BNC Dependency Bank 1.0 & 2.0

Additional Documentation
to Lehmann & Schneider 2012

http://www.helsinki.fi/varieng/journal/volumes/12/lehmann_schneider/

The Pro3Gres Annotation scheme

Gerold Schneider, University of Zurich

1 The Pro3Gres Annotation Scheme

The Pro3Gres parser[1] automatically adds syntactic annotation to texts that are tagged and chunked. It is described in detail in Schneider (2008). The tagset required in the input texts is the Penn Treebank tagset. The syntactic representation of the parser's output is a dependency grammar annotation. An overview of important relations is given in figure 1.

RELATION	LABEL	EXAMPLE
verb–subject	*subj*	*he sleeps*
verb–direct object	*obj*	*sees it*
verb–second object	*obj2*	*gave (her) kisses*
verb–adjunct	*adj*	*ate yesterday*
verb–subord. clause	*sentobj*	*saw (they) came*
verb–pred. adjective	*predadj*	*is ready*
verb–prep. phrase	*pobj*	*slept in bed*
noun–prep. phrase	*modpp*	*draft of paper*
noun–participle	*modpart*	*report written*
verb–complementizer	*compl*	*to eat apples*
noun–preposition	*prep*	*to the house*

Figure 1. Important dependency relations of Pro3Gres

The dependency grammar annotation is similar to GREVAL (Carroll et al. 2003) and to the Stanford Dependency scheme. Haverinen et al. (2008) have implemented a mapping of the Pro3Gres annotation scheme to Stanford scheme. We illustrate our set of dependency relations and give linguistic examples in this section.

Dependency Grammar (Tesnière 1959) focuses on grammatical relations, on government, on valency relations (e.g. Helbig 1992) and thus expresses the verb's central valency relations like subject and object. The valency concept was increasingly extended to other word classes than verb (e.g. relational nouns or adjectives have valencies) and also to adjuncts in addition to complements. These relations are what we refer to as major relation types in the following. The interpretation and the linguistic motivation of these dependency labels is straightforward.

[1] PRObabilistic RObust PROlog-implemented Grammatical Relation Extraction System

According to Tesnière, dependency relations are between nuclei. The concept of nucleus roughly corresponds to noun and verb chunks (e.g. Abney). Accordingly, the dependency relations that we produce are between noun and verb chunk heads.

In order to obtain fully connected parses, every nucleus in a sentence needs to be connected. For this technical reason, also words like complementizers, prepositions and conjunctions thus need to get attached. It is not straightforward how they should be attached in a linguistically meaningful way, and many different approaches have been suggested. We attach complementizers to the subordinate verb, and prepositions to the nouns in the PP. While these decisions can be seen as arbitrary, they mirror the original Dependency Grammar view that content words should be used as governors. We refer to these technically needed relations as minor relations. Sometimes also relations inside a chunk, for example the relation between an NP head noun and its determiner are described as dependency relations. We also include them in our discussion of minor relations.

While Dependency Grammar does typically not know empty categories, long-distance dependencies often create additional, so-called secondary or indirect dependencies. For example, in the *have-to* modal construction figure 2, *borrower* is both the overt subject of *have* and the implicit subject of the subordinate clause that is headed by the verb *pay*.

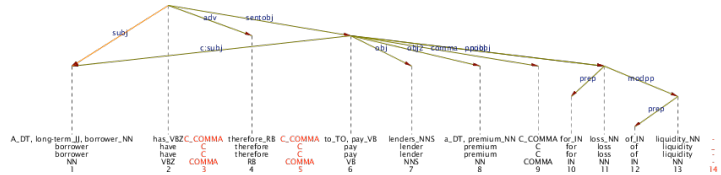


Figure 2. Long-distance dependency with a semi-modal verb

1.1 Major Relation Types

The interpretation of major relation types is typically straightforward. We illustrate the types and give examples in the following.

1.1.1 Subject

The subject relation *subj* expresses just what it means. Relatively many subjects occur in long-distance dependencies, which we have illustrated in figure 2. The Subject relation reports both active and passive subjects. Passive subjects alone can be searched using the 'Passive Subject' relation, which is a subset all subject relations. Results of a query for eat are shown in figure 3, an example sentence from the results in figure 4.

Your Query:'h1=eat r1=passive d1= eq1=' returned 603 results in BNCWWRI_go2a.

|< << >> >| Show Page: 1 Show chunks Show Tags New Query Go!

No	Reference	Solutions 1 to 20 Page 1/31 Processed for gerold at 130.60.18.177
1	KAD:136::10118702	A hearty supper was eaten and a bar constantly provided welcome liquid refreshment.
2	KAY:430::10125982	When it passes out of his hands, Gollum is so eaten up with desire for the Ring that even though he has become evil he helps Frodo find Mount Doom in order to stay with the Ring.
3	KAY:684::10126245	On the other hand if Herakleophorbia was eaten in excess it caused illnesses like tumours and cancer in humans.
4	K92:636::10130827	These definitions enable us to say quite categorically that a household's expenditure on food is consumption - _: the food will be eaten within a short period of time and that will be an end of the matter.
5	K96:724::10142302	where all else fails, contingencies are eaten up and the coffers are bare, doomsday would see other budgets being raided and Peter's services being run down to help pay for Paul.
6	K97:4064::10147079	Rachel, a former Quarry Bank pupil, became a household face after she was filmed seductively eating a Flake chocolate bar while relaxing in a bath in Venice.
7	K97:4363::10147414	Yesterday, a Cadbury spokeswoman said no decision had been taken to stop screening the Flake television advert in which Rachel is shown eating the chocolate bar while lying in a bath.
8	K97:6770::10149999	A spokeswoman for Cadbury said no decision had been taken to stop the television advert in which Rachel is shown eating a Flake while lying in a bath.
9	K97:10370::10153869	Then the princess raised her eyebrows when she realised she was expected to eat it.
10	K97:11123::10154703	Then the princess raised her eyebrows when she realised she was expected to eat it.
11	K51:1751::10198520	The UK subsidiary has been eating into the parent company's profits due to start up costs for its paging and mobile communications operations.
12	K55:5393::10221730	The story of orphans being eaten by horrible, scary giants such as curdblooding Fleshlumpeater and Bloodbottler on their way to conquer England's juicy human beans but captured by Her Majesty's army and air force was quintessential fantasy that children love.
13	K59:3427::10233207	That is being helped by the change in the turkey processing market in the past 15 years or so which has led to two-thirds of the national output, worth a total of 300 million a year, being eaten in portion and added value form.
14	K5A:58::10235019	It is very frustrating to see sites being literally eaten away, Mrs Gibson said.
15	K5D:9564::10255202	That means the mussels can theoretically be eaten raw, said Mr Horne.

Figure 3. Results of a query for 'eat' with passive subjects

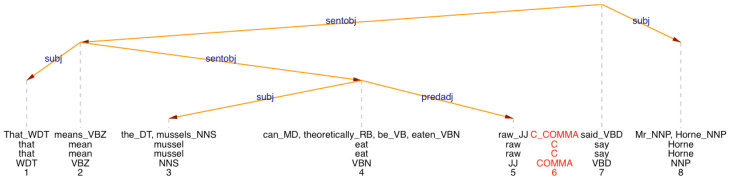


Figure 4. Syntactic analysis of a result from figure 3.

1.1.2 Objects: Object and Second Object

Also the object dependency is straightforward to interpret, although there are two complications. First, the complement of copular verbs like *be* is given an object label. Since copular verbs and regular verbs are almost always in complementary distribution, this does hardly create ambiguity. Second, there are two object relations: *obj* and *obj2*. *obj* is the object closer to the verb, *obj2* the more remote object, if there is any. In other words: Transitive verbs except for ditransitives just have an *obj* relation, ditransitive verbs which have two realized objects have an *obj* and an *obj2* relation, in which the *obj* is the indirect and *obj2* the direct object. The example query in figure Z finds all ditransitive verb occurrencies of *give* found by the parser. In detail, the query works as follows. All the example we five are from the written part of the BNC, corresponding to the selection of 'BNC-W written' in the 'Select Corpus' field. In the top fileds, in line 1) we restrict the 'Head' lemma (the terms head and governor are typically used interchangeably) to *give* and the 'Relation' drop-down list to object. We leave the 'Dependent', i.e. the object lemma unrestricted, which means that any object will be returned, no matter what its lemma may be. We take all directions and direct or indirect link types, which are the default settings. Then we click on the more-button to formulate the query for second object. We select Second Object from the drop-down list in line 2) an place no further restrictions. Line 1 and line 2 each contain a query for a dependency relation. The 'Binding' drop-down list shown in figure 5 allows us to combine

these otherwise unrelated queries into a query for a partial tree. We leave 'Head1) = Head 2)' which means that the head of line and line 2 are identical, or in other words, that the object and the second object attach at the same place, forming a 'flat' tree. If we had chosen 'Dependent 1) = Head 2)' we would search for a nested tree, in this case an object that has a second object attached to it – a linguistically very unexpected structure which reports no hits.

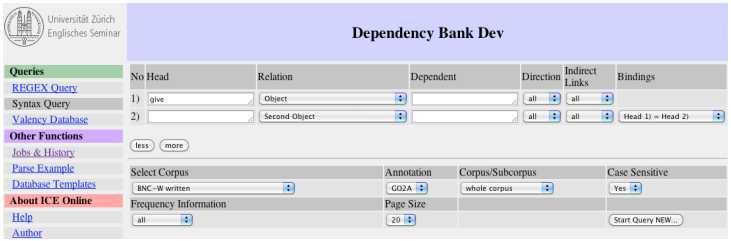


Figure 5. Binding of relations in the query

The parse tree of an example result is given in figure 6.

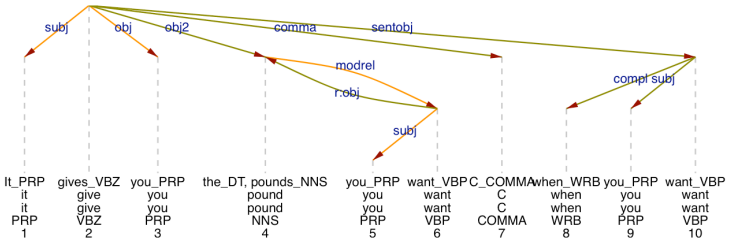


Figure 6. Example sentence containing the verb *give* which has an object and a second object

1.1.3 Adjunct

The adjunct relation *adj* attaches NPs that are used adverbially, such as temporal expressions. An example sentence is given in figure 7.

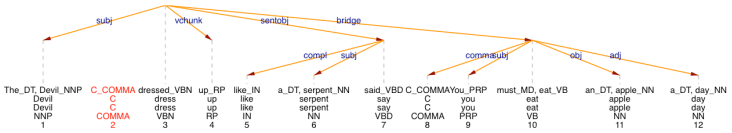


Figure 7. Example sentence containing the adjunct relation *adj*

1.1.4 Prepositional Phrases

Prepositional phrases are either attached to verbs, with the relation *pobj*, or to nouns, with the relation *modpp*. A subset of the verb-attached PPs are annotated as PP-complements, with the relation *pp:iobj*. For example, the query in figure 8

searches for PPs attached to *compare.* This query e.g. allows an investigation of *compare with* and *compare to*. Not that the distance between swap and the for-PP can be considerable, which poses serious problems if one does not have syntactically annotated data, and e.g. uses surface searches like windows-based approaches or regular expression queries.

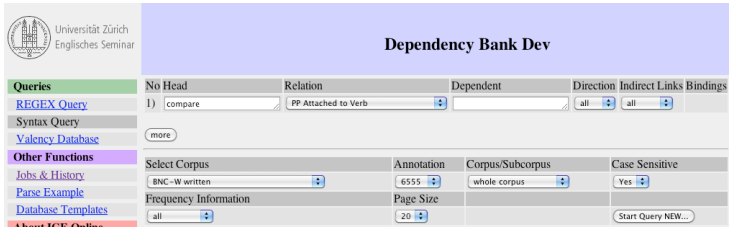


Figure 8. Query for PPs attached to the verb 'compare'

Figure 9 shows the results of a query for *swap* with a *for*-PP.

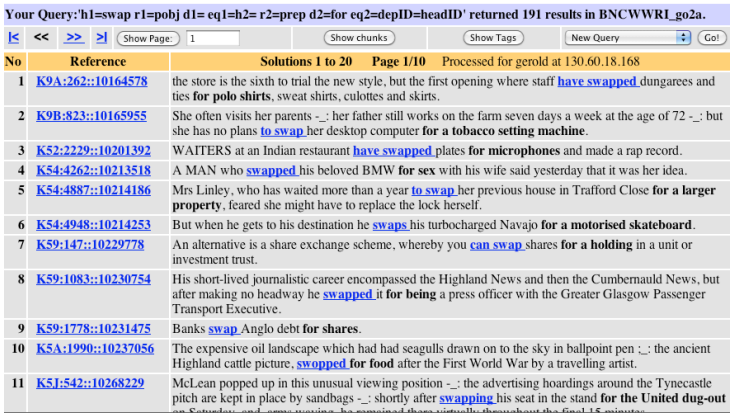


Figure 9. Results of a query for *swap* with a *for*-PP

The syntactic analysis of a sentence in the result set is given in figure 10. There is a small display issue: the labels expressing the verbal attachment of the PP and additionally giving it complement status, are not clearly legible, because the labels *pobj* and *pp:iobj* cover each other.

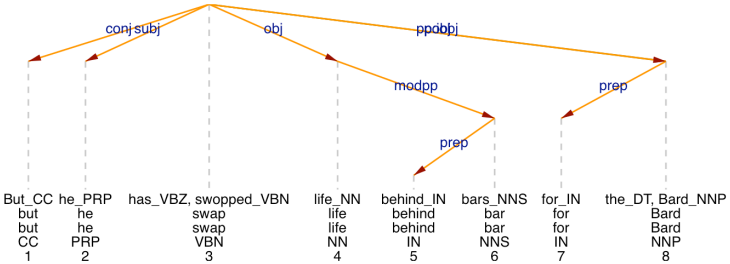


Figure 10. Syntactic tree of a hit from figure 9.

Finally, we give an example showing what people and governments are doing when they are *under pressure*. The query is shown in figure 11. In order to include only examples with high salience of *under pressure*, only fronted PPs (direction to the left in line 1) are included. The preposition is a dependent of the noun in the PP. The query is in line 2). This time we are searching for nested tree, in which the dependent of *pressure* is the preposition *under*. An excerpt of the results is given in figure 12.

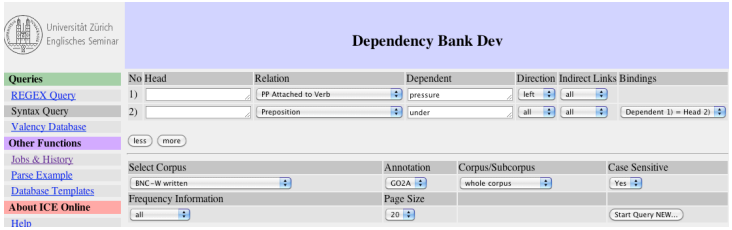


Figure 11. Query for PP 'under pressure' modifying verbs

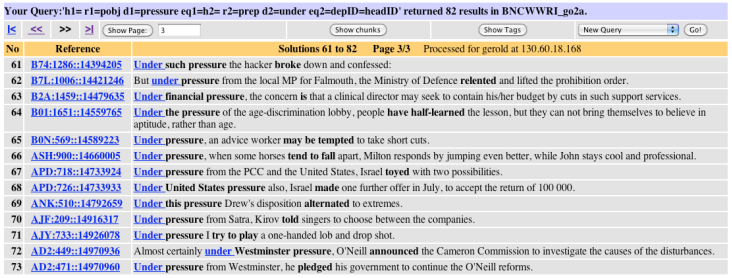


Figure 12. Results for the query in figure 11

1.1.5 Saxon Genitive

The Saxon Genitive relation has the label *pos* (for possessive). In the following example, we search for the relatively rare complex, i.e. premodified NPs that are dependents (i.e. possessors) in a Saxon Genitive relation. The query is in figure

13. We are searching for an unknown head which has a Saxon Genitive dependent whose lemma is *policy* in line 1). This dependent (hence the equality 'Dependent 1) = Head2)') in turn is head of a chunk-internal modification, as line 2) says. The results are in figure 14. Doublets in the result arise from multiple combinations where the possessor is premodified more than once.

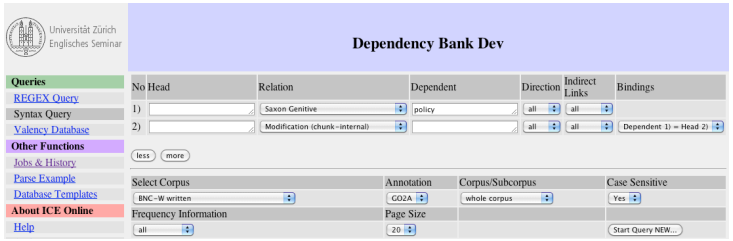


Figure 13. Query for a Saxon Genitive and chunk-internal modification

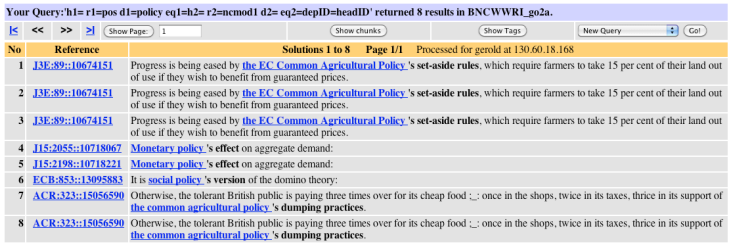


Figure 14. Results of the query in figure 13

1.1.6 Subordinate Clause

There are many types of clause subordination, we use the label *sentobj* for all of them. In the query in figure 15, we search for all words that have both a Saxon Genitive and a subordinated clause. This time our search tree consists of three elements: a Saxon Genitive, a chunk internal modification, and a subordinate clause. All of them restrict the head of the Saxon Genitive relation (also known as the possessee for the Saxon Genitive relation). The results are in figure 16.

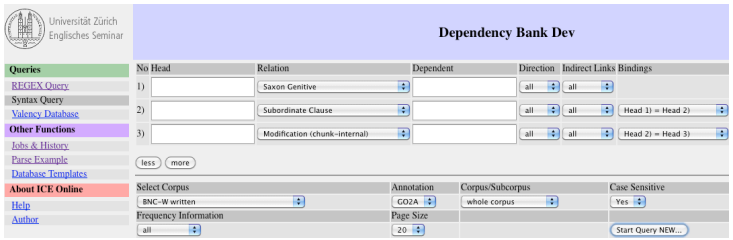


Figure 15. Complex query for subordinate clause

Your Query:'h1= r1=pos d1= eq1=h2= r2=ncmod1 d2= eq2=headID=headIDh3= r3=sentobj d3= eq3=depID=headID' returned 1076 results in BNCWWRI_go2a.

|< << >> >| Show Page: 1 Show chunks Show Tags New Query Go!

No	Reference	Solutions 1 to 20 Page 1/54 Processed for gerold at 130.60.18.168
1	KAY:439::10125991	Elrond **'s adamant refusal to take** the Ring is because he has considered its advantages but is wise enough to see that it would ruin him utterly.
2	K96:207::10141758	Anti-poverty campaigners have been angered by the Chancellor **'s budget decision to tax** domestic fuel.
3	K96:886::10142474	Workers may also have vital evidence to give about the interpretation of a parent **'s silence or refusal to give** information.
4	K97:688::10143445	Jon Gittens was the main victim of Rosenthal **'s latest attempt to convince** Souness he is worth a place in Liverpool's starting line-up.
5	K97:5385::10148511	Again, Palin **'s natural humour and ability to laugh** at a situation is never far away, but I can't shake the feeling that we've seen it all before somewhere.
6	K97:5385::10148511	Again, Palin **'s natural humour and ability to laugh** at a situation is never far away, but I can't shake the feeling that we've seen it all before somewhere.
7	K97:11634::10155277	Richens **'s lies and attempts to cover** up the killing were not necessarily inconsistent with his defence of provocation, said Lord Taylor.
8	K97:11815::10155480	The deal gives Time Warner **'s music publishing arm Warner/Chappell Music sole rights to market** Elton's catalogue of music from 1974 to the present as well as material from his next four albums.
9	K97:11815::10155480	The deal gives Time Warner **'s music publishing arm Warner/Chappell Music sole rights to market** Elton's catalogue of music from 1974 to the present as well as material from his next four albums.
10	K97:11815::10155480	The deal gives Time Warner **'s music publishing arm Warner/Chappell Music sole rights to market** Elton's catalogue of music from 1974 to the present as well as material from his next four albums.
11	K97:11815::10155480	The deal gives Time Warner **'s music publishing arm Warner/Chappell Music sole rights to market** Elton's catalogue of music from 1974 to the present as well as material from his next four albums.
12	K97:11815::10155480	The deal gives Time Warner **'s music publishing arm Warner/Chappell Music sole rights to market** Elton's catalogue of music from 1974 to the present as well as material from his next four albums.
13	K97:11815::10155480	The deal gives Time Warner **'s music publishing arm Warner/Chappell Music sole rights to market** Elton's catalogue of music from 1974 to the present as well as material from his next four albums.
14	K97:12032::10155721	It was Fischer **'s fifth attempt to get** the 10th win needed to clinch the series.
15	K9E:279::10168289	Following an ecology audit of ICI land, 21 sites in Europe, North America, India, Brazil and South Africa have been singled out to receive funds and expert assistance from ICI **'s Nature Link scheme to help** them conserve their wildlife.

Figure 16. Results for the query in figure 15

1.1.7 Relative Clauses: modrel and modpart

Full relative clauses have the label *modrel*, reduced relative clauses the label *modpart*. In the query in figure 17 we look for nouns that are modified by the reduced relative participle *extrapolate*. Results are in figure 18.

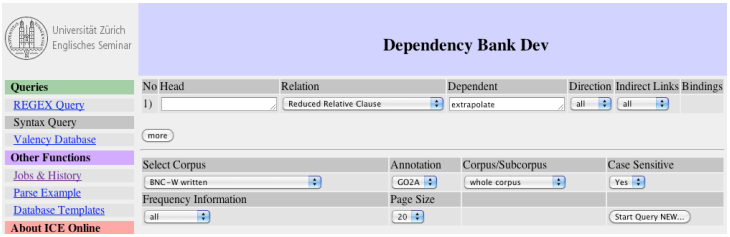


Figure 17. Query for reduced relative clause

Your Query:'h1= r1=modpart d1=extrapolate eq1=' returned 7 results in BNCWWRI_go2a.

|< << >> >| Show Page: 1 Show chunks Show Tags New Query Go!

No	Reference	Solutions 1 to 7 Page 1/1 Processed for gerold at 130.60.18.168
1	J1V:231::10761777	Extrapolating current trends, **the Select Committee** suggests that by the year 2000, the UK will run a 4 billion food and drink trade deficit with northern Europe alone.
2	H0U:772::11931901	Doolittle defined free volume fv in terms of the specific volume **extrapolated** to absolute zero, giving This definition of fv is, of course, different from that given above Equation(3.12) and fv is not a linear function of temperature in this case.
3	G1M:516::12292431	Even so, the tachyon signal was so faint that the neural net was having problems **extrapolating** a recognizable picture.
4	G0G:30::12357759	While it is possible that the missionary who baptized in the River Glen was the Briton, Rhun, and that Bede was mistaken when he located Paulinus at Yeavering, the statement about Rhun in the Historia Brittonum, inserted as it is in a somewhat garbled account **seemingly extrapolated** from the Ecclesiastical History, can not be regarded as undoubtedly signifying this and it is uncertain what weight can be attached to it.
5	CRM:340::13298430	The data points shown are for QDOT(, ref. 6 ;, :, refs 2, 3), the bulk-flow field(i) and the power spectrum **extrapolated** from the COBE quadrupole measurement, assuming a scale-invariant spectrum( ), with 1 error bars.
6	B14:199::14514796	Extrapolated , **this figure** means that as many as 1.5 million British drivers regularly drive after drinking too much.
7	B07:206::14569038	Estimates **extrapolated** from past trends in this way should be checked by monitoring the price actually paid for books, and subsequently adjusting where necessary.

Figure 18. Results for query in figure 17

1.1.8 Predicative Adjective

The predicative adjective relation *predadj* attaches predicative adjectives to copular verbs. An example is given in figure 19.

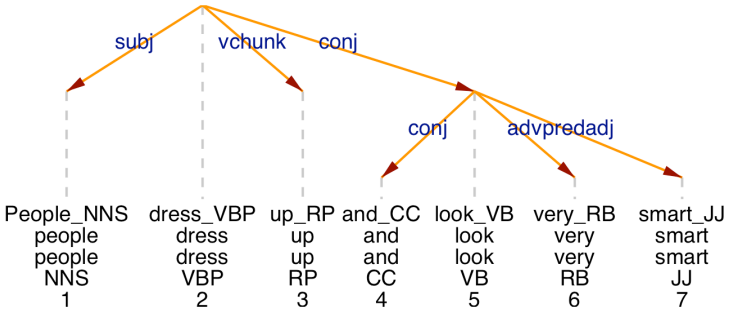


Figure 19. Syntactic analysis of a sentence containing a *predadj* relation

1.2 Additional Relation Types

1.2.1 Preposition

The Preposition relation *prep* allows one to constrain a query to certain prepositions in a PP. We have seen an example query, combining a restriction to the PP starting with *under* with PP direction to the left, in figures 11 and 12. The syntactic analysis of one sentence in the result set is given in figure 20.

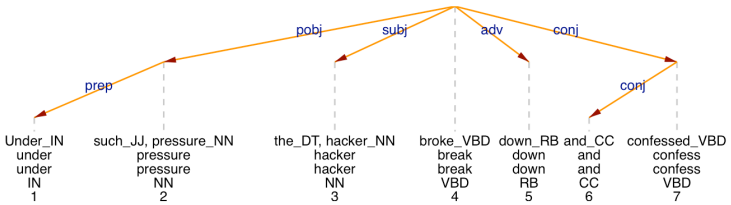


Figure 20. Analysis of a sentence containing *prep* with 'under' as dependent

1.2.2 Complementizer

Complementizers attach to their subordinate verb head with the *compl* relation. The query of figure 21 reports all instances in which it is a complementizer of a matrix clause headed by *suppose*. The results are in figure 22. Intuitively one might think that suppose leads to the complementizer that in most cases – here are some counterexamples. Note that the distance between *suppose* and *if* is often so long that surface searches would deliver considerable amounts of garbage.

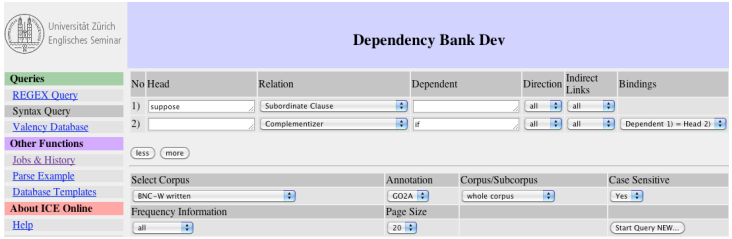
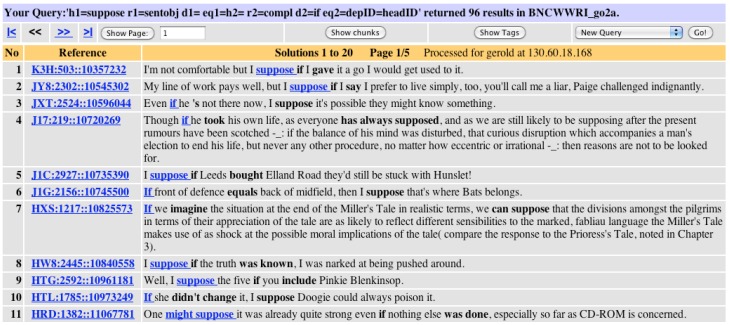


Figure 21. Query for complementizers with matrix verb 'suppose' and complementizer 'if'



Your Query:'h1=suppose r1=sentobj d1= eq1=h2= r2=compl d2=if eq2=depID=headID' returned 96 results in BNCWWRI_go2a.

Solutions 1 to 20 Page 1/5 Processed for gerold at 130.60.18.168

No	Reference	
1	K3H:503::10357232	I'm not comfortable but I **suppose if I gave** it a go I would get used to it.
2	JY8:2302::10545302	My line of work pays well, but I **suppose if I say** I prefer to live simply, too, you'll call me a liar, Paige challenged indignantly.
3	JXT:2524::10596044	Even if he 's not there now, I **suppose** it's possible they might know something.
4	J17:219::10720269	Though if he **took** his own life, as everyone **has always supposed**, and as we are still likely to be supposing after the present rumours have been scotched -_: if the balance of his mind was disturbed, that curious disruption which accompanies a man's election to end his life, but never any other procedure, no matter how eccentric or irrational -_: then reasons are not to be looked for.
5	J1C:2927::10735390	I **suppose if** Leeds **bought** Elland Road they'd still be stuck with Hunslet!
6	J1G:2156::10745500	If front of defence **equals** back of midfield, then I **suppose** that's where Bats belongs.
7	HXS:1217::10825573	If we **imagine** the situation at the end of the Miller's Tale in realistic terms, we **can suppose** that the divisions amongst the pilgrims in terms of their appreciation of the tale are as likely to reflect different sensibilities to the marked, fabliau language the Miller's Tale makes use of as shock at the possible moral implications of the tale(compare the response to the Prioress's Tale, noted in Chapter 3).
8	HW8:2445::10840558	I **suppose if** the truth **was known**, I was narked at being pushed around.
9	HTG:2592::10961181	Well, I **suppose** the five **if** you **include** Pinkie Blenkinsop.
10	HTL:1785::10973249	If she **didn't change** it, I **suppose** Doogie could always poison it.
11	HRD:1382::11067781	One **might suppose** it was already quite strong even **if** nothing else **was done**, especially so far as CD-ROM is concerned.

Figure 22. Results for the query in figure 21

1.2.3 Chunk-Internal Modification

According to Tesnière, dependencies are only between *nuclei*, which are headed by a content word. We express this by using chunks, and dependencies are only between chunk heads. Still, it is often useful to express chunk-internal relations, for example if the head is premodified by an adjective or a noun. This is exactly what the chunk-internal modification relation expresses. We have seen an example query, combining with clause subordination, in figures 15 and 16. The syntactic analysis of one sentence in the result set is given in figure 23. In order to keep the size of the syntax trees manageable for browsing, chunk-internal relations are not displayed, in our example there is no dependency link displayed between *decision* and the premodifying noun *budget*.

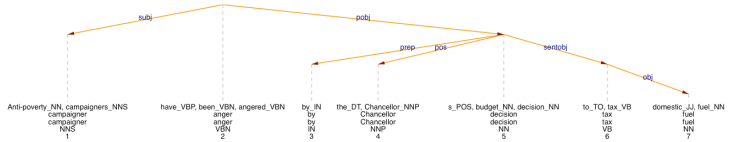


Figure 23. Sentence containing chunk-internal relations

1.2.4 Determiner

The Determiner dependency is always chunk-internal. For example, the word *consideration* appears 1639 times in subject position (according to one of our runs, depending on parser development, your count may vary a bit). 42.8% of them, 701, contain a determiner relation. Consideration also appears 2051 times in a verbally attached PP. Only 23.2% of them, 476, contain a determiner. This is partly due to the fact that the idiom *take into consideration*, which occurs 233 times, in all cases without a determiner. But even after deducting these counts, there is still a strong preference for determiner omission in verb-attached PPs.

1.2.5 Auxiliary

In most cases, both the auxiliary and the main verb are inside the verb chunk (as in 'have eaten' in figure 24. In questions, however, the auxiliary supporting verb gets fronted to the V2 position, and it is attached to the main verb by the auxiliary dependency. The chunk-internal and chunk-external auxiliary dependency can be queried separately or together. An example of a chunk-external syntactic analysis is given in figure 24 at the beginning of the sentence.

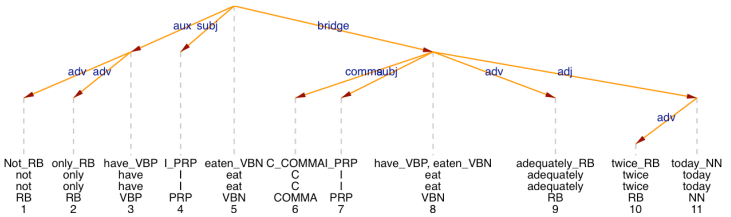
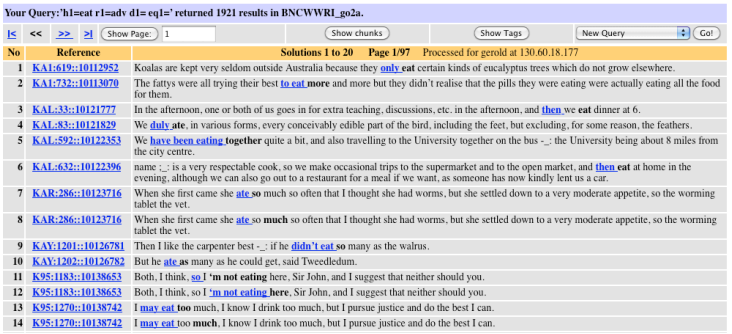


Figure 24. A syntactic analysis containing a chunk-external auxiliary relation

1.2.6 Adverb

The adverb relation attaches adverbs to verbs or nouns. As this relation is not based on a statistical model, its performance is low. Results for a query on adverbs of the verb *eat* are given in figure 25.



Your Query:'h1=eat r1=adv d1= eq1=' returned 1921 results in BNCWWRI_go2a.

Solutions 1 to 20 Page 1/97 Processed for gerold at 130.60.18.177

No	Reference	
1	KA1:619::10112952	Koalas are kept very seldom outside Australia because they **only eat** certain kinds of eucalyptus trees which do not grow elsewhere.
2	KA1:732::10113070	The fattys were all trying their best **to eat more** and more but they didn't realise that the pills they were eating were actually eating all the food for them.
3	KAL:33::10121777	In the afternoon, one or both of us goes in for extra teaching, discussions, etc. in the afternoon, and **then** we **eat** dinner at 6.
4	KAL:83::10121829	We **duly ate**, in various forms, every conceivably edible part of the bird, including the feet, but excluding, for some reason, the feathers.
5	KAL:592::10122353	We **have been eating together** quite a bit, and also travelling to the University together on the bus -_: the University being about 8 miles from the city centre.
6	KAL:632::10122396	name ;_: is a very respectable cook, so we make occasional trips to the supermarket and to the open market, and **then eat** at home in the evening, although we can also go out to a restaurant for a meal if we want, as someone has now kindly lent us a car.
7	KAR:286::10123716	When she first came she **ate so** much so often that I thought she had worms, but she settled down to a very moderate appetite, so the worming tablet the vet.
8	KAR:286::10123716	When she first came she **ate so much** so often that I thought she had worms, but she settled down to a very moderate appetite, so the worming tablet the vet.
9	KAY:1201::10126781	Then I like the carpenter best -_: if he **didn't eat** so many as the walrus.
10	KAY:1202::10126782	But he **ate as** many as he could get, said Tweedledum.
11	K95:1183::10138653	Both, I think, **so I 'm not eating** here, Sir John, and I suggest that neither should you.
12	K95:1183::10138653	Both, I think, so I **'m not eating here**, Sir John, and I suggest that neither should you.
13	K95:1270::10138742	I **may eat too** much, I know I drink too much, but I pursue justice and do the best I can.
14	K95:1270::10138742	I **may eat** too **much**, I know I drink too much, but I pursue justice and do the best I can.

Figure 25. Results of a query for adverbs modifying 'eat'

1.2.7 Adjective Translations

The adjective translation relation is a minor relation that is needed to allow gerunds to act as adjectives. An example is given in figure 26. The performance of this relation is quite low.

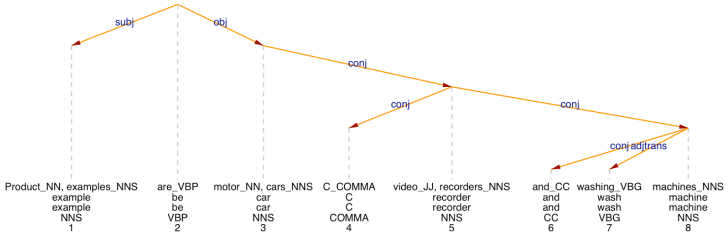


Figure 26. Sentence containing a correctly identified adjective translation

1.2.8 Noun Translation

The noun translation relation allows lonely adjectives to act as NP heads. An example is given in figure 27. The performance of this relation is very poor, so it will be reworked in the future.

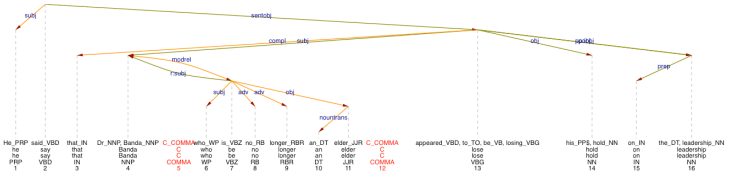


Figure 27. A noun translation

1.2.9 Comparison

The comparison relation is used for comparative structures, for example the one given in figure 28.

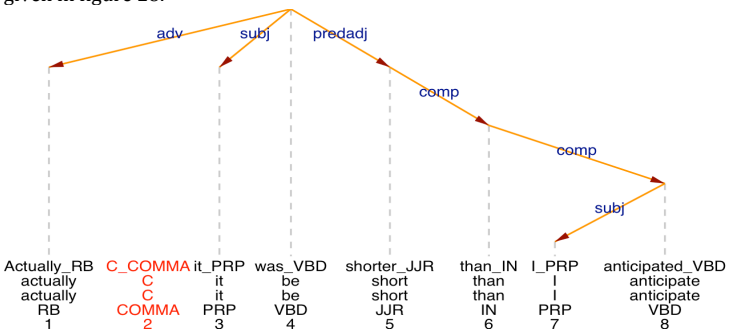


Figure 28. Sentence containing a comparison structure

1.2.10 Conjunction

The conjunction relation is a helper relation that is used to connect conjoined phrases and clauses.

1.2.11 Apposition

The apposition relation expresses nominal and adjectival appositions. As this relation is not present in the Penn Treebank which was used for training the parser, its performance is relatively low.

1.2.12 Nominal Chunk underchunking

The chunker that is used in the preprocessing step often creates chunks that are too small. We have managed to correct some cases of underchunking, by using a relation with the label *nchunk*. This is a heuristic extension, the performance is relatively low and the linguistic interpretation is not always clear, but typically co-incides with the chunk-internal modification. In the query tool, separate queries for nchunk are thus not available.

1.2.13 Bridge

The *bridge* relation is strictly speaking not a dependency relation, it connects partial parses which arise from grammar incompleteness, high parsing complexity in long sentences, fragments that are linguistically difficult to connect or hesitations and restarts in spoken language. In the majority of cases, the *bridge* relation rather expresses a shortcoming of the parser than a linguistically meaningful relation. In some cases, it indicates false starts or grammatical errors.

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