; the more native speakers of a language it applies to, that language is more likely to show the C-t effect. It is thus argued that the generalization here accounts for why the acceptability of the C-t context differs between languages as well as between the native speakers of a language. The C-t effect is accounted for in terms of the conflict of the pitch level on the element following the overt complementizer, i.e., the pitch should lower but actually rises on it. Based on the comparative study between Italian, Finland-Swedish and Dutch, all of which do not show the C-t effect, the optionality, preference and obligatoriness of an overt complementizer is discussed. It is argued that in the phonological/intonational environment where the pitch is more difficult to lower, the insertion of an overt complementizer is more preferable, and that the inserted complementizer acts as keeping the pitch level and enables the pitch to lower smoothly.

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1. Introduction

The *Complementizer-trace* (C-t) effect illustrates a difference in acceptability between the extraction of a subject and that of other sentential elements from embedded clauses. The extraction, e.g. of a *wh*-object, from an embedded clause is acceptable, regardless of whether the complementizer *that* is present or not; see (1a-b). On the contrary, the extraction of a *wh*-subject from an embedded clause is not acceptable when the complementizer *that* overtly appears as illustrated in (2a), but it is acceptable when the complementizer does not appear as illustrated in (2b).

- (1) a. What do you think [that John built ___]?
 b. What do you think [Ø John built ___]?
- (2) a. *Who do you think [that ___ built the house]?
 b. Who do you think [Ø ___ built the house]?

In the tradition of generative syntax, the unacceptability of the extraction of a *wh*-subject from an embedded clause has long been attributed to a syntactic ill-formedness. The C-t effect has been accounted for in terms of movement of a *wh*-phrase across a complementizer. A *wh*-object can cross the overt complementizer *that* as in (1a), whereas a *wh*-subject cannot cross the overt complementizer as in (2a). In Chomsky (1981, 1986), the C-t effect was provided a representational account: *wh*-subject movement occurs in the same way as *wh*-object movement; the trace of a *wh*-subject is illicit due to the violation of the *Empty Category Principle* (ECP). Since Chomsky (1995), the C-t effect has been provided various derivational accounts. Chomsky (2015) attempts to provide an account for why the ECP can be violated when the complementizer is deleted. That is, C, a *phase* head (Chomsky 2008), has functional features such as ϕ -features, and they are all inherited by T in the course of a derivation (Richards 2007, Chomsky 2008). When C is deleted, the embedded CP phase boundary disappears, which enables a *wh*-subject to be involved in further syntactic operations.¹

It has been assumed since Chomsky (2001) that narrow syntax is uniform for all languages with surface difference confined to phonology. If the C-t effect arose from a syntactic ill-formedness, the C-t construction should be unacceptable for any speaker of any language, contrary to what has been reported in the literature.² Thus, experimental investigation on

¹ There has been so much literature on the C-t effect that I do not review them here. See, e.g. Bošković (2011) for an account of (the avoidance of) the C-t effect in terms of the affixation of a null complementizer to a matrix verb. See Pesetsky (2017) for a good summary of the theoretical accounts for the C-t effect in the history of Chomskyan generative syntax, and the references therein.

² See Kandybowicz (2006) for the references therein.

phonological/intonational factors will reveal detailed intonational properties of the constructions relevant to the C-t effect and provide an account for the ungrammaticality of the C-t effect. However, a long tradition exists in experimental phonetics that one should describe the intonation of a sentence as precisely as possible, where a ‘sentence’ means a ‘grammatical sentence’ (cf. Ladd 2008). If the ungrammaticality of an alleged syntactic phenomenon comes from phonological/intonational factors, it is necessary to make phonetic analysis of ungrammatical sentences and provide an account for their ungrammaticality based on phonetic data.

In this paper, I discuss the C-t effect based on an intonational data. This paper is organized as follows. Section 2 reviews Kandybowicz (2006), a previous phonological approach to the C-t effect. Section 3 introduces phonetic data of the constructions relevant to the C-t effect from English and Finnish, both of which show the C-t effect. In section 4, I propose a generalization on the C-t effect: in the pitch gesture of the speaker who shows the C-t effect, the pitch is reset on the overt complementizer and the final pitch accent occurs within the complementizer clause. I claim that the C-t effect arises from the conflict of the pitch level on the element following the overt complementizer, i.e., the pitch should lower but actually rises on it. Section 5 presents phonetic data of the constructions relevant to the C-t effect from the languages which do not show the C-t effect, i.e. Italian, Swedish and Dutch, and discusses the optionality, preference and obligatoriness of an overt complementizer. Section 6 concludes this paper.

2. Previous phonological approach to the C-t effect

Kandybowicz (2006) claims that the C-t effect is a phonological phenomenon, and that phonological properties are so different between languages that the C-t effect will not be given a unified account. His claim is based on data from English and Nupe, both of which show the C-t effect:

(3) a. *Who do you think [that __ built the house]?

b. *Zèè u: bè [ke __ du nakàn] na o? [Nupe]
 who 3rd-SG seem that cook meat na o
 ‘*Who does it seem cooked the meat?’

The English complementizer is aligned at the left edge of the intermediate phrase composed of *that*-clausal elements, i.e. ...][_{intP} that ... (cf. Chomsky and Halle 1968). According to Kandybowicz, the C-t effect in English occurs when the following two conditions are satisfied: i) the overt complementizer and a trace are adjacent within the same prosodic phrase composed

of *that*-clausal elements; and ii) the overt complementizer is at the edge of the prosodic phrase.

On the contrary, the Nupe complementizer is aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... ke][_{intP} To determine that an overt complementizer is at the right edge of an intermediate phrase, Kandybowicz (2006) proposes the following criteria: i) an intonational break occurs after the complementizer; ii) the overt complementizer is lengthened; iii) the pitch is reset after the overt complementizer; and iv) phonological processes that should regularly occur are prevented. Then, the overt complementizer and a trace are not adjacent within the same prosodic phrase (composed of *that*-clausal elements), but the C-t effect still arises. On the assumption that the complement of the complementizer, TP, composes an intonation phrase, the C-t effect in Nupe is accounted for in terms of the violation of the condition that the edge of the intonation phrase, either [Spec,TP] or T, must be phonetically realized.

Kandybowicz's claims, however, can be criticized on both theoretical and empirical grounds. First, as long as one takes a phonological/intonational approach, one should not care about a trace. To be sure, the trace contributes to a semantic interpretation, e.g. in reconstruction, etc. But the trace does not have a phonetic form; it should not contribute to any prosodic phrasing to begin with. The approach is somewhat eclectic between syntactic theory and phonological theory; thus, a deeper conclusion cannot be drawn in his theory.

Secondly, contrary to his claim, it is not so important whether an overt complementizer is aligned at the left edge of the intermediate phrase composed of *that*-clausal elements as in English or at the right edge of the intermediate phrase composed of main-clausal elements as in Nupe. As we will see below, the prosodic phrasing of an overt complementizer differs between languages and even between the speakers of a language; despite such a great difference in the prosodic phrasing, the speakers who show the C-t effect have an intonational property consistently different from those who do not show the C-t effect.³

3. Intonational Properties of Languages that Show C-t Effect

From this section on, comparative experimental data is presented. Each of the test sentences was made in English and then systematically translated into the languages investigated. The test sentences comprised i) *wh*-object extraction with the complementizer, i.e. *what do you think that Bill wrote?*, ii) *wh*-object extraction without the complementizer, i.e. *what do you think Bill*

³ McFadden and Sundaresan (2018) attempts to provide an account for the C-t effect in terms of prosodic phrasing. Crucially, their prosodic phrasing of the English complementizer, i.e. ... that][_{intP} ... , is wrong. See also Cowart (1997, 2003) for an experimental work on the C-t effect in terms of a native judgments survey, and Ritchart et al. (2016), who conclude based on their perception study that the prosodic approach to the C-t effect is not given any support.

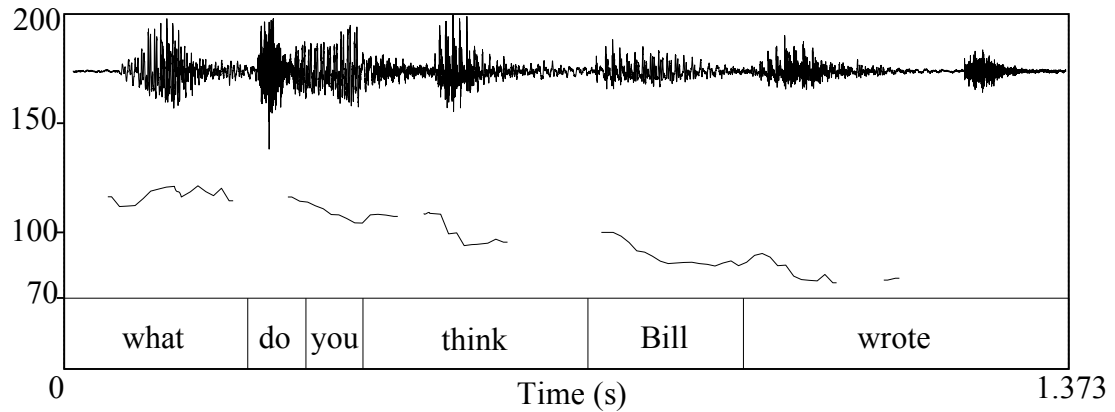
wrote?, iii) *wh*-subject extraction with the complementizer, i.e. *who do you think that wrote the book?*, and iv) *wh*-subject extraction without the complementizer, i.e. *who do you think wrote the book?*.⁴ Some of the informants other than English native speakers corrected minor morphophonological differences such as Case, agreement, the expression of a *wh*-phrase, etc. Before the recording was done, the informants were asked to do native judgments of the test sentences, grading from *OK*, *?*, to ***. They were asked to read out all the test sentences, even if they felt some of them to be odd. They read out each sentence three times in appropriately rapid speech, in such a way as they speak in a real-life conversation. The recordings were made in a quiet small lecture room by the author herself. The voice of the informants was directly recorded into the author's laptop (LENOVO S21e), into which PRAAT speech processing software (Boersma and Weenink 1996) had been downloaded. The traces of fundamental frequency (F0) were computed by the autocorrelation method of PRAAT.

In the previous section, Kandybowicz' (2006) four criteria to determine the prosodic phrasing of an overt complementizer were presented. But as mentioned there, it depends on individual languages whether a complementizer is aligned at the left edge of the intermediate phrase composed of *that*-clausal elements, i.e. ...][_{intP} C ... , or at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... C][_{intP} As we will see in data of various languages, an overt complementizer is not necessarily lengthened; the pitch is not necessarily reset after an overt complementizer, either. We will also see that regular phonological processes do occur, illustrated by the contraction between an overt complementizer and the morpheme that either precedes or follows it. Thus in this paper, I simply decide the prosodic phrasing of an overt complementizer by the presence of an intonational break either before or after the complementizer, whether it is very long in some languages or quite short in others. When an intonational break is present before a complementizer, it is judged as prosodically phrased with its complement and located at the left edge of the intermediate phrase composed of *that*-clausal elements: ...][_{intP} C When an intonational break is present after the complementizer, it is judged as prosodically phrased with a main clause and located at the right edge of the intermediate phrase composed of main-clausal elements: ... C][_{intP} Below, the data on the extraction of a *wh*-object, in which a complementizer and a subject, i.e. a prominent argument, are adjacent to each other, is presented to confirm the prosodic phrasing of the complementizer, and then the data on the extraction of a *wh*-subject is presented.

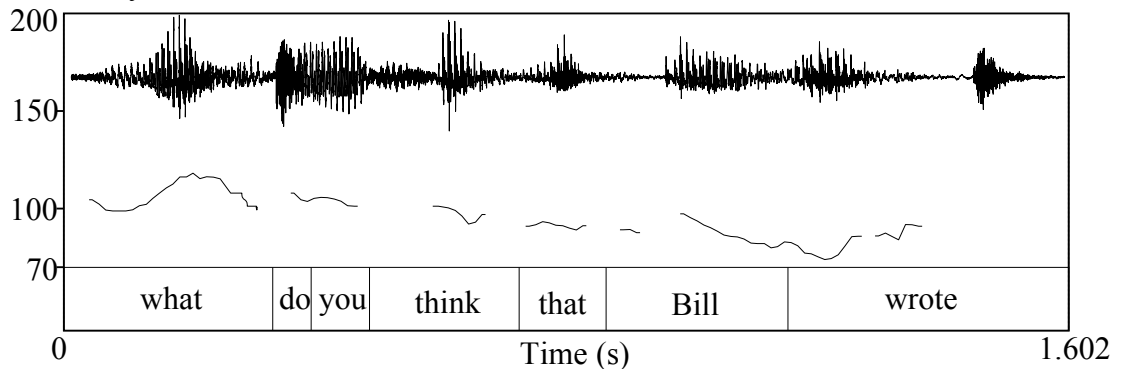
⁴ The test sentences also comprised *wh*-subject extraction with the complementizer and an adverbial phrase following it, i.e. *who do you think that under no circumstances would betray you?*. This construction is claimed to mitigate the C-t effect (Bresnan 1977). The data on this construction was recorded to confirm the pitch gesture of native speakers and is not presented here.

First, the pitch patterns of an English native speaker who does not permit the C-t context (male, born in Essex, the UK) are presented:⁵

(4) a. What do you think Bill wrote?



b. What do you think that Bill wrote?



In the extraction of a *wh*-object, when the complementizer *that* is absent as in (4a), the entire sentence is pronounced as one intonational phrase. The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence.⁶ When the complementizer is overt as in (4b), an intonational break occurs before the overt complementizer *that*. The overt complementizer is aligned at the left edge of the intermediate phrase composed of *that*-clausal elements, i.e. ...]_{intP} *that* ... (Chomsky and Halle 1968, Kandybowicz 2006). The pitch is reset on the complementizer. The final pitch accent occurs within the *that*-clause, here on the subject *Bill*.

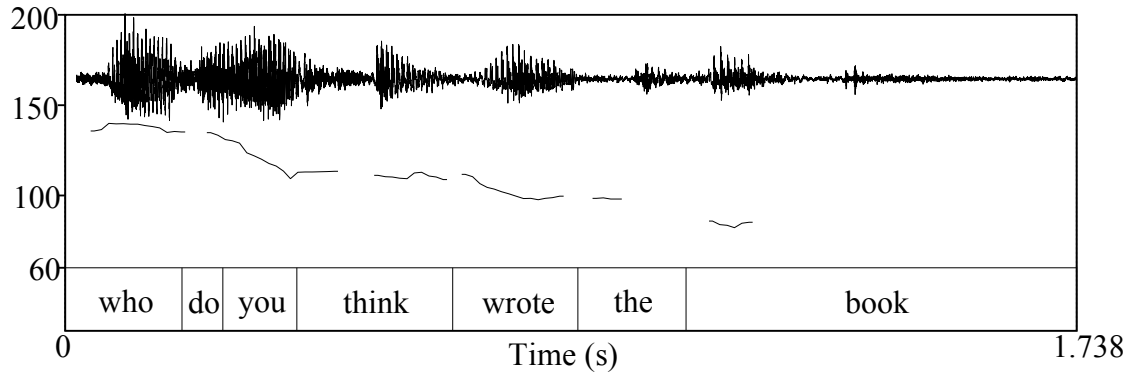
In the extraction of a *wh*-subject, when the complementizer is absent, the entire sentence is pronounced as one intonational phrase as in *wh*-object movement; see (5a). The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the

⁵ For the English intonational system, see Pierrehumbert (1980), Selkirk (1984, 1995), Bolinger (1998), Hirst (1998), Gussenhoven (2004), Ladd (2008) and Féry (2017), among others.

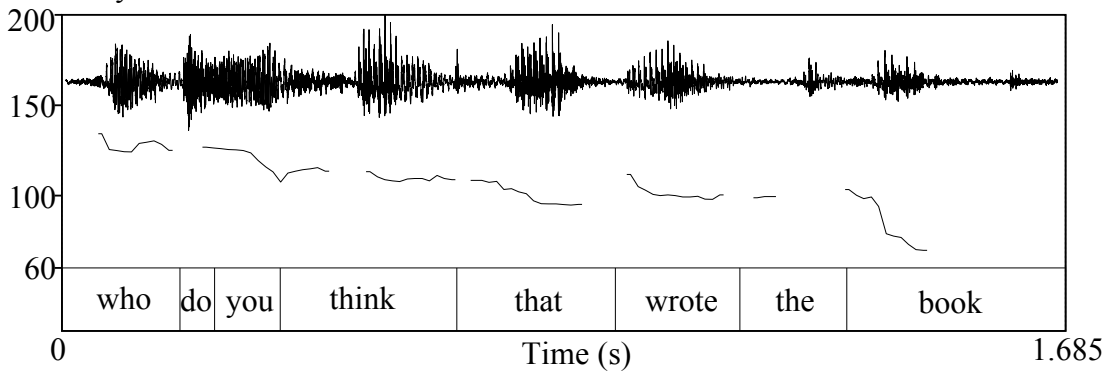
⁶ Cross-linguistically, the pitch falls at the end of a *wh*-question sentence (Bolinger 1978, Gordon 2016).

entire sentence. But when the complementizer is overt as illustrated in (5b), the pitch is reset on the complementizer and the final pitch accent occurs within the *that*-clause, here on the embedded verb *wrote*.

- (5) a. Who do you think wrote the book?

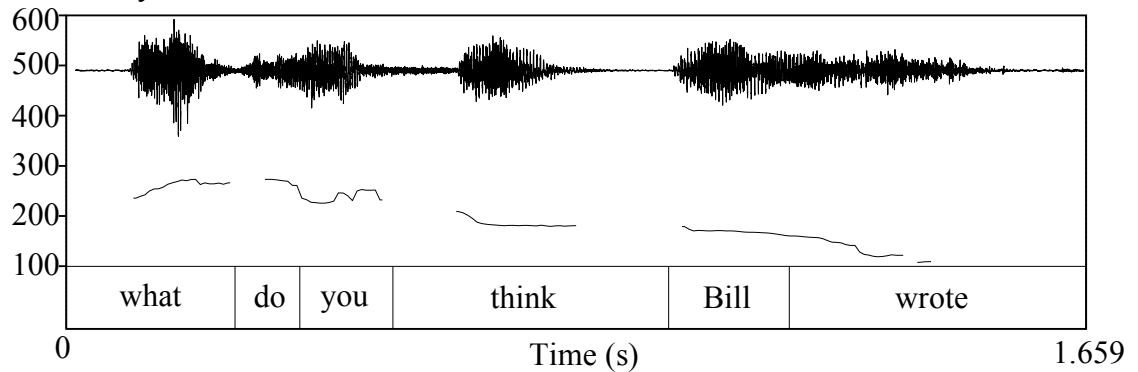


- b. *Who do you think that wrote the book?

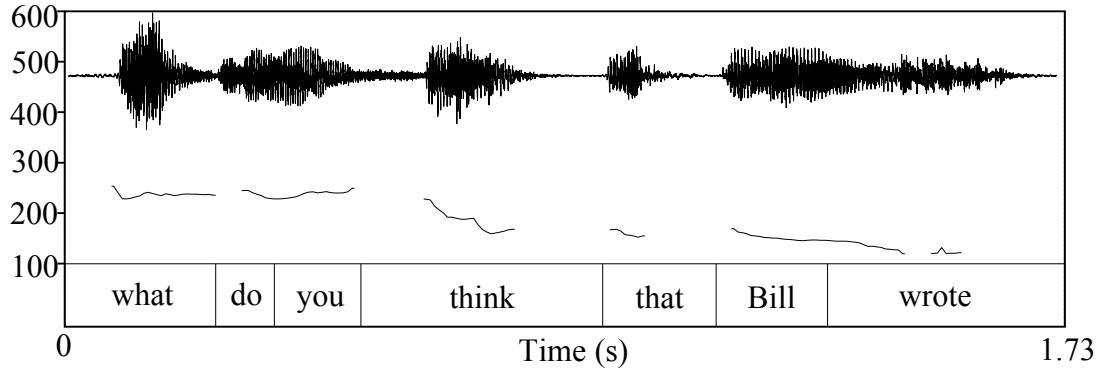


Secondly, the pitch patterns of an English native speaker who permits the C-t context (female, born in New Hampshire, the USA) are presented:

- (6) a. What do you think Bill wrote?



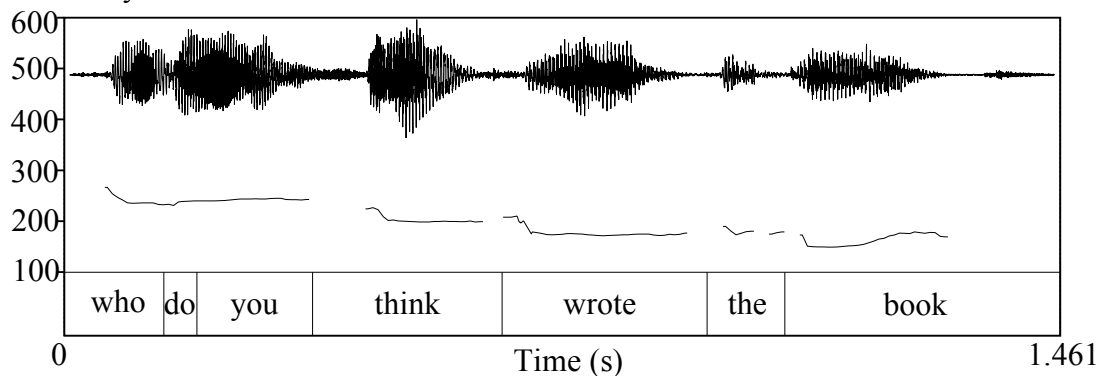
b. What do you think that Bill wrote?



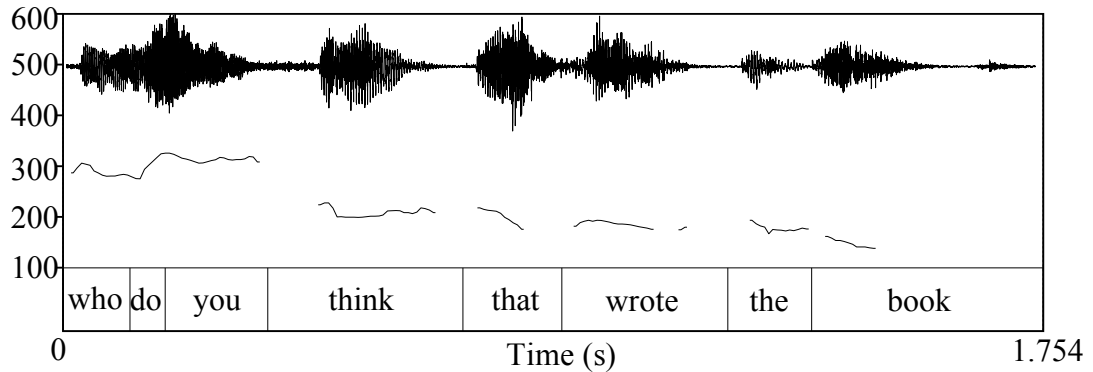
In the extraction of a *wh*-object, when the overt complementizer *that* is absent, the entire sentence is pronounced as one intonational phrase; see (6a). The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence. But contrary to the speaker who does not permit the C-t context, when the complementizer is overt, the pitch is not reset on the complementizer; the pitch continues to lower, as illustrated in (6b).

In the extraction of a *wh*-subject, when the complementizer is absent, the entire sentence is pronounced as one intonational phrase; see (7a). The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence. When the complementizer is overt, the pitch is not reset on the complementizer, contrary to the speaker who does not permit the C-t context; the pitch continues to lower; see (7b).

(7) a. Who do you think wrote the book?



b. ^{OK}Who do you think that wrote the book?



The same tendency is observed in Finnish: some Finnish native speakers show the C-t effect, but others permit the C-t context. In the extraction of a *wh*-object, the complementizer *että* ‘that’ can be either absent (8a) or present (8b). But in the extraction of a *wh*-subject, the absence of the overt complementizer (9a) is more acceptable than its presence (9b) for some speakers, though others accept both patterns.⁷

(8) a. Mitä luulet [Ø Billin kirjoittaneen ___]? [Fin.]
 what you-think Bill wrote
 ‘What do you think Bill wrote?’

b. Mitä luulet [että Bill kirjoitti ___]?
 what you-think [that Bill wrote
 ‘What do you think that Bill wrote?’

(9) a. Kenen luulet [Ø ___ kirjoittaneen kirjan]? [Fin.]
 who you-think wrote the-book
 ‘Who do you think wrote the book?’

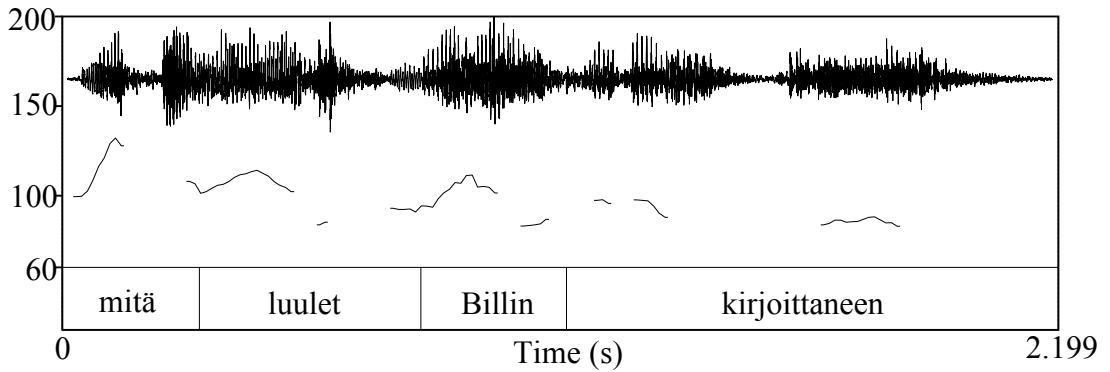
b. ?Ketä sä luulet [että ___ kirjoitti kirjan]?
 who you think that wrote the-book
 ‘Who do you think that wrote the book?’

First, the pitch patterns of a Finnish native speaker who does not permit the C-t context (male, born in Jämijärvi, Finland) are presented:⁸

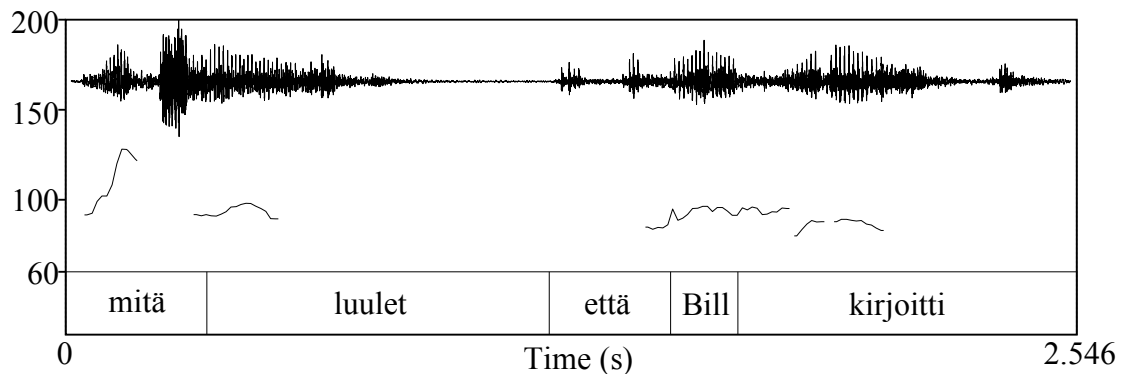
⁷ The form *kirjoittaneen* is past participle, and the form *kirjoitti* is past tense.

⁸ See Iivonen (1998), Suomi et al. (2008) and Nakai et al. (2009) for the Finnish intonational system.

(10) a. Mitä luulet Billin kirjoittaneen? ('what do you think Bill wrote?')



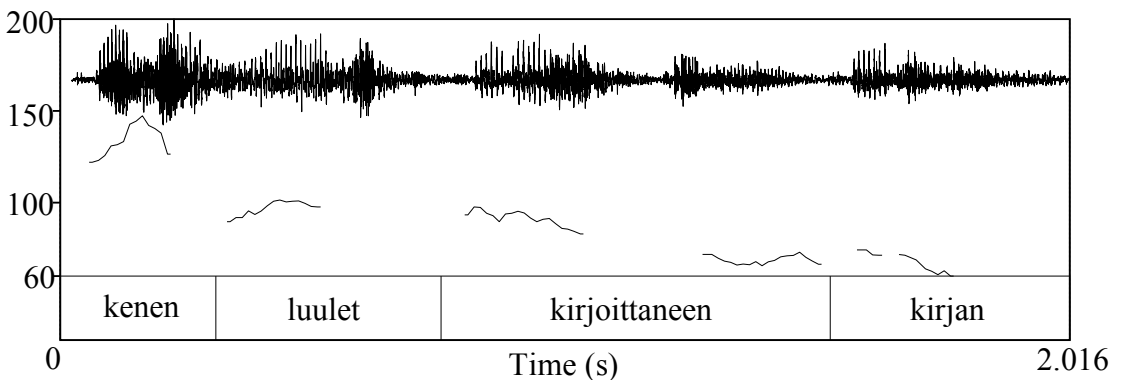
b. Mitä luulet että Bill kirjoitti? ('what do you think that Bill wrote?')



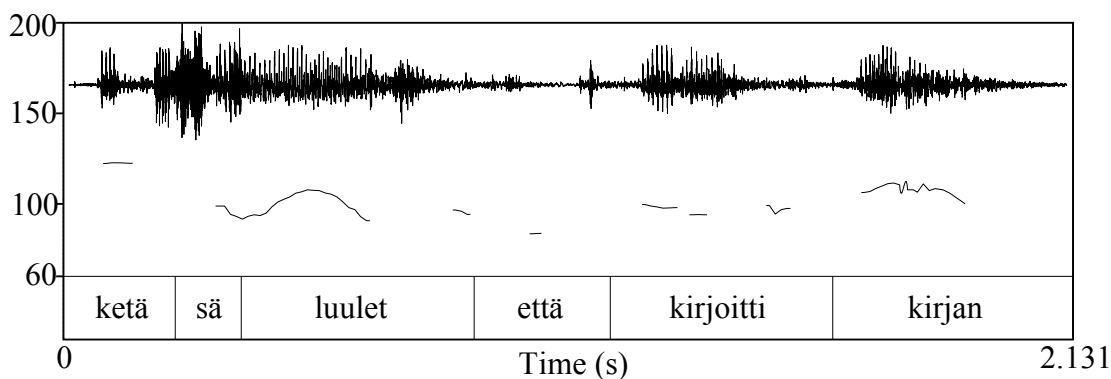
In the extraction of a *wh*-object as illustrated in (10a), when the complementizer *että* 'that' is absent, the entire sentence is pronounced as one intonational phrase. The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence. When the complementizer is overt as illustrated in (10b), an intonational break occurs before the overt complementizer *että*. In the same way as in English, the overt complementizer is aligned at the left edge of the intermediate phrase composed of *että*-clausal elements, i.e. ...][_{intP} *että* The pitch is reset on the complementizer and the final pitch accent occurs within the *että*-clause, here on the subject *Bill*.

The pitch patterns of the construction of *wh*-subject extraction are presented below:

(11) a. Kenen luulet kirjoittaneen kirjan? ('who do you think wrote the book?')



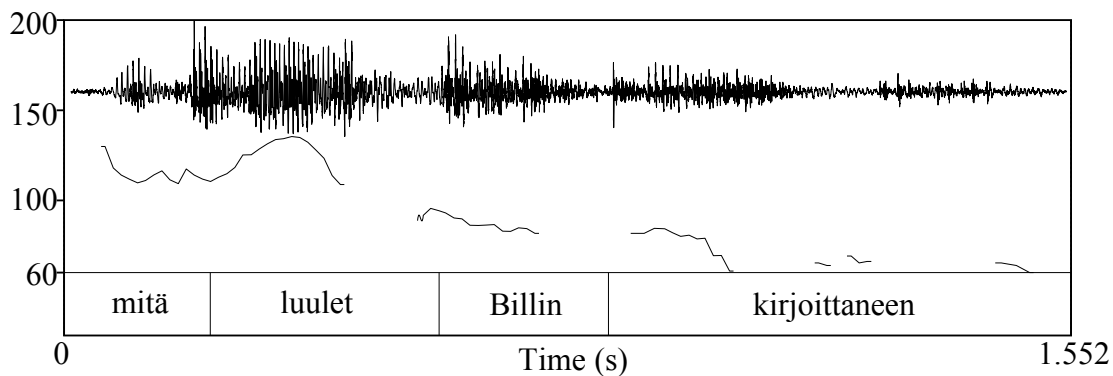
b. ?Ketä sä luulet että kirjoitti kirjan? ('who do you think that wrote the book?')



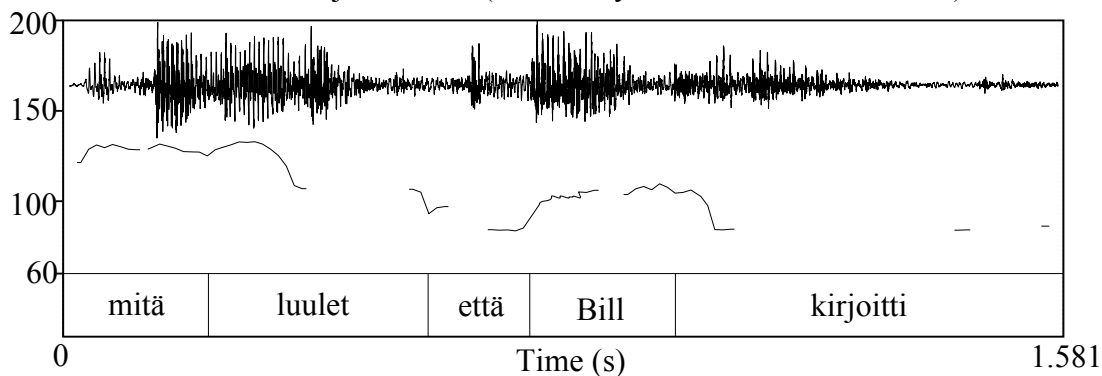
When the complementizer is absent, the entire sentence is pronounced as one intonational phrase as in *wh*-object extraction; see (11a). The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence. But when the complementizer is overt as in (11b), the pitch is reset on the complementizer and the final pitch accent occurs within the *että*-clause, here on the embedded object *kirjan* 'the book'.

Next, the pitch patterns of a Finnish native speaker who permits the C-t context (male, born in Turku, Finland) are presented:

(12) a. Mitä luulet Billin kirjoittaneen? ('what do you think Bill wrote?')



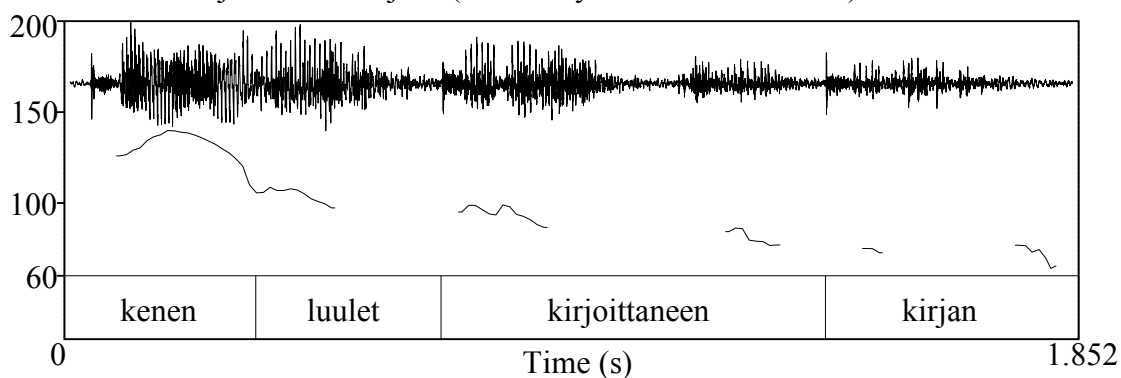
b. Mitä luulet että Billin kirjoittaneen? ('what do you think that Bill wrote?')



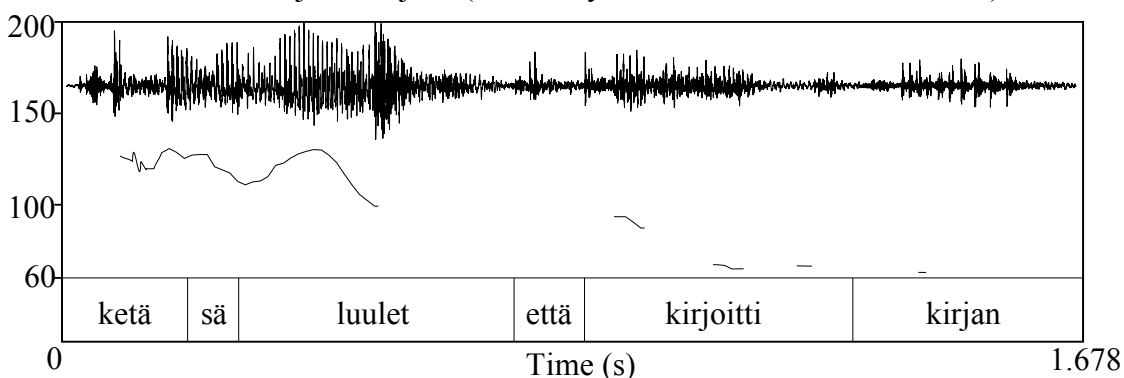
In the extraction of a *wh*-object, when the complementizer *että* ‘that’ is absent, the entire sentence is pronounced as one intonational phrase; see (12a). The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence. But contrary to the native Finnish speaker who does not permit the C-t context, when the complementizer is overt, the pitch is not reset on the complementizer; the pitch continues to lower, as illustrated in (12b). The first vowel *e-* of *että* is combined with the last consonant *-t* of the preceding verb *luulet* ‘you-think’, which produces a word-like unit, *luulet-että* [lu:letetta]. This contraction causes the complementizer *että* to be aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... (luulet-)että][_{intP} ... , with an intonational break present after the complementizer.

In the extraction of a *wh*-subject, when the complementizer is absent, the entire sentence is pronounced as one intonational phrase; see (13a). The pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence. When the complementizer is overt, the pitch is not reset on the complementizer, contrary to the speaker who does not permit the C-t context; the pitch continues to lower; see (13b). Here too, the first vowel *e-* of the complementizer *että* is combined with the last consonant *-t* of the preceding verb *luulet*, which produces a word-like unit, *luulet-että* [lu:letetta] and causes the complementizer *että* to be aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... (luulet-)että][_{intP}

(13) a. Kenen luulet kirjoittaneen kirjan? (‘who do you wrote the book?’)



b. ^{OK}Ketä sä luulet että kirjoitti kirjan? (‘who do you think that wrote the book?’)



4. Generalizing the C-t Effect from an Intonational Perspective

Based on English and Finnish, we have got a general description on the C-t effect. In the pitch gesture of the speaker who shows the C-t effect, the pitch is reset on the overt complementizer and the final pitch accent occurs within the complementizer clause, whereas in the pitch gesture of the speaker who permits the C-t context, the pitch is not reset on the overt complementizer and continues to lower. The generalization on the C-t effect is illustrated as follows:

(14) The C-t effect:

* \hat{C} t^{H*}

The pitch is reset on the complementizer, which is indicated by \wedge above C; the final pitch peak occurs within the complementizer clause, which is indicated by H*. The speaker who shows this pitch gesture does not permit the C-t context.

Note that generalization (14) applies to an individual speaker, not to an individual language. The pitch gesture and the pitch level differ depending on individual speakers. The more native speakers of a language (14) applies to, that language is more likely to show the C-t effect. When (14) applies to most of the speakers of a language, that language is said to show the C-t effect but can contain some exceptional speakers to whom (14) does not apply and who permit the C-t context. When (14) does not apply to most speakers of a language, that language is said not to show the C-t effect but can contain some exceptional speakers to whom (14) applies and who does not permit the C-t context. The generalization here thus provides an account for why the acceptability of the C-t context differs between languages as well as between the native speakers of a language.

From the intonational perspective, the difference in the acceptability of the C-t context is accounted for as follows. In the pitch gesture of the speakers who do not permit the C-t context, the pitch is reset on the overt complementizer and the final pitch accent occurs within the complementizer clause. When the pitch is reset, the pitch rises on the overt complementizer and continues to rise towards the final pitch peak. In the extraction of a *wh*-object as illustrated in (4b) and (10b), a phonologically prominent element, i.e. a subject, is adjacent to the complementizer. The high pitch that occurs on the complementizer continues to rise and the final pitch peak occurs on the subject. But in the extraction of a *wh*-subject, a verbal head is adjacent to the complementizer. The verbal head is not phonologically prominent in the

pitch should lower but actually rises after the (second) overt complementizer.¹¹ It is reported that when the complementizer is reduced/unstressed (16d), and when the complementizer is contracted with the Aux crossing a subject trace (16e), the C-t effect is mitigated. It is expected that the pitch is lower on the reduced/contracted complementizer than on the full form of the complementizer; the pitch level will not conflict on the non-prominent verbal head following the complementizer. When an adverbial phrase is inserted after the complementizer as illustrated in (16f), the C-t effect does not occur. Adverbials are phonologically prominent; the high pitch that occurs on the complementizer continues to rise and the final pitch peak occurs on the following adverbial.¹² The C-t effect does not occur in right node raising (16g), either. The first intermediate phrase starts with *who* and ends with *whether*, and the second one starts with *and* and ends with the complementizer *that*, after which an intonational break occurs. At this point, the high pitch is suspended on the complementizer, and the third intermediate phrase starts with the verbal head *cheated*. The highest pitch peak of the third one should occur on *cheated* since the pitch must lower finally in the entire *wh*-question. Thus, no conflict of the pitch level arises on the verbal head following the complementizer.¹³

Though detailed phonological/intonational properties are not clear,¹⁴ the generalization here is expected to apply to Nupe, which shows the C-t effect: since the pitch is reset after the complementizer as Kandybowicz (2006) states, the pitch is expected to rise after the complementizer. In the same way as in English, the C-t effect is mitigated when a phonologically prominent element follows the complementizer as illustrated in (17a), and also when the complementizer is reduced as illustrated in (17b).

¹¹ Kandybowicz states that in matrix subject relative clauses and clefts, the complementizer must be overt:

- i) the boy [**(that)* bottles fireflies]
- ii) It's my cousin [**(that)* bottles fireflies].

This is purely a matter of English grammar: the overt complementizer cannot be omitted to construct subject relative clauses and cleft sentences.

¹² This is confirmed by my data, which is not presented here. In the following test sentence,

- i) Who do you think [that under no circumstances would betray you]?
- the final pitch peak occurs on the adverbial phrase *under no circumstances*.

¹³ Kandybowicz states that *that*-clausal elements cannot be focused except the verbal head:

- i) ?Who did you say that __ WROTE Barriers yesterday?
- ii) ??/*Who did you say that __ wrote BARRIERS yesterday?
- iii) *Who did you say that __ wrote Barriers YESTERDAY?
- iv) *Who do you THINK that __ wrote Barriers (as opposed to say, know)?

For one thing, a sentence cannot have two foci since one sentence cannot make two assertions (Lambrecht 1994). For the other thing, the pitch rises on a (contrastively) focused phrase. This contradicts the pitch gesture of *wh*-questions in which the pitch falls after the highest peak on a *wh*-phrase and continues to fall. (ii-iv) is ruled out for these reasons. In the pitch gesture of the speakers who do not permit the C-t context, the pitch is reset and rises on the complementizer. When the pitch level on the verbal head that follows the complementizer is high, no conflict of the pitch level arises on that verbal head. Thus, the prominence on the verbal head that directly follows the complementizer is permitted.

¹⁴ See Hyman (2003) for the phonology of the African languages, and also Féry (2017) for an introduction of African lexical tones.

- (17) a. Zèé Musa gàn [gàná́n pányì lèé __ nì enyà] o? [Nupe]
 who Musa say that before PAST beat drum o
 ‘Who did Musa say that a long time ago beat the drum?’
- b. Zèé Musa gàn [’án __ nì enyà] o?
 who Musa say that beat drum o
 ‘Who did Musa say th’t beat the drum?’
- c. [_{intP} Zèé u: bè ke] [_{intP} u: du nakàn na o]?
 who 3rd-sg seem that 3rd-sg cook meat na o
 ‘Who does it seem cooked the meat?’

The pitch rises on the complementizer and continues to rise up to the following element in (17a); the pitch lowers on the reduced complementizer and is low on the following non-prominent verbal head in (17b). Thus, no conflict of the pitch level arises on the element following the complementizer in either of the cases. Recall that the Nupe complementizer is aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... ke][_{intP} Interestingly, it seems that this alignment of the complementizer is strictly obeyed in Nupe, and the pitch is obligatorily reset after the complementizer. Kandybowicz states that regular phonological processes are blocked between the complementizer and the following element. In (17c), to avoid hiatus, glide formation could occur between *ke* ‘that’ and *u:* (person marker), which would result in [kju:]. But due to the strict alignment of the complementizer at the right edge of the intermediate phrase composed of main-clausal elements and the obligatory pitch resetting after the complementizer, glide formation is blocked.¹⁵

Several predictions are made based on generalization (14). First, in a language that has LH as its basic contour, the C-t effect is likely to occur. This case is illustrated by French.¹⁶ The extraction of a *wh*-object across the complementizer *que* is acceptable (18a) but that of a *wh*-subject is not (18b) (Rizzi and Shlonsky 2007).

- (18) a. Qui crois-tu que Paul va aider __ ? [Fre.]
 who believe-you that Paul will help
 ‘Who do you believe that Paul will help?’

¹⁵ Kandybowicz claims that cases such as (17c), in which a function word such as a resumptive pronoun, i.e. *u:* (or a tense marker in other cases) follows the overt complementizer, illustrate the mitigation of the C-t effect. But as stated above, those cases simply illustrate the blocking of glide formation due to the strict alignment of the complementizer and the obligatory pitch resetting, not the mitigation of the C-t effect.

¹⁶ For the French intonational system, see Di Cristo (1998), Jun and Fougeron (2000), Gussenhoven (2004) and Féry (2017). See also Deprez et al. (2013) for an interesting discussion on the prosody of the French *wh*-question.

- b. *Qui crois-tu que __ va gagner?
 who believe-you that will win
 ‘Who do you believe will win?’

In French simple *wh*-questions such as *a qui as-tu prêté ce livre?* (to whom have-you lent this book ‘to whom did you lend this book?’), the highest pitch peak occurs on the sentence-initial *wh*-phrase, and the pitch continues to fall until the end of the entire sentence (Di Cristo 1998, Jun and Fougeron 2000). According to Di Cristo (1998), the pronoun *tu* ‘you’ composes a prosodic unit with the preceding *crois* ‘believe’ as in the context of (18a). Since the rightmost full vowel is assigned a stress in such a prosodic unit, the pronoun is exceptionally stressed, which causes the following overt complementizer to be aligned at the left edge of the intermediate phrase composed of *que*-clausal elements, i.e. ... *crois-tu*][_{intP} *que* It is expected that the pitch is reset on the complementizer and a high contour occurs after the complementizer. When a phonologically prominent element follows the complementizer as in (18a), the pitch gesture does not contradict the pitch movement of the basic LH contour. When a phonologically non-prominent verbal head follows the complementizer as in (18b), the pitch gesture contradicts the LH movement, which makes this sentence unacceptable.¹⁷

Secondly, in a language in which the pitch does not lower in *wh*-questions in the unmarked case, the C-t effect is likely to occur. This case is illustrated by Russian.¹⁸ The extraction of a *wh*-object is barely permitted as in (19a), and the extraction of a *wh*-subject is completely not permitted as in (19b) (Pesetsky 2017).

- (19) a. %Kogoty xočeš', čtoby Maša vstretila __? [Rus.]
 who you want that Maša meet
 ‘Who do you want Masha to meet?’
- b. *Kto ty xočeš', čtoby __ vstretil Mašu?
 who you want that meet Maša
 ‘Who do you want to meet Masha?’

¹⁷ An alternative account for the ungrammaticality of (18b) is that contrary to (18a), in which the complementizer composes a prosodic unit with the following prominent *Paul*, the complementizer cannot make a prosodic unit with any element and is phonologically/intonationally isolated in the sentence. It is reported that when the *que* form is changed to *qui*, the acceptability slightly rises (Rizzi and Shlonsky 2007):

i) %Quelle étudiante crois-tu qui __ va partir? [Fre.]
 which student believe you that will leave
 ‘Which student do you think will leave?’

The *que* form is composed of a consonant only, i.e. [k], whereas *qui* is composed of the consonant and a following vowel, i.e. [ki]. The *qui* form may manage to compose a prosodic unit by itself. I leave this possibility for future study.

¹⁸ See Svetozarova (1998) for the Russian intonational system.

In Russian *wh*-questions, the pitch rises on the initial *wh*-phrase and continues to be high until the end of the sentence, where the pitch finally falls (Svetozarova 1998). In such a language, a complex *wh*-question will be dispreferred: a high pitch cannot last so long. When a phonologically prominent element, the subject *Maša*, follows the complementizer as in (19a), the pitch is not low on the subject and finally falls on the verbal head *vstretila* ‘meet’. Since the pitch gesture does not contradict the continuation of a high pitch, this sentence is barely permitted. When the verbal head immediately follows the complementizer as in (19b), the pitch should be low but actually rises on the non-prominent verbal head. The conflict of the pitch level occurs on that verbal head; this sentence is totally unacceptable.

5. The Optionality, Preference and Obligatoriness of an Overt Complementizer

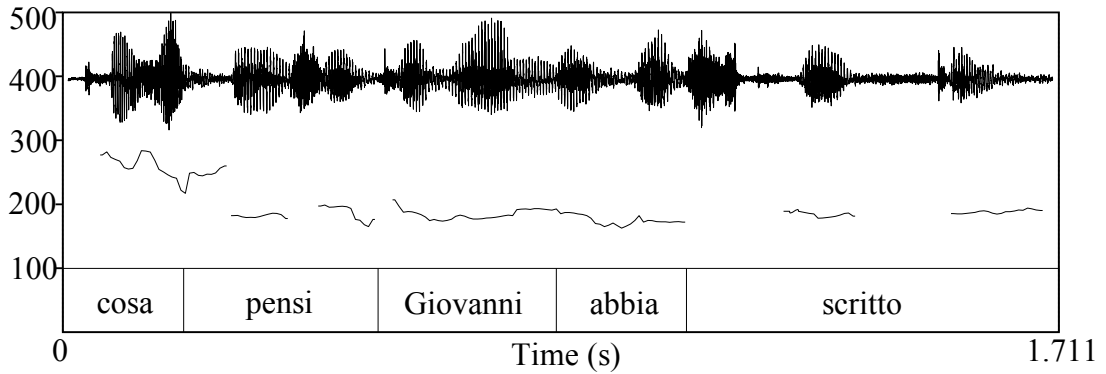
This section presents phonetic data of the constructions relevant to the C-t effect in languages that do not show the C-t effect, and discusses the optionality, preference and obligatoriness of an overt complementizer. In Italian, both the extraction of a *wh*-subject and that of a *wh*-object across an overt complementizer are acceptable (Rizzi 1982). In (20a-b), the *wh*-subject *chi* ‘who’ is extracted; in (21a-b), the *wh*-object *cosa* ‘what’ is extracted. The complementizer *che* ‘that’ can occur optionally in both cases.

- (20) a. Chi pensi [che __ abbia scritto il libro]? [Ita.]
 b. Chi pensi [Ø __ abbia scritto il libro]?
 who you-think that has wirten the book
 ‘Who do you think (that) wrote the book?’
- (21) a. Cosa pensi [che Giovanni abbia scritto __]?
 b. Cosa pensi [Ø Giovanni abbia scritto __]?
 what you-think that Giovanni has written
 ‘What do you think (that) Giovanni wrote?’

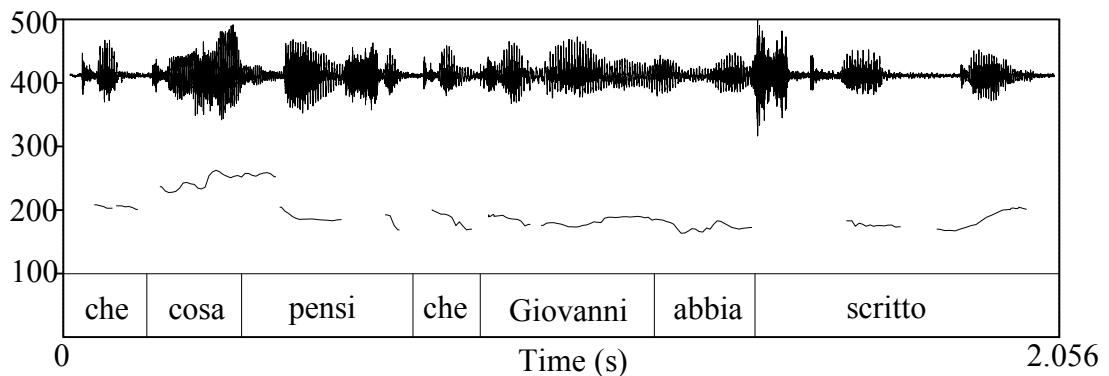
The pitch patterns of an Italian native speaker (female, born in Milan, Italy) are presented below:¹⁹

¹⁹ See Rossi (1998), D’Imperio and Rosenthal (1999) and Grice et al. (2005) for the Italian intonational system.

(22) a. Cosa pensi Giovanni abbia scritto? ('what do you think Giovanni wrote?')



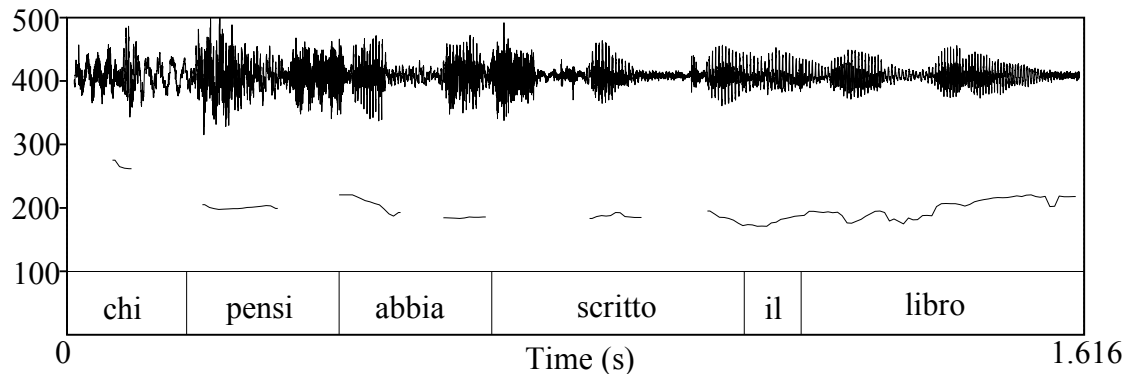
b. Che cosa pensi che Giovanni abbia scritto? ('what do you think that Gio. wrote?')

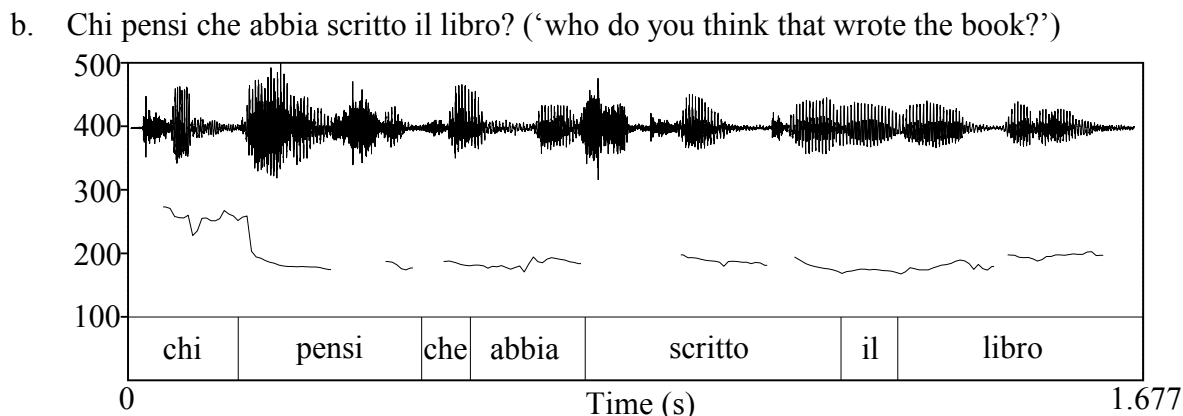


In the extraction of a *wh*-object, the entire sentence is pronounced as one intonational phrase, whether the complementizer *che* 'that' is overt as in (22b) or not as in (22a). The pitch peak occurs on the sentence-initial *wh*-phrase. The pitch is not reset on the complementizer and continues to fall until the end of the entire sentence, but it slightly rises on the final word (cf. Rossi 1998). When the complementizer is overt as in (22b), an intonational break occurs after the overt complementizer *che* 'that'. The overt complementizer is aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... *che*]_{intP}

The pitch patterns of the construction of *wh*-subject extraction are presented below:

(23) a. Chi pensi abbia scritto il libro? ('who do you think wrote the book?')





In the extraction of a *wh*-subject too, the entire sentence is pronounced as one intonational phrase, whether the complementizer is overt as in (23b) or not as in (23a). The pitch peak occurs on the sentence-initial *wh*-phrase. The pitch is not reset on the complementizer and continues to fall until the end of the entire sentence, but it slightly rises on the final word. The overt complementizer *che* [ke] is combined with the first vowel *a-* of the following Aux *abbia* ‘has’, which produces a word-like unit, *che-abbia* [kjabia]; in the context of hiatus, a glide *j* is inserted. This contraction causes the complementizer *che* to be aligned at the left edge of the intermediate phrase composed of *che*-clausal elements, i.e. ..._[intP] *che(-abbia)* ..., with an intonational break present before the complementizer.

In the same way as in the pitch gesture of the English and Finnish native speakers who permit the C-t context, the pitch is not reset on the overt complementizer *che* ‘that’ and continues to fall until when it slightly rises on a final word. The final pitch peak does not occur within a complement clause. The pitch continues to fall through the complementizer to a following sentential element, whether the latter is a prominent nominal (22b) or a non-prominent verbal head/Aux (23b). No conflict of the pitch level arises on the element following the complementizer, and the C-t effect does not arise. Since most of the speakers show this pitch gesture, the presence of the overt complementizer is optional in Italian. The prosodic phrasing of the overt complementizer is also optional, which depends on the phonological condition under which the contraction between the complementizer and the following Aux occurs.

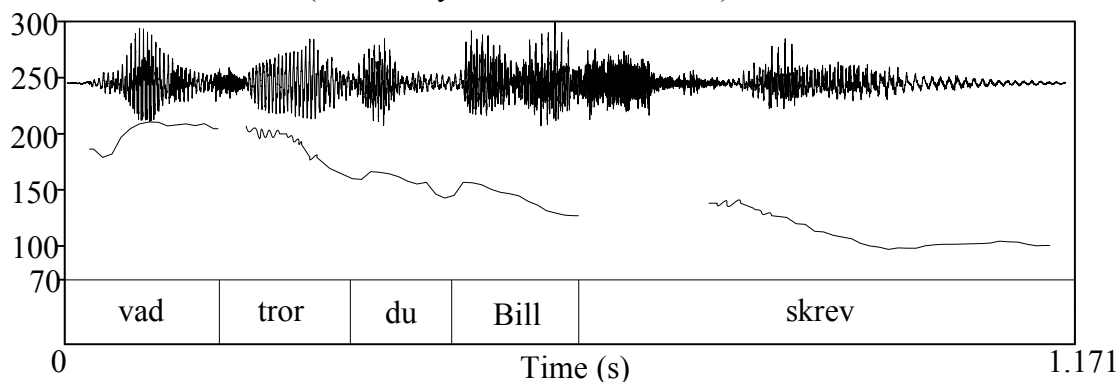
In Finland-Swedish, a variety of Swedish spoken in Finland, both the extraction of a *wh*-subject (24a-b) and that of a *wh*-object (25a-b) across the overt complementizer *att* ‘that’ are acceptable (Holmberg 1986). But the presence of the complementizer as illustrated in (24-25a) is preferred. That is, regardless of whether a phonologically prominent element is adjacent to the complementizer, the presence of the complementizer is preferable in Finland-Swedish.²⁰

²⁰ It should be noted that we here stick to Finland-Swedish. Most of the Swedish varieties spoken in Sweden show the C-t effect. Specifically, (24a) is ungrammatical for the speakers from Sweden.

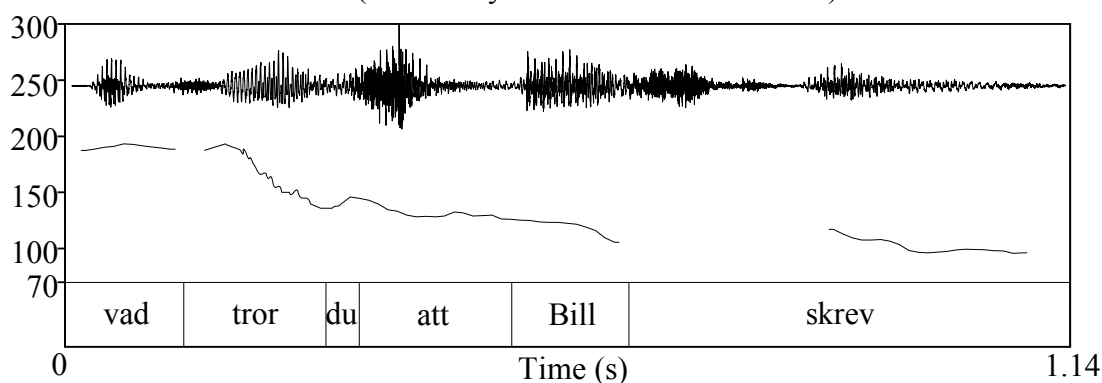
- (24) a. Vem tror du [att __ skrev boken]? [Swe.]
 b. Vem tror du [Ø __ skrev boken]?
 who think you that wrote the-book
 ‘Who do you think (that) wrote the book?’
- (25) a. Vad tror du [att Jon skrev __]?
 b. Vad tror du [Ø Jon skrev __]?
 what think you that Jon wrote
 ‘What do you think (that) Jon wrote?’

The pitch patterns of a Finland-Swedish native speaker (male, born in Turku, Finland) are presented:²¹

- (26) a. Vad tror du Bill skrev? (‘what do you think Bill wrote?’)



- b. Vad tror du att Bill skrev? (‘what do you think that Bill wrote?’)



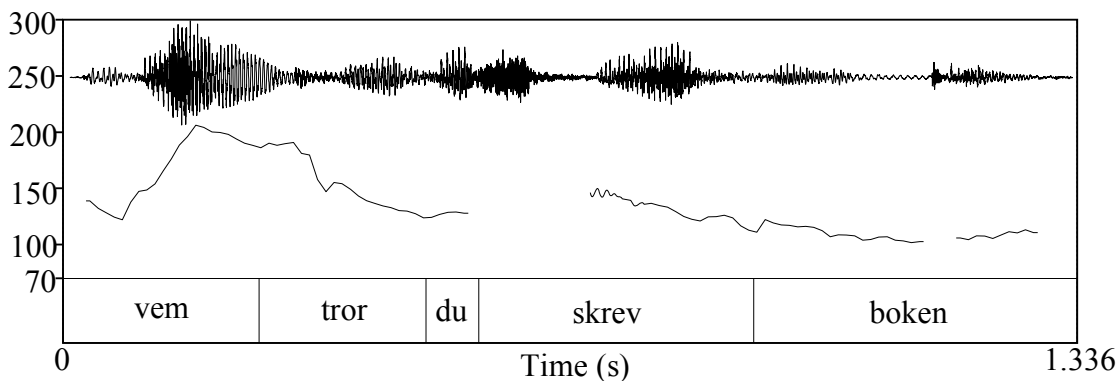
In the extraction of a *wh*-object, the entire sentence is pronounced as one intonational phrase, whether the complementizer *att* ‘that’ is overt as in (26b) or not as in (26a). The pitch peak occurs on the sentence-initial *wh*-phrase. The pitch is not reset on the complementizer and continues to fall until the end of the entire sentence. When the complementizer is overt as in

²¹ See Bruce (1977, 2005, 2007), Gårding (1998), Gussenhoven (2004), Riad (2014) and Féry (2017) for the Swedish intonational system.

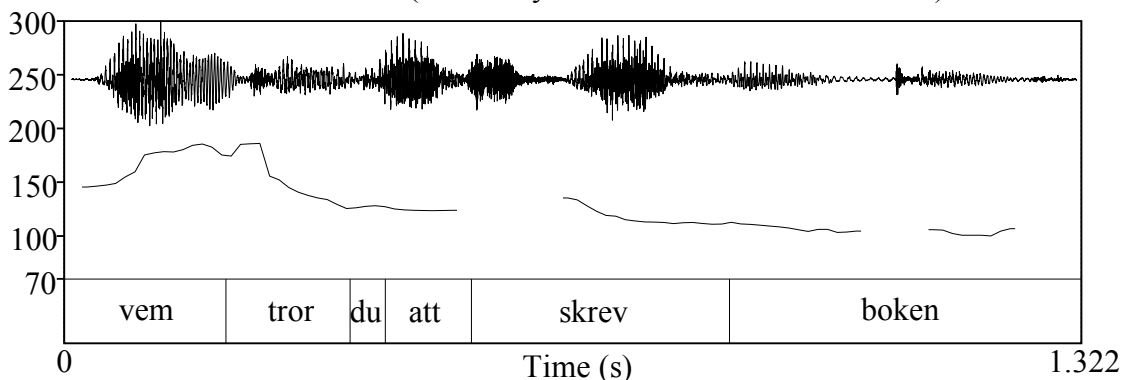
(26b), an intonational break occurs after the overt complementizer *att* ‘that’. The overt complementizer is aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... *att*]_{intP}

In the extraction of a *wh*-subject too, the entire sentence is pronounced as one intonational phrase, whether the complementizer is overt as in (27b) or not as in (27a). The pitch peak occurs on the sentence-initial *wh*-phrase. The pitch is not reset on the complementizer and continues to fall until the end of the entire sentence.

(27) a. *Vem tror du skrev boken?* (‘who do you think wrote the book?’)



b. *Vem tror du att skrev boken?* (‘who do you think that wrote the book?’)



In the same way as in the pitch gesture of those who permit the C-t context, after the pitch peak occurs on the sentence-initial *wh*-phrase, the pitch falls until the end of the entire sentence. In Finland-Swedish, a focus is manifested by a high pitch peak (Bruce 2005, 2007). Since the *wh*-phrases *vad* ‘what’ and *vem* ‘who’ are monosyllabic words, the high pitch that occurs on them continues up to the following verbal head *tror* ‘think’, on which the pitch falls. When the overt complementizer *att* ‘that’ is absent as illustrated in (26-27a), the pitch is still high on the subject *du* ‘you’; the pitch will not easily lower on the element that immediately follows *du*. When the overt complementizer is present as illustrated in (26-27b), it is aligned at the right edge of the intermediate phrase composed of main-clausal elements, i.e. ... *att*]_{intP} The pitch continues to fall until *att* ‘that’, after which an intonational break occurs. The low

pitch on the complementizer is kept on the following element, and the pitch is likely to lower on the latter, which accounts for the preference of the overt complementizer in Finland-Swedish.²²

Dutch obligatorily requires an overt complementizer, whether a *wh*-subject or any other sentential element is extracted (Perlmutter 1971). In (28a-b), the *wh*-subject *wie* ‘who’ is extracted; in (29a-b), the *wh*-object *wat* ‘what’ is extracted. Dutch is an SOV language in that the word order of embedded clauses is SOV: the arguments of a verb as well as adverbials are placed before a main verb in embedded clauses.²³ Regardless of whether a *wh*-subject or a *wh*-object is extracted, a phonologically prominent element is adjacent to the complementizer: in (28a-b), the object *het boek* ‘the book’ is adjacent to the complementizer; in (29a-b), the subject *Bill* is adjacent to the complementizer. Thus, the presence of the complementizer is obligatory in Dutch even when a phonologically prominent element is adjacent to it.

- (28) a. *Wie denk je [dat __ het boek heeft geschreven]?* [Dut.]
 b. **Wie denk je [Ø __ het boek heeft geschreven]?*
 who think you that the book has written
 ‘Who do you think (that) wrote the book?’
- (29) a. *Wat denk je [dat Bill __ heeft geschreven]?*
 b. **Wat denk je [Ø Bill __ heeft geschreven]?*
 what think you that Bill has written
 ‘What do you think that Bill wrote?’

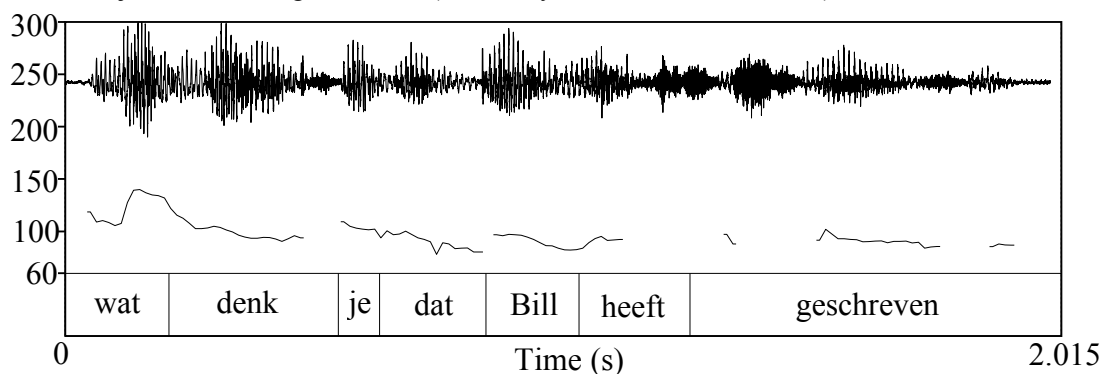
The pitch patterns of a Dutch native speaker (male, born in Amsterdam, The Netherlands) are presented below.²⁴ In the extraction of a *wh*-object as illustrated in (30), the entire sentence is pronounced as one intonational phrase. The pitch peak occurs on the sentence-initial *wh*-phrase. The pitch is not reset on the complementizer and continues to fall until the end of the entire sentence. An intonational break occurs before the complementizer *dat* ‘that’. The overt complementizer is aligned at the left edge of the intermediate phrase composed of *dat*-clausal elements, i.e. ...][_{intP} dat

²² As stated in footnote 20, the Swedish speakers from Sweden do show the C-t effect. The properties of the pitch gesture of the Swedish varieties in Sweden differ from those of Finland-Swedish (Bruce 2005, 2007). I leave a detailed phonetic analysis on the C-t effect in the entire Swedish varieties for future.

²³ In main clauses too, the word order is SOV when a sentence has an Aux: *Subj Aux ... V_{PP-main}*.

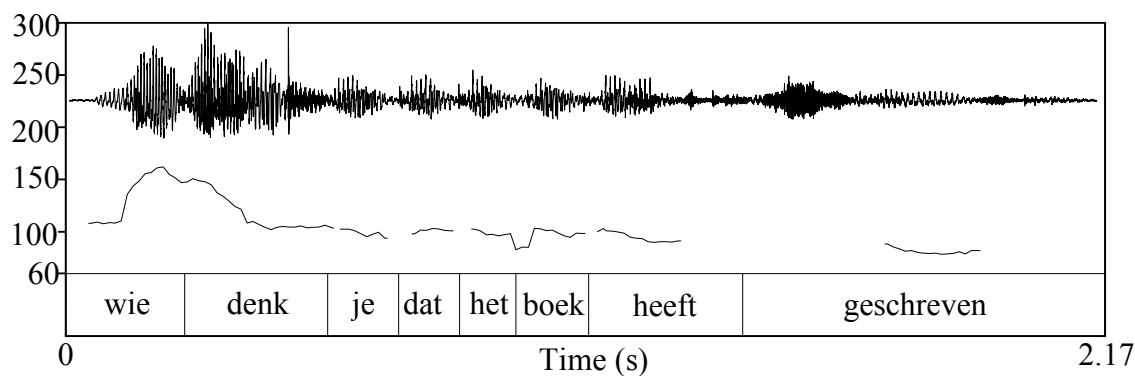
²⁴ See Gussenhoven and Rietveld (1988, 2000), t’ Hart et al. (1990), Sluijter and van Heaven (1995), Grabe et al. (1997), t’ Hart (1998) and Kirsner et al. (1998) for the Dutch intonational system.

(30) Wat denk je dat Bill heeft geschreven? ('what do you think that Bill wrote?')

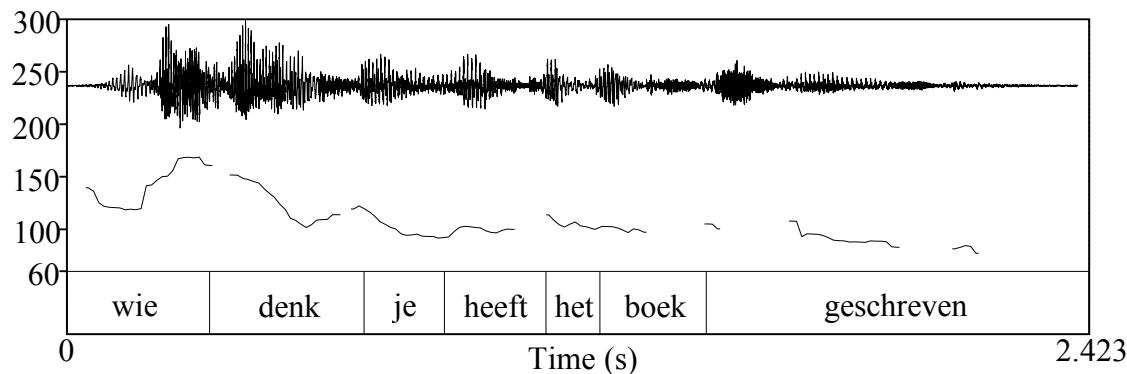


In the extraction of a *wh*-subject too, the entire sentence is pronounced as one intonational phrase. The pitch peak occurs on the sentence-initial *wh*-phrase. The pitch is not reset on the complementizer and continues to fall until the end of the entire sentence; see (31a). The absence of the complementizer is actually acceptable in the extraction of a *wh*-subject. But it is necessary to change the word order by fronting the Aux *heeft* 'has' before the object *het boek* 'the book', which construction is pronounced as one intonational phrase; see (31b).²⁵

(31) a. Wie denk je dat het boek heeft geschreven? ('who do you think that wrote the book?')



b. Wie denk je heeft het boek geschreven? ('who do you think wrote the book?')



²⁵ In my ongoing research, it has turned out that this sentence pattern is acceptable only when *denk je* is interpreted as an inserted phrase, i.e. *Who, do you think, wrote the book?*. I leave a more precise phonetic analysis of this construction for future.

In the same way as in the pitch gesture of the speakers who permit the C-t context, after the pitch peak occurs on the sentence-initial *wh*-phrase, the pitch falls until the end of the entire sentence. In SOV languages such as Dutch, the highest prominence is likely to be assigned to the position right before a main verb (Gundel 1988). Especially, Dutch has the *hat pattern* ('t Hart 1998), in which the pitch rises on a prominent word, and a high pitch continues until when the pitch falls on the last accentable syllable. Thus, the pitch could rise on a prominent element of an embedded clause, whether it is the subject *Bill* (30) or the object *het boek* 'the book' (31a). When the overt complementizer *dat* 'that' is inserted, an intonational break occurs before *dat*. It is aligned at the left edge of the intermediate phrase composed of *dat*-clausal elements, i.e. ...][_{intP} *dat* The pitch is not reset on the complementizer, and the pitch level on it is kept on the following element, which enables the pitch to lower smoothly. Thus, the presence of the overt complementizer is near obligatory in Dutch.

In sum, the optionality, preference and obligatoriness of an overt complementizer depends on different phonological/intonational environments in different languages, though the lowering pitch gesture of *wh*-questions does not differ. In the environment where nothing prevents the pitch from lowering, the insertion of an overt complementizer is optional, as illustrated by Italian. In the environment where the pitch is more difficult to lower, the insertion of an overt complementizer is more preferable as in Swedish and even obligatory as in Dutch. The inserted complementizer acts as keeping the pitch level and enables the pitch to lower smoothly.

6. Conclusion

I have presented a generalization on the C-t effect from the intonational perspective on the basis of a comparative investigation collecting phonetic data from English and Finnish, in both of which the C-t context is acceptable to some speakers but unacceptable to others, as well as from Italian, Swedish and Dutch, in which the presence of an overt complementizer is either optional (Ita.), preferable (Swe.) or obligatory (Dut.). The generalization on the C-t effect based on the data from English and Finnish is that in the pitch gesture of the speaker who shows the C-t effect, the pitch is reset on the overt complementizer and the final pitch accent occurs within the complementizer clause; in the pitch gesture of the speaker who permits the C-t context, the pitch is not reset on the overt complementizer and continues to lower. This generalization applies to an individual speaker, not to an individual language; the more native speakers of a language it applies to, that language is more likely to show the C-t effect. It has thus been argued that the generalization here accounts for why the acceptability of the C-t context differs between languages as well as between the native speakers of a language. The C-t effect has been accounted for from the intonational perspective in terms of the conflict of the pitch level on the

element following the overt complementizer, i.e., the pitch should lower but actually rises on it. Based on the comparative study between Italian, Finland-Swedish and Dutch, all of which do not show the C-t effect, the optionality, preference and obligatoriness of an overt complementizer has been discussed. It has been argued that in the phonological/intonational environment where the pitch is more difficult to lower, the insertion of an overt complementizer is more preferable, and that the inserted complementizer acts as keeping the pitch level and enables the pitch to lower smoothly.

A more interesting generalization on the C-t effect from the intonational perspective is expected to be gained in the future study. According to Pesetsky (2017), Wolof shows the C-t effect. Both Wolof and Nupe are Niger-Congo African. African languages are tone languages and have downstep which is caused by some lowering trigger. It is quite interesting if the C-t effect arises only in Niger-Congo varieties among all African languages. Pesetsky also states that some of the Arabic varieties show the C-t effect. I have collected data from speakers of some Arabic varieties. The data is so complicated that I leave the analysis on the C-t effect in Arabic for future. According to Maling and Zaenen (1978), Icelandic obligatorily needs an overt complementizer. With the facts on Finland-Swedish introduced in this paper taken into account, an interesting micro-parametric difference on the C-t effect between the Scandinavian languages from the intonational perspective will be revealed. Interestingly, Featherston (2005) reports that in German, which is a SOV language in the same way as Dutch, both the extraction of a *wh*-subject and that of a *wh*-object across an overt complementizer are degraded. It is highly expected that when an overt complementizer appears, the pitch is reset on it, which I leave for future study.

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