Journal of the International Phonetic Association (2024), **54**, pp. 974–1005
doi:10.1017/S0025100324000240

ARTICLE

Prosodic Disambiguation of Disjunctive Declaratives and Disjunctive Questions in Jordanian Arabic

Mohammad Ali Salah Bani Younes[1], Laura Colantoni[2,*] and Muhammad Swaileh A. Alzaidi[3]

[1]Department of English Language and Literature, Faculty of Foreign Languages, Al al-Bayt University, Mafraq, Jordan, [2]Department of Spanish and Portuguese, Faculty of Arts & Science, University of Toronto, Ontario, Canada, and [3]Muhammad Swaileh A. Alzaidi, Department of English Language, College of Language Sciences, King Saud University, Riyadh, Saudi Arabia
*Corresponding author. Email: laura.colantoni@utoronto.ca

(Received 31 October 2023; revised 26 November 2024; accepted 3 December 2024)

Abstract

This study investigates phonological and phonetic details of disjunctive declaratives (ddcls) and alternative questions (altqs) in Arabic. The aim of the phonological and phonetic analyses of these syntactically identical utterances is to find out the cues that are responsible for the disambiguation. Consequently, a production study eliciting ddcls and altqs was run with 20 participants producing 160 utterances (80 ddcls and 80 altqs). Findings reveal that ddcls and altqs are similar in having a global rise-fall contour, but differ in the phonetic implementation of the fall, since minimum F0 values are significantly higher in altqs than in ddcls, suggesting that there is a fall to mid in the former (proposing !H%) and a fall to low in the latter (L%). There are also significant phonological differences in the accentual features between both sentence types, i.e., the conjuncts are always accented in altqs, but they are deaccented in ddcls. The findings are a contribution to the prosody-meaning literature, showing the importance of prosody for syntactic disambiguation. The findings are used to propose a theory for the disambiguation of disjunctive sentences.

Keywords: phonetic and acoustic analysis; disjunctive declaratives; disjunction; alternative questions; intonation; prosody; Arabic

1 Introduction

The literature has consistently reported that prosody and phonetics play a role in disambiguating sentence types that are syntactically identical across languages (see Delais-Roussarie & Turco, 2019 for French; Bani Younes, 2020 for four Arabic dialects; Patience, Colantoni, Klassen, Radu, & Tararova, 2020; Colantoni, Klassen, Patience, Radu & Tararova, 2022 for English, Spanish, Mandarin and Inuktitut). Thus, we can hypothesize that this should also be the case in disjunctive declaratives (ddcls) and alternative questions (altqs) in Jordanian Arabic, given that they are syntactically identical. In other words, when there are two utterances with the same constituents in the same order (see (1a) and (1b) below), then there must be cues that help speakers and listeners of a language to distinguish between them.

(1) In Arabic:

a.	haːða	kitaːb	ʔaw	qaːmuːs
	this	book	or	dictionary
		C1 (X)	C2 (or)	C3 (Y)

'This is a book or a dictionary.'

b.	haːða	kitaːb	ʔaw	qaːmuːs
	this	book	or	dictionary
		C1 (X)	C2 (or)	C3 (Y)

'Is this a book or a dictionary?'

Both (1a) and (1b) are identical in wording, but (1a) is a declarative utterance with a disjunctive phrase (*X or Y*),[1] and (1b) is a disjunctive question, which is called an alternative question. The answer to the question in (1b) might be *kitaːb* ('book') or *qaːmuːs* ('dictionary'). The distinction between these utterances might be straightforward in languages that have a change in word order (e.g., do-support or auxiliary-subject inversion), such as English, or a question word, such as Modern Standard Arabic. Nonetheless, the ambiguity between the two readings arises in colloquial languages or dialects with no question words, such as French (see Delais-Roussarie & Turco, 2019) and Jordanian Arabic (see Bani Younes & Hellmuth, 2020; Bani Younes, 2020). In the absence of syntactic or lexical cues in identically worded utterances, prosody might play the role of disambiguation, which is reminiscent of the role that prosody plays in disambiguating between yes-no questions that have a declarative form and real declarative sentences in Arabic (Almalki & Morrill, 2016; El Zarka, 2017).

Prosody not only plays a role in disambiguating examples like (1a) and (1b) above, but also allows to distinguish questions with a similar surface structure but a different syntax, such as the true alternative questions (analyzed here) and questions containing a disjunction, which are interpreted as polar questions (Lai, 2008; Dayal, 2016: 258–9; Heindeinreich, 2019; Pruitt & Roelofsen, 2013).[2] Based on previous research on English, Dayal (2016) claimed that prosody is universally used to distinguish altqs from polar question interpretations. In particular, the two members of the disjunction (*X* and *Y* in '*X or Y*' phrases, see (1) above) are phrased independently in altqs, where each constituent receives a pitch accent,[3] and the utterance ends with a fall.[4] In cases of polar interpretations (henceforth yes-no questions), constituents are phrased together, at least one of the constituents is deaccented

[1] In this paper, X, or, and Y are used interchangeably with C1, C2, and C3, respectively.

[2] Whereas possible answers to the former are only one of the members of the disjunction (C1 or C3), the latter allows for multiple options, including negative or positive answers.

[3] Dayal (2016: 259) does not specify the type of pitch accents ("The same question results in an Alt_Q reading if accompanied with a prosodic break between the disjuncts and pitch accents on each of them" [. . .]). Our interpretation is that Dayal is contrasting accentuation in Alt-Qs vs. deaccentuation in polar questions.

[4] Heindeinreich (2019) conducted a production experiment with 90 American participants and showed that, although the presence of the intermediate phrase is variable across speakers, the final fall allows to automatically distinguish altqs from yes/no questions in 86% of the cases. This, in turn, is consistent with Pruitt & Roelofsen's (2013) proposal that the falling final contours are the most relevant feature in perception to distinguish these two types of questions.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

and the utterance ends with a rising contour.[5] This generalization regarding the role of prosody in disambiguating these two types of questions with disjunction to other languages proves problematic, since recent data on Arabic (Bani Younes, 2020) shows that in three out of the four varieties of Arabic analyzed, the choice of disjunctive element played a crucial role. The question that remains open is whether *Dayal's universal generalization can be extended further to account for the role of prosody in disambiguating disjunctive declaratives (statements) from disjunctive questions (specifically, altqs).* This is particularly relevant because both types of utterances are supposed to end with a falling contour. Answering such a question will help find out whether prosody can help distinguish the similarly worded altqs and disjunctive declaratives (ddcls), proving or rejecting the universal claim.

2. Previous studies on the prosody of disjunction

Previous research has investigated the shape of contours of disjunctive utterances in English and Arabic (see El-Hassan, 1988; Al Amayreh, 1991; Pruitt & Roelofsen, 2013; Hellmuth, 2018; Heindeinreich, 2019; Winans, 2019; Bani Younes, 2020; Bani Younes & Hellmuth, 2020; Meertens, 2021). However, all these studies dealt with only two types of disjunctive utterances: disjunctive yes-no questions and alternative questions.

Previous studies on the intonation of declarative utterances in Arabic (e.g., Rammuny, 1989; El-Hassan, 1991; Mitchell, 1993; Chahal & Hellmuth, 2014; Hellmuth, 2014; El Zarka, 2017) did not pay attention to the intonation or prosodic features of ddcls. They, instead, reported that declaratives (specifically, the *non-disjunctive* broad-focus ones) in Arabic end with a fall to L-L% (Chahal, 2001; Kelly, 2023, for Lebanese Arabic). A recent experimental study on Lebanese (Beirut) Arabic (Kelly, 2023) also shows that short broad focus declaratives have a rise-fall nuclear contour with the pitch accent being either L+H* or H*, which is not being affected by word-length (i.e., monosyllabic vs. disyllabic words). Similarly, altqs in Arabic have been largely ignored. Until recently, there was a lack of experimental studies of the prosody of altqs within the Autosegmental-Metrical Theory (AM) (Pierrehumbert & Beckman, 1988; Ladd, 2008). The only recent studies that empirically investigated the overall contour of altqs are Hellmuth (2018), which analyzed eight Arabic dialects, and Bani Younes (2020), which focused on JA.[6] Figure 1 below (Hellmuth 2018: 992) displays the overall contour of altqs in eight Arabic dialects, highlighting the similarities in the shape of these contours (i.e., a rise-fall). There are differences, however, in the way in which the rise-fall is manifested or in its onset, leading Hellmuth to argue for the need of further phonetic and phonological exploration of altqs.

Bani Younes' (2020) study, couched within the AM approach, has experimentally shown that the contour shape of altqs in Jordanian Arabic (JA) is a rise-fall, with both C1 (*X*) and C3 (*Y*) accented and with an !H% boundary at the end of the utterance. Thus, these prosodic details might help distinguish ddcls from altqs if it turns out that ddcls have different prosodic characteristics in the contour or the accentual status on the *X or Y* constituents.

Winans' (2019) study, like Bani Younes' (2020), was mainly concerned with what disambiguates yes-no questions with conjunctions from altqs, as they are similarly worded. The author, however, briefly noted that although the overall shape of the boundaries in ddcls and altqs might be the same phonologically (i.e., a fall) in Egyptian Arabic, future

[5] See Bani Younes (2020) for a revision of Dayal's cross-linguistic generalization. Bani Younes revisited Dayal's generalization using experimental evidence from altqs and disjunctive yes-no questions, but this study will discuss disjunctive declaratives, which were not covered by Bani Younes (2020).

[6] Both studies (i.e., Hellmuth (2018) and Bani Younes (2020)) did not touch upon phonetic and acoustic features of altqs in any of the nine dialects under study. They only described the overall contour using general terms like "fall", "rise" or "rise-fall".

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

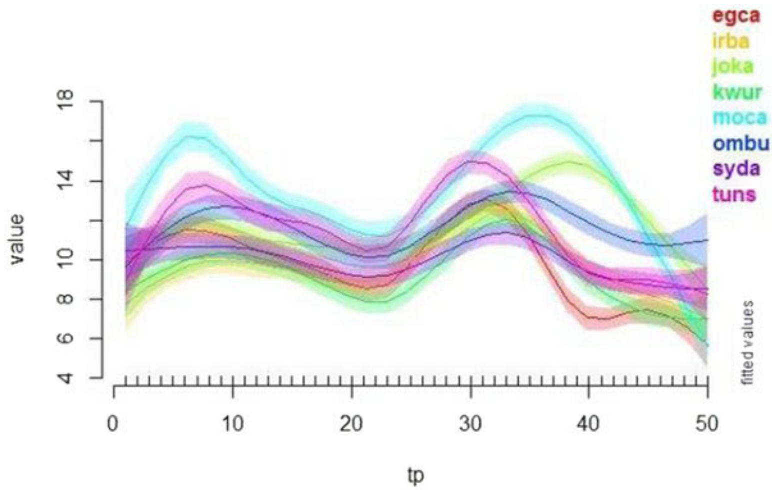


Figure 1. (Colour online) An example of a model prediction from Hellmuth (2018: 992), showing the overall contour of altqs in eight Arabic dialects (egca: Egyptian, irba: Iraqi, joka: Jordanian, kwur: Kuwaiti, moca: Moroccan, ombu: Omani, syda: Syrian, and tuns: Tunisian Arabic) over C1 (X), C2 (or), and C3 (Y).

work would need to investigate the exact shape of the boundary tones in both disjunctive utterances as the declination or the scale of the two 'falls' appeared to be different. Hence, Winans' study has informed the design of this production experiment, which seeks to determine the exact phonological and phonetic shape of boundary tones in the dialect under study here.

Previous studies on Arabic, however, did not investigate the third type of disjunctive declaratives (i.e., ddcls), which also have the same word order as altqs. Moreover, studies such as Winan (2019) and Bani Younes (2020) suggest the possibility of significant cross-dialectal variability in the choice of phonetic and lexical cues. This motivates the elicitation of comparable examples of ddcls and altqs obtained from the same speakers from the same city in Jordan. JA has been described as having three subdialects: Urban, Rural, and Bedouin (Abu-Abbas, Zuraiq & Al-Tamimi, 2010; Bani Younes, 2020; Na'eem, Abudalbuh & Jaber, 2020; Jaradat, Mashaqba & Huneety, 2022). For homogeneity purposes, the current study will be restricted to Urban JA, as spoken in Amman.[7]

Although research on Arabic is scarce, there are pioneering studies on French comparing the sentence types that we will analyze here (Delais-Roussarie & Turco, 2019). The goal of this research is to uncover what cues differentiate altqs and ddcls since both have similar falling contours. Their analysis shows that statements categorically end in an !H*L% contour; altqs, however, may end with the same contour or with a plateau that ends in a slight rise, which they label as !H*0%. Given the similarity in the phonological description, the authors further investigated the prosodic cues associated with *X or Y* constituents in ddcls and altqs. Specifically, they analyzed phonetic cues, such as pitch range, F0 slope, pitch scaling and durational cues (duration of the last syllable across sentence types) associated with

[7] There could be regional variations that might impact the prosodic features under study, but there seems to be no prior study addressing such differences in Jordanian dialects. To control for differences as much as possible, this study was restricted to Urban JA in one region (Amman). Moreover, participants have similar educational and socioeconomic backgrounds, and our sample is balanced for gender. Future research might look at such possible regional variations. Additionally, to determine if there are sociolinguistic factors that affect the prosody in Jordanian Arabic (e.g., gender), a future study with more female and male participants might be conducted as a follow up study. As for now, the analysis of sociolinguistic variables is beyond the scope of this paper.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

the *X or Y* constituents. Their results indicated that there is no difference between ddcls and altqs in lengthening, and that the two falls (i.e., those of ddcls and altqs) are phonetically different as ddcls had a larger pitch range and a steeper F0 slope at the end of the *X or Y* constituents. However, the pitch range and F0 steepness were larger for the non-final disjunct, i.e., the word in the place of *X*. As for pitch scaling, downstep was more frequent in ddcls, and upstep was more frequent in altqs, particularly on the last disjunct (i.e., on *Y*). In other words, the bumps of the pitch accent on *Y* are lower than those on *X* in ddcls, but they are higher in altqs.[8]

In summary, despite the growing literature on Arabic intonation, to our knowledge, there are still no studies that investigate which prosodic cues disambiguate ddcls and altqs. This indicates a need for a production study that simultaneously elicits examples of both sentence types.

3. Research questions and predictions

The main goal of this study is to determine the prosodic (phonological and phonetic) cues that disambiguate ddcls and altqs, given that they have the same syntax in Arabic. Thus, the study seeks to answer the following research questions, followed by their related predictions:

RQ1: How are disjunctive declaratives (ddcls) prosodically realized in JA, in terms of their contour shape over the X or Y constituents? And are disjunctive declaratives (ddcls) and alternative questions (altqs) similar or different in the accent distribution on the X or Y constituents and in the contour shape over these constituents?

H1: Based on previous research on Arabic broad-focus declaratives, we predict that ddcl will end with a fall (i.e., L%).[9] We also expect that ddcls and altqs will have a roughly similar contour shape over the *X or Y* constituents. This hypothesis is based on the literature reporting that altqs in JA end with a fall (see Al Amayreh, 1991; Hellmuth, 2018; Bani Younes, 2020). It is also based on the prediction above that ddcls will be realized with a final fall, given their broad focus status.[10] As for the accent distribution on the *X or Y* constituents, it is hypothesized that both utterance types will have different accentual distributions, i.e., ddcls and altqs will differ in the accent status on the *X or Y* constituents. This is based on the finding that JA altqs were reported to have both *X* and *Y* accented, but it is unknown whether one or both of final constituents in ddcls are accented.

RQ2: Are there phonetic differences in the (C1 (X), C2 (or), and C3 (Y)) constituents of ddcls and altqs in the minimum F0 (minF0) and maximum F0 (maxF0)?

H2: We also predict that there will be phonetic differences between the two sentence types in the *X or Y* constituents. Based on Delais-Roussarie and Turco's (2019) analysis of the

[8] See Delais-Roussarie and Turco (2019) for more details of the phonetic differences between the final and non-final disjuncts of ddcls and altqs in French, as they are beyond the scope of this study.

[9] We thank an anonymous reviewer who suggested that we needed to motivate this hypothesis further. It is true that ddcls have not yet been investigated in the literature, but this hypothesis was based on prior studies that reported that declaratives in JA end with a fall. Ddcls are declaratives after all, which is why we hypothesised the final falling contour.

[10] An anonymous reviewer suggested the possibility of having double focussed disjuncts in ddcls, but the three authors think that the current scenarios have a broad focus reading. It will be interesting, though, to design a production study in which scenarios will be constructed to explore whether ddcls can have a double focus interpretation.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

same sentence types in French, we expect declaratives to show lower F0 values associated with the *X* constituent and with the final boundary tone.

This study, hence, will experimentally investigate the intonation of ddcls in JA by phonetically and phonologically describing the intonational contour over the *X or Y* constituents, within the AM Theory, following previous studies on Arabic (e.g., Hellmuth, 2018; Bani Younes, 2020), as well as previous comparative studies in other languages focusing on the same structures (Delais-Roussarie & Turco, 2019). Then, the phonological description of ddcls will be compared with that of altqs reported here to determine how both types of utterances are disambiguated in JA. This qualitative phonological analysis will be corroborated by a quantitative acoustic analysis of the intonational contour associated with the *X or Y* constituents of both sentence types, in terms of the maxF0 and minF0. To achieve this goal, a production study using a Dialogue Completion Task (DCT) (see Blum-Kulka, House & Kasper, 1989; Vanrell, Feldhausen & Astruc, 2018; Bani Younes, 2020; Haddad, 2022; Abulehia & Khader, 2022) was carried out to elicit examples of ddcls and altqs from the same speakers.

If ddcls and altqs in JA turn out to be similar in their contour shape (i.e., with a rise-fall) over the *X or Y* constituent, then we will discuss their potential phonetic (e.g., maxF0, minF0, etc.) or phonological (e.g., different pitch accents) differences. As such, in addition to providing novel empirical data on JA, this study seeks to contribute to intonational theory by providing a phonological analysis accompanied by a phonetic analysis of the *X or Y* constituents of ddcls. Our final goal is to contribute to the literature on the prosody-meaning interface by pinpointing the prosodic cues (whether phonological or phonetic) that allow for the signalling of different sentence types. In this sense, if both utterance types prove to have different prosodic features, then this might help extend Dayal's cross-linguistic theoretical claim about disjunctive questions to include ddcls.

4. Methods

4.1 Materials

Twelve Dialogue completion task (DCT) scenarios were used: four eliciting ddcls, four eliciting altqs, and four eliciting distractors. The scenarios were designed in a way to elicit minimal pairs of ddcls and altqs, so that acoustic analyses of the *X or Y* constituent of the minimal pairs produced by the same speakers would allow us to determine the prosodic differences in F0 contours (see Delais-Roussarie & Turco, 2019, who also elicited minimal pairs of ddcls and altqs).[11] Following previous research (e.g., Hellmuth, 2006; Alzaidi, Xu & Xu, 2019; Bani Younes, 2020), the segmental contents of the *X* and *Y* were controlled to be mostly sonorants. Therefore, some Arabic phonemes that might disturb the F0 line (e.g., /ʕ/ and /ʔ/) were avoided. The words in the target position consisted of six paroxytone (/ˈ**li:**na/ 'Lina', /ˈ**di**:ma/ 'Deema', /ˈ**lan**dan/ 'London', /sijˈ**ja**:ra/ 'car', /l-ʔalma:ˈ**nij**ja/ 'the-German/German', and /l-ʔʊrdʊˈ**nij**ja 'the-Jordanian/Jordanian) and two oxytone (/riˈ**ja:dˤ**/ 'Riyadh' *and* /balˈ**lo:n**/ 'balloon') words. This is not ideal, since different pitch accents may be associated with different stress patterns, but it was a compromise when trying to design stimuli and contexts that were as natural as possible. However, and given that this study is not concerned with peak alignment on individual words but with the contour shape over the *X or Y* constituents, stress type was not balanced (see Hellmuth, 2018; Bani Younes & Hellmuth, 2020; Bani Younes, 2020 for a similar methodological design). Additionally,

[11] Eliciting minimal pair utterances while trying to keep the scenarios as natural as possible was challenging as some participants produced names that rhyme with the ones in the scenarios. For example, some participants produced *Layan*, rather than *Rayan*. However, this does not affect the design of the study.

since all participants produced the same tokens (even if there were some consonantal substitutions) any effect of different stress patterns should be minimized.

It might be worth noting that Arabic disjunctive utterances use two conjunction words (*willa* and *ʔaw*), and there was no agreement in the literature of Arabic dialects as to which one is mostly used in which utterance type (see Bani Younes, 2019; Bani Younes, 2020, Chapters 4 (4.1) and 5 for a thorough review of conjunctive words in disjunctive sentences in eleven Arabic dialects). However, given that Bani Younes' (2020) corpus and production studies on JA experimentally showed that *ʔaw* was more frequent than *willa* in disjunctive utterances, then this study uses disjunctive utterances with this most frequent conjunctive word. Bani Younes (2020) also reported that *willa* is not preferred in ddcls as its presence might make them sound more like altqs, which makes it prudent to avoid using this word in ddcls in this study. Although, as stated, *willa* is rare in ddcls, the conjunction *ʔaw* was mentioned in the scenarios to make sure that participants use it. This proved to be a successful strategy since none of the participants used *willa* in their answers.

In (2), we present two examples of the scenarios used, the first eliciting a ddcl and the second an altq. All scenarios used are included in Appendix 1:

(2)

SCENARIO ONE-ddcl

SPOKEN SCENARIO: *ʔinta bitiʕrif ʔinnuh raja:n ʔiħtima:l jizawwaʒ li:na ʔaw di:ma wa sˤadi:gak ʔiθθa:ni saʔalak ʔinnu raja:n ʔiħtima:l jizawwaʒ mi:n, xabru ʔinnuh ʔiħtimal jizawwaʒ wa:ħdih min halbinte:n: li:na ʔaw di:ma* (You know that Rayan is likely to get married to Lina or Deema, and your other friend asked you who Rayan is going to get married to. Tell him that Rayan might marry one of two girls, as far as you know, and they are Lina or Deema).

EXPECTED TARGET UTTERANCE: *raja:n ʔiħtima:l jizawwaʒ li:na ʔaw di:ma* (Rayan might marry Lina or Deema).

SCENARIO TWO-altqs

SPOKEN SCENARIO: *raja:n ka:n jiħki:lak ʔinnu ʔiħtimal jizawwaʒ li:na ʔaw di:ma, wa sˤadi:gak ʔiθθa:ni ħaka:lak ʔinnu raja:n ʔitazawwaʒ ʔisʔal sˤadi:gak ʕan ʔism lbinit ʔilli tazawwʒha raja:n bittaħdi:d wasuʔa:lak la:zim jidˤdˤamman hal ʔisme:n li:na ʔaw di:ma.* (Your friend Rayan used to tell you that he is thinking of getting married to Lina or Deema. Your other friend (e.g., Ali) tells you that Rayan has just got married. Ask Ali to specify the name of the girl that Rayan married. Your question should have the names: Lina and Deema).

EXPECTED TARGET UTTERANCE: *raja:n ʔitazawwaʒ li:na ʔaw di:ma* (Did Rayan marry Lina or Deema?)

Thus, the scenarios elicited 4 ddcls, 4 altqs, and 4 distractors from each of the twenty participants (12 scenarios x 20 participants), yielding 240 utterances (160 target utterances (80 ddcls and 80 altqs) plus 80 distractors). The order in which scenarios of ddcls and altqs were narrated to each participant was random. In other words, scenarios eliciting ddcls were presented first for some participants, followed by distractors and altqs. For other participants, altq scenarios were presented first, followed by distractors and ddcl scenarios. The distractors were always in the middle.

4.2. Participants

Twenty JA speakers (10 males & 10 females) participated in this study. Their ages ranged from 18 to 35 years (average = 26). All of them are third-generation speakers of Ammani

Jordanian Arabic, the newly formed dialect of Amman city (see Al-Wer, 2020 for a detailed description of this dialect). They all spoke Jordanian Arabic, which is their only native Arabic variety. Some spoke other languages (English: F4, M3, and M7; German: F4; French: M2). English is taught in Jordan from kindergarten on, so all speakers had had English classes during their studies even if they did not explicitly indicate this, which is the norm in Jordanian schools. For all the participants in our study, English instruction was limited to the classroom setting. None of the participants used English in their daily lives nor had spent more than six-months in an English-speaking country. It was made sure that none of the participants had speech or hearing problems.

4.3. Procedure

Participants were invited to participate by the researchers. They were asked to sign two written copies of the informed consent form (a copy for themselves), indicating their agreement to participate in the study. Likewise, they were given two copies of the information sheet, clearly stating the general research aims. All participants were briefed orally on the research purpose and how and where their data would be stored. Ethical standards were taken into consideration by obtaining ethics approval from the Institutional Review Board (IRB), at the university level (from the first author's institution).

Participants were recorded in a quiet room, free from noise distractions, using Zoom H5, a high-quality recorder, which was set at a default sampling rate of 44100Hz 16 bit. The first author narrated the short scenarios (see Section 4.1 'Materials') in JA to each participant on a one-on-one basis, and participants were asked to complete those scenarios, in a way that is expected to elicit ddcls and altqs (see Blum-Kulka, House & Kasper, 1989; Bani Younes, 2020; Bani Younes & Hellmuth, 2020 for a similar method). For instance, participants were asked to imagine a situation in which they wanted to ask someone to specify the girl's name that the man (Rayan, in the imagined context) wanted to marry (see (2) above). It was expected that participants would produce an altq for this scenario. Participants' productions of the expected ddcls and altqs were then recorded. All recorded long files were securely moved to password-protected files on the researchers' laptops, ready for analysis. The mean time for the recorded files was about 7 minutes.

Although other elicitation methods were contemplated, such as asking participants to read target sentences embedded in scenarios (see Delais-Roussarie & Turco, 2019), we decided not to use a reading task for several reasons. First, it is thought here that reading pace might affect the prosody of utterances, making them sound less natural. Second, it was reported (see Bani Younes, 2020) that participants reading colloquial JA might switch to Modern Standard Arabic in their production, because JA has no standardized writing rules (see Alzoubi, 2020). Thus, participants did not have the opportunity to see the written scenarios. Third, the DCT method was recently used to elicit disjunctive utterances in JA and other languages, and it successfully elicited the required data, which is why it is used in this study.

4.4. Analysis

Each recording was coded as F1, F2, F3, etc. for females and M1, M2, M3, etc. for males. A Praat (Boersma & Weenink, 2023) script[12] generated textgrids for all long sound files. The target utterances in the long textgrids were coded and numbered manually: ddcl1, ddcl2, etc. (for disjunctive declaratives), altq1, altq2, etc. (for alternative questions), and distr1,

[12] From the script (mark_pauses) text: Mietta Lennes 25.1.2002. Available here: https://lennes.github.io/spect/.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

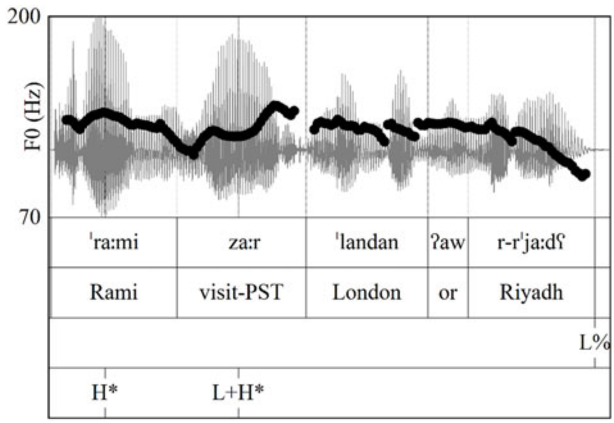


Figure 2. An example of the four tiers used in the analysis of the X or Y constituents: words, glosses, boundary tones, and pitch accents [joaa-ddcl2-m5]. The whole ddcl is *ra:mi za:r landan ʔaw r-rja:dʕ*, 'Rami visited London or Riyadh'. Note: The last tier here is empty for C1 (X, landan), C2 (*ʔaw*), and C3 (Y, *r-rja:dʕ*) in this declarative utterance because they were unaccented. The nuclear pitch accent of the whole utterance fell on the verb za:r before C1.

distr2, etc. (for distractors). Then, another Praat script[13] was used to cut out all labelled target utterances from the long file, generating a sound file for each target utterance, yielding 160 target items. A textgrid for each target utterance was created containing four tiers: one for Arabic words in IPA, one for glosses, one for boundary tones, and one for prominences (i.e., pitch accents) (see Figure 2); the four tiers were used only for the *X or Y* constituents of the target utterances (following Bani Younes' (2020) and Bani Younes & Hellmuth's (2020) analysis of disjunctive utterances, in different Arabic dialects).

As shown in Figure 2 and following other researchers (e.g., Hellmuth, 2018; Bani Younes, 2020; Bani Younes & Hellmuth, 2020; Hellmuth, in preparation), the phonological analysis of the relevant portions was restricted to three prosodic aspects.[14] These are the shape of the contour over the *X or Y* (e.g., rise, fall, rise-fall, etc.), the presence or absence of prominences (e.g., accented or unaccented) on '*X or Y*' constituents, and the shape of the final boundary tones at the end of the *Y* constituent (e.g., L% or H%). Focusing on the relevant phonological aspects in the analysis will be the first step in answering the research questions and will also help to compare the analysis of ddcls with a similar analysis of altqs from prior work (Bani Younes, 2020).

The ToBI phonological notations used to label pitch accents and boundary tones were adopted from the International Prosodic Alphabet (aka IPrA) (see Hualde & Prieto, 2016), representing language-independent labels widely used in AM Theory. These notations were used to label Arabic dialects in other studies and were reported to be suitable for Arabic (see Bani Younes, 2020; Hellmuth, in preparation). Within AM Theory, represented here by IPrA labels, there are two kinds of notations using two levels (H and L): pitch accents and boundary tones. The former is associated with stressed syllables while the latter with the end of the phrases, usually with the last syllable (see Bani Younes, 2020 for more details about AM Theory and ToBI-like IPrA labels; see also Figure 3 for the list of AM Theory labels used in this paper).

[13] Thanks to Sam Hellmuth for providing this script.

[14] We will be focusing on pitch accents and final boundary tones exclusively since our auditory and acoustic analysis of the data revealed no differences in the phrasing of these two sentence types. This is indeed consistent with previous literature on Arabic (see Hellmuth, 2018; Bani Younes, 2020) and also with experimental studies on American English (Heindeinreich 2019), which revealed that breaks between disjuncts were sporadically used.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

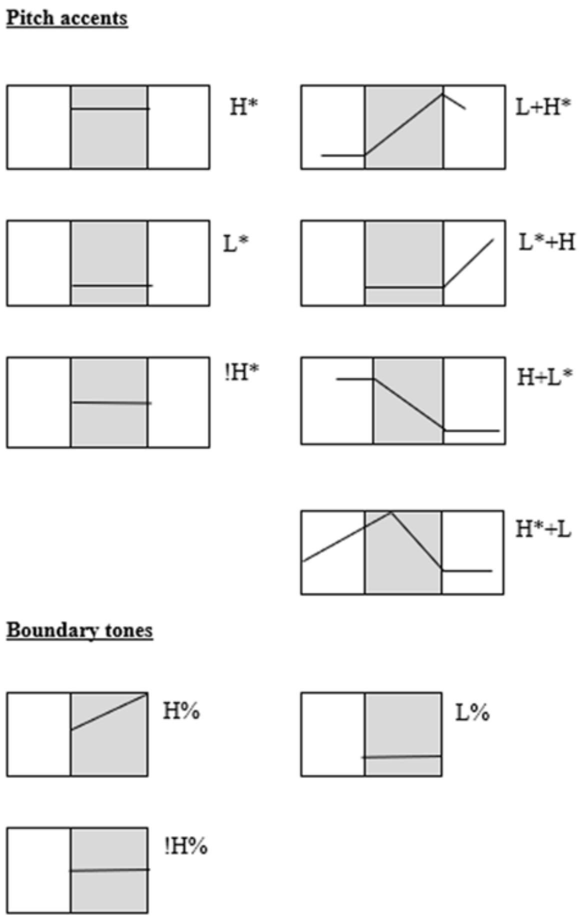


Figure 3. The list of IPrA ToBI-like labels used in this paper (adapted from Hellmuth, in preparation) and Bani Younes (2020, p. 42). The shaded columns represent stressed syllables for the list under pitch accents; for the list under boundary tones, they represent last syllables.

Two examples illustrating our labelling of pitch accents and boundary tones in this data are seen in Figure 4. The IPrA notation can be easily compared with the system used by the British School of intonation, which uses slashes (both the backslash and the forward slash, or a combination of both) to represent contours. Rises are usually represented with [/] and falls with [\] in the British tradition (see Wells, 2006).[15]

In order to conduct the phonological analysis and to label the pitch accents and boundary tones, each part of the *X or Y* portions was carefully listened to by two trained phonologists who are native speakers of Arabic (the first and the third authors),[16] and its F0 tract was also phonetically and phonologically examined, as it has been consistently done in the discipline (see Rammuny, 1989; Bani Younes, 2020; Hellmuth, in preparation). After this,

[15] See Bani Younes (2020, Chapter 2 (2.3, 2.4, and 2.6) for a thorough explanation of and comparison between the different intonational schools and theories of intonation.

[16] The first author was trained to use the ToBI and IPrA labels at the University of York (UK), and the third author was also trained to use them at University of Essex.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

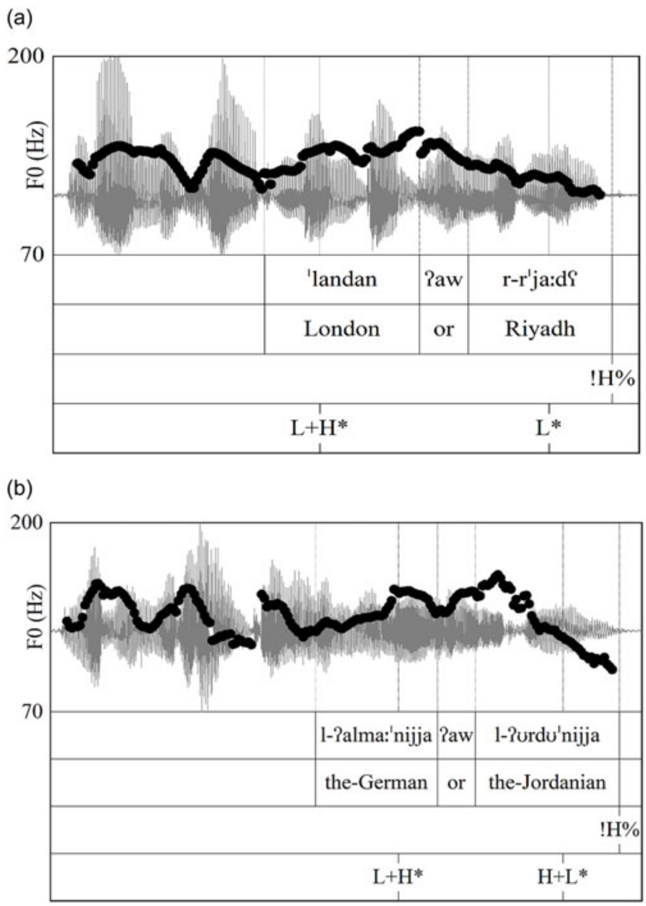


Figure 4. Two examples of an altq where the IPrA notations were assigned to pitch accented words on the fourth tier to indicate the presence of a pitch accent. The altq in (a) is *ˈraːmi ˈzaːr ˈlandan ʔaw r-rˈjaːdʕ?* 'Did Rami visit London or Riyadh?', which forms a minimal pair with the ddcl utterance in Figure 2. The altq in (b) is *dijiruːħ ʕdʒdʒaːmʕa l-ʔalmaːnijja ʔaw l-ʔʊrdʊnijja?* 'Did he choose to study at the German University or the University of Jordan?'.

we assigned a specific label following the criteria illustrated in Figure 3. This way of detecting and labelling pitch accents combines impressionistic (i.e., auditory) and instrumental approaches to intonation, providing reliable prosodic descriptions. Such a combination was recommended by pioneering researchers of intonation (e.g., Cruttenden, 1997). In cases in which the two trained phonologists differed in the labelling of pitch accents, they met and discussed the sentences that were labelled differently, by visually and auditorily examining the pitch tracks. Then, they agreed on the labelling of those utterances, and they were able to reach an absolute consensus.

The analysis of the *X or Y* portions will help determine whether there are differences between ddcls and altqs in terms of three prosodic factors: contour shape over the *X or Y constituents*, prominences on *X*, *or*, and *Y*, and the shape of boundary tones. The phonological analysis was supplemented by an acoustic analysis of the minimum and maximum F0 associated with each of the three constituents. These phonetic measurements were extracted using the ProsodyPro script (Xu, 2013) for each of *X or Y* constituents. In other

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

words, the domains for the phonetic measurements (minF0 and maxF0)[17] were each word (i.e., per *X*, per *or*, and per *Y*).

To compare the phonetic characteristics of final boundary tones, each utterance's final syllable (the boundary syllable) was labelled in Praat on a separate interval tier (see Section 4.1 'Materials' for more information on how sounds were controlled). The minimum F0 for those syllables was extracted using the same script, facilitating the comparison between the two sentence types when it comes to one ending lower than the other, in case both end with a fall. Finally, the contour shape over the *X or Y* constituents was obtained using the *gss* package for the SSANOVA (Gu, 2014) in R (R Core Team, 2022). This allowed us to plot the smoothed and time-normalized F0 obtained from the ProsodyPro script.[18] The F0 for the other individually plotted sentences was manually checked so that pitch tracking errors found in the *X or Y* constituents were corrected (following other researchers, e.g., Hellmuth, 2018; Delais-Roussarie & Turco, 2019; Bani Younes, 2020, Hellmuth, in preparation).

To determine whether there was a difference in the selection of pitch accents between ddcls and altqs, we ran a Fisher's Exact Test for Count Data in R (R Core Team, 2022). To determine whether there were differences between the maximum and minimum F0 between sentences we ran linear mixed effects models in R (R Core Team, 2022) using the lme4 package (Bates, Mächler, Bolker & Walker, 2015). Details of each model will be given in Section 5 'Results'. Finally, as mentioned, acoustic differences in the realization of *X or Y* constituents were assessed using SSANOVAs.

4.5. Potential limitations

There were some challenges during the DCT. Securing the number of female participants was one of them, as some females refused to be recorded out of their conservative personalities (see AbuSeileek & Rabab'ah, 2013; Bani Younes, 2020 for more details). The information sheet and the consent form helped reassure that their recordings are used only for academic and research purposes. Others, however, refused to participate in the study. The same was true for some male participants, exerting much effort to convince them to be recorded. Another challenge was that two participants misunderstood the narrated scenarios, producing irrelevant sentences such as wh-questions, surprise questions, etc. In order to overcome this problem, the researchers narrated the whole scenario again from scratch, which proved helpful in obtaining the relevant target sentence.

5. Results

The first research question concerned the prosodic realization of ddcls, an under-researched utterance type, in JA in terms of the contour shape over the *X or Y* constituents. It also aimed to find whether ddcls and altqs are prosodically similar in the contour shape and in the accent distribution on constituents 'X or Y'. To answer this question, we plotted the contour shapes of ddcls and altqs using time-normalized mean F0 values for the *X or Y* portions, across all 80 ddcls and 80 altqs produced by all 20 speakers. The extracted contours were smoothed, time-normalized, and plotted (Figure 5).

Figure 5 shows that the contour over the *X or Y* constituents is a rise-fall in ddcls. It also clearly indicates that both altqs (the top line) and ddcls (the bottom line) have a generally

[17] The ProsodyPro script (http://www.homepages.ucl.ac.uk/~uclyyix/ProsodyPro/) was used to automatically extract the minF0 and maxF0 values. MinF0 is defined as the lowest F0 value in a given word whereas maxF0 is defined as the highest F0 value in a given word.

[18] Interested readers are referred to the ProsodyPro script's website here (http://www.homepages.ucl.ac.uk/~uclyyix/ProsodyPro/) to see how Xu's script performs the time-normalization extraction.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

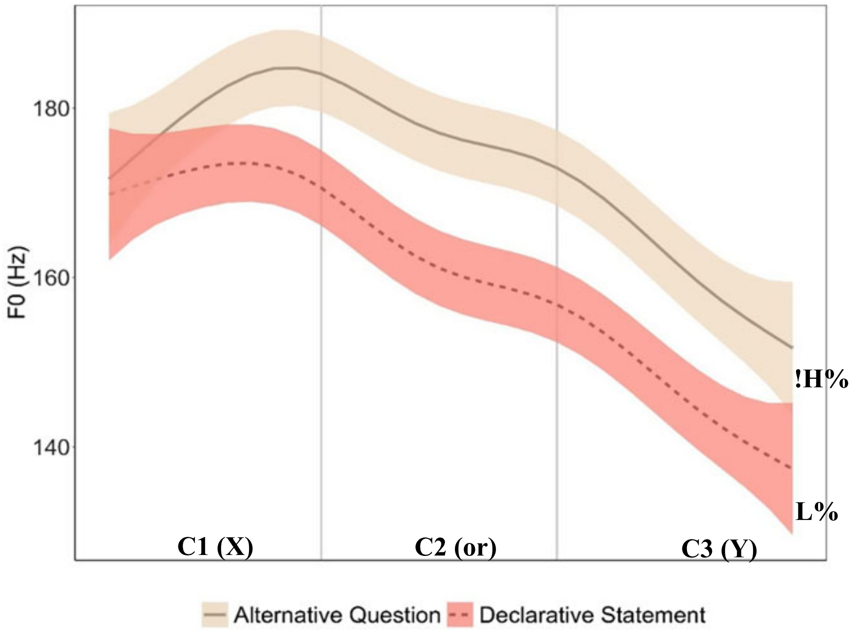


Figure 5. (Colour online) SSANOVA of the smoothed and time normalized mean F0 values for the X or Y constituents in all target utterances (N = 160), by sentence type. The three vertical lines represent the three constituents (C1(X), C2 (or), and C3 (Y)). The line on top represents the rise-fall contour of altqs (N = 80) over the X or Y; the one on the bottom shows the rise-fall contour of ddcls (N = 80) over the X or Y. The shaded area around each contour line (the ribbon) shows 95% confidence interval.

similar contour over the *X or Y*, suggesting that ddcls and altqs have a rise-fall contour, which partially answers the first research question.

The similarity in the contour shapes was labelled differently in the phonological analysis of the final boundary tone (L% for ddcls and !H% for altqs). As the SSAnova plots in Appendix 2 suggest, there seems to be consistency in the contour shape across speakers for each utterance type. As illustrated in Appendix 2, 15/20 participants make a clear difference between both sentence types in the realization of the *X or Y* constituents, with one participant (F7), who only uses boundary tones to distinguish altqs from ddcls. Additionally, all utterances had a rise-fall over the target constituents, with only two rising contours produced by F3 (ddcl4) and M4 (altq3). These participants might have misunderstood the relevant scenarios, producing a different contour. Examples of the prototypical contours produced by participants are shown in Figure 6.

As for the fall in altqs, most participants displayed a fall to mid, with the exception of a fall to low in six tokens produced by two participants: M1 (altq3 and altq4) and M2 (altq1, altq2, altq3, and altq4), which might be a sign of individual variation.

To determine whether one sentence type does end with a fall to mid and another with a fall to low, the minimum F0 values associated with the last syllable of each utterance (i.e., of the boundary syllable) were extracted (see Section 4.4 ‘Analysis’). Figure 7 displays the values obtained in each sentence type.

To determine whether the difference in minimum F0 values associated with the final boundary tones is significant between sentence types, we ran linear mixed-effects models. The independent variable is ‘sentence type’, and the dependent variable is the minimum

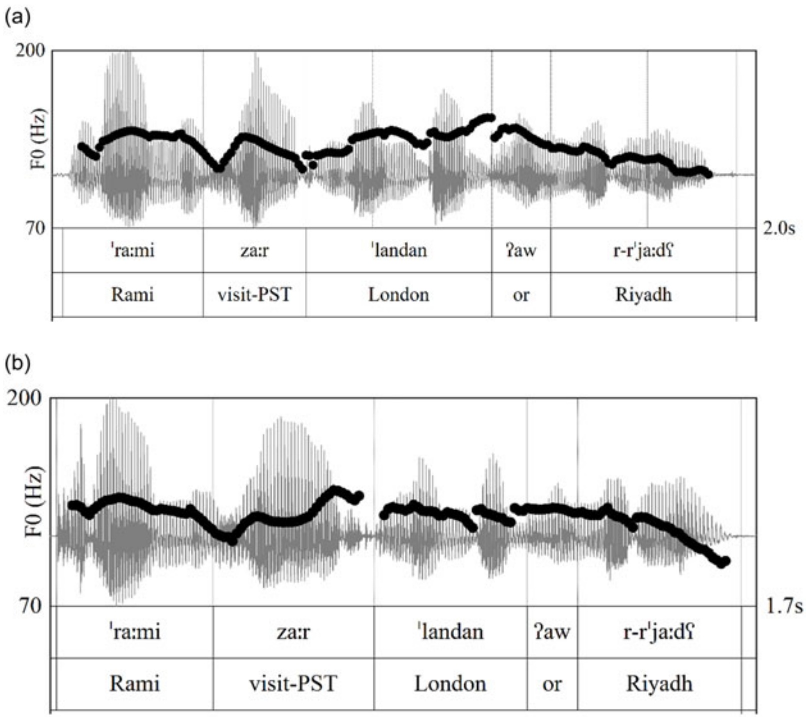


Figure 6. Examples of each sentence type as produced by a male participant (M5); (a) altq: *raːmi zaːr landan ʔaw r-rjaːdʕ*? 'Did Rami visit London or Riyadh?'; (b) ddcl: *raːmi zaːr landan ʔaw r-rjaːdʕ* 'Rami visited London or Riyadh'.

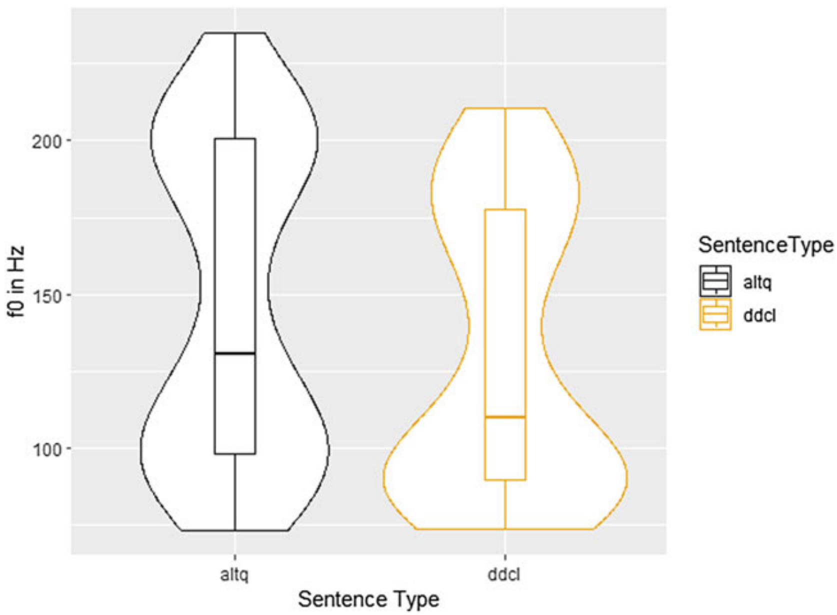


Figure 7. Violin plots containing boxplots showing the difference in the minimum F0 of the last syllables for both sentence types. The boxplots show the median and the interquartile range; the violin plots display datapoint distribution, across all participants.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

Table 1. Estimates and statistical results of the linear mixed-effects regression model

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	138.66	10.13	20.15	13.68	<.001***
SentenceType1	−9.04	2.09	19.20	−4.32	0.0003***

F0 for both sentence types. The independent variable was Helmert coded in R:[19] (−1) for alternative questions and (1) for declarative statements.[20] As is common in linguistics, both 'stimulus' and 'participants' were included in the model as random effects (see Baayen, Davidson & Bates, 2008; Bani Younes, 2020; Winter, 2020 for the use of random effects in mixed models). Three models were explored with a different syntax: the first (m1)[21] without the slope for 'SentenceType', the second (m2)[22] with a random intercept and slope for SentenceType within participant, i.e., (1 + SentenceType | participant), and the third model (m3) with no random slope for stimulus.[23] The log likelihood ratio tests using ANOVA (see Baayen, Davidson & Bates, 2008; Bani Younes, 2020; Winter, 2020) in R were then used to compare m1 and m2 (the R code: anova(m1, m2)). The results revealed that m2 was a significantly better fit than m1 ($p < .001$). Similarly, m2 and m3 were compared using ANOVA, and we selected m2, based on the results obtained ($p < .05$). Table 1 below presents the results of m2.

As shown in Table 1, SentenceType1 turned out to have a main effect. The intercept was positive and highly significant. Both the intercept and the variable 'sentence type' had significant p-values. The results showed that altqs (coded as −1) had significantly higher minimum F0 than ddcls in the boundary region, suggesting that the fall in ddcls is significantly lower than that in altqs. This result confirms that altqs had a fall to mid when compared to ddcls which had a fall to low. So, the answer to the first research question is that although both sentence types exhibit a similar rise-fall contour over the *X or Y* constituents, they differ phonetically in the scaling of the boundary tones: altqs end with a fall to mid whereas ddcls end with a fall to low.

The first research question also sought to determine whether ddcls and altqs are similar in the accent distribution on the *X or Y* constituents. To answer this part, a prosodic annotation of the *X or Y* in both utterance types was carefully implemented (see Section 4.4 'Analysis') using the IPrA notations inspired in Autosegmental-Metrical Theory. The first step of the analysis was to determine on the basis of auditory and acoustic information whether the *X* and *Y* constituents were accented or deaccented. The frequency of perceived accents on C1 (i.e., X) and C3 (i.e., Y) conjuncts is displayed in Table 2. The fact that the *X* and *Y* constituents are deaccented in ddcls should not come as a surprise since these constituents not only are given information, i.e., *X* and *Y* are mentioned in the preceding context (see Appendix 1), as is also the case with the altq scenario, but also are in a broad

[19] Sum Coding was also used to check if there are any differences in the results. However, we got the same results, so we stick to Helmert Coding. The R code used in this contrast coding is:
```
BoundarySentenceType <- factor(BoundarySentenceType, levels = c("altq", "ddcl"))
contrasts(BoundarySentenceType) <- contr.helmert(2)
contrasts(BoundarySentenceType)
```
[20] Sum coding code used is (BoundarySentenceType <- factor(BoundarySentenceType, levels = c("altq", "ddcl"))
contrasts(BoundarySentenceType) <- contr.sum(2)
contrasts(BoundarySentenceType)

[21] The R code used is m1<-lmer(boundary_MinF0~SentenceType+ (1|Participant) + (1|Stimulus), data = Boundary, REML = F)

[22] m2<-lmer(boundary_MinF0~SentenceType+ (1 + SentenceType|Participant) + (1|Stimulus), data = Boundary, REML = F)).

[23] m3<-lmer(boundary_MinF0~SentenceType+ (1|Participant), data = Boundary, REML = F)

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

Table 2. Percentage and frequency of accented *X* and *Y* constituents by utterance type

	Utterance Type	
Accent distribution	Altqs	ddcls
C1 (X)	100% (80)	7.5% (6)
C3 (Y)	100% (80)	(0)

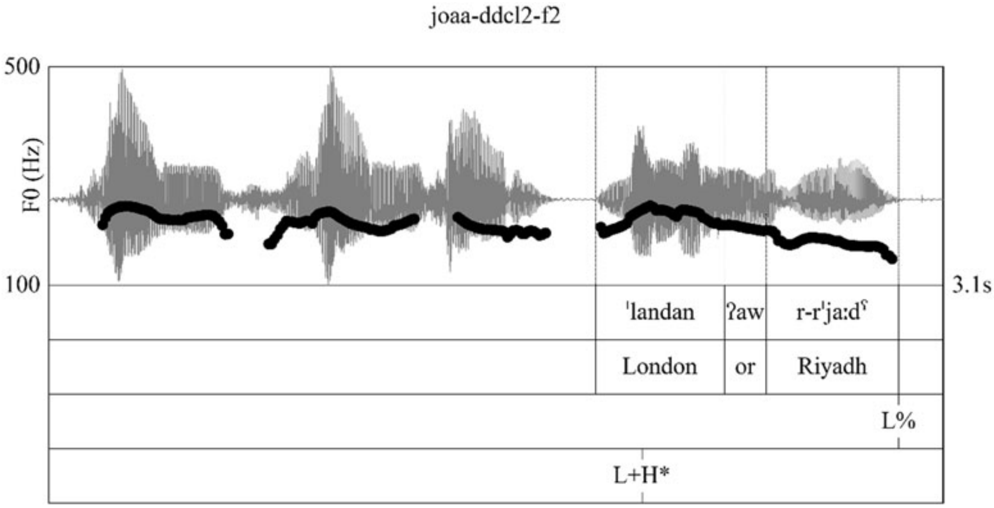


Figure 8. An example of an accented C1 (*X*) in a ddcl produced by a female speaker (F2); the sentence reads *raːmi zaːr landan ʔaw r-rjaːdʕ*, 'Rami visited London or Riyadh'.

focus context, namely the new information is the predicate instead of the referent of the *X or Y* constituents. This is consistent with previous research on German (Baumann, 2006; and particularly, Baumann & Riester 2013), which showed that elements that are high in the givenness scale tend to be deaccented. The second stage of the analysis was to determine the type of pitch accent (Tables 3 & 4) associated with the accented *X or Y* constituents.

Table 2 shows clear differences between both utterance types in the distribution of accents. This difference might be what disambiguates the two kinds of utterances. C1 (*X*) and C3 (*Y*) constituents in altqs were categorically accented. The typical contour of altqs was L+H* L* (or H+L*) !H%. The *X* constituent was associated with a L+H* in all tokens except for 8 tokens which had H* (see Table 3). Table 2 and Table 3 also show that the typical accentual distribution for ddcls was to have unaccented C1 (*X*) and C3 (*Y*), with only six tokens in which *X* was accented. Four of these six instances were produced by two speakers (M5 and F2). M2 and M3 produced the other two. Figure 8 also displays an example of ddcls where *X* was accented. The Y constituent (Table 4) was categorically deaccented in ddcls but was associated with a falling pitch accent in altqs.

A Fisher's Exact Test for Count Data[24] was run in R (R Core Team, 2022) to examine the relationship between accent distribution (accented *X* vs. *Y*) and utterance type (ddcls vs.

[24] A chi-Square Test of independence in R was first considered, but because there is a cell in the table with a small number (i.e., 0), Chi-Square estimation would not be accurate. Thus, the alternative is a Fisher's Exact Test for Count Data. To facilitate replicability, the R code used to run this test is provided here: myTable <- matrix(c(80, 80, 6, 0), nrow=2, ncol=2) fisher.test(myTable).

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

Table 3. Types and frequency of pitch accents associated with C1 (X) constituent by utterance type

	Utterance Type	
Accent distribution	altqs	ddcls
L+H*	72	5
H*	8	1

Table 4. Types and frequency of pitch accents associated with C3 (Y) constituent by utterance type

	Utterance Type	
Accent distribution	altqs	ddcls
L*	65	0
H+L*	15	0

altqs). A significant relationship was observed between accent distribution and utterance type, indicating that the utterance type is contingent on the presence or absence of accents on the *X* and *Y* ($p < .05$, with 95% confidence interval). This means the null hypothesis is rejected as there is sufficient evidence that the two variables (utterance type and accent distribution) are not independent.

As for the frequencies of pitch accents on the conjunctive word (*ʔaw*), there were only five instances in which *ʔaw* had H* pitch accent in altqs. It had no pitch accents in ddcls, showing that there is no relationship between accenting the conjunctive element and utterance type (only five occurrences of accented *ʔaw* in altqs (altq3-m3 (H*); altq3-m8 (H*); altq3-m6 (H*); altq2-f1 (H*); altq1-f2 (H*)).

In short, the above results answer the second part of the first research question, showing differences between ddcls and altqs in the accent distribution. In altqs both the *X* and *Y* are accented.

The second research question refers to phonetic differences in the realization of C1, C2, and C3, which might play an additional role in distinguishing the two sentence types. These acoustic measurements are minF0 and maxF0 associated with the *X or Y* constituents. We have already shown (see Tables 2–4) that the two sentence types statistically differ in the accentuation pattern with both C1 (X) and C3 (Y) being quasi-categorically accented in altqs, and *X* only displaying rising accents in six ddcl utterances. Here, we supplement this phonological analysis with an analysis of maxF0 and minF0 to provide more details about the realization of the *X or Y* constituents in these two sentence types. Boxplots and a series of linear mixed-effects models (see Section 4 'Methods' for details) were used to determine whether pitch differences were significant. Comparisons will involve differences between ddcls and altqs in the minF0 and maxF0 per constituent. Figure 9 visualizes the differences in maxF0 between the *X or Y* constituents in both sentence types, using boxplots and violin plots per constituent.

Data displayed in Figure 9 suggest that there might be differences in the maxF0 between both sentence types. In order to investigate such differences statistically, we ran separate models: one for C1 (i.e., X), one for C2 (i.e., *or*), and one for C3 (i.e., *Y*) to test the differences in the maxF0 (Tables 5–7). In all models, the independent factor (Sentence Type) was

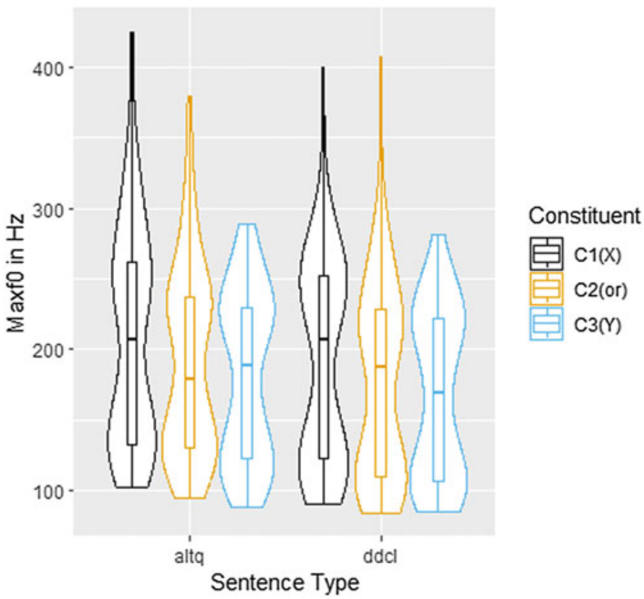


Figure 9. (Colour online) Violin plots containing boxplots showing the difference in maxF0 associated with X or Y constituents in both sentence types. The boxplots show the median and the interquartile range; the violin plots display datapoint distribution across all participants.

Table 5. Estimates and statistical results of the linear mixed-effects regression model for the maxF0 of the first constituent (C1, i.e., X)[a] in the '*X or Y*'

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	198.37	15.13	20.02	13.11	< 0.001***
Sen_Type1	−8.34	2.61	135.02	−3.19	0.001**

[a]Model syntax: MaxPitch_C1X<-lmer(Maxf0∼Sen_Type + (1|Participant), data = MaxPitchC1, REML = F)

Helmert coded: (−1) for alternative questions and (1) for declarative statements.[25] As it was the case when we analyzed the minimum F0 in boundary tones, several models with different syntax were considered. Singular models, however, were excluded. When comparing models, the log likelihood ratio tests using ANOVA (see Baayen, Davidson & Bates, 2008; Bani Younes, 2020; Winter, 2020) in R were run. Thus, to avoid singular models and collinearity and to be consistent across all models for the maxF0 and minF0, we selected the model syntax that was best fit to the data.

Tables 5–7 show that the intercepts are significant (C1 (X): p < .001; C2 (or): p < .001; C3 (Y): p < .001), which means that the maximum F0 is higher for all constituents in altqs than in ddcls. Similarly, 'SenType1' (ddcls) was statistically significant with a negative sign (C1 (X): p < .01; C2 (or): p < .05; C3 (Y): p < .001). In other words, the maxF0 values in C1, C2, and C3 in altqs (coded as -1) were statistically higher than those in ddcls. This is consistent with our phonological analysis showing that *X* and *Y* in altqs are accented while this is not the case in ddcls, as they have higher maxF0.

As for the minF0 per constituent, Figure 10 shows boxplots depicting the difference in minF0 for the *X or Y* constituents.

[25] Sum coding was also used, and we obtained the same results.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

Table 6. Estimates and statistical results of the linear mixed-effects regression model for the maxF0 of the second constituent (C2, i.e., or) [a] in the '*X or Y*'

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	183.03	13.49	20.04	13.56	< 0.001***
Sen_Type1	−7.07	2.79	135.06	−2.53	0.01*

[a] Model syntax: MaxPitchC2_C2Or <-lmer(Maxf0~Sen_Type + (1|Participant), data = MaxPitchC2, REML = F)

Table 7. Estimates and statistical results of the linear mixed-effects regression model for the maxF0 of the third constituent (C3, i.e., Y)[a] in the '*X or Y*'

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	174.31	12.92	20.00	13.49	< 0.001***
Sen_Type1	−6.70	1.15	136.01	−5.83	< 0.001***

[a]Model syntax: MaxPitchC3_C3Y <- lmer(Maxf0~Sen_Type + (1|Participant), data = MaxPitchC3, REML = F)

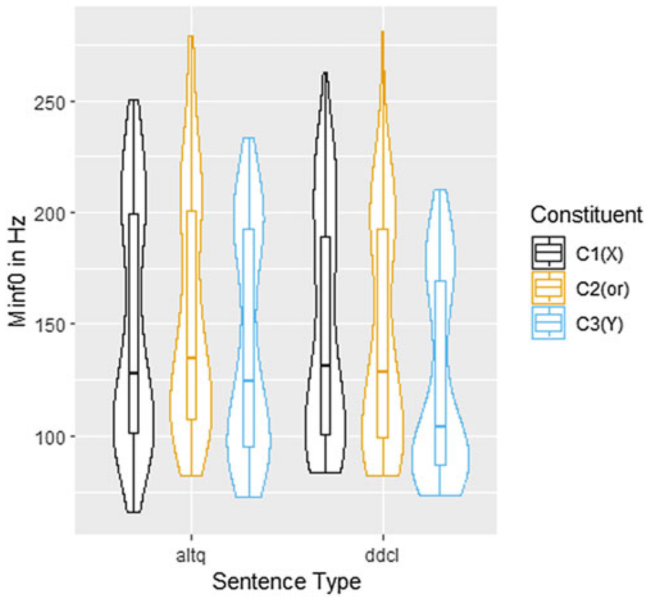


Figure 10. (Colour online) Violin plots containing boxplots showing the difference in minF0 of the *X* or *Y* constituents in both sentence types. The boxplots show the median and the interquartile range; the violin plots display datapoint distribution across all participants.

Figure 10 indicates that there might be differences between both sentence types in the minF0; C2 and C3 in ddcls appear to have lower F0 values than their counterparts in altqs. To determine if this was the case, we ran three models to test the differences in the minF0 (see Tables 8–10).

Tables 8–10 show that the intercepts are highly significant (C1 (X): p < .001; C2 (or): p < .001; C3 (Y): p < .001). A non-significant effect of Sentence Type was found for C1 (p=.87, see Table 8), but it still displays a tendency for C1 (X) in ddcls to have lower minF0 than C1 (X) in altqs. Tables 9–10 clearly indicate that ddcls have significantly lower minF0 in C2 and

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

Table 8. Estimates and statistical results of the linear mixed-effects regression model for the minF0 of the first constituent (C1, i.e., X)[a] in the '*X or Y*'

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	147.75	9.89	20.02	14.93	$< 0.001^{***}$
Sen_Type1	−0.36	2.28	138.02	−0.15	0.87

[a] Model syntax: MinPitch_C1X <-lmer(Minf0∼Sen_Type + (1|Participant), data = MinPitchC1, REML = F)

Table 9. Estimates and statistical results of the linear mixed-effects regression model for the minF0 of the second constituent (C2, i.e., or) [a] in the '*X or Y*'

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	148.60	9.77	20.02	15.20	$< 0.001^{***}$
Sen_Type1	−4.86	2.32	138.02	−2.09	0.03^{*}

[a] Model syntax: MinPitchC2_C2Or <-lmer(Minf0∼Sen_Type + (1|Participant), data = MinPitchC2, REML = F)

Table 10. Estimates and statistical results of the linear mixed-effects regression model for the minF0 of the third constituent (C3, i.e., Y) [a] in the '*X or Y*'

Fixed effects	Estimate	SE	df	t-value	p-value
Intercept	132.34	8.99	20.03	14.71	$< 0.001^{***}$
Sen_Type1	−8.68	1.97	138.03	−4.40	$< 0.001^{***}$

[a] Model syntax: MinPitchC3_C3Y <-lmer(Minf0∼Sen_Type + (1|Participant), data = MinPitchC3, REML = F)

C3 (C2 (or): $p < .05$; C3 (Y): $p < .001$), which is illustrated in the boxplot and the violin plot in Figure 9. That is, minF0 of C2 (or) in ddcls is significantly lower than minF0 of C2 in altqs, and minF0 of C3 (Y) in ddcls is significantly lower than minF0 of C3 in altqs. This is indeed consistent with our previous results regarding differences in the realization of boundary tones in both sentences.

To sum up, the first research question was addressed by examining the contour shape associated with the *X or Y* constituent in ddcls and altqs and by phonologically analyzing the accentual status of each of the members of the final constituent (i.e. C1, C2 and C3) in ddcls and altqs. The analysis showed that ddcls and altqs are similar in their contour shape (i.e., a global rise-fall), but the final fall in altqs was a fall to mid, whereas it was a fall to low in ddcls. An analysis of the pitch accent distribution revealed that C1 and C3 are associated with pitch accents in altqs and deaccented in ddcls, which is consistent with our hypotheses.

To answer the second research question, we compared minF0 and maxF0 values across the three constituents. The results showed that altqs are significantly different from ddcls in that they have higher maxF0 in all constituents. Ddcls also had lower minF0 in two constituents (C2 and C3).

6. Discussion

The first research question was concerned with (a) the contour shape of ddcls, over the *X or Y* constituents, (b) similarities or differences in the contours, and (c) similarities or differences in the accentuation of *X or Y*.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

Figure 5 clearly showed that the contour over the *X or Y* constituents of ddcls is a rise-fall. This is not unexpected, since ddcls are a sub-type of declaratives. Indeed, the contour obtained for ddcls produced by urban speakers of JA is similar to the one reported for non-disjunctive declaratives in the literature on JA and other Arabic dialects (Rammuny, 1989; El-Hassan, 1991; Mitchell, 1993; Chahal & Hellmuth, 2014; Hellmuth, 2014; El Zarka, 2017; Bani Younes, 2020). This finding is consistent with our first hypothesis, which predicted that ddcls would end with a final fall.

Moving to the part of the research question that was concerned with similarities or differences in the contours over the *X or Y* constituent of both sentence types, we showed (see Figure 5) that the contour shape of altqs in this study is a rise-fall (with a final fall to mid), which is in keeping with previous studies on altqs in JA (Al Amayreh, 1991; Hellmuth, 2018; Bani Younes, 2020), and also with the differences observed in French by Delais-Roussarie & Turco (2019).

On the surface, we can see that both sentence types end with a rise-fall. However, we found clear phonetic differences between the two falls observed in ddcls and altqs. Such differences were supported by our statistical results concerning the minimum F0 values in the last syllable of both sentence types (see Figure 7 and Table 1). In ddcls, the final fall is described here as a fall to low (see Figure 7). The majority of altqs, on the other hand, display a final fall to mid (though some participants produced a final fall to low), which resembles the differences obtained for French (Delais-Roussarie & Turco, 2019). The finding that altqs end with a fall to mid in our data is also in line with the results reported for altqs in Arabic (Al Amayreh, 1991; Bani Younes, 2020). Indeed, Delais-Roussarie and Turco (2019) discussed the differences between their phonological analysis, where 55% of altqs have an L% boundary tone and the rest end with a mid-tone, and their phonetic analysis, which revealed a consistent fall to mid in altqs. In light of the results reported for French, it is interesting to observe that the only participant (M2) who systematically produced a fall to low in altqs (i.e., he was responsible for 4/6 exceptional tokens), indicated that he had been speaking French for eight years (he started to learn French when he was 12 years old). Despite this exception, both utterance types (ddcls and altqs) have a roughly similar contour shape from a phonological point of view (i.e., a rise-fall), which confirms our prediction that the contour shape over the *X or Y* constituent of both utterance types would be similar. Nonetheless, from a phonetic point of view for the final contour shape, the two falls were different in the minimum F0 associated with the final syllable. The differences in the final fall observed lead us to think that the boundary tones in these two sentence types should be analyzed differently. Along the lines of Delais-Roussarie and Turco (2019), we propose that altqs in JA finish with an !H% whereas declaratives end in an L%. Future perception experiments would need to test this proposal.

The first research question also sought to find out whether the prosodic details (accent distribution) of the *X or Y* in ddcls and altqs were similar, allowing for the disambiguation of these sentence types. The phonological analysis of the *X or Y* constituents showed a significant difference between ddcls and altqs in accenting the *X* and *Y* (see Table 2). The findings also indicated that there is no difference between ddcls and altqs in accenting the conjunctive word *ʔaw*. Hence, both utterance types are dissimilar in the accentual status of *X* and *Y*, answering the research question. This finding supports our hypothesis that both utterance types would have a different accentual distribution on the *X or Y*, leading to differentiating ddcls from altqs. The finding that both *X* and *Y* in altqs are associated with pitch accents lends support to prior work on JA (Al Amayreh, 1991; Bani Younes, 2020). This is also consistent with Pruitt and Roelofsen's (2013) results for English but slightly differed from the results obtained for American English by Heindeinreich (2019) who observed that altqs are characterized by having a rising pitch accent associated only with the X constituent.

https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press

One possible explanation for having both *X* and *Y* accented in altqs rather than in ddcls might be that altqs ask addressees to choose one of the alternatives present in the *X* and *Y* constituents (e.g., 'London or Riyadh' in Figure 6a). In other words, forcing an addressee to select one of the alternatives in altqs rather than in ddcls might have made the relationship between the *X* and *Y* contrastive (see Pruitt, 2008; Bani Younes, 2020), which is also consistent with an analysis of each constituent being F-marked (see also Dayal, 2016; Delais-Rousserie & Turco, 2019). Speakers might have drawn addressees' attention to the alternatives by emphasizing them, sending a message that they need to select one of these two pitch accented items. Conversely, the purpose of declarative statements, including ddcls, is to inform addressees of the subject matter, rather than to ask them to choose one of the alternatives in the *X or Y* (i.e., a broad focus reading). Thus, speakers did not emphasize the *X* and *Y* because they did not want addressees to pick one, leaving the alternatives unaccented. As mentioned, this is expected since the *X* and *Y* constituents are known in ddcls, and, as such, these constituents are given information. As it has been shown for German (Baumann, 2006, Baumann & Riester, 2013), elements that are high in the givenness scale tend to be deaccented.

Our second research question concerned the phonetic differences between both sentence types in the minF0 and maxF0 of *X or Y* constituents. Figure 9 and Tables 5–7 reported the results of the maxF0 values, and as we observed, altqs displayed consistently higher values than ddcls in constituents C1, C2 and C3, whereas ddcls (see Figure 10 and Tables 8–10) had significantly lower minF0 values across these constituents (though it was non-significant for *X*). This finding is not surprising, given that ddcls and altqs were found to have differences in their accentual pattern. As such, the phonetic differences obtained, while being in line with our phonological analysis, allow us to precise what the differences are at different points in the *X or Y* constituent, including the final fall. Thus, albeit similar in the global rise-fall contour, the final constituents in altqs and ddcls differ in: (i) the type of fall, which is a fall to mid in altqs (!H%) and a fall to low in ddcls (L%), as observed for French (Delais-Rousserie & Turco, 2019); (ii) the maxF0 values obtained in all constituents which are consistent with a higher pitch register in altqs than in ddcls; (iii) the minF0 values, which are consistently lower in ddcls than in altqs. Moreover, these group differences are consistent with the individual patterns observed (Appendix 2). Although there are five participants whose contours overlap, for two of those (F5 and F7) we observed significant differences in the final fall. As such, our results appear to be consistent with those of Delais-Rousserie and Turco (2019) who found that, in French, the type of fall reliably distinguishes the two sentence types.

Having established the phonological and phonetic details of ddcls and altqs in production, we conclude that differences in accentuation (i.e., presence or absence of pitch accents on *X or Y*) and phonetic parameters (maxF0 and minF0 in the *X or Y* as well as minF0 in the boundary region) are used to distinguish between ddcls and altqs in JA. A future perception study taking the accentual status as an independent variable and testing its influence on participants' interpretation of the two sentence types could also lead to finding out how these syntactically identical utterances are perceptually disambiguated in JA. A future study could also replace the *X* and *Y* constituents from altqs with their counterparts from ddcls, to test if this substitution helps listeners choose the correct type of utterance, which is reminiscent of what Pruitt and Roelofsen (2013) did in their perception study on English altqs and yes-no questions. Additionally, future research might seek to find other phonetic differences between the two sentence types in the *X or Y* constituents (e.g., duration, speech rate, pitch register and scaling, alignment, slope, etc.), along the lines of Delais-Roussarie and Turco's (2019) study on French.

Finally, the theoretical implications of this paper can be summarized in four points. First, the findings show that AM theory along with its associated transcription system (IPrA) is applicable to Arabic as shown by the pitch accents and boundary tones used to label all utterances, supporting Bani Younes' (2020) and Hellmuth's (in preparation) claim about its applicability to Arabic dialects. Second, Bartels' (2013) theoretical assumption that having *X* and *Y* unaccented along with the fall does not necessarily make a disjunctive utterance an altq was also supported here in Arabic, since ddcl in this corpus had a rise-fall contour but did not have pitch accents associated with *X* and *Y* constituents.[26] Thus, results show that *an Arabic disjunctive utterance with a rise-fall contour and a rising pitch accent associated with X and a falling pitch accent associated with the Y constituents is an altq, and a disjunctive utterance with a rise-fall but without accents on X and Y is a ddcl.* These findings complement the empirical picture in Bani Younes' (2020) study, where it was found that having both *X* and *Y* unaccented and a final rising contour led to a disjunctive yes-no question reading in four Arabic dialects. Consequently, any theory that takes disjunction and simply adds the final fall to derive altq or ddcl meaning without controlling for focus (pitch accents) on *X* and *Y* would be incomplete. Such a theory must also consider, within its principles, that such sentence types might have phonetic (e.g., maxF0, minF0, etc.) as well as phonological differences (e.g., presence vs. absence of pitch accents associated with the final constituents). As such, the current results combined with Bani Younes' provide a comprehensive, experimentally grounded theoretical picture of the prosodic factors that account for the disambiguation of three string-identical disjunctive sentence types (ddcls, altqs, and disjunctive yes-no questions),[27] at least across most Arabic dialects.[28] The theoretical claims of this paper are a first step towards a theory of disjunction that maps prosody into meaning. Although future studies might test this proposal in other languages to build a typology, the present findings contribute to our understanding of how prosody maps into semantic and pragmatic theory, pointing out which prosodic and phonetic features contribute to the meaning of the utterance.

Third, these findings provide further experimental support for a theory accounting for the prosody of disjunctive utterances (see Pruitt & Roelofsen, 2013). This theory states that accenting both conjuncts along with having a final fall leads to an altq reading (see Pruitt & Roelofsen, 2013). Fourth, because the findings showed that the final constituents in ddcls and altqs are prosodically different (in the accentual status and some acoustic cues), Dayal's cross-linguistic generalization that disjunctive questions are disambiguated by prosody should not be restricted to disjunctive questions but could also be extended to include other disjunctive types, such as disjunctive declaratives, at least in Arabic. This extension is supported by the current experimental findings. Future studies on other languages might also test whether prosody alone can differentiate between ddcls and altqs, thus testing the need to extend Dayal's theoretical generalization to different disjunctive utterance types.

7. Conclusion

This study investigated the prosody of an under-researched sentence type (ddcls) in a DCT production study, and compared it with the prosody of altqs, using the same methodology.

[26] We remind the reader that, although the *X or Y* constituent is unaccented, they are not phrased independently. Indeed all utterance had prenuclear pitch accents as illustrated in Figure 2.

[27] The first two are studied in this paper while the third was studied in Bani Younes (2020) and Bani Younes & Hellmuth (2020).

[28] See Bani Younes (2020) for a cross-linguistic typology of languages that use disambiguating cues other than prosody. In such cases, the choice of conjunctive word might play a role in the disambiguation. However, the generalization in this study is restricted only to string-identical *X* or *Y* constituents in disjunctive utterances.

Results showed that both utterances are similar in the contour shape: i.e., a rise-fall associated with the '*X or Y*' but the final fall over the last syllable of the *Y* words was a fall to mid in altqs (i.e., !H%) and a fall to low in ddcls (i.e. L%). An analysis of the accentual pattern of *X or Y* revealed that the presence vs. absence of pitch accents in altqs vs. ddcls, respectively, plays a key role in distinguishing both sentence types. This difference is supported by the findings of our phonetic analysis, which showed that the maximum f0 values are higher in altqs than in ddcls, whereas the minf0 values are lower in ddcls than in altqs. A future perception study might build on these results to determine whether speakers of Jordanian Arabic rely on the presence vs. absence of pitch accents to distinguish these sentence types.

Competing interests The authors declare none.

Acknowledgments The third author would like to extend his sincere appreciation to the Researchers Supporting Project number (RSPD2024R714), King Saud University, Riyadh, Saudi Arabia.

8 Appendices: DCT Scenarios

Appendix 1. Scenarios used in the data collection

Scenarios eliciting ddcls

1. *ʔinta bitiʕrif ʔinnuh raja:n ʔiħtima:l jizawwaʒ li:na ʔaw di:ma wa sˤadi:gak ʔiθθa:ni saʔalak ʔinnu raja:n ʔiħtima:l jizawwaʒ mi:n, xabru ʔinnuh ʔiħtimal jizawwaʒ wa:ħdih min halbinte:n: li:na ʔaw di:ma.*

(You know that Rayan is likely to get married to Lina or Deema, and your other friend asked you who Rayan is going to get married to. Tell him that Rayan might marry one of two girls, as far as you know, and they are Lina or Deema).

2. *ʔitxajjal ʔinnak ʔibitiħki lasˤa:ħbak ʕan ʃahir lʕasal laʔaxu:k ra:mi, wa ʔinta biddak tiħki:lu ʔinnu ʔaxu:k za:r landan ʔaw r-rja:dˤ, la:kin ʔinta mu: mitʔakkid ʔaj madi:na za:rha la:kin mu: mu:him ʕindak ʔaj madi:na bittaħdi:d, lmuhim ʔinnak biddak ʔitxabbir sˤa:ħbak ʔinnu za:r landan ʔaw r-rja:dˤ, xabru. . .*

(Imagine you are talking to your friend about your brother Rayan's honeymoon. You want to tell him that your brother was honeymooning in London or Riyadh; it's not important for you the exact city name Rayan visited; all you want is to inform your friend that Rayan visited London or Riyadh on his honeymoon. Tell him this. . .).

3. *ʔabu:k biddu jiʃtari laʔibnak sijja:ra ʔaw ballo:n, la:kin ʔinta ma btiʕrif ʔaj wa:ħidih minhum ʔabu:k raħ jidʒi:bu laʔibnak, wa ʔinta biddak ʔitxabbir ʔibnak w tiħki:lu ʔinnu ʔabu:k biddu jiʃtari:lu sijja:ra ʔaw ballo:n, xabru. . .*

(Your father wants to buy your son a car or a balloon; you're not sure which one he is going to buy as it is not important for you to know this. You want to tell your son that your father will buy him a car or a balloon. Tell him. . .).

4. *sˤa:ħbak jigu:llak ʔinnu ʔibnu nidʒiħ bittawdʒi:hi w dʒa:b muʕaddal ʔimtija:z, w bina:ʔan ʕala ha:ða lmuʕaddal, jisʔalak sˤa:ħbak ʔiða mumkin jitˤlaʕ laʔibnu fi dʒdʒa:mʕa l-ʔalma:nijja ʔaw l-ʔʊrdʊnijja, wa ʔinta biddak tˤitˤamnu ʔinnu a:h mumkin jiru:ħ ʕalajhum laʔinnu muʕaddalu mumta:z, kajf raħ tiħki:lu...*

(Your friend is telling you that his son got a distinction in his Secondary Education exams (which are held at the national level). Based on such excellent grades, your friend asks you whether it is likely for his son to be accepted at the German University or the University of Jordan. You want to reassure him that his son may get accepted at the German University or the University of Jordan due to his son's excellent grades. Tell him. . .).

Scenarios eliciting altqs

1. *raja:n ka:n jiħki:lak ʔinnu ʔiħtimal jizawwaʒ li:na ʔaw di:ma, wa sˤadi:gak ʔiθθa:ni ħaka:lak ʔinnu raja:n ʔitazawwaʒ ʔisʔal sˤadi:gak ʕan ʔism lbinit ʔilli tazawwʒha raja:n bittaħdi:d wasuʔa:lak la:zim jidˤdˤamman hal ʔisme:n li:na ʔaw di:ma.*

(Your friend Rayan used to tell you that he is thinking of getting married to Lina or Deema. Your other friend (e.g., Ali) tells you that Rayan has just married. Ask Ali to specify the name of the girl that Rayan married. Your question should have the names: Lina and Deema).

2. *ʔitxajjal ʔinnak ʔibitiħki lasˤa:ħbak ʕan ʃahir lʕasal laʔaxu:k ra:mi, wa ʔinta biddak tiħki:lu ʔinnu ʔaxu:k za:r landan ʔaw r-rja:dˤ, la:kin ʔinta mu: mitʔakkid ʔaj madi:na za:rha bittaħdi:d, liða:lik ʔitxajjial ʔinnak biddak tisʔal zawdʒit ʔaxu:k ʕaʃa:n ʔitħaddid lmadi:na ʔilli za:rha ʔaxu:k ʔisʔalha. . .*

(Imagine you're talking to your friend about your brother Rayan's honeymoon. You want to tell him that your brother went to London or Riyadh on his honeymoon, but you're not sure which city of these two he visited. So, before telling your friend this information, ask your brother's wife (who is next to you now) to specify the city (London or Riyadh) that your brother visited (with her) on their honeymoon. Ask her now. . .).

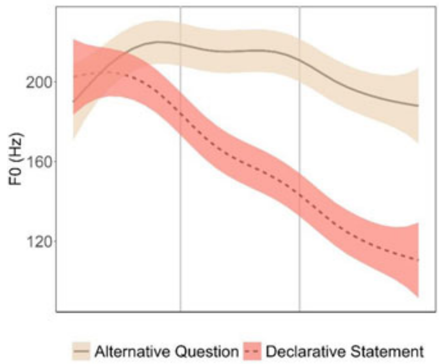
3. *ʔummak ħakatlak ʔinnu ʔabu:k biddu jiʃtari laʔibnak sijja:ra ʔaw ballo:n, la:kin hijja ma btiʕrif ʔaj wa:ħidih minhum ʔabu:k raħ jidʒi:bu, wiʃʃaxisˤ lwaħi:d ʔilli jiʕraf huwwa ʔibnak, liða:lik biddak tisʔal ʔibnak ʔinnu jiħaddlak biðˤðˤbitˤ ʔinnu ʔabu:k biddu jiʃtari:lu sijja:ra ʔaw ballo:n, ʔisʔalu. . .*

(Your mother told you that your father wants to buy your son a car or a balloon, but she does not know which one he is going to buy. The only person knowing this is your son as he is the person who asked your father to buy him one of the two options. So, you want to ask your son to say exactly what your father is going to buy him (from the two options: car or balloon). Ask him. . .).

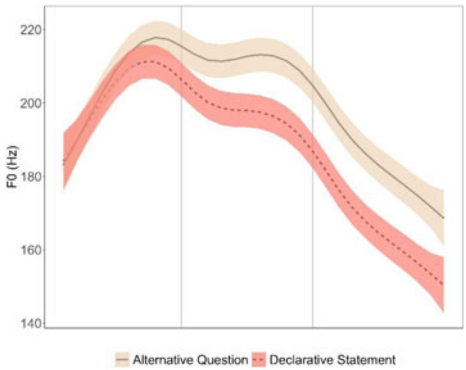
4. *sˤa:ħbak jigu:llak ʔinnu ʔibnu nidʒiħ bittawdʒi:hi w dʒa:b muʕaddal ʔimtija:z, ʔisʔalu lasˤa:ħbak ʕan dʒdʒa:mʕa ʔilli mumkin ʔibnu jiru:ħ ʕalajha min l-ʔalma:nijja ʔaw l-ʔʊrdʊnijja bittaħdi:d. . .*

(Your friend is telling you that his son got a distinction in his Secondary Education exams (which are held at the national level). There are two options for his son to choose from: German University or the University of Jordan. Ask your friend to pick the exact name of the university that his son would like to study in).

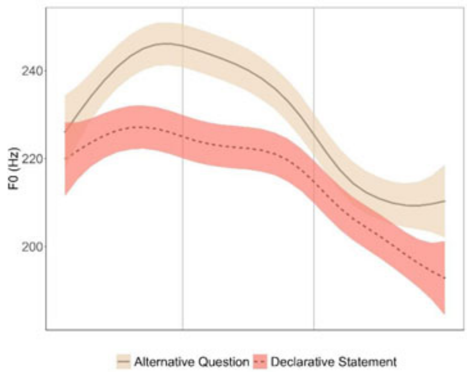
Appendix 2: Time-normalized SSAnova plots by participant



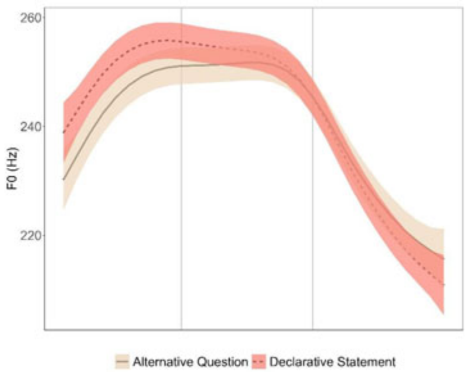
(1) Time-normalized SSAnova for F1



(2) Time-normalized SSAnova for F2

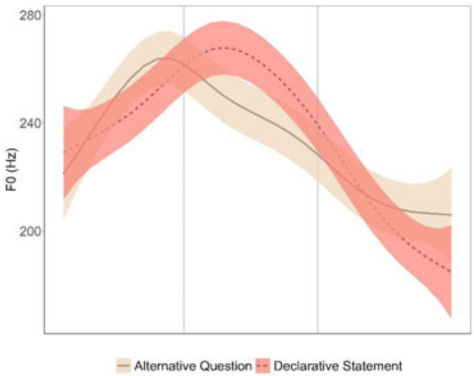


(3) Time-normalized SSAnova for F3

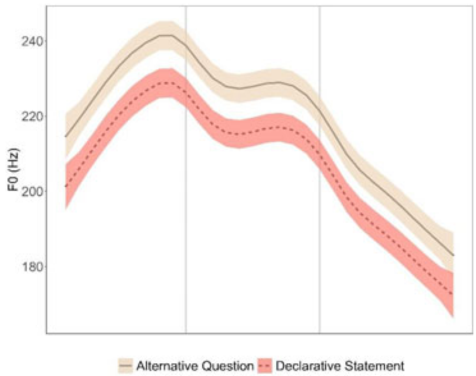


(4) Time-normalized SSAnova for F4

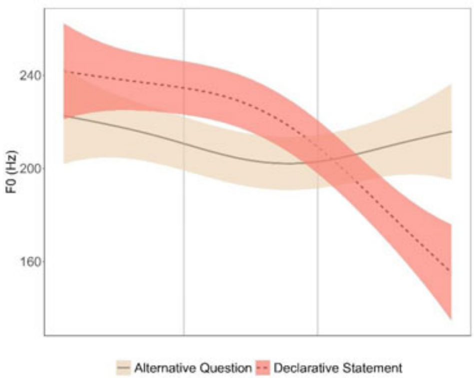
https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press



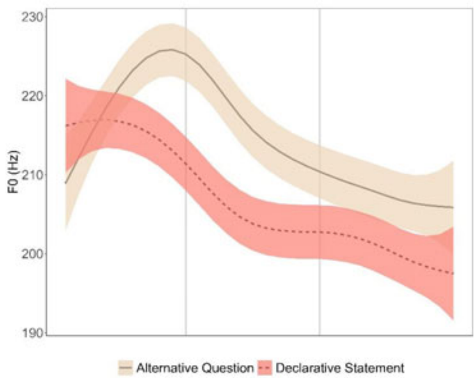
(5) Time-normalized SSAnova for F5



(6) Time-normalized SSAnova for F6

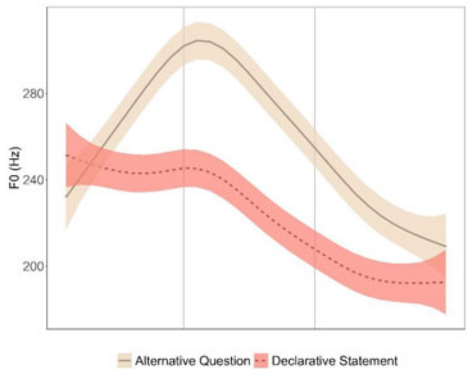


(7) Time-normalized SSAnova for F7

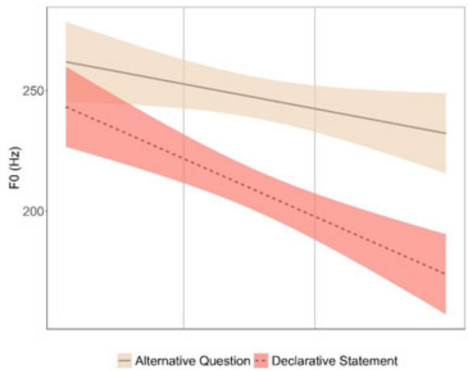


(8) Time-normalized SSAnova for F8

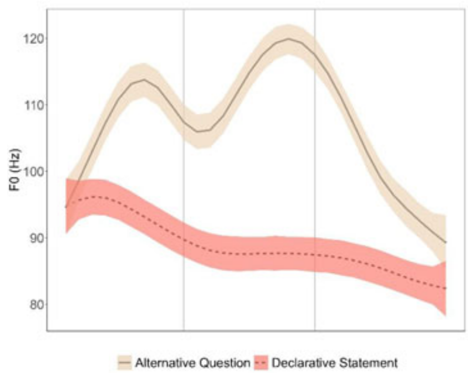
https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press



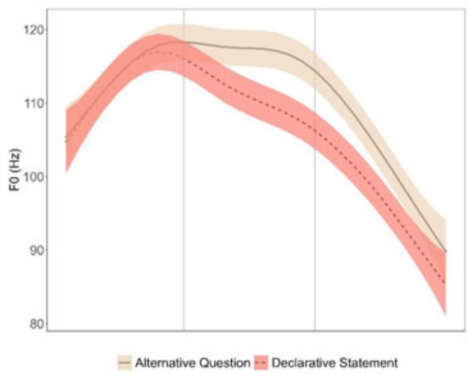
(9) Time-normalized SSAnova for F9



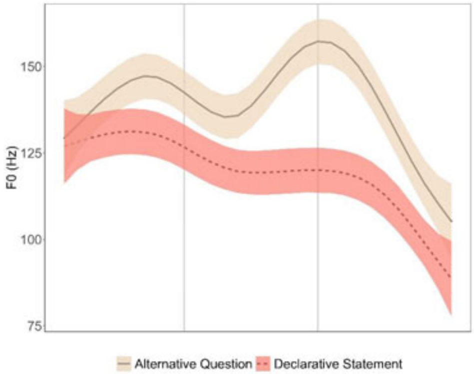
(10) Time-normalized SSAnova for F10



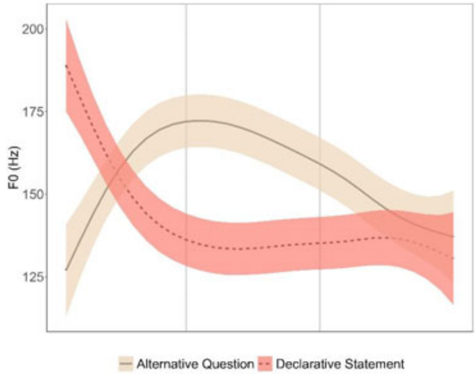
(11) Time-normalized SSAnova for M1



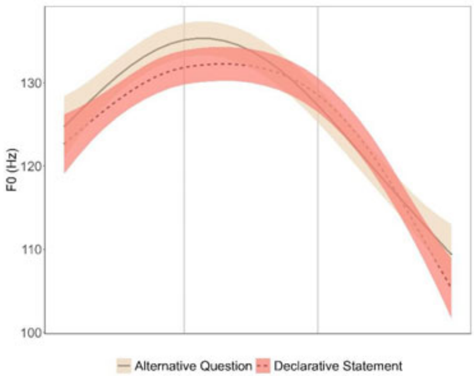
(12) Time-normalized SSAnova for M2



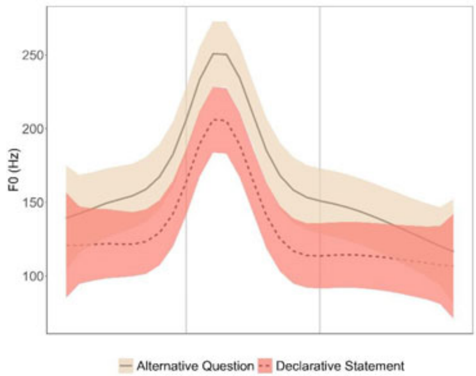
(13) Time-normalized SSAnova for M3



(14) Time-normalized SSAnova for M4

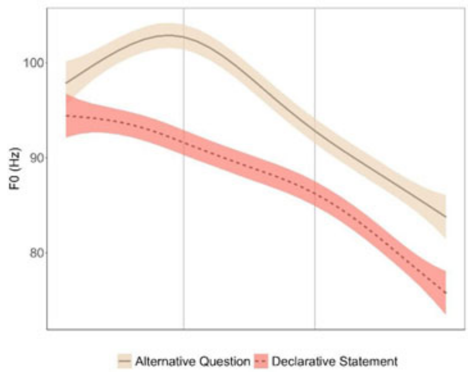


(15) Time-normalized SSAnova for M5

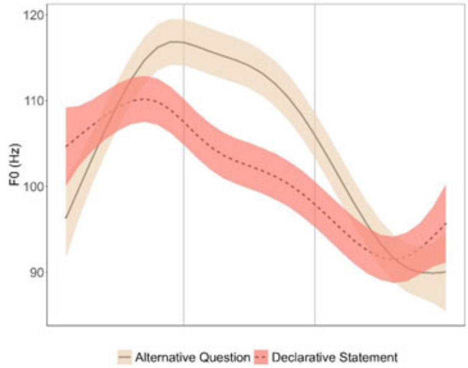


(16) Time-normalized SSAnova for M6

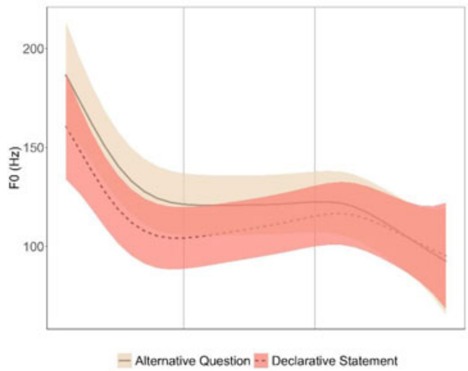
https://doi.org/10.1017/S0025100324000240 Published online by Cambridge University Press



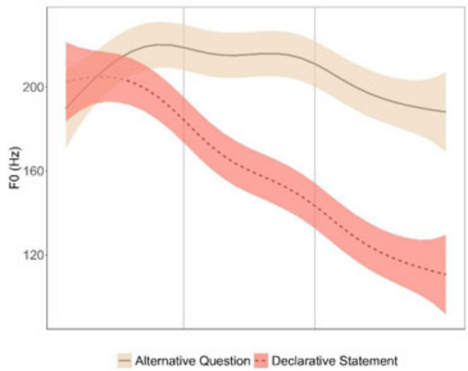
(17) Time-normalized SSAnova for M7



(18) Time-normalized SSAnova for M8



(19) Time-normalized SSAnova for M9



(20) Time-normalized SSAnova for M10

References

Abu-Abbas, Khaled, Wael Zuraiq & Feda Al-Tamimi. 2010. Assimilation and local conjunction in Arabic. *SKASE Journal of Theoretical Linguistics* 7(3), 64–83.

Abulehia, Wahhaj, & Tawfiq Khader Khader. 2022. Compliments and compliment responses among Palestinian EFL university learners: A sociolinguistic study. *Jordan Journal of Modern Languages and Literatures* 14(4), 847–867.

AbuSeileek, Ali Farhan, & Ghaleb Rabab'ah. 2013. Discourse functions and vocabulary use in English language learners' synchronous computer-mediated communication. *Teaching English with Technology* 13(1), 42–61.

Al Amayreh, Mousa Moh'd Khalil. 1991. A study of the basic intonational patterns in Standard and Jordanian Arabic. Master's thesis, University of Jordan. Amman, Jordan.

Almalki, Hussain & Tuuli Morrill. 2016. Yes/No question intonation in Urban Najdi Arabic. In *Proceedings of Speech Prosody Conference*, ed., by Jon Barnes, Nanette Veilleux, Stefanie Shattuck-Hufnagel, and Alejna Brugos, 606–610. Boston: Boston University.

Al-Wer, Enam. 2020. New-dialect formation: The Amman dialect. In Christopher Lucas and Stefano Manfredi (eds.), *Arabic and contact-induced change*, 551–566. Berlin: Language Science Press. https://doi.org/10.5281/zenodo.3744549

Alzaidi, Muhammad Swaileh, Yi Xu, & Anqi Xu. 2019. Prosodic encoding of focus in Hijazi Arabic. *Speech Communication* 106, 127–149.

Alzoubi, Elham. 2020. *Idioms and idiomatic expressions in Levantine Arabic: Jordanian Dialect*. New York: Routledge.

Baayen, R. Harald, Douglas J. Davidson, & Douglas M. Bates. 2008. Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language* 59(4), 390–412.

Bani Younes, Mohammad A. 2019, May. Disjunctive elements in nine Arabic dialects. Poster session/the PG Presentation Day, York, UK.
Bani Younes, Mohammad A. Salah. 2020. The role of phonology in the disambiguation of disjunctive questions. Doctoral dissertation, University of York, UK.
Bani Younes, Mohammad, & Sam Hellmuth. 2020. Disambiguating cues of disjunctive questions. In *Proceedings of the 11th International Conference of Experimental Linguistics*, ed., by Antonis. Botinis, 1–4. Athens: University of Athens.
Bartels, Christine. 2013. *The intonation of English statements and questions: A compositional interpretation*. New York: Routledge.
Bates, Douglas, Martin Mächler, Ben Bolker, & Steve Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1), 1–48. https://doi.org/10.18637/jss.v067.i01
Baumann, Stefan. 2006. The intonation of givenness. Evidence from German. Berlin and Boston: Max Niemeyer Verlag. https://doi.org/10.1515/9783110921205
Baumann, Stefan, & Riester, Arndt. 2013. Co-reference, lexical givenness and prosody in German. *Lingua* 136, 16–37.
Blum-Kulka, Shoshana, Juliane House, and Gabriele Kasper. 1989. Investigating cross-cultural pragmatics: An introductory overview. *Cross-cultural pragmatics: Requests and apologies* 31, 1–34.
Boersma, Paul, & David Weenink. 2023. *Praat: Doing phonetics by computer* [Computer program]. Version 6.3.10, retrieved 3 May 2023 from http://www.praat.org/
Chahal, Dana. 2001. Modelling the intonation of Lebanese Arabic using the autosegmental metrical framework: A comparison with English. PhD Dissertation, University of Melbourne.
Chahal, Dana, & Sam Hellmuth. 2014. The intonation of Lebanese and Egyptian Arabic. In Jun Sun Ah (ed.), *Prosodic typology II: The phonology of intonation and phrasing*, 365–404. Oxford: Oxford University Press.
Colantoni, Laura, Gabrielle Klassen, Matthew Patience, Malina Radu, & Olga Tararova. 2022. Perception and production of sentence types by Inuktitut-English bilinguals. *Languages* 7(3), 193. https://doi.org/10.3390/languages7030193
Cruttenden, Alan. 1997. *Intonation*. Cambridge: Cambridge University Press.
Dayal, Veneeta. 2016. *Questions*. Oxford: Oxford University Press.
Delais-Roussarie, Elisabeth, Brechtje Post, Mathieu Avanzi, Caroline Buthke, Albert Di Cristo, Ingo Feldhausen, Sun-Ah Jun, Philippe Martin, Trudel Meisenburg, Annie Rialland, Rafèu Sichel-Bazin, & Hiyon Yoo. 2015. Intonational phonology of French: Developing a ToBI system for French. In Sonia Frota and Pilar Prieto (eds.), *Intonation in Romance*, 63–100. Oxford: Oxford University Press.
Delais-Roussarie, Elisabeth, & Giuseppina Turco. 2019. Intonation of alternative constructions in French: Which cues allow distinguishing statements. In Ingo Feldhausen, Martin Elsig and Imme Kuchenbrandt (eds.), *Romance languages and linguistic theory: 15 selected papers from 'Going Romance' 30 Frankfurt*, 135–156. Amsterdam: John Benjamins.
Di Cristo, Albert. 2016. *Les musiques du français parlé*. Berlin and Boston: De Gruyter Mouton.
El-Hassan, Shahir. 1988. The intonation of questions in English and Arabic. *Abhath Al- Yarmouk* 22, 97–108.
El-Hassan, Shahir. 1991. Intonation-groups in English and Standard Arabic. *Dirasat* 18, 7–24.
El Zarka, Dina. 2017. *Arabic intonation*. Oxford: Oxford University Press. Retrieved from http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199935345.001.0001/oxfordhb-9780199935345-e-77
Gu, Chong. 2014. Smoothing spline ANOVA models: R Package gss. *Journal of Statistical Software* 58(5), 1–25.
Haddad, Sami. 2022. A theoretical review of the speech act of offering: Towards a categorization of its use in Jordanian Arabic. *Jordan Journal of Modern Languages and Literatures* 14(1), 219–236.
Heindenreich, Samantha. 2019. Disjunctive questions: Experimental evidence in prosody and discourse. PhD dissertation. Northwestern University.
Hellmuth, Sam. 2014. Investigating variation in Arabic intonation: The case for a multi-level corpus approach. In Samira Farwaneh and Hamid Ouali (eds.), *Perspectives on Arabic linguistics XX1V–XXV*, 63–89. Amsterdam: John Benjamins.
Hellmuth, Sam. 2018. Variation in polar interrogative contours within and between Arabic dialects. In Katarzyna Klessa, Jolanta Bachan, Agnieszka Wagner, Maciej Karpiński and Daniel Śledziński (eds.), *Proceedings of the 9th International Conference on Speech Prosody*. Poznań: Adam Mickiewicz University.
Hellmuth, Sam. in preparation. *Intonation in spoken Arabic dialects*. Oxford: Oxford University Press.
Hellmuth, Samantha. 2006. Intonational pitch accent distribution in Egyptian Arabic. Doctoral dissertation, University of London, UK.
Hualde, José, I., & Pilar Prieto. 2016. Towards an international prosodic alphabet (IPrA). *Laboratory Phonology: Journal of the Association for Laboratory Phonology* 5, 1–25. http://doi.org/10.5334/labphon.11
Yasin, Ayman. 2012. Syntaxt-Prosody interface: Evidence from Wh-movement in Jordanian Arabic and Egyptian Arabic. PhD Dissertation. Purdue University.

Yasin, Ayman, & Ibisaim Hussein. 2016. Deglottalization in Jordanian Arabic: Syntax-prosody interface. *Dirasat, Human and Social Sciences* 43(1).

Jaradat, Abdulazeez Ahmad, Bassil Mashaqba, & Anas Huneety. 2022. On pragmatics-syntax interface: The case of vocative nominals in Jordanian Arabic. *Jordan Journal of Modern Languages and Literatures* 14(2), 351–370.

Kelly, Niamh. 2023. Phrase-final intonation adjustments in Lebanese Arabic. *Journal of the International Phonetic Association* 53(1), 129–158.

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

Lai, Catherine. 2008. Prosodic cues for backchannels and short questions: really?. In *Proceedings of the Fourth Conference on Speech Prosody*, 413–416. Campinas, Brazil.

Lennes, Mietta. 2017. SpeCT - Speech Corpus Toolkit for Praat (v1.0.0). First release on GitHub (1.0.0). Zenodo. https://doi.org/10.5281/zenodo.375923.

Meertens, Erlinde Johanne. 2021. Alternative questions: From surface to meaning. Doctoral dissertation, Universität Konstanz, Germany.

Mitchell, Terence Frederich. 1993. *Pronouncing Arabic II*. Oxford: Oxford University Press.

Na'eem, Hani, Mujdey Abudalbuh, & Aziz Jaber. 2020. Medial tri-consonantal clusters in Urban Jordanian Arabic. *Jordan Journal of Modern Languages and Literatures* 12(1), 45–56.

Patience, Matthew, Laura Colantoni, Gabrielle Klassen, Malina Radu, & Olga Tararova. 2020. The perception and comprehension of English sentence types: Cross-linguistic influence and task effects. *Gradus* 5(1), 71–98.

Pierrehumbert, Janet, & Mary Beckman. 1988. Japanese tone structure. *Linguistic Inquiry Monograph 15*. Massachusetts: MIT Press.

Pruitt, Kathryn, & Floris Roelofsen. 2013. The interpretation of prosody in disjunctive questions. *Linguistic Inquiry* 44, 632–650.

Pruitt, Kathryn. (2008, March). *Mapping prosody to interpretation in alternative questions*. Poster presented at the 21st CUNY Conference on Human Sentence Processing, University of North Carolina, Chapel Hill, NC.

Rammuny, Raji. 1989. Instrumental and auditory analysis of Colloquial Jordanian Arabic, an update. *Journal of Arabic Linguistics* 20, 23–42.

R Core Team. 2022. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Styler, Will. 2022. *Using Praat for linguistic research*. Version 1.9.1. Retrieved from http://wstyler.ucsd.edu/praat/

Vanrell, Maria, Ingo Feldhausen, & Lluïsa Astruc. 2018. The Discourse Completion Task in Romance prosody research: Status quo and outlook. In Ingo Feldhausen, Jan Fliessbach and Maria del Mar Vanrell (eds.), *Methods in prosody: A Romance language perspective*, 191–227. Berlin: Language Science Press. https://doi.org/10.5281/zenodo.1441345

Wells, John Christophe. 2006. *English intonation: An introduction*. Cambridge: Cambridge University Press.

Winans, Lauren. 2019. Disjunction and alternatives in Egyptian Arabic. In Klaus von Hensinger, V. Edgar Onea Gaspar, and Malte Zimmermann (eds.), *Questions in discourse*, 237–285. Leiden: Brill. https://doi.org/10.1163/9789004378308_007

Winter, Bodo. 2020. *Statistics for linguists: An introduction using R*. London: Routledge.

Xu, Yi. 2013. ProsodyPro — A tool for large-scale systematic prosody analysis. In *Proceedings of Tools and Resources for the Analysis of Speech Prosody* (TRASP 2013), Aix-en-Provence, France.

Cite this article: Bani Younes Mohammad Ali Salah, Colantoni Laura, and Alzaidi Muhammad Swaileh A. (2024). Prosodic Disambiguation of Disjunctive Declaratives and Disjunctive Questions in Jordanian Arabic. *Journal of the International Phonetic Association* **54**, 974–1005. https://doi.org/10.1017/S0025100324000240