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The prosody of French *wh*-in-situ questions: Echo vs. non-echo¹

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This study compares the prosodic properties of French *wh*-in-situ echo questions and string-identical information seeking questions in relation to focus. Thirty-six (12×3) *wh*-in-situ questions were embedded in dialogues designed to elicit (A) echo questions expressing auditory failure, (B) information seeking questions with broad focus or (C) information seeking questions with narrow focus on the *wh*-phrase, i.e. a focus structure similar to the one of echo questions. Analyses regarding the F0, duration and intensity of the utterances produced by 20 native speakers of French show clear prosodic differences between the three conditions. Our results indicate that part of the prosodic properties of echo questions can be attributed to the presence of narrow focus (A and C vs. B) while another part is truly characteristic of echo questions themselves (A vs. B and C). In combination with known differences regarding their pragmatics, semantics and syntax, this sets echo questions apart as a separate question type. At the same time, our results offer evidence for prosodic encoding of focus in French *wh*-in-situ questions, confirming and adding to existing claims regarding the prosody of focus marking in French on the one hand and the presence of focus marking in *wh*-interrogatives on the other.

KEYWORDS: echo questions, focus, French, prosody, *wh*-in-situ questions

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1. INTRODUCTION

In French *wh*-questions, the *wh*-phrase can be located in different positions, as illustrated in (1a–b) below. In (1a), the *wh*-phrase is fronted (in combination with pronominal inversion).² In (1b), it is left in-situ, i.e. at the same position as the corresponding element in a declarative, as seen in (1c). The prosodic properties of questions with this *wh*-in-situ strategy form the topic of the current paper.

- (1) (a) Qui Jean a-t-il invité ?
 who Jean has-T-he invited
 ‘Who did Jean invite?’
 (b) Jean a invité qui ?
 Jean has invited who
 ‘Who did Jean invite?’
 (c) Jean a invité Pierre.
 Jean has invited Pierre
 ‘Jean invited Pierre.’

Wh-in-situ questions as in (1b) can be used as regular requests for new information.³ They are not part of the prescriptive grammar, but are frequently attested, often but not exclusively in an informal register (Quillard 2000, Myers 2007). Questions of this form also occur as echo questions, ‘echoing’ the previous utterance. This is exemplified in (2), where part of speaker A’s utterance was not clearly audible, prompting speaker B to ask for a repetition.

- (2) A: Jean a invité #####[noise].
 Jean has invited
 ‘Jean invited #####[noise].’
 B: Jean a invité qui ?
 Jean has invited who
 ‘Jean invited who? (I did not hear you.)’

There has been much discussion in the literature about the prosody of French *wh*-in-situ questions, but no consensus has been reached (see Section 2.2). Moreover, it is unclear whether echo and information seeking questions display different prosodic properties. In this paper, we report on a production experiment designed to thoroughly compare the prosodic properties of the two kinds of *wh*-in-situ question, controlling for focus marking.

[2] *Wh*-fronted questions can take several forms in French, one of which is pronominal inversion; another is insertion of *est-ce que*. For a recent overview of the different possibilities and analyses of the differences between them, see Reinhardt (2019).

[3] Whether or not *wh*-in-situ questions have the same pragmatic properties as *wh*-fronted questions is debated (see, among others, Chang 1997; Mathieu 2002, 2004; Oiry 2011).

The study contributes to the existing literature in several ways. It provides detailed prosodic descriptions of French *wh*-in-situ echo and information seeking questions. It then establishes that prosody clearly distinguishes the two, which is interpreted as an indication that echo questions should be regarded as a separate question type. It further shows that the prosody of French echo questions is congruous with a tentative generalisation we provide based on the existing literature, concerning the prosodic properties of *wh*-in-situ echo questions cross-linguistically. In addition, the study demonstrates that focus is prosodically marked in French *wh*-in-situ questions. It adds to the existing knowledge regarding the prosodic correlates of focus marking in French. What is more, it shows that focus may be marked in *wh*-interrogatives.

The paper is organised as follows. In [Section 2](#) we provide the necessary background information. [Section 3](#) presents the research question and the experimental design of our production experiment, for which we developed the elicitation paradigm SCRIPTED SIMULATED DIALOGUE. Using this paradigm, we manipulated the context preceding a *wh*-in-situ question in order to elicit a particular type of question (echo or information seeking) and a particular focus structure in information seeking questions. [Section 4](#) presents the results of the experiment and [Section 5](#) provides discussion of the findings. [Section 6](#) concludes the paper.

2. BACKGROUND

We commence by providing some background information regarding echo questions as opposed to information seeking questions ([Section 2.1](#)), the prosodic properties of French *wh*-in-situ (echo) questions ([Section 2.2](#)), the prosody of echo questions in other languages ([Section 2.3](#)), the role of focus in *wh*-questions ([Section 2.4](#)) and prosodic focus marking in French ([Section 2.5](#)).

2.1 *Echo questions versus information seeking questions*

Although *wh*-echo and information seeking questions can be string-identical, it is clear from the cross-linguistic literature that they display different properties in several components of the grammar.

From a syntactic point of view, the most obvious property of echo questions is that their *wh*-phrase can be left in-situ in many languages that obligatorily front the *wh*-phrase in information seeking questions, e.g. *John bought what?* (Reis 1992, Artstein 2002). Another syntactic difference is the possibility to replace only part of a constituent by a *wh*-phrase, e.g. *John bought a what?* (Reis 1992, 2012; Artstein 2002; Sobin 2010).⁴

Pragmatically, the use of an echo rather than an information seeking question signals that the speaker of the echo question does not yet accept a previous

[4] For more syntactic properties of echo questions, see for instance Artstein (2002), Sobin (2010) or Poschmann (2015).

discourse move (Ginzburg & Sag 2000, Engdahl 2006, Poschmann 2015, Biezma 2018). If the speaker of the echo question did not understand or perceive part of the previous utterance, s/he is not yet in a position to accept it; if the speaker is surprised by part of the previous utterance or does not believe it, s/he refuses to accept (part of) it for that reason.

Semantically, an information seeking *wh*-question is generally taken to be the set of propositions that constitute possible (true) answers to it, as depicted in (3) (Hamblin 1973, Karttunen 1977). An echo question raises a question regarding the meaning of a previous utterance, e.g. ‘What did you assert just now that John bought?’. Hence, the meaning of an echo question can be analysed as the set of propositions expressing the potential content of the preceding utterance, as in (4) (Ginzburg & Sag 2000, Engdahl 2006, Poschmann 2015, Biezma 2018). (In accordance with standard notation, the denotation of an utterance is placed between $\llbracket \ \rrbracket$ and a set of propositions is indicated by $\{ \ \}$.)

(3) *Information seeking wh-question*

\llbracket What did John buy? $\rrbracket = \{ \text{John bought a book, John bought a house, ...} \}$

(4) *Wh-echo question*

Preceding utterance: John bought #####[noise].

Echo question: John bought what?

\llbracket John bought what? $\rrbracket = \{ \text{the previous speaker said that John bought a book, the previous speaker said that John bought a house, ...} \}$

As echo questions clearly differ from information seeking questions regarding their syntax and their semantico-pragmatic properties, the question rises whether they display different prosodic properties as well.

2.2 *The prosody of French wh-in-situ echo and information seeking questions*

It is unknown whether speakers distinguish echo and information seeking questions by prosodic means in French. Previous research investigating the prosody of information seeking *wh*-in-situ questions has yielded conflicting results. French *wh*-in-situ echo questions have not yet been studied in much detail.

Most of the debate surrounding the prosody of French *wh*-in-situ information seeking questions has centred on the question whether the utterances obligatorily end in a large rise (i.e. a rise with a large pitch excursion), as proposed by Cheng & Rooryck (2000). In contrast, some authors claim that they standardly end in a fall (Di Cristo 1998; Starke 2001: 23; Mathieu 2002, 2016). A third position maintains that a sentence-final rise is possible, but optional rather than mandatory (Wunderli 1978, 1982, 1983; Wunderli & Braselmann 1980, Adli 2004, 2006; Di Cristo 2016). Testing Cheng & Rooryck’s (2000) claim experimentally, Déprez, Syrett & Kawahara (2013) concluded that the majority of speakers uttered information seeking *wh*-in-situ questions with a small final rise, although this result was not replicated by Tual (2017). Reinhardt (2019) shows in two corpus studies that

while French *wh*-in-situ questions have a tendency to display a sentence-final rise, this is not a strict constraint. Her studies settle the debate to some extent, but do not yet explain the observed variation.

Another line of research has focussed on the prosody associated with the *wh*-phrase. According to Baunaz & Patin (2009) and Baunaz (2016), the *wh*-phrase does not bear any accent when a *wh*-in-situ question is uttered out of the blue (see also Wunderli & Braselmann 1980, Wunderli 1982). In contrast, Gryllia, Cheng & Doetjes Gryllia et al. (2016) systematically found an emphatic pitch accent in questions uttered out of the blue as well as a rise at the end of the *wh*-phrase (see also Wunderli 1983, Zubizarreta 1998, Mathieu 2002, Engdahl 2006, Hamlaoui 2011).

So far, no studies have been designed to investigate the prosody of French *wh*-in-situ echo questions. There have been some brief descriptions, some of which describe echo questions as displaying a higher pitch overall (Di Cristo 1998, Boeckx 1999) or a sentence-final rise (Di Cristo 1998, 2016; Boeckx 1999; Mathieu 2002, 2016; Adli 2006; Engdahl 2006; Déprez et al. 2013). Also, echo questions are described as exhibiting a prominent accent on the *wh*-word (Chang 1997: 17; Mathieu 2002; Engdahl 2006). Engdahl (2006) mentions that the *wh*-word may also be lengthened. Déprez et al. (2013) investigated the prosody of echo questions in relation to information seeking questions experimentally, focussing exclusively on the final part of the utterance. This study offers some first evidence suggesting that the final rise in echo questions may be present more consistently and may display a somewhat larger pitch excursion. However, the methodology of the study does not allow for a statistical comparison of the question types, nor for a mapping of the F0 (i.e. pitch) movements to individual syllables.

In summary, it is not clear (i) what the prosodic properties are of *wh*-in-situ information seeking questions and (ii) whether these properties differ from the ones of *wh*-in situ echo questions, and if so, how: a final rise and an accent on the *wh*-phrase have been claimed for both question types.

2.3 *Cross-linguistic comparison*

For some languages other than French, there have been more detailed comparisons between *wh*-in-situ echo questions expressing auditory failure and information seeking questions. Although the reported prosodic properties of echo questions differ cross-linguistically, echo questions seem to be uttered with a distinct prosody in several languages. The following, tentative, generalisation seems to hold within the small sample of languages for which relevant descriptions could be found:

- (A) In languages in which *wh*-in-situ information seeking questions are uttered with a falling intonation, echo questions display a sentence-final rise.
- (B) In languages in which *wh*-in-situ information seeking questions are uttered with a rising intonation, echo questions also display an expanded pitch range.

Brazilian Portuguese (Kato 2013), Farsi (Esposito & Barjam 2007, Sadat-Tehrani 2011) and Manado Malay (Stoel 2007) are examples of pattern (A); pattern (B) is exemplified by North-Central Peninsular Spanish (González & Reglero 2018), Greek (Roussou, Vlachos & Papazachariou 2014) and Shingazidja, a Bantu language spoken on Comoros (Patin 2011). German also follows pattern (B), but the difference between the question types is very small (Repp & Rosin 2015), possibly because information seeking *wh*-in-situ is very restricted in this language. Mandarin Chinese seems to be the only language for which the two question types have been compared, but no distinct prosody for echo questions was consistently found (Hu 2002).

2.4 *Focus in wh-questions*

Focus has not been taken into account in the studies surveyed in the previous section. We will now motivate why we include focus in our study.

For declaratives, it is well-known that there is an interaction between the focus of a sentence and its prosodic properties (see for instance Büring 2016 for a recent overview). Although discussed to a lesser extent, the interaction between context and prosody has also been observed in *wh*-questions (Jacobs 1984, Erteschik-Shir 1986, Jacobs 1991, Lambrecht & Michaelis 1998, Engdahl 2006, Eckardt 2007, Truckenbrodt 2012, Büring 2016). Whereas some languages mark the *wh*-phrase prosodically as the focus of the question, this is not the case in all languages (Ladd 2009: 226–227). In many languages, including English, German and also French, the neutral location for the main accent is not on the *wh*-word and context may affect the prosody of a *wh*-question. In a *wh*-question such as (5), adapted from Erteschik-Shir (1986: 118), who cites Gunter (1966: 172), the accentuation represented in a. rather than the one in b. or c. is the most neutral one, while b. or c. impose specific restrictions on the context. For instance, (5b) might be uttered if the preceding context specifies that John ate the beans, but not at what point in time this happened. Similarly, (5c) could be uttered if the preceding context indicates the time at which John PREPARED the beans, but not when he ate them.

- (5) When did John eat the beans?
 - (a) When did John eat the **beans**?
 - (b) **When** did John eat the beans?
 - (c) When did John **eat** the beans?

The responses of researchers to this type of data fall into two categories. Some authors stress the grammatical character of the *wh*-phrase as the focus of the sentence and attempt to explain the prosodic properties of *wh*-questions without reference to focus (Culicover & Rochemont 1983, Lambrecht & Michaelis 1998). Others, viewing focus from the perspective of pragmatics, propose that the relation between context and prosody illustrated in (5) can be explained in terms of focus marking, similar to in declaratives (Jacobs 1984; Erteschik-Shir 1986; Jacobs 1991; Rosengren 1991; Kadmon 2001: 388–397; Reich 2002; Beyssade 2006; Engdahl 2006; Eckardt 2007; Truckenbrodt 2012; Buring 2016; Di Cristo 2016). Here we adopt the second approach, following the implementation of Jacobs (1984, 1991), which has been applied to French by Beyssade et al. (2004a, b).

In this approach, focus is defined as the part of the content that is ‘*inhaltlich besonders betroffen*’, i.e. specifically affected, by the illocutionary operator of the sentence (Jacobs 1984: 30). The partition of an utterance into focus and ground takes place within the scope of an illocutionary operator. In declaratives, the focus contributes the part of the content that is specifically affected by the assertive operator, i.e. the part that is asserted in particular and that is informative. In interrogatives, the focus is specifically affected by the question operator and provides information that is not given in the discourse situation in which the question is uttered. As Jacobs points out, it is important to distinguish the existential implicature that arises from all the *wh*-questions in (5), namely that there is a time at which John ate the beans, from the notion of ground. In (5a), the discourse situation does not need to provide information about the contents of the question as in this case the whole question is marked as focus. In (5b) and (5c), however, the context that directly precedes the question needs to specify the information that is marked as ground by the prosody of the *wh*-question. As a result, (5b) can only be uttered felicitously if the information that John ate the beans is given in the context directly preceding it, as the accent on *when* introduces a narrow focus on the *wh*-word. Similarly, the contextual restrictions on the use of (5c) follow from the narrow focus on the verb *eat*.

For *wh*-echo questions, it is commonly assumed that there is a narrow focus on the *wh*-phrase (Jacobs 1991, Bartels 1997, Reis 2012): the whole non-*wh* part of the utterance content must belong to the ground, since it is ‘echoed’ from the previous utterance. Assuming the approach to focus outlined above, the focus structure of information seeking *wh*-questions may be very different, depending on the preceding context. Therefore, a comparison between the two question types should involve information seeking questions with a focus structure resembling the one in echo questions, i.e. information seeking questions with narrow focus on the *wh*-phrase, as well as information seeking questions in a context that is maximally different from the echo context in the sense that it gives hardly any information about the content of the question.

2.5 Prosodic focus marking in French

In languages like English, focus is marked by the presence of the nuclear pitch accent (Pierrehumbert 1980, Selkirk 1984, Pierrehumbert & Hirschberg 1990); for French, this is less clear. The right edge of a focus is preferably aligned with (i.e. situated at) the right edge of a prosodic constituent (Clech-Darbon, Rebuschi & Rialland 1999; Féry 2001, 2013; Beyssade et al. 2004a, b; Hamlaoui 2008; Delais-Roussarie et al. 2015). A focus is marked by a tone at its right edge (Martin 1981, Rossi 1981); in this paper, we assume that this is the boundary tone associated with the right edge of the prosodic constituent (Intonation Phrase) with which the focus is aligned (Beyssade et al. 2004b).⁵

The boundary tone at the right edge of a focus tends to be low in declaratives and high in interrogatives, reflecting the illocutionary force of the utterance (Martin 1981, Clech-Darbon et al. 1999, Beyssade et al. 2004b, Delais-Roussarie, Doetjes & Sleeman 2004, Doetjes, Rebuschi & Rialland 2004; Delais-Roussarie et al. 2015). In all-focus utterances and sentences in which a narrow focus occurs sentence-finally, the tone is located at the end of the utterance. In other narrow focus utterances, the tone usually occurs twice, both at the end of the focus and at the end of the utterance: this phenomenon is referred to as TONE COPYING (Martin 1981). Specifically, Martin claims that the F0 minimum (in declaratives) or maximum (in interrogatives) of the final syllable of the focus is copied to the final syllable of the utterance.

Whereas it is generally accepted that a tone or accent marks the right edge of a focus, it is less clear whether the pre-focus domain is marked as well. Some authors have observed a compression of the pitch (Touati 1987, Jun & Fougeron 2000, Dohen & Løevenbruck 2004) and a reduced amplitude (Jun & Fougeron 2000). In contrast, Beyssade et al. (2004b) state that there is no pitch compression in the pre-focus domain.

Previous work on focus marking in French interrogatives rarely addresses *wh*-in-situ questions. According to Di Cristo (2016), French *wh*-in-situ questions can have a narrow focus on the *wh*-phrase or a broad focus reading, but this difference is not reflected in the prosody. Di Cristo claims that the right edge of the *wh*-phrase is marked by an accent in all cases. However, in the examples he discusses, the *wh*-phrase is situated at the end of the sentence. This means that the right edge of the focus co-occurs with the right edge of the sentence and tone copying cannot apply.

3. RESEARCH QUESTION AND EXPERIMENTAL DESIGN

The preceding subsections show that the prosodic characteristics of French *wh*-in-situ questions are not well understood. Moreover, it is unclear whether echo and

[5] Alternatively, one could assume that the prosodic boundary determines the position of the nuclear pitch accent which in turn is responsible for focus marking.

information seeking questions, which may be string-identical, are prosodically distinct, and if so, how. In this section, we present the research question and the experimental design of a production experiment that was designed to investigate this issue. Focus marking was taken into account in order to avoid a confound between the effects of focus marking and the effects resulting from the echo/non-echo distinction.

We also take steps to prevent another confound, which relates to the type of echo question under investigation. Two main types are commonly distinguished (Pope 1976, Bartels 1997). The type exemplified in example (2), repeated here for convenience, expresses a failure to perceive or understand part of a previous utterance.

- (2) A: Jean a invité #####[noise].
 Jean has invited
 ‘Jean invited #####[noise].’
 B: Jean a invité qui?
 Jean has invited who
 ‘Jean invited who? (I did not hear you.)’

Another common use of echo questions is to express an emotion in the spectrum of surprise, disbelief or outrage regarding part of a previous utterance, as would be the case if speaker B’s utterance in (2) had followed an utterance like *Jean a invité le président* ‘Jean invited the president’. Yet, the emotion of surprise itself can also affect the prosodic properties of speech utterances (Hirschberg & Ward 1992). Therefore, we focus in our investigation on the type of echo question that expresses auditory failure. We will use the term ‘echo question’ to refer to this particular type of *wh*-in-situ echo questions, unless specified otherwise. Hence, we formulated the following research question, which falls apart into three sub-questions:

(6) *Research question*

Are French *wh*-in-situ echo questions expressing auditory failure and ordinary information seeking questions prosodically distinct, and if so, how?

- A. What are the prosodic properties of French *wh*-in-situ echo questions expressing auditory failure?
- B. What are the prosodic properties of French *wh*-in-situ information seeking questions?
- C. If the answers to A. and B. differ, which differences can be attributed to focus width and which ones to the type of *wh*-question (echo/non-echo)?

In order to answer this research question we set up three conditions:

- (7) Condition A: Echo question expressing auditory failure.
 Condition B: Information seeking question with broad focus.
 Condition C: Information seeking question with narrow focus on the *wh*-phrase.

We elaborate on the properties of these conditions in [Section 3.2](#). The conditions were created by manipulating the context preceding the target sentences. We start by laying out the elicitation paradigm designed to accomplish this context manipulation ([Section 3.1](#)). Subsequently, the constructed materials are discussed, which include items and contexts ([Section 3.2](#)). We then lay out the recording procedure ([Section 3.3](#)), the participants ([Section 3.4](#)) and the acoustic ([Section 3.5](#)) and statistical analyses ([Section 3.6](#)).

3.1 *Elicitation paradigm: Scripted Simulated Dialogue*

To elicit the three conditions, we designed a paradigm that we will refer to as Scripted Simulated Dialogue. This elicitation paradigm simulates a series of short dialogues, in which the participant's interlocutor is a recorded voice. The participant's half of the dialogue is scripted: s/he reads his/her speech turns from a computer screen. Every dialogue has one target sentence or filler embedded in it, always at the same position in the dialogue. As this position is almost at the end of the dialogue, the preceding discourse can be used to manipulate a particular reading of the sentence. The participant does not know which is the target sentence.

Every dialogue is preceded by a description of the conversational setting, which contains information about who the interlocutors are and where the conversation takes place. The context manipulation thus has two elements: the description of the conversational setting and the preceding speech turns.

Following a dialogue, the participant receives a question about the information supplied by the recorded 'interlocutor'. The purpose of this is to direct the participants' attention to the content of the dialogue, rather than the form of the utterances.

3.2 *Materials*

Twelve target stimuli were created. As each of these was presented in three conditions, this yielded a total of thirty-six target utterances. The stimuli had twelve syllables; an example is shown in (8).

- (8) Tu as réservé quel resto pour jeudi soir ?
 you have booked which restaurant for Thursday evening?
 ‘You booked which restaurant for Thursday evening?’ (echo)
 ‘Which restaurant did you book for Thursday evening?’ (information s.)

All stimuli contained the pronoun *tu* ‘you’ as a subject (to avoid differences in the information status of the subject), followed by a verb composed of the auxiliary *as* ‘has’ and a three-syllable past participle. Next came the *wh*-phrase, which was the direct object of the utterance. It contained the *wh*-word *quel* ‘which’ and a disyllabic noun. We chose to use complex *wh*-phrases (rather than, for instance, *quoi* ‘what’) to keep the prosody associated with the *wh*-word distinct from the prosodic correlates of a possible phrase boundary at the end of the *wh*-phrase. A PP, composed of a one-syllable preposition and a three-syllable DP, followed the *wh*-phrase. Its purpose was to separate the prosody associated with the *wh*-phrase from the prosody associated with the end of the utterance.⁶ Sonorants were used as much as possible to facilitate F0 measurements.

The target sentences were intermingled with thirty-six fillers. Twelve of these were declaratives that resembled the discourse–pragmatic function of echo questions, such as *Désolé, je n’ai pas bien entendu* ‘Sorry, I didn’t hear that well’. The remaining 24 fillers were sentences that fitted naturally in the context and that were not *wh*-in-situ questions.

Each stimulus or filler was embedded in a dialogue. The dialogues had six speech turns in total (three for the participant and three for the recorded ‘interlocutor’). The stimulus or filler was part of the participant’s last speech turn, with the ‘interlocutor’s’ last speech turn following it. The dialogues, which were written and checked by three native speakers of French, were constructed to be natural and informal. The voice that represented the ‘interlocutor’ was a female native speaker of French, while the description of the conversational setting that preceded a dialogue was read by a male speaker (to make the distinction clear). Both were recorded in the phonetics lab at Leiden University.

Except for the dialogues containing fillers, each dialogue had certain properties that were intended to trigger either an echo question expressing auditory failure (Condition A), an information seeking question with broad focus (Condition B) or an information seeking question with narrow focus on the *wh*-phrase (Condition C). Figures 1, 2 and 3 present examples of dialogues used in the three conditions; in each case, the description of the conversational setting precedes the dialogue.

[6] Mathieu (2016) claims that speakers have a preference for an in-situ *wh*-phrase to be followed by some other material, while Hamlaoui (2011) makes the opposite claim (see Glasbergen-Plas 2020 for discussion). In our experimental items, the *wh*-phrase was always followed by a PP in order to separate the prosody associated with the *wh*-phrase from the prosody associated with the end of the utterance.

[Conversational setting] Tu es directeur d'une petite école primaire. La semaine prochaine, c'est la rentrée des élèves. Mais, demain, mercredi, c'est la pré-rentrée pour les maîtres et maîtresses. Tu es à l'école avec Axelle, ta secrétaire, pour organiser les dernières petites choses. Tu dis :

A *Et c'est reparti pour un an !*

B *Oui et avec deux classes et deux nouvelles maîtresses de plus.*

A *C'est bien qu'on ait prévu ce petit dîner pour faire plus ample connaissance.*

B *Oui, d'ailleurs je voulais te dire, pour qu'on soit au calme pour parler, j'ai réservé le resto « chez Monette » pour jeudi soir.*

A *Tu as réservé quel resto pour jeudi soir ?*

B *Chez Monette, dans la petite salle du fond, on devrait être tranquilles.*

[Conversational setting] You are the principle of a small primary school. Next week, it's the start of the new school year. But tomorrow, Wednesday, is the first day for the teachers. You are at the school together with Axelle, your secretary, to organize the last things. You are say:

A *So we start again!*

B *Yes, and with two new classes and two new teachers.*

A *It was a good idea to have this small dinner party to get to know each other.*

B *Yes, by the way, I wanted to tell you. In order to have a quiet place to talk, I booked the Chez Monette restaurant for Thursday evening.'*

A *You booked which restaurant for Thursday evening?*

B *Chez Monette. They have a back room that's usually quiet.*

Figure 1

Scripted Simulated Dialogue used in Condition A (echo question).

Speaker A represents the participant and Speaker B the 'interlocutor'. The target sentence is underlined, although this was not the case in the actual experiment.

In the example in Figure 1, pink noise would cover the word *Monette* (represented as struck through text), causing a need to ask for repetition. An episode of pink noise was also present in all other contexts (pertaining to the other conditions and the fillers), but in a position where it would not hinder the conversation, for instance on the final syllable of a long word.

Condition B was designed to elicit ordinary information seeking *wh*-in-situ questions with broad focus. Although the target sentence was preceded by context, it provided little information about the content of the question. Whereas the interlocutors would have to share certain assumptions to make it natural to ask an (in-situ) *wh*-question, no part of the content of the question would be mentioned in the preceding context. To signal this departure from the topic of the preceding conversation, a topic change marker was used (Fraser 1999), like *d'ailleurs tu ne m'as pas dit* 'by the way, you didn't tell me' in Figure 2.

In Condition C, the context was designed to force a reading as an information seeking question with narrow focus on the *wh*-phrase. The context would mention all elements of the content of the question except the *wh*-word, i.e. 'booking a restaurant for Thursday evening' in Figure 3. Hence, everything but the *wh*-word would belong to the ground of the focus domain. In order to implement this restriction on the context, while keeping the flow of the discourse natural,

[Conversational setting] Tu discutes avec Ernestine, ta femme. Elle part quelques jours en voyage d'affaires et rentrera mercredi, juste à temps pour ton anniversaire. Tu lui dis :

A *Bon voyage ma chérie. Tu as bien ton passeport ?*

B *Oui merci. Ah voilà mon taxi.*

A *Tu m'envoies un texto quand tu es arrivée à Londres ?*

B *Oui, oui bien sûr. A mercredi ; pour ta dernière soirée de trentenaire !*

A *Moque-toi ; dans six mois c'est ton tour. D'ailleurs tu ne m'as pas dit.*

Tu as réservé quel resto pour jeudi soir ?

B *Surprise...*

[Conversational setting] You're talking to Ernestine, your wife. She's going on a business trip for a few days and will be back on Wednesday, just in time for your birthday. You say:

A *Have a good trip love. Have you got your passport ?*

B *Yes thanks. Oh that's my taxi.*

A *Will you send me a text when you've arrived in London?*

B *Yes, sure, I will. On Wednesday; on your last evening in your thirties!*

A *Careful with the teasing; in six months it's your turn. By the way, you didn't tell me.*

Which restaurant did you book for Thursday evening?

B *Surprise...*

Figure 2

Scripted Simulated Dialogue used in Condition B (broad focus).

[Conversational setting] Tu es violoniste dans un orchestre amateur. Tu es en séance de répétition. Pendant que les flûtistes répètent un passage délicat, tu parles avec ta voisine Eléonore. Tu lui dis :

A *Tu pars en déplacement cette semaine ?*

B *Non pour une fois, je suis là toute la semaine. Ça tombe bien, c'est la remise de diplôme de ma fille jeudi. Du coup, nous allons en famille au restaurant.*

A *C'est marrant, Fleur m'a raconté la même chose.*

B *Oui, elle m'a dit qu'elle a réservé au Pavillon pour jeudi soir.*

A *Et toi, tu as réservé quel resto pour jeudi soir ?*

B *Le Bord du Lac.*

[Conversational setting] You play the violin in an amateur orchestra. During a rehearsal, while the flutists are practising a particularly difficult passage, you talk to Eléonore, who is sitting next to you. You say:

A *Are you going on a trip this week?*

B *No, just this once I'm going to be here all week. Good timing: it's my daughter's graduation ceremony on Thursday, so we're going out for a family dinner.*

A *Oh that's funny, Fleur said just the same thing.*

B *Yes, she told me she'd booked the Pavillon restaurant for Thursday evening.*

A *And which restaurant did you book for Thursday evening?*

B *Le Bord du Lac.*

Figure 3

Scripted Simulated Dialogue used in Condition C (narrow focus).

we used *wh*-in-situ questions with a contrastive topic, as in Engdahl (2006: 100). Subject pronouns in French are clitics and cannot be contrastively stressed (Kayne 1975). To express contrastive topichood, French uses another, 'strong' pronoun, which may be coreferential with a clitic (Lambrecht 1994: 115–116). We used *et toi* 'and you', which was taken up by the resumptive clitic *tu* 'you' in the clause proper. Hence, the sentence following the contrastive topic *et toi* 'and you' was string-identical to the target stimuli used in Conditions A and B.

3.3 *Recording procedure*

Recordings took place in a soundproof booth at Pôle Audiovisuel et Multimédia (PAM) at the University of Nantes. Participants were seated in front of a computer screen at an approximate distance of 50cm. They wore AKG K 44 perception headphones. The speech was recorded onto digital audio tape (DAT) at a sampling rate of 44.1 kHz, using a TASCAM DR-100 recorder and a TRAM TR50 clip-on microphone.

Participants were informed that they would be taking part in a series of short dialogues with a recorded 'interlocutor' that they would hear through their headphones and that their side of the dialogue would appear on the screen in front of them. They were encouraged to project themselves into the situation represented by the dialogue, speaking naturally, 'as if they were just talking to someone', and to repeat their utterance in case of a lapse. These instructions were presented visually on the computer screen and reiterated orally at the beginning of the experiment. After that, the experimenter did not intervene.

Participants pressed a key once they were ready to start the experiment. This would prompt the recording of the first conversational setting to be played through the headphones (in a male voice), while the screen was blank. Every conversational setting ended with *Tu dis*: 'You say:'. Then the participant's first speech turn would appear on the screen. The participant would utter his/her speech turn, after which s/he would press a key for the 'interlocutor's' speech turn to start playing through the headphones (in a female voice) while the screen was blank again. Then the participant's next speech turn would appear on the screen. This process would be repeated until the participant had uttered the question that formed the target sentence in his/her third speech turn (or a filler) and received an answer in the 'interlocutor's' third and last speech turn. The alternation of speaking, then pressing a key and listening to the 'interlocutor' very soon became an automatic process. After the last speech turn of every dialogue (items or filler), a multiple choice sentence completion task would appear on the screen, asking about information supplied by the 'interlocutor'. The participant would answer the question by pressing 1, 2 or 3. Feedback on the answer would appear on the screen: it was usually correct, since the task was designed to be easy if the participant paid attention to the 'interlocutor's' speech turns. The participant

would then press a key to move on to the next trial. The whole paradigm was programmed in E-Prime (Psychology Software Tools Inc. 2012).

The dialogues were randomized and presented to participants in three blocks, with breaks in between. Three practice trials were used for familiarisation purposes. The experiment lasted approximately an hour.

3.4 *Participants*

Twenty graduate and postgraduate students at the University of Nantes, monolingual native speakers of French, were reimbursed to participate in the experiment (13 female and 7 male, age range 18–29 years old). None of them reported any speech or hearing disorders.

3.5 *Acoustic analysis*

We obtained a total of 720 utterances. After inspection of the data for speech errors, hesitations or unnatural pausing, we excluded 98 utterances from further analysis. The remaining 622 utterances were segmented into phones, syllables and words using EasyAlign (Goldman 2011). The segmental boundaries were then checked and adjusted manually where necessary.

We inspected the utterances again to uncover any patterns in the data, such as the occurrence of different prosodic tunes within the data elicited in one condition. We marked the number of occurrences of each prosodic tune.

Based on this inspection, we selected the utterances for the statistical analyses. We followed the reasoning that if a. a prosodic tune occurred in the majority of cases elicited in a particular condition and b. none of the other tunes came close to its frequency, then this prosodic tune might be considered to be the characteristic prosodic tune of utterances elicited in that condition. We included the items uttered with these characteristic prosodic tunes in the statistical analyses, with the exception of cases that exhibited the characteristic prosodic tune, but with a variation (see also Section 4.1 below). This was done to achieve a sample that was as homogeneous as possible.

We selected the following seven F0 measurement points, which are visualised in Figure 4:

1. AUXILIARY LOW: The lowest F0 point of the auxiliary verb *as* ‘have’. (This point, rather than the first syllable *tu* ‘you’, was selected to capture the F0 in the beginning of the utterance, to avoid any influence from the preceding contrastive topic.)
2. PARTICIPLE HIGH: The highest F0 point of the final syllable of the participle.
3. WH-WORD HIGH: The highest F0 point of the *wh*-word *quel* ‘which’.
4. FINAL WH-PHRASE HIGH: The highest F0 point of the final syllable of the *wh*-phrase.

5. ANTEPENULTIMATE LOW: The lowest F0 point of the utterance's antepenultimate syllable.
6. PENULTIMATE LOW: The lowest F0 point of the utterance's penultimate syllable.
7. ULTIMATE HIGH: The highest F0 point of the final syllable of the utterance.

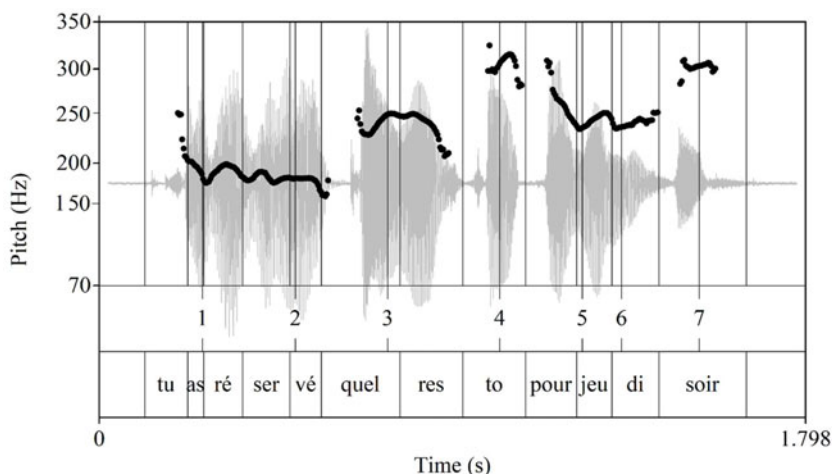


Figure 4

Waveform and F0 tune of the question *Tu as réservé quel resto pour jeudi soir?* 'You booked which restaurant for Thursday evening?' elicited in Condition A (echo question), together with a textgrid illustrating the seven measurement points.

We also obtained the following F0 measurements:

- A. PITCH RANGE, POINT 4 – POINT 1: The difference between the F0 maximum on the final syllable of the *wh*-phrase (a high point in the utterance) and the F0 minimum of the auxiliary (a low point in the utterance).
- B. TONE COPYING, POINT 4 – POINT 7: The difference between the F0 maximum at the final syllable of the *wh*-phrase (the focus in narrow focus questions) and the F0 maximum at the final syllable of the utterance.
- C. SENTENCE-FINAL PITCH MOVEMENT, POINT 7 – POINT 6: The difference between the F0 maximum at the final syllable of the utterance and the F0 minimum of the penultimate syllable (rise or otherwise).⁹

[7] The sentence-final pitch movement tends to start at the penultimate syllable of the utterance (Di Cristo 2016).

We extracted the F0 values with the help of a Praat script (Boersma & Weenink 2017), which took the values from the voiced part of the respective syllables. As rises in French have been shown to continue onto a sonorant syllable coda, and even (in rare cases) on a voiced obstruent coda (Welby & Løevenbruck 2005), we included voiced consonants in our analysis. The F0 values in Hertz were subsequently converted into semitones (st) to reduce variation. (We used the formulas $st = 12 \log_2 (Hz/100)$ for female speakers and $st = 12 \log_2 (Hz/50)$ for male speakers respectively, following Li & Chen 2012.) In addition, we extracted the duration and the mean intensity in decibel (dB) of every syllable, using two more Praat scripts.

3.6 Statistical analysis

We ran a series of linear mixed-effects models using the *lmer* function of the *lme4* package (Bates et al. 2015) in R (R Core Team 2017). *P*-values were obtained using the package *lmerTest* (Kuznetsova, Brockhoff & Christensen 2017). Specifically, we ran a model with the relevant measurement as the dependent variable, question type as a fixed factor, and items and participants as random factors for every measurement. To obtain all relevant comparisons we ran the analyses for each reference category (ECHO, BROAD FOCUS, NARROW FOCUS). The reader is referred to the statistical appendix for more details.

4. RESULTS

We now present the results of the experiment. First we provide descriptions of the three tunes that turned out to be characteristic of the utterances elicited in the respective conditions (Section 4.1). The remainder of the section is devoted to the comparisons between these three tunes with respect to F0 (Section 4.2) and duration and intensity (Section 4.3), after which we provide a summary of the results (Section 4.4). In short, the main results reveal that the utterances elicited in Condition A (echo questions) differ from those in Condition B (information seeking questions with broad focus) regarding F0 and duration, though not greatly regarding intensity. Comparisons with Condition C (information seeking questions with narrow focus on the *wh*-phrase) show that some of the differences are correlated with focus structure, indicating that these are correlates of focus marking. Other differences are not correlated with focus structure, suggesting that these mark the discourse–semantic function of echo questions.

4.1 Descriptions of the three characteristic prosodic tunes

Three prosodic tunes were frequently attested in the data; each of these tunes occurred in all three conditions. However, in every condition there was one tune that a. was attested much more frequently than any other tune and b. occurred only infrequently in the other conditions. Hence, this tune seemed to be the CHARACTERISTIC TUNE (CH.T.) of the respective condition. As mentioned, we

used the utterances pronounced with the characteristic tune of the respective condition as input for our analyses. The distribution of the different prosodic tunes is illustrated in Table 1. For the sake of presentation, we will refer to the characteristic tunes of the three conditions as the ECHO TUNE, the BROAD FOCUS TUNE and the NARROW FOCUS TUNE.

	Condition A	Condition B	Condition C
CH.T. Condition A (echo question)	188 (87%)	6 (3%)	17 (9%)
CH.T. Condition B (broad focus)	2 (1%)	146 (70%)	24 (12%)
CH.T. Condition C (narrow focus)	13 (6%)	37 (18%)	137 (69%)
Other tune or unclassifiable	13 (6%)	19 (9%)	20 (10%)
Total number of cases	216 (100%)	208 (100%)	198 (100%)

CH.T. = characteristic tune

Table 1

The prosodic tunes and their frequencies attested in Conditions A, B and C. Shading marks the characteristic tune of each condition.

We will now describe these three tunes. Figure 5 displays an example of an Echo Tune. In this tune, the F0 is quite low in the area of the utterance preceding the *wh*-phrase. There is a high point associated with the *wh*-word *quel* ‘which’. The F0 rises to an even higher point associated with the final syllable of the *wh*-phrase; this peak can be high in the speaker’s register. The F0 falls again on the PP, but not to the level of the beginning of the utterance: the F0 usually remains high. At the end of the utterance, the F0 rises to an extreme F0 level again, which is often similar to the F0 on the final syllable of the *wh*-phrase.

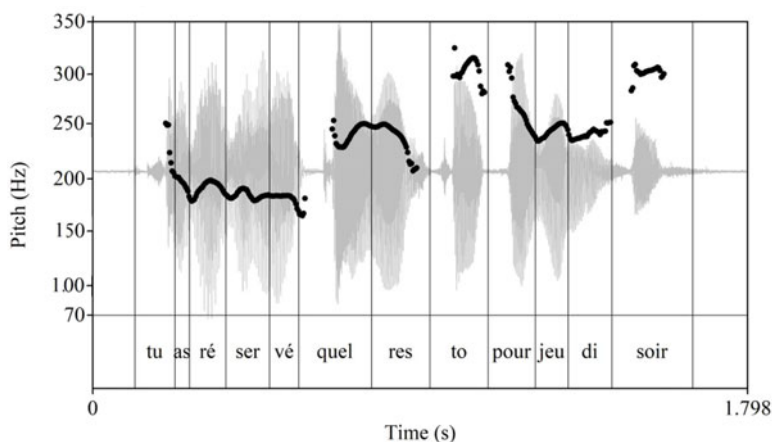


Figure 5

Waveform and F0 tune of the question *Tu as réservé quel resto pour jeudi soir?* ‘You booked which restaurant for Thursday evening?’, uttered with the Echo Tune by a female speaker.

Figure 6 shows an example of a Broad focus Tune. There is a high point associated with the *wh*-word *quel* ‘which’, as in the Echo Tune. Subsequently, there is a high point associated with the end of the *wh*-phrase, which varies in height. (The peak can be late, aligned with the preposition.) There is often an F0 fall between these two high points associated with the *wh*-phrase, but the F0 can also stay level, forming a plateau over the whole *wh*-phrase. The F0 then falls on the PP, after which the sentence usually ends with a rise, which is often (very) small.

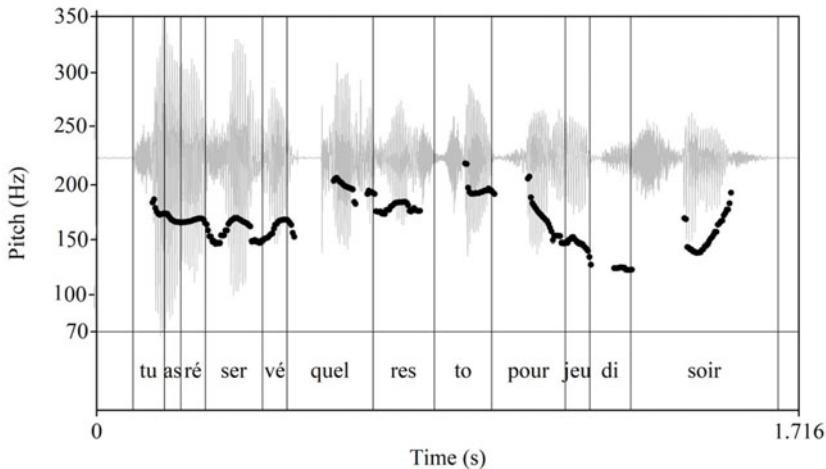


Figure 6

Waveform and F0 tune of the question *Tu as réservé quel resto pour jeudi soir?* lit.: ‘You booked which restaurant for Thursday evening?’, uttered with the Broad focus Tune by a male speaker.

Figure 7 (on next page) displays an example of a Narrow focus Tune. The speaker is the same as the one that uttered the example of the Echo Tune in Figure 5 above. Recall that utterances elicited in Condition C (narrow focus) were preceded by the contrastive topic *et toi* ‘and you’ (see Section 3.2 above for discussion). In the vast majority of cases, there is a high point associated with this contrastive topic (consistent with previous descriptions, Delais-Roussarie et al. 2004). Sometimes the contrastive topic is followed by a pause, with a subsequent pitch reset at the beginning of the utterance proper. When there is no pause, the F0 falls gradually from the high point of the contrastive topic: the fall covers *tu* ‘you’ and often (part of) *as* ‘have’. As in the Echo Tune, the rest of the area preceding the *wh*-phrase has low pitch. In contrast to both other tunes, there is either no high point associated with the *wh*-word, or a high point that is much lower. There is, however, a high point associated with the last syllable of the *wh*-phrase. On the PP following the *wh*-phrase, the F0 falls, often to the level of the area preceding the *wh*-phrase. At the end of the utterance there is an F0 rise,

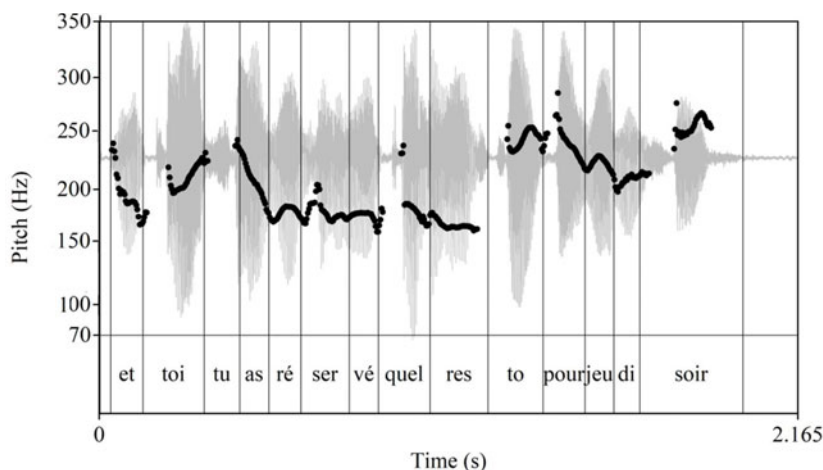


Figure 7

Waveform and F0 tune of the question *Tu as réservé quel resto pour jeudi soir?* lit.: 'You booked which restaurant for Thursday evening?', uttered with the Narrow focus Tune by a female speaker.

which often reaches a level similar to the high point at the end of the *wh*-phrase, like in the Echo Tune.

These descriptions show that there are clear differences between the three tunes. Nevertheless, two features are present in all of them. Firstly, there is a high point associated with the end of the *wh*-phrase, followed by a fall on the PP, which we interpret as a prosodic boundary. Secondly, all three tunes end with at least a small sentence-final rise (which seems larger in the Echo Tune and the Narrow focus Tune than in the Broad focus Tune).

Note that in all three characteristic tunes, one or both of these features were absent in some cases.⁸ We excluded the utterances with a variation from the statistical analyses to achieve a sample that was as homogeneous as possible. Hence, we conducted the analyses on 164 utterances exhibiting the Echo Tune in Condition A, 130 utterances exhibiting the Broad focus Tune in Condition B and 136 utterances exhibiting the Narrow focus Tune in Condition C.

[8] Of the 211 occurrences of the Echo Tune in all three conditions, 180 (85%) exhibited the prototypical tune, 30 (14%) seemed to lack a prosodic boundary and 1 (< 1%) lacked a sentence-final rise. Of the 172 occurrences of the Broad focus Tune in all three conditions, 149 (87%) exhibited the prototypical tune, 3 (2%) seemed to lack a prosodic boundary, 11 (6%) lacked a sentence-final rise and 9 (5%) seemed to lack both. Of the 187 occurrences of the Narrow focus Tune in all three conditions, 179 (96%) exhibited the prototypical tune and 8 (4%) lacked a final rise (none seemed to lack a prosodic boundary).

4.2 Comparisons of the three characteristic tunes regarding F0

We now turn to comparisons between the three tunes regarding their F0, starting with a visualisation of the average F0 at the seven measurement points in Figure 8. All reported differences in semitones (st) are significant; see Tables A1 and A2 in the statistical appendix for details. As shown in Figure 8, the Echo Tune and the Narrow focus Tune have lower pitch than the Broad focus Tune in the part of the utterance preceding the *wh*-phrase. At the participle ('participle high'), this difference is significant for both the Echo Tune (1.9 st) and the Narrow focus Tune (−2.3 st). At the auxiliary ('auxiliary low') however, the Echo Tune is significantly lower (−1.1 st), but the Narrow focus Tune only marginally so (−0.7 st). The F0 of the Echo Tune and the Narrow focus Tune does not differ in this part of the utterance.

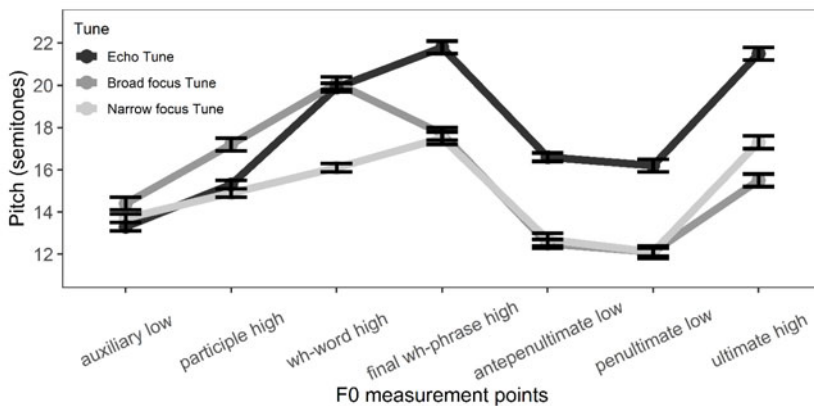


Figure 8

Average F0 at seven measurement points in the characteristic tunes of utterances elicited in Condition A (echo question), Condition B (broad focus) and Condition C (narrow focus), of the form *Tu as réservé quel resto pour jeudi soir?* lit.: 'You have reserved which restaurant for Thursday evening?'.

At the *wh*-word *quel* 'which' ('*wh*-word high'), the F0 maximum in the Echo Tune and the Broad focus Tune are equal in height. However, consistent with the observation of no or a much lower peak here (Section 4.1), the F0 maximum in the Narrow focus Tune is significantly lower than in both other tunes (−4.0 st Broad focus Tune, −3.8 st Echo Tune).

From the final syllable of the *wh*-phrase onwards, the tonal movements in all tunes seem to be the same, but the F0 in the Echo Tune is elevated. The high point on the final syllable of the *wh*-phrase ('final *wh*-phrase high') is much higher in the Echo Tune than in both other tunes (Broad focus Tune 4.1 st, Narrow focus Tune 4.3 st). The F0 remains much higher on the F0 minimum of the antepenultimate syllable ('antepenultimate low'), the F0 minimum of the penultimate syllable ('penultimate low') and the F0 maximum of the final syllable of the utterance

(‘ultimate high’). These F0 differences between the Echo Tune and the other two tunes are large: they range between 3.9 st and 6 st and are highly significant. The Narrow focus Tune and the Broad focus Tune behave similarly in this part of the utterance, with the exception of the final syllable of the utterance. There, the Narrow focus Tune has significantly higher pitch than the Broad focus Tune (1.8 st).

We now turn to the difference in F0 between certain points in the utterance. We first report on the pitch range, which was measured as the difference between the F0 maximum on the final syllable of the *wh*-phrase (‘final *wh*-phrase high’) and the F0 minimum at the auxiliary (‘auxiliary low’). This pitch range is larger in the Echo Tune (8.5 st) than in the Broad focus Tune (3.2 st) and the Narrow focus Tune (3.6 st). The large pitch range in the Echo Tune is mostly due to the very high F0 from the final syllable of the *wh*-phrase onwards. This is exacerbated by the low F0 in the area preceding the *wh*-phrase. The pitch range does not differ significantly between the Narrow focus Tune and the Broad focus Tune.

Another difference is that between the F0 maximum on the final syllable of the *wh*-phrase (‘final *wh*-phrase high’) (the focus in echo and narrow focus questions) and the F0 maximum on the final syllable of the utterance (‘ultimate high’). Recall that we measured this difference because narrow focus marking might result in similar values on the final syllable of the focus and the final syllable of the utterance (tone copying, see [Section 2.5](#) above). As can be seen in [Figure 8](#) above, the F0 maximum of these syllables is very similar in the Echo Tune and the Narrow focus Tune. The average difference between them is 0.6 st in the Echo Tune and only 0.1 st in the Narrow focus Tune. The difference is not especially small in the Broad focus Tune: on average 2.5 st. The difference between the Echo Tune and the Broad focus Tune, as well as the difference between the Narrow focus Tune and the Broad focus Tune, is significant, while the Narrow focus Tune and the Echo Tune do not differ significantly. The cause of the difference between the Narrow focus Tune and the Broad focus Tune is the higher F0 maximum on the final syllable of the utterance in the Narrow focus Tune (‘ultimate high’), since the F0 maximum on the final syllable of the *wh*-phrase (‘final *wh*-phrase high’) does not differ between these two tunes.

Finally, we measured the difference between the F0 maximum on the final syllable of the utterance (‘ultimate high’) and the F0 minimum of the penultimate syllable (‘penultimate low’), as an indication of the sentence-final pitch movement. This value is on average 3.4 st in the Broad focus Tune, 5.0 st in the Echo Tune and 5.3 st in the Narrow focus Tune. These values indicate the presence of a rise rather than a fall in all tunes. Still, the rise is significantly larger in both the Echo Tune and the Narrow focus Tune than in the Broad focus Tune, while it does not differ between the Echo Tune and the Narrow focus Tune. The larger rise in the Narrow focus Tune is again due to the higher F0 maximum on the final syllable of the utterance in the Narrow focus Tune, since the average F0 minimum of the penultimate syllable is the same in the Narrow focus Tune and the Broad focus Tune.

4.3 *Comparisons of the three characteristic tunes regarding duration and intensity*

In general, duration and intensity measurements were less informative than F0 regarding the differences between the three tunes. However, there are two observations to be made concerning duration (see also [Tables A3](#) and [A4](#) in the statistical appendix).

Firstly, the *wh*-word *quel* ‘which’ (\bar{x} length = 203 ms in the Echo Tune) is significantly longer in the Echo Tune than in both other tunes (26 ms longer than in the Broad focus Tune and 28 ms longer than in the Narrow focus Tune). The *wh*-phrase as a whole also has longer duration in the Echo Tune (36 ms longer than the Broad focus Tune and 38 ms longer than the Narrow focus Tune). There is also some lengthening of the syllable preceding the *wh*-word (the final syllable of the participle) compared to the Broad focus Tune (9 ms longer).

Secondly, the final and penultimate syllables of the utterance are shortened in the Echo Tune. (On the penultimate syllable, this difference was –12 ms compared to the Broad focus Tune and –15 ms compared to the Narrow focus Tune; on the final syllable, the difference was –26 ms compared to the Broad focus Tune.) The final syllable of the utterance is also shortened in the Narrow focus Tune (–19 ms compared to the Broad focus Tune). The Narrow focus Tune and the Echo Tune pattern together on this syllable and do not differ significantly from each other.

The role of intensity in distinguishing the three tunes is not very clear. We examined whether the Echo Tune had higher intensity than the other two tunes on the *wh*-word *quel* ‘which’ or the final syllable of the utterance, since this has been reported for German (Repp & Rosin 2015). However, this was not the case. The intensity on the *wh*-word in the Echo Tune was lower than in the Broad focus Tune (–1.2 dB) and the Narrow focus Tune (–1.1 dB) (see also [Table A5](#) in the statistical appendix).

In general, the sentences uttered with both the Echo Tune and the Narrow focus Tune displayed on average less intensity than the ones uttered with the Broad focus Tune (see [Table A6](#) in the statistical appendix). Many different syllables in the Echo Tune and the Narrow focus Tune exhibited this lower intensity. They were situated in the pre-focal area, the post-focal area and the focus (the *wh*-phrase) itself, i.e. scattered across the sentence.

4.4 *Summary of the results*

In all three tunes, there is a high point associated with the end of the *wh*-phrase, followed by a fall on the PP. Also, there is at least a very small sentence-final rise. In the Echo Tune and the Narrow focus Tune compared to the Broad focus Tune, the pitch is lower in the area preceding the *wh*-phrase. There is also a strong similarity in pitch between the F0 maximum on the final syllable of the *wh*-phrase (the focus) and the F0 maximum of the final syllable of the utterance. The sentence-final rise is larger in these tunes. Also, the final syllable of the

utterance has a shorter duration. Only in the Echo Tune, the F0 values are elevated from the final syllable of the *wh*-phrase onwards. As the pitch in the area preceding the *wh*-phrase is low, the pitch range is extremely large. In addition, the *wh*-word has a longer duration. The Echo Tune is not uttered with higher intensity. Finally, unique to the Narrow focus Tune is the absence of a high point on the *wh*-word *quel* ‘which’, or the presence of a point with a lower F0 value.

5. DISCUSSION

We built our analyses on the sentences uttered with the characteristic tune of every condition: the 87% of the cases elicited in Condition A uttered with the Echo Tune, the 70% of the cases elicited in Condition B uttered with the Broad focus Tune and the 69% of the cases elicited in Condition C uttered with the Narrow focus Tune. Assuming that these tunes are representative of questions uttered in their respective discourse contexts, we now analyse their prosodic properties. In our discussion, we first single out the prosodic correlates of focus width (Section 5.1). We then discuss some general prosodic properties of information seeking *wh*-in-situ questions (Section 5.2). Finally, we point out the distinguishing prosodic features of echo questions (Section 5.3).

5.1 *Prosodic correlates of focus marking: Focus in wh-in-situ questions*

The common prosodic properties of echo questions and information seeking questions with a narrow focus on the *wh*-phrase confirm the presence of focus marking in French *wh*-questions and offer evidence in favour of the approach adopted here, following Jacobs (1984, 1991), Beyssade (2006), and Beyssade, Delais-Roussarie & Marandin (2007). Our results also add to the existing knowledge of focus marking in French, providing insight into its prosodic correlates.

Firstly, the pitch in the area preceding the *wh*-phrase (the participle) is lower in echo questions and narrow focus information questions as compared to information seeking questions with broad focus. The participle is expected to be part of the focus in the broad focus questions, but precedes the focus in echo and narrow focus questions. Hence, this is evidence of pre-focal pitch compression, in line with findings by Touati (1987), Jun & Fougeron (2000) and Dohen & Loevenbruck (2004), but contra Beyssade et al. (2004b). In echo questions, pitch compression was also present on the auxiliary.

Next, the final syllable of the *wh*-phrase (the focus) and the final syllable of the utterance display the same F0 maximum: the average difference between these two values in an utterance was 0.1 st in information seeking narrow focus questions and 0.6 st in echo questions, but 2.5 st in broad focus questions. This is expected under current assumptions in the literature according to which a so-called illocutionary boundary tone at the end of a focus tends to be copied to the final syllable of the utterance. This boundary tone is in principle a low tone in declaratives and a high tone in interrogatives (see Section 2.5 and the references

mentioned there). Our data show that the phenomenon also occurs in *wh*-in-situ questions. Moreover, they make clear that what is copied is not a high tone in an abstract sense, but an absolute F0 value: in (echo) questions with narrow focus on the *wh*-phrase, the F0 maximum on the final syllable of the utterance is an exact copy of the F0 maximum of the final syllable of the focus, defying declination, providing experimental support to the initial claim by Martin (1981).

In addition, the final syllable of the utterance has a shorter duration in both echo and narrow focus questions than in questions with broad focus. In echo questions, the penultimate syllable is also shortened. This shortening may well be a correlate of the copied tone, which has not, to our knowledge, previously been described in the literature.

5.2 Prosodic properties of French *wh*-in-situ information seeking questions

In interpreting the results regarding *wh*-in-situ information seeking questions, it should be taken into consideration that the items used in this experiment contained complex *wh*-phrases of the type *quel N* ‘which N’. This may have affected the results and further research will have to show whether the same prosodic descriptions apply to *wh*-in-situ questions with simplex *wh*-phrases, e.g. *quoi* ‘what’ or *qui* ‘who’. With this in mind, we turn to the prosodic properties of French *wh*-in-situ information seeking questions.

Regarding the prosody associated with the *wh*-phrase, both broad focus questions and echo questions exhibited an accent on the *wh*-word *quel* ‘which’, followed by a high point (a prosodic boundary) at the end of the *wh*-phrase. This is very similar to the results described in Gryllia et al. (2016) (see also Wunderli 1983). It differs from the results described in Baunaz & Patin (2009) and Baunaz (2016), who did not find an accent on the *wh*-word in questions similarly uttered following a topic change marker (see also Wunderli & Braselmann 1980, Wunderli 1982). A possible reason for this difference might be the relatively short *wh*-phrases and/or short target stimuli used in these studies, as compared to the ones used in Wunderli (1983), Gryllia et al. (2016) and the current study.

In the narrow focus questions, the accent on the *wh*-word was either absent or significantly lower than in both broad focus and echo questions. The fact that the accent is diminished in the only condition where a contrastive topic precedes the utterance raises the question whether the lack of accentuation and the presence of the contrastive topic are related. A contrastive topic in French is associated with a high point, which Beyssade et al. (2004a, b) analyse as a pragmatic accent that they call a ‘C accent’. A C accent marks the use of a complex discourse strategy, such as a topic shift. The accent on in-situ *wh*-expressions has also been analysed as such a C accent. In sentences with several C accents, only one (usually the highest one in the syntactic tree) is obligatory (Beyssade et al. 2004a, b). This is illustrated in (9), which contains an obligatory C accent on the contrastive topic *le dimanche* ‘on Sunday’ and an optional one on *des cigarettes* ‘cigarettes’.

- (9) Que fume Bernard ?
 ‘What does Bernard smoke?’
- (a) Le **dimanche**, Bernard fume des **cigarettes**
 (, le reste de la semaine, il fume la pipe).
- (a’) Le **dimanche**, Bernard fume des cigarettes
 (, le reste de la semaine, il fume la pipe).
 ‘Bernard smokes cigarettes on Sunday
 (, the rest of the week he smokes his pipe).’

This seems to fit the data of our experiment. If we assume, following Beyssade et al. (2004b), that the *wh*-word did not obligatorily receive an accent because of the preceding accent on the contrastive topic, this would explain why the high tone associated with the *wh*-word is diminished in questions elicited in this condition.⁹

We now turn to the final part of the utterance, which is relevant in light of the disagreement on whether or not French *wh*-in-situ questions display a large sentence-final rise. Previous authors have argued for the obligatory presence (Cheng & Rooryck 2000, Déprez et al. 2013, Delais-Roussarie et al. 2015), optional presence (Wunderli & Braselmann 1980; Wunderli 1982, 1983; Adli 2004, 2006; Di Cristo 2016) and absence (Di Cristo 1998; Starke 2001; Mathieu 2002, 2016; Tual 2017) of such a rise (see Section 2.2). Recently, Reinhardt (2019) has shown that French *wh*-in-situ questions have a tendency to display such a rise, but also that this is not a strict constraint. In accordance with Reinhardt’s findings, we only observed a prominent final rise in a part of the data.

A new observation made in this study is that the presence of a large sentence-final rise is correlated with focus width. Information seeking questions with broad focus displayed only a very small rise, while both echo and narrow focus questions displayed a rise with a larger pitch excursion, induced by the higher F0 values on the final syllable of the utterance in those tunes. In turn, these seem to be due to the tone copying phenomenon (see Section 5.1 above): in narrow focus questions, the high F0 maximum at the end of the focus gets copied to the final syllable, thus raising the pitch on the final syllable of the utterance. Therefore, our data show that the presence of a prominent sentence-final rise in French *wh*-in-situ questions may well be the result of narrow focus marking. This explains some of the disagreement in the literature: French *wh*-in-situ questions may or may not display a large sentence-final rise, depending on their focus structure.

[9] The presence of the contrastive topic may also have influenced some other aspects of the results, which are not relevant for the current paper.

5.3 *Prosodic properties of French wh-in-situ echo questions expressing auditory failure*

Following the attribution of some of the prosodic properties of echo questions to focus marking (Section 5.1), we are now in a position to shed light on the distinguishing features of French echo questions expressing auditory failure.

The F0 of echo questions is much higher than in information seeking questions (of either type), but only from the final syllable of the *wh*-phrase onwards. This is only partly consistent with Di Cristo's (1998) and Boeckx' (1999) statements, who describe echo questions as displaying a high pitch overall. The pitch difference from the final syllable of the *wh*-phrase onwards is very large: on average approximately 4 semitones. Apart from this elevation of the pitch, the utterance seems to perform the same tonal movements as in narrow focus information seeking questions. Since the area preceding the *wh*-phrase has low pitch (as in narrow focus questions), the pitch range within echo questions is enormous: on average 8.2 semitones.

Interestingly, the *wh*-word *quel* 'which' does not have higher pitch than in information seeking questions with broad focus. This is thus not a distinguishing feature of echo questions, despite previous claims (Chang 1997: 17; Mathieu 2002). However, both the *wh*-word (and the *wh*-phrase as a whole) and the preceding syllable are lengthened, as predicted by Engdahl (2006). This longer duration is what distinguishes the *wh*-word in echo questions from that in broad focus information seeking questions.

A feature that is consistently mentioned in the previous literature as a property of echo questions in French is a sentence-final rise (e.g. Di Cristo 1998, Mathieu 2002, Déprez et al. 2013). Our findings confirm the presence of a rise, but show that the rise is not a distinguishing feature of echo questions. Moreover, although the pitch movement ends higher in echo questions, the rise does not seem to be larger when compared to information seeking questions with a similar focus width (i.e. narrow focus): the rise simply starts and ends higher. As suggested by González & Reglero (2018) for Spanish, the impression of a more prominent rise in echo questions might have been caused by their larger pitch range. Also, as some previous studies have considered questions in which the *wh*-phrase was the final element of the utterance, the sentence-final pitch movement may in some cases have been confounded with the pitch movements associated with the *wh*-phrase.

French echo questions were not differentiated from information seeking questions by higher intensity, differently from in German (Repp & Rosin 2015). On the *wh*-word, echo questions had less intensity than both types of information seeking questions.

These results show that speakers of French mark echo questions with a prosody that is different from information seeking questions. A distinct prosody for echo questions has been established for various other (unrelated) languages as well (Section 2.3). However, the current study on French seems to be the first one that explicitly excluded focus width as a potential confound, thus strengthening

the result. The existence of prosodic differences between echo questions and information seeking questions is in line with the presence of syntactic, semantic and pragmatic differences (Section 2.1) and indicate that echo questions should be regarded as a separate question type, with different properties from information seeking questions in all aspects of grammar.

Regarding the nature of the prosodic properties that set echo questions apart, we have raised the question whether a particular prosody marks echo questions cross-linguistically. In the languages studied so far, all prosodic descriptions of echo questions differ, but we tentatively proposed a generalisation based on the small available sample of languages (Section 2.3). We suggested that in languages with a falling sentence-final intonation in *wh*-in-situ information seeking questions (e.g. Farsi, Brazilian Portuguese), echo questions seem to display a rising sentence-final intonation, while in languages with a sentence-final rise (e.g. North-Central Peninsular Spanish, Greek, Shingazidja), echo questions seem to be marked by an expanded pitch range. This generalisation also holds for French, which falls neatly in the second category, with a sentence-final rise in both question types and an expanded pitch range in echo questions expressing auditory failure.

Although Sobin (1990, 2010), in two influential papers, labelled the rising intonation of echo questions in general ‘surprise intonation’, our results show that surprise is not needed for echo questions to be marked with a particular prosody. It is a question for further research to what extent our findings will generalise to French echo questions expressing surprise. In some other languages in which both types of echo questions have been studied, their prosody was only subtly different, e.g. in American English and German (Bartels 1997, Repp & Rosin 2015). In other languages, the prosodic features of echo questions expressing surprise were mostly similar to those expressing auditory failure, but more pronounced, e.g. a more expanded pitch range, as in North-Central Peninsular Spanish (González & Reglero 2018) or uttered at a higher pitch register, as in Shingazidja (Patin 2011). In investigating this for French, it should be kept in mind that a larger pitch range can be a marker of surprise (Hirschberg & Ward 1992) or emotion in general (Bänziger & Scherer 2005), as well as one of the main features of French echo questions expressing auditory failure.

Summarising the discussion, the results of the study indicate that French *wh*-in-situ echo questions differ from broad focus information seeking questions in many ways. We analysed some prosodic features of echo questions, namely those that were also present in information seeking questions with narrow focus, as due to focus marking. An example of this is the tone copying phenomenon, resulting in a larger sentence-final rise in both question types with narrow focus. Other prosodic features were uniquely attested in echo questions. These were an elevated pitch from the final syllable of the *wh*-phrase onwards, resulting in sentences with an extremely large pitch range, and a lengthening of the *wh*-word *quel* ‘which’. Hence, French *wh*-in-situ echo questions expressing auditory failure are prosodically distinct from their information seeking counterparts, even when

controlling for focus structure. In addition, the results demonstrate that focus is marked in French *wh*-in-situ questions.

6. CONCLUSIONS

The current study makes a direct comparison of French *wh*-in-situ echo and information seeking questions, controlling for the influence of focus on their prosodic properties. As the study targeted echo questions expressing auditory failure, the results are not confounded with the prosody associated with surprise. Broad focus information seeking questions display a high point associated with the *wh*-word, a high point followed by a fall (a prosodic boundary) at the end of the *wh*-phrase and a (small) rise at the end of the utterance. Echo questions expressing auditory failure share these characteristics, but their pitch is elevated from the final syllable of the *wh*-phrase onwards, resulting in a much larger pitch range. Also, the *wh*-word has a longer duration. French echo questions expressing auditory failure are not marked by higher intensity, nor by a sentence-final rise with a larger pitch excursion. These prosodic properties of French echo questions fall neatly in the tentative generalisation we proposed: in languages such as French, in which information seeking questions display a sentence-final rise, they are marked by an expanded pitch range. We conclude that echo questions display a prosody that is distinct from the prosody of information seeking questions, in addition to differences regarding their pragmatics, semantics and syntax. The fact that echo questions show different characteristics in all aspects of grammar sets them apart as a separate question type.

Furthermore, this study offers evidence for the presence of focus marking in French *wh*-in-situ questions. In particular, the pre-focal area is compressed, confirming Touati (1987) and Dohen & Løevenbruck (2004), and the F0 maximum at the end of the focus is copied to the final syllable of the utterance (Martin 1981). The current study shows that what is copied is not an abstract tone but an absolute F0 value, as already suggested by Martin (1981), but not experimentally tested so far. Moreover, the final syllable of the utterance is shortened. This confirms and adds to claims made in the literature on focus marking in French, while showing that we should not disregard information structural focus marking in (*wh*-)interrogatives.

STATISTICAL APPENDIX

Comparisons involving F0, duration and intensity

We only report the relevant comparisons. S.E. = standard error.

Measurement	Fixed effects	β	S.E.	p
'Auxiliary low'	Echo Tune	-0.91	0.26	< .001
	Narrow focus Tune	-0.49	0.27	.077
'Participle high'	Echo Tune	-1.89	0.19	< .001
	Narrow focus Tune	-2.15	0.21	< .001
'Wh-word high'	Echo Tune	-0.13	0.23	.58
	Narrow focus Tune	-3.40	0.25	< .001
'Final wh-phrase high'	Echo Tune	4.34	0.24	< .001
	Narrow focus Tune	0.14	0.26	.60
'Antepenultimate low'	Echo Tune	4.32	0.29	< .001
	Narrow focus Tune	0.65	0.31	< .05
'Penultimate low'	Echo Tune	4.33	0.36	< .001
	Narrow focus Tune	0.40	0.38	.29
'Ultimate high'	Echo Tune	6.13	0.37	< .001
	Narrow focus Tune	2.02	0.39	< .001
'Pitch range'	Echo Tune	5.32	0.37	< .001
	Narrow focus Tune	0.46	0.39	.24
'Tone copying'	Echo Tune	-1.95	0.46	< .001
	Narrow focus Tune	2.40	0.48	< .001
'Sentence-final pitch movement'	Echo Tune	1.64	0.54	< .01
	Narrow focus Tune	1.96	0.56	< .001

Note: The reference category is the Broad focus Tune.

Table A1

Results of linear mixed effects models for F0 measurements with the Broad focus Tune as reference category.

Measurement	Fixed effects	β	S.E.	p
'Auxiliary low'	Echo Tune	-0.43	0.26	.10
'Participle high'	Echo Tune	0.27	0.19	.16
'Wh-word high'	Echo Tune	3.53	0.23	< .001
'Final wh-phrase high'	Echo Tune	4.21	0.24	< .001
'Antepenultimate low'	Echo Tune	3.67	0.29	< .001
'Penultimate low'	Echo Tune	3.93	0.35	< .001
'Ultimate high'	Echo Tune	4.11	0.36	< .001
'Pitch range'	Echo Tune	4.86	0.36	< .001
'Tone copying'	Echo Tune	0.45	0.45	.32
'Sentence-final pitch movement'	Echo Tune	-0.32	0.53	.54

Note: The reference category is the Narrow focus Tune.

Table A2

Results of linear mixed effects models for F0 measurement points with the Narrow focus Tune as reference category.

THE PROSODY OF FRENCH *WH*-IN-SITU QUESTIONS

Measurement	Fixed effects	β	S.E.	<i>p</i>
Final syllable of the participle (syl. 5)	Broad focus Tune	-7.50	2.79	< .01
<i>Wh</i> -word <i>quel</i> 'which' (syllable 6)	Broad focus Tune	-25.80	3.23	< .001
	Narrow focus Tune	-25.85	3.20	< .001
<i>Wh</i> -phrase (syllables 6 to 8)	Broad focus Tune	-31.21	5.24	< .001
	Narrow focus Tune	-33.27	5.20	< .001
Penultimate syllable (syllable 11)	Broad focus Tune	11.41	2.18	< .001
	Narrow focus Tune	6.16	2.17	< .01
Ultimate syllable (syllable 12)	Broad focus Tune	29.5	3.99	< .001
	Narrow focus Tune	6.67	3.96	.09

Note: The reference category is the Echo Tune.

Table A3

Results of linear mixed effects models for duration with the Echo Tune as reference category.

Measurement	Fixed effects	β	S.E.	<i>p</i>
Ultimate syllable (syllable 12)	Broad focus Tune	22.83	4.26	< .001

Note: The reference category is the Narrow focus Tune.

Table A4

Results of linear mixed effects models for duration with the Narrow focus Tune as reference category.

Measurement	Fixed effects	β	S.E.	<i>p</i>
<i>Wh</i> -word <i>quel</i> 'which' (syllable 6)	Broad focus Tune	1.07	0.28	< .001
	Narrow focus Tune	0.69	0.28	< .05

Note: The reference category is the Echo Tune.

Table A5

Results of linear mixed effects models for intensity with the Echo Tune as reference category.

Measurement	Fixed effects	β	S.E.	<i>p</i>
Average of the average intensity of all twelve syllables	Echo Tune	-1.00	0.17	< .001
	Narrow focus Tune	-0.99	0.19	< .001

Note: The reference category is the Broad focus Tune.

Table A6

Results of linear mixed effects models for intensity with the Broad focus Tune as reference category.

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