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Experimental Evidence for the Role of Intonation in Evidential Marking

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Abstract

This paper investigates the role of intonation in the marking of directly-perceived information in Majorcan Catalan polar questions. We conducted a perception experiment in which a total of 72 participants were introduced to a set of twins who were exposed to different types of evidence for a given *p*(roposition). One twin inferred *p* based on direct sensory information (via one of the five senses), while the other had been told that *p* by a third party, that is, reported information. Participants listened to a set of discourse contexts that ended in critical stimuli with three attested combinations of particle/intonation in this variety of Catalan: (1) polar questions produced with a falling nuclear contour ¡H+L* L%; (2) polar questions headed with the particle *que* 'that' produced with ¡H+L* L%; and (3) polar questions headed with the particle *que* and produced with a rise-fall L+H* L%. After hearing the stimulus, participants had to decide which of the twins had uttered the question–the one who inferred a proposition (*p*) based on direct sensory information or the one who had been told *p* by a third party. The results show that listeners very consistently associate the *que* + L+H* L% combination with inferences drawn from direct sensory evidence as opposed to reported evidence. This shows that particles may work in tandem with intonation to convey the information source. Importantly, we show that intonation is a part of grammar that may be recruited for evidential strategies.

Keywords

Intonation, evidentiality, polar questions

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Introduction

Evidentiality refers to the source of information the speaker has for a described situation when producing an utterance. In Plungian's (2001) view, three main aspects of evidential values can be agreed upon. Evidential values may refer to information that has been perceived: (i) directly (i.e., visually); (ii) directly, but non-visually (i.e., through one of the other senses); or (iii) indirectly (i.e., the speaker has inferred the information, has reason to believe it is probable, or received it from another party) (Plungian, 2001, pp. 351–352). It is generally assumed that only some languages have grammaticalized evidentials, that is, inflectional or particle systems that have source-marking at the core of their semantics, for example languages such as Quechua, Tuyuca or Korean. In (1) this is illustrated for Quechua (Cerrón-Palomino, 2008, pp. 167–168), where the morphemes *mi* and *si* indicate how information was acquired. However, some languages instead use lexical evidential strategies, that is, they express evidentiality by means of adverbs like *supposedly* or *allegedly* in English, verbal forms like *es veu* 'it is seen' in Catalan (see (2), González, 2012) or the complementizer *que* 'that' in Spanish (as in (3), Demonte & Fernández-Soriano, 2013).

(1) (a) *Huk runa-**m** hamu-rqa-n* (direct). Quechua.
'A man came (I assert).'
(b) *Huk runa-**s** hamu-rqa-n* (indirect: reportative).
'A man came (I am told).'

(2) *S'han quedat sense llum a Girona.* **Es veu** *que hi ha nevat molt* (indirect: reportative). Catalan.
'The power is out in Girona. There must have been a lot of snow.'

(3) (a) *Oye*, ***que** el Barça ha ganado la Champions* (indirect: reportative). Spanish.
'Listen, [that] Barça has won the Champions.'
(b) ***Que** mañana no hay clase.*
'[That] tomorrow there are no classes.'
(c) (*En la cena nos llama un compañero*,) *oye **que** está nevando en el campo de vuelo.*
'At the dinner a colleague calls and says, hey it is snowing at the runway.'

Although the areas of evidentiality and epistemicity have attracted an increasing interest over the past two decades, a terminological consensus has not yet been reached. Three main views are found in the literature (Boye, 2012): those who advocate for a disjunction between the two categories (de Haan, 1999, among others), those who subscribe to an overlap between the two categories (van der Auwera & Plungian, 1998, among others) and those who favour an idea of inclusion and take one category to contain the other as a subcategory. In this last view, we find that either epistemic modality includes evidentiality as a subcategory (e.g., Palmer, 1986) or evidentiality comprises epistemic modality as a subcategory (e.g., Papafragou, 2000). For simplicity's sake, in this paper we will follow the first view, and consider epistemicity and evidentiality to be two different, though very related notions. We take evidentiality to refer to the source of the reported content, with epistemicity being related to the relationship between a speaker's belief and a given propositional content (de Haan, 2005, p. 379). There is a clear relationship, however, between epistemic and evidential expressions. Speaker certainty is typically based on some type of evidence, and often the line between evidentiality and epistemicity can be blurred (De la Mora & Maldonado, 2015).

There is a growing literature illustrating the important role played by prosody in conveying a speaker's degree of certainty about propositional content (Gravano, Benus, Hirschberg, German, & Ward, 2008 and Roseano, González, Borràs-Comes, & Prieto, 2016 for declaratives and interrogatives; Armstrong, 2015a, Armstrong & Prieto, 2015; Hara, Kawahara, & Feng, 2014; Michelas, Portes, & Champagne-Lavau, 2016; Vanrell, Mascaró, Torres-Tamarit, & Prieto 2013 for interrogatives), and thus the idea that epistemic information is signalled prosodically is less

controversial. The use of epistemic intonation in questions has also been shown to have implications for intonational development (Armstrong, 2014, 2016). Interestingly, some studies have also highlighted that prosody can serve as an evidential strategy in the marking of indirect evidence in so-called 'quotative strategies' (e.g., reported speech or discourse fragment reported directly) in different languages (Cabedo, 2007; Estellés-Arguedas, 2015; Günthner, 1999; Klewitz & Couper-Kuhlen, 1999; Mora & Álvarez, 2003). However, to our knowledge very few studies have shown that direct versus indirect evidential distinctions may be encoded through specific intonation contours. Escandell (2017) accounts for the variability in intonation contours found in Castilian Spanish polar questions by considering different evidential distinctions. Specifically, she combines two different categories: Q (unspecified sentence polarity) and Evid (source of information consisting of two values: Self and Other). The fall-rise is not specified in terms of information source. The high-rise pattern indicates that the source of the information is the speaker, whereas the rise-fall indicates the information source is some other individual. Henriksen, Armstrong and García-Amaya (2016) put forth a similar proposal for Manchego Spanish. While these authors do not use the term evidentiality per se, their analysis touches on intonational choice restricted by source-marking, proposing that L+H* H% marks a thought as speaker-attributed, while L+H* L% attributes a thought to someone other than the speaker, most often the interlocutor. Recently, Vanrell, Armstrong and Prieto (2014a) hypothesized that polar questions in Majorcan Catalan headed with the particle *que* 'that' along with the L+H* L% nuclear configuration in the Cat_ToBI system (Prieto et al., 2015) convey that the speaker inferred the proposition based on visual evidence. For instance, if a speaker sees a package with the shape of a book and subsequently asks someone whether it is a book, the particle/intonation contour combination *que* + L+H* L% (e.g., *Que és un llibre?* 'QP-It is a book?') is used. They ran a production experiment using the Discourse Completion Task (DCT), a questionnaire describing different scenarios designed to elicit a specific speech act (Blum-Kulka, House, & Kasper, 1989; see Vanrell, Feldhausen, & Astruc, accepted for a review of the work in which DCT has been applied to Romance prosody). Results showed a clear preference for the ¡H+L* L% contour (with no question particle) when information had been received based on hearsay (i.e., the information was conveyed to them by another individual). On the contrary, the *que* particle with the L+H* L% contour (henceforth QP + L+H* L%) was most commonly produced when visual direct evidence was specified in the context. In perception, however, the results were not as clear. Although stimuli with QP + L+H* L% were generally judged to be produced by someone who had visual evidence for something, they were also associated to evidence that the speaker had come to know by hearing it.

As argued in Vanrell et al. (2014a), the QP + L+H* L% combination is a construction that necessarily involves a particle *que* as well as a specific intonation contour. Surprisingly, although question particles in Catalan are rather common, to date they have received little attention. Prieto & Rigau (2007) found a substantial amount of dialectal variation in the prosodic realization and pragmatic meaning of questions headed by the particle *que* across varieties of Catalan. Thus, whereas in Rossellonese, Northern Central Catalan and Valencian Catalan, the use of *que* in questions is exclusively restricted to counter-expectational meaning, Northwestern Catalan, non-Northern Central Catalan and some Balearic varieties can use this particle for unbiased polar questions. Interestingly, it seems that in non-Northern Central Catalan the particle *que* can appear together with falling intonation to express questions involving a low cost[1] of the requested action for both the speaker and the hearer. These results are in line with those of Astruc, Vanrell & Prieto (2016), who investigated how politeness in offers and requests is encoded by intonation in Central Catalan, a language variety that presents both rising and falling (headed by the QP *que*) pitch contours for polar questions. The DCT methodology was used to elicit offers and requests in scenarios controlled for level of social distance, power and cost of the action. Results showed that speakers use rising pitch patterns more frequently with offers/requests involving a high cost on the part of the speaker or the hearer, and requests involving high

social distance. Moreover, questions produced with the falling pattern along with the QP *que* tend to be used more frequently with offers. All in all, it seems that the QP *que* (which is categorically produced with the falling contour) could be related to low-cost polar/confirmatory requests or offers in Central Catalan (that is, requests or offers where a positive answer is expected). Interestingly, in other Ibero-Romance varieties, such as Mexican Spanish, *que* can encode evidentiality (hearsay) in polar questions and declaratives (see (4) and (5) (De la Mora & Maldonado, 2015, p. 174).

(4) *¿Que ya no fumas?*
'[Que] you quit smoking?' (They say)
(5) *Que lo corrieron del trabajo. Me acabo de enterar.*
'[Que] he got fired. I just found out.'

In both (4) and (5), the speaker marks the propositional content as reported or hearsay, by heading the utterance with *que. Que*-constructions were also explored by Gras & Sansiñena (2015) in their analysis of conversations among adolescents (Corpus Oral del Lenguaje Adolescente) from Madrid (Spain). They consider *que*-constructions as expressing the 'entailment or linkage of the content of the turn to the context and, therefore, they can be understood as devices instructing the interlocutor to retrieve information from the context' (Gras & Sansiñena, 2015, p. 525). They also note that this construction is used to convey that the proposition is not brand new, linking the present utterance to the previous context, which could include 'the speech situation itself, preceding discourse or shared knowledge' (Gras & Sansiñena, 2015, p. 526). While it is not the central goal of this paper to uncover the specific contribution of the *que* particle, it is worth bearing in mind the potential semantic contribution of this particle in the domain of polar questions in Catalan, since it is an obligatory piece of the construction of interest.

In an attempt to find an explanation for the results obtained in Vanrell et al. (2014a), we observed that Aikhenvald and Storch, in their discussion of the 'semantic parameters at play in languages with grammatical evidentiality' (Aikhenvald & Storch, 2013, p. 7), note that there are recurrent terms that cover physical senses, and several types of inference and report. The following parameters are included: visual, sensory, inference, assumption, reported and quotative. Whereas the term *visual* covers evidence acquired through seeing, the term *sensory* includes hearing, and is often extended to smell and taste, and sometimes touch (Aikhenvald & Storch, 2013, p. 7). Based on Vanrell et al.'s (2014a) aforementioned results, we postulate that the QP + L+H* L% combination may be used by Majorcan Catalan speakers to call attention to a direct sensory inference made by the speaker, that is, an inference based on evidence that has become available to the speaker through one of the five senses: sight, hearing, touch, smell or taste. Consequently, in this paper, we seek to answer the following question: Do Majorcan listeners prefer the *que* + L+H* L% construction in situations where the speaker has just inferred visual direct evidence specifically? Or, by contrast, might listeners prefer the construction more generally when the speaker has inferred information based on any of the five senses: sight, touch, smell, hearing or taste?

2 Methods and materials

2.1 Participants

Seventy-two native speakers of Majorcan Catalan[2] (43 women, 29 men) participated in the experiment. Twenty-four of the participants were in the 18–24 age group, 25 in the 25–34 age group, 21 in the 35–54 age group and 2 in the 55+ age group. All participants completed a language dominance questionnaire that included questions about whether they used Catalan in their daily lives and to what extent they used Catalan (less than 25%, between 25% and 50%, between 50% and

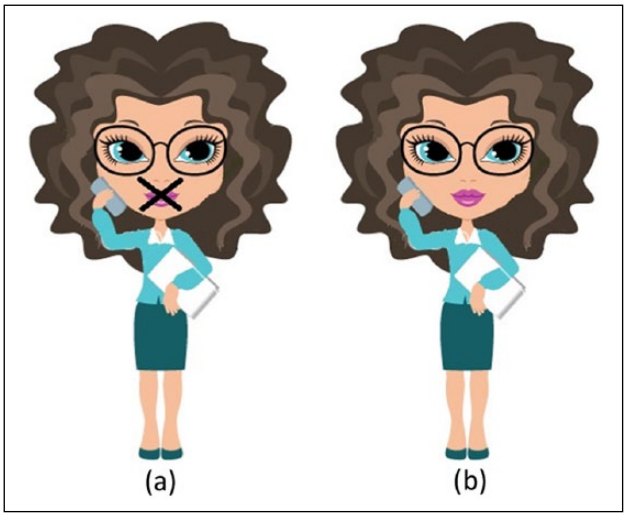


Figure 1. Illustration of the twin girls who refer to taste. (a) Xesca; (b) Llucia.
The figures to illustrate the different sets of twins were downloaded from the following webpage: https://www.vectorstock.com/ The standard license includes those uses not available for resale (see https://www.vectorstock.com/faq/members/standard-license).

Table 1. Examples of QP + intonation combinations.

Conditions	Particle	Intonation	Example
Condition 1	Ø	¡H+L* L%	*Ø Hi has posat pebre bo?* 'Is there pepper in the soup?'
Condition 2	Que	¡H+L* L%	***Que** hi has posat pebre bo?* '[Que] there's pepper in the soup?'
Condition 3	Que	L+H* L%	***Que** hi has posat pebre bo?* '[Que] there's pepper in the soup?'

75%, more than 75%). Eleven of the 72 participants reported using Catalan between 25% and 50% of the time in their daily routine, and 61% used Catalan over 75% of the time. Participants were naïve to the purpose of the experiment.

2.2 Materials

We designed a series of contexts where there was always a set of twins, one twin who infers a *p* from direct evidence (she or he sees/touches/smells/hears it directly) and another one who infers *p* based exclusively on the reported information. The contexts were as follows (6) (see Figure 1).

(6) 'This is Xesca and Llucia. Xesca burnt her tongue, so she cannot taste anything. Llucia can taste just fine. Xesca's mom told her there might be pepper in her soup, so she wants to ask about that. Llucia just tasted something like pepper in her soup and wants to ask about that. Now one girl will ask about the pepper in the soup. Tell me which girl you think asked the question: Was it Xesca, who was told there might be pepper in her soup, or Llucia, who just tasted it?'

After each context, one of three intonation + QP conditions followed. Table 1 shows the different QP-intonation combinations presented in the stimuli.[3]

Figure 2 shows the waveform, spectrogram and F0 contour for the three conditions, along with the broad phonetic, orthographic and prosodic transcription. The contexts were produced by a narrator (the first author, a native speaker of Majorcan Catalan) and the three intonation + QP conditions for each sense were produced by five different speakers of Majorcan Catalan (two males and three females) to control for a possible effect of the voice of the speaker. Each speaker produced three tokens of each intonation + QP condition and only one was chosen based on clarity and quality criteria. Both contexts and target questions were recorded using a Zoom H4n digital audio recorder (Zoom corporation, Japan) and AKG C520 microphone (Akustische und Kino-Geräte Gesellschaft m.b.H., Austria). All sentences were digitized at a 44,100 Hz sampling rate and 16 bit amplitude resolution.

The contour illustrated in Figure 2(a) is characterized by a rising slope over the syllables preceding the nuclear accent, which is falling (¡H+L*) and precedes a low boundary tone, L%. The contour shown in Figure 2(b) presents the same intonation illustrated in Figure 2(a). What makes the difference, however, is the presence of the QP *que* 'that.' The contour shown in Figure 2(c) is also headed by the QP *que* 'that', which bears a high tone and is then followed by a rising-falling nuclear configuration, that is, a L+H* nuclear accent that precedes a L% boundary tone.

To avoid training effects, for each of the five senses we had different items (see Table 2). All participants listened to the three different items for each sense. As stated above, we also controlled for two other factors: intonation and QP condition (three levels: *Ø* + ¡H+L* L%, QP + ¡H+L* L% and QP + L+H* L%) and speaker, that is, the speaker who produced the stimuli (five levels). Regarding these two factors, we followed a between-subject design so that participants would not guess the 'correct' answer by process of elimination. As such, each group of participants listened to only one of the three levels of the intonation + particle condition. The same was done for the case of the speaker producing the recordings; thus, each group of participants listened to just one speaker per sense.[4] Table 4 in Appendix 1 illustrates the design we followed for the whole experiment for the first combination of speakers (see the six different combinations in Table 5 in Appendix 1). We note that participants listened to just one speaker per sense, to all the items for each sense, and either to the percentage branch action A, B or C (see Note 5 for a brief explanation of this procedure). Thus, every participant was presented with a total of 15 stimuli (5 senses × 3 items).

2.3 Procedure

The listeners were asked to decide which of the twins uttered the stimulus–the one who could not possibly have direct sensory evidence for *p* (e.g., the twin with the burnt tongue), or the one who indeed had access to direct sensory evidence (e.g., the girl who tasted the soup). The contexts were presented both in written and audio form, but the target question was presented in audio form only.

2.4 Statistical analyses

Since our data involved categorical responses, non-parametric statistics were used. The statistical tests used were Friedman's analysis of variance (ANOVA) and the Wilcoxon signed-rank test. Friedman's ANOVA is the non-parametric equivalent of one-way repeated measures ANOVA and was used to test the differences between more than two experimental conditions when the same participants had been used in all conditions. The Wilcoxon signed-rank test is the non-parametric equivalent of the dependent *t*-test and, for that reason, it was used when differences between two groups were tested and the same participants were used in both conditions. When the Wilcoxon signed-rank test was performed, the Bonferroni correction was applied. This is a method used to counteract the problem of multiple comparisons and consists of simply dividing the probability of a Type I error (i.e., .05), by the number of tests that have been done. Thus, in the case where there

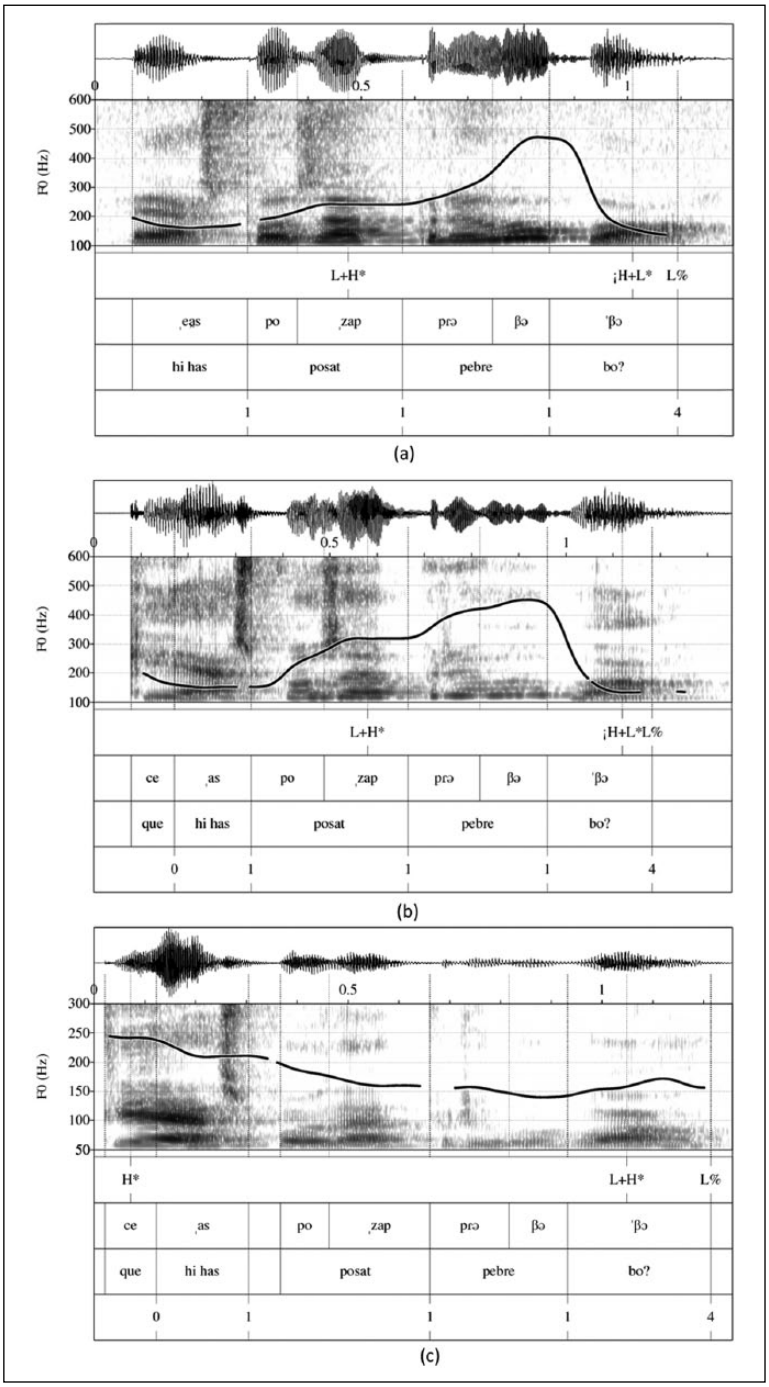


Figure 2. Waveform, spectrogram, F0 contour and broad phonetic, orthographic and prosodic transcription (in the Cat_ToBI system, see Prieto et al., 2015) of the sentence (a) *Hi has posat pebre bo?*$_{\text{¡H+L* L\%}}$ 'Is there pepper in the soup?'; (b) *Que hi has posat pebre bo?*$_{\text{¡H+L* L\%}}$ 'QP-There's pepper in the soup?'; (c) *Que hi has posat pebre bo?*$_{\text{L+H* L\%}}$ 'QP-There's pepper in the soup?'

Table 2. Experimental items used for each sense.

Sight	Touch	Smell	Hearing	Taste
Sewing machine	Leather sofa	Garlic	A cat meow	Cheese in the puree
Bird cage	Plastic flowers	Hot chocolate	A motorbike	Black pepper in the soup
Dog's food bowl	An itchy sweater	Fish stock	A canary singing	Mayo in the sandwich

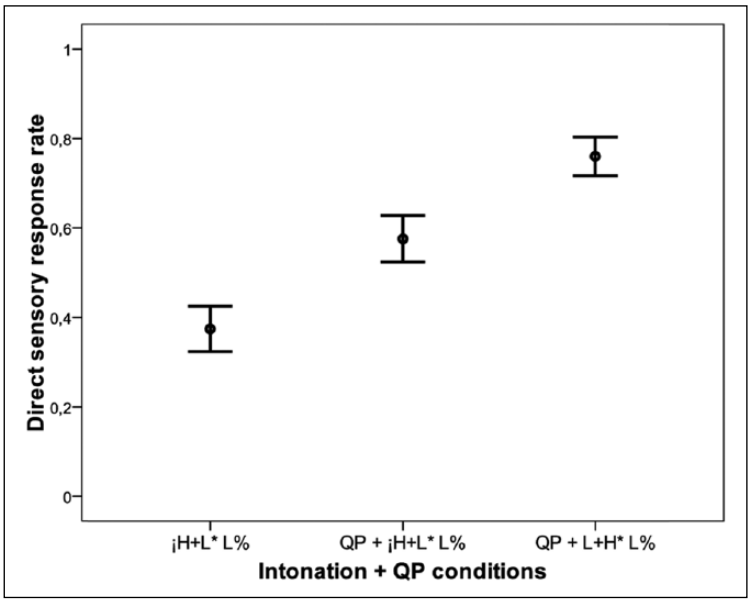


Figure 3. Direct sensory response rate for each intonation + QP condition. Error bars represent the confidence interval of the mean.

are three different experimental conditions and, consequently, three tests have been done, the new level of significance will be .016. That means that the results will not be accepted as significant if the result is less than .05, but will only be accepted as significant where the result is less than .016.

3 Results

The final database contained 1080 responses (5 senses × 3 items × 72 participants). Figure 3 shows the 'direct sensory' response rate for each intonation + QP condition. The 'direct sensory response rate' is defined as the number of responses for which the listener chose the twin with direct sensory evidence over the total responses. As can be seen, the highest rate (0.76) of direct sensory choice is triggered by the intonation condition QP + L+H* L%. In the QP + ¡H+L* L% condition, listeners responded at about the rate of chance (0.58 rate of direct sensory responses). In the *Ø* + ¡H+L* L% condition there were fewer direct sensory responses (0.37). From the results at hand, it can be seen that, although the use of the L+H* L% intonational pattern seems to be key in triggering direct sensory responses, the contribution of the QP *que* is not negligible. As we further explore the results, we observe that the direct sensory responses show a rate increase

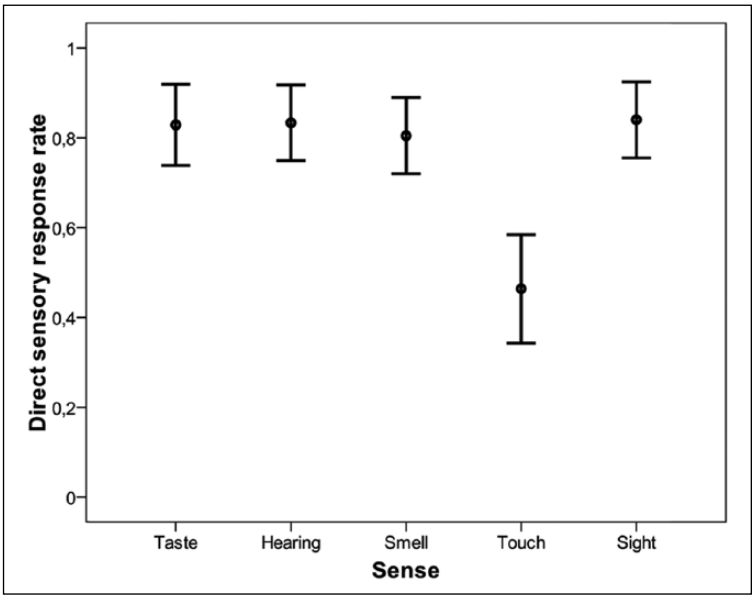


Figure 4. Direct response rate corresponding to the QP+ L+H* L% pattern for each sense. Error bars represent the confidence interval of the mean.

of 0.21 only when the QP *que* is present. However, the highest response rate (0.76) was only found when both the L+H* L% contour and the QP were presented in tandem. To determine whether the effect of the variable Intonation + QP on the response is statistically significant, we submitted the data to a Friedman's ANOVA test with Response (two levels: direct sensory vs. indirect sensory) as the dependent variable and Intonation + QP (three levels: *Ø* + ¡H+L* L%, QP + ¡H+L* L% and QP + L+H* L%) as independent variable. The results indicate that the participants' choices were significantly affected by the Intonation + QP condition, $\chi^2(2) = 236.2$, $p < .001$. Wilcoxon tests were used to follow-up on this finding. A Bonferroni correction was applied and therefore effects are reported at a .016 level of significance. The effect of the Intonation + QP condition was significantly different in all three comparisons: QP + L+H* L% versus QP + ¡H+L* L%, $T = 0$, $r = -.34$; QP + L+H* L% versus *Ø* + ¡H+L* L%, $T = 0$, $r = -.46$; and ¡H+L* L% versus QP + ¡H+L* L%, $T = 0$, $r = -.31$. Hence, we conclude that there exists an important effect of intonation + QP on the rate of direct sensory responses, whose size is medium to large (between Cohen's criteria of .3 and .5 for a medium and large effect, respectively) when QP + L+H* L% is compared to ¡H+L* L%. To summarize, the statistical results confirm our prediction that both the QP *que* and the intonational pattern L+H* L% are the primary contributors to expressing that the speaker has just inferred information based on direct sensory evidence.

Figure 4 focuses on just the QP + L+H* L% pattern and shows the direct sensory response rate for each sense. As in Figure 3, the direct sensory response rate corresponds to the number of direct sensory responses over the total responses. Each of the five senses displays a direct response rate of about 0.8, with the exception of touch, which only reaches 0.46. A Friedman's ANOVA test was performed using Response as the dependent variable and Sense as the independent variable. The variable Response was significantly affected by Sense, $\chi^2(2) = 107.3$, $p < .001$. Wilcoxon tests were used to follow-up on this finding. In addition, a Bonferroni correction was applied. All effects are reported at a .005 level of significance. It appeared that only touch significantly differed from all

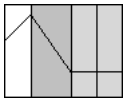
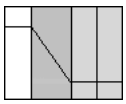
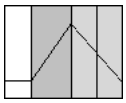
of the other senses (touch vs. smell, $T = 0$, $r = -.48$; touch vs. sight, $T = 0$, $r = -.46$; touch vs. taste, $T = 0$, $r = -.43$; touch vs. hearing, $T = 0$, $r = -.46$). The direct sensory response rate was also significantly different in smell compared to taste, $T = 0$, $r = -.27$. However, in the other cases the direct sensory response rate was not significantly different (hearing vs. taste, $T = 0$, *ns,* $r = -.21$; smell vs. hearing, $T = 0$, *ns,* $r = -.17$; sight vs. taste, $T = 0$, *ns,* $r = -.18$; sight vs. hearing, $T = 0$, *ns,* $r = -.11$; sight vs. smell, $T = 0$, *ns,* $r = -.20$). We can conclude that touch indeed triggered significantly fewer direct sensory responses compared to the other senses, and this effect was medium to large in size (according to Cohen's conventions).

4 Discussion and conclusions

In this paper we investigated the role of intonation in the marking of information as directly perceived in Majorcan Catalan polar questions. In previous production experiments (Vanrell et al., 2014a) a clear preference for the falling ¡H+L* L% intonation without the particle *que* 'that' was found, in contexts where information had been inferred based on hearsay. In this previous work, the rise-fall L+H* L% pattern headed by the particle *que* 'that' was associated with contexts in which the information had been inferred based on visual direct evidence. In perception, however, the results were not so consistent. Stimuli produced with the rise-fall pattern (QP + L+H* L%) were judged to be produced by someone who inferred the proposition based both on evidence that had come about through visual perception, but also through auditory perception (i.e., the listeners could associate the question QP-*You're going to sell shoes?* with the idea that the speaker heard or saw that the owners of the fruit store might sell shoes) (Vanrell et al., 2014a, p. 1024). Thus, for the present study it was within this context that we decided to assess the possibility that the QP + L+H* L% combination might not be restricted to visual sensory evidence alone. We aimed to find out whether this combination could be more generally used to mark evidence that has become available to the speakers through any of the five senses (sight, hearing, touch, smell or taste). Based on this hypothesis, we conducted a perception experiment in which participants were presented with a set of twins who were exposed to different types of evidence for a given proposition: one inferred *p* based on one of the five senses, and the other had been told that *p* by a third-party individual. Participants listened to polar questions with different types of particle/intonation conditions and had to decide which of the twins had produced the question–the one who based his/her evidence on direct sensory information, or the one who had been told *p* by a third party. The results show that the QP + L+H* L% contour triggers the highest rate of direct sensory responses, 0.76 (see Figure 3). We then looked for any specific patterns for the effect of the different senses on the rate of direct sensory responses (see Figure 4). All the senses display a rate of around 0.8, with the exception of touch, which only reaches 0.46. These results are in line with the predictions made by Aikhenvald and Storch (2013, p. 7) about the types of physical senses at play in the grammatical encoding of evidentiality across languages. The Majorcan Catalan results for the types of sensory triggers associated with QP + L+H* L% are then very much in consonance with other cross-linguistic trends, with touch being less commonly associated with sensory evidence.

To integrate the present data with the findings for Majorcan Catalan in Vanrell et al. (2013) (see Introduction), we propose that, when asking polar questions, speakers of Majorcan Catalan have a choice between the various contours and particle/contour combinations available to them for polar questions, namely: (1) the upstepped falling contour ¡H+L* L%; (2) the non-upstepped falling contour H+L* L%; and (3) the rising-falling contour headed by the particle *que* 'that', and these choices are based on both epistemic and evidential restrictions (see Table 3). The upstepped falling contour ¡H+L* L% is evidentially/epistemically unspecified. Evidentially/epistemically unspecified polar question intonation has been documented by Escandell (2017) for

Table 3. Epistemic and evidential distinctions found in Majorcan Catalan.

Cat_ToBI label	Nuclear configuration, schematic representation	Description
¡H+L* L%		Evidentially/epistemically unspecified–the speaker does not convey any information about her/his beliefs about the proposition.
H+L* L%		Epistemically specified–the speaker expresses her or his hypothesis about the state of events. The source for this hypothesis is not determined, since it can be based on beliefs, expectations, world knowledge, etc.
QP + L+H* L%[5]		Evidentially specified–the speaker has not perceived the proposition directly, but she or he has directly experienced a situation which she or he has interpreted to point towards *p*.

Peninsular Spanish, and also by Armstrong (2015b) for Puerto Rican Spanish. In such cases, the speaker does not convey any information about her/his beliefs about *p*, nor does she or he mark the source of *p.* Next, Vanrell et al. (2013) found that the non-upstepped contour is indeed epistemically specified. The speaker expresses her or his hypothesis about the state of events, marking this intonationally as their hypothesis. The source for this hypothesis, however, is not determined, since it can be based on beliefs, expectations, world knowledge, etc. Finally, the rising-falling contour headed by the particle *que* 'that' is specified for information source (evidentially specified). In particular, the speaker has not perceived the proposition directly, but she or he has directly experienced (through perception) a situation that she or he has interpreted to point towards *p* (Plungian, 2001, p. 352). Since a certain degree of uncertainty is still at play even after the direct perceptual experience, a polar question is still felicitous, since knowledge is not complete, and the speaker must still assume that the listener is more knowledgeable about the relevant proposition.

While we have focused heavily on the role of intonation in this paper, the fact that we are dealing with a particle + intonation construction cannot be ignored. We do not assess directly the role of the *que* particle in the experiment presented here, but it is quite possible, especially given the results shown in Figure 3, that the particle + intonation combination could be analysed through a compositional analysis, that is, both the particle and the intonation contour may make their own respective contributions to the meaning associated with the construction (see Vanrell, Ballone, Schirru, & Prieto, 2014b for an analysis of the meaning contribution of question particles in Sardinian). For instance, it could be the case that the *que* particle could contribute to the evidential nature of this construction (this is the most plausible explanation, considering that the use of the QP *que* substantially increases the direct sensory response rate, see Figure 3). As we note above, for instance, Gras & Sansiñena (2015) analyse *que* in Spanish declaratives as instructing the interlocutor to link the present utterance with information from the context. This is an especially attractive analysis for our data since the QP + L+H* L% construction necessarily links a question with information in the immediate context. We also point out, however, that without the *que* particle it is possible that the utterance might not be perceived by listeners as a question at all, since L+H* L% is typically associated with declaratives in Majorcan Catalan (Vanrell & Mascaró, 2013). It could therefore also be the case that the *que* particle does the work of marking the utterance as a question. This, however, leaves in question the specific contribution of the L+H* L% tune. Future work should evaluate whether the QP + L+H* L% construction is an arbitrary form–meaning pairing, or whether it is compositional.

In terms of the specific senses we examined, we did find that the sense touch behaved differently from the other four senses, with lower direct sensory response rates when the context referred to something that the speaker had just touched. Aikhenvald notes six semantic parameters in languages with grammatical evidentiality that cover 'physical senses, and several types of inference and of verbal reports' (Aikhenvald, 2004, p. 63). The semantic parameters include visual, non-visual sensory, inference, assumption, hearsay and quotative. We believe the first two parameters to be especially relevant for our results:

> Visual: covers information acquired through seeing;
>
> Non-visual sensory: covers information acquired through hearing, and is typically extended to smell and taste, and sometimes to touch.

Note that non-visual sensory does not necessarily include touch. As Aikhenvald points out, different systems treat touch in different ways. For example, in Ngiyambaa and Shipibo-Konibo, sensory evidentials can be used to refer to touch, while in Tariana, the sensory evidential does not refer to touch if the speaker touches something on purpose (to check if it's dry), instead they use the assumed evidential. The non-visual sensory evidential can be used if the touch is not controlled by the speaker (e.g., if the speaker steps on someone's dress or is bitten by a mosquito). We did not control for whether touch was in or out of the speaker's control and this could be interesting for future work. In any case, our results are quite characteristic of both visual and non-visual sensory marking of evidentiality, as has been shown for other languages.

All in all, our results add to the body of research supporting intonation as a part of the grammar that may be recruited for evidential strategies. Specifically, in polar questions bearing the QP + L+H* L% contour, the speaker expresses that she or he has based her/his inference on direct sensory information (i.e., *Que hi has posat pebre bo?*$_{\text{L+H* L\%}}$ 'QP-There's pepper in the soup?': I have made the inference based on my tasting experience of the soup). At the same time, we confirm that in this specific case the line between evidentiality and epistemicity is difficult to draw, since the fact that the speaker based her/his inference on direct sensory information (she or he saw, tasted, smelled or heard it) bears directly on her/his degree of certainty. For example, after performing the experiment, some participants said that they had no problems in identifying the contour uttered by the twin who inferred the proposition based on direct experience because it always sounded more certain and confident. Thus one might question to what extent this 'certainty' is encoded, or whether it is a pragmatic consequence of the evidential meaning. We point out, however, that Majorcan Catalan has a contour that is used to convey that a speaker has a belief about the propositional content expressed in a polar question. Vanrell et al. (2013) explored whether Majorcan Catalan listeners could distinguish whether or not a speaker had a belief about the answer to a polar question by means of two distinct nuclear falling pitch accents. The results of three behavioural tasks with 20 Majorcan Catalan listeners demonstrated that the difference in pitch scaling on the leading H tone of the H+L* nuclear pitch accent is key in distinguishing these two types of questions. Thus, whereas with a ¡H+L* pitch accent the speaker does not convey any expectation about the answer (see Table 3, top row), the H+L* pitch accent manifests the speaker's beliefs about the certainty of the proposition expressed (see Table 3, central row). It thus appears that Majorcan Catalan already has a contour for the marking of belief-presence on the part of the speaker, so we must ask why a language would grammaticalize the same type of meaning twice intonationally. Clark's Principle of Contrast states that any difference in form in a language marks a difference in meaning (Clark, 1987). To our knowledge, such redundancy is not common cross-linguistically, especially in the domain of polar questions (see Armstrong, 2015b, for Puerto Rican Spanish; Escandell, 2017, for

Peninsular Spanish). However, the hypothesis that the QP + L+H* L% construction marks epistemic meaning and not evidential meaning can be tested through constructed examples. If this were the case, then it should be felicitous when a speaker 'knows' something without any type of evidence, such as the constructed context in (7), where Laia has psychic powers and knows things without any particular evidence:

(7) Laia has psychic powers. Sometimes she knows some things and she cannot explain why. One day she met a girl in the park and, without the girl telling her anything, she felt that her name was Clàudia. Laia says to her:
   (a) *#Que noms Clàudia?* L+H* L%
   '[Que] Your name is Clàudia?'
   (b) *Noms Clàudia?* H+L* L%
   'Your name is Clàudia?'

In this case only the H+L* L% contour is felicitous, while the QP + L+H* L% construction is not felicitous. Similarly, the use of the construction in (8a) would sound strange, when it is followed by the speaker saying 'I just have a premonition.'

(8) (a) *?Que ha arribat, en Gabriel?* L+H* L% *És que tenc una premonició…*
   '[Que] Gabriel arrived? I just have a premonition…'
   (b) *Ha arribat en Gabriel?* H+L* L% *És que tenc una premonició…*
   '[Que] Gabriel arrived? I just have a premonition…'

(8a) would be odd to utter, since the idea of having a premonition clashes with what we will claim is an implicature generated by the QP + L+H* L% construction. This implicature is that the speaker has perceived the information through direct evidence. Since a premonition is not based on direct perceptual evidence, the construction is not felicitous. On the other hand, the belief-encoding contour is felicitous in (8b).

We also do not believe that QP + L+H* L% conveys speaker disbelief, since examples of speaker incredulity shown in Prieto & Cabré (2007–2012) demonstrate that the contour expressing incredulity in Majorcan Catalan polar questions is the same contour used in evidentially/epistemically unspecified polar questions (see Table 3, top row) but realized with a wider pitch range. Thus there is no evidence from production that the QP + L+H* L% construction is used for incredulity.

Additional support that our construction is related to evidentiality rather than epistemicity comes from previous results (Vanrell et al., 2014a), specifically those obtained through a multiple-choice questionnaire, for which we created three pragmatically neutral contexts and three different combinations of QP and intonational conditions (no QP + ¡H+L* L%, QP + L+H* L% and QP + ¡H+L* L%). The subjects had to answer two multiple-choice questions: one question related to the information source, and the other question related to the time at which the evidence was available (see (9) for an example of one of the trials).

(9) If Maria says 'You're going to sell shoes?' to the owners of the fruit store is it because Maria:
   (a) Heard that they might sell shoes;
   (b) Saw that they might sell shoes;
   (c) Heard or saw that they might sell shoes (but I'm not sure);
   (d) I don't know.

When did Maria hear or see it?
(a) Just now;
(b) A few hours ago;
(c) Yesterday;
(d) I don't know.

If we look at the results obtained for the first question, we see that the QP + L+H* L% combination elicited the highest rate of visual/auditory responses (54/360 responses) and visual/auditory (48/360) responses and no 'I don't know' responses (see Figure 6 in Vanrell et al., 2014a, p. 1024). These results strengthen the idea that the source of evidence is the primary meaning associated to this contour. Otherwise, this contour would have generated more 'I don't know' responses. Given the evidence from production as well as our constructed examples, we propose that the QP *que* + L+H* L% construction generates an implicature that the speaker based her/his inference on direct sensory information. We thus argue that speaker certainty is a pragmatic consequence, in the way of 'seeing is believing'–if a speaker directly perceives something she can be more sure about the truth of a proposition. For instance, if a speaker sees Lucy walking down the street in a new dress and says *I see that Lucy finally bought a new dress*, one might infer that the speaker is also certain that Lucy bought a new dress, even though the verb *see* is not directly conveying any information about certainty, but rather perception. The type of meaning conveyed by the QP + L+H L% construction shows some evidence that it generates a conventional implicature, in traditional Gricean terms (Grice, 1975). The meaning of the construction is non-truth-conditional, since it does not affect the truth conditions of the propositional content. However, given examples such as (8a), the evidential meaning does not seem to be cancellable. As such, we believe that the meaning conveyed through the QP + L+H* L% construction does not have to be calculated by the listener. As a pragmatic consequence, as we have said, speaker belief could be inferred, resulting in a conversational implicature. Conversational implicatures can indeed be cancelled, as in (10):

(10) Maria sees the shadow of an elephant outside the window.
Maria: *Que és un elefant?* L+H* L% *No pot ser…*
'[Que] It's an elephant? I don't believe it…'

In (10), the listener might infer that Maria believes that there is an elephant, since she used the evidential contour, and thus must believe it if she has evidence. But this perceived belief can easily be cancelled and be interpreted as disbelief instead.

Therefore the listener does not have to calculate the meaning of QP + L+H* L%, since it would be linguistically coded (conventional implicature) while the belief meaning would be calculated (conversational implicature). While, given the present literature, it is rare to find evidential meanings conveyed intonationally, we believe that such form–meaning mappings may be more common than previously thought, and future work should keep this in mind. It is perhaps not surprising, however, that intonation should be used to convey both evidentiality and epistemicity, since the two are so intimately related and, as we have shown above, many authors disagree about to what extent they are the same thing. Additionally, many languages use particles to mark both epistemic and evidential meaning, and intonation is often used to do the same work that particles do (Armstrong, 2015a; Enfield, Brown, & de Ruiter, 2012; Prieto & Roseano, 2016; Wakefield, 2010). We hope to have provided innovative methodological means for exploring this type of meaning, which is often difficult to do.

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Notes

1. According to Leech, actions can be evaluated in terms of what the speaker assumes to be its cost or benefit to the hearer or to the speaker (Leech, 1983, p. 107). Thus, an action like *Peel these potatoes* could be placed on a cost-benefit scale near to the 'cost to hearer' extreme. At some point, the 'cost to hearer' value will become 'benefit to hearer' and an action like *Have another sandwich* will be placed at the opposite extreme. The cost-benefit scale also involves a politeness scale in which the higher the cost for the hearer, the less polite the action; but the higher the benefit for the hearer, the more polite the action.
2. Majorcan Catalan is a variety of Catalan spoken in Majorca, the largest of the Balearic Islands with a population of roughly 865,000 inhabitants (Consell Insular de Mallorca, 2013). In 2007, 74.6% of the islands' inhabitants could speak Catalan and 91.3% could understand it (Associació de Sociolingüistes de Llengua Catalana, 2004; Querol, 2004).
3. It is important to note that we did not fully cross the lexical and intonational conditions. The combination of no QP and L+H* L% is unattested in this Catalan variety.
4. The between-subject design for the factor 'speaker' was implemented directing the listeners to one of six different versions of the experiment through different uniform resource locators (URLs), whereas for the 'intonation + particle' factor, we used the SurveyGizmo percentage branch action (surveygizmo.com). This procedure allows one to 'assign a percentage of respondents to see a specific set of questions that differs from another branch's set of questions' Branching: A/B Split Testing in Surveys 2005–2016.
5. Observe that, as opposed to other varieties of Catalan, Majorcan Catalan lacks the L+¡H* L% nuclear configuration for polar questions if it is not introduced by the QP *que* 'that.' This explains why we do not use the diacritic ¡ to mark this configuration, because it does not contrast with the declarative L+H*, since this polar question is always introduced by the QP que 'that.'

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Appendix 1

Table 4. Design followed in the whole experiment for URL 1 (see also Table 5).

			Percentage branch action		
			A	B	C
URL 1	Taste (female talker: MC)	Cheese	¡H+L* L%	QP + ¡H+L* L	QP + L+H* L%
		Black pepper	¡H+L* L%	QP + ¡H+L* L	QP + L+H* L%
		Mayonnaise	QP + L+H* L%	QP + ¡H+L* L	¡H+L* L%
	Smell (female talker: MB)	Garlic	QP + ¡H+L* L	¡H+L* L%	QP + L+H* L%
		Hot chocolate	QP + L+H* L%	QP + ¡H+L* L	¡H+L* L%
		Fish stock	QP + L+H* L%	QP + ¡H+L* L	¡H+L* L%
	Sight (female talker: FC)	Sewing machine	QP + ¡H+L* L%	¡H+L* L%	QP + L+H* L%
		Bird cage	¡H+L* L%	QP + L+H* L%	QP + ¡H+L* L%
		Dog's food bowl	QP + ¡H+L* L%	¡H+L* L%	QP + L+H* L%
	Hearing (male talker: MP)	A cat meow	¡H+L* L%	QP + L+H* L%	QP + ¡H+L* L%
		A motorbike	QP + L+H* L%	¡H+L* L%	QP + ¡H+L* L%
		A canary singing	QP + L+H* L%	¡H+L* L%	QP + ¡H+L* L%
	Touch (male talker: FF)	Leather sofa	QP + ¡H+L* L%	¡H+L* L%	QP + L+H* L%
		Plastic flowers	QP + L+H* L%	¡H+L* L%	QP + ¡H+L* L%
		An itchy sweater	QP + L+H* L%	QP + ¡H+L* L%	¡H+L* L%

Table 5. Speakers who produced the stimuli for each sense in each one of the six different versions of the experiment.

URL 1	URL 2	URL 3	URL 4	URL 5	URL 6
Taste (female talker: MC)	Taste (female talker: MC)	Taste (female talker: FC)	Taste (female talker: MB)	Taste (female talker: FC)	Taste (female talker: FC)
Smell (female talker: MB)	Smell (female talker: MB)	Smell (female talker: MC)	Smell (female talker: FC)	Smell (female talker: MC)	Smell (female talker: MC)
Sight (female talker: FC)	Sight (female talker: FC)	Sight (female talker: MB)	Sight (female talker: MC)	Sight (female talker: MB)	Sight (female talker: MB)
Hearing (male talker: MP)	Hearing (male talker: FF)	Hearing (male talker: MP)	Hearing (male talker: FF)	Hearing (male talker: MP)	Hearing (male talker: FF)
Touch (male talker: FF)	Touch (male talker: MP)	Touch (male talker: FF)	Touch (male talker: MP)	Touch (male talker: FF)	Touch (male talker: MP)