

# Coherence - An Experimental Approach

Tanja Schmid, Markus Bader, & Josef Bayer

## 1 Introduction

Since Bech (1955/57) and Evers (1975), German (and Dutch) infinitival constructions have attracted enormous attention from syntacticians. Traditionally, two different types of infinitive constructions are assumed for German. A representative of each type is given in (1):

- (1) a. ... dass Maria alle Verwandten zu kennen **scheint**.  
that Maria all relatives to know seems.  
'that Maria seems to know all relatives'
- b. ... dass Maria alle Verwandten zu kennen **prahlt**.  
that Maria all relatives to know boasts  
'that Maria boasts about knowing all relatives'

Superficially, the sentences in (1) differ only in the finite verb. Structurally, however, they differ to a much larger extent. For example, the infinitive in (1-b) can be extraposed together with its object but the infinitive in (1-a) cannot :

- (2) a. \*... dass Maria **scheint**, alle Verwandten zu kennen.  
that Maria seems, all relatives to know
- b. ... dass Maria **prahlt**, alle Verwandten zu kennen.  
that Maria boasts, all relatives to know

Infinitival constructions as in (2-b) are instances of non-coherent constructions. The infinitival complement forms an independent constituent which may be extraposed. It also forms a barrier for clause-bounded syntactic and semantic operations.

Infinitival constructions as in (2-a) are instances of coherent constructions. The infinitival complement does not form an independent constituent, as exemplified by the fact that it cannot be extraposed. It is also transparent for otherwise clause-bounded processes as will be shown on the basis of several

coherence tests below.

With respect to infinitival complements, two questions have figured prominently over the years and across various changes in linguistic theory: (i) What is the syntactic category of infinitival complements? (ii) What governs coherence? Answers given to (i) range from CP to IP to VP. Answers given to (ii) are usually rooted in certain assumptions about the lexical representation of verbs. Certain infinitive-taking verbs undergo a process of restructuring which results in clause union, the core property of which is a verbal complex in West-Germanic. These so-called coherent constructions contrast with non-coherent constructions in which the infinitive-taking verb rejects clause union. Since most of the verbs in question also allow extraposition, and since some even allow finite CP-complements, yet another question appears: (iii) are coherence verbs associated with multiple lexical entries? Most of the work so far rests on a somewhat fragile data base. A list of potential coherence verbs with a dative controller is given in Bayer and Kornfilt (1990, 38), but the judgements rest on individual intuition. Behavioral data could give important clues to a better understanding of the phenomenon and its place in grammar.

In this article we report the results of a questionnaire study on native-speaker judgements of coherent and non-coherent infinitive constructions. The leading questions thereby were: (i) Is there experimental evidence for the validity of the (non-) coherence tests and for the verb class differences mentioned in the literature? (ii) Can the factors be extracted that give rise to coherence?

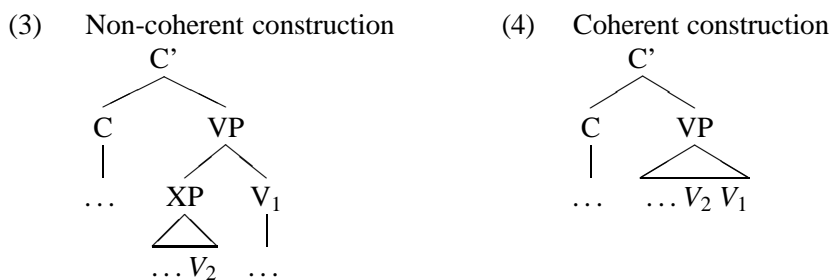
In the second section we give a short overview of the phenomenon of coherence, and introduce the (non-)coherence tests that were used in the questionnaire study. We also mention some triggers of coherence. The third section describes procedure, methods, and results of the questionnaire study. In the fourth section we will discuss the results of the questionnaire study, and in the last section we will conclude with some suggestions for future research.

## 2 Coherence

What may be savely deduced from the literature on (non-) coherence – apart from the mere existence of differently structured infinitival complements – is that in non-coherent constructions the infinitival verb projects, together with its complement(s) and modifiers, an autonomous phrase while in coherent constructions this is not the case. The exact structure of both non-coherent and coherent constructions is subject to debate as well as the question of how

coherence is achieved. For a rough overview, two general strategies can be distinguished: derivation or base generation.

It has either been assumed that coherent constructions are derived from a clausal variant by movement operations (either by X-movement, see Evers (1975) and many successors), or (remnant) XP-movement (e.g., Koopman and Szabolcsi (2000)) sometimes followed or replaced by a restructuring process including some kind of reanalysis and leading to verb cluster formation (e.g., Evers (1975), Haegeman and Riemsdijk (1986), Stechow and Sternefeld (1988)). Alternatively it has been assumed that verb clusters are base generated in coherent constructions (see, e.g., Haider (1993), Wurmbrand (2001)). For the purpose of this article it suffices to state that non-coherent constructions are structurally more complex than coherent constructions in that the embedded infinitive induces a bi-clausal structure, while the latter induces a mono-clausal structure. To stress the differences in structure we will assume in the following that in coherent constructions the embedded verb forms a verbal complex together with its matrix verb, either derived or base generated. Nothing hinges on this assumption, however. The different structures of coherent and non-coherent constructions are sketched in the following:



In (3)  $V_1$  and  $V_2$  head two separate lexical as well as functional projections. XP may be the extension of  $V_2$  or functional heads which are associated with the projection of  $V_2$ . In (4),  $V_1$  and  $V_2$  form a verb cluster in which  $V_2$  is the dependent head. The VP which is built up by  $V_1$  and the functional structure(s) associated with this VP, are the only clausal domains involved.

The questionnaire study has been carried out in order to obtain native speaker intuitions on several syntactic constructions which are generally used as tests for coherence or non-coherence, or which are ambiguous in this respect (see Bech (1955/57), Grewendorf (1988), Stechow and Sternefeld (1988), Haider (1993) among others).

## 2.1 Coherent constructions

The four constructions listed in (5) were used as tests for coherence. These constructions will be introduced in the following paragraphs.

- (5)
- a. Topicalization of the (restructured) verbal complex
  - b. 'Long' scrambling of a pronoun
  - c. 'Long-distance' passive
  - d. Wide scope of negation

**Topicalization of the verbal complex** In the first test, the matrix verb is topicalized, i.e. moved to Spec-CP together with the embedded verb. In the case of a coherent construction where the embedded verbs forms a constituent together with the matrix verb (either by a restructuring process or by base generation), this movement operation results in a grammatical sentence (cf. (6)). Verbs which are incompatible with verb-cluster (VC) formation lead to an ungrammatical result.

- (6) [Zu kaufen empfohlen] hat Max mir nur das Lexikon [t]  
To buy recommended has Max me only the lexicon

**'Long' scrambling of a pronoun** The second test uses scrambling of a pronoun which has its origin in the embedded infinitive in front of the subject of the matrix clause. As scrambling across clause-boundaries leads to ungrammaticality, a positive judgment of these sentences suggests that no clause boundary is present between the embedded infinitive and the matrix clause. We may therefore conclude that we are dealing with coherent constructions in these cases.

- (7) Was das Lexikon betrifft, so ist klar, warum [es] Max mir [t] zu  
What the lexicon concerns so is clear why it Max me to  
kaufen empfohlen hat.  
buy recommended has

**'Long-distance' passive** The 'long-distance' passive was mentioned in Höhle (1978, 176f.), where its occurrence was claimed to be restricted to the verb *versuchen*. Later, however, (cf. Bayer and Kornfilt 1990; Haider 1993) it has been seen as the result of verb-complex formation in general, and has been used as a coherence test on other matrix verbs as well, acknowledged for its

marginal status of acceptability, however. When in this construction the accusative object of the embedded verb becomes the nominative subject under passivization of the matrix verb, and when this configuration is grammatical whereas the accusative on the embedded object is not, then there is evidence for some kind of verbal complex, and hence for a coherent construction.<sup>1</sup>

- (8) [Der Wagen]<sub>NOM</sub>/\*[Den Wagen]<sub>ACC</sub> wurde mir [t] zu kaufen  
 The car-NOM/\*ACC was me to buy  
 empfohlen.  
 recommended

**Wide scope of negation** The last coherence test makes use of the scope of negation. In coherent constructions, a negated element which is placed inside the infinitival complement may take scope over the matrix verb (i.e. wide scope). As scope of negation is normally not allowed to cross clause boundaries we assume that there are no clause boundaries when the wide scope reading is possible, i.e. in these cases, we are again dealing with a coherent construction (cf. Lerner and Sternefeld 1984). The wide scope reading of the embedded negation is forced by a negative tag (*and the X also not*) following the main predicate. The brackets in (9) illustrate the wide scope domain of the embedded negative quantifier *kein Lexikon*:

- (9) [Max hat mir kein Lexikon zu kaufen empfohlen] und der Onkel  
 Max has me no lexicon to buy recommended and the uncle  
 auch nicht.  
 also not

With the presence of the negated tag, the only possible interpretation of the sentence in (9) is: *It is not the case that Max recommended to me to buy a lexicon.*

## 2.2 Non-coherent constructions

The following two configurations were used as tests for non-coherence:

- (10) a. Extraposition of the infinitival complement<sup>2</sup>  
 b. Narrow scope of negation

**Extraposition** When extraposition of an infinitival complement leads to a grammatical sentence, the extraposed phrase must have been a constituent on

its own, which is the case in non-coherent infinitival constructions.

- (11) Max hat mir empfohlen, [das Lexikon zu kaufen].  
 Max has me recommended the lexicon to buy

**Narrow scope of negation** When a negated element inside the infinitival complement may not take scope over the matrix verb but only over the embedded verb (i.e. narrow scope) then a scope-boundary must be present. Whenever narrow scope is the only possible interpretation of the negation, this strongly suggests that we are dealing with a non-coherent construction. In the questionnaire study, the narrow scope interpretation is forced by a positive tag (*and the X also*) which is only grammatical when the scope of negation does not leave the embedded infinitive. The brackets in (12) this time illustrate the narrow scope domain of the embedded negative quantifier *kein Lexikon*:

- (12) Max hat mir [kein Lexikon zu kaufen] empfohlen und der  
 Max has me no lexicon to buy recommended and the  
 Onkel auch.  
 uncle also

With the presence of the positive tag, the only possible interpretation of the sentence in (12) is: *It is the case that Max recommended to me not to buy a lexicon.*

### 2.3 Coherent or non-coherent?

There is one construction type which is usually assumed to be structurally ambiguous with respect to coherence: the intraposed construction in which the embedded infinitive immediately precedes the matrix verb and in which no additional triggers of coherence appear (like ‘long’ scrambling of a pronoun or other coherence tests, see above). Although sentences like (13) were used as instances of coherent constructions in Bech (1955/57, §191), many researchers (see, e.g., Grewendorf 1988; Stechow and Sternefeld 1988) have stated since then that in the absence of further evidence, intraposed constructions are ambiguous between a coherent and a non-coherent structure, i.e. both structures are possible in principle. The brackets in (13-a) indicate the non-coherent structure, and the brackets in (13-b) the coherent structure in the intraposed construction:

- (13) a. dass Max mir [nur das Lexikon zu kaufen] empfohlen hat.  
 b. dass Max mir nur das Lexikon [zu kaufen empfohlen hat].  
 that Max me only the lexicon to buy recommended has.

Examples like (13)— of course without the brackets — were included in the questionnaire study in order to see how acceptable they are. The important question is whether they are indeed perceived as ambiguous and therefore pattern with coherence tests and non-coherence tests alike.

#### 2.4 On lexical and positional triggers of coherence

Whether an infinitival complement is constructed coherently or non-coherently is mainly dependent on the lexical specification of the matrix verb. Verbs that embed a bare infinitive like modals, perception verbs, causatives, as well as raising verbs like *scheinen* ('to seem') obligatorily trigger coherence. Extraposition of the infinitival complement is generally not possible with any of them.

The picture is not so clear with respect to obligatorily non-coherent constructions, however. Although control verbs can always be construed as non-coherent, i.e. extraposition of their infinitival complement is always possible, certain (subclasses of) control verbs also show coherence properties when the infinitival complement is intraposed. This was exemplified for the verb *empfehlen* ('to recommend') in the previous section. The variation that control verbs exhibit as triggers for coherence has been related to characteristics like argument structure and control properties in the literature. Several generalizations concerning coherence and control properties have been suggested. A prominent generalization in this direction is Haider (1993, 251) who states as a necessary condition of coherence that the infinitival complement replaces the internal structural argument in a coherent construction, i.e., the accusative object.<sup>3</sup>

As there is still dispute among linguists about the exact range of control verbs allowing clause union, we concentrated on this verb class in the questionnaire study and measured the coherence properties of 56 control verbs with respect to the seven (non/ambiguously-)coherent construction types mentioned above. The control verbs were classified according to control properties, function of the infinitival complement, and argument structure as will be shown in detail in the following section.

In addition to lexical triggers, positional triggers seem to have an influence on whether a control verb constructs coherently or non-coherently. Looking at positional indicators of coherence, the following picture emerges:

Extrapolation of the entire infinitival complement is only compatible with non-coherence, whereas certain linearly unambiguous constituent structures are only compatible with coherence (e.g. verbal complex in SpecCP, ‘long’ scrambling, ‘long’ passive). The question is whether intraposition (‘in situ’) is ever compatible with non-coherence. It is one of the objectives of the questionnaire study to answer this question empirically.

### 3 Questionnaire Study

#### 3.1 Procedure

##### 3.1.1 Materials of Main Study

In the questionnaire study, 56 control verbs were tested as matrix verbs in the seven coherent, non-coherent, and ambiguously coherent constructions described above. An example sentence from the questionnaire study in all of its seven versions is shown in (14) through (16).

(14) **Coherence Tests**

a. **Topicalization of the (restructured) verb cluster (VC)**

Zu schreiben beschlossen hat Karla den Aufsatz.  
To write decided has K. the article

b. **‘Long’ scrambling of a pronoun**

Was den Aufsatz betrifft, so ist klar,  
What the article concerns so is clear  
warum ihn Karla zu schreiben beschlossen hat.  
why him K. to write decided has

c. **‘Long-distance’ passive**

Der Aufsatz wurde zu schreiben beschlossen.  
The article was to write decided

d. **Wide scope of negation**

Karla hat keinen Aufsatz zu schreiben beschlossen  
K. has no article to write decided  
und Friederike auch nicht.  
and F. also not

(15) **Non-Coherence Tests**

a. **Extrapolation of the infinitival complement**

Karla hat beschlossen, den Aufsatz zu schreiben.  
K. has decided the article to write

b. **Narrow scope of negation**

Karla hat keinen Aufsatz zu schreiben beschlossen.  
 K. has no article to write decided  
 und Friederike auch  
 and F. also

(16) **Ambiguous with respect to Coherence: Intraposition**

Karla hat den Aufsatz zu schreiben beschlossen.  
 K. has the article to write decided

The 56 control verbs fall into 5 classes according to the three properties listed in (17):

- (17) a. Which argument controls the external argument of the embedded infinitive?  
 Subject- vs. Object-Control
- b. What is the syntactic function of the embedded infinitive?  
 Direct Object vs. Prepositional Object<sup>4</sup>
- c. Is there a further object in addition to the infinitival clause?  
 No object vs. dative object vs. accusative object

Five of the subclasses that result from these criteria were used in the questionnaire study. These subclasses are shown in Table 1. The last column in this table shows the number of different verbs that were used within each verb class. In total, 70 sentences were constructed, 14 sentences for each of the 5

Table 1: Subclasses of control verbs used in the questionnaire study

Control	Infinitive in function of	Additional objects	Examples	Nr. of verbs
Subject	Accusative	∅	<i>versuchen</i> (try), <i>beschließen</i> (decide)	14
Subject	Accusative	Dative	<i>drohen</i> (threaten), <i>versprechen</i> (promise)	7
Subject	PP	∅	<i>aufhören</i> (stop), <i>klagen</i> (complain)	7
Accusative Object	PP	Accusative	<i>auffordern</i> (ask), <i>ermahnen</i> (urge)	14
Dative Object	Accusative	Dative	<i>erlauben</i> (allow), <i>verbieten</i> (forbid)	14

verb classes. Within the 14 sentences for a verb class, each verb appeared in either one sentence (verb classes with 14 different verbs, cf. Table 1) or in two sentences (verb classes with 7 different verbs). Each sentence appeared in seven versions according to the seven constructions described above.

From the 70 sentence septets, seven experimental lists were constructed according to a Latin Square design. Each list contained one version of each sentence, with an equal number of sentences in each combination of the two factors verb class and construction.

### 3.1.2 Materials of Control Studies

In addition to the main study on (non-)coherence, the questionnaire study included two further studies which served as control experiments and at the same time as filler items. As a control for the two main-study conditions involving scope of negation, the first control experiment investigated sentences with positive and negative sentence tags as shown in (18) and (19). All sentences were in the perfect tense and contained either a single main verb (cf. (18)) or a modal and a main verb (cf. (19)).

- (18) a. David hat (k)einen Dinosaurier gezeichnet.  
D. has a/no dinosaur drawn
- b. David hat (k)einen Dinosaurier gezeichnet und Petra auch.  
D. has a/no dinosaur drawn and P. too
- c. D. hat (k)einen Dinosaurier gezeichnet und P. auch nicht.  
D. has a/no dinosaur drawn and P. too not
- (19) a. David hat (k)einen Dinosaurier zeichnen müssen.  
D. has a/no dinosaur drawn must
- b. D. hat (k)einen Dinosaurier zeichnen müssen und P. auch.  
D. has a/no dinosaur drawn must and P. too
- c. D. hat (k)einen Dinos. zeichnen müssen und P. auch nicht.  
D. has a/no dinosaur drawn must and P. too not

36 sentences, each in 12 versions as shown in (18) and (19), were constructed. The experimental sentences were distributed on 12 experimental lists according to a Latin Square Design. Note that sentences involving a modal verb selecting an infinitival complement are first rate examples of obligatorily coherent constructions. Sentences as in (19-c) thus provide a lower bound of the ease of construing a negative sentence tag with a negative item contained in a coherent infinitival complement.

The second control experiment that was included in the questionnaire tested sentences as shown in (20). These sentences occurred with either subject-object word order (the order shown in (20)) or with object-subject word-order. The latter was obtained from the sentences in (20) by simply exchanging the positions of the bracketed constituents.

- (20) a. [<sub>S</sub> Gerd] hat [<sub>O</sub> das Hemd] sorgfältig gebügelt.  
           G.    has    the shirt   carefully ironed
- b. Was das Hemd betrifft, so ist klar, warum [<sub>S</sub> Gerd] [<sub>O</sub> es]  
           what the shirt   concerns so is clear why    G.        it  
           sorgfältig gebügelt hat.  
           carefully ironed    has

This control experiment was included to measure the complexity of a hanging topic, as is used in the pronoun scrambling condition of the main study. 24 sentences, each with four versions as shown in (20), were constructed and distributed over four lists according to a Latin Square Design.

### 3.1.3 Subjects and Procedure

For the questionnaire study, a sentence list from the main study (70 sentences) and a sentence list for each of the two control studies (36 sentences for control experiment 1, 24 sentences for control experiment 2) were combined into a single list of 130 sentences. The 130 sentences in each questionnaire were randomly ordered. The questionnaire contained a written instruction asking participants to judge the acceptability of each sentence on a scale from 1 („makes complete sense, is completely easy to understand”) to 5 („makes no sense, is very difficult to understand”).

35 students of the University of Konstanz were paid to participate in the experiment.

### 3.2 Results of Main Study

Table 2 shows the results of the main experiment of the questionnaire. Several statistical procedures were used to analyze these results.

**ANOVA** Two-way ANOVAS (Verb Class By Construction) with either subjects as random factor (F1) or items as random factor (F2) revealed a significant main effect of verb class  $F1(4,136)=42.46, p<.01$ ;  $F2(4,455)= 17.93, p<.01$ ), with the following rank order among the five classes: simple subject

Table 2: Results of main experiment:  
Mean ratings on a scale from 1 (best) to 5 (worst)

constructions	subj	subj+ dat	subj inf. as PP	obj-dat	obj-acc
extraposition	1.27	1.53	1.34	1.24	1.26
narrow negation	3.89	3.79	4.00	3.89	3.96
intraposition	2.19	2.90	2.73	2.49	2.77
VC-fronting	2.76	3.59	3.00	2.99	3.66
scrambling	2.30	3.44	2.44	2.66	3.43
wide negation	3.21	4.04	3.91	3.74	4.00
long passive	3.10	3.54	3.69	2.87	4.30

control (2.67), object control with dative object (2.84), subject control (inf. as PP) (3.02), subject control with dative object (3.26), object control with accusative object (3,34). With the exception of the last two verb classes, all pairwise comparisons were significant.

The main effect of construction was also significant. ( $F(6,204)=96.98$ ,  $p<.01$ ;  $F_2(6,455)=129.14$ ,  $p<.01$ ), with the following rank order among the seven constructions: extraposition (1.33), intraposition (2.61), pronoun scrambling (2.85), VC fronting (3.20), long passive (3.50), wide scope negation (3.78), narrow scope negation (3.90). All pairwise comparisons were significant with the exception of the comparison between wide and narrow scope negation.

Finally, the interaction between the two main factors was also significant ( $F(24,816)=4.55$ ,  $p<.01$ ;  $F_2(24,455)=2.14$ ,  $p<.01$ ). This reflects the finding that for the two constructions extraposition and narrow scope negation, verb classes did not differ from each other whereas they did differ within the other five conditions.

**Correlations** In order to test the hypothesis that coherence tests measure some common property „coherence”, we computed the correlations between the values that each of the 70 sentences from the questionnaire had received for the seven constructions. The ensuing pattern of 21 correlations can be summarized as follows. (i) The four coherence tests (VC topicalization, long scrambling, long passive and wide scope negation) all correlated with each other, with  $r$  ranging from .39 to .47 (all  $p$ 's  $< .01$ ).

(ii) The first of the non-coherence tests, extraposition, showed some correla-

tions with all other conditions ( $r$  from .23 to .32,  $p < .05$ ) except long scrambling and narrow negation (both  $p$ 's  $> .1$ ). The second of the non-coherence tests, narrow negation, did not correlate with any of the other constructions (all  $p$ 's  $> .1$ ). The finding that extraposition - a main test of non-coherence - also correlated to some degree with most of the other constructions is not completely unexpected given that the seven constructions in which each sentence appeared were as similar as possible with respect to their lexical content. All effects on participants' judgements which are caused by overall plausibility thus lead to some base-line correlations among the different constructions.

(iii) The structurally ambiguous intraposition condition correlated highly with each of the four coherence tests, with  $r$  ranging from .40 to .63, all  $p$ 's  $< .01$ . Furthermore, intraposition correlated with the non-coherent extraposition ( $r = .32$ ,  $p < .01$ ) but not with the non-coherent narrow negation ( $r = .11$ , n.s.). When extraposition was partialled out of the pairwise correlations, the coherence tests as well as intraposition still correlated substantially. For example, the partial correlations between intraposition and the other four coherence tests ranged from .36 to .60 instead of .40 to .63 without partialling.

In sum, the pattern of correlations is compatible with the hypothesis that the coherence tests are closely related in that they are sensitive to some common underlying factor of coherence.

**Principal Component Analysis** To further explore the correlations between the seven constructions used in the experiment, a principal component analysis was conducted. The rationale behind such an analysis is to see whether a high-dimensional data-space can be reduced to fewer dimension. In our case, the seven syntactic constructions tested in the questionnaire constitute the original dimensions of the data-space. A principal component analysis with three rotated factors led to the following picture. The first factor, which accounted for 40% of variance, was highly loaded on all four coherence tests as well as on intraposition. The second and the third factor account for 15% of variance each, and were highly loaded on extraposition and narrow scope of negation, respectively.

In sum, the results of the principal component analysis support the conclusion that all four coherence tests measure some common underlying property, and that intraposition patterns with the coherence tests but not with non-coherence tests. To show this in a more succinct way, Figure 1 plots for each of the five verb classes the mean of the four coherence tests (mean coherence), the mean of the two non-coherence tests (mean non-coherence), as

well as the results for sentences with intraposition. Figure 1 clearly reveals the sensitivity of mean coherence to verb class as well as the insensitivity of mean non-coherence to verb class. As also shown, intraposition behaves basically like mean coherence and not like mean non-coherence.

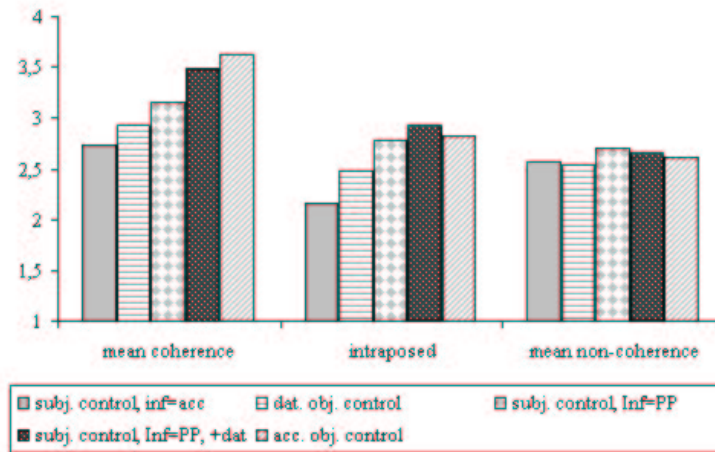


Figure 1: Mean coherence, intraposition, and mean non-coherence by verb class

**Verb-specific results** For reasons of space, we cannot discuss verb-specific results in any detail. However, to give at least an indication of variation within verb classes, Table 3 lists the ten verbs that received the best mean judgments on the four coherence tests. Note that these results are based on either a single sentence or on two sentences, as indicated in the last column of this table (cf. the last column of Table 1). Despite the limited amount of data for each single verb, Table 3 reveals some interesting patterns. Not surprisingly, *versuchen* ('to try') came out as the „most coherent” verb. Furthermore, among the ten most coherent verbs there were six subject-control verbs with the infinitival clause in function of the direct object. However, also two object control verbs as well as two subject control verbs with the infinitive in function of PP found their way into this „top-ten list”. As for the latter, its probably no accident that we find the two inchoative verbs *beginnen* and *anfangen* (both meaning 'to begin, to start') in Table 3. As pointed out in footnote 4, these verbs can be used either with a PP-argument (*mit etwas beginnen* 'to begin something')

Table 3: The Ten „Most Coherent” Verbs

Verb	Verb class	Mean Coherence	Nr of sentences
<i>versuchen</i> (try)	subj. control	2.16	1
<i>beginnen</i> (begin)	subj. control/prep	2.33	2
<i>anfangen</i> (start)	subj. control/prep	2.39	2
<i>planen</i> (plan)	subj. control	2.43	1
<i>erlauben</i> (allow)	obj. control + dat	2.44	1
<i>glauben</i> (believe)	subj. control	2.44	1
<i>gestatten</i> (allow)	obj. control + dat	2.58	1
<i>beabsichtigen</i> (intend)	subj. control	2.60	1
<i>erwägen</i> (consider)	subj. control	2.63	1
<i>vergessen</i> (forget)	subj. control	2.64	1

or with a direct object (*etwas beginnen* 'to begin something').

The reason for classifying these verbs nevertheless as belonging into the class of verbs for which the infinitive has the function of a PP rests on the observation that in the examples that were used in the questionnaire pronominalization of the infinitive preferentially makes use of the pronominal PP *damit* 'there-with' instead of the direct object *das* 'this'. This is shown by sentence (21) which is an original example from the questionnaire study. The question in (21-b) sounds more natural with *damit* than with *es*.

- (21) a. Theresa hat begonnen, das teure Rindfleisch zu essen.  
 T. has begun the expensive beef to eat  
 'Theresa has started to eat the expensive beef.'
- b. Wann hat sie damit / das begonnen?  
 When has she there-with / this begun  
 'When has she started to do this?'

### 3.3 Results of Control Studies

Table 4 shows the rating judgments for the control study on sentence tags (cf. (18) and (19) for example sentences).

Three-way ANOVAS (Verb x Tag x Negation) revealed first of all a main effect of tag ( $F(1,68)=515.91$ ,  $p<.01$ ;  $F(2,70)=2856.72$ ,  $p<.01$ ), reflecting

Table 4: Results of Control Experiment 1:  
Mean ratings on a scale from 1 (best) to 5 (worst)

		No Tag	Matching Tag	Mismatching Tag
V alone	- Negation	1.01	1.27	4.76
	+ Negation	1.10	1.52	4.1
Modal + V	- Negation	1.18	1.56	4.6
	+ Negation	1.18	1.59	3.94

the fact that sentences without tags received better judgments than sentences with matching tags (1.1 vs. 1.48;  $t_1=3.43$ ,  $p<.01$ ;  $t_2=7.9$ ,  $p<.01$ ), which in turn received better judgements than sentences with mismatching tags (1.48 vs. 4.35;  $t_1=25.94$ ,  $p<.01$ ;  $t_2=61.15$ ,  $p<.01$ ).

The main effect of negation was also significant ( $F(1,34)=9.42$ ,  $p < .01$ ;  $F(1,35)=22.53$ ,  $p < .01$ ), as was the interaction between negation and tag ( $F(1,68)=18.16$ ,  $p < .01$ ;  $F(2,70)=42.47$ ,  $p < .01$ ). This reflects the finding that for sentences with no tag, negated and non-negated sentences did not differ from each other (both  $t_1$  and  $t_2 < 1$ ), for sentences with matching tags, there was a tendency for negated sentences to be judged worse than non-negated sentences (1.56 vs. 1.41;  $t_1=1.41$ ,  $p=.16$ ;  $t_2=2.16$ ,  $p<.05$ ), whereas for sentences with mismatching tags negated sentences were judged significantly better than their non-negated counterparts (4.02 vs. 4.67;  $t_1=6.48$ ,  $p<.01$ ;  $t_2=9.88$ ,  $p<.01$ ).

The factor verb was not significant ( $F(1,34)=3.24$ ,  $p=.08$ ;  $F(1,35)=1.37$ ,  $p=.25$ ) but the interaction between verb and tag was ( $F(1,68)=13.37$ ,  $p<.01$ ;  $F(2,70)=5.76$ ,  $p<.01$ ), reflecting the fact that for both sentences without tags and sentences with matching tags sentences without any modal verb in addition to the main verb were judged worse than sentences without a modal verb (Condition *No tag*: 1.18 vs. 1.03;  $t_1=2.87$ ,  $p<.01$ ;  $t_2=1.77$ ,  $p=.08$ . Condition *Matching tag* 1.39 vs. 1.58;  $t_1=3.55$ ,  $p<.01$ ;  $t_2=2.35$ ,  $p<.05$ ) whereas for sentences with mismatching tags the reverse was true (4.27 vs. 4.43;  $t_1=3.08$ ,  $p<.01$ ;  $t_2=2.06$ ,  $p<.05$ ).

The interaction between verb and negation ( $F(1,34)=3.03$ ,  $p=.09$ ;  $F(1,35)=2.11$ ,  $p=.15$ ) and the interaction between all three factors (both  $p$ 's  $>.1$ ) were not significant.

The main conclusions to be drawn from this control study are that participants were clearly able to discriminate between matching and mismatching sentence tags, and that infinitival complementation with modals as matrix verbs only marginally reduced the acceptability ratings in comparison to sen-

tences without any infinitival complementation. The relevance of these findings with respect to the main study will be considered in the main discussion.

The rating judgments for the control study on topicalization and word order are shown in Table 5 (cf. (20) for example sentences).

Table 5: Results of Control Experiment 2:  
Mean ratings on a scale from 1 (best) to 5 (worst)

	Subject > Object	Object < Subject
Simple Structure	1.04	1.30
Topicalization	1.56	1.78

As shown in Table 5, the two factors of order and construction worked basically in an additive fashion. Sentences with OS word order were judged worse than sentences with SO word order ( $F(1,34) = 25.90, p < .01$ ;  $F(1,23) = 22.51, p < .01$ ), and sentences with topicalization were judged worse than simple sentences ( $F(1,34) = 31.90, p < .01$ ;  $F(1,23) = 85.76, p < .01$ ). These two factors did not interact (both  $F_1$  and  $F_2 < 1$ ).

These results show that combining object-subject word-order with a hanging-topic reduces acceptability in comparison to simple subject-object sentence to some degree. This finding has to be taken into account when interpreting the condition pronoun-scrambling of the main study. When it is taken into account, it underlines the high acceptability of sentences with pronoun scrambling with some classes of control verbs.

#### 4 Discussion

The main results of the questionnaire on (non-)coherence can be summarized as follows.

- (i) As shown by both the correlations and the principal component analysis, the coherence tests can be considered valid. They significantly correlate with each other but not with the non-coherence tests.
- (ii) Sentences with intraposed infinitival complements - which are ambiguous between a coherent and a non-coherent structure - clearly pattern with the coherence and not with the non-coherence tests.
- (iii) The questionnaire provides evidence for the similar behavior of verbs within a given verb class. In general, the verbs whose infinitival complement replaces or appears in the function of the accusative object (subject control verbs and dative object control verbs) are judged better in coherent constructions than verbs whose infinitival complement obligatorily replaces

a prepositional object. This result is in accordance with the generalization (cf. Haider 1993, 251) that the infinitival complement replaces the internal structural argument in coherent constructions. At the same time, the results also show substantial variation within verb classes.

In addition to these main results, several other interesting observations can be made. For reasons of space, we have to restrict ourselves to two observations. First, as shown in Table 4, negated sentences with a modal verb and a following negative tag were judged as quite acceptable (mean judgment = 1.59). For control verbs, in contrast, even the best verb class - simple subject-control verbs - received only a mean judgment of 3.24 (cf. the row *wide negation* in Table 2). However, this does not mean that there is a categorical split between modal verbs and control verbs with regard to wide scope of negation. With some examples, also sentences with control verbs received quite good ratings. For example, wide scope of negation with the verb *versuchen* ('to try') received a rating of 1.66 which is in the same range found for modal verbs in the first of the two control studies.

A similar point can be made for sentences exhibiting long passive. While this construction was rated rather low overall, some verbs gave rise to quite acceptable sentences. Interestingly, among the five long-passive sentences judged best, four contained object-control verbs with a dative argument (*beibringen* ('to teach'): 1.75; *befehlen* ('to order'): 2.0; *empfehlen* ('to recommend'): 2.0; *gestatten* ('to allow': 2.0), followed by a subject-control verb (*versuchen* ('to try'): 2.17). Note that this observation is also clearly visible in Table 2. Object-control verbs with a dative object as a class received the best value for the long-passive construction.

## 5 Conclusion: Directions for Future Research

The questionnaire study reported in this article is obviously only a first step toward a better understanding of the complicated web of phenomena involved in infinitival complementation. Even a quick look at Wurmbrand (2001) and the review of this work by Reis and Sternefeld (2004) proves the necessity of doing more empirical research in this area.

In addition, eliciting native speakers' judgments in the way reported also raises important questions as to the status of these judgments. For example, what should we make of the result that sentences with intraposed infinitival clauses patterned with the coherence tests throughout? Does this mean that these sentences are not ambiguous after all, or is this finding the joint result of knowledge of grammar and parsing principles making use of this knowl-

edge? Addressing questions like these will - we hope - lead to a clearer picture of infinitival complementation in particular, and the nature of grammatical knowledge in general.

## Notes

- 1 The fact that only the matrix verb undergoes passivization supports the V-cluster (mono-clausality) theory. In other languages long passives may rest on recurring passivization, e.g. English *Newcastle takes its name from the castle which was begun to be rebuilt by Rufus*, cited in Visser (1973). See also Kornfilt (1996) on Turkish.
- 2 Another test for non-coherence is pied piping of the infinitival complement. As this test is also a movement test similar to extraposition we did not include it in the questionnaire study.
- 3 Less fine-grained generalizations, e.g., that subject control verbs construct coherently and object control verbs construct non-coherently face a number of counter examples, see Meurers (2000), Haider (1993) for discussion. As Haider (1993, 251) notes, his condition is necessary but not sufficient for coherence as verbs like *bedauern* ('regret') fulfill the condition but are not easily constructed coherently. In the questionnaire study, these verbs were left out as they could not have been constructed parallel to the other examples.
- 4 When these verbs occur with an infinitival clause but without an overt PP, either the infinitival clause replaces the PP or there is a covert PP. In either case, the PP would interfere with restructuring. Notice, however, that there are also verbs like *anfangen* ('to begin') which can take a PP (*damit anfangen*) or not, as seen in *Er hat den Roman angefangen* ('He started (to read) the novel').

## References

- Bayer, Josef and Jaklin Kornfilt  
 1990 Restructuring effects in German. In E. Engdahl, M. Reape, M. Mellor, and R. P. Cooper, (eds.), *Parametric Variation in Germanic and Romance: Proceedings for a DYANA Workshop, September 1989*, Edinburgh Working Papers in Cognitive Science, pp. 21–42. Centre for Cognitive Science, University of Edinburgh, Edinburgh.
- Bech, Gunnar  
 1955/57 *Studien über das deutsche verbum infinitum. (Det Kongelige Danske Videnskabers Selskab; Dan. Hist. Filol. Medd. Bind 35, no.2 (1955) & Bind 36, no.6 (1957). New edition 1983. Niemeyer, Tübingen.*

- Evers, Arnold  
1975 *The Transformational Cycle in Dutch and German*. Doctoral dissertation, Rijksuniversiteit Utrecht.
- Grewendorf, Günther  
1988 *Aspekte der deutschen Syntax. Eine Rektions-Bindungs-Analyse*. Narr, Tübingen.
- Haegeman, Liliane and Henk van Riemsdijk  
1986 Verb projection raising, scope, and the typology of rules affecting verbs. *Linguistic Inquiry*, 17: 417–466.
- Haider, Hubert  
1993 *Deutsche Syntax - generativ. Vorstudien zu einer projektiven Theorie der Grammatik*. Narr, Tübingen.
- Höhle, Tilmann N.  
1978 *Lexikalistische Syntax. Die Aktiv-Passiv-Relation und andere Infinitkonstruktionen im Deutschen*. Niemeyer, Tübingen.
- Koopman, Hilda and Anna Szabolcsi  
2000 *Verbal Complexes*. MIT Press, Cambridge, Mass.
- Kornfilt, Jaklin  
1996 NP-movement and restructuring. In Robert Freidin, (ed.), *Current Issues in Comparative Grammar*. MIT Press, Cambridge, MA.
- Lerner, Jean-Yves and Wolfgang Sternefeld  
1984 Zum Skopus der Negation im komplexen Satz des Deutschen. *Zeitschrift für Sprachwissenschaft*, 3: 159–202.
- Meurers, Detmar  
2000 Lexical generalizations in the syntax of German non-finite constructions. Technical Report 145, Arbeitspapiere des Sonderforschungsbereichs 340.
- Reis, Marga and Wolfgang Sternefeld  
2004 Review article of "S. Wurmbrand: Infinitives, restructuring and clause structure". *Linguistics*, 42(2): 469–508.
- Stechow, Arnim von and Wolfgang Sternefeld  
1988 *Bausteine syntaktischen Wissens*. Westdeutscher Verlag, Opladen.
- Visser, Fredericus Th.  
1973 *An Historical Grammar of the English Language*. E.J. Brill, Leiden.
- Wurmbrand, Susanne  
2001 *Infinitives. Restructuring and Clause Structure*. Mouton de Gruyter, Berlin.