

The interaction between relevant-set based operators and a topic–predicate dimension*

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Abstract

Hungarian relevant-set based operators, such as universally quantified noun-phrases and the *also*-quantifier, signal a logico-pragmatic relation between their explicit meaning and a broader implicit set of relevant participants which property can be mentioned as “double referentiality” of the operator. Furthermore, they indicate the new or correcting information in a topic–predicate dimension which belongs to the broader world of the discourse. Our research aims to identify the differences by investigating the suprasegmental features of *each*-quantifiers and *also*-quantifiers on the Hungarian left-periphery indicating the two functions in the topic–predicate dimension. Short sentences in which quantifiers functioning either as the main (new/correcting) information or as a topic (anchor of relevant information) were read by 41 non-linguist native Hungarian subjects. The pitch, intensity and duration properties were analyzed by Praat. On the basis of paired t-tests of the data, it can be stated that a two-dimension model of information structure is required to capture the phenomenon.

Keywords: information structure, quantifiers, prosody, Praat, information focus

1. Introduction

Since the leitmotif of *Linguistics Beyond and Within* 2017 was *The Outskirts of the Regular*, this paper discusses noun phrases modified by the universal determiner *mind(en)* ‘every’, called universally quantified noun phrases by É. Kiss (2002). In contrast to general noun phrases (1a–a’), they do not trigger two types of *verbal prefix – verb stem* order (1b–b’).

- (1) a. Lilla el-jött.
 Lilla VM-come.Past.3Sg
 ‘Lilla has come.’
 a’. Lilla jött el.
 Lilla come.Past.3Sg VM
 ‘It was Lilla who has come.’

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- b. Mindhárom barátom el-jött.
 All_three friend.Poss.1Sg VM-come.Past.3Sg
 ‘All three of my friends have come.’
- b' * Mindhárom barátom jött el.
 All_three friend.Poss.1Sg come.Past.3Sg VM

Expressions modified with *csak* ‘only’ or *nemcsak* ‘not only’ (2a) seem to behave similarly in the sense that they tolerate only the *verbal prefix – verb stem* word order.

- (2) a. * Csak / Nemcsak Lilla el-jött.
 Only / Not_only Lilla VM-come.Past.3Sg
- b. Csak / Nemcsak Lilla jött el.
 Only / Not_only Lilla come.Past.3Sg VM
 ‘Only / Not only Lilla has come.’

Nevertheless, the quantifier, which never evokes a *verb stem – verbal prefix* order, can have a topic (3) or a predicate/comment function (4) in a prosodic and pragmasemantic point of view.

- (3) a. Köszönöm érdeklődő kérdésedet! Úgy jellemezném a barátaimat, hogy Anti imádja a teniszt, Béci szeret sakkozni és pingpongozni,
 ‘Thank you for your inquiring question! I can characterize my friends the way that Anti likes tennis, Béci gladly plays chess and table tennis,’
- b. *Csaba is* szeret pingpongozni, Top_∃✓
Csaba also like.3Sg tabletennis.Inf,
 ‘*Csaba also* gladly plays table tennis,’
- c. Anti és Csaba lelkes komolyzene-rajongó, Béci és Csaba gyakran sörözik,
 ‘Anti and Csaba are great fans of classical music, Béci and Csaba often drink beer’
- d. és *mindhárom* barátom oda-van Scarlett Johanssonért. Top_∀✓
 and all_three friend.Poss1Sg VM-be.3Sg Scarlett Johansson.Cau
 ‘and *all three* of my friends are crazy about Scarlett Johansson.’
- (4) a. Azt gondolod, hogy csak Béci szeret pingpongozni, és csak Anti van oda Scarlett Johanssonért?
 ‘Do you think that it is only *Béci* who gladly plays table tennis, and it is only *Anti* who is crazy about Scarlett Johansson?’
- b. \CSA*ba is* szeret pingpongozni, Pred_∃✓
- c. és \MIND*három* barátom odavan Scarlett Johanssonért. Pred_∀✓

As for the structure of the paper, the following section elaborates on the theoretical background of quantifiers and information focus and provides an appropriate model to capture the dual function of the relevant-set based operators. Then comes a section in which the statistically significant differences in prosodic properties of the quantifier types mentioned above are described, on the basis of Alberti and Szeteli’s (2017) methodology. They are differentiated along the lines of old/given and new/predicative information (Szűcs, 2016), based on an experiment with the participation of 41 non-linguist native Hungarian subjects. The paper concludes with a section which, in addition to some concluding remarks, presents a further phenomenon in favor of our two-dimension operator model.

2. Towards a two-dimension model of Hungarian information structure

This part is devoted to the question as to which pre-V part of the Hungarian sentence *each*-quantifiers and *also*-quantifiers belong to.

The current stances are (still) all essentially based on É. Kiss (2002) (see also Szabolcsi, 1997; Alberti and Medve, 2000). According to Laczkó (2016, p. 217), both types of (non-contrastive) quantifier belong to the *predicate portion* of the sentence (Table 1), while Varga (2016, p. 46) places them in the zone that he calls the *Comment* (Table 2).

Table 1: Hungarian sentence articulation, according to Laczkó (2017, p. 60)

TOPIC	PREDICATE				
(A) (contrastive) topic, sentence adverb	(B) quantifier	(C) focus/VM		(D) verb	(E) postverbal constituents
		(Ca) focus	(Cb) VM		

Table 2: Structural positions in the Hungarian Sentence, according to Varga (2016, p. 46)

Sentence	
T*	Comment
	Dist* { (F) } V PostV* (PDMA) (VMod)

As can be seen in the two tables, the two zones mentioned above, preceded by the topic zone (cf. T*), are practically the same, since the formula Dist* in Varga’s (2016, p. 46) approach refers to nothing else but a sequence of quantifiers. Note in passing that the reason for this abbreviation is that it is a prominent property of quantifiers that they are to be interpreted in a *distributive* manner. In the sentence *mindkét fiú felemelte a zongorát* ‘both boys lifted the piano,’ for instance, the natural group-interpretation according to which the two boys lifted the piano together as a group is excluded. Only the much more artificial (distributive) reading according to which one boy lifted the piano alone and the other also lifted it alone is available.

An *each*-quantifier, very rarely, is analyzed in the literature as a topic, but only as a contrastive topic (Laczkó, 2016, p. 216, Varga, 2016, p. 74).

At this point it is worth making some words on contrastive topics. In Hungarian, the scope order of preverbal (non-*in-situ*) constituents corresponds to their surface order (5a-a’); as shown by the proposed paraphrase of (5b), however, quantifiers in (Spec,CTopP), marked by a special intonation, which the symbol ‘^’ refers to in (5b), give the impression of having inverse scope, apparently violating this generalization (É. Kiss, 2002, p. 25).

- (5) Illustration of the inverse-scope puzzle in Hungarian
- a. KEvés diák olvasott <el> MINden regényt ^<el>.
 few student read.Past.3Sg away(VM) each novel.Acc away(VM)
 ‘It holds only for few students that the given student has read each novel.’

- a'. MINden regényt KEvés diák olvasott el.
 each novel.Acc few student read.Past.3Sg away(VM)
 'It holds for each novel that few students have read it.'
- b. ^MINden regényt # KEvés diák olvasott el.
 each novel.Acc few student read.Past.3Sg away
 Meaning: practically the same as that given in (5a), and not that given in (5a')

This paper is not concerned with such type of quantifier; the interested reader is referred to Farkas and Alberti (2017). Note that such an approach is a preferable alternative, for those accepting multiple spell-out (e.g. Uriagereka, 1999) first applied to Hungarian by Surányi (2009). Now we intend to verify that both *each*-quantifiers and *also*-quantifiers can also serve as non-contrastive topics. Hence, our proposal is based on a two-dimension operator model.

One dimension is a relevant-set based (logico-pragmatic) tier (see Table 3). Roles in this tier can be identified on the basis of the system of the five types of logico-pragmatic content given in the table as follows. If the reference of a noun phrase is associated with a particular operator character in an utterance, then, by referring to *r*, a whole set of its pragmatic alternatives is evoked as background knowledge shared by the interlocutors. Such alternatives are thus not referred to explicitly, but only implicitly. Due to the given operator, some logical claim is predicated of the implicit referents.

Table 3: *The system of operators in Hungarian*

	✓	¬
∃	Q _∃ : <i>also</i> -quantifier	C _{Top} : contrastive topic
∀	Q _∀ : <i>each</i> -quantifier	Foc: (contrastive) focus
	Top _P : (non-contrastive) topic	

In all five examples shown in Table 4, the set of implicit referents consists of persons who can be regarded in a given context as alternatives to a person who is called Lilla. They all together form the *relevant set*. Suppose the implicit participants are Anna, Bea and Cili; so the relevant set now consists of four people.

Table 4: *Illustration of the system of operators in Hungarian*

	✓	¬
∃	LILla is EL- jött. Lilla also away(VM) came 'Lilla also came here.'	^LILla # EL- jött. Lilla away(VM) came 'As for Lilla, she came here [but there is another person who did not come here].'
∀	MINdenki EL- jött. everyone away(VM) came 'Everyone came here.'	LILla jött el. Lilla came away(VM) 'It was Lilla who came here.'
	LILla EL- jött. Lilla away(VM) came 'Lilla came here.'	

The corresponding sentence with an *also*-quantifier then provides the additional semantic information—in addition to the “explicit content” that Lilla came here, which is true in all the five variants—that what holds for Lilla also holds for (\checkmark) at least one (\exists) implicit participant. The additional information due to the contrastive topic is that what holds for Lilla does not hold for (\neg) at least one (\exists) implicit participant.

In certain contexts, there is (said to be) a “weaker” interpretation (eg., Gyuris 2009), which can be regarded as the application of the above-sketched strict logical interpretation but to an epistemic variant of the given proposition:

- (5) \wedge LILLA EL- jött.
 Lilla away(VM) came
 ‘As for Lilla, *I am sure that* she came here [but there are other persons in whose case *I am not sure that* they came here].’

The contribution of (contrastive) focus is captured in Table 4 as follows: what holds for Lilla is a piece of information that uniformly (\forall) does not hold for (\neg) the implicit participants.

The *each*-quantifier realizes the fourth logical possibility in the following sense: everyone is referred to implicitly (since the general expression *mindenki* “everyone” can have no other function in the given context than evoking what is termed above the relevant set), and hence the corresponding sentence can be interpreted as claiming that the information “someone came here” holds truly (\checkmark) for each implicit participant (\forall).

As for the fifth operator, the non-contrastive topic, it can be placed in the system just sketched as an operator realizing the logical alternative of providing no information on the implicit participants. The translations illustrate these (context-based) semantic contributions. As for the formal cues of these operators, relative to the basic variant with a topic, the two types of quantifier can be recognized by means of characteristic elements such as *is* ‘also’ and the prefix *mind-* ‘each’. The two contrastive operators can be recognized relying on peculiar intonational and word-order phenomena. The contrastively topicalized element bears a special rising and then falling intonation (\wedge) and is followed by a short pause ($\#$). The focused element bears a strong **FOCUS STRESS** and seems to substitute for the preverb compared to the neutral word order.

The other dimension is the topic–predicate, or topic–comment, tier, to be determined in the broader world of the discourse in a basically Buringian (1997; 2003) style (cf. Gécseg, 2013; Szűcs, 2017) considering the tradition of Bródy (1991).

The next table presents the connection between the two dimensions.

Table 5: Relevant-set based pragmatico-logical contributions and **topic–predicate** status

	\checkmark			\neg
\exists	<i>is</i> 'also'	<i>is</i> 'also'	<i>nemcsak</i> 'not only'	Contrastive topic
\forall	<i>mind</i> 'each'		<i>mind</i> 'each'	Narrow focus (identification by exclusion)
\emptyset	Topic			Verbal modifier

The coloring intends to demonstrate that the dimension of relevant-set based/ “double” referentiality and the dimension of the topic–comment tier is only partially independent. Only the *each*- and *also*-expressions produce real independence: they can serve as both topics, serving as anchors for new information, and predicates/comments, providing this new information. *Nemcsak*-expressions and identificational foci (whose contribution is often characterized as “identification by exclusion” (É. Kiss, 1998)), however, can appear only as predicative elements left-adjacent to the verb stem performed with a deleting stress. Of the elements showing no double referentiality, normal topics are only of a topic character while verbal prefixes/modifiers triggering no deleting stress can function only as part of the comment portion of the sentence. As for contrastive topics, they do not occur in the predicative/comment zone in Hungarian, in spite of the fact that their Janus-faced logical character suggests a potential occurrence in the predicate/comment zone. A contrastive topic can appear in different pre-V parts of the sentence, but there are no arguments against a hypothesis according to which these potential places are all inside the topic portion. The occupation of the two extremities of the topic portion by a contrastive topic is illustrated in (6a-b):

- (6) a. /PETit bezzeg a drágalátos haverod \Llilinek mutatta be.
 Peti.Acc [CTop] the precious friend.Poss.2Sg Lili-Dat introduce.Past.3Sg in(VM)
 ‘As for Peti, your precious friend has introduced him to Lili.’
- b. A drágalátos haverod persze /PETit \Llilinek mutatta be.
 the precious friend.Poss.2Sg of_course Peti.Acc Lili-Dat introduce.Past in(VM)
 ‘As for Peti, your precious friend has introduced him to Lili.’

3. Suprasegmental features of the Hungarian relevant-set based operators

In the experiments, we attempted to transfer the appropriate reading of the *each*-quantifier and the *also*-quantifier into our subjects’ minds. Therefore, the whole text presented in (3-4) was offered as a verbal stimulus for them. Then the relevant sequences were cut out and analyzed by Praat.

3.1. *Methods of the experiment*

The 41 non-linguist native Hungarian subjects, all first-year students of the University of Pécs, took part in the research voluntarily. They were not paid for their participation in the experiment. We have not intended to regulate the ratio of females to males, which was 35:6; it is postponed to future research to attempt to identify gender-dependent features in the relevant area (NB: a conjecture is that what males tend to express by means of stronger intensity is rather expressed by means of higher pitch by females).

After studying the short dialogue parts in (3-4) laid out in textboxes through 1 or 2 minutes, the participants told the conductor of the experiment that they have already been prepared for reading out the given texts. Since the goal of the research was to imitate spontaneous speech as truly as possible, the following instructions were given.

1. Please read out, or more precisely, play the following discourse parts by using a tone which is not monotonous; project yourselves to the situation on the basis of the given linguistic context.
2. Read out every single word in the word order given, because even tiny details may be crucial.
3. While playing the situation, consider that the punctuation is not completely given. Only dots and question marks have been used (NB: we must not have used the elements of punctuation immediately referring to tonal features, e.g., exclamation marks). Thus the participants had to read out the parts as they expected themselves to do that in an everyday communication situation.

The relevant utterances were embedded in a broader linguistic research in which different verbal stimuli were used to trigger different interpretations in the subjects' minds, following the methodology applied by Alberti and Szeteli (2017) to differentiate functions of discourse markers with the same phonetic forms constituting polysemous networks.

The experiments were recorded by a dictaphone (44,1 kHz/16 bit). The relevant fragments were analyzed by Praat.

3.2. Distinguishing the two information-structure based functions

The suprasegmental properties of the fragments presented in (3-4), repeated here as (7-8) were investigated along three parameters. Duration values of the single words, intensity values of their first syllables, and pitch values of the vowels of the first syllables were measured.

- | | | |
|-----|--|---------------------|
| (7) | a. <i>Csaba is szeret pingpongozni,</i>
<i>Csaba also like.3Sg tabletennis.Inf,</i>
<i>'Csaba also gladly plays table tennis,'</i> | Top _∃ ✓ |
| | b. és <i>mindhárom</i> barátom oda-van Scarlett Johanssonért.
and all_three friend.Poss1Sg VM-be.3Sg Scarlett Johansson.Cau
<i>'and all three of my friends are crazy about Scarlett Johansson.'</i> | Top _∀ ✓ |
| (8) | a. \CSaba is szeret pingpongozni, | Pred _∃ ✓ |
| | b. és \MINDhárom barátom odavan Scarlett Johanssonért. | Pred _∀ ✓ |

From the duration data presented in (9), it can be claimed that the elements with a predicative character, compared to the other words of the fragment, proved to be longer than the homophonous elements with a topic character. These elements considered are the universal-quantifier determiner *mindhárom* 'all three' in (8b) and the proper noun *Csaba* in (8a), which is the word bearing the main stress instead of the particle *is* 'also'.

- | | |
|-----|--|
| (9) | Mean of the duration values in milliseconds |
| | a. The element of a Top _∃ ✓-character: 239 ms, with a 1167 ms long continuation of the fragment |
| | a'. The element of a Pred _∃ ✓ character: 250 ms, with a 1039 ms long continuation |
| | b. The element of a Top _∀ ✓ character: 502 ms, with a 778 ms long continuation |
| | b'. The element of a Pred _∀ ✓ character: 522 ms, with a 738 ms long continuation |

Figures 1-4 illustrate that different tendencies between the two readings could be measured in the intensity values as well as in the pitch values in the whole set of the subjects.

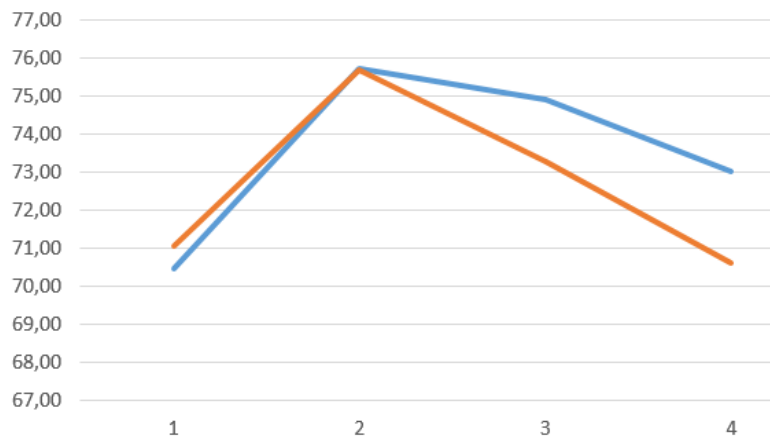


Figure 1: Mean values of the intensity (in dB) in the case of the each-quantifier in topic context (blue) and in predicative context (orange) (n=41)

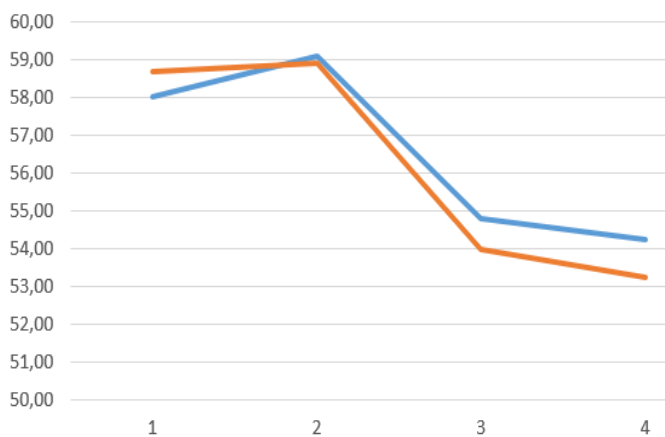


Figure 2: Mean values of the pitch (in semitones, see Matteson et al. 2013) in the case of the each-quantifier in topic context (blue) and in predicative context (orange) (n=41)

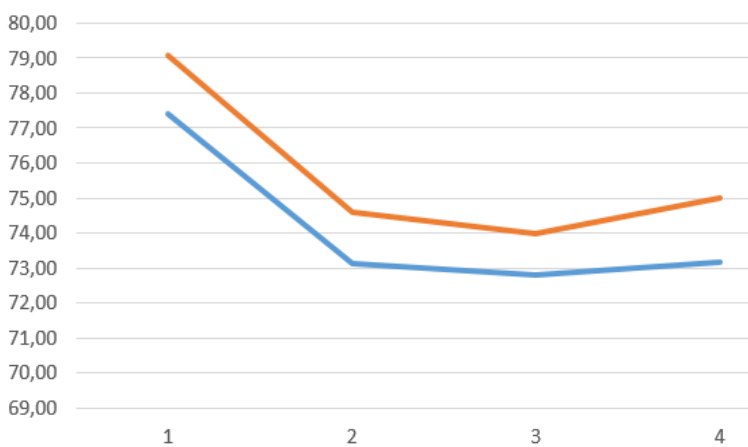


Figure 3: Mean values of the intensity (in dB) in the case of the also-quantifier in topic context (blue) and in predicative context (orange) (n=41)



Figure 4: Mean values of the pitch (in semitones) in the case of the also-quantifier in topic context (blue) and in predicative context (orange) ($n=41$)

In addition to the whole set of experimental subjects, a subgroup of 31 was also investigated. Participants have been excluded for two reasons: (i) they did not pronounce all elements of the fragments to be read out, and/or (ii) their irregular voicing made it difficult to identify the pitch values (see McGlone, 1967; Hollien and Wendahl, 1968; Blomgren et al. 1998 cited by Markó, 2013, p. 19).

F-tests and paired t-tests were applied to prove that the differences between the multitudes are significant. Our goal was to differentiate the alternative readings of the two quantifiers, more or less in the same way. Thus we can formulate tendencies concerning the location of operators in the topic–predicate dimension.

In Table 6, the duration data were considered along with the ratio $m=l_q/(l_f-l_q)$ mentioned above, where l_q is the duration of the given quantifier, and l_f is that of the given fragment. The same table presents the maximal contrasts in intensity and pitch within the corresponding entire clauses, with the purpose of identifying the significant difference in the falling of the intensity and the pitch:

Table 6: Results of the statistical tests for the whole set ($n=41$) and the subset ($n=31$)

		$n=41; p<0,05$	$n=41; p<0,01$	$n=31; p<0,05$	$n=31; p<0,01$
Q\exists	duration	False	False	False	False
	intensity	True	True	True	True
	f_0	True	True	False	False
Q\forall	duration	False	True	False	False
	intensity	False	False	False	True
	f_0	True	True	False	True

The cells with value *False* in Table 6 show the advantageous cases in which the null hypothesis that the difference is occasional is to be rejected.

The duration tests differentiated the two readings of the quantifiers in both cases and in both sets of subjects. The intensity differences between the two kinds of *each*-quantifiers (see Figure 1) also proved to be significant, at least with the weaker margin of error, that is, with 95% confidence (NB: as little as a 3 dB difference means a twofold intensity of the sound). It is also

presented in Figure 2 that there is a difference between the pitch values of the two *each*-quantifiers, but, according to Table 6, it only became significant after the exclusion of the problematic subjects. In the case of the subset (n=31), the two readings of the *also*-quantifier also proved to be significantly different in respect of pitch values.

It can be concluded that the two relevant-set based operators under investigation can also be produced and interpreted in appropriate situations as a topic.

4. Conclusion and loose ends

As a potential development of the experimental part, we plan to use multimodal stimuli in future researches: namely, visual stimuli (Surányi and Turi, 2017; Tóth and Csátár, 2017), or voice stimuli (Alberti and Szeteli, 2017), or the combination of the two.

On the one hand, the use of the research material of this paper as a further voice stimulus (Alberti and Szeteli, 2017) can serve as valuable control in new tasks for new subjects to measure the same factors. On the other hand, multimodal stimuli will make a better understanding of the test situation possible.

It is also an important research task, with the ultimate purpose of obtaining a comprehensive picture of the relevant-set based operators, to reconcile our research, in a theoretical as well as in a methodological sense, with such inspiring experiments concerning scope taking properties of quantifiers in Hungarian as Surányi and Turi's (2016; 2017) approach.

We conclude the paper with an analysis of chains of *wh*-words, which also serve as evidence for the existence of the two types of quantifiers.

É. Kiss (1992) claims that pre-V *wh*-word chains function according to the following formula of operators: Q*F. That is, only the last *wh*-word functions as an interrogative operator while the first k-1 *wh*-words substitute for ("disguised") universal quantifiers (10a), as corroborated by the congruent scheme of answer presented in (10a').

- (10) a. Ki kinek \KIT mutatott be?
 who who.Dat who.Acc introduce.Past in?
 'Who introduced whom to whom?'
 That is, 'Tell me, please, for *each* pair x and y of persons, who has been introduced to y by x.'
- a'. Ali például Balázsnak és Csabának a \HÚgát mutatta be, Daninak és Edének pedig a \NŐvérét. Balázs Alinak egy \VOLT \BARátnőjét ajánlotta,...
- 'Ali, for instance, introduced his little sister to Balázs and Csaba while his elder sister to Dani and Ede. Balázs introduced to Ali one of his ex-girl-friends.'
- b. ^(?)\KI kinek kit mutatott be?
 who who.Dat who.Acc introduce.Past in?
 'Who introduced whom to whom?'
 'That is, 'I know that x introduced z to y. Identify, please, this triplet <x,y,z>.'
- b'. Ali mutatta be Balázsnak a \HÚgát.
 'Ali introduced his little sister to Balázs.'

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