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ARTICLE

The role of prosody in interpreting surprise questions in French

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Abstract
Previous research shows that speakers use prosody to disambiguate between string-identical canonical information questions and noncanonical questions conveying surprise. In this study, we investigated whether the prosodic cues produced by speakers are enough for naïve listeners to distinguish between the two readings of two distinct question structures in French that can express either a request for information or an emotive reaction of surprise: 'qu'est-ce que' and 'c'est quoi ce NP' questions. This article provides experimental evidence that listeners can in fact disambiguate between the two interpretations based on prosodic cues alone, in particular the contour and the duration of the question word.

Résumé
Des recherches antérieures ont établi que les locuteurs utilisent la prosodie pour faire la distinction entre des demandes d'information, qui sont des questions canoniques, et des questions non canoniques exprimant une réaction de surprise lorsque celles-ci ont la même forme. La présente étude cherche à établir si les indices prosodiques produits par les locuteurs suffisent pour que des destinataires naïfs fassent la différence entre les deux lectures possibles de deux types de questions en français : les questions en 'qu'est-ce que' et les questions en 'c'est quoi ce SN', toutes deux susceptibles d'exprimer soit la demande d'information soit la surprise. En se basant sur des résultats expérimentaux, cet article montre que les indices prosodiques seuls permettent en fait aux destinataires de désambiguiser les deux interprétations. La durée du mot interrogatif et le contour intonatif sont des critères importants pour cette désambiguisation.

Keywords: dislocation; non-canonicity; surprise; questions; prosody

1. Introduction[1]

This article examines the role of prosody in the interpretation of two distinct question structures that can convey the non-canonical meaning of surprise: *qu'est-ce*

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que (e.g., *qu'est-ce que tu racontes?*, What is it you tell, 'What are you talking about?') and *c'est quoi ce NP* (e.g., *c'est quoi ce truc?*, It is what this thing, 'What is this thing'?) in French. It reports on a perception experiment seeking to determine whether prosodic cues enable listeners to differentiate between the canonical, i.e., information-seeking, construal and the non-canonical, i.e., surprise-disapproval construal of string identical *qu'est-ce que* questions and *c'est quoi ce NP* questions. It aims to contribute to a better understanding of the role of prosody in the profiling of questioning speech acts. It is argued that a surprise construal and an information-seeking construal can be distinguished based on prosodic cues. More specifically, a longer duration (in time) of the sentence and a longer duration of the question word are associated with surprise questions. However, this result is reported to be more reliable in the case of *c'est quoi ce NP*, which turns out to be a more conventionalized surprisal construction than *qu'est-ce que* questions. First, the theoretical background regarding non-canonical questions is presented in Section 2. Section 3 is devoted to the experimental design of the perception study. Section 4 presents the results of the experiment. Section 5 provides a discussion of those results.

2. Background

In the classical philosophical approach to speech acts (Searle, 1969), questions are categorized as directives that have the illocutionary force of requesting information from the addressee. A canonical question is an information-seeking question (ISQ) asked by an ignorant speaker who expects the addressee to be knowledgeable. The illocutionary force of a canonical question matches the interrogative clause type.[2] More recently, Farkas (2022, p. 297) refined this definition by associating canonical questions with the following default contextual assumptions made by the discourse participants: speaker ignorance, addressee competence, addressee compliance and issue resolution goal. In a canonical information seeking act, the speaker does not know the answer and assumes the addressee knows the missing information. The issue that is raised is expected to be resolved in the immediate future: "the act of placing an issue on the Table steers the conversation towards a state in which the issue is resolved, as a result of the speech act" (Farkas, 2022, p. 325). A non-canonical question arises when these default assumptions are overridden by a special context or markers that induce special discourse effects. Non-canonical questions have a range of functions that deviate from the information-seeking one. They may introduce bias, a non-neutral epistemic state (either total ignorance or full knowledge in the case of rhetorical questions), or the speaker's emotional state (see Trotzke (2023) for a comprehensive study of all types of non-canonical questions). They are traditionally viewed as indirect speech acts (Celle, 2018) and their form and prosody are expected to differ from those of canonical questions. Non-canonical questions typically highlight an element in the information structure and convey the speaker's attitude, which may be reflected in marked word order, marked

[2]However, from a linguistic viewpoint, it is questionable whether such a correspondence actually exists. Siemund (2018, p. 15) thus points out that the three major clause types – i.e., declarative, interrogative and imperative – may be mapped onto multiple illocutionary forces, giving rise to indirect speech acts. Crosslinguistically, this correspondence is even more problematic when it comes to minor clause types (exclamatives, optatives, hortatives, prohibitives).

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wh-elements, special modal particles (Trotzke, 2023) or other "indicators of indirectness" (Meibauer, 2019). Recent studies suggest that far from solely relying on context and conversational implicature, the pairing between certain forms and their non-canonical meaning may result from a "natural convention" (Simons & Zollman, 2019) derived from pragmatic competence.

In French, speakers have a choice between a wide range of wh-interrogatives to ask a question. A *what* question may be formed either with the interrogative particle *est-ce que* adjoined to the interrogative *que* word (*qu'est-ce que tu racontes?*, What is it you tell, 'What are you talking about?') or using an in situ declarative question (Beyssade, 2006, p. 181) followed by a right dislocation (*c'est quoi ce projet?,* It is what this project, 'What is this project about?'). A third option would be an interrogative marked by subject clitic-verb inversion (*Que racontes-tu?*, What tell you, 'What are you talking about?', possibly followed by a right dislocation (*Qu'est-ce ce projet?*, What is this project, 'What is this project about?'), but this is uncommon in spoken language. Several studies (Blanche-Benveniste (1997), Boucher (2010b), Coveney (2012), Druetta (2018) among others) have pointed out that the subject clitic-verb inversion structure has been gradually replaced by the *qu'est-ce que* question and the in situ question, which both exhibit the preferred word order in French, i.e., SV(O). We further argue that these questions may both be used either canonically to ask for information or non-canonically to indicate the speaker's surprise and disapproval, meaning 'What the heck are you talking about?' and 'What the hell is this project about?'.

Turning to the syntax-prosody interface, one might suggest that certain prosodic patterns coupled with certain sentence structures contribute to the conventionalization of non-canonical questions, rather than the expression of secondary meaning through indirect speech acts. Surprise questions (SQs)[3] are a case in point. They emerge as a question type in its own right not only syntactically but also prosodically in languages where the same syntax may be used in canonical and non-canonical questions.[4] In Estonian, for instance, prosody allows differentiating between string-identical interrogative sentences that may either express surprise or seek information (Asu et al., 2023). SQs are characterized by enhanced prosody that conveys both surprise, i.e., emotional expressivity (Celle & Pélissier, 2022) and non-canonicity, i.e., the non-information-seeking function. Asu et al. (2023) argue that emotional expressivity is emphatically realized by a longer duration and a wider pitch range, while non-canonicity is reflected through lower mean, initial and final pitch and creaky voice. They also point out that prosody

[3]In this article 'surprise questions' is short for 'surprise disapproval questions', as originally coined by Obenauer (2004, 2005, 2006).

[4]In certain languages, the distinction between ISQs and SQs may be syntactically marked. In Bellunese dialects, for instance, different *what*-words are in complementary distribution to encode either ISQs or 'surprise-disapproval questions' with a *why*-like meaning. See Obenauer (2004, 2005, 2006) and Munaro & Obenauer (1999, 2002). French does have a *why*-like non-argumental use of *qu'est-ce que* (for example, *qu'est-ce que vous rigolez là-bas?* 'What are you doing laughing out there?', 'Why are you laughing out there?') in which syntax is sufficient to assign a surprise construal (see Dekhissi (2016), Celle and Pélissier (2022) and Celle (2023)). In this article, however, our focus is on the prosody of string-identical ISQs and SQs, so as to determine if duration is enough to tell them apart including when the syntax is compatible with either reading.

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signals a characteristic information structure by marking counterexpectation with a focal accent.

In French as well, prosody allows differentiating between string-identical SQs and ISQs. As shown in Celle and Pélissier (2022)'s production experiment, *qu'est-ce que* questions and *c'est quoi ce NP* (*it is what this* NP, that is, an in situ question with a right dislocation) exhibit different prosodic features when elicited to express surprise or to request information. While ISQs are characterized by a rising final contour, this is not the case for SQs, which do not seek information but request an explanation for a surprising phenomenon that is put in focus by the wh-word. In SQs, the speaker's epistemic and affective state is caused by some state of affairs that contradicts their expectations. As in Estonian, lengthening and a slower speech rate have been identified as crucial for marking expressivity and non-canonicity.

This article investigates how prosody helps the hearer to recognize the speaker's intentions. It reports on a perception experiment based on string-identical questions with *c'est quoi ce* NP and with *qu'est-ce que* that participants had to judge. In other words, participants had to rely on prosodic cues such as length and type of contours to identify either the non-emotional information-seeking intent or the underlying expression of surprise. In the latter case, this inferential process amounts to decoding expressed vocal cues, as happens in the process of emotion communication (Scherer et al., 2011). In the literature, accuracy scores in the decoding of emotions are reported to be higher in nonlinguistic emblematic expressions (such as *yuck!* expressing disgust) or vocal bursts than in speech-embedded emotion expressions, except in the case of surprise (Hawk et al., 2009). Indeed, previous studies on surprise have shown that effortful prosodic features such as expanded pitch range and pitch level trigger an interpretation of surprise in cue words (Lai, 2009). However, Lai (2009) also argues that speech-embedded prosody is not sufficient to interpret these cue words as expressing surprise without context. Furthermore, *right* and *really*, as isolated cue words, do not pattern alike, which she puts down to the inherent interrogative semantics of *really*, as opposed to *right*. This indicates that the prosodic surprise features strengthen the questioning meaning when it is already semantically encoded. Interestingly, her findings suggest a semantic correlation between the surprise and information seeking ratings. In and of themselves, the prosodic correlates of surprise are not sufficient to lead to the perception of questioning. With an underlying questioning semantics, however, questioning is strengthened by surprise prosodic features.

Based on these findings, we hypothesize that prosodic cues are a valid indicator to decode SQs and ISQs, all the more so as the sense of questioning is present in all of our stimuli. Although not information-seeking, SQs are biased questions (Celle & Pélissier, 2022) that do request an explanation for what is deemed contrary to the speaker's expectations.[5]

[5]As our focus is on how prosody can help to disambiguate between ambiguous string-identical questions, questions where the post-focal entity coincides with a negatively-connotated noun or a figurative noun were not considered. These questions are not ambiguous (such as *C'est quoi ce con?* 'It is what this prick' *What a prick!* or *C'est quoi cette embrouille?* 'It is what this confusion?' *What's all this confusion?*) and conventionally express the speaker's negative evaluation of a state of affairs that violates their expectations. As explained in Celle (2023), a negatively-connotated or figurative noun in post-focal position precludes the referential reading of *quoi*, which blocks the information-seeking reading.

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3. Methods

Participants

Forty-seven participants took part in the experiment at the end of 2021, all with French as a native language, with ages ranging from 19 to 61 (mean: 23.77, median: 21, SD: 7.76). All were residents in Ile-de-France, i.e., in the Paris region. All had normal or corrected to normal vision and audition. Forty-four participants described themselves as bilinguals, i.e., speaking English above a B2 level. Fifteen of the participants grew up with other languages, with a range of various European and non-Indo-European languages.

Materials

Stimuli design: The 24 pairs of sentences from a previous production experiment (Celle & Pélissier, 2022) were used, i.e., 12 pairs of string-identical SQs and ISQs with *qu'est-ce que* and 12 pairs with *c'est quoi ce* NP. As the goal of this experiment was to see whether listeners could rely on prosodic cues produced by speakers to differentiate between the canonical and non-canonical interpretation of the sentence, we used the recordings obtained from the production experiment instead of having the stimuli recorded by a trained speaker. This guarantees that our results are not the product of the trained speaker making an overt difference between the two conditions during the recording phase, but reflect perception of what speakers produce (more) naturally.[6] The production experiment yielded recordings from 19 French speakers who each recorded three times half the material (each sentence was only recorded in its ISQ ***or*** SQ version). For the perception experiment, we chose to have two repetitions of each item in each condition (i.e., 2 repetitions of each of the 12 pairs with *C'est quoi* and 12 pairs with *Qu'est-ce que*), yielding a total of 96 stimuli to select. The full list of stimuli is available in the Appendix.

The selection procedure for the specific items to be used as stimuli went as follows. First, all male speakers were removed from the pool to guarantee more harmony in the stimuli.[7] Second, the first author of this article pre-selected recordings from the production experiment that i) corresponded to the expected meaning of the item and ii) were clear and of the best quality possible, with a limit of five recordings per item. After this first selection phase, some speakers from the original experiment were left with just one recording (participants 10 and 15) due to a poorer quality of their recordings. We additionally removed one speaker who did not have an adequate recording of one of the items, which left us with 12 speakers. One recording per condition was then selected by the second author of this article for each item based on the pre-selection made by the first author, according to the following constraints: (1) each speaker must contribute two recordings, one per condition (ISQ/SQ), (2) those two recordings cannot be from the same item. For example, if a recording from speaker 13 was selected for the ISQ interpretation of item 1 of the *C'est quoi* set, then this speaker could not contribute the recording of

[6]Although note that this was not obtained in a natural setting but in a production experiment, where participants are still relatively likely to emphasize the prosodic contrast more than in a natural conversation.

[7]Significant cross-gender differences have been found for several prosodic parameters, in particular regarding f0 (see e.g. Pépiot (2014)).

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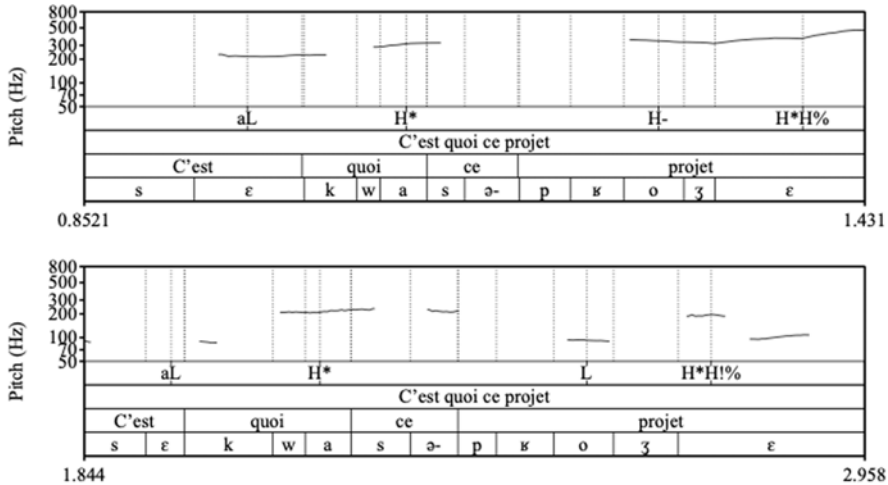


Figure 1. Example 1: F0 contours for ISQ reading (above) and SQ reading (below) of the sentence "*C'est quoi ce projet?*" 'What is this project?'.

the SQ interpretation of that same item. As we chose two recordings per item condition, this means that in the final set of stimuli, we have a total of eight sentences per speaker, two for an ISQ and two for an SQ for each marker, all from different item pairs.

Acoustic analysis: We then proceeded to an acoustic analysis of duration and pitch of these 96 items. We used the Polytonia (Mertens, 2021) script for Praat (Boersma & Weenink, 2016) to perform an acoustico-perceptual annotation of tones. The resulting tonal analyses were then translated into ToBI annotation, following the principles of French prosodic grammar (Delais-Roussarie et al., 2015): generally, one tone is assigned per content word, unless perceptual grouping with the following material is evident. In *c'est quoi* constructions, *quoi* forms a content word and carries a pitch accent, and the following NP also bears a pitch accent, followed by a final boundary tone. In our *qu'est-ce que* constructions, the correspondence between grammatical forms and prosodic features is more complex since the sentences can be longer. Finally, we corrected detection and annotation errors by carefully listening to and systematically inspecting the F0 contour, especially in cases where laughter or devoicing caused pitch-tracking failures. Examples of F0 contours can be seen in Figures 1 and 2 below.

The analysis showed that duration is a significant prosodic cue that allows differentiating surprise questions from information seeking questions, SQs being longer that ISQs for both constructions (497 vs 350 ms; $\beta = 0.15$, $SE = 0.29$, $t(30) = 5.11$, $p < .0001$ for *c'est quoi* constructions and 390 vs 295 ms; $\beta = 0.10$, $SE = 0.25$, $t(26) = 3.79$, $p < .001$ for *qu'est-ce que* constructions). While some variability is observed, rising contours appear in ISQs while the contours associated with SQs are falling (L*L%), especially on the final word.[8] In particular, there were

[8]See OSF files for details: https://osf.io/qawms/?view_only=345de1c1c76e446984407c0e48434b99

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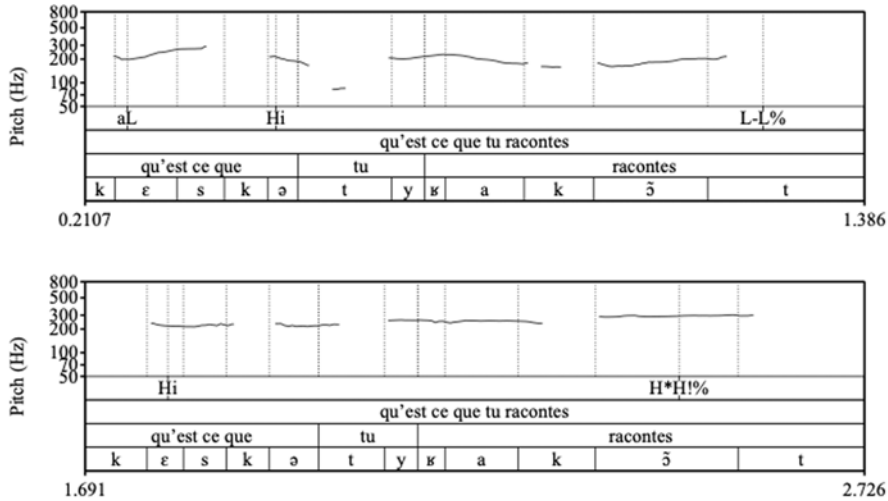


Figure 2. Example 2: F0 contours and segmentation for ISQ reading (above) and SQ reading (below) of the sentence "*Qu'est-ce que tu racontes?*" 'What are you saying?'.

more low-high contours on *c'est quoi* for ISQs than SQs ($\chi^2(4) = 12.01$, $p = .017$;[9] standardized residuals (SR) = |3.25|,[10] 23 vs. 12 occurrences) and more high (HH*) and falling (HL*) contours for SQs (respective standardized residuals: |2.10| with 6 vs. 1 occurrences and |2.13| with 4 vs 0 occurrences). Contours on the final noun were significantly different, with more rising contours for ISQs ($\chi^2 = 27.42$, $p < .0001$, SR = |3.47|) and more falling contours for SQs (SR = |3.40|). For *qu'est-ce que*, the analysis of the contours on the question word showed a significant effect of condition ($\chi^2 = 10.03$, $p = .025$) with more falling contours (HL) for surprise than for information (SR = |2.06|). The difference between conditions was also significant on the final contour ($\chi^2 = 25.19$, $p < .0001$), with more rising contours for ISQs (SR = |3.43|, 11vs. 1 occurrence) and falling contours for SQs (SR = |3.42|, 16 vs. 4 occurrences).

List preparation: These 96 items were then used to constitute four different lists in the following manner. Each list contained both conditions of each pair for both markers (i.e., participants heard all the conditions), but each item was presented three times (twice in the same condition, once in a different condition) to prevent the development of response strategies by the participants, in three different voices.

[9]A chi-square test was run to test whether the proportion of stimuli with each contour differed between the two sentence conditions (ISQs vs SQs). A significant test indicates that there are differences in the contours between the two. As there were cells with very few items (i.e., very few to no sentences occurring with a given contour in a given condition), we used a chi-square test with a Monte Carlo simulation to improve reliability of the results.

[10]A standardized residuals post-test was conducted to check on which contours the two conditions differed. In this test, an absolute value of residuals superior to 2 indicates that the cell contributes significantly to the effect, and therefore, that there is a significant difference between ISQs and SQs on this contour.

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This means that only 72 of the 96 stimuli were presented in a given list. Which condition was repeated was counterbalanced across lists as well as specific recordings (i.e., if list A contained item '*c'est quoi* Item 1' in its ISQ version twice and its SQ version once, then list B contained '*c'est quoi* Item 1' in its SQ version twice and once in its ISQ version). The remaining two lists served to counterbalance which of the two recordings was used for the condition presented only once. Six filler items from the original experiment, whose interpretation was constrained by syntax (i.e., more canonical questions and exclamatives), were also included (e.g., "*Quelle maison il a achetée?*" 'What house did he buy?' or "*Quelle femme il a épousée!*", 'What a woman he married!'). Each filler was presented in both conditions to the participants, yielding 12 additional stimuli per list, each recorded by a different speaker. The fillers were the same across all lists. Each of the four lists thus contained a total of 84 stimuli.

Procedure

The experiment was run online with PCIbex (Zehr & Schwartz, 2018), an interface that provides tools to run online experiments. Participants were instructed (in French) to listen to a sentence once and then decide on the intention of the speaker between an information request and expressing surprise (binary choice). Instructions in French are available in the Appendix. Participants answered by using a key on the keyboard or the mouse. No response time was collected.[11] The experiment started with four practice sentences with a different marker from the experimental sentences (*Quel*) and which were either questions or exclamatives, based on their prosody (e.g., *Quel manteau tu as choisi,* 'What coat did you choose?/ What a coat you chose!'). Participants then responded to the 84 items of the list presented in a randomised order to guarantee the absence of response strategies. Distribution of participants across lists was done automatically by PCIbex. The whole experiment took between 20 and 30 minutes to complete. No compensation was offered to participants.

Statistical analyses

All analyses were carried out using R v. 4.2.1 (R Core Team, 2020) and package lme4 v. 1.1.31 (Bates et al., 2015).

The dependent variable was accuracy, i.e., whether participants chose the expected meaning of the item (information-seeking question or surprise), coded as a binary variable (0: unexpected answer, 1: expected answer). The accuracy data was analysed with a generalized linear mixed effect model (glmer() function), with a binomial family and a logit link. For each dependent variable of interest, a model was first constructed with the following contrast-coded factors and their interactions as fixed effects: condition (ISQ: −0.5 vs. SQ: 0.5) and question word

[11]As the experiment was run online, and the mouse could be used to answer, it was not possible to control response time, which was not collected. However, as pointed out by an anonymous reviewer, the response times could be interesting to investigate, as non-canonical speech acts involve slower processing (Trotzke & Reimer, 2023).

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(Q-word) (*c'est quoi*: −0.5 vs *qu'est-ce que*: 0.5). The random effects structure always included an intercept by participant, an intercept by item, and an intercept by speaker (of the stimulus) to account for variability in production. A random slope for condition by participant was added when relevant unless it led to singularity issues. To solve convergence issues, the Bobyqa optimizer was used and the maximal number of iterations was increased to 20,000 (Powell, 2009). We used an alpha level of .05 for determining significance. The significance of main effects and interactions was assessed by model comparisons with the anova() function. Estimates are reported from a summary of the model. 95% confidence intervals were calculated using the Wald method with the confint.merMod() function of lme4. The $R^2_{Marginal}$ and $R^2_{Conditional}$, which summarize respectively the explanatory power of the fixed-effects structure and the combined explanatory power of the fixed and random effects structure, were calculated using the r.squaredGLMM() function of the MuMIn package version 1.47.1 (Barton, 2020). For binomial models, the theoretical R^2 are reported. Follow-up tests were carried out with estimated marginal means and trends with the emmeans() function of the package emmeans (Lenth, 2017) and interaction plots were plotted with the interactions package (Long, 2019). *P* values were adjusted with the Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995) to correct for multiple comparisons. Model fit was evaluated with the DHARMa package (Hartig, 2024). A detailed report of the analyses including model fit and residual tests is available here: https://osf.io/qawms/overview?view_only=09b5d28da9ca47b6b74c76a7c4b6b2aa.

4. Results

General performance

Participants performed above chance on critical stimuli ($M = 75.71\%$, $SD = 7.00\%$), as confirmed by a one-sided t-test ($t(46) = 25.14$, $p_{adj} < .0001$, 95% CI = [73.99, Inf]), demonstrating a reliable ability to distinguish between SQs and ISQs without any contextual help (Cohen's d = 3.67, i.e., an effect considered "large"). There was a significant effect of condition (ISQ vs. SQ) on the accuracy in the perception task ($\beta = -1.01$, 95% CI [−1.64; −0.37], $z = -3.12$, $p_{adj} = 0.003$, $R^2_{Marginal} = 0.053$, $R^2_{Conditional} = 0.42$), as participants were more accurate on ISQs ($M = 81.97\%$, $SD = 10.76$) than on SQs ($M = 69.44\%$, $SD = 10.55$).

Link with production

To see whether the results of the production experiment reported in Celle and Pélissier (2022) related to performance in perception, we looked at whether the duration of the question word, the contour of the question word and the contour on the final word influenced accuracy in recognition. We examined the duration of the full sentences, and then the duration of each question word separately. For the following models, the effect of condition is not investigated as it is already significant in the full model presented above. Only the results relating to the duration in production and contours are reported in detail.

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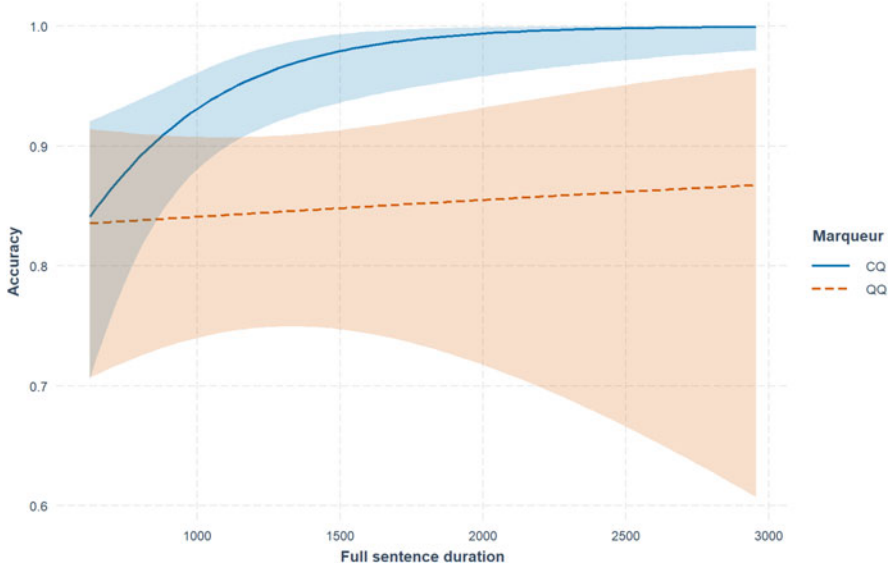


Figure 3. Predicted accuracy in discrimination between SQs and ISQs as a function of full sentence duration for each question word. Note that this graph reflects the results predicted by the generalized linear model and not the raw data. The x axis shows the duration of the full sentence in the auditory stimuli used in the experiment, and the y axis shows the accuracy predicted by the model based on the results of the perception experiment, taking into account fixed and random effects. The confidence interval is shown as a filled area around the slope.

Full sentences

The interaction between duration of the full sentence and question word was significant ($\beta = -0.96$, 95% CI [−1.72; −0.19], $z = -2.47$, $p_{adj} = .015$, $R^2_{Marginal} = 0.08$, $R^2_{Conditional} = 0.42$): the effect of duration was only significant with the *c'est quoi* marker ($\beta = 0.64$, 95% CI [0.21; 1.07], $z = 2.94$, $p_{adj} = .004$), not with *qu'est-ce que* ($p = .75$). As can be seen in Figure 3, a longer total duration of the sentence was associated with more accurate categorizations of the sentence, but only with *c'est quoi*. This shows that for the *c'est quoi* sentences, the longer the full sentence was, the more likely participants were to classify it correctly, regardless of whether it was an ISQ or an SQ.

C'est quoi

We next aimed to investigate the role of prosodic parameters (duration and contour of the question word, contour of the Final noun) on Accuracy depending on condition (ISQ vs SQ). We ran separate analyses for duration of the question word, question word contour and final noun contour.[12]

[12]As there was considerable variability in the production of the contours, we chose to exclude those that were only produced a handful of times. To avoid extra loss of data, a model was run separately for the duration of the question word (full dataset), the question word contour and the final noun contour (the latter two also had duration as a fixed effect to account for that variability). All models included a random

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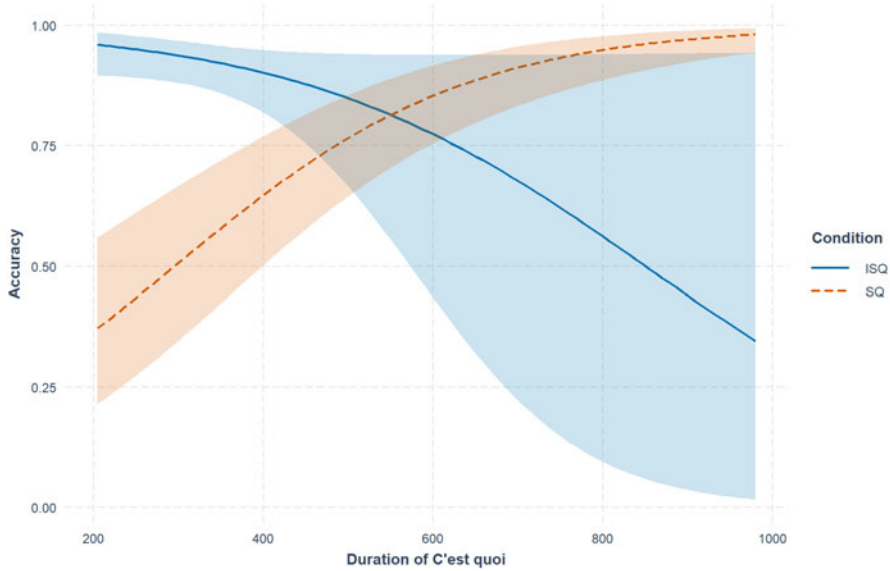


Figure 4. Predicted accuracy in identification of ISQs and SQs as a function of the duration of *C'est quoi*. Note that this graph reflects the results predicted by the generalized linear model and not the raw data. The x axis shows the duration of the question word while the y axis shows the Accuracy in perception predicted by the model based on the results of the experiments. The confidence interval is represented by a filled area around the slope. This shows that accuracy for SQs increases with the duration of the marker, while performance for ISQs decreases.

The analyses of the duration of *c'est quoi* revealed a significant interaction between condition and duration of the question word ($\beta = 1.62$, 95% CI [0.84; 2.39], $z = 4.08$, $p_{adj} < .001$, $R^2_{Marginal} = 0.16$, $R^2_{Conditional} = 0.41$). The interaction plot (see Figure 4) shows that when the duration of the question word was longer, participants performed better on ISQs and worse on SQs. This suggests that participants tended to classify utterances with a longer question word as SQs, confirming that a longer duration of the question word is associated with an SQ interpretation. Model comparisons also revealed a main effect of duration of *c'est quoi* (χ^2 (1) = 37.38, $p_{adj} < .001$) and condition (χ^2 (1) = 49.38, $p_{adj} < .001$).

The next analysis tested the effect of the contour of *c'est quoi*. As the only contour that occurred on several items in both ISQs and SQs was a low start followed by a high pitch accent (aL H*; 23 ISQ items, 12 SQs), two analyses were run: one limited to the aL H* contour, and one limited to the SQs to investigate the more variable contours occurring in that condition. As the acoustic analyses on the stimuli showed that the aL H* contour was reliably associated with ISQs (see above *Materials – acoustic analysis of stimuli*), we expected an effect of condition showing that participants performed better in the ISQ than SQ condition with this contour. Analyses confirmed this hypothesis ($\beta = -1.72$, 95% CI [−2.25; −1.18], $z = -6.24$,

intercept for participant, item, and speaker (to account for speaker variability in the production of the contours).

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$p_{adj} < .001$, $R^2_{Marginal} = 0.13$, $R^2_{Conditional} = 0.36$) – participants performed better with ISQs (88.20%) than SQs (73.91%) with this contour. The second analysis on SQs[13] did not reveal a significant effect of contour – participants were not more accurate in classifying SQs when the contour was one of those significantly associated with that category (i.e., H H* or H L*) compared to the contour associated with ISQ (i.e., aL H*).

A final analysis tested the effect of the final noun contour. Two contours were found to differ significantly between ISQs and SQs: a rising contour (H*H%) was associated with ISQs and a falling contour (L*L%) was associated with SQs. The effect of the contour was tested separately for each condition as there was a large imbalance in the number of stimuli with each contour between ISQs and SQs.[14] For ISQs, the effect of contour was significant ($\beta = -1.02$, 95% CI [−1.68; −0.36], $z = -3.02$, $p_{adj} = .005$, $R^2_{Marginal} = 0.05$, $R^2_{Conditional} = 0.29$[15]): participants were more accurate to classify utterances as ISQs when they followed the rising contour (92.98 %) than any other one (83.30 %). For SQs, the effect of contour was also significant ($\beta = 1.09$, 95% CI [0.59; 1.59], $z = 4.29$, $p_{adj} < .001$, $R^2_{Marginal} = 0.29$, $R^2_{Conditional} = 0.64$). However, those results were unexpected, as participants were more accurate in classifying SQs when they followed another contour (so one not significantly associated with SQs in our dataset, 81.70%) than the contour associated with SQs (falling, 59.0%).[16] This suggests that, despite the fact that a falling contour was found to be significantly associated with SQs, it was not interpreted as a reliable cue by the listeners.

To summarize, participants were more accurate classifying SQs when the question word was longer, and more accurate classifying ISQs when the utterance followed a rising contour on the question word and on the final noun. This suggests that listeners used both contour and duration cues to distinguish between ISQs and SQs with *c'est quoi*.

Qu'est-ce que

We followed the same procedure as with *c'est quoi*. The first model included as fixed effects the condition (ISQ vs. SQ), the duration of the question word, and their interaction. This model revealed a significant interaction between condition and

[13]As one of the contours occurring with SQs did not occur with ISQs, a separate analysis was run on SQs only. The selected contours were the low start followed by high pitch accent (aL H*) as well as the two contours that were found to be reliably associated with SQs: a high-anchored accentual phrase (HH*) and a falling accent (HL*) (see above *Materials – acoustic analysis of stimuli*). The contours were coded with a treatment contrast, with a L H* as the baseline.

[14]For each condition, all contours that were not the significant contour (rising for ISQs and falling for SQs) were coded as "Other" – therefore comparing Accuracy in the presence of the contour most associated with the condition vs. another contour.

[15]Given that the model with the three random intercepts (Participant, Item, Speaker) was singular, the random intercept for Speaker was removed as its contribution to the variance explained was 0.

[16]Note that these results should however be taken with caution, as the QQ-plot of the residuals flagged mild quantile deviations. However, tests for overdispersion and zero inflation were not significant, and Kolmogorov–Smirnov tests did not indicate systematic deviations from the expected distribution of residuals. This suggests that the warning reflects sample imbalance rather than a substantive model misspecification. The model was therefore retained as the best-fitting specification.

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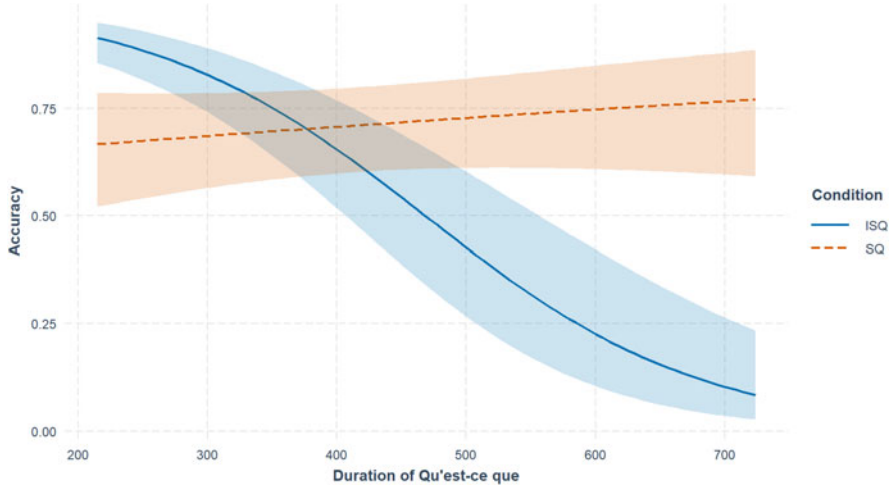


Figure 5. Accuracy in identification of ISQs and SQs as a function of the duration of *"qu'est-ce que"*. Note that this graph reflects the results predicted by the generalized linear model and not the raw data. The x axis shows the duration of the question word while the y axis shows the Accuracy in perception predicted by the model based on the results of the experiment. The confidence interval is represented by a filled area around the slope. This shows that accuracy for ISQs decreases with the duration of the marker, while performance for SQs slightly increases.

duration ($\beta = 1.20$, 95% CI [0.86; 1.53], $z = 7.03$, $p_{adj} < .001$, $R^2_{Marginal} = 0.11$, $R^2_{Conditional} = 0.31$). Figure 5 shows that, indeed, accuracy dropped when the duration of *qu'est-ce que* increased. This means that ISQs with a longer question word tended to be falsely interpreted as SQs. In our production experiment, a lengthening of *qu'est-ce* was associated with SQs, so this suggests that duration may be a strong cue to SQ interpretation.

The second analysis investigated the role of the question word contour, focusing on three contours: low followed by early rise (aL Hi), high start (Hi), and falling (HL) (the latter one found to be significantly associated with SQs, see above *Materials – acoustic analysis of stimuli*).[17] Model comparisons revealed a significant interaction between condition and contour (χ^2 (2) = 12.69, $p_{adj} = .003$; $R^2_{Marginal} = 0.15$, $R^2_{Conditional} = 0.32$). Post-hoc analyses with emmeans() showed that, for SQs, accuracy was better when the question word followed a high start (Hi) contour compared to a low-high (aL Hi) contrast (Est. = −1.08, SE = 0.29, $z = -3.80$, $p_{adj} = .001$), but participants were not more accurate with the falling contrast, despite its association with SQs in production. Additionally, for the aL Hi contrast, participants performed better with ISQs (86.18%) than SQs (55.34%), suggesting that this cue is possibly interpreted as a marker of information-seeking question, even though it was not reliably associated with this condition in the production of our stimuli (4 ISQs had this contour but 8 SQs).

[17]There were no occurrences of stimuli with an initial low contour (aL L) in the SQ condition, so that specific contour was excluded from analyses. The effect of duration was kept in the model as it was shown to have an effect (see above).

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The third analyses focused on the effect of the contour of the final word on accuracy.[18] The model for ISQs did not reveal an effect of the final contour (χ^2 (1) = 0.44, p_{adj} = .50), nor did the model for SQs (χ^2 (1) = 0.55, p_{adj} = .50). This suggests that the final contour in the *qu'est-ce que* sentences was not used as a cue to disambiguate between ISQ and SQ interpretations.

To summarize, participants were more accurate classifying SQs when the question word was longer. ISQs were more accurately categorized when the question word followed a rising contour. This suggests that listeners used both contour and duration cues to distinguish between ISQs and SQs with *qu'est-ce que*, like with *c'est quoi*.

5. Discussion

Overall, the participants performed above chance on critical stimuli, which suggests that prosody is a valid cue to distinguish between ISQs and SQs. However, participants were more accurate with ISQs. This gives credence to the idea that canonical questions can be self-containedly interpreted as such, while the surprise construal needs to be supported by an additional adequate context (see Lai (2009)). Interestingly, participants seem to rely on different cues to identify each interpretation: a rising contour on the question word (and, for *c'est quoi ce NP*, on the final noun) is associated with an ISQ interpretation, while a lengthening of the question word signals a surprise interpretation. Duration thus seems to be a prosodic cue that is reliably associated with surprise. Lengthening of the interrogative word correlates with a better performance on SQs but a worse performance on ISQs, as some ISQs were falsely construed as SQs. In the absence of context, lengthening is thus interpreted as a surprise cue by default, thus altering the threshold at which a question is perceived as surprising. This finding corroborates Jakobson (1960)'s claim that "emphatic prolongation" is a correlate of "emotive speech". It also concurs with more recent studies on the effects of lengthening on wh-words (Trotzke & Turco, 2015).

Note, however, that the two structures investigated do not fare evenly in this respect. Lengthening plays a significant role in decoding *c'est quoi ce NP* as an SQ both at the level of the question word and the full sentence. One might wonder why an in situ question with a right dislocation is more reliably interpreted as an SQ than a *qu'est-ce que* question. Our contention is that the surprise reading relies on a combination of syntactic, information-structural and prosodic features that are more easily perceived in the *c'est quoi ce NP* construction. As argued by Lefeuvre (2015, p. 49), while left dislocations generally appear before statements, right dislocations tend to appear after interrogative sentences for information-structural reasons. An in situ question followed by a right dislocation puts the question word into focus. The post-focal entity appears in the right periphery of the clause "simply

[18]Like with *c'est quoi*, each condition was characterized by a majority contour (rising for ISQs and falling for SQs) and very few occurrences of many other contours. As a result, we followed the same procedure as above, and ran analyses separately by conditions, coding the majority contour as one level and combining the other contours into an "Other" level.

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specifying what is to be elucidated."[19] By making the focus salient, this construction enables the hearer to reliably interpret the question as either an ISQ or an SQ depending on the duration of the question word.

In the in situ question, *quoi* is a strong interrogative pronoun that occurs in a metrically-strong position, the primary accent on *quoi* marking the right boundary of the interrogative phrase. This demarcation separates the interrogative phrase from the dislocated constituent at three levels: i) at the syntactic level, the right dislocated constituent is separated from the clause structure; ii) at the information-structural level, focus and ground are also distinguished (see below). The lengthening of *quoi* corresponds to a metrical accent assigned to the last syllable of the interrogative phrase;[20] iii) at the illocutionary level, the interpretation of the clause as a question comes first, the identification of the subject the question is about being delayed.

The choice of an in situ question has an impact on the nature of the focus. The focus is a narrow focus, presenting only a constituent of the utterance as new information. Through the equative structure, the subject clitic pronoun *c'* is cataphorically identified with the dislocated constituent. The latter consists of an NP in which the demonstrative designates an entity that is accessible to the speech participants. In other words, the referent belongs to the ground. It corresponds to background information. As pointed out by Stéfani & Horlacher (2017), the right dislocation is typically used to designate a referent that is immediately perceived. Clearly, the focus is not on the existence of that entity, but on its identification.

(1) C'est quoi ce truc?
It is what this thing[21]
(a) 'What is this thing?'
(b) 'What the hell is that stuff?' 'What is that stuff doing here?'

The partition between narrow focus and ground enables the hearer to better perceive what is in focus. In the information-seeking construal (a), an answer is expected to identify the designated referent. In the surprise reading (b), the longer duration of the interrogative word allows the hearer to infer that the presence of the designated referent in the situational context is counterexpectational. Lengthening is motivated by a clash between the speaker's expectations ("That thing is not expected to be here") and contextual evidence ("That thing is here"). There may be something odd about the referent or its location, which is reflected in the enhanced prosody of the focus. By using an evaluative right dislocation, the speaker has engaged in an

[19]Our translation of "simple précision de ce qui doit être élucidé."

[20]Importantly, French does not have lexical stress. Metrical stress is assigned at phrasal level, more precisely at the right edge of a phrase (Beyssade et al., 2004). Beyssade et al. (2004, p. 467) point out that "the duration of a syllable bearing a primary accent is at least 20% longer than the duration of its unaccented counterpart". Crucially, the syllable that is affected by lengthening in "*c'est quoi ce NP*" SQs is the syllable that is stressed in ISQs. This difference in length level might explain why it is reliably perceived as either information-seeking or surprise-expressing.

[21]Following the Leipzig Glossing Rules, the interlinear gloss in (1), (2) and (3) reflects word-by-word correspondence, not a grammatical translation.

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"assessment activity" (Stéfani & Horlacher, 2017) and the question calls for an explanation.

The insertion of the interrogative particle *est-ce que* in fronted position in the interrogative phrase *qu'est-ce que* is an alternative construction to ask a *what*-question. Systematic perusal of various corpora of spoken and literary French by Lefeuvre (2015) reveals that the in situ construction (*c'est quoi* + right dislocation) is preferred over *qu'est-ce que c'est* to ask about the identity of a predicative element. Across corpora, the *c'est quoi* construction appears to be ten times more frequent than the *qu'est-ce que* construction. Lefeuvre found the earliest attestations of the *c'est quoi* construction to date to the 1920s and concludes that the in situ construction has established itself as the most common way of asking a question about a predicative element.

The *c'est quoi* question thus emerges as a new construction that is gradually replacing *qu'est-ce que*. Lefeuvre's corpus-based results are in line with Boucher's (2010b, 2010a) claims that phrase-final stress placement in French results in the weakening of the initial position in interrogatives. At the information-structural level, focus marking similarly requires both prosodic phrasing and syntactic restructuring, as it cannot be marked with pitch accents. As argued by Féry (2001, p. 2), "in French, due to the absence of lexical stress, the phonological counterpart of focus is different from that of many other European languages."

Although the weak interrogative word (*que*) is reinforced by *est-ce que* in *qu'est-ce que*, fronted *qu'est-ce que* does not allow making the focus structure salient in the same way as *c'est quoi* does. Firstly, with *qu'est-ce que* the focus domain may be either broad (2), presenting the whole utterance as new information, or narrow (3):

(2) Qu'est-ce qui t'arrive?
What is it that you happens
(a) 'What is happening to you?'
(b) 'What the hell is happening to you?'

(3) Qu'est-ce que tu racontes?
What is it that you tell
(a) 'What are you talking about?'
(b) 'What the hell are you talking about?'

As stated by Féry (2001, p. 26), "the tonal phrasing is more clearly marked under narrow than under wide focus", which might contribute to a better performance in the perception of the difference between SQs and ISQs in (3) than in (2).

Secondly, the clause structure of *qu'est-ce que* questions does not partition focus and ground. The interrogative word scopes over the ground: in *qu'est-ce que tu racontes*, it is presupposed that "you are talking about something", while the fronted question word puts the nature of the object constituent in focus.

Therefore, the focus structure is not as prominent as in the case of *c'est quoi ce NP*, which separates the focus from the ground. This might explain why hearers are less accurate in distinguishing the *qu'est-ce que* pairs. While the long duration of the interrogative word (*quoi*) is a reliable cue to identify the focus as counterexpectational when prosodic phrasing coincides with the clausal

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boundaries, it is not sufficient if the focus domain is wider or not clearly separated from the ground.[22]

Nonetheless, listeners do consider the duration of the first syllable of *qu'est-ce que* to be meaningful. In the case of information-seeking *qu'est-ce que* questions, the shorter realization of the first syllable was significantly recognized. Longer *qu'est-ce* was falsely associated with SQs. This indicates that hearers are aware that duration is an important prosodic cue to distinguish between ISQs and SQs, even if it is not sufficient.

One might put forward another reason for the better performance of the participants in *c'est quoi* questions with longer full sentences and a longer interrogative word. Lengthening is an unambiguous prosodic cue in the case of *c'est quoi ce NP*, whereas it may signal various types of non-canonicity in the case of *qu'est-ce que*. It is therefore more reliable in the former than in the latter.

Longer *qu'est-ce* is not restricted to the surprise meaning. It may also indicate a rhetorical question.[23] Rhetorical questions are typically associated with fronted interrogatives and are also prosodically marked by lengthening in French (Beyssade & Delais-Roussarie, 2022) as in other languages such as Estonian (Asu et al., 2023), English (Dehé & Braun, 2019) or German (Braun et al., 2019).

By contrast, *c'est quoi ce NP* with a long realization of the question word can only be interpreted as an SQ. The rhetorical reading is ruled out with in situ questions (Quillard, 2001). While in situ interrogatives are compatible with echo questions, which are also marked through lengthening (Glasbergen-Plas et al., 2020), the right dislocation blocks the echo reading by drawing attention to some new referent. The anaphoric reading is excluded as soon as the resumptive pronoun *c'* is pronounced, as it cataphorically refers to a referent in the ground.[24]

This paves the way for an unambiguous surprise reading of the *c'est quoi ce NP* construction when the question word is pronounced with a long realization. This construal obtains regardless of context, which suggests that it does not depend on pragmatic inferencing. Therefore, we argue that this non-canonical surprise question should be regarded as a conventionalized form-prosody-function pairing. In the literature, a difference is generally made between two types of indirect speech acts. Building on Green (1975)'s distinction between hints and whimperative constructions in the directive use of interrogatives, Beyssade and Marandin (2006) state that speech act assignment in indirect speech acts is based either on inferences

[22]In line with Michelas and German (2020), our findings suggest that focus marking and focus interpretation involve a variety of cues.

[23]However, rhetorical questions were not included in our experiment. We would need to broaden the scope of the experiment to compare the length of interrogative sentences and interrogative words in both rhetorical and surprise questions.

[24]The expressive meaning conveyed by this construction is thus clearly different from the pragmatic value of 'explicit activation' that motivated the earliest attestations of in situ interrogatives. Larrivée (2019) shows that as in situ interrogatives have become more widely used, they have become less and less associated with reference to discourse-old information. Larrivée (2019: 114) puts this development in perspective with Meillet's (1912: 394) spiral model in language change: "The spiral model supposes that a new variable is introduced in a grammatical category to express 'intensity', a value which is lost with increased usage, calling for a new 'intense' variable to arise." We further argue that once the discourse-old, explicitly activated status is lost, as is the case with in situ interrogatives in contemporary French, a new expressive sense can arise, relying on the marked combination of the right dislocation with prosody.

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or on "grammatical (lexical or constructional) means". More recently, this distinction has been taken up to tease apart indirect speech acts from conventionalized non-canonical questions. Trotzke and Reimer (2023) argue that surprise-disapproval questions in German (e.g. Was regnet das denn jetzt?, 'Why is it raining now (of all times!)?') involve different comprehension processes than indirect requests, such as *Kannst du mir das Salz reichen?* 'Can you pass me the salt?'. In non-canonical questions, as opposed to indirect requests, the illocutionary force is encoded by the linguistic form. This leads to a more accurate interpretation, but at a higher processing cost. Furthermore, Trotzke and Reimer (2023) point out that non-canonical speech acts are processed slower than their canonical counterparts. These differences in processing might explain why there is some variation between non-canonical *qu'est-ce que* and *c'est quoi ce NP* in our results. While the combination of lengthening of the interrogative word with the right dislocation in the *c'est quoi ce NP* construction can help the hearer to accurately identify the illocutionary force of the surprise question, this comprehension process is harder with *qu'est-ce que* because it may either contradict the sentence structure in the non-argumental use, or compete with other types of non-canonicity, such as rhetoricity.

One might also argue, as suggested by an anonymous reviewer, that the significantly higher frequency of *c'est quoi* than *qu'est-ce que* across spoken corpora (Lefeuvre, 2015) facilitates the listeners' ability to better identify the pragmatic variants of *c'est quoi* through their prosody. Being more exposed to *c'est quoi* than to *qu'est-ce que* in actual communication settings, speakers become more proficient in prosodically distinguishing between the canonical and the non-canonical uses of *c'est quoi*. This difference can then result in higher entrenchment than in the case of *qu'est-ce que*. In a real world situation, speakers will also rely on context and on other lexical cues to select the right interpretation of a question. By narrowing down the focus on ambiguous string-identical questions, our perception study has shown that prosodic cues, and lengthening in particular, play a key role in the interpretation of a new form-function pairing.

6. Conclusion

The aim of our experiment was to determine if listeners can reliably use prosodic cues to distinguish between string-identical information-seeking questions and surprise questions. Results show that this is indeed the case, with listeners using cues such as the duration of the question word, its contour, and, in the case of *c'est quoi ce NP*, the contour of the final noun. Lengthening, which was previously found to be a consistent cue for surprise meanings in production (Celle & Pélissier, 2022) was also associated with surprise by the listeners, which even led to falsely interpreted cases. However, the participants performed better with the *c'est quoi ce NP* construction than with the *qu'est-ce que* question in the surprise condition. This suggests that lengthening combined with narrow focus and syntactic restructuring is a reliable cue. Under such circumstances, the surprise meaning of questions is unambiguous and the construction provides a conventionalized form-prosody-function pairing. Our results thus indicate that the prosodic cue of lengthening is particularly strong

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combined with a cluster of semantic, syntactic and information-structural properties. While corroborating Jakobson's (1960) claim that "emphatic prolongation" is a correlate of "emotive speech", our findings also suggest that the perception of expressivity relies on lengthening *in* specific constructions. This non-tonal cue thus contributes to establishing a 'new connection' (Diewald et al., 2021, pp. 89–90) between a form and expressive meaning.

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APPENDIX – List of stimuli

1. *C'est quoi*
   It is what
   'What is it?'

Pair	French sentence	English translation
1	C'est quoi ce vin rouge ?	'What (the hell) is this red wine?'
2	C'est quoi ce truc ?	'What (the hell) is this thing?'
3	C'est quoi ce style ?	'What (the hell) is this style?'
4	C'est quoi ce film ?	'What (the hell) is this film?'
5	C'est quoi ce club ?	'What (the hell) is this club?'
6	C'est quoi ce site ?	'What (the hell) is this website?'
7	C'est quoi ce régime ?	'What (the hell) is this diet?'
8	C'est quoi ce projet ?	'What (the hell) is this project?'
9	C'est quoi ce poisson ?	'What (the hell) is this fish?'
10	C'est quoi cet appareil ?	'What (the hell) is this device?'
11	C'est quoi ce message ?	'What (the hell) is this message?'
12	C'est quoi ce chapeau ?	'What (the hell) is this hat?'

2. *Qu'est-ce que*
   What is-it that
   'What'

Pair	French sentence	English translation
1	Qu'est-ce que tu racontes ?	'What (the hell) are you talking about?'
2	Qu'est-ce qui t'arrive ?	'What (the hell) is happening to you?'
3	Qu'est-ce qu'ils veulent faire un RER fribourgeois ?	'What do they want to build, a suburban railway in Fribourg?' or 'Why do they want to build a suburban railway in Fribourg?'
4	Qu'est-ce que tu racontes ce soir ?	'What will you be talking about tonight?' or 'What the hell are you talking about this evening?'
5	Qu'est-ce que tu fais dans cette classe ?	'What (the hell) are you doing in this class(room)?'
6	Qu'est-ce que tu regardes ?	'What (the hell) are you looking at?'
7	Qu'est-ce que je fais ?	'What (the hell) am I doing?' or 'What shall I do?'
8	Qu'est-ce que tu attends ?	'What (the hell) are you waiting for?'
9	Qu'est-ce que tu chantes là ?	'What are you singing there?' or 'What are you talking about?'

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10	Qu'est-ce que tu es venue faire en Provence ?	'What have you come to do in Provence?' or 'What are you doing in Provence?'
11	Qu'est-ce que tu fabriques ?	'What (the hell) are you doing?' 'What are you making?'
12	Qu'est-ce que je suis en train de faire ?	'What (the hell) am I doing?'

3. Instructions in French

Instructions before the experiment

Lors de cette expérience, vous devrez écouter des phrases et dire quelle était l'intention de la personne qui parle parmi deux possibilités (exprime-t-elle un étonnement ou demande-t-elle une information ?). Appuyez sur la touche "E" du clavier pour l'étonnement et sur la touche "I" pour l'information.

Question displayed during the experiment

"La personne exprime-t-elle son étonnement ou demande-t-elle une information ?"

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