The prosody of rhetorical questions: A cross-linguistic view[1]

Nicole Dehé, Bettina Braun, Marieke Einfeldt, Daniela Wochner and Katharina Zahner
Universität Konstanz

Abstract

This paper provides a survey of our knowledge of the prosody of rhetorical questions, i.e. questions that do not require an answer and try to commit the listener to the presupposed answer, as compared to the prosody of string-identical genuine, information seeking-questions. The survey includes semantic literature on questions, corpus data, and experimental evidence from production and perception experiments. It covers a range of typologically different languages (German, English, Icelandic, Italian, Standard Chinese, Cantonese, Japanese, French) that have different word-level and phrase-level characteristics. The main finding is.that rhetorical and information-seeking questions differ reliably in terms of the following prosodic characteristics: (i) F0-features (e.g., position and type of pitch accent, type of boundary tone, as well as more global f0-parameters, depending on language type); (ii) duration / speaking rate (rhetorical questions are typically longer / produced with slower speaking rate than information-seeking questions). Often, but not always, rhetorical questions are produced with non-modal voice quality.

Keywords: rhetorical questions, prosody, cross-linguistic

[1] The research presented here was funded by the DFG as part of the research unit 'Questions at the Interfaces' (FOR 2111, project P6), of which Bettina Braun and Nicole Dehé are co-PIs (grant numbers BR 3428/4-1 and BR 3428/4-2, and DE 876/3-1 and DE 876/3-2, respectively). We thank María Biezma and Maribel Romero for discussions of the pragmatics of rhetorical questions, Mizuki Satoh and Yurie Hara for checking on the Japanese examples and glossing, Meiqiao Li for checking on the Standard Chinese examples, and Claire Beyssade and Elisabeth Delais-Roussarie for sharing their French expertise with us and for providing sound files.

1 Introduction

This paper provides a survey of our knowledge of the prosody of rhetorical questions (RQs) as compared to the prosody of information seeking-questions (ISQs). Since the literature on the prosody of RQs is mostly limited to polar (yes/no) questions (1) and *wh*- (constituent) questions (2), the paper focuses on these two question types, leaving other question types (e.g., alternative questions, tag questions) for future studies.

(1) Polar question
Does anyone like liver?

(2) *Wh*-question
Who likes liver?

We take a cross-linguistic approach, comparing results from languages with (typologically) different prosodic systems (Jun 2005, 2014). Specifically, we include four head-prominence intonation languages (German, English, Icelandic, Italian), two head-prominence tone languages (Standard Chinese and Cantonese), and two head/edge-prominence languages, one containing a lexically specified pitch accent on about half of the words of the lexicon (Japanese), one without lexical prominence marking (French). This choice of languages is driven foremost by the availability of data.

In the remainder of this introductory section (Sections 1.1 through 1.3), we establish the relevant semantic/pragmatic background on ISQs and RQs and on non-prosodic cues to rhetorical meaning. Section 2 surveys insights from the non-experimental literature. Section 3 outlines the prosody of RQs vs. ISQs for the languages that have been studied experimentally in production and/or perception. Section 4 discusses these results from a cross-linguistic perspective, identifying differences and commonalities in how prosodic cues to rhetorical vs. information-seeking meaning are employed across languages, both within prosodically related languages and across typological boundaries. Finally, Section 5 provides a conclusion and outlook.

1.1 Information-seeking questions

Information-seeking questions (ISQs, also known as neutral, literal, prototypical, or genuine questions) perform the directive speech act of requesting information. According to Krifka (2011: 1747), polar questions "request an answer that specifies whether the proposition expressed by their sentence radical holds or does not hold"; the expected answer may be 'yes' (i.e., 'there is someone who likes liver' for (1)) or 'no' ('there is nobody who likes liver') (see also Groenendijk & Stokhof 1984; Karttunen 1977). Semantically, positive polar questions hence denote the set of possible answers (or resolutions) {p, ¬p}; but see Biezma & Rawlins (2012) for non-neutral ISQs. *Wh*-questions "create an open proposition by leaving parts of the description of the proposition unspecified" (Krifka 2011: 1744). The open parameter is represented by the *wh*-pronoun; information about the open parameter is provided by the expected answer (e.g., the interlocutor would provide the name of a person who likes liver as an answer to the question in (2)). Semantically, a *wh*-question is represented either as a set of propositions that would constitute felicitous answers (Hamblin 1973; Karttunen 1977; Groenendijk & Stokhof 1984) or as an incomplete expression (e.g., Hausser & Zaefferer 1979; von Stechow & Zimmermann 1984).[2]

1.2 Rhetorical questions

Like ISQs, rhetorical questions (RQs) are formally (i.e., surface-syntactically and semantically) interrogatives, but they differ from ISQs in discourse function. In particular, according to Biezma & Rawlins (2017) and much previous literature, they have three main characteristics. First, RQs do not expect an answer (Banuazizi & Creswell 1999; Hudson 1975; Ilie 1995; Quirk et al. 1985; Wilson & Sperber 1988). Second, RQs have the feel of an assertion (see also Gutiérrez Rexach 1998; Han 2002; Quirk et al. 1985; Rohde 2006; Sadock 1971). Third, RQs do not have to but can optionally be answered (Caponigro & Sprouse 2007; Rohde 2006). As Dehé & Braun (2020b) note, these characteristics are related: if RQs have the force (or the feel) of assertions, then the speaker does not request an answer; however, since RQs are formally questions, an answer is still possible.[3]

---

[2] In addition to or instead of seeking information, utterances with interrogative syntax may serve other functions, among them initiating repair, requesting confirmation or offering (Krifka 2011).

[3] Note that the range of forms that have been subsumed under the label of RQs in the literature is very heterogeneous in form, usage, and semantic meaning. RQs in this wider sense include, among others, monological questions (see Truckenbrodt 2004 for discussion), leading questions (used as rhetorical device for persuasion, e.g.

In a corpus study, Rohde (2006) finds that answers to RQs are overwhelmingly confirmations and backchannels, while answers to ISQs are predominantly yes/no-responses (to polar questions) or statements (to *wh*-questions), suggesting that RQs "do not function … like regular questions but instead express an opinion" to which the addressee may react (Rohde 2006: 143). This fits in with Biezma & Rawlins' (2017: 304) observation that RQs are often used to "*extract a commitment* to the rhetorical point" from an interlocutor (italics in original). Also, while for ISQs there is a high degree of uncertainty as to the answer on the part of the speaker of the ISQ, for RQs there is no uncertainty. Instead, the answer is in the common ground and obvious to all interlocutors (Biezma & Rawlins 2017; Caponigro & Sprouse 2007; Rohde 2006) or is intended to be added to the common ground (Biezma & Rawlins 2017). Biezma & Rawlins (2017: 306f.) further argue that for a question to be interpreted as an RQ, it "must conventionally indicate the speaker's attitude … that the question they are asking is *non-inquisitive in context*" (their italics). Goto (2018) further notes that there may be a continuum between ISQs and RQs if cues are ambiguous, and that an emotional coloring of the voice (e.g., a sarcastic tone of voice) may lead the listener towards an RQ interpretation.

1.3 Non-prosodic cues to rhetorical meaning of interrogatives

Various cues to information-seeking vs. rhetorical meaning have been identified in the literature. One cue is world knowledge as well as the given situational context. For example, it is common knowledge that the Pope is catholic, thus the question *Is the Pope catholic?* will most likely be interpreted as an RQ (RQ used as retort, see fn. 3) rather than an ISQ (Han 2002). Second, morpho-syntactic cues may serve as cues to rhetorical meaning. For example, polar questions containing strong negative polarity items (NPIs) can only have a rhetorical meaning (see (3a), from Han 2002: 204). In *wh*-questions with weak NPIs that are not c-commanded by the trace of the *wh*-element only the rhetorical meaning is available (see (3b), from Han 2002: 205). For Japanese, Goto (2018: 122) reports that the hearsay construction *to-*

in parliament or courtrooms, cf., e.g., Ilie 1995), RQs used as retorts (Schaffer 2005), and inferentially assertive interrogatives (*So does John have a car then?*, Bartels 1999). The experimental studies reported on below do not include all these forms, uses, and meanings, but are generally restricted to RQs that occur in dialogues and that do not assert their surface propositions. We are aware that this approach inhibits a fully comprehensive account. However, work on the prosody of RQs is generally in its infancy and to this date provides only a very limited set of (types of) RQs and only an incomprehensive account of their prosodic realization.

iu can be used to signal rhetorical meaning (see (3c)). Goto (2018: 121f.) furthermore mentions the non-referential use of the noun *mono* 'thing' as cue to rhetorical meaning in interrogatives; see (3d), which cannot be interpreted as ISQ. For other languages, lexical elements such as particles or adverbials may indicate rhetorical meaning. For English, Han (2002) argues that *after all* may induce rhetorical meaning (see (3e), from Han 2002: 204). In German, optional discourse particles indicate rhetorical meaning. In (3f), for example, from Bayer & Obenauer (2011: 454), *schon* cannot have its lexical meaning 'already', but instead marks the question as rhetorical, although here the rhetorical meaning also follows from world knowledge to a certain extent. In less clear contexts, *schon* may have its lexical, temporal meaning. In Chinese, questions with *nandao* have rhetorical meaning; see (3g), from Xu (2012: 509).

(3) Morpho-syntactic and lexical cues to rhetorical interpretation

a. Did John lift a finger to help Sam? (No!)

b. What has Sam ever contributed to the project? (Nothing!)

c. Dare ga shiru to+iu no ka.
Who NOM know QUOT+say NMLZ Q
'Who do you say knows?'

d. Dare ga shit+teiru mono (desu) ka.
Who NOM know+PROG NMLZ (COP) Q
'Who knows?'

e. After all, who helped Mary? (Nobody!)

f. Wer zahlt schon gerne Steuern?
Who pays PRT gladly taxes
'Who likes paying taxes! (Nobody!)'

g. Nandao zhe jiushi shichang jingji (me)?
Nandao this be market economy Q
'Is this a market economy?' (= This isn't a market economy.)

However, these cues to RQs (perhaps with the exception of world knowledge and context) may be optional and as a consequence, an RQ may look exactly like an ISQ on the syntactic surface. The questions in (1) and (2), for example, are felicitous as both ISQ and RQ. In informal written language (e.g., Twitter), the rhetorical meaning may be indicated by excessive punctuation (Zymla 2014). Crucially, in oral language, the intended meaning is encoded in the prosodic

properties of the relevant interrogative (Biezma & Rawlins 2017; Gutiérrez Rexach 1998). Exactly how this works is the focus of the following sections. It is important to keep in mind from the outset that prosodic cues are not restricted to intonational cues, but comprise phonetic cues such as duration and voice quality, too.

2 Prosodic differences between ISQs and RQs: Introspective, theoretical and corpus approaches

The assumption that the difference between ISQs and RQs is cued by intonation is uncontroversial (e.g. Biezma & Rawlins 2017; Cheng 1977; Gutiérrez Rexach 1998; Han 2002). In the semantic literature (e.g. Han 2002), the focus is generally on the intonational realization of the final part of the utterance, i.e., (rise to) high terminus vs. (fall to) low terminus, although assumptions diverge as to the exact realization of the terminus. The opposition between rise and fall is found in particular for English polar questions, which typically have rising intonation when information-seeking (Bartels 1999; Hedberg et al. 2017; Hedberg & Sosa 2002; Pierrehumbert & Hirschberg 1990; Schubiger 1958), but are assumed to be falling when rhetorical (Han 2002). This is related to the assumption that RQs express assertions (like declaratives, whose intonation is also falling, but unlike genuine questions); see Bartels (1999), Han (2002). Corpus studies do not fully confirm this difference between ISQs and RQs argued for in the semantic literature. Banuazizi & Creswell (1999) investigated the intonation of polar questions in telephone conversations in the American English SWITCHBOARD corpus. They analyzed 102 polar RQs and 2106 polar ISQs. Of the 102 polar RQs, only 45 (44.1%) ended in a final fall (L-L%), but 57 (55.9%) ended in a final rise (H-H%). In comparison, in polar ISQs, 89.7% ended in a rise. The case is even less clear for *wh*-questions, because information-seeking *wh*-questions in languages like English and German typically have falling intonation contours (e.g., Bartels 1999; Hedberg & Sosa 2002; Hedberg et al. 2010; Pierrehumbert & Hirschberg 1990; Schubiger 1958 for English, Grice et al. 2005a; Kohler 2004; Oppenrieder 1988; Oppenrieder 1991; von Essen 1964 for German), and RQs are assumed to be falling, too (Bartels 1999). In another corpus study, also for English, Hedberg et al. (2010) analyzed 26 *wh*-RQs. Of these, 21 ended in falling contours but five were rising. However, it is conceivable that the rising non-ISQs in Hedberg et al. (2010) did not come from genuine RQs but from some other kind of non-ISQs, because their set of RQs also comprised back-channel questions and questions to self, i.e., the set of RQs was more like a collection of

non-ISQs than RQs proper. To identify the prosodic properties of RQs, it is important to keep the category 'clean'. Equally important is a more fine-grained analysis of the prosodic realization, beyond the dichotomy final fall vs. final rise.

Using data drawn from a German TV cooking show, an investigation of the prosody of RQs in German spontaneous speech was carried out as a follow-up on the experimental results reported on in Section 3.1.1 below (Braun et al. 2020). The results show that despite more variation in their prosodic realization, RQs and ISQs in spontaneous speech essentially exhibit the same prosodic characteristics as RQs and ISQs in lab speech; see also Section 4.4 for a methodological discussion. Specifically, RQs were most often realized with a rising (L*+H) nuclear accent in both polar and *wh*-questions. Edge tones differed across question types such that for polar ISQs, the most frequent edge tone was a high-rise (H-^H%), while polar RQs were mostly realized with a mid-high plateau (H-%) or a low-rise (L-H%). *Wh*-ISQs equally often ended in a low edge tone (L-%) or a high rise (H-^H%), while *wh*-RQs most frequently terminated at a low level (L-%). RQs were furthermore produced with a slower speech rate than ISQs.[4]

3 Prosodic differences between ISQs and RQs in production and perception

This section reports on experimental studies on the prosody of RQs in German, English, Icelandic, Italian, Standard Chinese, Cantonese, Japanese and French, mostly in production. Perception data are reported subject to availability (German and Japanese). In line with relevant literature on prosodic typology (Jun 2005, 2014), we divide these languages into head-prominence intonation languages (German, English, Icelandic, Italian; Section 3.1), head-prominence tone languages (Standard Chinese, Cantonese; Section 3.2), and head/edge-

[4] Throughout the paper, we use language-specific annotation conventions in the autosegmental framework (e.g., Pierrehumbert 1980; Ladd 2008). For German, this is GToBI (German ToBI; Grice & Baumann 2002; Grice et al. 2005). For English, we use MAE_ToBI (Beckman & Elam 1997; Beckman et al 2005). MAE_ToBI differs from GToBI in some specific ways relevant here. For example, the high rising edge tone (GToBI: H-^H%) corresponds to H-H% in MAE_ToBI, and the mid-high plateau H-% in GToBI corresponds to H-L% in MAE_ToBI. The assumption in MAE_ToBI is that the H- phrase accent upsteps L% to a value in the middle of the speaker's range, and L% is therefore higher than L% in L-L%, and lower than the upstepped H% boundary tone in H-H%. A ToBI framework does not yet exist for Icelandic, however in the annotation given here, we follow previous research in Icelandic intonation (Dehé 2009, 2010, 2018; Dehé & Braun 2020). For all other languages, we follow the literature referenced in the respective sections.

prominence languages with lexical pitch accents (Japanese) and post-lexical pitch accents (French), cf. Section 3.3. Section 4 offers a cross-linguistic comparison including all three groups.

3.1 Head-prominence intonation languages

Head-prominence languages are languages in which phrase-level prosodic prominence is marked by the phrase head using post-lexical (or intonational) pitch accents associated with the head (Jun 2005, 2014). In intonation languages, F0 is used to convey meaning at a post-lexical level, e.g., to distinguish between illocution types (e.g., questions vs. statements), or to convey attitudinal or expressive meaning (e.g., surprise, anger) or information structure. Focus and syntactic/semantic groupings are typically marked by pitch accents and/or deaccenting. Along with pitch accents, the pitch at the edge of a prosodic constituent, most prominently the right edge of an utterance or intonational phrase, may be used to convey meaning, e.g., to distinguish between speech acts or express special connotations. For example, in Icelandic, all utterance types are falling to a low terminus by default, but a rising F0 contour expresses special connotations such as surprise or impatience (Árnason 2005, 2011).

Each head-prominence intonation language has its own inventory of pitch accents. Generally speaking, pitch accent types differ from each other in several respects, including whether they are rising (L*+H, L+H*) or falling (e.g., H*+L) or level (monotonal H* or L*), and how the tonal targets are aligned with the segmental string. In the context of RQs, we find that two properties of pitch accents are particularly relevant: (i) whether they are bitonal, specifically rising from L to H (L*+H, L+H*), or monotonal (H*, L*), and (ii), within bitonal rising accents, how local low (L) and high (H) targets are aligned with the segmental string (late rise to peak L*+H vs. early rise to peak L+H*). These differences are illustrated in Figure 1. The syllable shaded grey (*Man*) is the stressed one. Figure 1a shows a (monotonal) peak accent (H*), which can be distinguished from the rising accents in Figures 1b and 1c based on the absence vs. presence of a sharp F0 rise leading to H. Figures 1b and 1c are bitonal rising accents, which differ in the alignment of the tonal targets. In the early rise accent (Figure 1b), H is aligned within *Man* (hence L+H*), in the late rise accent (Figure 1c), L is aligned within *Man*, but H is aligned outside the stressed syllable, hence L*+H.

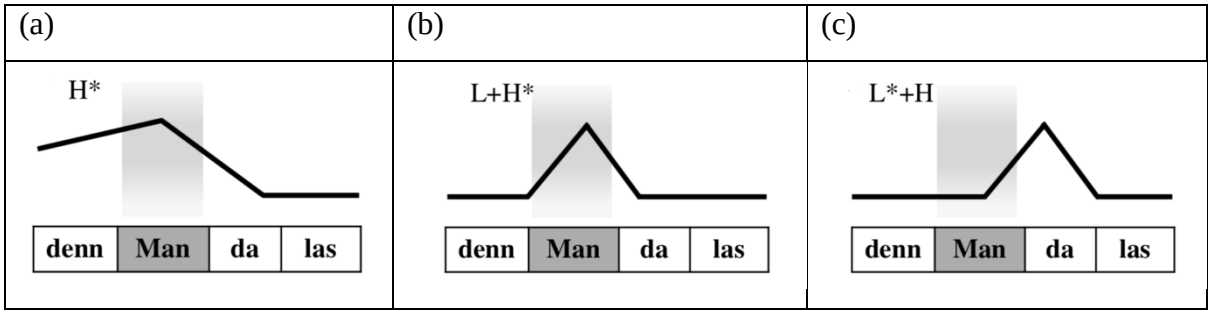


Figure 1. Illustration of monotonal H* accent (a), bitonal (rising) L+H* accent (b), and bitonal (rising) L*+H accent (c); stressed syllable *Man* preceded by particle *denn* and followed by syllables of the same noun (*Mandalas*).

3.1.1 German

German is a verb-second language with verb-first polar questions (see (4)). In standard *wh*-questions (see (5) for a *wh*-subject question), the *wh*-word (or *wh*-phrase) occurs in sentence-initial position.

(4) Mag jemand Limonen? (German polar question)
Likes anybody limes
'Does anybody like limes?'

(5) Wer mag Limonen? (German *wh*-question)
Who likes limes
'Who likes limes?'

It has been shown for ISQs in German that polar ISQs are commonly realized with a nuclear low-rise (GToBI: L* H-^H%), and *wh*-ISQs are typically realized with a nuclear fall (GToBI: L+H* L-%) in both read and spontaneous speech (Grice et al. 2005a; Kohler 2004; Oppenrieder 1988; Oppenrieder 1991; von Essen 1964).

The prosody of German RQs as compared to string-identical ISQs was first piloted in Wochner et al. (2015) and then systematically tested using a speech production paradigm (Braun et al. 2019). German RQs differ in their prosodic realization from ISQs in several ways. Within polar questions, both illocution types are typically rising. However, while ISQs typically terminate in a high-rise (GToBI: H-^H%), RQs frequently rise to a level not as high,

but best described as a mid-high plateau (H-%) (see Table 1 for percentages taken from Braun et al. 2019). A relatively high number of RQs also ended in H-^H%, however there was a strong tendency for the rise in RQ to have a smaller F0-range than in ISQs. If the rise to H-% occurs in polar questions, hearers can be almost 100% sure that RQ is the intended interpretation (see Table 1, row 2). *Wh*-ISQs typically terminate in a final fall (L-%). However, Braun et al. (2019) found that *wh*-ISQs also allowed for a variety of different edge tones, including rising edge tones (L-H%, H-^H%). *Wh*-RQs, on the other hand, were mostly (94% in Braun et al.'s data) realized with a terminal fall (L-%), suggesting that any other edge tone is rather infelicitous. An L-% edge tone is therefore predictive of RQ interpretation at a level of 68% (see Table 1, row 4), and combined with an L*+H nuclear accent, this goes up to 100% (see directly below for nuclear accents). Taken together, the terminus of the utterance (edge tone) clearly plays a role for the distinction between ISQs and RQs in German for both polar and *wh*-questions. Crucially, it emerges that a simple binary distinction between a final rise and a final fall, which has been suggested in some of the semantic literature on the basis that RQs have assertive properties (see Section 2 above), is clearly insufficient (see Braun et al. 2019 for details, as well as the discussion in Section 4.1 below).

Like edge tones, the use of different types of nuclear accents plays an important role to distinguish between ISQs and RQs in German polar and *wh*-questions. In polar ISQs, the typical accent is a low target (L*), in *wh*-ISQs, it is a rise to a high peak associated with the accented syllable (L+H*). As Braun et al. (2019) show, both polar and *wh*-RQs most frequently have rising nuclear accents, but the rise differs in tonal alignment from the one used in *wh*-ISQs, such that in RQs, the low target is typically associated with the accented syllable and the peak is reached later (late rise: L*+H) (see Table 1 for distributions). Note that an early rise, L+H*, also occurred in 21% of Braun et al.'s (2019) *wh*-RQs. When it did, however, a lower scaling of tonal targets was observed than in *wh*-ISQs, which suggests that within *wh*-questions, RQs are realized with a lower pitch register than ISQs, possibly to make up for an otherwise phonologically identical contour. When present, the early rise signals rhetoricity very reliably, even reaching 100% in combination with L-% (Table 1, row 4).

Table 1 summarizes the most important tonal events in the nuclear area for German RQs, based on (Braun et al. 2019). According to their results, the nuclear contours L*+H H-% for polar questions, and L*+H L-% for *wh*-questions, have the highest probabilities to signal an RQ meaning (97% and 100%, respectively).

German RQs	Edge tone	Nuclear accent	Nuclear tune
Most frequent prosodic event in **polar RQs** (frequency in %) p(Event|Context)*100	H-% (67%)	L*+H on object (57%)	L*+H H-% (54%)
Highest probability for **polar RQ** (probability in %) P(Context|Event)*100	H-% (98%)	L*+H on object (97%)	L*+H H-% (97%)
Most frequent prosodic event in ***wh*-RQs**	L-% (94%)	L*+H on object (57%)	L*+H L-% (54%)
Highest probability for ***wh*-RQ**	L% (68%)	L*+H on object (98%)	L*+H L-% (100%)

Table 1. Frequency of most frequent edge tones, nuclear accents and nuclear tunes for German polar-RQs and *wh*-RQs (rows 1 and 3), relative to the total number of events in that illocution type, i.e., the probability that a given tonal event occurs, given an RQ context: p(Event|Context). Rows 2 and 4 indicate the probability that a certain tonal event is indicative of an RQ illocution (relative to an ISQ), i.e., the reverse conditional probability: p(Context|Event) – provided it occurred more than 10 times. This was calculated by dividing the number of events in the RQ condition by all occurrences of this event. All figures are taken from Braun et al. (2019). Row 1 reads: 'Of all polar RQs, 67% have an H-% edge tone' (accordingly for nuclear accent and nuclear tune). Row 2 reads: 'If a polar question is realized with H-%, the probability for it to be an RQ is 98%' (accordingly for nuclear accent and nuclear tune); rows 3 and 4 accordingly. The nuclear tune is the combination of nuclear accent and edge tone.

Crucially, L*+H is used across question types (polar, *wh*) to mark rhetoricity. One particularity with regard to this L*+H accent found by Braun et al. (2019) in RQs is that it often differed in tonal alignment from the L*+H reported elsewhere in the literature. In particular, while the peak of L*+H accents is commonly reported to be aligned with the post-tonic syllable (e.g., Braun 2006; Lommel & Michalsky 2017), Braun et al. (2019) found that both the low and the

high tonal target of L*+H accents in RQs are often aligned within the stressed syllable. Whether or not this justifies the addition of a new category of bitonal pitch accent (e.g., (L+H)*), and whether its use and meaning can be exclusively related to RQs, is an important question for future research.

Compared to the nuclear region, the prenuclear region of the intonational contour plays a minor role in the distinction between ISQs and RQs in German. In the polar questions reported on by Braun et al. (2019), the subject (*jemand* in (4)) was almost always unaccented in both ISQs and RQs. While prenuclear accents on the verb did occur in just over 50%, there was no difference in either frequency or accent type between ISQs and RQs, thus prenuclear accents do not serve as a cue to the difference between illocution types in polar questions. See also Wochner & Dehé (2018), who compared polar ISQs, RQs and exclamatives. Here, too, it emerged that the prenuclear area was often unaccented, although most frequently in ISQs (88% of the ISQ data), followed by RQs (72%) and exclamatives (50%). When prenuclear accents did occur, they were mostly rising (L*+H, L+H*) in exclamatives and RQs, as compared to a peak accent (H*) in ISQs. Differences between ISQs and RQs were found for the prenuclear area of *wh*-questions, however (Braun et al. 2019). Specifically, the *wh*-word was more frequently accented in ISQs than in RQs, and the verb was associated with a prenuclear accent more often in RQs than in ISQs. Regarding the production data reported on by Braun et al. (2019) and Wochner & Dehé (2018), however, note that the produced utterances were short, and the relevance of the prenuclear region may generally increase with increasing utterance length or more linguistic material preceding the material associated with the nuclear accent.

The most salient non-tonal parameter distinguishing RQs from ISQs is duration. In both polar and *wh*-questions, RQs have longer durations than ISQs. In their data, Braun et al. (2019) observed an increase of duration from ISQs to RQs of 16% on average. In particular, the final constituent, i.e., the object noun, is longer in RQs than in ISQs. Along with duration, voice quality contributes to the distinction between RQs and ISQs (Braun et al. 2019). In both polar and *wh*-questions, RQs were more often realized with breathy voice quality than ISQs. Breathiness was mainly associated with the beginning of the utterance, i.e., with the finite verb in polar questions and the *wh*-word in *wh*-questions, and decreased towards the end of the utterance.

Figure 2 (polar questions) and Figure 3 (*wh*-questions) provide representative examples of prototypical realizations of ISQs and RQs in German.

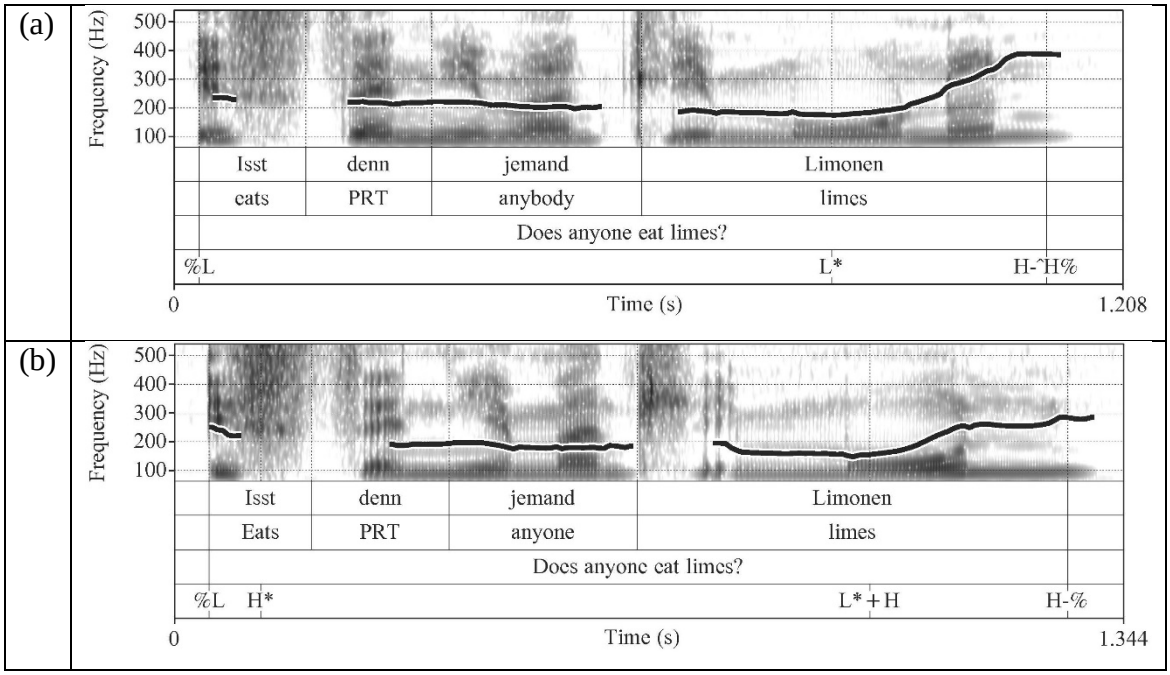


Figure 2. Spectrograms and pitch tracks of prototypical realizations of German polar questions (top: ISQ, bottom: RQ). Tier 1: German words; tier 2: English word-by-word translation; tier 3: broad translation; tier 4: annotation according to GToBI.

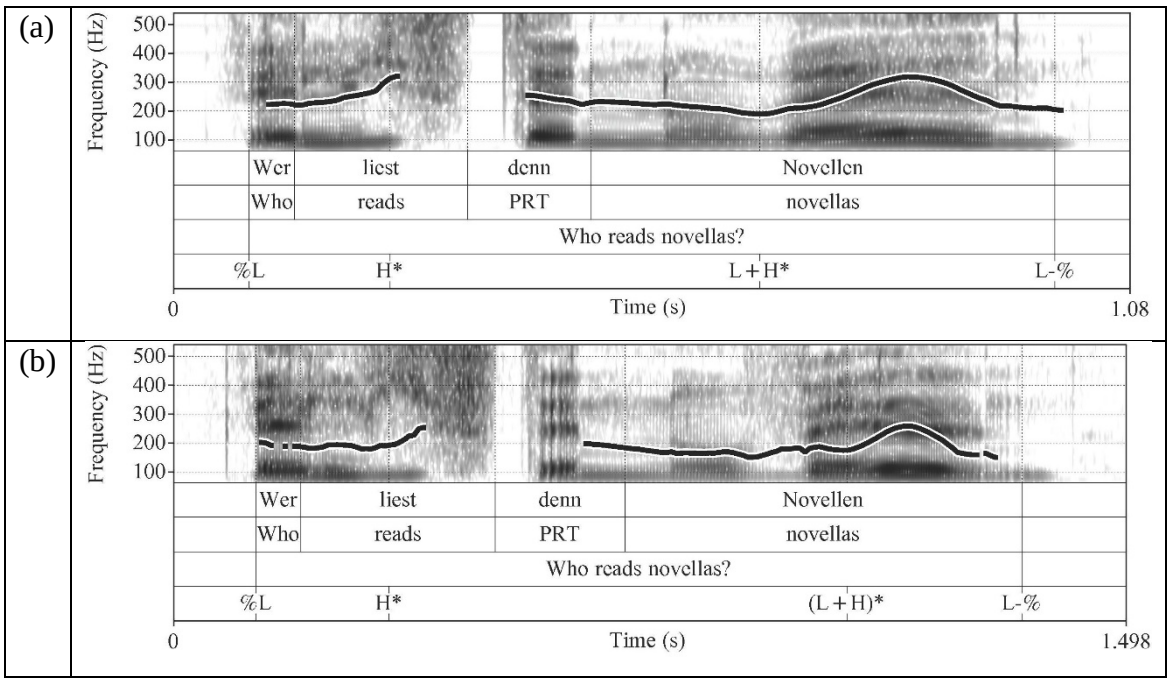


Figure 3. Spectrograms and pitch tracks of prototypical realizations of German *wh*-questions (top: ISQ, bottom: RQ). Tiers as in Figure 2.

Following up on the production experiment, a perception experiment was designed to test whether and how listeners use the cues identified in the production data to identify RQ meaning

(Kharaman et al. 2019). German listeners classified *wh*-questions as ISQ, RQ or 'other'. The results show that nuclear pitch accent type (late-peak accent L*+H vs. early-peak accent H+!H*), duration (long vs. short), and voice quality (breathy vs. modal voice) differentiated between *wh*-ISQs and *wh*-RQs. Specifically, *wh*-questions were more likely to be judged as RQs when realized with a L*+H pitch accent, long duration, and/or breathy voice. When all three cues coincided, questions were classified as RQs in almost 97% of the cases. The proportion decreased as soon as one cue was removed. Nuclear accent type was the strongest perceptual indicator of RQ meaning, while duration and voice quality did not differ in their relative relevance. Kharaman et al. (2019) conclude that pitch accent type is a strong but insufficient cue to illocution type. For unambiguous interpretation, intonational cues need to be complemented by non-tonal parameters, specifically duration and voice quality (see also Braun et al. 2018).

3.1.2 English

English is an SVO language with verb-first polar questions (see (1) above). The main verb, however, cannot occur in first position (**Likes anyone liver*?), instead an auxiliary verb is inserted (*Does anyone like liver*?). In standard *wh*-questions, the *wh*-word is placed in initial position (see (2)). Typically, ISQs in English have the following intonational realization in both read and spontaneous speech (see Bartels 1999; Dehé & Braun 2020b; Hedberg et al. 2017; Hedberg & Sosa 2002; Hedberg et al. 2010; Pierrehumbert & Hirschberg 1990; Schubiger 1958): English polar ISQs are predominantly realized with a low rise starting from a low accented syllable (MAE_ToBI: L* H-H%) or with a high rise (MAE_ToBI: H* H-H%). *Wh*-ISQs, on the other hand, are generally realized with a nuclear high fall (MAE_ToBI: H* L-L%).

RQs differ from ISQs prosodically in several ways. Unlike the impression sometimes made in the semantic literature (see Section 2 above), the terminus of the utterance (edge tone) is not the key criterion across the board, at least not in Western Canadian English, which was experimentally investigated by Dehé & Braun (2020b). The edge tone is distinctive only for polar questions, but not for *wh*-questions (Dehé & Braun 2020b). *Wh*-questions are predominantly falling to a low terminus (L-L%) in both ISQs and RQs. Polar questions are predominantly rising, but ISQs rise continuously to a high level in the speaker's range (H-H%), while RQs more frequently rise only to a mid-level, resulting in a mid-high plateau

(MAE_ToBI: H-L%; 85% in Dehé & Braun's 2020b data, see Table 2).[5] When this mid-high plateau occurs, the interpretation of a polar question as RQ is highly likely to be correct (Table 2, second row). Therefore, like in German, a simple distinction between rise and fall is insufficient for polar questions (see Dehé & Braun 2020b for details).

Like in German, the nuclear accent contributes to the distinction between ISQs and RQs in English. The nuclear pitch accent type plays a role in both *wh*- and polar questions. Within *wh*-questions, the typical accent in ISQs is the peak accent (H*, !H*), while in RQs it is a rise to a high peak (L+!H*). Within polar questions, the difference between RQs and ISQs is less obvious as far as the nuclear accent is concerned, because it is typically L* across the board. However, taking together nuclear accent and edge tone, the nuclear contour tells the difference (a final rise to high is more frequent in ISQs than in RQs). In polar questions, the position of the nuclear accent also plays a role. In Dehé & Braun's (2020b) study, a rising nuclear accent (L*+H) was associated with the syntactic subject in about one quarter of RQs (*Does ANYone like liver?*), but this was the case in less than 5% in ISQs. In other words, a nuclear accent early on in the utterance, unless due to information structure (not the case in Dehé & Braun 2020b), hints to rhetorical interpretation. As can be seen in Table 2, the probability of a polar question to be best interpreted as RQ if realized with the nuclear accent on the subject instead of the object is 82% (based on Dehé & Braun's 2020b data). If the early nuclear accent combines with H-L%, the duration (or: extension) of the final plateau is increased, thus strengthening its function of signaling rhetoricity.

Table 2 summarizes the most important tonal events in the nuclear area for RQs in English, based on Dehé & Braun (2020b). According to their results, a nuclear accent on the subject followed by H-L% for polar questions, and L+!H* on the object noun followed by L-L% for *wh*-questions have the highest probabilities to signal RQ meaning (87% and 70%, respectively).

[5] Remember from footnote 4 that H-L% in MAE_ToBI corresponds to H-% in GToBI, thus English and German have the occurrence of the final mid-high plateau in RQs in common.

English RQs	Edge tone	Nuclear accent	Nuclear tune
Most frequent prosodic event in **polar RQs** (frequency in %) p(Event|Context)	H-L% (53%)	L* on object (67%)	L* H-H% (35%) L* H-L% (32%)
Highest probability for **polar RQ** (probability in %) P(Context|Event)	H-L% (85%)	Nuclear accent on subject, no accent on object (82%)	Nuclear accent on subject H-L% (87%)
Most frequent prosodic event in ***wh*-RQs**	L-L% (87%)	L+!H* on object (59%)	L+!H* L-L% (55%)
Highest probability for ***wh*-RQ** (probability in %)	L-L% (49%)	L+!H* on object (69%)	L+!H* L-L% (70%)

Table 2. Frequency of most frequent edge tones; nuclear accents and nuclear tunes for English polar-RQs and *wh*-RQs (rows 1 and 3), relative to the total number of events in that illocution type. Rows 2 and 4 indicate the probability that a certain tonal event is indicative of an RQ illocution (relative to an ISQ), provided it occurred more than 10 times. All figures are taken from Dehé & Braun (2019). Rows read like in Table 1.

In the prenuclear region, Dehé & Braun (2020b) observe more unaccented verbs in polar ISQs than in polar RQs (although in general, the verb is mostly unaccented), and more rising (L*+H) accents associated with the *wh*-pronoun in RQs compared with a typical peak (H*) accent in ISQs.

The most robust phonetic parameter to distinguish between English ISQs and RQs is duration, with longer durations in RQs than in ISQs in both polar and *wh*-questions (Dehé & Braun 2020b). Another relevant phonetic parameter is voice quality. For English *wh*-questions, Dehé & Braun (2020b) find more breathiness associated with the *wh*-word in RQs than in ISQs, which is reminiscent of the results for German reported in (Braun et al. 2019).

3.1.3 Icelandic

Syntactically, Icelandic is an SVO, verb-second language throughout (see Thráinsson 2007 for the syntax of Icelandic). Polar questions are verb-initial, without the use of an auxiliary (unlike English; see (6)). The default structure for *wh*-questions has a *wh*-pronoun in initial position (see (7)).

(6) Borðar einhver límónur? (Icelandic polar question)
Eats anybody limes
'Does anybody eat limes?'

(7) Hver borðar límónur? (Icelandic *wh*-question)
Who eats limes

Unlike in German and English, the default intonational contour of both polar and *wh*-ISQs in Icelandic is a fall to a low terminus (L-L%), just like in declaratives (Árnason 1998a, 2005, 2011; Dehé 2018; Dehé & Braun 2020a), thus the edge tone generally makes no contribution to the distinction between interrogatives and declaratives, or any other utterance type. The prosodic difference between utterance types lies in pitch accent types. Specifically, declaratives and polar questions have nuclear rises, but the peak of the rise is aligned later with respect to the nuclear syllable in polar questions (L*+H) than in declaratives (L+H*), and *wh*-questions have a nuclear peak accent (H*); see Árnason (2011) and Dehé & Braun (2020a).

In Icelandic, the intonational terminus of the utterance (boundary tone) does not play a role for the distinction between ISQs and RQs, as it is generally a fall to low (L-L%). Similar to the distinction between declaratives, polar questions and *wh*-questions, the crucial differences between ISQs and RQs are differences in pitch accent type (see Dehé & Braun 2020a for details). In polar questions, it is the timing of the nuclear rise that distinguishes between polar ISQs and polar RQs. Specifically, there are more late rises (L*+H) in ISQs, and more early rises (L+H*) in RQs. Within *wh*-questions, ISQs typically have (monotonal) peak accents (H*/!H*/^H*), while RQs, similarly to polar RQs and declaratives, have (bitonal) rising accents with the peak aligned in the stressed syllable (L+H*/L+!H*/L+^H*).

Table 3 summarizes the most important tonal events in the nuclear area for RQs in Icelandic, based on Dehé & Braun (2020a). According to their results, the nuclear contours

'early rise on object L%' for polar questions, and 'early rise on object L%' for *wh*-questions have the highest probabilities to signal an RQ meaning, 61% and 71%, respectively.

Icelandic	Edge tone	Nuclear accent	Nuclear tune
Most frequent prosodic event in **polar RQs** (frequency in %) p(Event|Context)	L-L% (100%)	Early-rise on object (L+H*/L+!H*/L+^H*) (66%)	Early-rise on object L% (66%)
Highest probability for **polar RQ** (probability in %) P(Context|Event)	L-L% (51%)	Early-rise on object 61%	Early-rise on object L% (61%)
Most frequent prosodic event in ***wh*-RQs**	L-L% (100%)	Early-rise on object (85%)	Early-rise on object L% (85%)
Highest probability for ***wh*-RQ** (probability in %)	L-L% (53%)	Early-rise on object (71%)	Early-rise on object L% (71%)

Table 3. Frequency of most frequent nuclear accents, edge tones and nuclear tunes for Icelandic polar RQs and *wh*-RQs (rows 1 and 3), relative to the total number of events in that illocution type. Rows 2 and 4 indicate the probability that a certain tonal event is indicative of an RQ illocution (relative to an ISQ). All figures are taken from Dehé & Braun (2020a). Rows read like in Table 1.

Another intonational difference between ISQs and RQs in Icelandic is found in the prenuclear region, i.e., the beginning of the question (Dehé & Braun 2020a). First, more prenuclear accents were found in RQs than in ISQs in both polar and *wh*-questions. Prenuclear accents were also intonationally 'stronger' (i.e., they involved more pitch movement and were thus analyzed as a rise rather than a peak or low target) in RQs than in ISQs. There is also an intonational difference within *wh*-questions in utterances without prenuclear prominence such that *wh*-ISQs start higher than *wh*-RQs, i.e., there are more initial high boundary tones (%H) in ISQs than in RQs.

Like in German and English, there are also durational differences between ISQs and RQs in Icelandic. Dehé et al. (2018) found longer durations for RQs than for ISQs across question types in both the nuclear and the prenuclear region. Specifically, the *wh*-word in *wh*-questions and the sentence-initial verb in ISQs were longer in RQs than in ISQs. Likewise, the nuclear syllable was longer in RQs than in ISQs. Interestingly, longer syllable duration is manifested not only in the rhyme, but in the onset of the nuclear syllable, too (Dehé et al. 2018). Previous literature maintains that it is the rhyme (the vowel in open syllables and the coda consonant (cluster) in closed syllables) that may be lengthened, e.g., under stress or emphasis (e.g., Árnason 1998b, 2011; Haugen 1958), thus onset lengthening is not necessarily expected. Whether this effect is specific to RQs or whether it also occurs in other contexts is a question for future research.

3.1.4 Italian

Italian is an SVO language. Polar questions (see (8)) are not marked morpho-syntactically, i.e., they have SVO order like declaratives. In *wh*-questions (see (9)), the *wh*-element is fronted.

(8) Vuoi una mela? (Italian polar question)
do.you.want an apple
'Do you want an apple?'

(9) Chi vuole una mela? (Italian *wh*-question)
Who wants an apple
'Who wants an apple?'

Italian intonation shows an enormous range of regional variability as well as inter-variety variation (e.g., Gili Fivela et al. 2015). It is therefore difficult (if not impossible) to speak of a Standard Italian intonation in general. This is also true for polar and *wh*-questions. The prosody of Italian RQs has recently been studied for the Bari variety, including both polar and *wh*-RQs by Sorianello (2018, 2019), which is why we focus here on the Bari variety.

According to Grice et al. (2005b), the typical intonation pattern for polar ISQs in Bari Italian is an early rising nuclear accent followed by a fall to low: L+H* L-L%. The peak in the

nuclear accent is reached in the middle of the accented syllable. Instead of L-L%, Bari polar ISQs may have L-H%, resulting in a L+H* L-H%, which, according to Grice et al. (2005b: 367), is an "optional stylistic variant" (see also Gili Fivela et al. 2015: 170 for illustration). Empirical support comes from Savino's (2012) map task study investigating the intonation of polar ISQs in 15 Italian varieties including Bari. For Bari polar ISQs, she identifies L+H* L-L% as the most common nuclear contour, with an occasional extra terminal rise after the rising pitch accent (H%). Grice et al. (2005b: 383f.) also observe truncation of the final fall such that it only reaches a mid-level of the speaker's range. *Wh*-ISQs in Bari (as well as in several other varieties) are associated with a H+L* L-H% or H+L* L-L% nuclear contour, i.e., a nuclear fall to a low accented syllable followed by a final fall or rise (Gili Fivela et al. 2015: 179). *Wh*-questions share this nuclear accent with statements.

Interrogatives in Sorianello's (2018, 2019) Bari data are realized with three different nuclear accents: L+H*, L* and H+L*. Within polar questions, L+H* is most common in both ISQs and RQs. Within *wh*-questions, H+L* is most frequent in *wh*-ISQs, but L+H* is almost equally frequent (just over 50% and just under 50%, respectively). H+L* is also the most frequent accent type in *wh*-RQs (around 40%), followed by L+H* (around 30%). L* stands out since it is exclusively found in *wh*-RQs (Sorianello 2018). Sorianello (2018) also finds differences between edge tones realized in ISQs and RQs. While all types of edge tones can be found in both ISQs and RQs in her data, ISQs are rising more often than RQs. L% is the most frequent edge tone for RQs (62% of polar RQs, 56% of *wh*-ISQs in Sorianello's data), while ISQs terminate in either H% or LH% in over 50% of the cases. Note that this result is not fully in line with previous research sketched above. In Savino's (2012) data, 82% of polar questions were realized with a L+H L-L% contour. Also with respect to F0, Sorianello (2018) finds that pitch excursion in *wh*-ISQs is approximately three semitones larger than in *wh*-RQs.

Sorianello (2019) argues that within RQs, the edge tone reflects pragmatic functions. Specifically, RQs used to mitigate the assertion predominantly end in H%, while RQs that amplify a personal opinion have a falling contour (L%). The nuclear accent reflects the function of the RQ only in *wh*-questions. Specifically, H+L* is more often used for amplification, L+H* for mitigation (Sorianello 2019).

Regarding phonetic parameters, Sorianello investigated intensity and duration, but only duration seems relevant for the distinction between ISQs and RQs. Sorianello (2018) reports that a final accented vowel was generally longer in *wh*-RQs than in *wh*-ISQs. However, for a final unaccented vowel, the overall duration of the utterance and speech rate did not signal

rhetoricity. Interestingly, the speed of accompanying manual co-/pro-speech gestures seem to contribute to the distinction between an RQ and a biased but still information-seeking question (Ippolito 2019). While slow gesturing is associated with RQs, fast gestures are linked to biased questions.

3.2 Head-prominence tone languages

Unlike intonation languages, which have lexical stress, tone languages have lexical tone, i.e., F0 is used to distinguish meanings at the lexical level (e.g., Gussenhoven 2004; Yip 2002) or use tone to mark grammatical distinctions such as tense or case (e.g., Yip 2002). One way to represent tone is by numbers 1-5, where 1 is at the low end of a speaker's pitch range and 5 at their high end (e.g., T51 represents a tone falling from high to low). Another way is by diacritics placed on the tone-bearing unit (e.g., è for a falling tone, 'e' representing any tone-bearing unit; see International Phonetic Alphabet for all diacritics).[6] The tone languages included in this paper belong to head-prominence languages because phrasal prominence is derived from the tonal specification in the lexicon. The overall shape of the F0 contour is considerably constrained by the canonical form of the lexical tones, but post-lexical prominence is achieved by manipulating phonetic parameters such as pitch range and duration (Jun 2014). Along with its lexical function, F0 in tone languages also serves post-lexical functions, such as marking focus (or: information structure) and speech acts, e.g., interrogativity (e.g., Zhang et al. to appear; Xu 2019 for overviews). Tone languages thus provide an interesting test case for the question of how the F0 contour contributes to the distinction between ISQs and RQs at utterance level. Here, we include Standard Chinese and Cantonese. For both languages, the prosodic differences between ISQs and RQs have recently been addressed by use of production experiments.

[6] https://www.internationalphoneticassociation.org/content/full-ipa-chart (accessed 4 December 2020).

3.2.1 Standard Chinese

In Standard Chinese, every syllable carries one of four lexical tones (Chao 1956): Tone 1 (T55, high-level; ē), tone 2 (T35, rising é), tone 3 (T214, falling from low-rising; ě) and tone 4 (T51, falling, also known as the neutral tone; è). Standard Chinese frequently employs particles to signal questions, e.g., 么 ma, 吧 ba, 呢 ne (Chao 1968; Li 2006; Liing 2014). The sentence-final particle 么 *ma/me* is commonly used to turn a statement into a polar question, see (10).

(10) 有人 吃 柠檬 (么）

Yǒurén chī níngméng (me)

Somebody eat lemon Q

'Somebody eats lemons. / Does anybody eat lemons?'

Since sentence-final particles are optional, declaratives and polar questions may be string-identical. Global and local properties of the F0 contour as well as duration are used to distinguish between string-identical declaratives and questions. In particular, polar ISQs are produced with higher overall F0 than string-identical declaratives (Lee 2005; Liu & Xu 2005; Yuan 2006), with the difference in F0 becoming larger towards the end of the utterance (Yuan 2006). Contrary to Cantonese, where questions end in a final rise irrespective of the lexical tone (see below), Standard Chinese is more faithful to the shape of the lexical contour at the end of the utterance (see Zhang et al. to appear for a summary). That is, tone 4 is still a falling tone in questions, but its range is reduced; tone 2 is rising also in questions, but compared to declaratives, it is realized with an enhanced F0 range in the rise (Zhang et al. to appear). Furthermore, except for the last syllable, syllables are shorter in polar questions than in declaratives (Yuan 2006).

Standard Chinese is a *wh*-in-situ language (Cheng 1991). *Wh*-questions and *wh*-declaratives may be string-identical. In *wh*-questions, *shénme* is the *wh*-pronoun meaning 'what', while in string-identical declaratives, together with the licensor *diǎnr* (‘a little’), it is an indefinite / existential, meaning 'a little bit of something' (cf. Yang 2018). F0 and other prosodic cues distinguish between the two utterance types. For example, in sentences containing *shénme*, *wh*-ISQs exhibit higher F0 compared to string-identical declaratives, mostly towards the end of the utterance (Liu et al. 2016; Yang 2018). Yang (2018) further shows an increased F0 range

in *shénme* 'what' for questions. Additionally, utterance and word durations are shorter in *wh*-ISQs than in declaratives, with the exception of the *wh*-word *shénme* (Yang 2018); see also Yang et al. (2020).

In Standard Chinese, ISQs and RQs may be string-identical, both within polar and *wh*-questions. Zahner et al. (2020) studied the prosody of ISQs and RQs following the experimental protocol developed in Braun et al. (2019) for German, using polar and *wh*-questions as given in (11) and (12), respectively. Within the 22 experimental items of each question type, all four tones occurred on the last syllable of the object noun (N=4 for tone 3, N=6 for all other tones).

(11) **有人 吃 柠檬 么**? (Standard Chinese polar question)

Yǒurén chī níngméng me?
Anyone eat lemon Q
'Does anyone eat lemons?'

(12) 谁 **吃** 柠檬? (Standard Chinese *wh*-questions)

Shéi chī níngméng?
Who eats lemons

RQs differ prosodically from string-identical ISQs in terms of F0 (global and local properties) as well as duration and voice quality (Zahner et al. 2020). Specifically, RQs were globally produced with lower mean F0 than ISQs in both polar and *wh*-questions. Regarding local F0 properties, the first constituent (i.e., *yǒurén* 'anyone' in polar questions, *shéi* 'who' in *wh*-questions) showed a wider pitch range in RQs than in ISQs, mainly due to a lowering in the low tonal target. At the end of the utterance, RQs were also lower in pitch than ISQs, but the overall shape of the lexical tone was preserved. This local F0 difference between ISQs and RQs was smaller for tone 3 than for all other lexical tones in both polar and *wh*-questions. Zahner et al. (2020) explain this specific behavior of tone 3 by the shape of the tone itself, which is (i) the most complex one to produce and (ii) the one that involves the lowest tonal target, which makes it harder to lower F0 even further. Figure 4 provides representative examples of Standard Chinese polar questions, Figure 5 pictures *wh*-questions (top: ISQs, bottom: RQs); from Zahner et al. (2020).

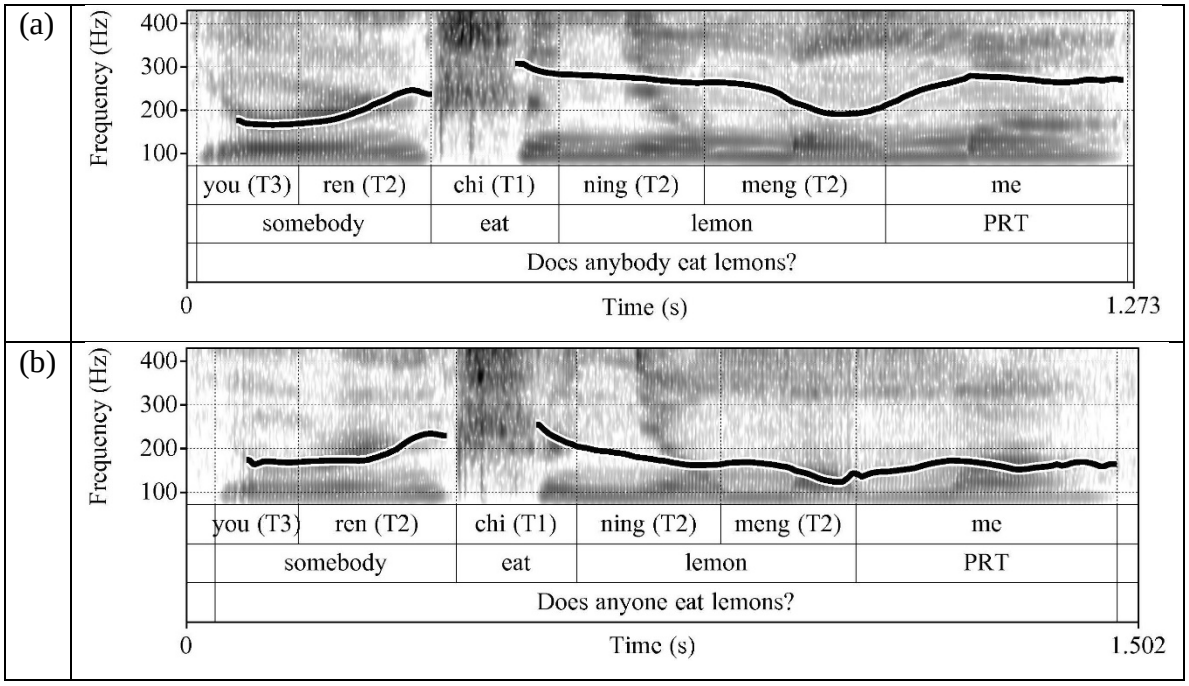


Figure 4. Spectrograms and pitch tracks of representative examples of Standard Chinese polar questions (top: ISQ, bottom: RQ). Tier 1: syllables and their lexical tones; tier 2: English word-by-word translation; tier 3: broad translation.

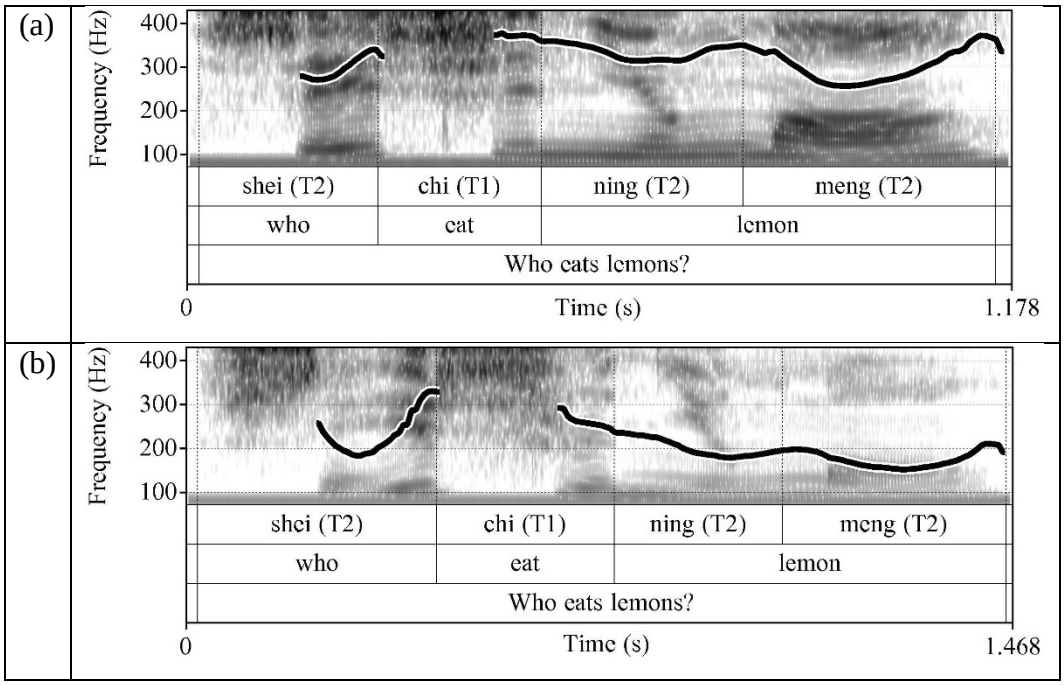


Figure 5. Spectrograms and pitch tracks of representative examples of Standard Chinese *wh*-questions (top: ISQ, bottom: RQ). Tiers as in Figure 4.

Zahner et al. (2020) also found longer durations in Standard Chinese RQs than in ISQs, both for overall utterance duration and individual constituent durations (except for particle *me* in

polar questions). Within both polar and *wh*-questions, the first constituent showed the largest relative difference between ISQs and RQs. Moreover, Zahner et al. (2020) report differences in voice quality between ISQs and RQs. Specifically, more instances of glottalized voice were found in RQs than in ISQs in the first and the last constituent of both polar and *wh*-questions. Again, tone 3 behaved special: if the object noun had tone 3, the noun was highly glottalized in both ISQs and RQs. There was still more glottalization in RQs than in ISQs, but the difference between RQs and ISQs was smaller than for all other tones. The special behaviour of tone 3 with respect to glottalization is in line with (Kuang 2017, 2018), who shows that creaky voice accompanies low targets in Standard Chinese tones.

3.2.2 Cantonese

Cantonese has six basic lexical tones: two rising tones, tone 2 (T25) and tone 5 (T23), one falling tone, tone 4 (T21), and three level tones, tone 1 (T55), tone 3 (T33), and tone 6 (T22) (e.g., Bauer & Benedict 1997; Fox et al. 2008).[7] Cantonese employs sentence-final particles (SFPs) as well as F0 modifications to convey speaker attitude or emotions (e.g., Sybesma & Li 2007 for SFPs, Cheang & Pell 2009 for F0). Previous literature on Hong Kong Cantonese question intonation has generally focused on declarative questions (also referred to as 'intonation questions' in the relevant literature) as compared to declaratives, showing that declarative questions are realized with overall raised F0 contours as compared to declaratives, as well as with terminal rises (e.g., Flynn 2001; Fox et al. 2008; Ma et al. 2006a, 2006b). Terminal rises occur regardless of the canonical form of the lexical tone associated with the sentence-final element.

In this section, we focus on *wh*-questions, because the studies on the prosody of RQs in Cantonese we are aware of include *wh*-questions only. Cantonese *wh*-questions are *wh*-in-situ (Matthews & Yip 1994: 323; Cheng 1991: 19). With respect to intonation, they are generally falling (Chow 2002, cited by Chen & Mok 2015), although Chen & Mok (2015) find both falling and rising patterns possibly due to the nature of their experimental materials as well as

[7] Bauer & Benedict (1997: 111) mention a seventh basic tone, which "some speakers may have". They also explain (ibid.) that due to phonetic variation, the actual number of tones "uttered by any given speaker far exceeds the number of basic tones", but that the total number of basic tones can be reduced to six or seven.

the experimental setting. Most importantly, *wh*-questions in their materials did not contain SFPs, which are otherwise widely used in *wh*-questions, perhaps leading to rising terminals as in declarative questions.

In a recent study, Lo et al. (2019a, 2019b) investigate the prosody of *wh*-ISQs vs. *wh*-RQs in Cantonese. They used a production design similar to the one used in Braun et al. (2019), Dehé & Braun (2020a, 2020b) and Zahner et al. (2020), but included three types of RQs along with ISQs: (i) negative RQs (RQ-), for which the suggested answer is 'nobody' (equivalent to the ones tested for German, English, Icelandic, Standard Chinese, French); (ii) positive RQs (RQ+), for which the suggested answer is 'everybody'; and (iii) RQs as retorts (e.g. *Is the Pope catholic*?, see footnote 3 above). Twelve *wh*-subject questions, which were ambiguous between ISQs and RQs, were used (see the example in (13), from Lo et al. 2019b: 504). All six tones occurred on the object noun (the last word before the SFP) in equal shares. Half of the target sentences contained the SFP *aa1* (吖), the other half contained *aa3* (呀). Both SFPs are felicitous in both ISQs and RQs (Lo et al. 2019a), although there is a tendency for *aa1* to be less neutral with respect to speaker's attitude than *aa3* (Sybesma & Li 2007: 1760).

(13) Jau5 bin1go3 soeng2 jam2 gaa1fe1 aa1/aa3? (Cantonese *wh*-question)
have who like drink coffee SFP
'Who wants to drink coffee?'

Based on data elicited from 15 native speakers of Cantonese, Lo et al. (2019b) find that both ISQs and RQs start at a high F0 level, are falling throughout the utterance, and terminate at a low level. However, ISQs and RQs differ in the general height of the F0 contour. Specifically, RQs are realized with overall lower F0. Moreover, RQs had longer utterance durations than ISQs.

Lo et al. (2019a) investigated the prosodic properties of the SFPs *aa1* (吖) and *aa3* (呀) in *wh*-ISQs vs. *wh*-RQs. Regarding F0 realized on the SFP, positive RQ+ and retorts were overall higher compared to RQ- and ISQs, and that they were rising, while RQ- and ISQs were low and only slightly rising. There was a tendency for RQ- to be lower than ISQs, and this tendency was stronger for *aa3* than for *aa1*, but neither the difference between RQ- and ISQs, nor the one between the SFPs turned out to be significant. With respect to duration, Lo et al. (2019a) find longer SFP durations in RQ- as compared to ISQs. There was no difference between ISQs and RQ+ or retorts.

3.3 Head/edge-prominence languages

In head/edge-prominence languages, post-lexical phrasal prominence is marked by both the head and the edge of a phrase (Jun 2005, 2014). They include languages that have a lexical pitch accent and edge tone (e.g., Japanese), as well as languages that have post-lexical pitch accents and edge tones (e.g., French). The edge tone has a demarcative function. In French, for example, it marks the edge of the smallest phrasal prosodic constituent, the Accentual Phrase (AP; see Delais-Roussarie et al. 2015). Each non-IP final AP has an obligatory final rise, in which the high tonal target is realized on the prominent syllable (Di Cristo 1998; Jun & Fougeron 2000, 2002; Welby 2006). Given this structure, French intonation is perceived by sequences of rising pitch movements (Delais-Roussarie et al. 2015). Focus and syntactic/semantic groupings in head/edge-prominence languages are typically marked by changes in prosodic constituency (Jun 2014).

3.3.1 Japanese

Japanese is a head/edge-prominence language that marks the left edge of an accentual phrase with a rising accent and the right edge with a low tone (Gussenhoven 2004). About half of the words of the Japanese lexicon carry a lexically specified pitch accent, specifically a pitch fall on one mora (e.g. Gussenhoven 2004; Haraguchi 1996).

In Japanese *wh*-questions, the *wh*-pronoun occurs in sentence-initial position or in-situ (e.g., Kitagawa 2005; Morita 2019). Questions can be marked by the sentence-final particle *ka*, which is, however, not obligatory, in particular not in informal speech (e.g., Watanabe 2002; Yoshida & Yoshida 1996). Itani (1993) argues that *ka* can also be used in exclamatives, suggesting an analysis of *ka* as a special kind of non-declarative marker, expressing desirable thought. In combination with other particles, *ka* can also occur in self-addressed questions and expository questions (Goto 2018).

Miura & Hara (1995) conducted an experimental study to investigate the prosodic differences between ISQs and RQs using four sentences (two polar and two *wh*-questions, one of each with a lexical pitch accent on the first constituent, one without). RQs were defined for participants as "questions presupposing a negative statement" (Miura & Hara 1995: 293). We focus on the results for *wh*-questions. This is because the polar questions used in this study had

declarative syntax and in their rhetorical interpretation expressed disbelief or incredulity, thus possibly obscuring the comparability of the results. The two *wh*-questions used in the study are given in (14) and (15) (from Miura & Hara 1995: 292).

(14) Dare ga kai+masu. (Japanese *wh*-questions)
Who NOM buy+HON
ISQ: 'Who will buy?' RQ: 'Who would buy?!'

(15) Nani ga oki+masu. (Japanese *wh*-questions)
What NOM happen+HON
ISQ: 'What will happen?' RQ: 'What would happen?!'

The results from ten speakers showed that RQs were longer in duration than ISQs, in particular when they started at a low pitch level. Furthermore, RQs had a larger F0 excursion than ISQs. While this goes against findings for other languages, one possible reason for the deviant findings in Japanese may be the fact that the polar RQs in Miura & Hara's (1995) paradigm expressed incredulity, which is often signaled by higher f0. In our view, it is conceivable that incredulity became part of the interpretation of *wh*-RQs used in the same paradigm, as well.
It has also been shown that Japanese listeners exploit prosodic cues to distinguish RQs from ISQs. In a forced-choice identification experiment, in which listeners judged a series of synthesized target questions as either ISQ or RQ, there were significant effects of duration and F0 range on the initial and final constituent. Specifically, longer durations, lower initial pitch and higher final pitch led to more rhetorical responses, but the effect of initial pitch lowering was strongest.

3.3.2 French

Following Jun's (2005, 2014) classification, European French is a head/edge-prominence language with post-lexical pitch accents and edge tones.[8] Interrogative syntax is variable in French, see, e.g., Druetta (2018); Kaiser (2020). Polar questions may (i) have declarative word

[8] There is no general agreement in the literature about this; see, for example, Caroline Féry's work on French intonation for a different account (e.g., Féry 2017), which assumes no pitch accents in French.

order, or may be morpho-syntactically marked by (ii) subject-verb-inversion or (iii) the interrogative particle *est-ce que*. *Wh*-questions show even more syntactic variation; the following variants occur: (i) ex-situ (fronted) *wh*-word followed by inverted verb and subject, (ii) *wh*-ex-situ without inversion, (iii) *wh*-ex-situ variants with *est-ce que*, and (iv) *wh*-in-situ variants. Given the existing literature on the prosody of French RQs, we limit our discussion here to polar questions formed with the interrogative particle *est-ce que* (see (16)) and *wh*-questions with *qui* 'who' (see (17)), which are felicitous in both an ISQ and an RQ reading.

(16) Est-ce que quelqu'un mange des épinards? (French polar question)
is.it that anybody eats INDF spinach
'Does anybody eat spinach?'

(17) Qui mange des épinards? (French *wh*-question)
who eats INDF spinach
'Who eats spinach?'

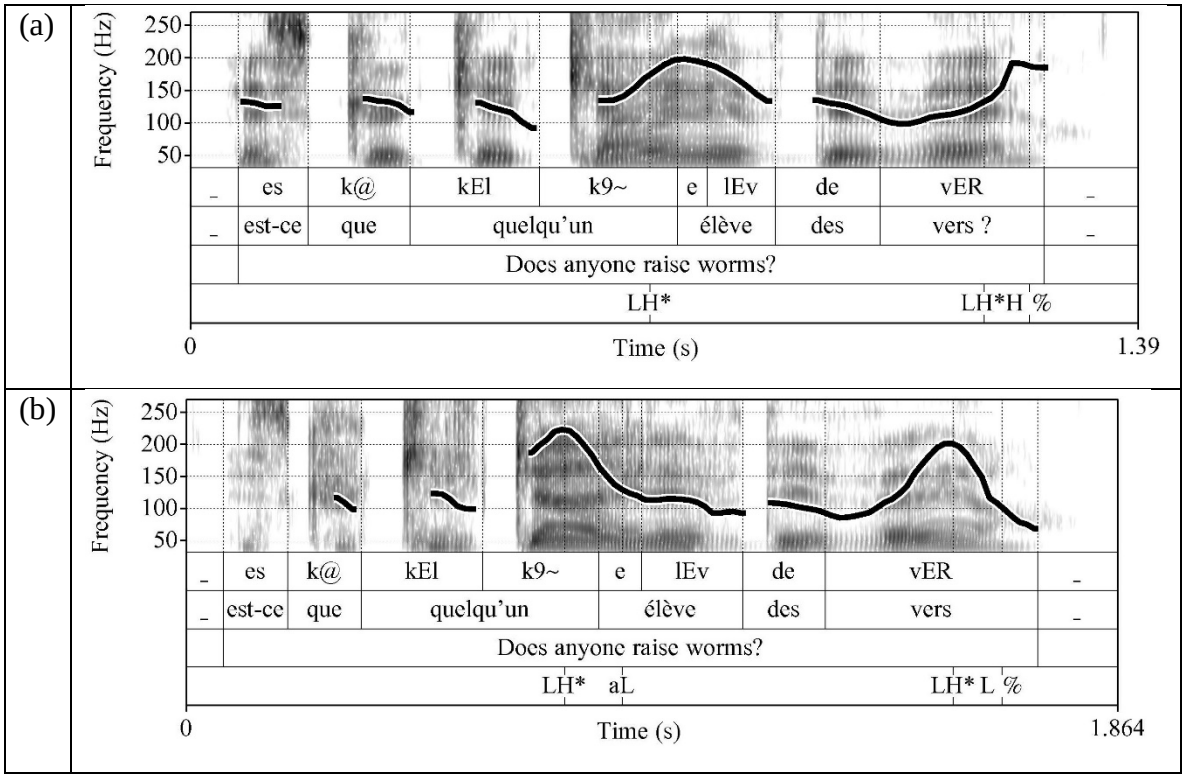
The typical intonation contour for polar ISQs formed with the interrogative particle *est-ce que* is a nuclear rise, or !H* H% (Delais-Roussarie et al. 2015).[9] However, according to (Delais-Roussarie et al. 2015: 84), this contour is "less stable" than, for example, in declarative questions, which are realized with a nuclear final rise (H* H%) by default (Delais-Roussarie et al. 2015; Di Cristo 1998). For *wh*-ISQs using *qui*, the *wh*-word can be realized with a rising movement or a H* pitch accent. The nuclear contour is generally (but not necessarily) a falling one (L* L%), see Delais-Roussarie et al. (2015).

Regarding the prosody of RQs in French, Di Cristo (2016: 320, 329) describes questions with "a rhetorical value", including self-addressed questions, as ending in an elongated stretch at a low pitch level, accompanied by syllable lengthening. In what follows, we report on the main results from the first experimental production study of the prosody of French RQs, which

[9] According to Delais-Roussarie et al (2015), L* H% is the default contour for polar questions with morpho-syntactic or lexical markers, i.e. including polar questions with *est-ce que*. To this, Elisabeth Delais-Roussarie (personal email 18 March 2020) adds that declarative questions have mostly H* H%, and that other polar questions (including polar questions with *est-ce que* and polar questions with subject-verb inversion) have !H*, LH* or L* as pitch accents, mostly followed by H%. The default for polar questions, according to Elisabeth Delais-Roussarie (p.c.), is thus L* or !H* followed by H%.

was conducted by Beyssade & Delais-Roussarie (to appear) with 12 native speakers, replicating Braun et al. (2019)'s protocol.

With respect to F0, Beyssade & Delais-Roussarie (to appear) found no specific nuclear contour for ISQs vs. RQs, but the main generalization seems to be that falling contours are more frequent in RQs than in ISQs, while rising nuclear contours were more frequent in ISQs than in RQs. Specifically, polar-ISQs were most frequently realized with a nuclear rise (LH* H% in 47% of the cases), followed in frequency by a high plateau (!H* 0%, in 25% of the cases), but also with rising-falling contour (LH*L, in 25% of the cases). Polar-RQs were also realized with a variety of contours: with a rising-falling contour (LH*L) in 25% of the cases, a rising contour (LH*H%) in 25%, a plateau contour (!H* 0%) in 25%, and a falling contour (!H* L%) in 20% of the cases. *Wh*-ISQs were almost always rising or ended in a high plateau (LH*H%, in 50%, !H* 0% in 42% of the cases). *Wh*-RQs, in turn, showed a more diverse pattern, ending in a rise or a plateau in about 50% of the cases, and ending in a final fall in about 47% of the cases. Prototypical realizations are plotted in Figure 6 for polar questions and Figure 7 for *wh*-questions.[10]



[10] We thank Claire Beyssade and Elisabeth Delais-Roussarie for sharing their sound files and TextGrid files, from which these figures were produced.

Figure 6. Spectrograms and pitch tracks of prototypical realizations of French polar questions (top: ISQ, bottom: RQ). Tier 1: segmentation at syllable level; tier 2: segmentation at word level; tier 3: English translation; tier 4: annotation according to French ToBI (Delais-Roussarie et al. 2015).

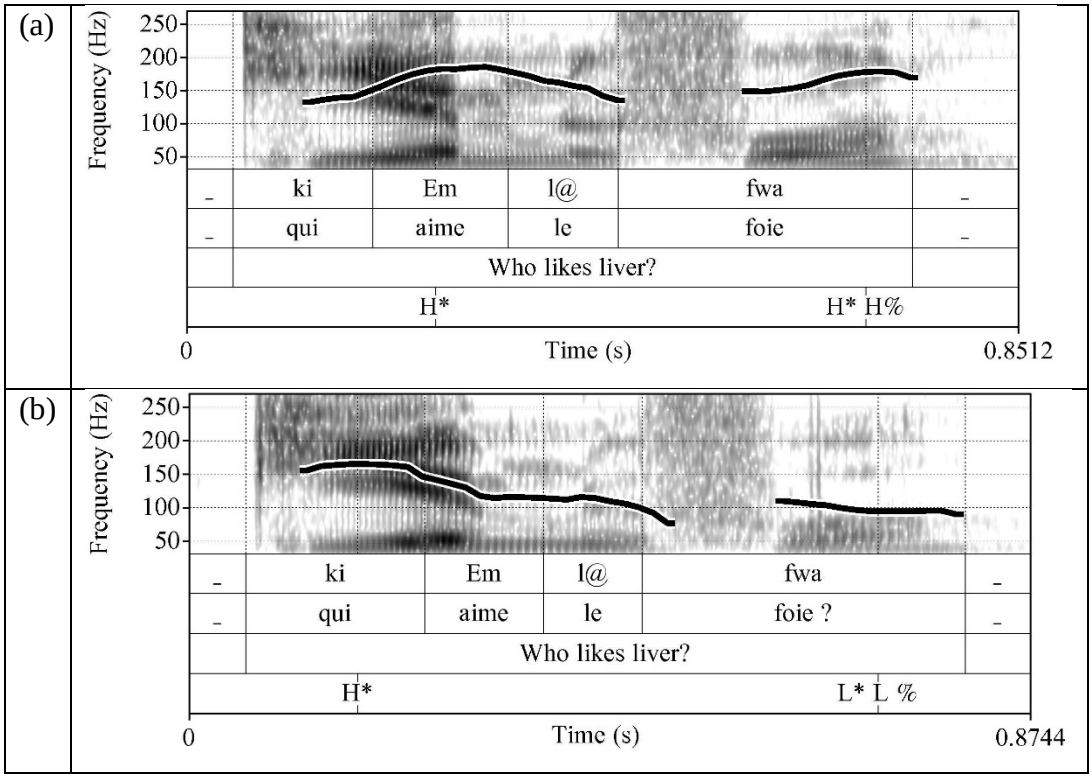


Figure 7. Spectrograms and pitch tracks of prototypical realizations of French *wh*-questions (ISQ at the top, RQ at the bottom); tiers as in Figure 6.

Beyssade & Delais-Roussarie (to appear) also found phonetic differences between RQs and ISQs. First, ISQs were produced with higher overall F0 than RQs. However, the global pitch range was not always larger in ISQs than in RQs. In fact, the pitch range was compressed after the *wh*-element in *wh*-RQs, see Figure 7b, similar to post-focus sequences in French declaratives (e.g., Delais-Roussarie et al. 2002; Féry 2014; Jun & Fougeron 2002). French also employs durational cues to distinguish ISQs from RQs. ISQs showed a faster speech rate than RQs (in both polar and *wh*-questions), i.e., as in other languages, RQs had generally longer durations than ISQs. A speaker-specific analysis revealed that for one third of the speakers, speech rate was higher for ISQs than RQs in 85% of the cases, for another third it was higher in more than 65% of the productions, while another third did not use this cue.

Beyssade & Delais-Roussarie (to appear) point out that the differences in pausing and F0 compression in *wh*-questions might reflect a difference in phrasing across illocution types. While the *wh*-element tended to be followed by a phrase break (manifested as pause) in *wh*-RQs (in 65% of the cases), such a break occurred more infrequently in *wh*-ISQs (in 24% of the cases only). For polar questions, the difference in the number of phrase breaks across illocution type was less pronounced. In polar-RQs, a break after the indefinite occurred in 62% of the cases, while in polar-ISQs a break occurred in 41% of the cases.

4 Cross-linguistic discussion of prosodic cues to RQs: differences and commonalities

The previous sections have shown that all languages surveyed here make use of prosody to distinguish between ISQs and RQs, although they may do so in different ways. In this section, we offer a comparison between the languages. The comparison is organized according to the three prosodic parameters that have been identified as contributing to the distinction between ISQs and RQs across languages: F0 (Section 4.1), utterance/constituent duration/speech rate (4.2), and voice quality (4.3). Each of these cues is used cross-linguistically, but the actual implementation of a cue is language-specific. Section 4.4 revisits the languages for which the prosody of RQs has been studied using different methodologies (map task experiment, controlled production experiment, corpus study) and compares the respective results.

4.1 F0

F0 is used to mark the difference between ISQs and RQs in all languages included here. In head-prominent intonation languages, F0 is first and foremost relevant in the variation of pitch accents and edge tones. Two characteristics of **nuclear pitch accents** are relevant: position and type. At least in the data elicited so far, position is relevant in English only, and only in polar questions, where the nuclear accent in RQs may fall on the subject rather than the sentence-final object. In Dehé & Braun's (2020b) data, this was the case in approximately one quarter of polar RQs. This placement can thus not be called typical, however, when it does occur, it is a

very strong indicator of rhetoricity (see Table 2).[11] By type of nuclear accents, we relate to two properties: (i) whether a pitch accent is bitonal (rising, falling) or monotonal (high, low), and (ii) within bitonal accents, alignment of tonal targets with respect to the segmental string. All intonation languages surveyed above make use of pitch accent types to signal rhetoricity, but based on the existing literature, Italian does so to a much lesser extent than German, English and Icelandic (and we see differences within the latter three as well). In Bari Italian, the presence of the L* pitch accent in *wh*-RQs (along with the overall larger pitch excursion in *wh*-ISQs than in *wh*-RQs; Sorianello 2018) seems to be the safest prosodic cue to rhetorical meaning found so far. German, English and Icelandic make more extensive use of nuclear pitch accents to mark the difference between ISQs and RQs, although they do so in slightly different ways. Specifically, in English and Icelandic *wh*-questions, the main difference is between a monotonal high accent in *wh*-ISQs and a bitonal rising accent in *wh*-RQs, both typically followed by a fall to low, while in German *wh*-questions, the main difference is in the tonal alignment of rising L+H accents (early rise L+H* in ISQs, late rise L*+H in RQs). In polar questions, German mainly uses the difference between monotonal and bitonal accents (low L* in ISQs, rising L*+H in RQs), suggesting that L*+H is generally a pitch accent used in RQs, while Icelandic uses alignment differences (late rise L*+H in ISQs, early rise L+H* in RQs). No difference with respect to type of pitch accents is found in English polar questions (L* in both ISQ and RQ); here, accent position and combination with edge tone (high rise in ISQ, plateau in RQ) take over.

In the **prenuclear area**, we find similarities between Icelandic and English such that more complex (that is, bitonal) accents are more frequently produced in *wh*-RQs than in *wh*-ISQs. For English, this difference between *wh*-ISQs and *wh*-RQs has been interpreted by Dehé & Braun (2019) along the following lines. The *wh*-word represents the unspecified part of the proposition in *wh*-ISQs, i.e., the speaker requests information to fill the open slot and s/he therefore marks the *wh*-word with H*. In RQs, on the other hand, the *wh*-word corresponds to the obvious answer, rather than the unknown one, and thus a different accent type is used. This interpretation may perhaps be extended to Icelandic, but it does not explain the lack of a similar difference in German. However, one possible explanation is that German *wh*-RQs are more specifically marked in the nuclear area. Specifically, the nuclear contour L*+H L-% is a very

[11] Note that in Dehé & Braun's (2020b) study, information structure (i.e., subject focus) can be excluded as a factor leading to a nuclear accent on the subject because it was carefully controlled for.

safe indicator of rhetorical meaning, much more so than in both English and Icelandic (compare the last rows in Table 1 vs. Tables 2 and 3). Note, moreover, that across languages, target utterances used in the materials of production experiments were relatively short, thus prenuclear accents would perhaps play a more important role in longer utterances. This is clearly a matter for future research, in particular, because prenuclear accents have shown to be relevant for the distinction between illocution types elsewhere. In Dutch, for example, prenuclear pitch patterns help to disambiguate between declarative questions and string-identical declarative statements (Van Heuven & Haan 2002). Petrone & Niebuhr (2014) identify the relevance of height, shape and alignment differences in prenuclear accents in German for the distinction between questions and statements.

The role of the **edge tone** or **boundary tone** is limited in the intonation languages tested so far. This is especially true for Icelandic, which does not make use of the final part of the F0 contour at all: both polar and *wh*-questions are falling to L% throughout, regardless of illocution type. This confirms previous literature on Icelandic intonation maintaining that L% is the default for all utterance types (e.g., Árnason 1998a, 2005, 2011). On the other hand, Árnason (2011: 323) also maintains that Icelandic questions may use rising intonation to signal "special connotations" such as surprise, or impatience (see also Árnason 2005). It would therefore have been thinkable at least, at the outset of the experiment, that rising intonation would be used in RQs, too, to indicate that the meaning of the interrogative, which is string-identical with ISQs, conveys a pragmatically different meaning. However, Icelandic RQs use pitch accents instead. Unlike Icelandic, both German and English do make use of the intonational terminus of the utterance to distinguish between ISQs and RQs. However, English does so only in polar questions. English *wh*-questions are falling throughout. A similar pattern is found for German. The most striking difference between ISQs and RQs in both English and German is within polar questions: ISQs are realized with a steep rise, while RQs are realized with a mid-high plateau. Notice that these results for edge tones go against previous literature (e.g., Bartels 1999; Han 2002; see Section 2 above), which assumes low boundary tones for RQs given their assertive-like pragmatics. Instead, a three-way distinction can be observed for English and German: a low terminus (L%) in declaratives, a rise to high in ISQs, and a mid-high plateau in RQs. Bari Italian has more rising ISQs and more falling RQs, although the differences are not very large, and this result is not fully in line with previous work on the intonation of Bari Italian ISQs (Savino 2012). In French, differences with respect to the

intonational terminus (and contour) were found for both question types (more final rises and high plateaus in ISQs, vs. more final falling or rising-falling contours in RQs).

One important point to make is that RQs do not simply have "an intonational contour of an assertion" (Han 2002: 215). This makes sense, given that semantically RQs are questions and not assertions (Biezma & Rawlins 2017; Caponigro & Sprouse 2007). Like ISQs, RQs denote a set of answers, although speakers of RQs presuppose the answers to be part of the common ground (e.g., Biezma & Rawlins 2017). This is not the case for ISQs, in which the answer is not supposed to be common knowledge. Moreover, RQs retain functions of questions in that they can optionally be answered (Biezma & Rawlins 2017; Caponigro & Sprouse 2007). Pragmatically, RQs and assertions may be considered to have a similar effect in the discourse in that eventually, their propositional content is added to the common ground, resulting in the assertive-like feel of RQs. However, this is achieved in different ways (Biezma & Rawlins 2017). (Default) Assertions function as proposals to add (new) information to the common ground, which discourse participants may agree on or deny. RQs, however, indicate that the information is already part of the common ground and force discourse participants to accommodate their common ground accordingly. Given these differences, we would not expect RQs to have the same intonational contour of assertions, but would expect the differences to be reflected in prosody, as they are in the data reported above.

In the head/edge-prominence languages Japanese and French, as well as in the head-prominence tone languages Standard Chinese and Cantonese, global (spanning the utterance) and local (related to one constituent) pitch height plays a crucial role. These languages have in common that lowered F0 (but not necessarily a difference in F0 range) is generally a cue to RQs. Specifically, Standard Chinese and Cantonese RQs have lower F0 contours than ISQs. French, like Standard Chinese, has higher overall F0 in ISQs than in RQs. In Japanese, which has larger F0 excursion in RQs than in ISQs, the lower initial pitch in RQs was the strongest cue to RQ meaning in perception.

For the tone languages, it is important to keep in mind that the shape of the F0 contour is largely determined by the canonical form of the lexical tones. For Standard Chinese, the effects found for pitch height were found for all tones, except that tone 3 is somehow different due to the interaction between low pitch and creakiness. For Cantonese (Lo et al. 2019a, 2019b), an analysis split by tone has yet to be done. A corresponding comparison with Standard Chinese will be particularly interesting because Cantonese sentence-level intonation may override the shape of lexical tones, unlike Standard Chinese, which preserves the canonical shape of lexical

tones at utterance level (e.g., Yang 2018; Yuan 2004). In Cantonese rising (declarative) questions, for example, the F0 of the utterance-final tones T21, T23, and T22 all fall together with the rising tone T25. The higher-level tones T55 and T33 are also produced with a rise, but the tones remain distinct due to their higher start (Zhang et al. to appear).

Taken together, properties of F0 generally play a role for the distinction between ISQs and RQs across languages. This result is expected, given that it is very much in line with prosodic differences between illocution types found elsewhere in the literature. To give but a few examples, Neapolitan Italian uses tonal alignment to distinguish between narrow focus statements and string-identical polar questions (D'Imperio 2000); in Dutch, prenuclear pitch patterns help to disambiguate between declarative questions and string-identical declarative statements (Van Heuven & Haan 2002; see also Petrone & Niebuhr 2014 for the relevance of height, shape and alignment differences in prenuclear accents in German); in Standard Chinese, we find differences in local and global pitch height in declaratives compared with string-identical *wh*-questions (Yang 2018) and polar questions (Liu & Xu 2005; Xu 2019); and in Cantonese, the difference between declaratives and declarative questions has been shown to be encoded in properties of F0 (e.g., Flynn 2001; Fox et al. 2008; Ma et al. 2006a, 2006b).

However, the present overview also shows that the ways in which F0 is used to mark the difference between ISQs and RQs is complex and also to some extent language-specific, even within typological groups (see, e.g., the varying use of pitch accent types in the head-prominence intonation languages German, English and Icelandic). Nevertheless, typological differences play a role, too. For example, pitch accents are relevant in the intonation languages, but global and local pitch height are mainly relevant in the tone languages.

4.2 Duration

Duration turns out to be a very robust cue to pragmatic meaning. Effects of duration were found in all languages, and they all go in the same direction. Specifically, shorter constituent and utterance durations and faster speech rates were generally found for ISQs than for RQs. Note that for Cantonese, only negative RQs, i.e., the same type of RQs that has also been tested for the other languages reported on here, show the same effects for duration, i.e., longer durations for RQs than ISQs. No such effects were found for positive RQs and retorts. It remains to be seen in future research whether this difference between RQ- and the other types carries over to

other languages. If that is the case, then it will be conceivable that longer durations may be more of a cue to negative attitude, rather than to RQ illocution.

In any case, the results obtained for duration are reminiscent of previous results regarding duration differences between questions and statements in several languages. For example, questions are produced with a faster speech rate (shorter durations) than statements in German, Manado Malay, Orkney English, and Dutch (Heuven & Zanten 2005; Niebuhr 2013; Niebuhr et al. 2010), and polar questions have shorter syllable durations than declaratives in Standard Chinese (Yuan 2006).

Overall, the results for duration suggest that speakers generally plan and use less time for questions than for statements (or: assertions) and for assertion-like questions such as (negative) RQs. Future experiments will have to reveal differences (or commonalities) in duration between RQs and statements. Using a three-way comparison comparing polar ISQs, polar RQs and string-identical (verb-first) exclamatives, Wochner & Dehé (2018) have already shown that durations are shortest for ISQs and longest for exclamatives, perhaps attributable to the fact that RQs are interrogatives syntactically but assertion-like pragmatically, while exclamatives have been argued to be declaratives syntactically, despite string-identical surface structure (Rosengren 1992).

4.3 Voice quality

As another non-tonal parameter, voice quality plays a role in all languages, for which it was included in the analysis. In German, both polar and *wh*-RQs were more often realized with breathy voice quality than ISQs, mainly at the beginning of the utterances. Likewise, breathiness is a relevant feature in English: the *wh*-word in *wh*-RQ is more often associated with breathiness than the *wh*-word in ISQs. In Standard Chinese, we find that glottalized voice occurs more often in RQs than in ISQs. While the specific kind of voice quality relevant in RQs differs between languages, it follows that RQs are associated with 'non-modal' voice quality, ISQs with modal voice quality.

Similar to the results for duration, the fact that voice quality plays a role for the distinction between ISQs and RQs fits in with previous findings on the use of voice quality to mark linguistic or rather paralinguistic distinctions. For example, (Schourup 1985) shows for English that exasperated attitude is sometimes expressed by means of breathy voice quality. Cantonese uses voice quality to mark sarcasm (Cheang & Pell 2009).

4.4 A word on methodology

Finally, a word is due on methodology. For three of the languages surveyed here (German, English, and Italian), results have been obtained using evidence from complementary methods, comparing laboratory speech and (semi-)spontaneous speech. Naturally, spontaneous speech data are less controlled and thus syntactically and lexically more varied than laboratory data. We therefore expect to find more prosodic variation in spontaneous speech. On the other hand, in order to fully understand the prosody of a phenomenon and to use the insights in dialogue systems, didactics, or to understand interlanguage phenomena, we first need to control for other factors to isolate the influence of illocution type. Also, main patterns with respect to nuclear accents and edge tones should ideally be very similar in the two registers (see Xu 2010) for a general discussion of the use of lab speech vs. spontaneous speech in linguistic research).

For German, the prosody of RQs as compared to string-identical ISQs was first systematically tested using a speech production paradigm (Braun et al. 2019). The results were then validated against spontaneous speech based on data obtained from a German cooking show broadcast on television, including the same type of RQs (Braun et al. 2020). Generally speaking, more variation was found in the prosodic realization of RQs in spontaneous speech, but nevertheless, RQs and ISQs in spontaneous speech essentially exhibit the same prosodic characteristics as RQs and ISQs in lab speech, and differences were minor. Comparing the two methodologies in the German production data, the most reliable intonational cues to RQ meaning were (i) the L*+H pitch accent, which was the most frequent accent type in RQs in both polar and *wh*-questions, and (ii) the final mid-high plateau (H-%) in polar RQs vs. the high-rise (H-^H%) terminating polar ISQs, although in addition to H-%, the low rise (L-H%) occurred with equal frequency in spontaneous polar RQs. Another important commonality between laboratory speech and spontaneous data was the way in which the temporal cue of duration/speech rate was used: across methodologies, overall durations were longer for RQs than for ISQs. Voice quality was not assessed in Braun et al. (2020) because the audio quality was not good enough for annotation. However, note that perception data further validated that listeners were sensitive to pitch accent type, duration, as well as voice quality when asked to decide between the two illocution types (Kharaman et al. 2019). For German, we thus conclude with some certainty that intonational and durational cues, as well as voice quality signal rhetorical meaning.

For English, we find commonalities between experimental (Dehé & Braun 2020b) and corpus data (Hedberg & Sosa 2011) with regard to the final edge tone in polar questions (ISQs typically have a high-rising terminus H-H%, while RQs end in a mid-high plateau H-L%). This is in line with Hedberg & Sosa's (2011) interpretation, according to which polar questions ending in H% have inquisitive meaning, while non-rising polar questions are non-canonical and non-inquisitive in meaning.

For Italian, we observe differences between Savino's (2012) map task data and Sorianello's (2018) experimental data regarding the edge tone. Specifically, Savino finds more falling polar ISQs in her data. However, Savino (2012) does not study the intonation of RQs, thus a full comparison between the two experimental methodologies is perhaps not in order, and more spontaneous speech data are needed to allow for a meaningful comparison.

5 Conclusion and Outlook

The previous sections have clearly shown that the difference in meaning between ISQs and RQs is reflected in their prosodic realization. Among the prosodic cues employed in the different languages are properties of the F0 contour as well as duration and voice quality. Crucially, all languages reported on here use these cues, although not in the same ways.

While this paper surveyed important findings, naturally, open research questions remain for future research. To begin with, while there is now sufficient data from a number of typologically different languages to get an idea of how RQs are likely realized and which prosodic parameters are used to mark rhetorical meaning, further languages can always be added, and even within the languages already investigated, more questions remain than have already been answered. For any language studied in the future, our prediction would be that the same parameters (F0, duration, voice quality) will be found to distinguish between ISQs and RQs, but that specifications will vary. Based on our results, the most likely parameter to be used in the same way across languages is duration, but it seems to us too early on the basis of the few languages studied so far to make generalized predictions.

One open issue regards the cross-linguistic prosodic realization of RQs with different functions (e.g., negative RQs, positive RQs, retorts; cf. Lo et al. 2019b for Cantonese) and the relationship between RQs and paralinguistic functions such as attitudes and sarcasm/irony. Some of the cues to rhetorical illocution are similar to cues reported for sarcasm (Grice et al.

2005a; Lommel & Michalsky 2017) or irony (Bryant & Fox Tree 2005). This issue may be seen as a challenge for pragmatic theory (finding a generalization that fits all uses) and is important to define the prosody-meaning interface.

Another open issue is the relevance and impact of different cues to rhetorical meaning in relation to one another, both in production and perception, and both within prosody and beyond. Within prosody, we need more work on the relative contribution of the different cues (F0, duration, voice quality). For example, can increased duration make up for an atypical edge tone or pitch accent? Can breathy voice quality, which is more typical of RQs, override ISQ intonation? We know of some studies that have started to address these questions regarding the (relative) role of prosodic cues to rhetorical meaning, but more work is needed, so we may expect results in the near future. Beyond prosody, the question arises of how prosodic cues compare to contextual, morpho-syntactic or lexical-semantic cues. In the experiments discussed here, ISQs and RQs were string-identical, which made it necessary for speakers to prosodically mark the intended illocution type suggested by the context. This raises the question, however, whether interrogatives that are morpho-syntactically or lexically marked for (or at least heavily biased towards) one particular illocution type would still be realized with the same prosodic cues found in RQs not marked in those ways. The German data drawn from the cooking show (Braun et al. 2020) suggests that they would be. The data set contained a number of interrogatives that were unambiguously marked as rhetorical through lexical means or by the context, and yet there were prosodic differences between RQs and ISQs. More data is necessary to address this issue in more detail. A related question is whether prosodic information could override the interpretation suggested by the context or by morpho-syntactic or lexical marking.

We have no doubt that the reader will come up with more open questions than these, as can the authors of this paper think of more issues. We leave these to future research and look forward to the results.

References

Árnason, Kristján (1998a): Toward an analysis of Icelandic intonation. In: Stefan Werner (ed.), *Nordic Prosody. Proceedings of the VIIth Conference, Joensuu 1996*. Frankfurt a.M. et al: Peter Lang, 49-62.

— (1998b): Vowel shortness in Icelandic. In: Wolfgang Kehrein & Richard Wiese (eds.), *Phonology and Morphology of the Germanic Languages*. Tübingen: Niemeyer, 3-25.

— (2005): *Hljóð. Handbók um hljóðfræði og hljóðkerfisfræði*. Reykjavík: Almenna bókafélagið.

— (2011): The Phonology of Icelandic and Faroese Oxford: Oxford University Press.

Banuazizi, Atissa & Cassandre Creswell (1999): Is that a real question?: Final rises, final falls and discourse function in yes-no question intonation. In: Sabrina J. Billings, John P. Boyle & Aaron M. Griffith (eds.), *CLS 35-1: Papers from the main session*. Chicago: Chicago Linguistics Society, 1-13.

Bartels, Christine (1999): *The intonation of English statements and questions. A compositional interpretation.* New York & London: Garland Publishing.

Bauer, Robert S. & Paul K. Benedict (1997): *Modern Cantonese Phonology*. Berlin: Mouton de Gruyter.

Bayer, Josef & Hans-Georg Obenauer (2011): Discourse particles, clause structure and question types. In: *The Linguistic Review* 28, 449-491.

Beckman, Mary E. & Gayle Ayers Elam (1997): Guidelines for ToBI labelling (version 3.0). http://www.cs.columbia.edu/~agus/tobi/labelling_guide_v3.pdf (accessed 22 April 2020). The Ohio State University Research Foundation.

Beckman, Mary E., Julia Hirschberg & Stefanie Shattuck-Hufnagel (2005): The original ToBI system and the evolution of the ToBI framework. In: Sun-Ah Jun (ed.), *Prosodic Typology*. Oxford: Oxford University Press, 9-54.

Beyssade, Claire & Elisabeth Delais-Roussarie (to appear): Prosodic study of French rhetorical questions. In: *Linguistic Vanguard* (Special Issue on non-canonical questions).

Biezma, María & Kyle Rawlins (2012): Responding to alternative and polar questions. In: *Linguistics and Philosophy* 35.5, 361-405.

— (2017): Rhetorical questions: Severing asking from questioning. In: Dan Burgdorf, Jacob Collard, Sireemas Maspong & Brynhildur Stefánsdóttir (eds.), *Proceedings of SALT 27 (2017)*. 302-22.

Braun, Bettina (2006): Phonetics and phonology of thematic contrast in German. In: *Language and Speech* 49.4, 451–493.

Braun, Bettina, Nicole Dehé, Jana Neitsch, Daniela Wochner & Katharina Zahner (2019): The prosody of rhetorical and information-seeking questions in German. In: *Language and Speech* 62.4, 751-778.

Braun, Bettina, Daniela Wochner, Katharina Zahner & Nicole Dehé (2018): Classification of interrogatives as information-seeking or rhetorical questions. In: Julien Epps et al. (eds.), *Proceedings of the 17th Australasian International Conference on Speech Science and Technology (SST 2018), 4-7 Dec 2018 Sydney, Australia*. 125-128.

Braun, Bettina, Marieke Einfeldt, Gloria Esposito & Nicole Dehé (2020): The prosodic realization of rhetorical and information-seeking questions in German spontaneous speech. In: *Proceedings of Speech Prosody, 10th International Conference (2020), 24-28 May 2020, Tokyo, Japan, 2020*. DOI: 10.21437/SpeechProsody.2020-70.

Bryant, Gregory A. & Jean E. Fox Tree (2005): Is there an ironic tone of voice? In: *Language and Speech* 48.3, 257-277.

Caponigro, Ivano & Jon Sprouse (2007): Rhetorical questions as questions. In: Estela. Puig-Waldmüller, *Proceedings of Sinn und Bedeutung 11*. Barcelona: Universitat Pompeu Fabra, 121-133.

Chao, Yuen Ren (1956): Tone, intonation, singsong, chanting, recitative, tonal composition and atonal composition in Chinese. In: Morris Halle et al. (eds.), *For Roman Jakobson: Essays on the Occasion of his Sixtieth Birthday*. The Hague: Mouton. 52–59.

Chao, Yuen Ren (1968): *A grammar of spoken Chinese*. Berkeley: University of California Press.

Cheang, Henry S. & Marc D. Pell (2009): Acoustic markers of sarcasm in Cantonese and English. In: *Journal of the Acoustical Society of America* 126.3, 1394-1405.

Chen, Shuwen & Peggy Pik Ki Mok (2015): Question intonation in Hong Kong English: Interaction between Cantonese and English. In: *Proceedings of the 18th International Congress of Phonetic Sciences, 10-14 August 2015, Glasgow, Scotland, UK*. https://www.internationalphoneticassociation.org/icphs-proceedings/ICPhS2015/proceedings.html

Cheng, Lisa (1991): *On the typology of wh-questions*. Cambridge, MA: MIT Press.

Cheng, Robert L. (1977): Taiwanese question particles. In: *Journal of Chinese Linguistics* 5, 153-185.

Chow, S. (2002): *A phonetic study of the intonation in Hong Kong Cantonese*. Hong Kong: City University of Hong Kong.

D'Imperio, Mariapaola (2000): *The role of perception in defining tonal targets and their alignment*. PhD dissertation, The Ohio State University.

Dehé, Nicole (2009): An intonational grammar for Icelandic. In: *Nordic Journal of Linguistics* 32.1, 5-34.

— (2010): The nature and use of Icelandic prenuclear and nuclear pitch accents: Evidence from F0 alignment and syllable/segment duration. In: *Nordic Journal of Linguistics* 33.1, 31-65.

— (2018): The intonation of polar questions in North American ('heritage') Icelandic. In: *Journal of Germanic Linguistics* 30.3, 213-259.

Dehé, Nicole & Bettina Braun (2020a): The intonation of information-seeking and rhetorical questions in Icelandic. In: Journal of Germanic Linguistics 32.1, 1-42.

— (2020b): The prosody of rhetorical questions in English. *English Language & Linguistics* 24.4, 607-635.

Dehé, Nicole, Bettina Braun & Daniela Wochner (2018): The prosody of rhetorical vs. information-seeking questions in Icelandic. In: Katarzyna Klessa et al. (eds.), *Proceedings of the 9th International Conference on Speech Prosody 2018, 13-16 June 2018*, Poznán, Poland, 403-407, DOI: 10.21437/SpeechProsody.2018-82.

Delais-Roussarie, Elisabeth et al. Brechtje Post, Mathieu Avanzi, Carolin Buthke, Albert Di Cristo, Ingo Feldhausen, Sun-Ah Jun, Philippe Martin, Trudel Meisenburg, Annie Rialland, Rafèu Sichel-Bazin & Hi-Yon Yoo. (2015): Intonational phonology of French: developing a ToBI system for French. In: Sónia Frota & Pilar Prieto (eds.), *Intonation in Romance.* Oxford: Oxford University Press, 63-100.

Delais-Roussarie, Elisabeth, A. Rialland, J. Doetjes & J.M. Marandin (2002): The Prosody of post-focus sequences in French. In: *Proceedings of the 1st International Conference on Speech Prosody 2002, Prosody, Aix en Provence, France*.

Di Cristo, Albert (1998): Intonation in French. In: Daniel Hirst & Albert Di Cristo, *Intonation systems: A survey of twenty languages*. Cambridge: Cambridge University Press, 195-218.

— (2016): *Les musiques du français parlé. Essais sur l'accentuation, la métrique, le rythme, le phrasé prosodique et l'intonation du français contemporain*. Berlin: De Gruyter.

Druetta, Ruggero (2018): Syntaxe de l'interrogation en français et clivage écrit-oral: une description impossible? In: Marie-José Béguelin, Aidan Coveney & Alexander Guryev (eds.), *L'interrogative en français*. Bern: Peter Lang, 19-50.

Essen, Otto von (1964): *Grundzüge der hochdeutschen Satzintonation*. Ratingen: Henn Verlag.

Féry, Caroline (2014): Final compression in French as a phrasal phenomenon. In: Stacey Katz Bourns & Lindsy L. Myers (eds.), *Perspectives on linguistic structure and context: Studies in honor of Knud Lambrecht*. Amsterdam: John Benjamins, 133–156.

— (2017): *Intonation and prosodic structure*. Cambridge: Cambridge University Press.

Flynn, Choi-Yeung-Chang (2001): *Intonation in Cantonese*. Dissertation, School of Oriental and African Studies, University of London.

Fox, Anthony, Kang Kwong Luke & Owen Nancarrow (2008): Aspects of intonation in Cantonese. In: *Journal of Chinese Linguistics* 36.2, 321-367.

Gili Fivela, Babara, Cinzia Avesani, Marco Barone, Giuliano Bocci, Claudia Crocco & Mariapaola D'Imperio (2015): Intonational phonology of the regional varaieties of Italian. In: Sónia Frota & Pilar Prieto (eds.), *Intonation in Romance*. Oxford: Oxford University Press, 140-197.

Goto, Risa (2018): *Rhetorical questions: A relevance-theoretic approach to interrogative utterances in English and Japanese*. Tokyo: Hituzi Syobo Publishing.

Grice, Martine & Stefan Baumann (2002): Deutsche Intonation und GToBI. In: *Linguistische Berichte* 191, 267-298.

Grice, Martine, Stefan Baumann & Ralf Benzmüller (2005a): German intonation in autosegmental-metrical phonology. In: Sun-Ah Jun (ed.), *Prosodic Typology*. Oxford: Oxford University Press, 55-83.

Grice, Martine, D'Imperio Mariapaola, Michelina Savino & Cinzia Avesani (2005b): Strategies for Intonation Labelling across Varieties of Italian. In: Sun-Ah Jun (ed.), *Prosodic Typology*. Oxford: Oxford University Press, 362-389.

Groenendijk, Jeroen A.G. & Martin J.B. Stokhof (1984): *Studies on the semantics of questions and the pragmatics of answers*. Dissertation: University of Amsterdam.

Gussenhoven, Carlos. 2004. *The phonology of tone and intonation*. Cambridge: Cambridge University Press.

Gutiérrez Rexach, Javier (1998): Rhetorical questions, relevance and scales. In: *Revista Alicantina de Estudios Ingleses* 11, 139-155.

Han, Chung-hye (2002): Interpreting interrogatives as rhetorical questions. In: *Lingua* 112. 201-229.

Haraguchi, Shosuke (1996): Syllable, mora and accent. In: Takashi Otake & Anne Cutler (eds.), *Phonological structure and language processing*. Berlin: De Gruyter, 77-94.

Haugen, Einar (1958): The Phonemics of Modern Icelandic. In: *Language* 34.1, 55-88.

Hedberg, Nancy & Juan M. Sosa (2011): A unified account of the meaning of English questions with non-canonical intonation. Paper presented at the International Seminar on Prosodic Interfaces, Jawaharlal Nehru University, New Delhi, India.

Hedberg, Nancy, Juan M. Sosa & Emrah Görgülü (2017): The meaning of intonation in yes-no questions in American English: A corpus study. In: *Corpus Linguistics and Linguistic Theory* 13.2, 321-368.

Hedberg, Nancy & Juan Manuel Sosa (2002): The prosody of questions in natural discourse. In: *Proceedings of the 1st International Conference on Speech Prosody 2002, Prosody, Aix en Provence, France*.

Hedberg, Nancy, Juan Manuel Sosa, Emrah Görgülü & Morgan Memeni (2010): Prosody and pragmatics of wh-interrogatives. Paper presented to the 2010 Annual Conference of the Canadian Linguistics Association, 2010.

Heuven, Vincent J. van & Judith Haan (2002): Temporal development of interrogativity cues in Dutch. In: Carlos Gussenhoven & Natasha Warner (eds.), *Papers in Laboratory Phonology 7*. Berlin/New York: Mouton de Gruyter, 61-86.

Heuven, Vincent J. van & Ellen van Zanten (2005): Speech rate as a secondary prosodic characteristic of polarity questions in three languages. In: *Speech Communication* 47.1, 87-99.

Hudson, Richard A. (1975): The meaning of questions. In: *Language* 51.1, 1-31.

Ilie, Cornelia (1995): The validity of rhetorical questions as arguments in the courtroom. Special Fields and Cases. In: F.H. van Eemeren et al. (eds.), *Proceedings of the 3rd International Conference on Argumentation*. Amsterdam: SICSAT, 73-88.

Ippolito, Michaela (2019): Gestures as markers on non-canonical questions. In: Julian J. Schlöder, Dean McHugh & Floris Roelofsen (eds.), *Proceedings of the 22nd Amsterdam Colloquium*. 574–583.

Itani, Reiko (1993): The Japanese sentence-final particle ka: A relevance-theoretic approach. In: *Lingua* 90.1-2, 129-47.

Jun, Sun-Ah (2005): Prosodic typology. In: Sun-Ah Jun (ed.), *Prosodic Typology*. Oxford: Oxford University Press, 430-458.

— (2014): Prosodic typology: by prominence type, word prosody, and macro-rhythm. In: Sun-Ah Jun (ed.), *Prosodic Typology II: The phonology of intonation and phrasing*. Oxford: Oxford University Press, 520-540.

Jun, Sun-Ah & Cécile Fougeron (2000): A phonological model of French intonation. In: Antonis Botinis (ed.), *Intonation: Analysis, modeling and technology*. Dordrecht: Kluwer, 209-242.

Jun, Sun-Ah & Cécile Fougeron (2002): Realizations of accentual phrase in French intonation. In: *Probus* 14, 147-172.

Kaiser, Georg (2020): *Syntax des Französischen*. Berlin: Erich Schmidt Verlag.

Karttunen, Lauri (1977): Syntax and semantics of questions. In: *Linguistics and Philosophy* 1.1, 3-44.

Kharaman, Mariya, Manluolan Xu, Carsten Eulitz & Bettina Braun (2019): The processing of prosodic cues to rhetorical question interpretation: Psycholinguistic and neurolinguistics evidence. In: *Interspeech 2019, 20th Annual Conference of the International Speech Communication Association, Graz, Austria, September 15-19, 2019*. ISSN: 1990-9772 .

Kitagawa, Yoshihisa (2005): Prosody, syntax and pragmatics of wh-questions in Japanese. In: *English Linguistics* 22.2, 302-346.

Kohler, Klaus J. (2004): Pragmatic and attitudinal meanings of pitch patterns in German syntactically marked questions. In: G. Fant et al. (eds.), *From traditional phonology to modern speech processing—Festschrift für Professor Wu Zongji's 95th birthday*. Beijing: Foreign Language Teaching and Research Press, 205–215.

Krifka, Manfred (2011): Questions. In: Klaus von Heusinger, Claudia Maienborn & Paul Portner, *Semantics: An International Handbook of Natural Language Meaning. Vol. 2*. Berlin: Mouton de Gruyter, 1742-1785.

Kuang, Jianjing (2017): Covariation between voice quality and pitch: Revisiting the case of Mandarin creaky voice. In: *Journal of the Acoustical Society of America* 142.3, 1693–1706.

Kuang, Jianjing (2018): The influence of tonal categories and prosodic boundaries on the creakiness in Mandarin. In: *Journal of the Acoustical Society of America* 143.6, EL509-EL515.

Ladd, D. Robert (2008): *Intonational phonology, 2nd edition*. Cambridge: Cambridge University Press.

Lee, Ok Joo (2005): *The prosody of questions in Beijing Mandarin*. PhD dissertation, Ohio State University.

Li, Boya (2006): *Chinese final particles and the syntax of the periphery*. Utrecht: LOT.

Liing, Woan-Jen (2014): *How to ask questions in Mandarin Chinese*. PhD dissertation, The City University of New York.

Liu, Fang & Yi Xu (2005): Parallel Encoding of Focus and Interrogative Meaning in Mandarin Intonation. In: *Phonetica* 62.2-4, 70-87.

Liu, Xuefei, Aijun Li & Yuan Jia (2016): How does prosody distinguish Wh-statement from Wh-question? A case study of Standard Chinese. In: Jon Barnes et al. (eds.), *Proceedings of the 8th International Conference on Speech Prosody 2016, 31 May - 3 June 2016, Boston, USA*, DOI: 10.21437/SpeechProsody.2016. 1076-1080.

Lo, Roger Yu-Hsiang, Angelika Kiss & Maxime Tulling (2019a): The prosodic properties of the Cantonese sentence-final particles aa1 and aa3 in rhetorical *wh*-questions. In: Sasha Calhoun et al. (eds.), *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019*. Canberra, Australia: Australasian Speech Science and Technology Association Inc, 502-506.

— (2019b): The prosody of Cantonese information-seeking and negative rhetorical *wh*-questions. Paper presented at the Annual Meeting of the Canadian Linguistic Association, Vancouver, BC.

Lommel, Nicole & Jan Michalsky (2017): Der Gipfel des Spotts. Die Ausrichtung von Tonhöhengipfeln als intonatorisches Indiz für Sarkasmus. In: Aina Urdze & Nataliya Levkovych, *Linguistik im Nordwesten. Beiträge zum 8. Nordwestdeutschen Linguistischen Kolloquium, Bremen, 13.–14. Dezember 2015. (Diversitas Linguarum 42)*. Bochum: Brockmeyer, 33-60.

Ma, Joan K-Y, Valter Ciocca & Tara L. Whitehill (2006a): Effect of intonation on Cantonese lexical tones. In: *Journal of the Acoustical Society of America* 120:6, 3978-3987.

— (2006b): Quantitative analysis of intonation patterns in statements and questions in Cantonese. In: *Proceedings of the 3rd International Conference on Speech Prosody 2018, 2-5 May 2006, Dresden, Germany*.

Matthews, Stephen & Virginia Yip (1994): *Cantonese: A comprehensive grammar*. London: Routledge.

Miura, Ichiro & Noriyo Hara (1995): Production and perception of rhetorical questions in Osaka Japanese. In: *Journal of Phonetics* 23.3, 291-303.

Morita, Hisashi (2019): The syntax, semantics, and pragmatics of covert pied-piping in Sinhala and Japanese *wh*-questions. In: *Journal of East Asian Linguistics* 28.1, 307–356.

Niebuhr, Oliver (2013): The acoustic complexity of intonation. In: Eva Liina Asu-Garcia & Pärtel Lippus (eds.), *Nordic Prosody: Proceedings of the XIth Conference, Tartu 2012*. Frankfurt a.M. et al: Peter Lang, 15-29.

Niebuhr, Oliver, Julia Bergherr, Susanne Huth, Cassandra Lill & Jessica Neuschulz (2010): Intonationsfragen hinterfragt - Die Vielschichtigkeit der prosodischen Unterschiede zwischen Aussage- und Fragesätzen mit deklarativer Syntax. In: *Zeitschrift für Dialektologie und Linguistik* 77.3, 304-346.

Oppenrieder, Wilhelm (1988): Intonatorische Kennzeichnung von Satzmodi. In: Hans Altmann (ed.), *Intonationsforschungen*. Tübingen: Niemeyer, 169–206.

Oppenrieder, Wilhelm (1991): Zur intonatorischen Form deutscher Fragesatze. In: Marga Reis & Inger Rosengren (eds.), *Fragesätze und Fragen. Referate anläßlich der 12. Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft, Saarbrücken 1990*. Berlin: De Gruyter, 243-261.

Petrone, Caterina & Oliver Niebuhr (2014): On the intonation of German intonation questions: The role of the prenuclear region. In: *Language and Speech* 57.1, 108-146.

Pierrehumbert, Janet (1980): *The phonology and phonetics of English intonation*. PhD dissertation, Massachusetts Institute of Technology.

Pierrehumbert, Janet & Julia Hirschberg (1990): The meaning of intonational contours in the interpretation of discourse. In: Philip R. Cohen, Jerry Morgan & Martha E. Pollack, *Intentions in Communication*. Cambridge, MA: MIT Press, 271-311.

Quirk, Randolph, Sidney Greenbaum, Geoffrey Leech & Jan Svartvik (eds.) (1985): *A comprehensive grammar of the English language*. New York: Longman.

Rohde, Hannah (2006): Rhetorical questions as redundant interrogatives. In: *San Diego Linguistic Papers* 2, 134-168.

Rosengren, Inger (1992): Zur Grammatik und Pragmatik der Exklamation. In: Inger Rosengren (ed.), *Satz und Illokution, Band 1*. Tübingen: Niemeyer, 263-306.

Sadock, Jerrold M. (1971): Queclaratives. In: *Papers from the seventh regional meeting, April 16-18, 1971*. Chicago Linguistics Society. 223-231.

Savino, Michelina (2012): The intonation of polar questions in Italian: Where is the rise? In: *Journal of the International Phonetic Association* 42.1, 23-48.

Schaffer, Deborah (2005): Can rhetorical questions function as retorts? Is the Pope Catholic? In: *Journal of Pragmatics* 37.4, 433-460.

Schourup, Lawrence C. (1985): *Common discourse particles in English conversation*. London: Routledge.

Schubiger, Maria (1958): *English Intonation: Its Form and Function*. Tübingen: Max Niemeyer.

Sorianello, Patrizia (2018): Tra prosodia e pragmatica: il caso delle domande retoriche. In: *Studia e Saggi Linguistici* 2, 39-71.

Sorianello, Patrizia (2019): 'A che serve saperlo?' Funzioni pragmatiche e variazioni intonative della domanda retorica. In: Elena Nuzzo & Ineke Vedder, *Studi AItLA 9: Lingua in contesto. La prospettiva pragmatica*. Milan: Officinaventuno, 89-108.

Sybesma, Rint & Boya Li (2007): The dissection and structural mapping of Cantonese sentence final particles. In: *Lingua* 117.10, 1739–1783.

Thráinsson, Höskuldur (2007): *The Syntax of Icelandic*. Cambridge: Cambridge University Press.

Truckenbrodt, Hubert (2004): Zur Strukturbedeutung von Interrogativsätzen. In: *Linguistische Berichte* 199, 313-350.

Watanabe, Akira (2002): Loss of overt Wh-movement in Old Japanese. In: David W. Lightfoot (ed.), *Syntactic Effects of Morphological Change*. Oxford: Oxford University Press, 179-195.

Welby, Pauline (2006): French intonational structure: Evidence from tonal alignment. In: *Journal of Phonetics* 34.3, 343-371.

Wilson, Deidre & Dan Sperber (1988): Mood and the analysis of non-declarative sentences. In: Jonathan Dancy, J.M.E. Moravcsik & C.C.W. Taylor, *Human Agency: Language, Duty and Value*. Stanford, CA: Stanford University Press, 77-101.

Wochner, Daniela & Nicole Dehé (2018): Prosody meets pragmatics: a production study on German verb-first sentences. In: Katarzyna Klessa et al. (eds.), *Proceedings of the 9th International Conference on Speech Prosody 2018, 13-16 June 2018, Poznán, Poland*, 418-422, DOI: 10.21437/SpeechProsody.2018-85.

Wochner, Daniela, Jana Schlegel, Bettina Braun & Nicole Dehé (2015): The prosody of rhetorical questions in German. In: *Interspeech 2015, 16th Annual Conference of the*

International Speech Communication Association, Dresden, Germany, September 6-10, 2015. ISSN: 1990-9770.

Xu, Beibei (2012): *Nandao*-questions as a special kind of rhetorical questions. In: Anca Chereches (ed.), *Proceedings of the 22nd Semantics and Linguistic Theory Conference, University of Chicago, Illinois, May 18-20, 2012*. Linguistic Society of America, 508-526.

Xu, Yi (2010): In defense of lab speech. In: *Journal of Phonetics* 38.3: 329-336.

— (2019): Prosody, tone and intonation. In: Katz, William F. Peter F. Assmann (eds.), *The Routledge Handbook of Phonetics*. London: Routledge, 314-356.

Yang, Yang (2018): *The two sides of wh-indeterminates in Mandarin: a prosodic and processing account*. Utrecht: LOT.

Yang, Yang, Stella Gryllia & Lisa Lai-Shen Cheng (2020): Wh-question or wh-declarative? Prosody makes the difference. In: *Speech Communication* 118, 21-32.

Yip, Moira (2002): *Tone*. Cambridge: Cambridge University Press.

Yoshida, Kosaku & Takurou Yoshida (1996): Question marker drop in Japanese. In: *ICU Language Research Bulletin* 11, 37–57.

Yuan, Jiahong (2004): *Intonation in Mandarin Chinese: Acoustics, perception, and computational modeling*. PhD dissertation, Cornell University.

— (2006): Mechanisms of question intonation in Mandarin. In: Q. Huo et al. (eds.), *Chinese Spoken Language Processing: 5th International Symposium, ISCSLP 2006, Singapore, December 13-16, 2006. Proceedings.* Berlin: Springer, 19-30.

Zahner, Katharina, Manluolan Xu, Yiya Chen, Nicole Dehé & Bettina Braun (2020): The prosodic marking of rhetorical questions in Standard Chinese. In: *Proceedings of Speech Prosody, 10th International Conference (2020), 24-28 May 2020, Tokyo, Japan*. 389-393, DOI: 10.21437/SpeechProsody.2020-80.

Zhang, Jie, Duanmu San, and Yiya Chen (to appear): Prosodic systems: North Asia. In: Carlos Gussenhoven and Aoju Chen (eds.), *The Oxford handbook of language prosody.* Oxford: Oxford University Press.

Zymla, Mark-Matthias (2014): *Extraction and analysis of non-canonical questions from a Twitter-corpus*. MA Thesis, University of Konstanz.

Corresponding author:
Nicole Dehé
Fachbereich Linguistik, Universität Konstanz
Fach 186
78457 Konstanz
nicole.dehe@uni-konstanz.de