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Constraint cumulativity and gradience: *Wh*-scrambling in Persian

Aria Adli *

University of Hamburg and Zentrum für Allgemeine Sprachwissenschaft, Berlin, Germany

ABSTRACT

This paper presents an analysis of *wh*-scrambling in Persian based on gradient judgment data. The experimental approach allows a more precise and reliable analysis of syntactic phenomena, in order to highlight nuanced differences in markedness. Data on simple, complex, and multiple *wh*-questions as well as long NP-scrambling is presented that were collected during fieldwork in Tehran, and using a gradient acceptability judgment test. The analysis provides a view on *wh*-scrambling where focus properties play an important role. The nuanced yet systematic differences within the range of well-formed constructions are captured with the concept of *preference constraint*. Their effects cumulate (in terms of violations costs). Finally, it is shown that the notion of gradience does not blur the qualitative distinction of grammatical vs. ungrammatical. Only grammatical and marginal, though not ungrammatical constructions are sensitive to preference constraints.

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1. Introduction

Persian exhibits many word order possibilities, both in declaratives and interrogatives. This work addresses *wh*-scrambling in Persian, which still belongs to the rather understudied languages, and accounts for the findings based on a gradient notion of grammar. It presents a quantitative comparison of the acceptability of constructions from simple, complex, and multiple *wh*-syntax as well as from long distance NP-scrambling. It applies a gradient acceptability judgment test – a proven experimental technique from the growing field of empirical grammar research. This method helps to provide nuanced and more reliable evidence for syntax-theoretical research questions. The reported judgment patterns are based on a controlled data collection from a sample (and not from one or only a few informants). The notion of gradience allows us to propose an analysis of Persian *wh*-syntax that is at least descriptively more precise, and the empirical results about the constructions in question highlight in turn more general properties of markedness in grammar.

In this work I will analyze more closely the relation between scrambling and (contrastive) focus in Persian, distinguishing between scrambling of elements that are [±wh] and [±NP], as well as distinguishing between in situ elements, local scrambling, and long scrambling out of non-islands. As regards multiple *wh*-questions, I include the object marker [±OM] in the design, in order to discuss its relation with superiority.

It is not within the scope of this paper to give a broad overview of the various theories of scrambling that have been proposed since Ross (1967). There is ample literature on a variety of languages, such as Japanese (Saito, 1985, 1992; Fukui and Naoki, 1993), German (Haider, 1988; Fanselow, 1990; Webelhuth, 1992; Müller and Sternefeld, 1993), Dutch (Neeleman, 1994), Turkish (Kural, 1992), Icelandic (Holmberg, 1986 in the context of Icelandic object shift; Haider and Rosengren, 2003), Hindi (Mahajan, 1990, 1994), Korean (Kim, 1992), Hungarian (Kiss, 1994, 2003), Warlpiri (Hale, 1983), Russian, (Bailyn, 1995), etc. I will mainly rely on Karimi's (2005) analysis of scrambling in Persian. I cannot do justice to all arguments that have been given in favor of or against the A-movement approach (e.g. the analysis of Mahajan, 1990 for local

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* Tel.: +49 30 2241 4836.
  E-mail addresses: aria.adli@uni-hamburg.de, aria.adli@nyu.edu.

scrambling) or in favor or against the A'-movement approach (e.g. Saito, 1985); neither can I do justice to Webelhuth's (1992) approach where the landing site has mixed A and A' properties, or to the mixed approach of Miyagawa (1997) who associates A-movement with a feature on T and A'-movement with focus. Moreover, I am not considering approaches according to which the "scrambled" constituent is base-generated in its surface position, as proposed for example by Riemsdijk (1989), Neeleman and Reinhart (1998), Fanselow (2003), or Bošković and Takahashi (1998) (see Chocano, 2007, for a discussion).

Rather, this work tries to come up with a rigorous quantitative set-up, and to present an analysis of the nuances between acceptability degrees in terms of two types of constraints. I believe that this perspective can at least offer a new perspective on the descriptive state of affairs in which full attention is paid to fine-grained differences. In this respect this study is in line with the growing body of work that has demonstrated in the last years how experimentally obtained gradient judgments by offering an improved level of precision and reliability, can provide important evidence to difficult theoretical issues (e.g. Bard et al., 1996; Keller, 2000; Meyer, 2002; Featherston, 2005; Adli, 2006; various papers in Fanselow et al., 2006; Alexopoulou and Keller, 2007).

In the course of this paper I will account for the picture of differences of acceptability between the constructions by two types of constraints: *preference constraints*, whose violation lowers the degree of acceptability but does not necessarily cause ungrammaticality, and *well-formedness constraints*, whose violation results in ungrammaticality. I show that information structure is a central element for understanding the rich word order pattern in Persian constituent questions. An important assumption is that scrambled *wh*-NPs have to be [+c(ontrastive)-focus].

The detailed structure of the paper is as follows. Section 2 introduces relevant aspects concerning syntactic movement in Persian. It presents basic assumptions on Persian word order and phrase structure, briefly mentions some differences between *wh*-scrambling and structural *wh*-movement as well as some between long *wh*-scrambling and long NP-scrambling. Section 3 discusses the results of the gradient acceptability judgment test. It begins with an overview of the test sentences and the linguistic factors that are studied, discusses some theoretical premises (context dependency, markedness, constraint cumulativity), and outlines the experimental methodology. Thus, the gradient acceptability judgments of the test sentences are successively treated in six analyses of variance. The empirical picture will be explained by a series of nine preference constraints and three well-formedness constraints. The results will also show a general property of gradience in grammar, namely that the effects of cumulativity are barely manifesting in ungrammaticality.

2. Syntactic movement and word order in Persian

2.1. Basic word order and phrase structure

Persian is a pro-drop language that exhibits SOV as the unmarked surface order.[1] Genetically it belongs to the Indo-Iranian branch of the Indo-European language family (cf. Ruhlen, 1987:58). Persian exhibits a large number of word order variants, both in declaratives and in interrogatives. This is demonstrated with a set of *wh*-questions.[2] Sentences (1a) and (1a') show two forms with the temporal *wh*-adjunct at preverbal (though non-initial) position. They differ in the linear order of direct object and *wh*-adjunct. (1b) shows another possibility of 'rearrangement': The *wh*-adjunct is still preverbal (and follows the object as in (1a)), but the subject stands in postverbal position. Also *wh*-object NPs can occur in non-initial, preverbal position, as show the examples (1c) and (1c'). OM in the gloss represents an object marker modifying the whole phrase rather than the head noun, which has been analyzed by Ghomeshi (1997) as a phrasal affix (this notion goes back to Nevis' 1985 analysis of Finnish particle clitics).

(1a)	sɒrɒ	ketɒb	-eʃ	-o	kej	xæride?	[S O Adj$_{wh}$ V]
	Sara	book	-her	-OM	when	bought	
	'When did Sara buy her book?'						
(1a')	sɒrɒ	kej	ketɒb	-eʃ	-o	xæride?	[S Adj$_{wh}$ O V]
	Sara	when	book	-her	-OM	bought	
(1b)	ketɒb	-eʃ	-o	kej	xæride sɒrɒ?		[O Adj$_{wh}$ V S]
	book	-her	-OM	when	bought Sara		
(1c)	bɒbæk	ki	-ro	emruz	zæde?		[S O$_{wh}$ Adj V]
	Babak	who	-OM	today	hit		
(1c')	bɒbæk	emruz	ki	-ro	zæde?		[S Adj O$_{wh}$ V]
	Babak	today	who	-OM	hit		
	Who has Babak hit today?'						

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[1] Henceforth, I will use the term canonical order in the sense of the natural surface structure in an unmarked context (what has been sometimes called "natural order").

[2] Throughout this work, Persian examples which are normally written in a variant of the Arabic script are transliterated into IPA symbols (Majidi and Ternes, 1999). IPA is a clear international standard, known within and partly also beyond the community.

The following examples show that the *wh*-element can occur in initial position. (2a) is an example with a *wh*-adjunct, (2b) a variant of it with postverbal subject, and (2c) an example with a *wh*-NP.

(2a)	kej	sɒrɒ	ketɒb	-eʃ	-o	xæride?	[Adj$_{wh}$ S O V]
	when	Sara	book	-her	-OM	bought	
(2b)	kej	ketɒb	-eʃ	-o	xæride	sɒrɒ?	[Adj$_{wh}$ O V S]
	when	book	-her	-OM	bought	Sara	
(2c)	ki	-ro	bɒbæk	emruz	zæde?		[O$_{wh}$ S Adj V]
	who	-OM	Babak	today	hit		

However, it is illicit to place the *wh*-element into postverbal position (an exception to this observation is mentioned later).

(3a)	*sɒrɒ	ketɒb	-eʃ	-o	xæride	kej?	[S O V Adj$_{wh}$]
	Sara	book	-her	-OM	bought	when	
(3b)	*xæride	kej	ketɒb	-eʃ	-o	sɒrɒ?	[V Adj$_{wh}$ O S]
	bought	when	book	-her	-OM	Sara	
(3c)	*bɒbæk	emruz	zæde	ki	-ro?		[S Adj V O$_{wh}$]
	Babak	today	hit	who	-OM		

In complex sentences containing a *wh*-construction, the *wh*-element can either remain in the lower CP or be moved into the higher CP. The *wh*-NP is base-generated in the embedded complement sentence, which is introduced by the Persian counterpart of the matrix bridge verb "think". The *wh*-element remains in situ in the first case and is moved to the initial position of the matrix clause in the second case.

(4a)	fekr-mikon	-i	ke	bɒbæk	emruz	ki	-ro	zæde?
	think	-you	that	Babak	today	who	-OM	hit
(4b)	[ki	-ro]$_i$	fekr-mikon	-i	ke	bɒbæk	emruz	t_i	zæde?
	who	-OM	think	-you	that	Babak	today		hit

'Who do you think that Babak has hit today?'

Specific direct object-NPs, as in the examples above, are followed by an affix (in spoken language *-o*, *-ro* or *-jo*, in written or formal language *-rɒ*) which is generally assumed to be a specificity and case marker, glossed OM. Interestingly, OM has also consequences for the capability to displace the respective argument. Moving *wh*-object-NPs bearing OM over a *wh*-subject (or a *wh*-adjunct) in a multiple *wh*-question is not forbidden, as has been pointed out by Lotfi (2003:182/183).

(5a)	ki	tʃi	xord?
	who	what	ate
(5b)	*tʃi	ki	xord?
	what	who	ate
(6a)	ki	tʃi	-ro	xord?
	who	what-OM	ate
(6b)	tʃi	-ro	ki	xord?
	what-OM	whoate

'Who ate what?'

The sentences (1a) to (6b), given here as an introduction into the descriptive facts of Persian *wh*-syntax, represent at the same time the experimental test sentences of this study and will be taken up in section 3.

As regards the phrase structure of modern Persian Karimi and Taleghani (2007), building on Karimi (2005:25), suggest (7). (8) is essentially identical to (7), except for an AdvP, which I assume to be optionally projected above the *v*P boundary and where adverbs are located (I will not deal with the issue of clause-initial adverbs, discussed in Cinque, 2004; and in Karimi, 2005:124/125). This view is consistent with Cinque (1999) who argues that the object, being an argument of the verb, is base-generated within the VP, while the adjunct occupies the VP border.[3]

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[3] I am indebted to Simin Karimi for a fruitful discussion and suggestions on the placement of adverbs in Persian.

(7)   [$_{CP}$ [$_{TopP}$ [$_{FocP}$ [$_{NegP}$ [$_{TP}$ [$_{T}$ [$_{vP}$ [$_{v'}$ [$_{PredP}$] V]]]]]]]]
       $\underbrace{\qquad\qquad\qquad}$
       Operator/Discourse Phase $\underbrace{\qquad\qquad}$
                                       Lexical Phase

(8)   [$_{CP}$ [$_{TopP}$ [$_{FocP}$ [$_{NegP}$ [$_{TP}$ [$_{T}$ [$_{AdvP}$ [$_{vP}$ [$_{v'}$ [$_{PredP}$] V]]]]]]]]]]

TP can have an optional specifier (not represented in (7) and (8)), which is the landing site of a certain type of topic (see below). Spec of TP is part of what Karimi (2005) calls the operator/discourse phase (inspired by the 'functional phase' in Chomsky, 2001), where functional elements such as topic and contrastive focus are moved to (see also Grohmann's 2003 notion of an Ω-domain for discourse information). The specifier of the optionally projected TopP hosts another type of topic. The specifier of the optionally projected FocP hosts contrastively focused elements (see for example Rizzi, 1997; Kiss, 1998). The fact that focus appears preverbally is in line with an often observed typological pattern in SOV language (see Horvath, 1986; Kim, 1988).

The Spec of TP and the Spec of TopP can also host non-subjects, as long as they are topics. Persian is not a subject-prominent language, such as English, German, French, Spanish, etc., but a topic-prominent language such as Hungarian (Kiss, 1995, 1997, 2002), Finnish (Holmberg, 2000), or Russian (Holmberg and Nikanne, 2002). Any specific element can be [+topic] in a topic-prominent language. Following the VP-Internal Subject Hypothesis (Koopman and Sportiche, 1991; Chomsky, 1995; McCloskey, 1997), the subject is base-generated at the Spec of vP. It remains there if it is not a discourse-functional unit (when phrasal elements in Persian are not contrastively focused or topic, they remain inside vP, i.e. there is no obligatory movement of the subject to the Spec of TP, Karimi, 2005:111–113). If the subject functions as a background topic (already present in the discourse), it is moved to the Spec of TP; if it functions as a shifted topic (implicating a change of attention in the discourse, as suggested by Svenonius, 2002; Karimi, 2005), it is moved to the Spec of TopP. Svenonius (2002:214) refers to these two types as "continued topic" and "switch topic", Frascarelli and Hinterhölzl (2007), more recently, as "familiar topic" and "aboutness shift topic". Therefore, the operator/discourse domain includes two topic positions, one (contrastive) focus projection, and the CP itself.

With regard to the "true" in situ position of *wh*-phrases, Kahnemuyipour (2001) suggests that the base position of *wh*-phrases in constituent questions differs from the position of corresponding non-*wh*-phrases in the declarative counterparts. A similar idea had already been proposed for Spanish by Uribe-Etxebarria (2003). I do not adopt this position. It is not clear why the syntactic component should generate *wh*-elements in a different position. This claim is conceptually unattractive, since one would give up a basic aspect of the "direct relation" between interrogatives and their declarative counterparts. Furthermore, the data that Kahnemuyipour (2001) presents are not convincing. He states (p. 46) that the *wh*-adjunct *koʤɒ* ("where") can only have an echo interpretation in postverbal position as in (10a), although the non-*wh*-phrase *xune* is postverbal in the declarative (9). He assumes the form (10b) with the *wh*-element in preverbal position to be the true information question.

(9)   æli je   sɒæt piʃ ræft   xune.
        Ali one hour ago went   home
        'Ali went home one hour ago.'

(10a)   æli je   sɒæt piʃ ræft   koʤɒ?
        Ali one hour ago went   where
        'Where did Ali go one hour ago?'

(10b)   æli je   sɒæt piʃ koʤɒ ræft?
        Ali one hour ago where went

His examples contain directional motion verbs. In Persian, for reasons that are not yet fully understood, these verbs have a peculiar syntactic behavior. They differ from other verbs precisely in the fact that they allow postverbal *wh*-adjuncts (see also the illicit cases (3a) to (3c)). Furthermore, (10a) is not restricted to an echo reading, but can well be a true information question. What distinguishes (10a) from (10b) on a pragmatic level is the fact that the former comes with an additional requirement with respect to semantic presupposition. For example, in the situation described by (10a) it is presupposed that both speaker and hearer know that Ali went somewhere. An answer like *hiʤɒ* ("nowhere") to question (10a) is odd, while it is felicitous with (10b). In this sense (10a) cannot be uttered "out of the blue" (more on this in section 3.2.1). Karimi (2003) considers the possibility that the adjunct of place might be exceptionally base-generated in postverbal position in constructions with directional motion verbs. This position would be in line with the typological observation that motion verbs show exceptionality on various levels (Talmy, 2006; Ameka and Levinson, 2008). As soon as we turn to non-motion verbs, it becomes evident that (9), (10a), and (10b) fall short of proving that the base position is postverbal.

(11a) * æli je   sɒæt piʃ xɒbeʃ bord koʤɒ?
         Ali one hour ago fell asleep where

(11b) æli   je   sɒæt piʃ koʤɒ   xɒbeʃ bord?
      Ali   one   hour ago where   fell asleep

Another word order phenomenon in Persian is XP postposition, which is however restricted to spoken language.[4] Interestingly, the more casual the speech, the higher the frequency of postposing (15% in speech situations of high spontaneity according to Frommer, 1981). Sentences (12a) to (12c) show examples with postposed subject, direct object, and adjuncts taken from Frommer's (1981) transcriptions. (1b) and (2b) have also shown postposition, namely of the subject.

(12a)   diruz   inʤɒ næ-bud   ostɒd.   (Frommer, 1981:142)
         yesterday   here NEG-was   professor
         'The professor wasn't here yesterday.'

(12b)   dɒri-zæbt-mikoni   in -o?   (Frommer, 1981:145)
         recording$_{2sg,dur,progr}$ this-OM
         'Are you recording this?'

(12c)   Sohel, to   zire in -o   pɒk-kærdi diruz?   (Frommer, 1981:156)
         Sohel, you under this-OM cleaned   yesterday
         'Sohel, did you clean under here yesterday?'

Frommer (1981:171/172) finds the following hierarchy of postposability (from most to least frequent): adjuncts expressing destination, indirect objects and prepositional adverbs, direct objects with OM, adverbial adjuncts (without preposition), subjects, direct objects without OM. Although we see that postposing is a phenomenon not restricted to adjuncts expressing destination, they distinguish themselves from all other postposable elements: according to Frommer's (1981:126–128) statistics 80% of all postposed elements are destinations in spontaneous colloquial language. In addition, they mostly bear focus (stress) and do not express background information. Other postposed elements do not show focus (their F0 reveals a trailing intonation). They rather constitute a background topic. For example, 90% of postposed subjects are non-focused (Frommer, 1981:137).

I assume that postposed elements in Persian (excluding adjuncts expressing destination) are always topics, mostly background topics but sometimes also shifted or contrastive topics.[5] Persian has a syntactic position coming along with contrastive focus interpretation, however not at the right edge of the sentence, but in the left periphery (FocP). Postposed elements in Persian cannot be phonologically focused either; they cannot carry a contrastive nuclear accent. Not much is known so far about the grammatical status of constructions with postposition. I assume that they are syntactically more or less suboptimal constructions and that there is a hierarchy of markedness corresponding to Frommer's (1981:171/172) hierarchy of postposability. In section 3.4.3 I will compare constructions with and without subject postposition in interrogatives with different *wh*-position.

2.2. Wh-scrambling and information structure

In the following I will briefly outline the properties of local *wh*-scrambling in comparison with local *wh*-operator movement. Persian shows a variety of possible positions for the *wh*-phrase, including the stipulated in-situ position and a fronted position. Sentences such as (13) show that the locally displaced *wh*-phrase lands in a position right-adjacent to the complementizer *ke* ("that"), which is one indication of a landing site below the Spec of CP for scrambled *wh*-elements. Furthermore, we can observe that *wh*-elements can be moved out of an embedded sentence, but they do not need to land in the leftmost position as is shown in (14). This landing site can be explained by means of the phrase structure (8), assuming that the *wh*-element lands in the Spec of FocP, while the subject has been moved to the Spec of TopP.[6] In line with the assumptions on subject topics, the subject *rɒmin* in (13) is a background topic, while *mɒmɒn* in (14) is a shifted topic.

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[4] The term postposition is used descriptively. It is out of the scope of this paper to discuss whether the surface order is the result of genuine postposition or the result of preposing of the verb. I do not go into the issue of symmetry vs. antisymmetry (but see Takano, 2003; Bhatt and Dayal, 2007).

[5] One possible explanation for the remnant 10 % of postposed subjects that Frommer (1981: 137) did not analyze as non-focused could be the fact that they were shifted or contrastive topics. Contrastive topics contain a focus, but their dominating information structural entity is an aboutness topic (Krifka, 2007: 44). One should also bear in mind that information-structural classification of spontaneous speech data is a very challenging task (in the sense that the overlap between theory and data is often less than perfect, but this is not the focus of this paper).

[6] An anonymous reviewer pointed out that Rizzi (1997:298) has also suggested FocP as a landing site for *wh*-phrases in Italian main questions, a language with structural *wh*-movement. Rizzi (1997) builds his assumption on the incompatibility of *wh*-phrases with contrastively focused constituents. However, a relevant difference between Persian and Italian is the fact that the former allows *wh*-phrases right-adjacent to the complementizer, which the latter does not as is shown in (i). One could object that the ungrammaticality of (i) is due to the fact that *wh*-phrases in (non-multiple) Italian *wh*-questions have to be moved into the left periphery of the matrix clause. Interestingly, French – a language with structural *wh*-movement – does not allow a landing site right-adjacent to the complementizer, neither, although it allows *wh*-in-situ in many embedded *wh*-constructions.

(13)	fekr-mikoni [CP ke [FocP ki	-roj [TP rɒmini [vP ti tj tu mehmuni bebine]]]]
		thinkdur., 2sg.	that	who -OM	Ramin		in party		seesubj., 3sg.
		'Who do you think that Ramin will see at the party?'

(14)	[TopP mɒmɒni [FocPki	-roj[vPti fekr-mikone [CP ke [TP bætʃehɒk [vP tk tj tu mehmuni bebinæn]]]]]]
			mom		who -OM	thinkdur., 3sg.	that childpl.		in party		seesubj., 3sg.
		'Who does mom think that the children will see at the party?'

German provides for both scrambling and operator movement but displacement of *wh*-elements is normally carried out by structural *wh*-movement. We see in example (15a) (from Müller, 1995:143) that scrambling of *wh*-elements creates unacceptable results.[7] Only constructions with partial *wh*-movement (the so-called *Was-w-constructions*) like example (15b) (from McDaniel, 1989:589) allow the displacement of a *wh*-phrase into an intermediate position where *was* serves as a kind of scope marker (cf. Tappe, 1981).

(15a)	?? Wann	hat [IP	warumi [IP	der	Fritz ti	geschlafen]]?
			When	has		why		the	Fritz		slept

(15b)	Wasi	glaubst [IP	du [CP	wanni [IP	Hans ti	an welcher	Universität	studiert	hat]]]?
			What	think		you	when		Hans	at which		university	studied	has

Karimi's (2005) analysis of scrambling in Persian shares two basic assumptions with Kural's (1992) analysis of scrambling in Turkish: (i) scrambling is movement into an A'-position,[8] (ii) a *wh*-phrase must be in a focus position (this statement is more specific for Persian: a *wh*-NP must be in a contrastive focus position).[9] According to Karimi (2005) scrambling can have a discourse-functional effect on the output of the derivation, representing topic or focus (unlike, for example, Fukui and Naoki, 1993; Saito and Fukui, 1998, who characterize scrambling as an semantically vacuous, optional operation undone at LF). Movement related to information structure (e.g. focus movement in the sense of Bošković, 1997b; to some extent also scrambling in the sense of Haider and Rosengren, 2003; scrambling in the sense of Karimi, 2005) has been proposed as an alternative way to motivate the displacement of the *wh*-element.[10] According to this proposal, the displacement is either motivated by inherent focus features of the *wh*-elements – an assumption that is not unproblematic (for a discussion, see Erteschik-Shir, 1986; Lambrecht and Michaelis, 1998) – which have to be displaced in order for those features to be checked (e.g. Bošković, 1997a,b, 2000). Or, as has been proposed by Karimi (2005) the displacement is motivated by the selection of the EPP feature in the sense of Chomsky (2000) from the lexicon, optionally assigned to a phase head (such as Foc) to attract the movement of the *wh*-phrase. Or, as has been proposed by Haider and Rosengren (2003:250), the displacement is truly optional without the need of any syntactic trigger in a minimalist-technical sense. According to Karimi (2005) the focus interpretation of *wh*-phrases (and by extension also non-*wh*-phrases) is contrastive under very specific circumstances. Contrastive focus can be achieved in Karimi's (2005:154) approach by three means (depending on the language one or more of these options are available): syntactically by overt movement of XP into the Spec of FocP (which applies to *wh*-NPs in Persian), morphologically (for example with the morpheme -ga which marks contrastive focus in Navajo, cf. Hale et al., 2003), or phonologically by heavy stress presumably interpreted at PF (which applies to non-*wh*-NPs in Persian).

(i)	*Pensi	che	chi	Marco	ha	visto	alla	festa?
	think2sg	that	who	Marco	has	seen	at-the	party
(iia)	*Tu	penses	que	qui	Marco	a	vu	à	la	fête?
	you	think2sg	that	who	Marco	has	seen	at	the	party
(iib)	Tu	penses	que	Marco	a	vu	qui	à	la	fête?
	you	think2sg	that	Marco	has	seen	who	at	the	party
	'Who do you think that Marco has seen at the party?'

[7] Beck (2006: 4) takes a different stance on the matter. However, her examples of scrambling of the lower *wh*-phrase in German multiple *wh*-questions are in my opinion very marginal at best.

[8] Similar to Mahajan (1990) and Webelhuth (1992), Kural (1992) observes both A'- and A-properties in Turkish scrambling. However, he makes the point that scrambling in Turkish always targets an A'-position (possibly a CP-adjoined position), and that the A-properties can be explained by the focus relations. Kural (1992) refers to Mahajan's (1990: 26) observation that there is no weak-cross-over effect when the *wh*-element undergoes local fronting in the Hindi example below. Hindi is language which exhibits *wh*-scrambling, and also allows both *wh*-in-situ and scrambled *wh*-elements (according to Mahajan, 1990 they are fronted into an IP-adjoined position and QR at LF). Based on such data, Mahajan (1990:26) argues that local scrambling in Japanese can not only be A'- but also A-movement.

(i)	kis	-koi	uskiii	bahin	t	pyaar	kartii	thii ?
	who	-DO	his	sister		love	do-imp-f	b-pst-f
	'Who did her sister love?'

[9] However, the concrete form of Kural's (1992) focus theory differs radically from Karimi's (2005) approach. He does not assume a fixed structural focus position in the tree structure but a position relative to the verb. Moreover, he argues that all *de*focused constituents vacuously scramble out of their base positions.

[10] The idea of a pragmatic or discourse function of syntactic movement had already been proposed by Jackendoff (1973), Culicover and Rochemont (1983), and Rochemont (1986).

It has been argued that there are three different types of displacement (or three different sorts of *Move*, see Webelhuth, 1992; Dayal, 1994): (i) A-movement, (ii) A'-movement in the case of structural *wh*-movement and scrambling into the CP domain, and (iii) A'-movement in the case of long distance scrambling (which is not assumed to be a typical operator movement). These movement types show different syntactic or semantic properties (e.g. concerning binding relations and scope determination). Karimi (2005:123) considers movement (including scrambling) into the operator/discourse domain given in (7) as A'-movement. A'-scrambling had already been proposed by Saito (1985). Mahajan (1990) takes a different stance on the nature of scrambling. According to him, local scrambling is ambiguous between A- and A'-movement, while long distance scrambling is analyzed as A'-movement. The evidence is based on data from binding and weak-cross-over effects (see footnote 8). Webelhuth (1989) takes a different stance, too. He proposed a "mixed approach" in the sense that he assumed the landing site to have binding properties of both A- and A'-movement. He characterizes scrambling as a non-A, non-operator position (later Saito, 1992 tries to unify their views). I adopt the assumption that local *wh*-scrambling into the CP domain in Persian is A'-movement based on evidence in Karimi (1999b, 2005:53ff.): licensing of parasitic gaps and unbound anaphora presumably.[11] Karimi (2005) works with the distinction between languages with structural *wh*-movement and languages with scrambling of the *wh*-element (henceforth, I refer to the first one as "*wh*-movement" and to the second one as "*wh*-scrambling"). These two instances of displacement correlate with different landing sites. While the landing site of *wh*-movement is the Spec of CP, she assumes it to be the Spec of FocP for *wh*-scrambling in Persian. I adopt Karimi and Taleghani's (2007) view that only *wh*-arguments land in FocP, while *wh*-adjuncts (at least those without a nominal element, see below) might behave like sentential adverbs. They state that in situ *wh*-arguments bear information focus, henceforth i-focus (the non-presupposed nature of the information it carries in the sense of Kiss, 1998), while *wh*-arguments fronted to the Spec of FocP have contrastive focus, henceforth c-focus ([+contrastive] identificational focus expressing exhaustive identification in Kiss, 1998). I assume that both in situ *wh*-arguments and in situ *wh*-adjuncts bear i-focus (given that *wh*-elements always represent the non-presupposed part of the sentence), while non-scrambled sentential adverbs can be discourse-functionally neutral.

The information-structural properties of scrambled *wh*-elements can be captured in terms of exhaustivity.[12] Scrambled *wh*-elements in Persian can be characterized as a subtype of contrastive focus, which Krifka (2007:33) calls *exhaustive focus*, similar to focus movement in Hungarian (Kiss, 1998:267). The denotation of an exhaustive question is a complete set of propositions which intuitively constitute its true answers. So-called non-exhaustivity markers like English *for example* or Persian *mæsælæn* force a non-exhaustive reading. While *mæsælæn* is possible with the *wh*-argument in base position in (16a), it is illicit as a non-exhaustivity marker with the scrambled *wh*-argument in (16b) (it can be used but only with a different pragmatic function, namely as an expression of irony or incredulity in a biased question).

(16a) bɒbæk   diruz   mæsælæn   ki   -ro   did?
       Babak   yesterday for example who   -OM   saw
(16b) # mæsælæn ki   -ro   bɒbæk diruz did?
       for example who   -OM   Babak yesterday saw
       'Who for example did Babak see yesterday?'

As regards Persian, we can state the following: (ia) Questions in which the *wh*-element has not been scrambled have a non-exhaustive denotation. (ib) Questions with a scrambled *wh*-argument are exhaustive. (ic) Questions with a scrambled *wh*-adjunct can be either non-exhaustive or exhaustive. Whether they are exhaustive or non-exhaustive seems to depend on the type of *wh*-adjunct.[13] (ii) Scrambled non-*wh*-elements behave somewhat similar to scrambled *wh*-adjuncts, but they can in addition be topical (whether they are focus or topic depends, according to Karimi, 2008, on intonational properties). Thus, scrambled *wh*-arguments are [+c-focus/exhaustive], scrambled *wh*-adjuncts are [+c-focus/exhaustive] or [-c-focus/exhaustive], scrambled non-*wh*-elements are [+c-focus/exhaustive], or [+topic], or discourse-functionally neutral. This approach is in line with the *flexible exhaustivity* approach of Beck and Rullmann (1999) according to whom "the basic denotation of questions is a non-exhaustive one, but where exhaustivity may arise as a result of several factors that are, so to speak, external to the question itself." We can capture these different discourse functions by a distinction between background scrambling and focus scrambling, where the former corresponds to [-c-focus] and the latter to [+c-focus] (for a similar idea, see Miyagawa, 1997). I work with Krifka's (2007) definition of focus, based on Rooth's (1992) Alternative Semantics, given in (17). Focus triggers alternatives that correspond to the Hamblin (1958, 1973) meaning of questions, i.e. a set of propositions, each being the denotation of a congruent answer.

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[11] Note, however, that Karimi (2005: 225ff.) pursues a different line of arguments, questioning the typology of movement in terms of A-A' distinction altogether.
[12] The issue of weak vs. strong exhaustivity is not discussed here (but see Groenendijk and Stokhof, 1982, 1984).
[13] According to Stepanov and Tsai (2008) some *wh*-adjuncts (e.g. those denoting purpose or reason) do have a nominal element. From their point of view, Karimi and Taleghani's (2007) assumption that *wh*-adjuncts do not have an internal +Foc feature, would have to be limited to those *wh*-adjuncts that lack a nominal element (e.g. those denoting reason or manner). It is beyond the scope of this paper to work out this question. It can be a fruitful issue for future research to make a fine-grained analysis of the information structure of different *wh*-adjunct types in Persian scrambling constructions along various dimensions (±contrastive, ±weakly/strongly exhaustive, etc.).

(17)   A property F of an expression α is a Focus property iff F signals (a) that alternatives of (parts of) the expression α or (b) alternatives of the denotation of (parts of) α are relevant for the interpretation of α.

I will later corroborate the view that the focus properties are crucial in understanding scrambling. After the clear-cut acceptability contrasts presented so far, I will turn attention to nuanced, though systematic differences in markedness between local scrambling of [±wh] and [±NP] elements.

2.3. Long scrambling vs. long Wh-movement

Let us also highlight some properties of long scrambling in Persian, and compare it to long distance operator movement. Persian allows multiple scrambled *wh*-phrases as in (18a), or long *wh*-fronting (qua long scrambling) combined with local fronting (qua short scrambling) into the Spec of TopP as in (18b).[14] (18b) indicates that this movement does not induce topic islands (which is one of the tests for distinguishing *wh*-movement and topicalization from scrambling). Note that Persian *ke* ('that') does not induce a that-trace effect (Hashemipour, 1989:260; Karimi, 1999a; Darzi, 2008:111).

(18a)   [$_{FocP}$ ki$_i$ [bɒ   ki]$_j$ [*pro* fekr mikoni   [$_{CP}$ (ke) t_i t_j beræxse]]]?
            who with who   think$_{dur,2sg}$ (that)   dance$_{subj,3sg}$
        'Who do you think will dance with whom?'

(18b)   [$_{FocP}$ [be ki]$_j$ [momken -e [$_{CP}$ ke   [$_{TopP}$ [golɒ -ro]$_i$ [un t_i t_j dɒde bɒʃe]]]]]?
            to who possible -is   that   flowers-OM   he/she   given$_{subj,3sg}$
        'To whom is it possible that he/she gave the flowers(TOP)?'

It is well known that long distance operator movement is prohibited when several phrases have to go through the same intermediate CP landing site as in (19), or when one phrase has to go through an already occupied intermediate CP as in (20), where this position is occupied by a locally topicalized element coming along with V2. Consequently, long *wh*-movement and topicalization cannot appear simultaneously in English and German which both are languages with operator movement (see also Müller, 1995:332).[15]

(19)   *[$_{CP}$ What$_i$ [to Ben]$_j$ do you think [$_{CP}$ Mary will give t_i t_j]]?
(20)   *Ich weiss [$_{CP}$ wen$_i$ du   sagtest [$_{CP}$ t'_i Ede$_j$ habe$_k$ [t_i t_j getroffen t_k]]]
         I   know   who you   said   Ede   has$_{subj}$ met

Karimi (2005:201–215) observes that a subject, direct object, indirect object, or adjunct cannot be scrambled into a target clause, when there is already such an (overt) element in the target or intermediate clause. However, this is possible with operator movement.

(21)   *[tʃi   -ro]$_i$ foruʃænde bætʃehɒ -ro   tæʃviɣ kærd   [$_{CP}$ ke   *pro* t_i bexæræn]?
         what -OM salesperson children -OM encouraged$_{3sg}$ that   buy$_{subj,3pl}$
        'What did the salesperson encourage the children to buy?'
(22)   What$_i$ do you persuade John [PRO to buy t_i]?

We know that long scrambling is A'-movement. Saito's (1992:76) Japanese example (23a) shows evidence from binding, which were first proposed by Mahajan (1990) for Hindi. (23b) shows cross-over evidence from Hindi long *wh*-scrambling (Mahajan, 1990:39). Both sentences should be grammatical if long distance movement was A-movement.

(23a)   *[Karera-o$_i$ [[otagai$_i$ -no   sensei] -ga [$_{CP}$ [$_{IP}$ Hanako -ga t_i hihansita]
         they -ACC   each other-GEN   teacher -NOM   Hanako -NOM   critized
         to]   itta]] (koto)
         COMP   said   FACT
        'Them$_i$, each other's$_i$ teachers said that Hanako criticized t$_i$.'

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[14] Note that German also allows the combination of both long scrambling out of a CP and short scrambling, as shows the that-sentence below, which is a minor modification of an example in Haider and Rosengren (1998: 83). However, unlike the Persian examples (18a) and (18b), (i) does not involve extraction of a *wh*-element.
(i)   ...dass [so viel   Geld]$_i$ man nicht glauben würde [dass [am hellichten Tag]$_j$ jemand t_i t_j klauen könnte]
            ...that so much money one not believe would that in broad daylight someone steal could
          '...that one would not believe that someone could steal in broad daylight so much money(TOP)'.
[15] I am omitting a deeper discussion of the problematic interaction of *wh*-movement with scrambling and topicalization (e.g. Müller & Sternefeld's 1996 *Principle of Unambiguous Binding* (p. 496); or Karimi's 2005 *Constraint on Interpretation* (225ff.)).

(23b) *kis -ko$_i$ uskii$_i$ bahin-ne   socaa [$_{CP}$ ki   raam-ne t dekhaa thaa]?
       who -DO   his   sister   thought   that Ram   seen   be-past
       'Who$_i$ did his$_i$ sister think that Ram had seen?'

Wh-scrambling in Persian, whether local or long, is uniformly analyzed as A'-movement by Karimi (2005). However, the experimental approach will highlight several systematic differences in markedness, namely between long scrambling of [+*wh*] and [-*wh*], as well as between long scrambling into the matrix vs. into the intermediate CP. I will argue that a focus-based scrambling theory, together with the assumption that Persian intermediate CPs have a defective FocP, can account for these facts.

3. Analyses of gradient acceptability judgments

3.1. Major descriptive aspects of the test sentences

This section begins with the most important test hypotheses, and then presents the experimental method as well as some more theoretical preliminaries. For reasons of space, I will not repeat the sentences, but refer the reader to the beginning of section 2. Rather, I will systematically place them in table form and resume major descriptive points.

3.1.1. Simple wh-questions

The experimental material takes into account (i) three different positions of the *wh*-element, (ii) the type of *wh*-element (adjunct or argument), and (iii) the possibility of postposed subjects (Table 1). As regards the position of the *wh*-element, I distinguish between (i) non-initial, preverbal, (ii) initial, and (iii) postverbal (final or non-final). Recall that I assume the canonical word order in Persian to be SOV. Therefore, apart from *wh*-subjects, *wh*-in-situ elements are always in non-initial, preverbal position in sentences with overt subject. Examples (1a) and (1c) show the order 'object before temporal/locative adjunct' (henceforth O Adj$_{temp}$ V), while (1a') and (1c') are 'temporal/locative adjunct before object' (henceforth Adj$_{temp}$ O V). According to the phrase structure in (8), no scrambling to FocP has taken place in (1a') and (1c'). Assuming a link between contrastive focus, context dependency, and markedness, we expect these structures to be unmarked.

Interrogatives with postverbal *wh*-element are included for two reasons: (i) They do not constitute presumably well-formed constructions, which allow us to study the behavior of the constraint-based model in ungrammaticality. (ii) However, the exact status of these constructions, whether all are clearly unacceptable or some are marginal, is not clear.

Besides the position of the *wh*-element, the experimental design distinguishes between *wh*-adjuncts and *wh*-NPs (*wh*-type). It has been shown that *wh*-arguments and *wh*-adjuncts behave differently in a variety of ways. According to Lotfi (2003) *wh*-adjuncts, in contrast with *wh*-arguments, do not have a case requirement and should therefore obey less restrictions. Karimi and Taleghani (2007) assume different internal structures for *wh*-adjuncts and *wh*-arguments, and they also propose different landing sites for the respective initial *wh*-element. I look at the question whether *wh*-adjuncts and *wh*-NPs are equally displaceable or whether we find differences in markedness. Adjuncts expressing movement destinations are generally avoided in the material given that they probably follow specific syntactic rules. In order to keep the number of test sentences manageable in the experimental protocol for simple *wh*-questions, I limited myself to direct object *wh*-NPs, i.e. the quantitative results do not cover *wh*-subjects and indirect *wh*-objects.[16]

Finally, the design takes into consideration an additional word order option in Persian interrogatives, namely postposition. Various elements are postposable in Persian (see section 2.1). As has been stated in section 2.1, postposability is a complex phenomenon in Persian with a marked pattern of variation. According to Frommer (1981), this phenomenon might even reflect some change in progress, given the unusual status of Persian in the typological system of Greenberg (1963, 1966) (see section 3.4.3). If we found signs that could indicate an increasing acceptability of postposition, i.e. that postposition is not degraded or marked, the nature of such a change would constitute a new and interesting line for future research. Limiting the number of test sentences in the experimental design, postposition was only studied with subjects and *wh*-adjuncts.

3.1.2. Complex questions with embedded wh-constructions

We will then turn to constructions with more than one CP node and long movement. In section 3.5.1 I will first look at complex (2-CP) constructions such as (4a) and (4b) and compare them with their analogous simple (1-CP) versions (Table 5).

After the comparison of local and long *wh*-scrambling, I will include in section 3.5.2 the construction (24) in the design. The purpose will be to compare two different forms of long scrambling, namely the long *wh*-scrambling construction (4b) with the long NP-scrambling construction (24) (Table 6).

(24) ʃivɒ goft [ke [otɒɣ -o]$_i$ hæds mizæne [ke nærges t_i tæmiz kærde bɒʃe]].
      Shiva said that room -OM guesses$_{3rd,sg.}$ that Narges   cleaned   had
      Shiva said that she guessed that Narges had cleaned the room.

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[16] Recall that Karimi (2005: 136–149, 196–214) shows that *wh*-subjects, direct and indirect *wh*-objects obey the same island restrictions, that they target the same position, and that they behave equally with respect to [±c-focus]. It is still conceivable that they differ by *nuances* of markedness. However, it is up to future research to make a systematic comparison of gradient judgments.

3.1.3. Multiple wh-questions

Finally, multiple *wh*-questions (5a), (5b), (6a), and (6b) are studied (Table 7). The experimental design distinguishes between the order of subject and object on the one hand, and between the presence and absence of the object marker, on the other. The latter allows us to assess the role of the object marker suffix in the syntax and semantics of multiple questions, specifically its relationship with superiority.

3.2. Basic assumptions

Before presenting the experimental method and results, I will introduce two theoretical aspects that will play an important role in the following analysis. The first one refers to the difference between i-focus and c-focus, which is important for an understanding of the syntax and semantics of Persian *wh*-questions, and the relation with contextual requirements and markedness. I assume that processes at the interface levels of syntax are crucial for the effects of preference constraints, which in turn account for gradient differences within the range of acceptable constructions. The second point concerns the idea of cumulating constraints.

3.2.1. C-focus, context, and markedness

In this subsection, I explain that constructions with contrastive focus have a greater context dependency than constructions without. Context dependency translates into markedness when the sentence is presented in isolation, which can be measured with the graded acceptability judgment test.

Let us first look at c-focus in classic declarative examples. While focus in general (i-focus and c-focus) has the function of assigning a value to the variable introduced by the presupposition, c-focus, in addition, negates the value given to the variable by the presupposition in order to assign an alternative value to it (Zubizarreta, 1999:4226–4228). C-focus as in (26) assigns a different value to the variable introduced by its context statement in (25). It has both a metagrammatical function, such as correction, repair, denial, reassertion of the hearer's presupposition, and a grammatical function, i.e. the introduction of a variable with its value (for details on the semantic aspect of focus, see Szabolcsi, 1981; Krifka, 1991; Diesing, 1992; Rooth, 1992; Schwarzschild, 1999; Krifka, 2007).

(25)   I'm sure that John bought a car in Madrid, although he has no money.

(26)   No, John did not buy a car. He bought a BICYCLE in Madrid.

What does this mean for *wh*-scrambling in Persian? We have seen that a *wh*-element in situ as in (27a) normally carries i-focus, while a scrambled *wh*-NP as in (27b) has c-focus. Interestingly, question (27a), supposed to be asked in an out-of-the-blue manner, can be neutrally answered by *hitʃi* ("nothing"), while the same answer to (27b) would be odd.

(27a)   bɒbæk   emʃæb   tʃi   mipæze?
          Babak   tonight   what   cook$_{hab., 3sg.}$

(27b)   tʃi$_k$ bɒbæk   emʃæb t_k mipæze?
          what   Babak   tonight   cook$_{hab., 3sg.}$
          'What does Babak cook tonight?'

I assume that neutral *wh*-questions always have existential presupposition, in line with authors like Katz and Postal (1964:116), Keenan (1971), etc. (see Fitzpatrick, 2005, for a different position). The fact that (27a) can be answered by "nothing" does therefore *not* mean that there is no existential presupposition. I agree with Haida (in press) who argues that negation can be used to protest against the existential presupposition. (27b) comes along with what has been called "strong presupposition" (see Cheng and Rooryck, 2000, concerning French *wh*-in-situ questions).[17] The strong presupposition of c-focused *wh*-NP in (27b) implies that the existence has *already* been established during the previous discourse, which limits the range of values that can be assigned to the variable. For example, in the discourse preceding question (27b) it could have been stated that no one should disturb Babak in the kitchen, because he wants to finish his cooking before the guests arrive. An answer of non-existence such as "nothing" would be in contradiction with the Common Ground (in the sense of Karttunen, 1974; Stalnaker, 1974) so far developed between the discourse participants.[18] Note that it is not impossible to answer "nothing" to (27b), however not as a neutral statement but only as a contrastively focused answer: Its grammatical function would then assign the value "nothing" to the variable, its metagrammatical function (correction) would carry on the information already in the Common Ground that Babak is cooking *something*. One can also put it in the following terms: A

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[17] The same seems to hold for the exceptional cases of well-formed postverbal *wh*-elements such as (10a).

[18] In this sense the term "strong presupposition" is misleading, because as soon as information has been added to the Common Ground, it is not presupposition in the sense of requirements for the input Common Ground any more (see van der Sandt, 1988). An anonymous reviewer raised the important question whether the notion "strong presupposition" in (27b) could be derived via Schwarzschild's (1999) approach (which might help to put this notion on a firmer footing). At the present state of knowledge, I have to leave this question unanswered. It is up to future research to conduct a systematic comparison of constructions of the type (27a) and (27b) with regard to phenomena commonly associated with givenness, e.g. to conduct an experimental phonological study on accent patterns and deaccentuation; see also Büring (2006) on the interaction of focus and givenness.

speaker who utters a question presents a set of alternative propositions to the addressee. The addressee is requested to choose the ones from the set considered to be true in the present situation. Given the Common Ground, the answer "nothing" to (27b) is not in the set.

It becomes clear that Persian *wh*-questions which are [+c-focus] are more context-dependent than their [-c-focus]-counterparts, because they have to be preceded by a discourse in which the existence of an entity corresponding to the *wh*-element has been established (see also Toosarvandani, 2008:697). Furthermore, recall that [+c-focus] *wh*-questions are [+exhaustive]. The denotation is the complete set of true answers (and not just possible answers as in the case of non-exhaustive denotations). But how can we "detect" context dependency if all we measure are gradient acceptability judgments? Both [+c-focus] and [-c-focus] constructions are equally felicitous with an adequate context. The solution is: removing the context. While [-c-focus] constructions can be uttered out-of-the-blue, [+c-focus] constructions are affected by the absence of a context. This operation does not result in ungrammaticality, but in a lower degree of gradient acceptability. The issue of context dependency in syntax and markedness is not new. Lenerz (1977) and Höhle (1982) consider the difference between constructions that are acceptable independently of context and constructions that are dependent on context, as theoretically meaningful (this distinction has already been described by Chomsky, 1964:385). In order to take theoretically into account this difference, Höhle (1982) defines the concept of *markedness*. He suggests that a sentence S_1 is less marked than a sentence S_2 if it can occur in more context types than S_2. This definition has been taken up by Müller (1999) and is also relied on by Keller (2000). The methodological choice to present *isolated* sentences in the judgment test, i.e. sentences out of context, thus allows us to translate c-focus-specific context dependency into markedness, which is measured on an acceptability scale. The prediction is that Persian *wh*-phrases scrambled to FocP will show a higher degree of markedness than their in situ variants when presented without context. Note that we are presumably talking of fine nuances within the range of acceptable constructions.

3.2.2. Constraint cumulativity

I work with a model based on two types of constraints: preference constraints whose violation results in gradience (lowering the degree of acceptability without necessarily causing ungrammaticality), and well-formedness constraints whose violation results in ungrammaticality. While the latter is not a conceptual innovation, the former directly reflects the notion of gradience. I further assume that each constraint violation comes with its specific violation cost. Although I am not working in a framework of competition, such as optimality theory (Prince and Smolensky, 1993), my view is inspired by several modifications of standard OT, who have incorporated the idea of a type of constraint whose violation leads to suboptimality without necessarily causing ungrammaticality. Standard OT makes no prediction about gradience. Constraint competition predicts one grammatical winner, while the other candidates of the set are supposed to be ungrammatical. The use of constraint types with different impact on acceptability is not new. However, such a distinction has been only proposed so far by authors who acknowledge the existence of gradience in grammar and who try to account for this phenomenon (e.g. Müller, 1999; Keller, 2000; Coetzee, 2004; Gutiérrez-Bravo, 2006).[19] Keller (2000:43&321) uses the concepts "soft constraint" (leading to mild unacceptability when violated) vs. "hard constraint" (triggering serious unacceptability when violated) (cf. also Sorace and Keller, 2005). Uszkoreit (1987) proposes a numeric implementation based on constraint cumulativity in which the degree of acceptability is the weighted sum of the violation costs associated with each constraint (i.e. the violation of one constraint can lower the degree of acceptability more than the violation of another constraint). Keller (2000:252) builds on this idea and proposes that constraint ranking could be implemented based on numeric violation costs.

I try to come up in sections 3.4–3.6 with a series of preference constraints and well-formedness constraints which do not only account for categorical but also for fine-grained judgment differences between various Persian *wh*-constructions.[20] Preference constraints will be represented in the form $P > Q$, meaning that P is preferred over Q in the sense that P comes along with a higher degree of (gradient) acceptability than Q, i.e. the use of Q instead of P comes with a specific violation cost. However, it is beyond the scope of this work to try to build a computational model based on numeric violation costs. Such a model would have to address the non-trivial issue of *fitting* all gradient measurements in a (linear or non-linear) equation of the presumed numeric violation costs. Rather, I want to show the *plausibility* of a model in which the effect of preference constraints are cumulative, and in which preference constraints do not show an effect any more as soon as a well-formedness constraint is violated.[21]

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[19] According to Müller (1999), some competitions lead to more than one optimal candidate which, in a second step, undergo a new competition on the basis of a different set of constraints, namely markedness constraints. Coetzee (2004, 2006) proposes in his rank-ordering model of EVAL (ROE) a critical cut-off that he defines as a position on "the constraint hierarchy that divides the constraint set into those constraints that a language is willing to violate (resulting in markedness) and those that a language is not willing to violate" (Coetzee, 2004: 18). Gutiérrez-Bravo (2006) builds on the OT syntax framework (Grimshaw, 1997; Costa, 1998; Samek-Lodovici, 2007), but he assumes that the order of the candidates in a tableau (from the winner to the one which violates the highest ranked constraints) directly maps on a markedness scale (from most to least acceptable).

[20] I draw my conclusions on experimental data on Persian. Therefore, I cannot answer the question which ones of the presumed preference constraints are operative in other languages. I will not discuss neither, how these constraints might fit in a model of universal constraint ranking.

[21] In order to deal with the fitting issue, Keller (2000: 256–265) proposes an approach based on Gaussian elimination. Alternatively, one can add an additional variable to the algebraic system of the linear equation (work in progress by the author). The results of the present work are necessary groundwork to further quantitative modeling, because an algebraic model has to build on basic conceptual assumptions (e.g. whether preference constraints and well-formedness constraints should be modeled differently or not).

3.3. Methodology: instrument of measurement

This work applies a sample-based experimental method for collecting judgment data, using inferential statistical methods of analysis. In other words, one looks at the differences in the judgments and separates the (systematically unaccountable) error variance from (systematically intelligible) sources of variance. An increasing number of authors (which represent, however, still a tiny minority among syntacticians) have pointed out the fundamental methodological problem with which grammar research is confronted due to a lack of standard for data quality concerning acceptability judgments (which can compromise the major task of the syntactician, namely building a formal theory that can explain the data). Sometimes crucial theoretical aspects rely on judgments that are flagrantly doubtful, i.e. that the overwhelming majority of native speakers would most probably not share – a problem already pointed out by Levelt (1974:vol. 2, p. 6). This phenomenon becomes particularly critical when we deal with data from languages in which only a small minority of the scholars in the field is proficient.

This situation is one reason why "myths" about certain constructions sometimes emerge when they keep being quoted by different authors. In this respect, Schütze (1996) presents examples from the literature on English, and Adli (2004:35–40, 2005) on the literature on French and Spanish. Sternefeld (1998b:156) even quotes an example from German in which the same author presented, in each of three subsequent publications, a different judgment pattern to the same contrasting pair of sentences. The problem of unreliable judgments is more notorious in the field of suboptimal sentences, i.e. constructions that are neither obviously well-formed nor clearly unacceptable – and we all know that many aspects of syntactic theory already rely on judgments about such more or less marginal constructions. In the case of suboptimal constructions we usually deal with what can be called second-order judgments: these judgments represent the end result of a complex cognitive process and often reflect a non-scrutinized, subjective interpretation of the syntactician, who mentally "translates" a perception of suboptimal acceptability into a binary choice in terms of acceptable vs. unacceptable. The unsatisfactory character of this non-scrutinized, internal "translation" of an intuitively metrical to a theoretically categorical scale of acceptability – accurately described by Sorace and Keller (2005:1498) as an "artificial classification into acceptable and unacceptable examples" – has triggered the introduction of a few, loose intermediary levels in form of symbols like "?" or "?*" which we already find in works from the 1960s (for example Ross, 1967). Belletti and Rizzi (1988) even work with as many as seven different implicit degrees of acceptability. Furthermore, systematic differences in acceptability *within* the range of well-formed constructions are usually overlooked or ignored without the dedicated consideration of nuances. One should not neglect the fact that the use of a gradient concept of acceptability does not only concern the description of the data (e.g. reliability and validity of judgments), but it also raises questions of theoretical nature on how to account for gradience. The data was collected with a gradient acceptability judgment test during fieldwork in Tehran between December 2004 and February 2005.[22] The sample is balanced between women and men, and consisted of 98 native speakers of Persian within the age range 18 to 46 (the mean age is 29 years).[23] They all hold at least a high school diploma. The data of 91 persons were taken into consideration, 7 persons were excluded because they did not meet the validity criteria.[24] The technique used in this work applies the principle of *graphic rating* (cf. Guilford, 1954:270; Taylor and Parker, 1964). Its test-theoretical properties and successful application has been described in Adli (2004:81–111). Subjects express their judgments by drawing a line on a bipolar scale with the endpoints "−" (clearly unacceptable) and "+" (obviously acceptable). The scale had a length of 122 mm (i.e. 4.80 in.). The length of the line represents the degree of acceptability perceived.[25] The test was presented in an A4 ring binder containing two A5 sheets. The upper one holds the reference sentence, the lower one two experimental sentences. In order not to only provide the endpoints "−" and "+" but also a scale anchor, subjects rated one reference sentence, (28), at the end of the training phase that remained visible throughout the test.

(28) ʔtʃerɒ æli$_i$ bɒ xodeʃ$_i$ bord hosejn -o?
      why Ali with himself took Hossein -OM
      'Why did Ali take Hossein with him?'

Only the lower sheet with the experimental sentences was turned after completing the rating of its two sentences. Due to the postverbal position of the specific object, the reference sentence is a marked but not ungrammatical construction (see

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[22] The data is part of the larger *sgs* database (**s**peech production - **g**rammaticality judgments - **s**ocial data), an ongoing project to build up a multilingual corpus of French, Persian, Spanish, and Catalan. It includes and combines three sources of data: syntactically tree-annotated transcriptions of spontaneous speech, gradient grammaticality judgments, and social background information of speaker.

[23] Native language is defined as the language which was already the dominant one at the age of six and whose proficiency has not been diminished by attrition later on (e.g. due to migration). Multilingual individuals were accepted as subjects as long as Persian was not a non-dominant language (neither in the first six years nor later). Careful selection with respect to the first language is important in a multilingual country like Iran, where at present only an estimated 50% of the population meets the stated criterion. According to Gordon (2005), only one third of the population would even count as native speakers of Persian. The table on linguistic diversity of countries in Gordon (2005) lists Iran on position 33 (note that Persian is labeled as "Western Farsi" in the Ethnologue's classification).

[24] 4 persons were excluded, because Persian cannot be considered as their (dominant) first language (see footnote 23). 3 other persons were excluded due to insufficient cooperation (i.e. lack of motivation or lack of time).

[25] Although Arabic script is written from right to left, a pretest revealed that subjects perceive a rating scale as more natural, if its direction goes from left to right, i.e. its minimum is expected at the left. This fact might be due to a relation between the numerical character of a rating scale and the directionality in the writing of decimal numbers which, contrasting to the rest of the script, are written in Persian from left to right.

چرا علی با خودش برد حسین؟ [R1]

−   +

شیوا گفت که اتاقُ حدسٌ می زنه که نرگس تمیز کرده [44]

−   +

حسین کیُ عصر خوشحال کرده؟ [26]

−   +
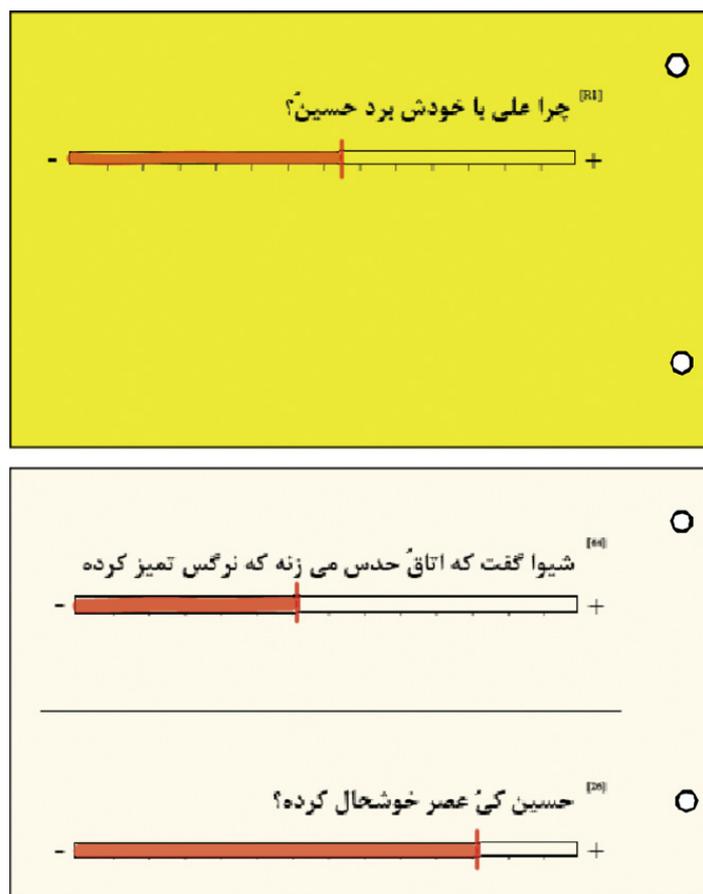
Fig. 1. Example sheet of the gradient acceptability judgment test.

section 2.1). This mostly results in an intermediate scale anchor as is shown in Fig. 1.[26] For quantifying the acceptability level, subjects could thus not only estimate the distance from the endpoints, but they could also compare the experimental sentence with the judgment already assigned to the reference sentence. In other words, they could take into consideration whether the experimental sentence had a higher or lower value, and as to how much higher or lower this value was. Therefore, the test uses a bipolar, anchored graphic rating scale with the characteristic that the subjects choose the anchor for themselves. One essential element of this instrument of measurement consists in its instruction and training phase requiring roughly one third of the total test time. In a 9-step procedure the concepts of *isolated grammaticality* and *gradience* were imparted (cf. Adli, 2004 for further details), and practiced judging 8 instruction and training sentences. An understanding of what I call isolated grammaticality helps to reduce interferences with extra-grammatical factors (e.g. an intuitive sense of pragmatic plausibility). Subjects were generally instructed to restrict their judgment to the spoken variety, i.e. their ratings should not be biased by the fact that a certain word order is not considered as licit in the written variety although it is accepted in the spoken variety, or vice versa.[27] In addition, they were taught the distinction between echo- and non-echo-questions. They should exclude the echo-interpretation from their considerations, which is important when rating *wh*-in-situ constructions. As regards gradience, the instruction and training phase led participants first from a binary to an ordinal and then to a truly metrical concept of acceptability. In the end, participants should not only be able to place different

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[26] Instead of the classic rating scale, Bard, Robertson & Sorace (1996) propose the use of magnitude estimation. This approach is typically applied in the measurement of psychophysical variables. The particular properties of a psychometrical function motivates the use of magnitude estimation, where the estimation is carried out in *multiplicative* relation to a reference value. However, it seems doubtful to me, whether this situation can be transferred to the domain of grammaticality judgments, where we do not dispose of the required psychophysical parameters (we neither have a quantifiable *just noticeable difference* value, nor a constant error). One has to have good reasons in order to deviate from the common measurement scale and to postulate a special case. The cross-modality matching carried out by Bard, Robertson & Sorace (1996: 52ff.) cannot validate such a claim, either. Furthermore, the authors wrongly assume that the results obtained by magnitude estimation are superior to common rating results in terms of scale quality. There is a wide consensus in empirical methodology that the levels of most rating scales can be considered equidistant (construct validity and a sufficient number of levels assumed), i.e. rating results can be assumed to be metrical.

[27] Note that Persian shows a pronounced difference between the written and the spoken variety which is, for example, much more distinct than in modern French (but nevertheless less distinct than, say, in Arabic). Frommer (1981: 13–16) enumerates four prominent characteristics of spoken Persian: verb-stem contraction, different 3rd person singular agreement suffix for various tenses, cliticization of the Persian analogue of the verb "be", and the phonetic change of [ɒ] to [u] before the nasals [n] and [m]. In addition, a substantial number of lexemes is exclusive to the written variety. The script of the experimental sentences reflect the forms of the spoken variety, for example in the case of the object and specificity marker: OM is not written as [rɒ], but as [o], [ro], or [jo] (using either the letter و or the diacritic ٵ).

constructions in an order, but also to have a sense of the proportionality of the acceptability values. In average, the training and instruction lasted 15 min (reflecting the fact that understanding the notion of gradient acceptability and how to express it on a rating scale is anything but trivial, especially for non-linguists), the experimental phase itself 25 min.[28]

Each construction was presented in 3 lexical variants to every person. The dependent variable is the mean value of the 3 variants.[29] There are 11 different simple *wh*-questions, (1a) to (3c), 3 complex constructions, (4a), (4b), and (24), as well as 4 multiple *wh*-constructions, (5a) to (6b). Given that each construction comes in 3 lexical variants, we base our results on (11 + 3 + 4) × 3 = 54 experimental sentences (see Appendix A for a complete list of the material). All experimental sentences use different lexical material for the (non-pronominal) NPs and the verb (except for the matrix bridge verbs "think" and "say" in the complex construction of the type (4a), (4b), and (24)), in order to avoid artifacts due to semantic repetition. 4 different versions of the test were used which only differed in the order in which the experimental sentences were presented, thereby compensating any possible order effect. The graphic rating lines were measured at a 1-mm (=0.04 in.) accuracy level. In view of a better readability, methodological aspects of the applied statistical techniques as well as the detailed quantitative results of each analysis of variance can be found in Appendix A. Readers less familiar with the concepts of analysis of variance (e.g. main effect, interaction, simple main effect, partial η^2 effect size) are invited to read the first part of Appendix A before continuing with the following sections.

3.4. Simple wh-questions

Three different, partly overlapping ANOVA designs will be constructed in the following subsections based on the full picture of the simple *wh*-questions given in Table 1 in section 3.1 (and listed at the beginning of section 2). They will focus (i) on the unmarked order and local NP-scrambling of ±*wh* (section 3.4.1), (ii) on the comparison between in situ and scrambled *wh*, and the comparison between *wh*-adjunct and *wh*-NP scrambling, and the ungrammaticality of postverbal *wh* (section 3.4.2), (iii) on NP postposition and postverbal *wh*-elements (section 3.4.3). Fig. 2 summarizes the mean gradient acceptability values of the sample and gives a good overview of the result pattern (for reasons of space, I do not repeat all test sentences presented further above). The higher a sentence on the *y*-axis, the higher its degree of acceptability. Note however, that arithmetic means do not show an important parameter that one needs to know in order to find out whether a difference is statistically significant or not: the variance (more precisely, the standard error which also includes information on the sample size). The line chart helps in a more intuitive understanding, but any detailed conclusions have to be drawn based on the statistical tests.

3.4.1. Unmarked order

In a first step, I will compare both constructions with non-initial, preverbal *wh*-position, namely the O Adj$_{temp}$ V order and the Adj$_{temp}$ O V order. According to Karimi and Taleghani's (2007:169) phrase structure, the canonical order is Adj$_{temp}$ O V. I repeat the test sentences with original numbering, indicating the phrase structure.

(1a)   [$_{TopP}$ sɒrɒ$_i$ [$_{TP}$ ketɒb -eʃ -o$_k$ [$_{AdvP}$ kej   [$_{vP}$ t_i t_k xæride]]]]
         Sara   book -her -OM   when   bought

(1a') [$_{TopP}$ sɒrɒ$_i$ [$_{TP}$ [$_{AdvP}$ kej   [$_{vP}$ t_i ketɒb -eʃ -o   xæride]]]]
         Sara   when   book -her -OM bought
         'When did Sara buy her book?'

(1c)   [$_{TopP}$ bɒbæk$_i$ [$_{FocP}$ ki -ro$_k$ [$_{TP}$ [$_{AdvP}$ emruz [$_{vP}$ t_i t_k zæde]]]]]
         Babak   who -OM   today   hit

(1c') [$_{TopP}$ bɒbæk$_i$ [$_{TP}$ [$_{AdvP}$ emruz [$_{vP}$ t_i ki -ro   zæde]]]]
         Babak   today   who-OM hit
         'Who has Babak hit today?'

Scrambled *wh*-arguments in Persian are [+c-focus], hence more context-dependent, in contrast with canonical *wh*-elements, which are generally [-c-focus], hence less context-dependent. In section 3.2.1 I argued that c-focused *wh*-questions are, when out of context, more marked than *wh*-questions with i-focus. If this idea is on the right track, then we can

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[28] Some authors have opted for the opposite strategy applying a technique called speeded acceptability judgments, where the subject has to make a binary classification of sentences in terms of acceptability as quickly as possible (e.g. McElree and Griffith, 1995). The criterion of construct validity requires to choose the approach(es) that is/are best suited for measuring what one wants to measure. Sometimes the ideal can also consist of a well-chosen combination of complementary methods, when different techniques capture different relevant aspects of the human language faculty. I believe that nuanced acceptability judgments that should reflect systematic differences in markedness require a *slow* approach in which subjects have time to assess all details. Rather than producing artifacts or psycholinguistic contamination, the slow approach results in precision and validity. Based on various experiments that I have carried out in the last years, I feel confident to claim that the most serious source of artifact is insufficient instruction. It increases the number of situations in which subjects, namely non-linguists, confound relevant grammatical aspects and irrelevant aspects (in this respect the creativity of subjects can be surprising: irrelevant aspects can be pragmatic plausibility, opaque ideas of "elegance", etc.).

[29] The difference between the satisfactory average-measure-ICC of 0.84 (McGraw and Wong, 1996) and a low single-measure-ICC of 0.59, reported by Adli (2004: 108), confirms that it is essential to use various lexical variants for each construction, i.e. it would be largely insufficient to have only one lexical example of each syntactic structure in question.

Table 1
Simple *wh*-questions in this study, according to *wh*-position, *wh*-type, and subject position.

wh-position ⇒	non-initial, preverbal				initial		postverbal	
	Adj O V		O Adj V					
wh-type ⇒	*wh*-adjunct	*wh*-NP	*wh*-adjunct	*wh*-NP	*wh*-adjunct	*wh*-NP	*wh*-adjunctc	*wh*-NP
⇓ subject position								
preverbal	(1a')	(1c')	(1a)	(1c)	(2a)	(2c)	(3a)	(3c)
postposed			(1b)		(2b)		(3b)	
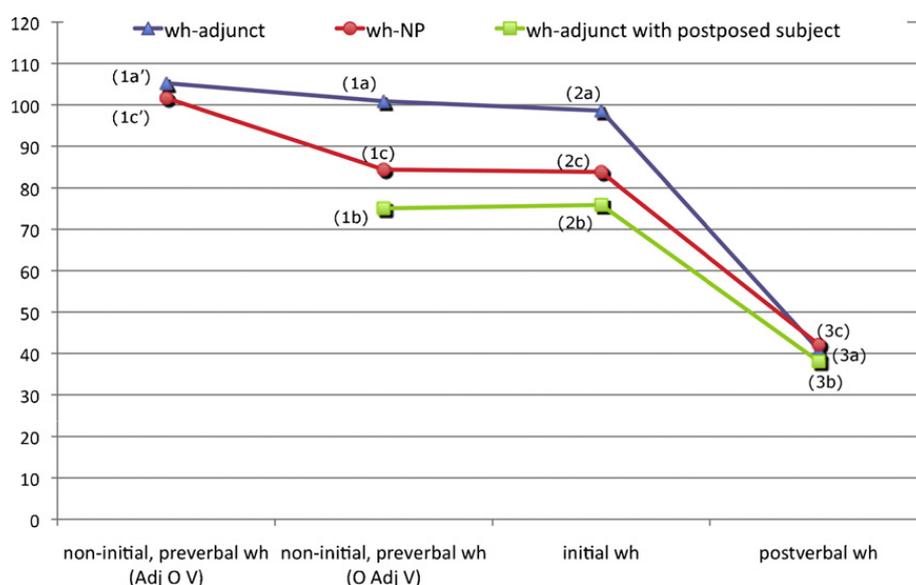
Fig. 2. Acceptability values of simple *wh*-constructions.

Table 2
ANOVA I - design for variables '*wh*-type' and 'adjunct position'.

A: *wh*-type ⇒	a_1: *wh*-adjunct	a_2: *wh*-NP
⇓ B: order of Adj_{temp} and O		
b_1: O Adj_{temp} V	(1a)	(1c)
b_2: Adj_{temp} O V	(1a')	(1c')

hypothesize that the Adj_{temp} O V order is also the unmarked case. This issue is tested by a two-way analysis of variance with the two within-subjects variables '*wh*-type' and 'adjunct position' as is shown in Table 2. The first two data points of the top two lines in Fig. 2 graphically show the relevant mean values. The conclusions of this analysis are restricted to temporal/ locative adjuncts, since I am not systematically distinguishing adjunct types according to their semantic role (see e.g. Bakovic, 1998) and their modifyee (VP, IP, or CP, in terms of Rigau, 2002).

Main effect test B 'order of Adj_{temp} and O' is significant ($p < 0.000$). Constructions of the type (1a') and (1c') with the Adj_{temp} O V order have a higher acceptability value than constructions of the type (1a) and (1c) with the O Adj_{temp} V order. The empirical findings show that the unmarked sequence in Persian is Adj_{temp} O V and suggest that the assumption, according to which context dependency translates into markedness with isolated sentences, is on the right track. In what follows I will henceforth call the unmarked variants (1a') and (1c') *wh*-in-situ, irrespective of the fact whether there was string-vacuous movement (i.e. displacement without changing the linear order) or not.[30]

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[30] Unless there is compelling evidence, I do not consider string-vacuous (parallel) movement such as Adj_i O_k t_i t_kV for the unmarked order. First, I try to minimize the amount of stipulated derivations for the unmarked case. Second, under the assumption that scrambled *wh*-NPs in Persian are [+c-focus], a derivation like Adj_i *wh*-O_k t_i t_kV makes wrong predictions (and (1c') would by definition not be unmarked anymore, see also footnote 1).

The second result of ANOVA I is the significant interaction A × B ($p < 0.000$). This interaction is due to the fact that the difference Δ between the unmarked Adj_{temp} O V and the marked O Adj_{temp} V word order is clearly smaller for *wh*-adjunct questions compared to *wh*-NP questions ($\Delta(1a)(1a') < \Delta(1c)(1c')$). One could also say that the O Adj_{temp} V order comes along with a sharp decrease in acceptability for *wh*-NPs, but only a very light decrease for *wh*-adjuncts. This difference is revealed by the partial η^2 values of the simple main effect tests $B|a_i$ which test for the adjunct position separately for *wh*-adjuncts and *wh*-NPs. As a descriptive measure of the size of a given effect, the partial η^2 value quantitatively represents the cost of a constraint like (29) for the sample. While $B|a_1$, i.e. (1a) vs. (1a'), has only a partial η^2 of 0.1 ($p < 0.002$), $B|a_2$, i.e. (1c) vs. (1c'), has a partial η^2 of 0.537 ($p < 0.000$). The cost for violating this constraint can be estimated by the difference Δ of the two partial η^2 values, which amounts to 0.437. This result offers interesting insight into the difference between the scrambling of *wh*-arguments and non-*wh*-arguments: As the phrase structures above show, the contrast boils down to a difference between a locally scrambled non-*wh*-argument as in the marked order (1a) and a locally scrambled *wh*-argument as in the marked order (1c). This finding is summarized in (29) (which concerns, like the following preference constraints, scrambling out of non-islands).

(29) local NP[-*wh*]-scrambling > local NP[+*wh*]-scrambling (preference constraint)

What is behind preference constraint (29)? The different degrees of acceptability after scrambling *wh*-arguments vs. non-*wh*-arguments are a consequence of different degrees of context dependency, or more accurately, of different degrees of difficulty to reconstruct an adequate context which meets the requirements to a plausible Common Ground. Scrambled *wh*-arguments are always [+c-focus], while scrambled non-*wh*-arguments can also be discourse-functionally neutral. Interestingly, (1a) and (1c) differ with respect to the size of the focus domain.[31] While (1c) contains a scrambled *wh*-NP and is thus [+c-focus], (1a) contains a *wh*-adjunct, which is [-c-focus] (yet it is focused, namely [+i-focus], given that it is a *wh*-phrase). Selkirk's (1984:207, 1995) focus projection rules, according to Büring (2006) the standard view on the matter, are not assumed to apply to contrastive focus, i.e. the focus domain of c-focused constituents is more restricted. Thus, the projection rules cannot apply to (1c), but they can apply to (1a). One can hypothesize that (29) is a reflex of a more general constraint, according to which broader focus is preferred over narrower focus (for sentences presented out of context).[32]

3.4.2. Comparing in-situ, initial, and postverbal wh

I will now turn to the effect of the *wh*-position (variable A) and, once again, of the *wh*-type (variable B) with a second analysis of variance. The O Adj V construction is disregarded in the design shown in Table 3 (I will come back to this word order variant in section 3.4.3).

The statistical results show a main effect, A, of the *wh*-position ($p < 0.000$), i.e. in situ, initial, and postverbal *wh*-questions do not have the same acceptability. There is a monotonic decrease starting with the *wh*-in-situ form, continuing with the *wh*-initial construction, and ending at the low value for postverbal *wh*-constructions. Contrasting with the presumed in situ constructions (1a') and (1c'), the *wh*-element has been scrambled to the left edge in (2a) and (2c). This finding is expressed in (30).[33] The violation cost is estimated by the partial η^2 values of pairwise contrast effect tests between single levels of variable A. They exhibit a difference between *wh*-in-situ and *wh*-initial with a partial η^2 of 0.505 (a_1 vs. a_2: $p < 0.000$).

(2a) [kej_k [$_{TP}$ $sɒrɒ_i$ [$_{AdvP}$ t_k [$_{vP}$ t_i ketɒb -eʃ -o xæride]]]][34]
      when Sara   book -her -OM bought
      'When did Sara buy her book?'

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[31] I owe this observation to an anonymous reviewer. Focus projection rules with regard to contrastive and non-contrastive focus are an interesting issue in Persian that merit further investigation. Karimi (2005: 154) distinguishes syntactic, morphological and phonological means to achieve contrastive focus interpretation (see section 2.2). Movement of *wh*-NPs to FocP is a syntactic mean. Future research has to clarify (i) whether and how phonology comes into play in syntactic means of contrastive focusing (taking Kahnemuyipour, 2003 as a starting point), and (ii) whether focus projection differs for syntactic and phonological means of contrastive focusing.

[32] The analysis also reveals a difference between *wh*-adjunct and *wh*-NP questions, which is, however, in comparison fairly small: The simple main effect test $A|b_2$ (i.e. (1a') vs. (1c')) shows that in the unmarked word order, argument questions come along with a cost of partial $\eta^2 = 0.097$ compared to adjunct questions. I dispense with raising the question whether there is a constraint, according to which *wh*-adjunct questions are preferred over *wh*-NP questions in isolated context (such as *wh*[−NP]-question > *wh*[+NP]-question). However, if other experimental results confirm this pattern (preferably in a clearer way), that line of argument should be pursued.

[33] One might be tempted to explaining the difference between the in situ constructions (1a') and (1c') and the *wh*-initial constructions (2a) and (2c) by the fact that the subject is a shifted topic (Spec of TopP) in the first case, while it is a background topic (Spec of TP) in the latter. However, evidence against an effect of the type of topic comes from a comparison of the O Adj V constructions (1a) with the *wh*-initial constructions (2a) (or likewise of (1c) with (2c)). Although the subject is a shifted topic in the former and a background topic in the latter, the constructions do not have different acceptability values (see the non-significant pairwise contrast a_1 vs. a_2 in section 3.4.3 and the corresponding non-significant result reported in the last part of the appendix).

[34] With *wh*-adjuncts behaving like sentential adverbs (Karimi and Taleghani, 2007), the temporal *wh*-adjunct must be adjoined to some functional projection above TP (background-topical subjects are placed in Spec,TP). Karimi (2008:1276) suggests that the ungrammaticality of the example below is due to the fact that Persian does not allow CP adjunction. Consequently, scrambled *wh*-adjuncts have to be placed in a different landing site (alternatively, one has to allow CP adjunction, but restrict it to sentential adverbs). I will not further discuss the issue of the left-peripheral landing site for scrambled *wh*-adjuncts; several aspects of *wh*-adjuncts in Persian offer fruitful opportunities for further research (see also footnote 13).
(i) *$rɒmin_i$ goft [$_{CP}$ be sɒrɒ [$_{CP}$ ke bɒbæk golɒ -ro t_i dɒd]]
      Ramin said to Sara that Babak flowers -OM gave
      'Ramin said that Babak gave the flowers to Sara.'

Table 3
ANOVA II - design for variables 'wh-position' and 'wh-type'.

A: *wh*-position ⇒	a_1: non-initial, preverbal *wh* (*wh*-in-situ)	a_2: *wh*-initial	a_3: postverbal *wh*
⇓ B: *wh*-type			
b_1: *wh*-adjunct	(1a')	(2a)	(3a)
b_2: *wh*-NP	(1c')	(2c)	(3c)

(2c)   [$_{FocP}$ ki   -ro$_k$ [$_{TP}$ bɒbæk$_i$ [$_{AdvP}$ emruz [$_{vP}$ t_i t_k zæde]]]]
         who -OM   Babak   today   hit

    'Who has Babak hit today?'

(30)   in situ *wh* > scrambled *wh*   (preference constraint)

Furthermore, we see that this difference is less pronounced compared to the difference between *wh*-initial and postverbal *wh* with a partial η^2 of 0.772 (a_2 vs. a_3: $p < 0.000$). These values confirm the fact that we have on the one hand the well-formed *wh*-in-situ and *wh*-initial constructions (which show however, nuanced differences among each other), and the ill-formed postverbal *wh*-constructions, on the other. In general, postverbal *wh*-elements are ungrammatical in Persian. This finding supports my criticism of Kahnemuyipour's (2001) analysis according to which *wh*-elements are base-generated in postverbal position. This line of argument can only be considered for *wh*-adjuncts of space in constructions with directional motion verbs, which have an exceptional behavior.[35] The pronounced decrease for the postverbal *wh*-construction reflects a violation of the well-formedness constraint (32) (and for (3c) also (31)), i.e. (3a) and (3c) have an incorrect discourse-functional interpretation. It is plausible to assume that postverbal *wh*-elements follow the same rules that govern postposed XPs in general. We have seen in section 2.1 that postposed XPs are [+topic]. This property conflicts with the fact that *wh*-elements cannot be topical, expressed by (32) (consequently, I do not agree with the occasionally expressed opinion according to which *wh*-elements can be (contrastive) topics, see for example Comorovski, 1996:144; or Willis, 2008).

(31)   Scrambled NPs[+*wh*] must be [+c-focus].   (well-formedness constraint)

(32)   *Wh*-elements cannot be [+topic].   (well-formedness constraint)

It is interesting to take note of Kural's (1992:18–26) observation that *wh*-elements in Turkish can be in canonical position as well as scrambled to initial position, but that they cannot be postverbal. And he also observes that postverbal XPs cannot be focused.

(33a)   Ahmet   kimi   görmüş?
         Ahmet   who-ACC see-PAST-AGR
         'Who did Ahmet see?'

(33b)   *Ahmet   görmüş   kimi?
         Ahmet   see-PAST-AGR who-ACC

A noteworthy result is the significant interaction A × B ($p < 0.000$), i.e. we find a specific interplay of both variables. This will be further analyzed by means of simple main effect tests. In a first step, simple main effects B|a_i test for the difference between *wh*-adjunct and *wh*-NP separately for each of the three *wh*-positions. The overall significance of main effect B is to some degree due to the contrast (1a') vs. (1c'), as shows B|a_1 with a partial η^2 of 0.097 ($p < 0.002$), but in particular due to the contrast (2a) vs. (2c), as shows B|a_2 with a partial η^2 of 0.453 ($p < 0.000$). I estimate the violation cost by the difference Δ of the two partial η^2 values that amounts to 0.356. A displaced *wh*-NP is more marked than a displaced *wh*-adjunct in *wh*-initial constructions.

(34)   *wh*[-NP]-scrambling > *wh*[+NP]-scrambling (preference constraint)

(34) can be explained along similar lines as preference constraint (29): Scrambled *wh*-arguments are always [+c-focus], while scrambled *wh*-adjuncts are not (unless they belong to the subclass which is assumed to have a nominal element). The

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[35] Apart from examples with directional movement verbs, Kahnemuyipour (2001: 47) builds his evidence on sentences with embedded clauses as in (i). In my opinion, this is not convincing. He does not pay attention to the fact that the postverbal element is an adjunct clause. They behave differently from phrasal adjuncts which are unmarked in preverbal position as in (ii), while being marked in postverbal position (see Karimi, 2001, 2005:10).

(i)   æli bɒ   mærjæm   ezdevɒdʒ kærd   tʃon   dus-eʃ-dɒʃt.
       Ali with   Maryam   married   because   liked-her
       'Ali married Maryam because he loved her.'

(ii)   æli   bɒ   mærjæm   bexɒtere   eʃɣ   ezdevɒdʒ kærd.
       Ali   with   Maryam   because of   love   married
       'Ali married Maryam out of love.'

former are more context-dependent than the latter.[36] The displaceable property of Persian *wh*-adjuncts also relates to the fact that they are quantificational. Karimi and Taleghani (2007) argue that in situ *wh*-adjuncts are quantificational being a QP, while in situ *wh*-arguments are not given their DP status (irrespectively of the quantificational property of all *wh*-elements given the *wh*-feature movement to C, as they point out).

However, we would expect the postposed subject to lower the acceptability value, which is not the case (see next section). It is striking that this effect does not show up in constructions with the *wh*-element in postverbal position – all sentences with postverbal *wh*-element are equally unacceptable. My interpretation is that these sentences violate (at least) one well-formedness constraint, which not only (and expectedly) has a dramatic effect on acceptability; also, that violation hardly leaves any space for the subtle effects of preference constraints (more on this later).

3.4.3. Including postposition in the analysis

ANOVA III (Table 4) differs from the design of ANOVA II in the fact that variable B distinguishes here between subjects in preverbal and postposed position (see also section 2.1). It allows us to study the impact of the subject position, and of the possible interaction between *wh*-position and XP-postposition. The top and the bottom line in Fig. 2 graphically represent the arithmetic means. This design only takes into account *wh*-adjuncts.

The test of main effect A '*wh*-position' is very similar to the one calculated in section 3.4.2, but it is not redundant. Concerning the non-initial preverbal *wh*-position, ANOVA II took into consideration the Adj O V variant. Now the design in Table 4 takes into account the O Adj V variant for which we have a form with postposed subject. It covers *wh*-adjunct questions in which the subject is either in preverbal or postposed position.

Main effect A is significant ($p < 0.000$). Compared to ANOVA II, the lines corresponding to this design do not show the same kind of development between the different levels of the variable '*wh*-position'. Instead of the monotonic decrease reported in section 3.4.2, there is practically no slope between the non-initial, preverbal O Adj_{wh} V and the *wh*-initial construction, reflected in the non-significant pairwise contrast a_1 vs. a_2 ($p < 0.545$). The O Adj_{wh} V constructions with the non-initial, preverbal *wh*-position, as well as the constructions with initial *wh*-position, have in common that they are non-canonical word orders. In other words, they exhibit some sort of rearrangement, although of different elements and to different landing sites. It was already said that in the O Adj_{wh} V construction (1a) the object is scrambled and the *wh*-adjunct remains in situ, while in the *wh*-initial construction (2a) the *wh*-adjunct is scrambled and the object remains in situ. These results reveal that the scrambling of non-*wh*-NPs and the scrambling of *wh*-adjuncts are identical in terms of the acceptability value, summarized in (35).[37]

(35)   NP[-*wh*] scrambling = adjunct[+*wh*] scrambling

This finding is not surprising, because scrambling of non-*wh*-NPs and *wh*-adjuncts have a common information-structural and semantic property: They are compatible with a background scrambling analysis, and they can both have a non-exhaustive denotation (see section 2.2). Taken together, (34) and (35) show that *wh*-adjuncts and non-*wh*-elements are more readily displaceable than *wh*-arguments in Persian local scrambling (in isolated context). The latter do not result in c-focus-specific contextual requirements.

The results also show a pronounced decline towards the postverbal *wh*-order, reflected in the significant pairwise contrast a_2 vs. a_3 ($p < 0.000$) with a high partial η^2 of 0.831. The impossibility of postverbal *wh*-elements (except for directional movement verbs) has already been captured by the well-formedness constraint (32) above.

Main effect test B reveals significant ($p < 0.000$) corresponding to the lower acceptability value of constructions with postposed subject compared to those with the subject in canonical position. I express these findings in preference constraint (36). The cost of postposed subjects corresponds - after excluding the postverbal *wh*-constructions - to a partial η^2 value of 0.594. The exclusion of ill-formed constructions is due to the fact that the subtle effects of preference constraints are obscured, once a well-formedness constraint is violated.

(36)   preverbal subject position > postposed subject (preference constraint)

We have seen in section 2.1 that postposition is not restricted to subjects, but is rather possible with a number of different elements. From an information-structural perspective, postposed elements are comparable (apart from adjuncts expressing destination). I therefore consider a generalization of (36) as plausible, stipulating that non-postposed constituents are generally preferred over postposed constituents (again excluding destinations). It would also be plausible to assume that the

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[36] In order to verify that the cost of *wh*-NP scrambling in isolated context is stable across different sentences, I compared in a separate analysis of variance (which I do not expose in full length here) (1c) and (2c), which are two non-canonical word orders with *wh*-NP. Not surprisingly, the results show no difference between (1c) and (2c), either (p < 0.758). In both cases, the *wh*-argument has been scrambled to FocP. The difference between them, is that the (shifted-topical) subject is raised to TopP in (1c), while the (background-topical) subject is raised to TP (2c); however, this is not relevant in contextual terms, because in both cases the subject can be assumed to be "background in some sense" (Svenonius, 2002: 214): The respective entity is clearly commented on in the preceding or following discourse for background topics, while some (of what Svenonius calls) "features" of the respective entity or concept have been made salient for shifted topics.

[37] Although (35) is logically not an inequation but an equation, it can also be treated, like (34), as a preference constraint. In this case, the features on both sides of the equation can be viewed as having equal costs (or as having a cost of 0). The same applies to (38) in section 3.5.1.

Table 4
ANOVA III - design for variables 'wh-position' and 'subject position'.

A: *wh*-position ⇒	a_1: non-initial, preverbal *wh* (O Adj$_{wh}$ V)	a_2: *wh*-initial	a_3: postverbal *wh*
⇓ B: subject pos.			
b_1: preverbal	(1a)	(2a)	(3a)
b_2: postposed	(1b)	(2b)	(3b)

cost of most other postposed elements is lower than the cost for postposed subjects. Subjects rank low in the postposability hierarchy stated by Frommer (1981: 171/172), meaning that postposed subjects have a higher degree of markedness.

At the same time we notice a significant interaction A × B ($p < 0.000$) due to a specific combination effect of the *wh*-position and the subject position: Simple main effect tests B|a_i show that a difference between canonical and postposed subjects exists for O Adj$_{wh}$ V constructions (B|a_1: $p < 0.000$) and for initial *wh*-constructions (B|a_2: $p < 0.000$), but not for sentences with postverbal *wh*-element (B|a_3: $p < 0.080$). Constraint (36) is therefore not valid for the ill-formed postverbal *wh*-construction. Recall that simple main effect B|a_3 in the analysis of variance in section 3.4.2 has also been non-significant. There is no difference between (3a), (3b), and (3c). Preference effects disappear as soon as we deal with the ill-formed postverbal *wh*-construction. These limitations reveal a general property of ungrammatical constructions stated in (37) (I will come back to it later).[38]

(37)　　Principle of consistency in ungrammaticality: The violation of a well-formedness constraint results in a low acceptability value with minimal variation.

According to Frommer (1981), the larger issue behind the phenomenon of postposing in the context of Persian word order is the question as to whether Persian is losing its verb-final property. Evidence for such a syntactic change in progress would have been in line with Greenberg's (1963, 1966) typological generalizations. All phrasal elements other than VP are head-initial in Persian. Furthermore, Persian has prepositions rather than postpositions. It is therefore unusual that Persian is at the same time verb-final.[39] This combination of the position of the head and the verb position is a rarity making Persian an unusual member of type III languages in Greenberg's (1963) classification. These unusual combinations are considered as "disharmonic" and unstable over time, as for example Hawkins (1979:647) states: "The currently extremely disharmonic languages should not have been in a disharmonic state for a long period of time" (for a critical discussion see also Krifka, 1985; Dryer, 1992). As regards Persian, this view implies a pressure towards loss of the verb-final property (or towards loss of head-initiality), as is also hypothesized by Dabir-Moghaddam (2006). The empirical results above are limited to the postposition of subjects. However, the effect discovered is sufficiently clear. It does not support the hypothesis on the loss of verb-final property. Obviously, this is a first exploration and stronger conclusions can only be drawn based on real longitudinal data of a full range of postposition phenomena, or based on a rigorous study within the framework of apparent time (Labov, 2007).

3.5. Complex wh-questions and long scrambling

3.5.1. Complex wh-questions with embedded wh-construction

The ANOVA design shown in Table 5 includes four different *wh*-argument questions (Fig. 3). It takes up two simple constructions from section 3.4, namely the *wh*-in-situ (Adj O$_{wh}$ V) variant (1c') and the form with initial *wh*-element (2c). Sentences (4a) and (4b) represent the analogous complex versions of these constructions (all test sentences are repeated below with their original numbering).

(1c')　　bɒbæk　emruz　ki　　-ro　　zæde?
　　　　　Babak　today　who　-OM　hit
(2c)　　ki　　-ro　　bɒbæk　emruz　zæde?
　　　　　who　-OM　Babak　today　hit

(4a)　　fekr-mikon　-i　　ke　　bɒbæk　emruz　ki　　　-ro　　zæde?
　　　　　think　　　　-you　that　Babak　today　who　-OM　hit
(4b)　　[ki　-ro]$_i$　fekr-mikon　-i　　　ke　　bɒbæk　emruz　t_i　　zæde?
　　　　　who-OM　　think　　　　-you　that　Babak　today　　　hit

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[38] Sentence (3b) also involves direct object postposing alongside subject postposing. As a matter of fact, if preference constraints were effective for the constructions with a postverbal *wh*-element, we could expect an even lower acceptability value for (3b), presumably due to another violation of a preference constraint analogous to the one in (36).

[39] Karimi (2005: 4–7) briefly discusses Kayne's (1994) theory of antisymmetry, according to which all S O V languages should be derived from an underlying S V O order. She rejects this view maintaining the assumption of an S O V base order.
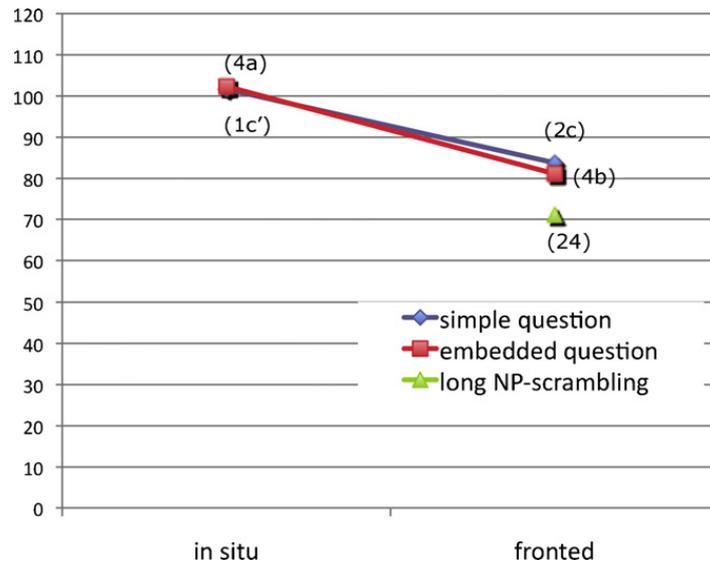
Fig. 3. *Wh*-in-situ, local and long fronting.

Table 5
ANOVA IV - design for variables 'sentence complexity' and '*wh*-position'.

A: sentence complexity ⇒ ⇓ B: *wh*-position	a$_1$: simple question	a$_2$: complex question
B$_1$: in-situ *wh*-NP	(1c')	(4a)
B$_2$: initial *wh*-NP	(2c)	(4b)

Main effect A 'sentence complexity' is non-significant ($p < 0.405$). It has no effect on the acceptability value whether the *wh*-construction is simple or complex. This also holds for the interaction $A \times B$ ($p < 0.089$), i.e. sentence complexity does not act via the *wh*-position, either.

The only relevant variable is the *wh*-position itself, as shows the significant main effect B ($p < 0.000$). We see that it is not important whether a *wh*-argument undergoes local *wh*-scrambling as in (2c) or long *wh*-scrambling as in (4b), expressed in (38). What does matter is whether the *wh*-element is scrambled at all which we have already observed in section 3.4.2: We see that preference constraint (30) holds for both simple and complex *wh*-questions, i.e. *wh*-in-situ (i-focused) questions are preferred over *wh*-scrambled (c-focused) ones no matter if the *wh*-element originates in the matrix or in the embedded clause.[40]

(38)   local [+*wh*]-scrambling = long [+*wh*]-scrambling

A different pattern has been reported by Mahajan (1990: 128-130) for Hindi *wh*-questions embedded by a matrix bridge verb. Not only is (39a) with the *wh*-element embedded more marked, it is even considered as ungrammatical. The *wh*-element must be fronted in these constructions (according to Mahajan, the phenomenon is only absent if the embedded clause is an infinitival).

(39a) * raam-ne   socaa   ki kOn aayaa hE
       Ram-ERG   thought   who has come
       'Who did Ram think has come?'

(39b) kOn   raam-ne   kahaa ki aayaa hE
       who   Ram-ERG   said   has come
       Who did Ram say has come?

Interestingly, Hindi *wh*-elements can stay in situ, if a question particle *(kyaa)* is present in the matrix clause (which could be seen as an overt typing particle in the sense of Cheng, 1991).[41]

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[40] Long *wh*-adjunct scrambling has not been part of the experimental protocol. However, there is so far no evidence indicating that they should behave differently from local *wh*-adjunct scrambling (such as being forced into a different landing site). I therefore consider it plausible to assume that local and long *wh*-scrambling for both adjuncts and NPs do not differ.

[41] Karimi & Taleghani (2007) follow Aoun & Li's (1993) claim that there is a *wh*-operator in the Spec of CP, and they assume obligatory movement of the *wh*-feature to C in order for it to be in an Agree relation with the *wh*-operator (guaranteeing scope marking and sentence typing).

(40) raam-ne　kyaa　socaa　　ki　kOn　aayaa　hE
　　　Ram-ERG　PART　thought　　who　has　come
　　　'Who did Ram think has come?'

3.5.2. Long NP-scrambling vs. long wh-scrambling

In the following I compare long *wh*-scrambling as in (4b) and long NP-scrambling as in (24) (Table 6). In (24) the specific direct object-NP (*otɒɣ-o*) has been scrambled out of the lowest CP into the intermediate CP. Note that the scrambled element is in both cases an NP. However, it is [+*wh*] in (4b) and [-*wh*] in (24).

(24)　ʃivɒ　goft [ke　[otɒɣ -o]$_i$　hæds mizæne [ke　nærges　t_i　tæmiz kærde bɒʃe]].
　　　Shiva　said　that　room -OM　guesses$_{3rd,sg.}$　that　Narges　cleaned　　　had
　　　Shiva said that she guessed that Narges had cleaned the room.

A t-test for 2 paired samples determines whether both constructions differ. The results show a significant difference between (4b) and (24) ($p < 0.000$). Long NP-scrambling has a lower acceptability value than long *wh*-scrambling (Fig. 3). We can resume this result in the following observation (which will be traced back to the preference constraint (44) given below).

(41)　long NP[+*wh*]-scrambling > long NP[-*wh*]-scrambling

Given preference constraint (29) (local NP[-*wh*]-scrambling > local NP[+*wh*]-scrambling) postulated before, we can draw a picture with "crossed lines" concerning the markedness differences of NP[±*wh*] scrambling with respect to local and long scrambling. At first sight, this finding seems to corroborate the assumption according to which local and long scrambling represent different instances of *Move* (Webelhuth, 1992; Dayal, 1994). It is not predicted by Karimi's (2005:217) analysis where long NP-scrambling and *wh*-fronting in Persian are reduced to the same underlying syntactic rule (see chapter 2.3 on the lack of an A/A'-contrast, and on the fact that the target clause cannot host two constituents with the same grammatical function, like subject, object, etc.). One might also think that the lower acceptability value of (24) is a complexity effect due to a level of iterative CP-embedding of 2, compared to a level of 1 in (4b). Nevertheless, an essential result of section 3.5.1 was precisely the fact that there is no complexity effect in *wh*-constructions. Although we do not have yet evidence for extending this assumption to non-*wh*-constructions, an explanation of the contrast between (4b) and (24) in terms of mere complexity seems to me a rather implausible hypothesis.

However, an important observation is the difference in landing site of the scrambled elements. The *wh*-element lands in the matrix clause in (4b), while it lands in the intermediate CP in (24). In order to further pursue this hypothesis, I look at two *wh*-interrogatives which both contain two embedded complement clauses, i.e. which both have intermediate CPs.[42] In (42a) the *wh*-element has been scrambled to the intermediate CP (to a position right-adjacent to the complementizer), and in (42b) it has been scrambled to the beginning of the matrix clause.

(42a)　ʃivɒ　　goft [ke　[tʃi -ro]$_i$　hæds mizæne [ke　nærges　t_i　tæmiz kærde bɒʃe]]?
　　　　Shiva　　said　that　what-OM　guesses$_{3rd,sg.}$　that　Narges　　cleaned　　had

(42b)　[tʃi -ro]$_i$　ʃivɒ　goft [ke　hæds mizæne [ke　nærges　t_i　tæmiz kærde bɒʃe]]?
　　　　what-OM　Shiva　said　that　guesses$_{3rd,sg.}$　that　Narges　　cleaned　　had
　　　　What did Shiva say that she guessed that Narges had cleaned?

Although both variants are possible constructions, (42a) is more marked than (42b). Interestingly, (42a) requires, in addition, heavy stress on the *wh*-argument tʃi-ro without which the sentence would be odd. We also find a similar contrast between the declarative construction (24) above with NP-scrambling to the intermediate CP and its counterpart in (43) below: (24) is more marked than (43). In the latter the direct object-NP has been scrambled to the initial position of the matrix clause.[43] Furthermore, the scrambled NP *otɒɣ-o* in (24) also requires heavy stress, contrasting with (43).

(43)　[otɒɣ -o]$_i$　ʃivɒ　goft [ke　hæds mizæne [ke　nærges　t_i　tæmiz kærde bɒʃe]].
　　　room -OM　Shiva　said　that　guesses$_{3rd,sg.}$　that　Narges　cleaned　　had

We can summarize these observations by the preference constraint (44) (making (41) spurious), and estimate its violation cost by the partial η^2 value 0.212 of analysis V.

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[42] Note that the following intuitions are not based on evidence from a gradient grammaticality judgment test. Only future research applying this empirical technique can provide an estimation of the respective costs.

[43] Persian not only lacks structural *wh*-movement but also structural topicalization (see section 2.3). Recall that structural topicalization shares a number of restrictions with structural *wh*-movement in languages with structural operator movement, while fronting of a non-*wh*-constituent into TopP shares restrictions with *wh*-scrambling in Persian.

Table 6
t-Test design for two types of long distance movement.

Long *wh*-scrambling	Long NP-scrambling
(4b)	(24)

(44) long scrambling to matrix CP > long scrambling to intermediate CP

The fact that scrambling into an intermediate position is more marked both for scrambled NP[-*wh*] and NP[+*wh*], and that in all cases it requires heavy stress (which scrambling into the matrix position does not require) might be explained in terms of a defective intermediate landing site for contrastively focused elements. I want to suggest that intermediate sentences in Persian differ from matrix sentences in that they have a defective C system: In a nutshell, movement into an intermediate FocP does not lead to a contrastive focus interpretation and a phonological focus strategy has to be applied. The notion of defectivity has been used in various ways in the literature. According to Chomsky (2000, 2001) it refers to lack of features, according to Pesetsky and Torrego (2007) it refers to lack of value. Pires (2006: chap. 2) discusses two hypotheses: Defective domains could be distinct regarding the functional projections they allow, or they could display the same functional projections with the functional heads lacking feature specifications. The discussion on defectivity has often centered on TPs in non-finite domains, mainly certain infinitive constructions and sentential gerunds. Gallego & Uriagereka (2007) also argue for the existence of a defective version of CP. Interestingly, they show that such defective CPs have "weak left-peripheral activity" restricting the possibilities of fronting. They argue that this approach can explain the asymmetries between indicative and subjunctive dependents in Spanish, by assuming that the embedded subjunctive in (45b) has a defective CP. (45a) allows movement of a focal element into the left periphery, because the embedded CP is complete.

(45a) Juan dijo [$_{CP}$ que [*muchas cosas*$_i$ [$_{TP}$ *pro* había   visto *t*$_i$]]]
        Juan said   that   many   things   had$_{3rd,sg,,indic.}$ seen
        'Juan said that a lot of things he had seen!'

(45b) *Juan quería [$_{CP}$ que [*muchas cosas*$_i$ [$_{TP}$ *pro* viera *t*$_i$]]]
        Juan wanted   that   many   things   see$_{3rd,sg,,subj.}$
        'Juan wanted a lot of things for him to see!'

My analysis for the preference described by (44) is that intermediate sentences in Persian have a defective C system, more precisely a defective focus phrase FocP$_{def}$, which does not give rise to a c-focus interpretation. However, a *wh*-NP that is scrambled into the Spec of FocP$_{def}$ is not ungrammatical, because the grammar can resort to a phonological c-focus strategy in order to ensure the required interpretation (being a landing site for potential topics, the Spec of TP is not available as an alternative landing site for the *wh*-NP in accordance with (32)). Therefore, the *wh*-element in an intermediate CP requires heavy stress.[44] What is behind the syntactic operation is an information-structural requirement formulated as the well-formedness constraint (31), according to which scrambled NPs[+*wh*] must be [+c-focus]. (42a) is possible with heavy stress, although more marked than (42b). Therefore, assuming that Persian intermediate C-structures are defective and movement into FocP$_{def}$ cannot yield a focus interpretation, we can substitute (44) by (46).

(46) For scrambled NP[+*wh*]:
       syntactic c-focus strategy > phonological c-focus strategy   (preference constraint)

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[44] The pattern is reverse for (42a) and (42b), if "wonder" is chosen as the matrix verb, i.e in this case landing in the intermediate CP is not the preferred case. (ia) is more marked than (ib).

(ia)   ʃivɒ æz xodeʃ porsid [ke [tʃi -ro]$_i$ hæds mizænæn [ke nærges *t*$_i$ tæmiz kærde bɒʃe]]?
        Shiva from herself asked   that what-OM guesses   that Narges   cleaned   had

(ib)   [tʃi -ro]$_i$ ʃivɒ æz xodeʃ porsid [ke hæds mizænæn [ke nærges *t*$_i$ tæmiz kærde bɒʃe]]?
        what-OM Shiva from herself asked that guesses   that Narges   cleaned   had
        'Shiva wondered what she guessed that Narges had cleaned?'

Verbs of indirect questions have an exceptional behavior. Other matrix verbs of stating and thinking, such as *fekr kærdæn* "think", *xijɒl kærdæn* "believe", confirm the pattern observed with (42a) and (42b), i.e landing in the matrix CP is preferred over the intermediate CP. Interestingly, we even observe this pattern with non-bridge matrix verbs (e.g. ɣæbul kærdæn "confirm", ɣæbul nækærdæn "deny", ʃæk dɒʃtæn "doubt"), i.e. verbs with a less factive interpretation (Kiparsky and Kiparsky, 1971) – irrespective of the generally higher markedness of constructions with non-bridge verbs (e.g. Cattell, 1978; Kluender, 1992; Müller and Sternefeld, 1995). This pattern with the verb "wonder" requires some other explanation. We also observe in other languages that verbs selecting indirect questions can have a peculiar behavior. For example, while *wh*-in-situ in French true information questions can usually occur in embedded sentences, it is prohibited with the matrix verb *se demander* ("wonder"). A (speculative) starting point is to assume that Persian indirect questions embedded by the verb "wonder" exceptionally have matrix properties, i.e. a left-periphery with a complete (non-defective) FocP.

However, how can we account for the facts in (24) and (43) in which the scrambled element is not a *wh*-phrase? In this case one can gain insight using analogy in syntactic reasoning, similar for example to the use of analogy by Reis (2000: 27) in her account of "blends" between properties of constructions with V2 extraction and constructions with integrated sentential parenthetical, or similar to what Sternefeld (1998a:28) is doing when he compares constructions with partial *wh*-movement and the semantically parallel colon constructions in German. We can then state that whatever relates structural long topicalization and structural long *wh*-movement in languages with operator movement, also relates long *wh*-scrambling and long NP-scrambling in Persian.[45] In other words, given that structural long topicalization and structural long *wh*-movement are syntactically kin operations in languages with structural operator movement, it is plausible to assume kinship between the analogous operations in languages without operator movement, thus between long *wh*-scrambling and long NP-scrambling in Persian. Therefore, I assume information-structural requirements for long NP-scrambling in Persian – the operation responsible for (non-structural) topicalization – that are similar to those observed with *wh*-scrambling. Consequently, I extend principle (31) and (46) by including long NP-scrambling.

(47)　Scrambled NP[-*wh*] and long distance scrambled NP[-*wh*] must be [+c-focus].

(48)　For scrambled NP[+*wh*] and long distance scrambled NP[-*wh*]:

　　　syntactic c-focus strategy > phonological c-focus strategy

Thus, long NP-scrambling also targets FocP. Likewise, it has to resort to phonological c-focus marking in intermediate CPs where FocP is defective. The results highlighted so far systematic differences in markedness depending on [±NP], [±*wh*], and the landing site. These fine-grained differences can be explained with different matrix and intermediate CPs, as well as with the information-structural properties of scrambling. The latter had already been pointed out by Kural (1992:93) in his analysis of Turkish: "It appears that for an analysis of scrambling in any language to be complete, one must in take into account, the focus/ presupposition structure created by the process".

One remaining and noteworthy observation comes from a comparison between the examples of long NP-scrambling on the one hand and the examples of long *wh*-scrambling, on the other. Long NP-scrambling seems to be generally more marked than long *wh*-scrambling, i.e. (24) is more marked than (42a), and (43) is more marked than (42b). Although analogous requirements for long NP-scrambling and long *wh*-scrambling are assumed, the latter produces a higher degree of unacceptability. For some reason, it is easier to give a focus interpretation to the *wh*-element *tʃi-ro* than to the NP *otʊɣ-o* (one has the impression that the latter needs to be "stressed more heavily" than the first one in order to produce the same effect). This observation is in line with those voices which assume *wh*-elements to come along with an inherent focus property (by which I do not necessarily mean a syntactic focus feature requiring feature checking). Lambrecht et al. (1998), for example, argue that the *wh*-element generally constitutes the focus of the question (see section 2.2). I assume that this inherent focus property on its own does not satisfy the well-formedness constraint (47) – also because (47) requires *contrastive* focus. But it nevertheless conveys some sort of "advantage" for its fulfillment.

3.6. Multiple wh-Questions

After the discussion of simple *wh*-constructions in section 3.4 and complex *wh*-constructions in section 3.5 I now turn to another insightful field of interrogative syntax, namely multiple *wh*-questions. Data on multiple interrogatives have been taken as evidence in several approaches relevant to the discussion on Persian *wh*-questions. Bošković (1997a,b, 2000) discusses the absence of superiority effects in Serbo-Croatian in the context of his focus movement approach. Kahnemuyipour (2001) has to confront the contradiction that Persian does show superiority effects (which he tries to deal with by analyzing them as "apparent superiority effects" along the lines of Bošković). Karimi (2005), on the other hand, relies on evidence from multiple *wh*-questions to corroborate her view according to which *wh*-scrambling in Persian is not triggered by focus features to be checked, but rather by the EPP in the sense of Chomsky (2000). Data from multiple elements having undergone long distance movement come into play in the distinction between languages with *wh*-operator movement and languages with *wh*-scrambling. Finally, Lotfi (2003) discusses the possible role of case in the licensing of non-canonical *wh*-orders. Underlining the importance of obtaining reliable data, we find in the literature different opinions about the well-formedness of multiple *wh*-questions in which a specific *wh*-object-NP (i.e. with the OM) precedes a *wh*-subject-NP such as (6b) given below: According to Kahnemuyipour (2001: 55) as well as to Karimi (2005:151) they are ill-formed, while they are well-formed according to Lotfi (2003: 173).[46] Data mismatch among authors concerning stipulated superiority effects is nothing rare: Meyer (2002: 247/248)

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[45] Analogical reasoning is a heuristic tool. It does not offer deeper answers, but it can hint to a promising direction for future research. It is promising and desirable to further investigate the technical reasons for the kinship between long *wh*-scrambling and long NP-scrambling.

[46] Kahnemuyipour (2001) assumes that subjects or objects first move to a relatively deep focus landing site (according to him immediately above *v*P) and then move again to a higher position in the left periphery in order to check syntactic features other than focus features. That second movement step would be responsible for the acceptability contrasts presented in the test sentences (5a) to (6b). Furthermore, note that Kahnemuyipour (2001) even marks one D-linked example of a fronted *wh*-object-NP with OM as ungrammatical. He does not discuss the issue as to whether the OM or D-linking have any consequences on superiority effects.

(i)　kodum　　-o　　ki　　gereft?
　　which one　-OM　who　got
　　'Who got which one?'
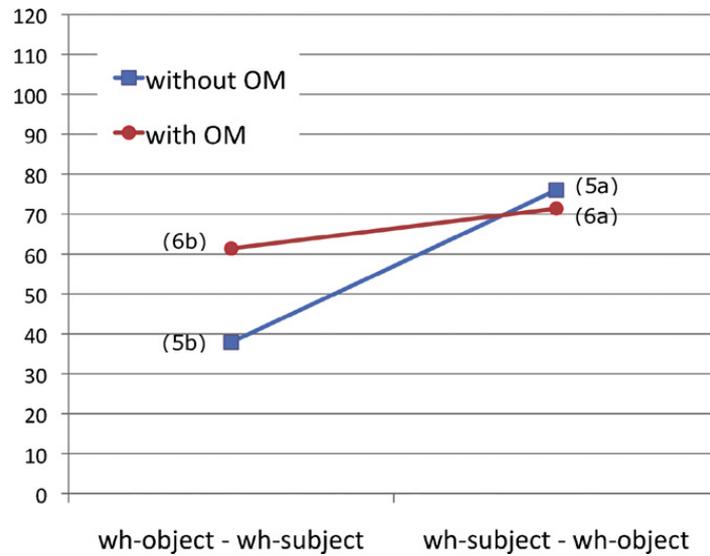
Fig. 4. Subject/object order and object marker.
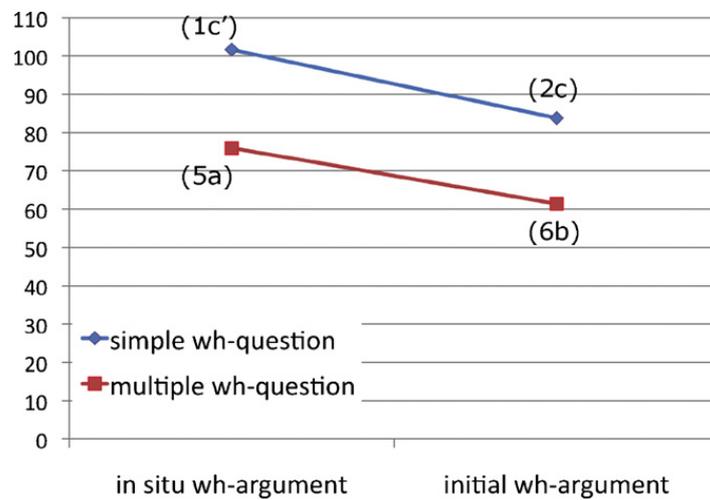
Fig. 5. Simple vs. multiple *wh*-questions.

needs 2 pages to fit a table in which he summarizes the contrasting opinions of 15 studies on superiority in various Slavic languages (finally he goes collecting his own experimental acceptability judgments).

(5a)   ki   tʃi   xord?
        who   what   ate

(5b)   *tʃi   ki   xord?
        what who ate

(6a)   ki   tʃi -ro   xord?
        who what-OM   ate

(6b)   tʃi -ro ki   xord?
        what-OM who   ate
        'Who ate what?'

In the following I will restrict myself to the question whether we find superiority effects in Persian constructions like (5b) and (6b) and what the role of the object marker is. Obviously, much more can be said on multiple *wh*-questions. I will not develop the issue of the semantic analysis of multiple focus constructions (Krifka, 1992) and the structure of multiple c-focus *wh*-questions (Surányi, 2007). And I will only briefly discuss constructions with multiple *wh*-fronting (see various papers in

Boeckx and Grohmann, 2003). I assume that multiple scrambled *wh*[+NP]-elements (or, more generally, multiple phrases with contrastive focus) occupy multiple specifiers of FocP in Persian (however, many instances of multiple *wh*-questions in Persian with canonical word order can be analyzed as multiple *wh*-in-situ constructions). As regards the OM, Karimi (2005:4) draws attention to the fact that the basic word order of sentences with both specific direct object (i.e. with OM) and PP is *S* O_{+OM} *PP V*, while the canonical order of sentences with both non-specific object and PP is *S PP* O_{-OM} *V*.[47] Given that Karimi and Taleghani (2007:169) place O_{+OM} inside *v*P, O_{-OM} can be assumed to be in PredP (Karimi and Taleghani's 2007 VP) which is the domain of existential closure in the sense of Diesing (1992), Kratzer (1995), and Diesing and Jelinek (1995). Thus, O_{+OM} escapes existential closure and receives interpretation outside of PredP.

3.6.1. Multiple wh-questions and the syntax/semantics of the object marker

One aspect that neither Kahnemuyipour (2001) nor Karimi (2005) take into account in their discussion of multiple *wh*-questions, is the role of the OM which Lotfi (2003) brings up. He looks at a variety of data on Persian multiple *wh*-questions including different constellations with *wh*-subject-NPs, *wh*-object-NPs and *wh*-adjuncts, and shows that superiority effects with *wh*-objects depend on the presence or absence of the OM and on the *wh*-type (*wh*-argument vs. *wh*-adjuncts) of the moved and the crossed element. Essentially, his findings can be resumed on a descriptive level by the following two points: (i) a *wh*-adjunct can scramble, but it cannot cross a *wh*-object-argument, (ii) a *wh*-object-argument can only cross other *wh*-arguments/*wh*-adjuncts if it bears the OM.

Table 7 shows the two-factorial design for the analysis.

The results reveal a significant main effect A '*wh*-subject/*wh*-object order' ($p < 0.000$). Multiple *wh*-questions with the order subject-before-object, have a higher acceptability value than those with the order object-before-subject. This result confirms the intuition already expressed by various authors that we find the preference for *wh*-subject-before-*wh*-object, known from languages sensitive to superiority, and also described for Persian. However, we need to look closer to the OM.

The significant interaction A × B ($p < 0.000$) indicates that the effect of the object marker is specific to the order of *wh*-subject and *wh*-object. The differences between the two orders come with very disparate effect sizes. As regards multiple *wh*-questions with the order subject-before-object (simple main effect B|a_1), sentence (5a) without the object marker is preferred over sentence (6a) with the object marker. This difference has a noticeable, but comparatively non-striking partial η^2 of 0.095 ($p < 0.003$). The direction is inverse for the order object-before-subject (simple main effect B|a_2) where sentence (6b) with object marker is preferred over sentence (5b) without (Fig. 4).

In this case, we observe a more pronounced partial η^2 of 0.367 ($p < 0.000$). These results, firstly, confirm that Lotfi's (2003: 173) intuition has been accurate with regard to the disputed status of (6b). The order object-before-subject is only clearly degraded, if the *wh*-object lacks the object marker (note that within a nuanced picture, (6b) should still be considered as somewhat suboptimal and not as fully acceptable).

What explains the role of the object marker in Persian multiple *wh*-questions? Essentially this affix has been associated with case and with specificity. The analysis of the OM as a specificity marker goes back to Browne (1970). Karimi (1990) adds that the OM also marks oblique (i.e. non-nominative) case. Ghomeshi (1997) proposes that the OM is a phrasal affix which heads a KP (Kase Phrase), case-marking NPs which are adjoined to VP. Windfuhr (1987) claims that the OM marks topic (which I do not consider as convincing, given scrambled, OM-marked *wh*-NPs, which are [+c-focus] and [-topic]).

The gradient acceptability judgments have confirmed Lotfi's (2003) observation of the crucial role of the OM. He puts forward the case aspect of the OM, and explains the facts by a case filter restriction on scrambled *wh*-objects (p. 182/183).[48] Basically, their displacement would not be restricted by superiority any more, if case requirements are met by the OM.[49]

Curiously, no attention has been paid to the fact that OM and D-linking (Pesetsky, 1987) have the same "repair effect". As a matter of fact, they are one and the same phenomenon. The parallelism comes to fore looking at the aspect of specificity in the analysis of OM (Browne, 1970; Karimi, 1990, 1996, 2003). "This phenomenon, which Pesetsky calls D-linking (discourse linking), is exactly the phenomenon characterized here as specificity" (Enç, 1991: 7).

Further note that the OM correlates with the property of referent uniqueness. Sentence (5a) allows both a pair list and a single pair interpretation, while (6a) only allows a single pair interpretation. Also compare (49a) and (49b). While (49a)

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[47] (i) shows the *S* $O_{+specific}$ *PP V* structure, (ii) the *S PP* $O_{-specific}$ *V* structure.
(i)   æli   kɒset   -o   bærɒje ɒrezu   xærid.
      Ali   cassette-OM   for   Arezou   bought
      'Ali bought the cassette for Arezou.'
(ii)   æli   bærɒje   ɒrezu   kɒset   xærid.
      Ali   for   Arezou   cassette   bought
      'Ali bought cassettes for Arezou.'

[48] Lotfi (2003) points out that *wh*-adjuncts are not supposed to require case-marking for scrambling. He further assumes a base-generated Q as an indefinite morpheme which is sister to the lowest *wh*-word, similar to Hagstrom's (1998) analysis of *wh*-markers. A fixed sequence of movements should then account for the differences between *wh*-arguments and *wh*-adjuncts as regards superiority: in a first step *wh*-arguments scramble, in a second step Q-movement occurs, and in a third step *wh*-adjuncts scramble.

[49] Arnon et al. (2006) propose a psycholinguistic account in terms of language processing. They argue that the relation between object case marking and superiority effects follows from the availability of information about the thematic assignment. They show that the smaller the number of nouns in a language which are ambiguous between nominative and accusative, the weaker the superiority effects measured by gradient acceptability judgments and reading times. This approach should account for the observation that the effects of superiority are strong in English, moderate in German and not apparent in Russian. Along their lines, the processing of Persian multiple *wh*-questions with the OM would be similar to what has been observed with Russian, and without OM the processing would be similar to what has been observed with English.

Table 7
ANOVA V - design for variables 'subject/object *wh*-order' and ' ± OM'.

A: *wh*-subject/*wh*-object order ⇒ ⇓ B: case/specificity marker	a₁: *wh*-subject - *wh*-object	a₂: *wh*-object - *wh*-subject
b₁: [−OM]	(5a)	(5b)
b₂: [+OM]	(6a)	(6b)

allows a pair list reading (which – in line with (54) given below – is also preferred over the single pair reading), (49b) can only receive a single pair reading. (49b) means that all children have read the same book. The same holds for (50a) (pair list, single pair) and (50c) (only single pair) further below.

(49a)　hæme　bætʃe -hɒ je　ketɒb　xundæn?
　　　　all　　child　-PL one book　　read
　　　　'All children have read one book.'

(49b)　hæme　bætʃe -hɒ je　　ketɒb　-o　　xundæn?
　　　　all　　child　-PL one　book　　-OM　read

Without a dedicated case filter requirement, the analysis of Persian multiple *wh*-questions is more parsimonious. However, there is a trade-off: In spite of numerous attempts (e.g. Rullmann and Beck, 1998; Pesetsky, 2000; Hirose, 2003; Boeckx and Grohmann, 2004), D-linking remains a poorly understood concept. In the following (and in the meanwhile), I adopt Comorovski's (1996) account of D-linking in terms of a general felicity condition on answerability.

Let us first inspect multiple *wh*-fronting. We find the same restrictions; a *wh*-object scrambled to FocP can come without the OM as long as it has not crossed another *wh*-phrase (recall that *ke* ('that') does not induce a that-trace effect, cf. section 2.3).

(50a)　[$_{FocP}$ ki$_i$　tʃi$_j$ [*pro* fekr mikoni [$_{CP}$ (ke) t_i t_j xord]]]?
　　　　who what　　think$_{dur,2sg}$　　(that)　　ate$_{3sg}$
　　　　'Who do you think ate what?'

(50b)　*[$_{FocP}$ tʃi$_j$　ki$_i$ [*pro* fekr mikoni [$_{CP}$ (ke) t_i t_j xord]]]?
　　　　what who　　think$_{dur,2sg}$　　(that)　　ate$_{3sg}$

(50c)　[$_{FocP}$ tʃi -ro$_j$　ki$_i$ [*pro* fekr mikoni [$_{CP}$ (ke) t_i t_j xord]]]?
　　　　what-OM who　　think$_{dur,2sg}$　　(that)　　ate$_{3sg}$

Rudin (1988) had already observed that Romanian and Bulgarian, two languages that allow multiple *wh*-movement, show restrictions on the order of *wh*-phrases which are surprisingly similar to those observed in English superiority effects. The Bulgarian examples (51a) and (51b) show that the subject must come first. If the *wh*-object in (51b) is substituted with its D-linked counterpart, the construction is clearly improved.

(51a)　Koj　kogo　e　vidjal?
　　　　who whom is　seen
(51b)　*Kogo　koj　e　vidjal?
　　　　whom who is　seen
　　　　'Who saw whom?'

(52a)　John knows who saw what.
(52b)　*John knows what who saw.

Comorovski (1996) refers to these observations with multiple *wh*-fronting in order to challenge the view of LF movement as such, claiming that the *wh*-in-situ (or an empty operator associated with it as suggested by Watanabe, 1992) does not need to move at LF for interpretation purposes. She also reports her survey that shows that Chinese and Korean (often referred to as "pure" *wh*-in-situ languages) do *not* show LF intervention effects. Rather Comorovski (1996: 90/91) claims, in line with Reinhart (1998), that *wh*-phrases can always be interpreted in the position in which they actually occur. She accounts for the ungrammaticality of sentences like (51b), and the "repair effect" observed with D-linking, by the following semantic/pragmatic condition which does not make any reference to LF-movement: Questions have to be *answerable* (see also Guerzoni, 2003).[50] She assumes that wide-scope *wh*-phrases in multiple constituent questions receive universal

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[50] Reinhart (1998: 38), too, underlines the role of pragmatic factors with regard to D-linking: "I believe that D-linking, as well as many of the other instances of what is called 'presupposition' is a purely pragmatic notion which is not directly encoded into the computational system."

quantification and that they are answerable if, and only if, the wide-scope *wh*-phrase ranges over a set of known membership. This makes it possible for the answerer to pair *every* individual in the set over which the wide-scope *wh*-element ranges with some individual in the set over which the narrow scope *wh*-element ranges. The wide-scope *wh*-phrase is then only answerable if it is discourse-linked or specific. Thus, the OM ensures that the wide-scope *wh*-element in (6b) is answerable, because it can range over a set of known membership. The felicity condition on answerability in the sense of Comorovski's (1996) is expressed by the well-formedness constraint (53).

(53) Questions must be answerable.

Having said this, let us now turn to the result of simple main effect $B|a_1$: (5a) without OM is preferred over (6a) with OM in the order subject-before-object. How can we explain this finding? Note that both *wh*-elements are assumed to be in situ in (5a) and (6a).[51] We can account for the facts by assuming the preference constraint (54). Whenever we have both interpretational possibilities, the single pair reading comes along with a moderate additional cost, estimated by the partial η^2 of 0.095.

(54) pair list reading > single pair reading (preference constraint)

Preference for the pair list reading is nothing unusual. It is consistent with the empirical observation in Bošković (1998), who shows in a comparison between languages that a pair list reading is always available, whereas a single pair reading is only possible in languages with specific structural properties.[52]

One remaining issue concerns the preference for the subject-before-object order as has been revealed by main effect A. In order to isolate the mere order preference from the biasing interaction with the presence or absence of OM (i.e. from the effect of violating constraint (53)), only (6a) and (6b) are compared by means of the simple main effect test $A|b_2$. We do not expect superiority effects due to the OM. However, this effect is significant ($p < 0.000$), though the object-before-subject order does not come along with a dramatic decrease in acceptability (the partial η^2 cost amounts to 0.180). The non-canonical order is slightly more marked than the canonical order. At this point we can benefit in a synergetic way from the findings obtained by the analysis of simple *wh*-questions in section 3.4: The preference for the subject-before-object order follows from the preference for the *wh*-in-situ order expressed in (30), which itself can be traced back to the fact that [-c-focus] constructions are less context-dependent. In the object-before-subject order the *wh*-object is [+c-focus] and thus more marked out of context.[53] However, the question arises as to why we have found in section 3.4.1 (see there the simple main effect $B|a_2$) that *wh*-scrambling in simple *wh*-argument questions comes along with a cost amounting to a partial η^2 of 0.537, while the fronting of the *wh*-argument in multiple *wh*-questions has only a partial η^2 cost of 0.180 (if anything, one would expect the latter to have a higher cost). First, we can interpret this finding as corroboration of the conclusion that there is no superiority effect in Persian in the presence of the OM. Secondly, the difference in costs shows another effect, namely that the lower the position of a construction on the acceptability scale (i.e. the more marked the construction), the less the effect of preference constraints. Multiple *wh*-questions have in general a lower degree of acceptability than simple *wh*-questions (see next section). In the same way that ungrammaticality leaves no or nearly no space for the subtle effects of preference constraints, suboptimality reduces (but does not eliminate) the margin of their effects. This behavior is nothing counter-intuitive in the field of cognition and perception. According to a fundamental principle in psychophysics, our perceptual differential capacity becomes weaker the more intense the stimuli become. For example, the louder the noise, the more difficult it is to perceive a small change in intensity. It seems plausible to me that acceptability judgments behave similarly when it comes to suboptimal, noisy constructions ("noisy" in the sense that the violation of one or more preference constraints effects the perception and evaluation of the construction).

3.6.2. The cost of multiple wh-questions

A follow-up ANOVA is calculated in which variable A distinguishes between simple and multiple *wh*-questions and variable B between in situ and initial *wh*-arguments as is shown in Table 8. As regards the examples of multiple *wh*-

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[51] Sentences like (i) and (ii) with an adverb in AdvP illustrate the difference between multiple *wh*-in-situ phrases and scrambling of one (or more) *wh*-phrases into FocP. As expected, the scrambled *wh*-subject in (ii) has a contrastive interpretation which its counterpart in (i) lacks. If the adverb was removed from (i), the default interpretation would remain non-contrastive (unless additional contrastive stress on a *wh*-phrase forces a contrastive reading). The same holds for the test constructions (5a) and (6a).

(i)   [$_{TP}$ [$_{AdvP}$ diruz   [$_{vP}$ ki   bɒ   ki   ræxsid]]]
                      yesterday   who   with whom danced

(ii)   [$_{FocP}$ ki$_j$ [$_{TP}$ [$_{AdvP}$ diruz   [$_{vP}$ t$_j$ bɒ   ki   ræxsid]]]]
           who   yesterday   with   whom danced
       'Who danced yesterday with whom?'

[52] There is often disagreement in the literature on the availability of single pair reading in a particular language (as regards English, cf. Hirschbuehler, 1985). Formulating the interpretational property in terms of a preference constraint such as (54) in which the cost is language-specific could be a path worth to be explored.

[53] This line of arguments partly reminds the idea expressed in Rudin (1989) who essentially claims that the superiority assumption might interfere with a more general preference for the order *wh*-subject before *wh*-object, which she observes in Polish, Serbo-Croatian, Russian and Ukrainian.

Table 8
ANOVA VI - design for variables 'subject/object *wh*-order' and ' ± OM'.

A: type of *wh*-question⇒	a_1: simple *wh*-question	a_2: multiple *wh*-question
⇓ B: position of *wh*-argument		
b_1: in situ	(1c')	(5a)
b_2: initial	(2c)	(6b)

questions, the least marked variants are selected for methodological reasons: Sentence (5a) without OM is chosen for the in situ variant, in order to exclude artifacts due to the cost of violating preference constraint (54). Likewise, sentence (6b) with OM is chosen for the variant with scrambled *wh*-argument to exclude a violation of preference constraint (53).

Main effect A is significant ($p < 0.000$). Simple *wh*-questions are preferred over multiple *wh*-questions, and the latter come with a cost amounting to a partial η^2 of 0.400. These findings can be summarized with the preference constraint (55) given below. Main effect B is also significant ($p < 0.000$) confirming the preference for the canonical word order expressed in (30). Furthermore, the distinction between simple and multiple *wh*-questions is in this design fully independent (interaction A × B is non-significant, $p < 0.211$), i.e. the effect of the *wh*-position is basically the same in simple and multiple *wh*-questions (Fig. 5).

The higher degree of markedness of multiple *wh*-questions compared to simple *wh*-questions is expressed by the following constraint.

(55) simple *wh*-questions > multiple *wh*-questions   (preference constraint)[54]

I have come in this and the last subsection to the conclusion that the presence or absence of superiority effects in Persian crucially depends on the OM. An analysis in terms of semantic conditions of answerability would be also in line with Reinhart (1998: 34) who considers a framework without LF movement as slimmer and also more in line with the idea of economy. However, if superiority effects are derived from a general semantic condition and if the *wh*-elements are interpreted in situ, then the evidence in favor of Karimi's (2005) assumption that *wh*-scrambling is triggered by the EPP in the sense of Chomsky (2000) is weakened. Her main argument is based on presumed MLC-related restrictions in cases when several elements bear the same discourse features, e.g. contrastive focus as it is assumed to be the case for fronted *wh*-elements, and at the same time compete for the same position, e.g. Spec of FocP.

3.7. Summarizing the syntactic properties of wh-questions in Persian

In a first step, a set of simple *wh*-questions was analyzed, distinguishing between three different *wh*-positions, *wh*-adjunct or *wh*-argument, and subject in preverbal or postposed position. (i) C-focus constructions are more context-dependent and thus more marked when presented in isolation. In accordance with the assumed phrase structure (7), the Adj_{temp} O V order in which no *wh*-element has been moved to FocP is the unmarked case. (ii) (29) expresses the finding that local scrambling of a non-*wh*-argument is preferred over local scrambling of a *wh*-argument. (iii) *Wh*-in-situ is preferred over *wh*-scrambling, which is summarized in (30). (iv) I stated in (31) and (32) that scrambled *wh*-NPs must be [+c-focus], and that *wh*-elements cannot be [+topic]. (v) (34) formulates a preference of *wh*-adjunct scrambling over *wh*-NP scrambling. (vi) I then observed in (35) that scrambling of non-*wh*-NPs and of *wh*-adjuncts, which both are compatible with background scrambling, have the same impact on acceptability. (vii) A preference for subjects in preverbal position over postposed subjects is expressed in (36). I suggest that (36) also applies to other phenomena of postposing (except for adjuncts expressing destination). (viii) We observed that various ungrammatical constructions differ only minimally; effects of constraint cumulativity are not manifest any more for ill-formed structures as stated in (37).

Then, this study turned to complex sentence constructions. (ix) I stated in (38) that local and long *wh*-scrambling have the same impact on the acceptability. The preference for in situ *wh*-questions as stated in (30) is exactly the same in simple and complex questions. (x) The comparison of constructions with long *wh*-scrambling and constructions with long NP-scrambling unveiled the relevance of the target CP. The matrix CP is preferred over an intermediate CP as landing site in long scrambling, because intermediate C systems have a defective FocP. In (47) and (48) I trace this difference back to a [+c-focus] requirement for both scrambled *wh*-elements and long distance scrambled NPs, preferably to be satisfied syntactically rather than phonologically. The kinship that we observe between *wh*-scrambling and long NP-scrambling does not embrace short NP-scrambling (or short [-*wh*] scrambling in general).

In a third step, I analyzed multiple *wh*-questions with different linear orders of *wh*-subjects and *wh*-objects, and with or without the OM. (xi) The "repair effect" of OM in the object-before-subject order and D-linking are seen as the same

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[54] The deeper reason for (55) is not clear to me. All I can say so far is that it seems to be related to a basic semantic difference between simple and multiple *wh*-questions (see also Wachowicz, 1974). The answer of a multiple *wh*-question specifies the function by "scanning the *entire* set" (Comorovski, 1996: 53) denoted by the common noun in the sentence-initial interrogative phrase.

phenomenon. The answerability condition (53) inspired by Comorovski (1996) has been suggested for this not yet fully understood phenomenon. The preference for the subject-before-object order, which also shows up with the OM (i.e. when there should be no superiority), follows from the already stated preference for the *wh*-in-situ order. (xii) Whenever both readings are possible, the pair list interpretation is preferred over the single pair interpretation, stated in (54).

I repeat and resume in (55a) to (55j) the preference constraints where violation results in gradience (they are reordered to better show the similarities and differences). For clarity purposes, I also state (55f), although I had argued that it follows from (55 h). The violation costs estimated by partial η

Main effect A is significant ($p < 0.000$). Simp values are indicated. Recall that partial η^2 values range from 0 to 1. According to Cohen's (1988) widely accepted convention for the behavioral sciences, a partial η^2 value of 0.06 can be considered as medium, and a value of 0.14 as large. The reported effects of the constraints range between medium and (very) large. Thus, the nuanced differences of acceptability and fine-grained contrasts of markedness are clear and visible.

	constraint	cost	section
(55a)	in situ *wh* > scrambled *wh*	0.505	(section 3.4.2)
(55b)	*wh*[-NP]-scrambling > *wh*[+NP]-scrambling	0.356	(section 3.4.2)
(55c)	NP[-*wh*] scrambling = adjunct[+*wh*] scrambling	––––	(section 3.4.3)
(55d)	local [+*wh*]-scrambling = long [+*wh*]-scrambling	––––	(section 3.5.1)
(55e)	local NP[-*wh*]-scrambling > local NP[+*wh*]-scrambling	0.437	(section 3.4.1)
(55f)	long scrambling to matrix CP > long scrambling to intermediate CP	0.212	(section 3.5.2)
(55 g)	preverbal subject position > postposed subject	0.594	(section 3.4.3)
(55 h)	For scrambled NP[+*wh*] and long distance scrambled NP[-*wh*]:		
	syntactic c-focus strategy > phonological c-focus strategy	see (55f)	(section 3.5.2)
(55i)	pair list reading > single pair reading	0.095	(section 3.6.1)
(55j)	simple *wh*-questions > multiple *wh*-questions	0.400	(section 3.6.2)

(56a) to (56c) state the well-formedness constraints where violation leads to ungrammaticality.

(56a) Scrambled NP[+*wh*] and long distance scrambled NP[-*wh*] must be [+c-focus]. (section 3.5.2)

(56b) *Wh*-elements cannot be [+topic]. (section 3.4.2)

(56c) Questions must be answerable. (section 3.6.1)

4. Conclusion

In this work I tried to show how the use of gradient acceptability judgments and statistical methods contributes to a more precise description of the syntax of *wh*-questions in Persian and the underlying operation of *wh*-scrambling. Persian is considered as a case of A'-scrambling which exhibits both background and focus scrambling. I accounted for the nuanced differences between the different constructions by means of cumulative constraints. I distinguished between preference constraints which, when violated, lower the degree of acceptability without necessarily causing ungrammaticality, and well-formedness constraints, whose violation always triggers ungrammaticality. The methodology of gradient judgments allowed the estimation of the cost associated with a constraint.

I have listed above the set of preference constraints that co-determine the acceptability value of Persian *wh*-questions and which come with a certain cost. We have seen that information structure played an important part in accounting for preference relations, in particular the contextual requirements of contrastive focus. It suggests that the interface levels of syntax cannot be adequately studied without an approach based on gradience. This finding is in line with Keller (2000:321/322), who considers "soft constraints" to be located at the interface between syntax and semantics/pragmatics, while he assumes "hard constraints" to be purely structural.

The results highlight an important characteristic of grammar. Ungrammatical constructions are surprisingly consistent: once a well-formedness constraint is violated, additional violations of preference constraints do not add to the overall result. The clear violation of a well-formedness constraint (e.g. the prohibition of postverbal *wh*-elements), does not allow for nuances any more. Based on this evidence, I have postulated (37), according to which the violation of a well-formedness constraint results in a low acceptability value with minimal variation.[55] (37) contradicts Keller (2000:244), who claims that "the degree of ungrammaticality of a structure increases with the number of constraints it violates, both for soft and hard constraints." Two hypotheses emerge for explaining (37). The first one assumes that cumulativity does apply for all types of

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[55] The principle of consistency in ungrammaticality is also in line with the results in Adli (2005), which show for various French constructions that gradient judgments on suboptimal and ungrammatical sentences have, compared to felicitous constructions, a high statistical consistency in terms of the intraclass correlation coefficient ICC, i.e. the judgments exhibit little intra-speaker variation.

constructions, but that there is a floor effect with acceptability judgments. The resulting acceptability value cannot fall below a certain threshold. The cost of an illicit postverbal *wh*-position is already so high that this well-formedness constraint on its own brings the value down to the lower threshold (which might only be under-run by what Fanselow and Féry, 2002 call ineffable constructions). The second possibility is that a preference constraint is simply not valid for ungrammatical constructions. This second possibility assumes that the grammar becomes blind for preference constraints once a well-formedness constraint has been violated. In other words, syntax would function in a gradient manner within the range of grammatical (presumably also marginal) constructions, but would switch to a categorical manner for ungrammaticality. At this stage of the research, I do not want to (and cannot) choose between these hypotheses that are both consistent with the picture so far presented.[56] If the principle of consistency in ungrammaticality (37) can be generalized, we hold an interesting diagnostic tool in our hand: the distinction between grammaticality and ungrammaticality reflects in the manifestation vs. non-manifestation of cumulative effects of preference constraints. Furthermore, it helps to identify the type of a newly postulated constraint. It is a preference constraint if we find cumulativity with another given preference constraint; otherwise it is a well-formedness constraint.

It has been mentioned that intermediary degrees of acceptability are often employed in generative-syntactic studies, without however scrutinizing their use. Gradience should not be considered as some epiphenomenon but rather as an integral part of grammar. This concept helps to better account for phenomena of variation such as scrambling and the nuanced, systematic effects of information structure.

Appendix A

A.1. Statistical methodology

The measures of the acceptability judgments are statistically analyzed by multi-way analyses of variance for repeated measures (ANOVA) (Lindman, 1974; Rietveld and van Hout, 2005), using the software SPSS. Analysis of variance allows one to test for the effects of various independent variables, as well as for the interactions between them. It assumes that each single measurement x_{ijm} can be decomposed into several systematic effects and an error component (Bortz, 2005: chapter 12). For illustration purposes, (57) shows the structural components of a two-way analysis of variance with between-subject variables A and B:

(57) $x_{ijm} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \varepsilon_{ijm}$

x_{ijm} is the single measurement of subject m at the level combination ij. μ is constant for all single measurements x_{ijm} and represents the mean value of all measurements (i.e. it is the study-specific general measurement level). α_i is the specific effect of level i of variable A, β_j is the specific effect of level j of variable B, $\alpha\beta_{ij}$ is the interaction effect of the variable level combination ab_{ij}, and ε_{ijm} is the measurement error of the single measurement. (57) shows that main and interaction effects are independent. Main effect test A tells us whether the null hypothesis $\alpha_1 = \alpha_2 = ... = \alpha_i = ... = \alpha_p = 0$ has to be rejected or not. Other main and interaction effect tests are analogous.

Results on main and interaction effects are further analyzed in this work by ANOVA contrast effect tests and simple main effect tests. Pairwise contrast effect tests a_1 vs. a_2 can be used to understand, for example, whether main effect A is due to a difference between these two levels. The simple main effect test $A|b_j$ would tell us whether main effect A has an effect, if only level j of the independent variable B is taken into consideration. If, for example variable A distinguishes between the three *wh*-positions in situ, initial, and postverbal, and variable B between sentences with *wh*-adjuncts and *wh*-NPs, then $A|b_1$ tests whether the *wh*-positions differ if we only look at *wh*-adjuncts. Unlike main effect test A which looks for a difference between the three positions, but taking into consideration both *wh*-adjuncts and *wh*-NPs. Furthermore, the information on a significant ANOVA result can be complemented by the partial η^2 value which expresses the amount of variance explained by an effect. The partial η^2 value is an important descriptive measure adding a supplementary, non-inference-statistical information to the inference-statistical information of significance (Cohen, 1973), see also Keren & Lewis (1979: 119).[57] It is broadly used in psychology (its systematic report is even required by the American Psychological Association, 2001: 25). In the field of language studies, I am only aware so far of few studies in applied linguistics that have worked with partial η^2 (e.g. Kondo-Brown, 2005). As a descriptive measure, it can be used to quantify the size of a certain effect. It indicates the proportion of total variation attributable to the factor partialling out (excluding) other factors from the total nonerror variation (Cohen, 1988). It is suitable for comparing the effect size across different factorial designs. In the context of a study in which certain grammatical properties are kept constant and others systematically varied, partial η^2 offers the interesting

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[56] One can imagine a (somewhat hypothetical) scenario that could bring about a decision. Imagine a construction that violates p preference constraints where p is a very high number – so high, that the total violation cost makes the sentence clearly ungrammatical. Imagine another construction that violates not only these p preference constraints, but also another one. Under the first hypothesis, both constructions have the same degree of grammaticality, because we assume the threshold value to be reached with p violations. Under the second hypothesis, $p+1$ violations result in an even lower degree of grammaticality.

[57] This statement should not be misunderstood in the sense that a result is "nearly significant", "marginally significant", or "highly significant". There is no more or less significant.

possibility to estimate the exact "cost" that comes along with a significant grammatical property in the sample. The value ranges from 0 to 1.[58]

A.2. Experimental material

The sentences below are shown in IPA. The original test material used the Persian variant of Arabic script and reflected the characteristics of colloquial speech (see footnote 27).

Simple *wh*-questions

S O Adj$_{wh}$ V: (1a)
sɒrɒ ketɒbe-ʃ-o kej xæride?
æhmæd gæzɒ-ʃ-o kej xorde?
hæsæn kæʃ-eʃ-o kodʒɒ gerefte?

S Adj O$_{wh}$ V: (1c')
æli diruz ki-jo dide?
bɒbæk emruz ki-jo zæde?
sæhær sob tʃi-jo dʒɒ gozɒʃte?

S O V Adj$_{wh}$: (3a)
*mohæmmæd tʃæmæn-o zæde kej?
*færibɒ ɣæzɒ-ro poxte kej?
*zibɒ moælem-eʃ-o dide kodʒɒ?

S Adj$_{wh}$ O V: (1a')
nimɒ kej otɒɣ-eʃ-o tæmiz kærde?
sohejlɒ kej nævɒr-o guʃ kærde?
mortezɒ kodʒɒ mɒʃineʃ-o furuxte?

Adj$_{wh}$ S O V: (2a)
kej elhɒm pærdehɒ-ro ʃoste?
kej sæid zæmineʃ-o furuxte?
kodʒɒ behruz puleʃ-o gom kærde?

V Adj$_{wh}$ O S: (3b)
*xunde kej emtehɒneʃ-o negɒr?
*gerefte kej gærdæmbændeʃ-o simɒ?
*ændɒxte kodʒɒ ɒʃɣɒl-o sɒleh?

O Adj$_{wh}$ V S: (1b)
dɒɒ-ʃ-o kej xunde nærges?
mɒʃin-o kej ʃoste æli?
xunæʃ-o kodʒɒ sɒxte rezɒ?

Adj$_{wh}$ O V S: (2b)
kej mɒdæreʃ-o dide hæmid?
kej næɣɒʃiʃ-o keʃide ɒzitɒ?
kodʒɒ lebɒseʃ-o duxte zohre?

S Adj V O$_{wh}$: (3c)
*sohejl pæriruz æsæbɒni kærde ki-jo?
*mohsen sob nɒrɒhæt kærde ki-jo?
*mæhsɒ bæhɒr kɒʃte tʃi-jo?

S O$_{wh}$ Adj V: (1c)
æmir ki-jo diʃæb xune gozɒʃte?
hosein ki-jo æsr xoʃhɒl kærde?
ʃejdɒ tʃi-jo ɣurub ʃekæste?

O$_{wh}$ S Adj V: (2c)
ki-jo fɒteme æsr dævɒ kærde?
ki-jo æmir diruz moætæl kærde?
tʃi-jo sæmirɒ diʃæb ʃekæste?

Complex *wh*-questions and long NP-scrambling

in-situ *wh*-NP: (4a)
fekr mikoni ke kɒmrɒn ki-ro dævæt kærde?
fekr mikoni ke lɒle ki-ro æzjæt kærde?
fekr mikoni ke mærjæm tʃi-ro post kærde?

long distance NP-scrambling: (24)
behnɒz goft ke xunæ-ro$_i$ hæds mizæne ke æli t_i xæride bɒʃe.
ʃivɒ goft ke otɒɣ-o$_i$ hæds mizæne ke nærges t_i tæmiz kærde bɒʃe.
nedɒ goft ke ʃerkæt-o$_i$ hæds mizæne ke ækbær t_i furuxte bɒʃe.

initial *wh*-NP: (4b)
ki-ro$_i$ fekr mikoni ke lejlɒ t_i tæmbih kærde?
ki-ro$_i$ fekr mikoni ke dʒæmɒl t_i estexdɒm kærde?
tʃi-ro$_i$ fekr mikoni ke robɒb t_i sefɒreʃ dɒde?

Multiple *wh*-questions

S$_{wh}$ O$_{wh}$, [-OM]: (5a)
ki tʃi xærid?
ki tʃi xord?
ki tʃi ɒvord?

S$_{wh}$ O$_{wh}$, [+OM]: (6a)
ki tʃi-ro sefɒreʃ dɒd?
ki tʃi-ro goft?
ki tʃi-ro did?

O$_{wh}$ S$_{wh}$, [-OM]: (5b)
tʃi ki fekr kærd?
tʃi ki furuxt?
tʃi ki ʃenid?

O$_{wh}$ S$_{wh}$, [+OM]: (6b)
tʃi-ro ki dorost kærd?
tʃi-ro ki xund
tʃi-ro ki neveʃt?

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[58] Finally, an important preliminary step of the statistical analyses consists of the specification of values for the error probabilities α and β, as well as for the effect size ε. I consider fair hypothesis testing, i.e. α = β (see Erdfelder and Bredenkamp, 1994), with an error probability of 5% or lower at medium effect size to be the ideal statistical strategy in a theoretical discipline like syntax. α and β are equally important, because the conclusion that the grammaticality of certain constructions is identical (i.e. a non-significant result) and the conclusion that the grammaticality of certain constructions is different (i.e. a significant result) has the same practical impact for the purposes of grammar research. These parameters can only be achieved with sufficiently large sample sizes, which is the case in this study with N = 91 for a repeated-measures design. Power analyses show that fair hypothesis testing is possible at α = β = 1.3% for variables with two levels or α = β = 0.5% for variables with three levels which represent very low error probabilities. Variables with three levels are variable A in Table 3, and variable A in Table 4. All other variables in Table 2 to Table 6 have two levels. The non-sphericity correction ε is always set to 1, and the correlation between repeated measures to 0.5. The power analyses are carried out with the software G*Power 3.0.6 (Faul et al., 2007).

A.3. Detailed quantitative results

ANOVA I (Table 2): We can use the values of the analysis of variance without adjustment of the degrees of freedom (see Bortz, 2005), since sphericity is assured for variable A (Mauchly-W = 1.0; df = 0), variable B (Mauchly-W = 1.0; df = 0), and for the interaction A × B (Mauchly-W = 1.0; df = 0). The Mauchly test indicates the validity of the F statistics. This is the case, if the variance-covariance matrix is circular in form (Huynh and Mandeville, 1979). If the Mauchly test is significant, we cannot assure sphericity. In this case the degree of freedom is corrected using the Greenhouse-Geisser value (G-G adjustment).

main effect A: $SS_A = 9190.369$; $df_A = 1$; $df_{AxSub} = 90$; $F_A = 67.567$; partial $\eta^2 = 0.429$; $p < 0.000$
main effect B: $SS_B = 10663.645$; $df_B = 1$; $df_{BxSub} = 90$; $F_B = 94.349$; partial $\eta^2 = 0.512$; $p < 0.000$
simple main effect B|a_1: Pillai's PS = 0.100; F = 9.959; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.100$; $p < 0.002$
simple main effect B|a_2: Pillai's PS = 0.537; F = 104.269; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.537$; $p < 0.000$
simple main effect A|b_2: Pillai's PS = 0.097; F = 9.703; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.097$; $p < 0.002$
interaction AxB: $SS_{AxB} = 3814.008$; $df_{AxB} = 1$; $df_{AxBxSub} = 90$; $F_{AxB} = 36.650$; partial $\eta^2 = 0.289$; $p < 0.000$

ANOVA II (Table 3): We can assume sphericity for variable B (Mauchly-W = 1.0; df = 0), but neither for variable A (Mauchly-W = 0.486; df = 2; $p < 0.000$), nor for the interaction A × B (Mauchly-W = 0.895; df = 2; $p < 0.007$). A Greenhouse-Geisser adjustment of 0.66 sets the degree of freedom of variable A to 1.321. The adjusted degree of freedom of the interaction A × B is 1.809, based on a Greenhouse-Geisser correction of 0.905.

main effect A (G-G adj.): $SS_A = 391784.784$; $df_A = 1.321$; $df_{AxSub} = 118.864$; $F_A = 376.387$; partial $\eta^2 = 0.807$; $p < 0.000$.
main effect B: $SS_B = 4444.105$; $df_B = 1$; $df_{BxSub} = 90$; $F_B = 50.329$; partial $\eta^2 = 0.359$; $p < 0.000$.
interaction AxB (G-G adj.): $SS_{AxB} = 6208.189$; $df_{AxB} = 1.809$; $df_{AxBxSub} = 162.836$; $F_{AxB} = 34.482$; partial $\eta^2 = 0.277$; $p < 0.000$.
simple main effect B|a_1: Pillai's PS = 0.097; F = 9.703; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.097$; $p < 0.002$.
simple main effect B|a_2: Pillai's PS = 0.453; F = 74.582; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.453$; $p < 0.000$.
simple main effect B|a_3: Pillai's PS = 0.011; F = 1.002; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.011$; $p < 0.319$.

ANOVA III (Table 4): There is sphericity for variable B (Mauchly-W = 1.0; df = 0) and the interaction A × B (Mauchly-W = 0.938; df = 2; $p < 0.059$), but not for variable A (Mauchly-W = 0.615; df = 2; $p < 0.000$). As regards variable A, a Greenhouse-Geisser adjustment of 0.722 is applied.

main effect A (G-G adj.): $SS_A = 281358.167$; $df_A = 1.444$; $df_{AxSub} = 129.930$; $F_A = 428.742$; partial $\eta^2 = 0.826$; $p < 0.000$.
main effect B: $SS_B = 39934.910$; $df_B = 1$; $df_{BxSub} = 90$; $F_B = 123,698$; partial $\eta^2 = 0.579$; $p < 0.000$
interaction AxB: $SS_{AxB} = 14209.205$; $df_{AxB} = 2$; $df_{AxBxSub} = 180$; $F_{AxB} = 44.927$; partial $\eta^2 = 0.333$; $p < 0.000$.
pairwise contrast a_1 vs. a_2: SS = 95.998; df = 1; $df_{error} = 90$; F = 0.368; partial $\eta^2 = 0.004$; $p < 0.545$.
pairwise contrast a_2 vs. a_3: SS = 415624.665; df = 1; $df_{error} = 90$; F = 442.961; partial $\eta^2 = 0.831$; $p < 0.000$.

ANOVA IV (Table 5): Sphericity is assured for variable A (Mauchly-W = 1.0; df = 0), for variable B (Mauchly-W = 1.0; df = 0), and for the interaction A × B (Mauchly-W = 1.0; df = 0).

main effect A: $SS_A = 89.281$; $df_A = 1$; $df_{AxSub} = 90$; $F_A = 0.701$; partial $\eta^2 = 0.008$; $p < 0.405$.
main effect B: $SS_B = 34718.129$; $df_B = 1$; $df_{BxSub} = 90$; $F_B = 130.768$; partial $\eta^2 = 0.592$; $p < 0.000$
interaction AxB: $SS_{AxB} = 250.275$; $df_{AxB} = 1$; $df_{AxBxSub} = 90$; $F_{AxB} = 2.958$; partial $\eta^2 = 0.032$; $p < 0.089$.

t-Test (Table 6): $N_{pairs} = 91$; $s_d = 19.457$; df = 90; t = 4.921; partial $\eta^2 = t^2/(t^2 + df) = 0.212$; $p < 0.000$.

ANOVA V (Table 7): There is sphericity for variable A (Mauchly-W = 1.0; df = 0), variable B (Mauchly-W = 1.0; df = 0), and the interaction A × B (Mauchly-W = 1.0; df = 0).

main effect A: $SS_A = 52572.282$; $df_A = 1$; $df_{AxSub} = 90$; $F_A = 103,699$; partial $\eta^2 = 0.535$; $p < 0.000$.
main effect B: $SS_B = 8118.692$; $df_B = 1$; $df_{BxSub} = 90$; $F_B = 29.444$; partial $\eta^2 = 0.247$; $p < 0.000$.
interaction AxB: $SS_{AxB} = 17954.253$; $df_{AxB} = 1$; $df_{AxBxSub} = 90$; $F_{AxB} = 58.386$; partial $\eta^2 = 0.393$; $p < 0.000$.
simple main effect A|b_1: Pillai's PS = 0.556; F = 112.831; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.556$; $p < 0.000$
simple main effect A|b_2: Pillai's PS = 0.180; F = 19.771; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.180$; $p < 0.000$.
simple main effect B|a_1: Pillai's PS = 0.095; F = 9.446; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.095$; $p < 0.003$.
simple main effect B|a_2: Pillai's PS = 0.367; F = 52.173; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.367$; $p < 0.000$.

ANOVA VI (Table 8): There is sphericity for variable A (Mauchly-W = 1.0; df = 0), for variable B (Mauchly-W = 1.0; df = 0), and for the interaction A × B (Mauchly-W = 1.0; df = 0).

main effect A: $SS_A = 52509.269$; $df_A = 1$; $df_{AxSub} = 90$; $F_A = 59.920$; partial $\eta^2 = 0.400$; $p < 0.000$.
main effect B: $SS_B = 23977.070$; $df_B = 1$; $df_{BxSub} = 90$; $F_B = 111.283$; partial $\eta^2 = 0.553$; $p < 0.000$
interaction AxB: $SS_{AxB} = 245.318$; $df_{AxB} = 1$; $df_{AxBxSub} = 90$; $F_{AxB} = 1.585$; partial $\eta^2 = 0.017$; $p < 0.211$.
simple main effect B|a_2: Pillai's PS = 0.317; $F = 41.704$; df = 1; $df_{error} = 90$; partial $\eta^2 = 0.317$; $p < 0.000$.

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