

Abstract

This paper reports on part of a larger investigation of polar questions in Urdu/Hindi. Our overall study is concerned with how the interfaces between prosody, syntax, and semantics/pragmatics interact with respect to forming non-canonical readings for questions. In this paper, we focus on the prosody-syntax interface in particular and show how this is crucial for disambiguating between the polar and the wh-constituent uses of Urdu/Hindi *kya* ‘what’. We work with the architecture of the prosody-syntax interface developed by Bögel (2015) and show how prosodic information guides syntactic disambiguation, which in turn results in the activation of the appropriate semantic information (polar vs. wh-constituent readings).

1 Introduction

This paper reports on part of a larger investigation of polar questions in Urdu/Hindi. Our overall study is concerned with how the interfaces between prosody, syntax, and semantics/pragmatics interact with respect to forming non-canonical readings for questions. In this paper, we focus on the prosody-syntax interface in particular and show how this is crucial for disambiguating between the polar and the wh-constituent uses of Urdu/Hindi *kya* ‘what’. We work with the architecture of the prosody-syntax interface developed by Bögel (2015) and show how prosodic information guides syntactic disambiguation, which in turn results in the activation of the appropriate semantic information (polar vs. wh-constituent readings).

As illustrated in (1)–(3), the wh-element *kya* ‘what’ is highly polyfunctional in Urdu/Hindi. We have so far identified uses in: a) constituent questions as in (1); b) polar questions as in (2); and c) the so-called scope marking construction.

- (1) anu=ne uma=ko **kya** di-ya?
Anu.F=Erg Uma.F=Dat what give-Perf.M.Sg
‘What did Anu give to Uma?’ (Wh-Constituent Question)
- (2) **kya** anu=ne uma=ko kitab d-i?
what Anu.F=Erg Uma.F=Dat book.F.Sg.Nom give-Perf.F.Sg
‘Did Anu give a/the book to Uma?’ (Polar Question)

Example (3) illustrates the scope marking construction (Dayal, 1996, 2000). In the declarative version, illustrated in (3-a), a pleonastic element *ye* ‘this’ is coindexed with an embedded that-clause. In the wh-counterpart, the *ye* ‘this’ is re-

[†]We gratefully acknowledge funding from the DFG. The work presented here was done as part of project P4 of the DFG-funded research unit FOR 2111 *Questions at the Interfaces*.

Very many thanks go to Rajesh Bhatt and Veneeta Dayal for the original inspiration and some further discussions, to Ghulam Raza for help with the data, suggestions, general pointers and interesting discussions and to Doug Arnold, Bettina Braun, Regine Eckardt, Gillian Ramchand, Craige Roberts, Maribel Romero and Louisa Sadler for helping us to come to grips with the phenomena and to Maria Biezma for in-depth cooperation. Many thanks go to Habiba, who has been one of our main informants.

position is the most natural position for the wh-word, as shown in (5).

- (5) a. sita=ne d^hyan=se **ram=ko** dek^h-a t^h-a
 Sita.F=Erg carefully Ram.M=Acc see-Perf.M.Sg be.Past-M.Sg
 'Sita had looked at Ram carefully'
- b. sita=ne d^hyan=se **kis=ko** dek^h-a t^h-a?
 Sita.F=Erg carefully who.Obl=Acc see-Perf.M.Sg be.Past-M.Sg
 'Who had Sita looked at carefully?'

However, a closer investigation reveals that the default position for wh-words in constituent questions is actually the immediately preverbal position, as in (6).

- (6) a. sita=ne ram=ko dek^h-a t^h-a
 Sita.F=Erg Ram.M=Acc see-Perf.M.Sg be.Past-M.Sg
 'Sita had seen Ram.'
- b. ram=ko **kis=ne** dek^h-a t^h-a?
 Ram.M=Acc who.Obl=Erg see-Perf.M.Sg be.Past-M.Sg
 'Who saw Ram?'

This immediately preverbal position has been identified independently as a syntactic focus position (Gambhir, 1981; Butt & King, 1996, 1997; Kidwai, 2000). Given that wh-words inherently designate focus because they open up a set of alternatives among which the answer should be selected as per Rooth's Alternative Semantics (Rooth, 2016), it follows that the default position for constituent question wh-words should indeed be the immediately preverbal focus position.

Further evidence for this analysis comes from a comparative study of Hindi and Indian English conducted by Féry et al. (2016). In the context of investigating information structure, they asked informants to produce sentences in response to a given context. They asked questions which targeted a specific grammatical relation, as in (7) and recorded the word order of the answer to the question.

- (7) a. *In front of the well, who is pushing the car?* (Questioning the Subject)
 b. *In front of the well, what is the man pushing?* (Questioning the Object)

The results for Hindi are shown in (8). When the object is questioned, the word order is always SOV. This is the wh-in-situ order, but it is also the order predicted by an analysis in which the object appears in an immediately preverbal focus position because this is what has been questioned and is thus placed in focus.

(8)

	SOV	OSV
Subject Questioned (n=28)	6	22
Object Questioned (n=26)	26	–

When the subject was targeted for questioning, the results were less clear, but an overwhelming number of responses place the subject in the immediately prever-

bal position, rather than using the default SOV word order. These results are again in line with an immediately preverbal focus position, which is where the response to the questioned item is being placed.

A web-based acceptability judgement test with speakers of Urdu conducted by Jabeen (2017) corroborates the results of Féry et al. (2016). We thus conclude that the default position for focused items is the immediately preverbal position. As the default position for focus, this is also the preferred position for wh-words in constituent questions.¹

However, the immediately preverbal position is only the preferred position for wh-words in constituent questions. Manetta (2012) demonstrates that wh-phrases have the same kind of scrambling possibilities as normal NPs. So, wh-words can in principle appear anywhere in the clause, as shown in (9).

- (9) a. anu=ne uma=ko **kya** di-ya?
 Anu.F=Erg Uma.F=Dat what give-Perf.M.Sg
 ‘What did Anu give to Uma?’
 b. %**kya** anu=ne uma=ko di-ya?
 c. anu=ne **kya** uma=ko di-ya?
 d. anu=ne uma=ko di-ya **kya**?

However, there are several things to notice about the distribution of the wh-words. For one, the different word orders go hand in hand with differences in interpretation. These differences are subtle as they fall within the realm of pragmatics. For example, Butt et al. (2016) investigate examples as in (10) where the wh-word appears immediately postverbally within the verbal complex (Bhatt & Dayal, 2007; Manetta, 2012) between the main verb and attendant auxiliaries. They argue that this immediately postverbal position within the verbal complex reflects a secondary focus position. The pragmatic effect of the other word orders remains to be fully investigated and understood.

- (10) sita=ne d^hyan=se [dek^h-a **kis=ko** t^h-a]?
 Sita.F=Erg carefully see-Perf.M.Sg who.Obl=Acc be.Past-M.Sg
 ‘Who had Sita looked at carefully?’

Also note that *kya* ‘what’ is dispreferred in the clause initial position. This holds for *kya* ‘what’, but not for other wh-words, as the contrast between (9) and (11) shows with respect to **kis** ‘who/whom’.

- (11) a. **kis=ne** uma=ko tofa di-ya?
 who=Erg Uma.F=Dat present.M.Sg.Nom give-Perf.M.Sg
 ‘Who gave Uma a present?’
 b. uma=ko **kis=ne** tofa di-ya?
 c. uma=ko tofa **kis=ne** di-ya?
 d. uma=ko tofa di-ya **kis=ne**?

¹We leave aside the issue of questions with multiple wh-words for now.

We put forward an explanation for this asymmetry in this paper by attributing the dispreference for the clause initial position due to interference by the distribution of polar *kya*.

3 Polar Questions

Polar questions in Urdu/Hindi are string identical to the corresponding declarative, as shown in (12) and (13). The difference between question vs. declarative status is signaled via intonation. Declaratives have an L-L% intonational phrase boundary, while a polar question is signaled by an L/H-H% intonational phrase boundary.

- (12) (ʃahina=ne norina=ko mara)_{L-L%}
 Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
 ‘Shahina hit Norina.’ (Declarative)
- (13) (ʃahina=ne norina=ko mara)_{L/H-H%}
 Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
 ‘Did Shahina hit Norina?’ (Polar Question)

3.1 Distribution of Polar *kya*

Polar questions can optionally be expressed with *kya* ‘what’, as shown in (14). This use of *kya* has been dubbed “polar *kya*” by Bhatt & Dayal (2015).

- (14) **kya** ʃahina=ne norina=ko ma-ra?
 what Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
 ‘Did Shahina hit Norina?’

Grammars and previous literature report polar *kya* as appearing only clause initially in Urdu/Hindi (Glassman, 1977; Platts, 1884; Masica, 1991; Montaut, 2004). Given established crosslinguistic patterns and the fact that Urdu declaratives and polar questions are string identical, a likely hypothesis is that polar *kya* is a question marker that serves to differentiate polar questions from declaratives.

However, Bhatt & Dayal (2015) convincingly establish that polar *kya* is not a question marker. They note that it is optional in matrix clauses, something that one would not expect from a clause typing marker. They also show that polar *kya* is generally disallowed in embedded clauses, whereby complements of so-called “rogative” predicates like *wonder*, *investigate*, *ask*, *examine* (Lahiri, 2002, 287) as in (15-b) are an exception.

- (15) a. *anu jan-ti hai [ki kya tum cai
 Anu know-Impf.F.Sg be.Pres.3.Sg that what you tea
 pi-yo-ge?]
 drink-2.Pl-Fut.M.Pl
 Intended: ‘Anu knows whether you will drink tea.’ (Non-rogative)

- b. anu jan-na cah-ti hai [ki kya tum cai
 Anu know-Inf.M.Sg want-Impf.F.Sg be.Pres.3.Sg that what you tea
 pi-yo-ge?]
 drink-2.Pl-Fut.M.Pl
 ‘Anu wants to know whether you will drink tea?’ (Rogative)

Bhatt & Dayal (2015) further point out that polar *kya* can actually appear anywhere in the clause, as shown in (16). This is also not a property generally associated with question markers, which tend to have a fixed position; in South Asian languages, this tends to be either clause initial or clause final (Masica, 1991).

- (16) (kya) anu=ne (kya) uma=ko (kya) kitab (%kya)
 what Anu.F=Erg what Uma.F=Dat what book.F.Sg.Nom what
 d-i (kya)?
 give-Perf.F.Sg what
 ‘Did Anu give a/the book to Uma?’

They also note that the *kya* is strongly dispreferred in the immediately preverbal position. We hypothesize that this is because the immediately preverbal position is the default focus position, which is an unnatural position for the polar *kya*. Conversely, it is the most natural position for *wh*-words in constituent questions and given that *kya* can appear in both constituent and polar questions, we posit that the most salient reading of *kya* in this position is the constituent one. The polar reading is therefore dispreferred.

This hypothesis is borne out by examples such as (17), which in principle should preferentially give rise to a polar reading since both of the core arguments of *mara* ‘hit’ are present in the clause. However, when we asked informants to pronounce the string in (17), they overwhelmingly chose to pronounce it as a constituent question and had severe trouble pronouncing it as a polar question.

- (17) jahina=ne norina=ko **kya** ma-ra?
 Shahina.F=Erg Norina.F=Acc what hit-Perf.M.Sg
 Polar Reading: ‘Did Shahina hit Norina?’
 Preferred Wh-Constituent Reading: ‘What did Shahina hit Norina with?’

3.2 Function of Polar *kya*

If we follow Bhatt & Dayal’s arguments that polar *kya* is not a question marker, then we need to determine what its function is. Bhatt & Dayal suggest that it is used to partition a clause roughly into given vs. new (cf. the “watershed” idea of Krivonosov 1977; Grosz 2016). Material to the left of polar *kya* is thus taken as given and not available for being questioned (Bhatt & Dayal, 2015).

- (18) A. **anu=ne kya** uma=ko tofa di-ya?
 Anu.F=Erg what Uma.F=Dat present.M.Sg.Nom give-Perf.M.Sg
 'Did Anu give a/the present to Uma?'
 B. #nahĩ, **asim=ne** di-ya
 no Asim.M=Erg give-Perf.M.Sg
 'No, Asim did.'

However, our own investigations showed that when a constituent to the left of polar *kya* is prosodically prominent, it can indeed be questioned.

- (19) A. **anu=ne_{Prominent} kya** uma=ko tofa
 Anu.F=Erg what Uma.F=Dat present.M.Sg.Nom
 di-ya?
 give-Perf.M.Sg
 'Did ANU give a/the present to Uma?'
 B. nahĩ, **asim=ne** di-ya
 no Asim.M=Erg give-Perf.M.Sg
 'No, Asim did.'

We are therefore assume the hypothesis articulated by Biezma et al. (2017) that polar *kya* is a focus sensitive operator which associates with focused material. It will either associate with a stressed item in the clause or, per default, with the item to its right. The function of polar *kya* as a focus sensitive operator is to constrain the set of possible answers viable in the context of an utterance. It imposes restrictions on what the question is about and conveys assumptions regarding the possible answers that plain information-seeking questions do not convey. These extra assumptions lie at the heart of the fact that polar *kya* questions tend to be used for non-canonical meanings, such as rhetorical questions of the type in (20). That is, the use of polar *kya* adds an extra pragmatic dimension and differentiates polar *kya* questions from plain polar questions as in (20).

- (20) tu pagal hai kya?
 you crazy be.Pres.3.Sg what
 'Are you crazy?' Script of *Socha Na Tha*

We do not go into the details of Biezma et al.'s proposal here, nor do we reproduce their argumentation. The focus of this paper lies on the disambiguation of polar vs. constituent *kya*.

4 Ambiguity Resolution via the Interface Architecture

Recall that some strings are ambiguous between polar *kya* and wh-constituent questions. This is illustrated below via examples taken from movie scripts.

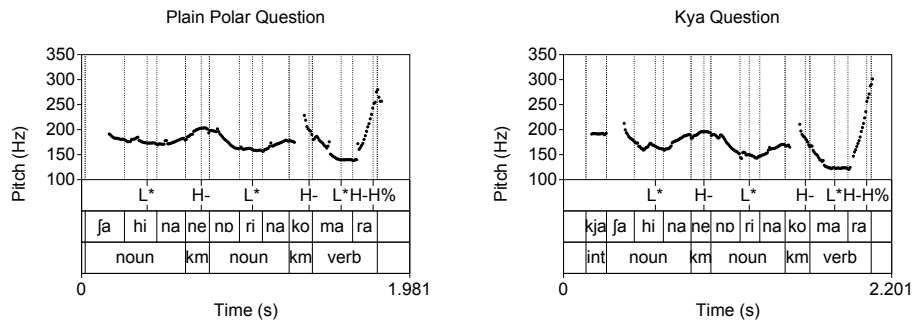
- (21) mē **kya** bol-ū?
 I.Nom what speak-1.Sg
 Constituent Question: ‘What should I say?’
 Polar Question: ‘Should I say (something)?’ Script, *Ankhon Dekhi*
- (22) **kya** taklif ho rah-i hai [...]?
 what bother.Nom be Prog-F.Sg be.Pres.3.Sg
 Constituent Question: ‘What’s bothering (you)?’
 Polar Question: ‘Is something bothering (you)?’ Script, *Ankhon Dekhi*
- (23) ab **kya** mafi māg-ē tom=se?
 now what forgiveness.M.Sg.Nom ask-Pl you.Fam=Inst
 Constituent Question: ‘It’s no use apologizing now.’
 (Lit.: ‘What forgiveness can I ask of you?’)
 Polar Question: ‘Am I supposed to ask for your forgiveness now?’
 Script, *Ankhon Dekhi*

While the examples are in principle ambiguous, they can be disambiguated via the context they occur in. They can also be reliably disambiguated via their attendant prosody as each of the readings are prosodically distinct.

4.1 Prosodic Information

Our investigations have shown that the polar *kya* always has a flat or falling intonation while the constituent question *kya* has a high tone H*. Urdu/Hindi generally exhibits a L* H- pattern on all prosodic phrases (Genzel & Kügler, 2010), with a larger pitch excursion on focused phrases. Given this, the flat intonation of polar *kya* is interesting. The contrast between the plain polar question and the polar *kya* question in (24) is shown in the figure below.

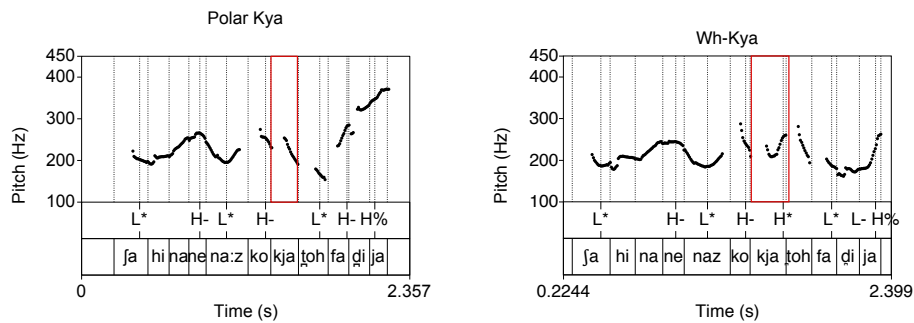
- (24) (**kya**) jahina=ne norina=ko ma-ra?
 what Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
 ‘Did Shahina hit Norina?’



The difference between the H* of the constituent question *kya* and the flat/falling intonation of the polar *kya* is further illustrated by the pitch tracks following and illustrating (25), which repeats examples (4-a) and (4-b).

In addition to the prosodic differences between polar *kya* and constituent question *kya*, polar questions can be distinguished from constituent questions via the boundary tones: constituent questions pattern like declaratives and have L-L% as a boundary tone (with some variation as in the example below) while polar questions end on a high tone (L/H-H%), as also illustrated in the pitch tracks.

- (25) jahina=ne naz=ko **kya** tofa di-ya?
 Shahina.F=Erg Naz.F=Dat what present.M.Sg.Nom give-Perf.M.Sg
 ‘Did Shahina give a gift to Naz?’ (Left Pitch Track)
 ‘What gift did Shahina give to Naz?’ (Right Pitch Track)



4.2 Syntax

In what follows we work with the example in (26) and show how we integrate prosodic information via the prosody-syntax interface proposed by Bögel (2015) in order to disambiguate polar vs. constituent *kya* readings.

- (26) alina=ne zain=ko **kya** tofa di-ya t^h-a?
 Alina=Erg Zain=Acc what present.M.Sg give-Perf.M.Sg be.Past-M.Sg
 Constituent Question: ‘What gift did Alina give to Zain?’
 Polar Question: ‘Did Alina (actually) give a gift to Zain?’

In terms of syntactic analysis, we base ourselves on the approach to Urdu syntax established as part of the Urdu ParGram grammar (Butt & King, 2007). The Urdu ParGram grammar uses a flat structure in which all major constituents are allowed to scramble. One of these major constituents is the verbal complex, labeled VC in the c-structure analyses.

Following Slade (2011), we analyze *kya* as a Q node within the c-structure. We furthermore assume only one underspecified *kya* ‘what’ for the polar and the *wh*-readings.² Figure 1 shows the c-structures for both interpretations of *kya*: While

²We could assume two separate lexical and syntactic entities and treat polar and constituent question *kya* as an accidental homophony. However, crosslinguistic evidence shows that there is a general

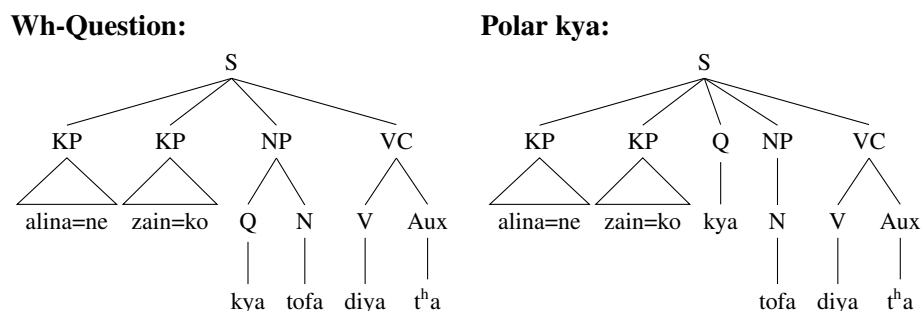


Figure 1: C-structures for the *wh*-reading and for *polar kya*.

kya forms an NP together with the associated N in the *wh*-reading, it remains an independent daughter of S in the *polar kya* interpretation.

4.3 The Syntax-Prosody Interface

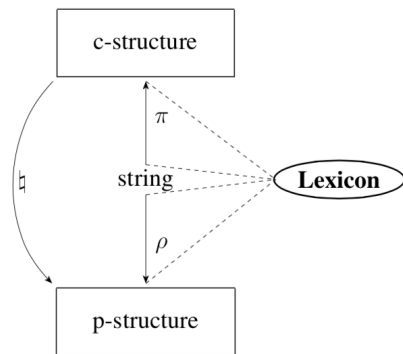
Initial LFG proposals for the p(rosodic)-structure were “syntactocentric” (cf. Jackendoff 2002, see, e.g., Butt & King (1998)), but newer proposals have moved towards seeing prosody as a more independent level of representation (Mycock, 2013; Dalrymple & Mycock, 2011; Dalrymple & Nikolaeva, 2011; Bögel, 2015). Prosody is taken to interact with morphosyntax, but is not derived from it.

For the analysis of *kya*, we follow the version of the syntax-prosody interface proposed by Bögel (2015). Based on the assumption that *listening* and *speaking* are inherently different processes at the interface between prosody and syntax (and grammar in general), the proposal makes a crucial distinction between *production* and *comprehension* and the grammar-internal position of the single modules between the two terminal points of *meaning* and *form*:

- *Production/generation/speaking*:
from meaning to form (syntax → prosody)
- *Comprehension/perception/listening*:
from form to meaning (prosody → syntax)

Two information transfer processes are assumed at the interface between syntax and prosody: The *Transfer of structure* (η) relates syntactic and prosodic constituency. The *Transfer of vocabulary* (ρ) associates morphosyntactic and phonological information within the lexicon and projects these onto the respective structures. The figure below shows how these new projections are integrated into the LFG architecture.

trend for ‘what’ to be used for other question types and we believe that this is not an accident. We are working on a unified semantic approach to polar and constituent question *what* and we here anticipate that approach by positing just one underlying and underspecified entry for *kya*.



η : The *Transfer of structure* \rightarrow Information on syntactic and prosodic grouping, and on intonation is exchanged.

ρ : The *Transfer of vocabulary* \rightarrow Associates morphosyntactic and phonological information on lexical elements and projects them to their respective structures.

We illustrate how the system works with a concrete example involving the *comprehension* of the utterance in (26). In a very first step the acoustic signal corresponding to (26) is received and processed by a hearer. As the speech signal is processed, the phonetic information is identified and used to analyze the speech signal in terms of phonological categories. The speech signal is divided into syllables that are associated with further information, e.g., pitch and duration (as shown in the upper part of Figure 2). These ‘raw’ acoustic cues are then parsed into categorical information, e.g., about intonational cues such as H* or L-L%, as shown in the lower part of Figure 2.³

- The ‘raw’ speech signal information:

DUR.	0,07	0,17	0,16	0,15	0,28	0,13	0,25	0,23	0,13	0,13	0,11	0,14	SIGNAL
F ⁰	177	183	204	216	181	177	205	188	166	164	140	136	↓
VALUE	[ə]	[li]	[na]	[ne]	[zæn]	[ko]	[kja]	[to]	[fa]	[di]	[ja]	[t ^h a]	
INDEX	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀	S ₁₁	S ₁₂	...

- Categorical interpretation on the basis of ‘raw’ information:

PHRAS.	INTERPRETATION
TOBI	H*	L-L%	↓
DUR.	0,07	0,17	0,16	0,15	0,28	0,13	0,25	0,23	0,13	0,13	0,11	0,14	SIGNAL	
F ⁰	177	183	204	216	181	177	205	188	166	164	140	136	↓	
VALUE	[ə]	[li]	[na]	[ne]	[zæn]	[ko]	[kja]	[to]	[fa]	[di]	[ja]	[t ^h a]		
INDEX	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀	S ₁₁	S ₁₂	...	

Figure 2: Processing of Speech Signal

The (segmental) information coming from the speech signal is matched against the p-form of a multidimensional lexicon which includes information about syntactic category, segmental structure, morphological class, functional information, and meaning. Sample lexical entries for the noun *tofa* ‘gift’ and the question word *kya* ‘what’ are provided in Table 1. In the table ‘s-form’ is short for ‘syntactic form’ and ‘p-form’ is short for ‘phonological form’.

concept	s-form	p-form
'GIFT'	N (↑ PRED) = 'tofa' (↑ NUM) = sg (↑ GEND) = masc	SEGMENTS /t̥ o f a/
	Q (↑ INT-FORM) = kya	SEGMENTS /k j a/

Table 1: Lexical entries for *kya* and *tofa*.

Once a p-form is identified in the multidimensional lexicon, the s-form information associated with it also becomes available and can be used as input to c-structure terminal nodes via the π projection (Kaplan, 1987; Asudeh & Toivonen, 2009). This is the *Transfer of Vocabulary*.

While all of the information associated with a given lexical entry becomes available for processing (or production), once one of the dimensions (e.g., c-structural or p-structural information) is accessed, we maintain LFG's principles of modularity. We do this by only allowing each of the dimensions within the lexicon to be accessed by the module whose information it encodes. That is, f-structure works with the f-structural annotations, c-structure works with the syntactic category, semantic structure with the semantic forms and p-structure with the phonological information. This is already part of standard LFG and we continue to leverage the multidimensionality of an LFG lexicon.

We now turn to the *Transfer of Structure* which relates c-structure to associated information in p-structure. This is the crucial part of the prosody-syntax interface with respect to information that goes beyond the lexicon. The projection \natural is defined as the inverse projection of π composed with ρ , as shown in (27).⁴

(27) **Transfer of Structure — Definitions**

- where $\natural(\equiv \rho(\pi^{-1}))$
- where S_{min} refers to the *first* syllable within the scope of a node
- where S_{max} refers to the *last* syllable within the scope of a node,
for example: $(\natural(T(*))S_{max} \text{ PHRASING}) =)_i$

We define S_{min} as the first syllable within a node and S_{max} as the last syllable within a node. We need to be able to access parts of the speech signal in order to check for intonational information and do this on the basis of syllables, into which the speech signal has been segmented.

⁴In the LFG architecture relations between components of grammar are governed by projection functions that map between different structures. For example, the ϕ -projection relates c-structure to f-structure. These functions can be inverted so that the inverse ϕ -projection relates f-structure to c-structure. These inverse functions allow for the inclusion of information from other modules. For example, information about surface syntactic scope can be accessed via an inverse function from f-structure to c-structure.

4.4 Analysis

With the prosody-syntax interface in place, we are now in a position to show how the utterance in (28) (repeated from (26)) can be disambiguated.

- (28) alina=ne zain=ko **kya** tofa di-ya t^h-a?
 Alina=Erg Zain=Acc what present.M.Sg give-Perf.M.Sg be.Past-M.Sg
 Constituent Question: ‘What gift did Alina give to Zain?’
 Polar Question: ‘Did Alina (actually) give a gift to Zain?’

4.4.1 Constituent Question *kya*

We begin with the constituent question reading of *kya*. In this case, *kya* carries a H*, which can be accessed via the Transfer of Structure as in (29).

- (29) *kya*: ($\uparrow(T(*)S$ ToBI) = H*

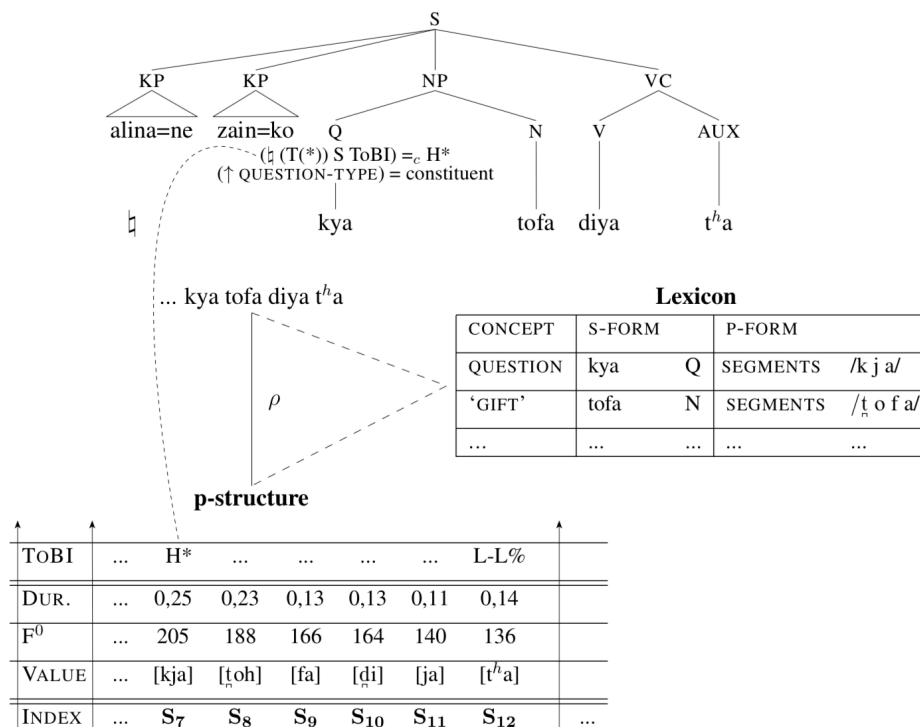


Figure 3: *kya* as a constituent question

The c-structure analysis and the lexicon are repeated in Figure 3, as is the relevant part of the speech signal processed into a vector of syllables. The speech signal contains a H* on S7, which is the word ‘kya’. This *kya* is accessed in the Lexicon via the Transfer of Vocabulary. The Lexicon relates the p-form / k j a / to the syntactic form, which specifies that it is a Q at c-structure. The lexicon otherwise

has nothing to say about *kya*. It is completely unspecified whether this *kya* signals a constituent or a polar question.

The rules of our grammar allow for two c-structure analyses of the utterance in (29) as shown in Figure 3 and 4. However, the c-structure in Figure 3 is only licensed if *kya* can be interpreted as a constituent question. In order to be interpreted this way, it needs to be associated with an H*. This is part of the grammatical knowledge of the language and is encoded in our analysis as part of the c-structure annotation on *kya* in Figure 4, as shown in (30).

$$(30) \quad \text{NP} \longrightarrow \begin{array}{c} \text{Q} \qquad \qquad \text{N} \\ (\downarrow(T(*))S \text{ ToBI}) =_c \text{H}^* \\ (\uparrow \text{QUESTION-TYPE}) = \text{constituent} \end{array}$$

The c-structure annotation on Q features a constraining equation which ensures that *kya* can only be inserted as a terminal Q node if there is a H* on the corresponding p-form. This is ensured via the Transfer of Structure, which relates c-structural and p-structural information via the \downarrow projection.

If *kya* is indeed associated with a H* in the speech signal, then this can be identified as a constituent question and this information is passed along to the f-structure via the second annotation under Q in (30): an equation assigning the value “constituent” to the feature QUESTION-TYPE.

4.4.2 Polar *kya*

The analysis for polar *kya* is shown in Figure 4. Here *kya* is analyzed as an immediate daughter of S. There is no syntactic or prosodic evidence to indicate that *kya* forms a constituent with any other item in the clause. Additionally, given that all immediate daughters of S can scramble as part of the word order variation exhibited by Urdu/Hindi, the ability of *kya* to scramble can be dealt with via the shuffle operator on a par with the other major constituents of S.

The c-structure analysis in Figure 4 is only possible if *kya* does not carry a H*. Again, the lexical entry for *kya* has nothing in particular to say about *kya* with respect to the syntax other than that it is a Q. It is the same underspecified entry seen with respect to Figure 3. And again, the major work is done by the f-structure annotations on Q and by the \downarrow projection invoked by these annotations.

$$(31) \quad \text{S} \longrightarrow \dots \begin{array}{c} \text{Q} \qquad \qquad \dots \\ (\downarrow(T(*))S \text{ ToBI}) \neq \text{H}^* \\ (\uparrow \text{QUESTION-TYPE}) = \text{polar} \end{array} \dots$$

The f-structure annotations on Q in (31) say two things: 1) this is a polar question; 2) but only if there is no H* on *kya*. The information as to whether the negative constraint on Q in (31) is satisfied or not is again determined via the Transfer of Structure, which relates prosodic with syntactic information via the \downarrow projection.

We have not made use of the boundary tone information (H-H% for polar vs. L-

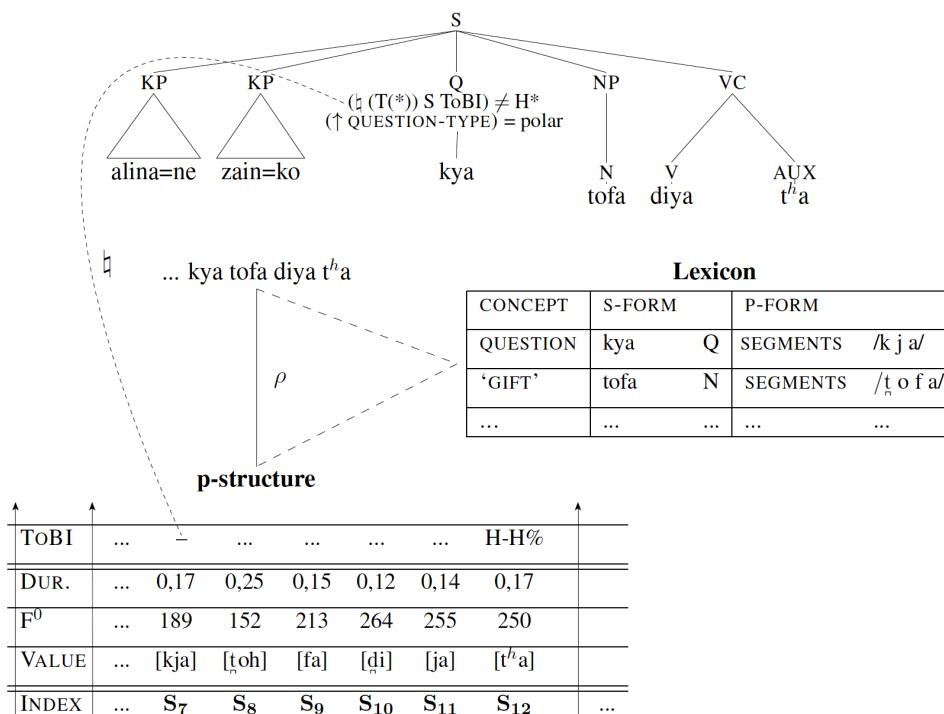


Figure 4: *kya* as a polar question

L% for wh-constituent questions) in our analysis. In our prosodic work on Urdu, we have found that the boundary tones tend to vary (cf. also Puri 2013). The variation is mainly due to phonetically governed factors and is in line with crosslinguistic observations on variable realizations of boundary tones. For purposes of presentation we have abstracted away from the variation in this paper and have not included boundary tone information as part of our proposal for disambiguating between polar and wh-constituent *kya*. Instead, we have relied on the phonological information associated with *kya* as this information appears to be very reliable.

4.5 Preferences and Interfacing with Semantics/Pragmatics

In this final analysis section we address several issues that remain open. One is the issue of preferences found with regard to the distribution of polar vs. wh-constituent *kya*. Another is the focus sensitive nature of polar *kya* and the determination of its scope.

4.5.1 Preferences in Distribution

Recall that polar *kya* and wh-constituent *kya* in principle have the distribution of other major constituents in the clause. However, polar *kya* is dispreferred in the immediately preverbal position while wh-constituent *kya* is dispreferred in the clause

initial position.

- (32) (kya) anu=ne (kya) uma=ko (kya) kitab (%kya)
what Anu.F=Erg what Uma.F=Dat what book.F.Sg.Nom what
d-i (kya)?
give-Perf.F.Sg what
'Did Anu give a/the book to Uma?
- (33) (%kya) anu=ne (kya) uma=ko (kya) d-i (kya)?
what Anu.F=Erg what Uma.F=Dat what give-Perf.F.Sg what
'What did Anu give to Uma?

We propose that polar *kya* is dispreferred in the immediately preverbal position because this is the default position for focus, hence the most natural position for wh-constituent *kya* and hence also an unnatural position for polar *kya* as a focus sensitive operator.

The reason for the dispreference for the clause initial position by wh-constituent *kya* is not as clear. We believe the most likely explanation is a historical one. Given that the older descriptions of polar *kya* only allow for a clause initial use, it is likely that the freer distribution is due to historical change. If this is true, then it is likely that the clause initial position is still more firmly associated with polar *kya*. Another possible explanation could be that the clause initial position is the one in which polar *kya* appears most frequently. However, a small study of the script of the Bollywood movie *Socha Na Tha* suggests that this explanation is not on the right track. Of a total of 24 polar questions found with *kya*, the distribution of the polar *kya* was: 7 initial, 5 medial and 12 final.⁵

Whichever historical or synchronic reason there is for the difference in distribution, the positional dispreferences can be modeled most conveniently via the OT-style constraints implemented as part of the XLE grammar development platform (Frank et al., 1998; Crouch et al., 2017). These constraints serve to disprefer an analysis in which wh-constituent *kya* is placed clause initially and in which polar *kya* is placed in the immediately preverbal position. The OT-style constraints implemented within XLE can be used in both directions: parsing and generation. Given that Bögel's prosody-syntax architecture takes the needs of comprehension vs. production very seriously, these OT-style constraints are exactly right for our analysis.

4.5.2 Semantics/Pragmatic Interpretation

The polar vs. wh-constituent *kya* are associated with very different meanings. We have not gone into the semantic interpretation of either construction in any detail in this paper. We did note that our current research sees polar *kya* as a focus sensitive operator that adds extra restrictions on the question and conveys assumptions

⁵We found a total of 649 questions, of which 204 were polar questions.

regarding what the possible answers could or should be. Plain information-seeking polar questions do not trigger such extra pragmatic inferencing.

We do not discuss the precise details and formulation of this pragmatic account here (but cf. Biezma et al. 2017). We do, however, ensure that syntax provides all of the necessary information needed for semantic/pragmatic interpretation. We assume a syntax-semantics/pragmatics interface that does “description by analysis” (Halvorsen & Kaplan, 1988), whereby a semantic analysis is arrived at on the basis of information provided by another level of representation. For semantics, this is generally taken to be the f-structure.

In our analysis the following information is made available at f-structure. The feature-value `QUESTION-TYPE polar` vs. `QUESTION-TYPE constituent` signals the type of question, triggering the relevant semantic interpretation. With respect to polar questions, it is also necessary to know whether it is a plain polar question or whether the question contained a polar *kya*. This information can be provided by associating an extra feature with *kya* in Figure 4: `INT-FORM kya`. This registers the fact that there was a *kya* in the polar question at f-structure and thereby makes this information easily retrievable for semantic interpretation at s-structure.

Further information that is needed is the scope of the focus sensitive polar *kya*. Recall that the polar *kya* can be associated with either: 1) a constituent to its right; 2) a constituent that is prosodically prominent. The first option applies in the absence of a prosodically prominent constituent. We propose a Metarulemacro (Crouch et al., 2017) that is triggered as part of the rule containing a polar *kya*. A metarulemacro is a macro rule that applies to all other rules of the grammar. Within the LFG ParGram grammars, for example, metarulemacros are standardly used to capture constituent coordination. That is, rather than writing individual rules for each constituent in the grammar to allow for the coordination of that constituent, the metarulemacro applies to all rules of the grammar and adds in the possibility of constituent coordination where appropriate.

In our case, for each constituent in the clause (daughters of S), a metarulemacro checks whether this constituent is prosodically prominent. The checking happens via the Transfer of Structure at the prosody-syntax interface, whereby the information of whether a constituent is prosodically prominent or not is tested via the \downarrow projection. If there is no prosodically prominent constituent, then the scope of polar *kya* is determined via f-precedence so that the right sister of polar *kya* is picked out as the entity that the focus sensitive operator *kya* applies to.

5 Conclusion

In this paper, we have investigated various uses of *kya* ‘what’ in Urdu/Hindi. We focused particularly on polar *kya* vs. wh-constituent *kya* and showed that ambiguities arise because of their distributional possibilities in the clause. Prosodic information is crucial for the resolution of these ambiguities. We demonstrated how the

relevant prosodic information can be accessed via the syntax given the architecture proposed by Bögel (2015).

Our analysis sees *kya* ‘what’ as a lexically underspecified item. *kya* is specified as polar *kya* vs. a constituent wh-word as part of the syntactic analysis due to annotations at c-structure. The c-structure analysis in turn depends on prosodic information encoded in the speech signal.

Polar *kya* is optional in polar questions. We briefly discussed its function and pointed to the conclusion in Biezma et al. (2017) that polar *kya* is a focus sensitive operator which conveys restrictions on the expected answer. The details of this analysis are the subject of future work. In this paper, we focused on laying the foundations for that future work by sorting through the uses of *kya*, proposing syntactic analyses for polar vs. wh-constituent *kya* and showing how to integrate vital prosodic information via the prosody-syntax interface.

References

- Asudeh, Ash & Ida Toivonen. 2009. Lexical-Functional Grammar. In Bernd Heine & Heiko Narrog (eds.), *The Oxford Handbook of Linguistic Analysis*, 425–458. Oxford: Oxford University Press.
- Bayer, Josef. 2006. Wh-in-Situ. In Martin Evarraert & Henk van Riemsdijk (eds.), *The Blackwell Companion to Syntax*, Oxford: Blackwell Publishing.
- Bhatt, Rajesh & Veneeta Dayal. 2007. Rightward scrambling as rightward movement. *Linguistic Inquiry* 38(2). 287–301.
- Bhatt, Rajesh & Veneeta Dayal. 2015. Polar Questions and Disjunction: clues from Hindi-Urdu polar *kyaa*. Talk given at the University of Texas, Arlington.
- Biezma, María, Miriam Butt & Farhat Jabeen. 2017. Interpretations of Urdu/Hindi polar *kya*. Talk presented at the Workshop *Non-At-Issue Meaning and Information Structure*, Oslo, May.
- Bögel, Tina. 2015. *The Syntax-Prosody Interface in Lexical Functional Grammar*: University of Konstanz dissertation.
- Butt, Miriam, Farhat Jabeen & Tina Bögel. 2016. Verb Cluster Internal Wh-Phrases in Urdu: Prosody, Syntax and Semantics/Pragmatics. *Linguistic Analysis* 40(3–4).
- Butt, Miriam & Tracy H. King. 1996. Structural Topic and Focus without Movement. In M. Butt & T. H. King (eds.), *Proceedings of the First LFG Conference*, CSLI Publications.
- Butt, Miriam & Tracy H. King. 2007. Urdu in a parallel grammar development environment. In T. Takenobu & C.-R. Huang (eds.), *Language Resources and Evaluation: Special Issue on Asian Language Processing: State of the Art Resources and Processing*, vol. 41, 191–207.
- Butt, Miriam & Tracy Holloway King. 1997. Null elements in discourse structure. Written to be part of a volume that never materialized. <http://ling.uni-konstanz.de/pages/home/butt/>.

- Butt, Miriam & Tracy Holloway King. 1998. Interfacing phonology with LFG. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG98 Conference*, CSLI Publications.
- Crouch, Dick, Mary Dalrymple, Ronald M. Kaplan, Tracy Holloway King, John T. Maxwell III & Paula Newman. 2017. *XLE Documentation*. Palo Alto Research Center. http://ling.uni-konstanz.de/pages/xle/doc/xle_toc.html.
- Dalrymple, Mary & Louise Mycock. 2011. The prosody-semantics interface. In *Proceedings of LFG11*, Stanford: CSLI Publications.
- Dalrymple, Mary & Irina Nikolaeva. 2011. *Objects and information structure*. Cambridge: Cambridge University Press.
- Dayal, Veneeta. 1996. *Locality in wh quantification*. Dordrecht: Kluwer Academic Publishers.
- Dayal, Veneeta. 2000. Scope marking: Cross-linguistic variation in indirect dependency. In Uli Lutz, Gereon Müller & Arnim von Stechow (eds.), *Wh-scope marking*, 157–193. Amsterdam: John Benjamins. Volume 37 of *Linguistics Today*.
- Féry, Caroline, Pramod Pandey & Gerrit Kentner. 2016. The prosody of focus and givenness in Hindi and Indian English. *Studies in Language* 40(2). 302–339. doi:10.1075/sl.40.2.02fer.
- Frank, Anette, Tracy Holloway King, Jonas Kuhn & John Maxwell. 1998. Optimality Theory style constraint ranking in large-scale LFG grammars. In Miriam Butt & Tracy Holloway King (eds.), *Proceedings of the LFG98 Conference*, CSLI Publications.
- Gambhir, Vijay. 1981. *Syntactic Restrictions and Discourse Functions of Word Order in Standard Hindi*: University of Pennsylvania, Philadelphia dissertation.
- Genzel, Susanne & Frank Kügler. 2010. The prosodic expression of contrast in Hindi. In *Speech Prosody 2010*, Chicago.
- Glassman, Eugene H. 1977. *Spoken Urdu*. Lahore: Nirali Kitaben.
- Grosz, Patrick. 2016. Information structure and discourse particles. In Caroline Féry & Shinichiro Ishihara (eds.), *The Oxford Handbook of Information Structure*, Oxford: Oxford University Press. doi:10.1093/oxfordhb/9780199642670.013.36.
- Halvorsen, Per-Kristian & Ronald M. Kaplan. 1988. Projections and Semantic Description in Lexical-Functional Grammar. In *Proceedings of the International Conference on Fifth Generation Computer Technology*, 1116–1122. Reprinted 1995 in Dalrymple et al. (eds) *Formal Issues in Lexical-Functional Grammar*.
- Jabeen, Farhat. 2017. Position vs. prosody: Focus realization in Urdu/Hindi. In *Phonetics and Phonology in Europe (PaPE)*, Köln, Germany.
- Jackendoff, Ray. 2002. *Foundations of language*. New York: Oxford University Press.
- Kaplan, Ronald. 1987. Three seductions of computational psycholinguistics. In Peter Whitelock, Harold Somers, Paul Bennett, Rod Johnson & Mary McGee Wood (eds.), *Linguistic Theory and Computer Applications*, 149–188. London:

- Academic Press.
- Kidwai, Ayesha. 2000. *XP-Adjunction in Universal Grammar: Scrambling and Binding in Hindi-Urdu*. Oxford: Oxford University Press.
- Krivonosov, Aleksej. 1977. Deutsche Modalpartikeln im System der unflektierten Wortklassen. In H. Weydt (ed.), *Aspekte der Modalpartikeln*, 176–216. Tübingen: Niemeyer.
- Lahiri, Utpal. 2002. On the proper treatment of ‘expletive wh’ in Hindi. *Lingua* 112. 501–540.
- Manetta, Emily. 2012. Reconsidering rightward scrambling: Postverbal constituents in Hindi-Urdu. *Linguistic Inquiry* 43(1). 43–74.
- Masica, Colin. 1991. *The Indo-Aryan languages*. Cambridge: Cambridge University Press.
- Montaut, Annie. 2004. *Hindi Grammar*. München: Lincom-Europa.
- Mycock, Louise. 2013. Discourse functions of question words. In M. Butt & T.H. King (eds.), *Proceedings of the LFG13 Conference*, Stanford: CSLI Publications.
- Platts, John T. 1884. *A dictionary of Urdu, classical Hindi, and English*. W. H. Allen and Co.
- Puri, Vandana. 2013. *Intonation in Indian English and Hindi late and simultaneous bilinguals*: University of Illinois, Urbana Champaign dissertation.
- Rooth, Mats. 2016. Alternative semantics. In Caroline Féry & Shinichiro Ishihara (eds.), *Oxford Handbook of Information Structure*, Oxford: Oxford University Press.
- Silverman, Kim, Mary Beckman, John Pitrelli, Mari Ostendorf, Colin Wightman, Patti Price, Janet Pierrehumbert & Julia Hirschberg. 1992. TOBI: A standard for labeling English prosody. In *Proceedings of the 1992 International Conference on Spoken Language Processing*, Banff.
- Slade, Benjamin. 2011. *Formal and Philological Inquiries into the Nature of Interrogatives, Indefinites, Disjunction, and Focus in Sinhala and other Languages*: University of Illinois at Urbana-Champaign dissertation.