Non-Sentential Utterances: A Corpus Study

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ABSTRACT. *Dialogue is full of intuitively complete utterances that are not sentential in their outward form, most prototypically the "short answers" used to respond to queries. As is well known, processing such non-sentential utterances (NSUs) is a difficult problem on both theoretical and computational grounds. In this paper we present a corpus-based study of NSUs. We propose a comprehensive, theoretically grounded classification of NSUs in dialogue based on a sub-portion of the British National Corpus (BNC). The study suggests that the interpretation of NSUs is amenable to resolution using a relatively intricate grammar combined with an utterance dynamics approach. That is, a strategy that keeps track of a highly structured dialogue record of entities that get introduced into context as a result of utterances. Complex, domain-based reasoning is not, on the whole, very much in evidence.*

RÉSUMÉ. *Le dialogue est rempli d'énoncés intuitivement complets, mais qui ne sont sont pas des propositions hors de leur contexte, typiquement les réponses courtes aux questions. Le traitement de tels énoncés non phrastiques (*Non Sentential Utterances, NSUs*) est connu comme étant difficile, d'un point de vue théorique comme calculatoire. Dans cet article, nous proposons une étude basée sur corpus des NSUs. Nous proposons une classification dans le dialogue complète et théoriquement fondée, sur la base d'une portion du* British National Corpus (BNC). *Cette étude suggère que l'interprétation des NSUs est susceptible d'être résolue grâce à une grammaire relativement complexe, combinée avec une approche fondée sur la dynamique des énoncés, c'est-à-dire une stratégie qui garde la trace d'un enregistrement fortement structuré du dialogue des entités introduites dans le contexte par les énoncés. Il n'est notamment pas évident qu'un raisonnement complexe et centré sur un domaine spécifique soit nécéssaire.*

KEYWORDS: *Ellipsis, HPSG, Fragmentary utterances, Corpus analysis.*

MOTS-CLÉS : *Ellipsis, HPSG, Expressions fragmentaires, Analyse de corpus.*

1. Introduction

Most grammars of English encode in some form a rule akin to $S \rightarrow NP\ VP$. In particular, this involves the assumption that for an expression to constitute a complete sentence it must contain a verbal constituent. If one identifies the start symbol of a grammar (also known as *root*) with the type *sentence*, or at least with a subclass of sentences, then we have as a consequence that complete utterances need to be verb-containing sentences. These assumptions constitute perhaps a more or less reasonably accurate description of the grammatical situation for texts. However, as is well known, dialogue is full of intuitively complete utterances that are not sentential in the above sense, most prototypically the 'short answers' used to respond to queries. Processing such fragments, non-sentential utterances (NSUs), is commonly assumed to be a difficult problem on both theoretical and computational grounds, requiring in the general case sophisticated domain-based reasoning.[1]

To date, nonetheless, as far as we aware, there has not been an attempt to come up with a comprehensive, theoretically grounded classification of NSUs as they occur in a large scale corpus. Such a taxonomy should reflect the range of forms NSUs can present, together with the interpretations they can convey. The outcome of such work should be to provide indications as to what types of NSUs are relatively easy to accommodate using existing theoretical tools, and also to indicate the extent to which sophisticated domain-based reasoning is required in resolution. In this paper we undertake a corpus-based study of NSUs, specifically the British National Corpus (BNC) [BUR 00], with these aims in mind.

The structure of the paper is the following: we start by informally describing the classes of NSUs encountered in the BNC. In Section 3 we discuss how our classification scheme was devised and applied to the BNC. The results of the corpus investigation are discussed in Section 4. We then sketch the theoretical framework that has underpinned this investigation—a combination of KOS [GIN 96, GIN , COO 01], a theory of dialogue context, with the Head Driven Phrase Structure Grammar (HPSG) of [GIN 01c]. Finally, we present our conclusions in Section 6: our basic claim will be that, to a large extent, the NSUs encountered in our study are amenable to resolution based on an utterance dynamic strategy. That is, a strategy that keeps track of a highly structured dialogue record of entities that get introduced into context as a result of utterances. Complex, domain-based reasoning is not, on the whole, very much in evidence.

2. A corpus-based taxonomy of NSUs

In this section we present a corpus-based taxonomy of non-sentential utterances. It was designed after an exhaustive analysis of 10 dialogue transcripts randomly cho-

1. See in particular [CAR 91] for a detailed analysis of fragments, with resolution based on plan recognition techniques.

sen from the BNC.[2] The identification of the different types of phrasal utterances was performed mostly manually in order to capture the maximal number of phenomena, although the search engine SCoRE ([PUR 01]) was also used to detect specific examples. The taxonomy was then tested by annotating a 200-speaker-turn section from 30 dialogue transcripts using decision trees to guide the classification process. In the current investigation, the annotation was performed by the authors. At the time of writing, however, the decision trees are being tested by naive annotators with the aim to evaluate the accuracy and the agreement between annotations. We expect to present the results of this experiment in the future.

In what follows, we informally describe and exemplify each class. At the end of the section we explain the rationale behind our taxonomy.

2.1. *Short Answers*

Short answer is a wide cover term for fragments that typically occur in the context of a response to a query. In this case, we use the term only to designate short answers which are responses to *wh*-questions, i.e. elliptical phrasal utterances with a *wh*-phrase as a source in some previous question in the context. We distinguish between *argumental short answers* (1a) and *adjunct short answers* (1b).

(1) a. A: Who's that?
B: My Aunty Peggy *[last or full name]*. My dad's sister. [G58, 33–35][3]

b. A: Can you tell me where you actually got that information from?
B: From our wages and salary department. [K6Y, 94–95]

2.2. *Answers to polar questions*

Typically polar questions are associated with queries that can be answered using words like "yes" and "no". We call this type of answer to yes/no questions *plain affirmative answer* and *plain rejection* respectively. As the following examples show, however, a polar question can also be answered by a fragment.

(2) a. A: The one three six three goes out through the Sutton on Forest, does it?
B: Sutton on Forest, yeah. [J9T, 312]

b. A: Did you shout very loud?
B: Very loud, yes. [JJW, 571-572]

2. Two of them are transcripts of completely unrestricted, free conversation (KST, KSV), three are informal interviews (K68, K69, JA2), two are more formal interviews (K6K, K65), another two are conversations in seminars (JJ7, JK1) and one is the transcript of a public county council meeting (J9T).
3. This notation indicates the BNC file (G58) together with the sentence numbers (33–35).

c. A: Is that Mrs. John [*last or full name*]?
B: No, Mrs. Billy. [K6K, 67-68]

When a yes/no question is answered negatively, a cooperative speaker often goes on to provide an appropriate alternative, as in (2c). B's answer in (2c) is an instance of what we call *help rejections*.We also consider *help rejections* responses to assertions that correct some item present in the previous utterancce, like the following:

(3) a. A: Well I felt sure it was two hundred pounds a, a week.
B: No fifty pounds ten pence per person. [K6Y, 112–113]

b. A: Joan had an eight hour car journey to get ...
B: Nine hours. [K6Y, 1153–1154]

In (2a) and (2b), the dialogue participant B answers affirmatively by repeating a fragment of the query. This kind of NSU is quite common as a response to a clarification request:

(4) A: Did you say [*last or full name*] school?
B: [*last or full name*] school. [H5G, 67-68]

We call this kind of positive answer a *repeated affirmative answer*.[4]

2.3. *Clarification Ellipsis*

The term Clarification Ellipsis (CE) includes all NSUs that concern the content or form of a previous utterance that has failed to be fully comprehended, like B's utterances in (5):

(5) a. A: Erm, didn't, at Needham Market didn't people live in there or <*unclear*> main entrance?
B: Where?
A: At Needham Market Station. [HDK, 93–95]

b. A: I do anything, roam about, go harvesting on the harvest fields.
B: Go harvesting? [H5G, 51–52]

c. A: [..] they used to come in here for water and bunkers you see.
B: Water and? [H5H, 59–60]

4. In fact, an additional class of phrasal affirmative answers could be considered: fragments that imply a positive response and add more information. An example could be B's response in the following dialogue: A: *Are you leaving?* B: *Tomorrow.*
Since we have not found any instance of this kind of *help affirmative answer* in the sub-corpus our investigation is based on, we do not consider them in our taxonomy.

In this paper, we do not provide a detailed analysis of elliptical clarification requests. The range of possible forms and readings of clarification requests (not only those which are non-sentential) within a theoretical framework similar to this one is discussed in [PUR 02b].

2.4. *Sluicing*

A sluice, first described in detail by [ROS 69], is a bare question–denoting *wh*-phrase. There are two main types of sluices, distinguished mostly by whether they are used to express reprise/echo questions or not. Reprise sluices involve a signalling of an inability to adequately comprehend the preceding utterance and they will therefore be classified as instances of Clarification Ellipsis. In this class we only include sluices that involve a request for additional information beyond what the speaker of the previous utterance thought was required.

(6) a. A: Can I have some toast please?
B: Which sort? [KCH, 104–105]

b. A: They wouldn't do it, no.
B: Why? [H5H, 202–203]

2.5. *Check Questions*

Check questions are short queries like "allright?" and "okay?", which a speaker utters to ensure that the addressee has understood what has been said.

(7) A: This, this dimension is about er where you prefer to focus your attention and where you get your psychological energy from.
Okay?
B: Oh, right. [G3Y, 162–164]

2.6. *Acknowledgements*

Acknowledgements are utterances like "okay", "yes" and "mm" that signal that the previous utterance was understood. Sometimes an acknowledgement also counts as an acceptance of a previous assertion. However, since the difference between acknowledgements and acceptances can often be uncertain, we include both of them in this class.

We classify as acknowledgements plain acknowledgements like "okay" and "yes" as well as acknowledgements performed by repeating (a part of) the utterance that is being accepted, like in the following example:

(8) A: I'm at a little place called Ellenthorpe.
B: Ellenthorpe. [HV0, 383–384]

2.7. *Fillers*

The class *filler* includes fragments used by a speaker to fill a gap left by a previous incomplete utterance. Fillers can be used either because a previous speaker has left an utterance "hanging" or because the filler performer interrupts.

(9) A: And another sixteen percent is the other Ne Nestle coffee <*pause*> erm Blend Thirty Seven which I used to drink a long time ago and others <*laugh*> and twenty two percent is er <*pause*>
B: Maxwell. [G3U, 292–293]

2.8. *Propositional modifiers*

Many adverbials can function as NSUs conveying a complete message. Although they behave like modifiers semantically, in these stand-alone uses their content is propositional. This class mainly includes modal adverbs like B's utterance in (10a).

(10) A: I think there'd probably somebody with expanded polystyrene ceiling that's been pulled out.
B: Probably. [HV0, 390–391]

2.9. *Factual modifiers*

As shown in A's last utterance in (11), some evaluative adjectives like "good", "amazing" and "interesting" also have stand-alone uses. We called them *factual modifiers* for reasons that will become clear later (Section 5.4).

(11) A: So we we have proper logs? Over there?
B: It's possible.
A: Brilliant! [KSV, 2991–2994]

2.10. *Bare modifier phrases*

A related class are bare modifier phrases. In this case, the NSU is not a word like in the previous category but a full phrase, usually a PP, that behaves like an adjunct modifying some previous utterance in the context. The phrase "With the same showers!" in the following example is an instance of this kind of NSU:

(12) A: They're single, the accommodation is single then is it?
B: Yes it is.
A: Well you can stay on with your boyfriend if you want to!
B: Well, if they got, they got men and women in the same dormitory!
A: With the same showers! [KST, 992–996]

2.11. *Fragments introduced by connectives*

Finally, a NSU can consist of a discourse connective like "and", "or" and "but" introducing a fragment, like B's utterance in (13):

(13) A: Alistair [*last or full name*] erm he's, he's made himself er he has made himself coordinator.
B: And section engineer. [H48, 141–142]

2.12. *The Taxonomy: Rationale*

From an empirical point of view, the taxonomy we have presented is obviously constrained by the data found in the analysed corpus. The particular instances of NSUs we encountered constituted the starting point of the taxonomy. Where one goes from there is of course rather open territory. Our classification scheme was motivated by several factors.

Most fundamentally, our taxonomy aims to distinguish between fragmentary utterances with different semantic properties. That is, each class indicates some particular aspect of the NSU itself related with the resolution of its content, given the theoretical account of context and its interaction with the meaning of linguistic expressions that we will briefly present in Section 5. For each NSU, the classification involves making choices related with the following parameters:

– the semantic content of the utterance;
– the syntactic form of the utterance or the occurrence of a particular form;
– the phonological/orthographical form of the utterance;
– the purpose and role of the utterance in the dialogue.

In terms of their role in the dialogue, the classes in the taxonomy could be classified into four main categories:

Queries. All queries which are non-sentential would fall in this category. Our taxonomy includes three different subtypes of non-sentential queries: *sluices*, *CE* and *check questions*.

Answers. This category includes not only answers to questions posed in queries, but also answers to concealed questions and corrective responses to assertions, which are understood as answers to the current question under discussion as we will see below. The classes in our taxonomy that would fall in this category are *short answers*, *plain affirmative answers*, *repeated affirmative answers*, *plain rejections*, *help rejections* and *propositional modifiers*.

Statements. Within this category, we can distinguish between completions (that correspond to *fillers* in our taxonomy) and extensions. *Propositional modifiers*, *factual modifiers*, *bare modifiers phrases* and *fragments introduced by connectives* would fall into extensions.

Communication management. This category includes utterances that have to do with the communication process directly. It would include *plain acknowledgements*, *repeated acknowledgements*, *check questions* and *CE*.

Some NSU classes fall in more than one of the above categories (e.g. *CE* and *check questions* fall both into "Questions" and "Communication management"). The fact that some of these four categories are orthogonal may suggest the possibility of building an annotation scheme using different dimensions, as the one described in [ALL 97]. However, we have chosen a simplified one-dimensional scheme that only sets queries and answers apart from the remaining types of NSU, as reflected by the decision trees we present in the next section. This choice was mainly dictated by methodological considerations which took into account our intention of letting naive subjects perform the classification. We felt that in an annotation performed by non-linguistically trained subjects, a simplified scheme would give better results (in terms of agreement between annotators). With this methodological considerations in mind, we next describe in detail the annotation scheme based on the taxonomy presented here.

3. Towards a classification scheme

The importance of reliability mechanisms to evaluate computational linguistics work on discourse and dialogue has often been stressed in recent years (e.g. [CAR 96]). Such an evaluation typically takes the form of experiments in which non-expert human subjects are asked to annotate texts from a corpus according to a certain classification scheme. The agreement between their annotations, or between their annotations and expert annotations, is then measured using reliability methods like the one described in [CAR 96] that involves *kappa* statistics. To verify whether non-trained subjects are capable of recognising a proposed classification is a precondition for using these schemes in the large-scale annotation exercises which are necessary, for instance, to create automatic annotation systems or to evaluate a system performance.

In order to provide a means for the experimental evaluation of our taxonomy, we designed a classification scheme for NSUs in dialogue corpora based on decision trees. Although the results we present in this paper were achieved after an annotation performed by the authors, from a methodological point of view it was important to design the trees in a way that would make the annotation task doable by non-expert subjects. The decision trees were thus designed to provide the chance of replicating the results of our research. We are currently engaged in work in which naive annotators use the decision trees we present below to classify NSUs in a portion of the BNC dialogue corpus.

3.1. *Experimental Conditions*

Our corpus-based investigation of NSUs was performed using the BNC, which is a ∼100 million SGML-encoded corpus of current British English compiled by the Oxford University Text Archive (see [BUR 00]) with a ∼10 million word sub-corpus of dialogue transcripts.

For this experiment we used a sub-portion of the dialogue transcripts consisting of 7542 sentences, created by excerpting a 200-speaker-turn section from 30 transcripts over all dialogue domains.[5] We classified all NSUs found in such sub-corpus according to the tags given in the next section. To guide the classification process we used the decision trees discussed in section 3.3.

3.2. *NSU-Tags*

The labels we used to tag utterances are the following:

`ShortAns` for short answers;

`AffAns` for plain affirmative answers to polar questions;

`RepAffAns` for repeated affirmative answers to polar questions

`Reject` for plain negative answers to polar questions;

`HelpReject` for help negative answers to polar questions;

`CE` for Clarification Ellipsis;

`Sluice` for sluicing;

`CheckQu` for check questions;

`Ack` for plain acknowledgements and acceptances;

5. The files in question are GU3, G3V, G3Y, G42, G43, G4K, G4V, G4W, G4X, G5C, G5E, G5X, GYR, G58, H48, H4P, H5D, H5G, H5H, H60, H61, HDD, HDH, HDK, HDL, HDM, HDY, JA3, K6Y and KSR.

`RepAck` for repeated acknowledgements and acceptances;

`Filler` for fillers;

`PropMod` for propositional modifiers (stand-alone modal adverbs);

`FactMod` for factual modifiers (stand-alone evaluative adjectives)

`BareModPh` for bare modifier phrases;

`Conj+frag` for fragments introduced by a conjunction;

`Other` for NSUs that do not fall in any of the above categories.

3.3. *A labelling scheme using Decision Trees*

In this section we present the decision trees designed to guide the annotation. Figure 1 shows the initial tree, which makes an initial distinction between queries, answers and the rest of NSU types. This main tree is then divided in three subtrees, one for each sub-portion of NSU classes, that appear in Figure 2, Figure 3 and Figure 4 respectively.

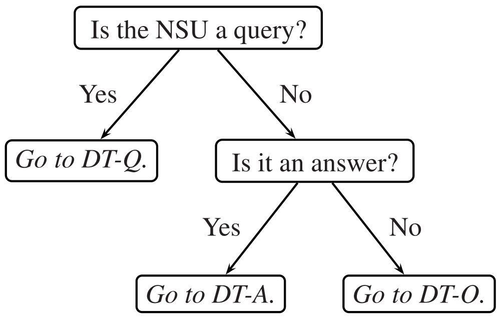

Figure 1. *Decision Tree DT-NSU*

The questions in the nodes of the trees resort to different kinds of information. In order to keep the decision procedure as intuitive as possible, the nodes use the most appropriate criteria in each specific case. The query that distinguishes between sluices and check questions in DT-Q (Figure 2), for instance, uses syntactic/semantic information about the utterance, whereas the nodes that attempt to identify NSUs that are a repetition of some (sub-)utterance in a previous turn use phonological, or more precisely given that we used dialogue transcripts, orthographic, criteria. In some nodes, the queries appeal to the speaker's intention or mental state.

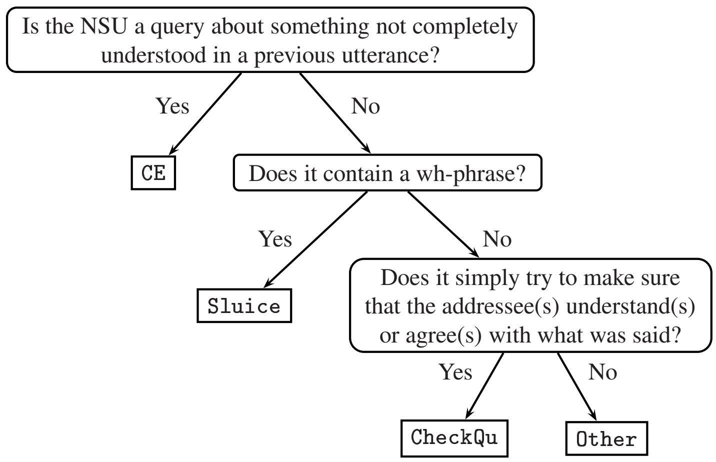

Figure 2. *Decision Tree* DT-Q

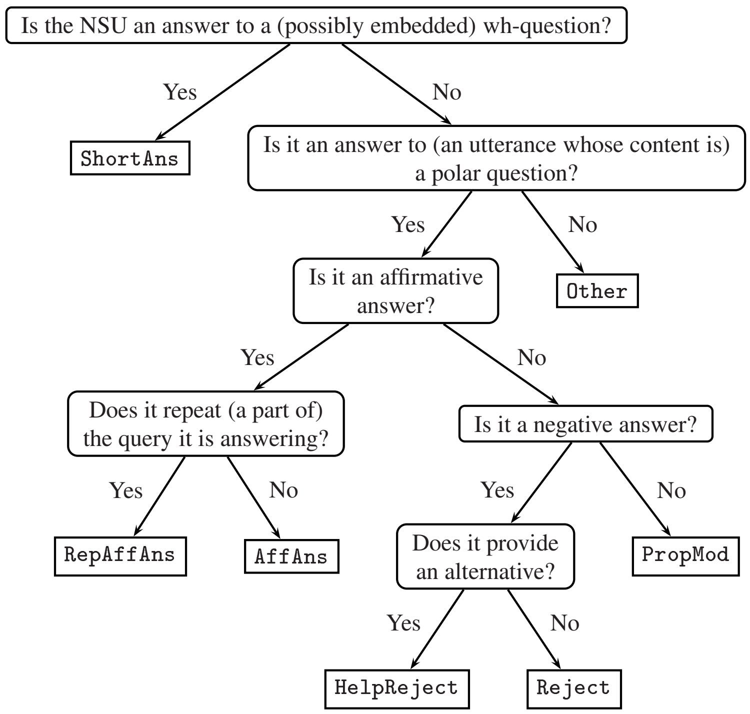

Figure 3. *Decision Tree* DT-A

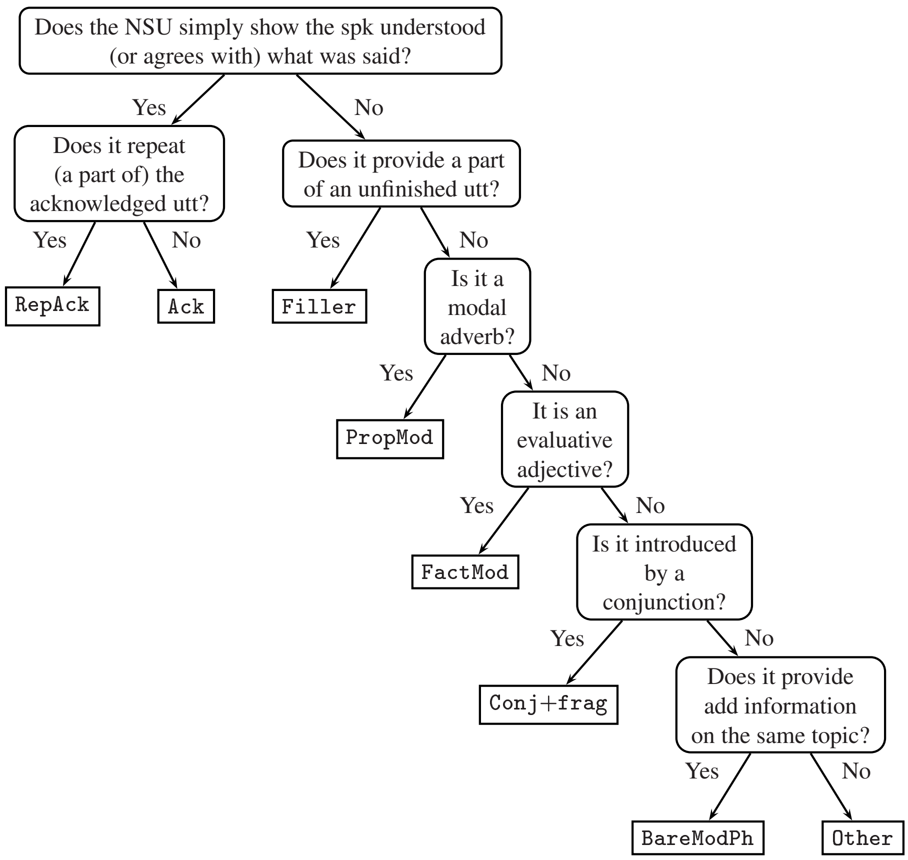

Figure 4. *Decision Tree* DT-O

Each subtree contains a label `Other` to allow for possible alternatives not considered in the current classification and avoid incorrect annotations. The tag `PropMod` appears in both DT-A (Figure 3) and DT-O (Figure 4), given that a propositional modifier like *possibly* can be used either as an answer or as a modifier of some previous assertion.

Thus the binary decision trees provide a labelling scheme to annotate NSUs. That is, a procedure to assign a label to each NSU according to the taxonomy discussed in previous sections. However, given the anaphoric component of NSUs, it would be desirable to consider a complementary scheme concerned with identifying the links between phrasal utterances and their source in the conversational context. The decision procedure concerned with the anaphoric aspect of NSUs should mainly involve two tasks: (i) identifying and tagging the source that allows to resolve the content of the phrasal utterance and (ii) measuring the distance between the source and the fragment.

Although the investigation and results presented here do not include this dimension, we believe that it can be smoothly added to our labelling scheme: once an NSU is appropriately tagged following the decision trees, the annotators should be asked by additional instructions to indicate the source of the NSU and to measure the distance between the two.

4. Results

Following the classification scheme described above, we identified and classified 841 NSUs, which make up 11.15% of the total number of sentences in the searched transcripts (7542).[6] The distribution of NSUs classified according to the classes discussed in previous sections is shown in full in Table 1. The distributions are presented as percentages of all NSUs found, together with the total number of utterances of each NSU class.

The distribution of queries and answers is additionally shown in Table 2 and Table 3. This allows us to see the proportion made up by each of these superclasses. The first numerical column shows the total number of utterances found for each class, the second one shows the distribution of each class as percentages of all either queries or answers found and the third column shows their distribution as percentages of all NSUs identified.

Since Table 2 and Table 3 present the results obtained by using the decision trees in Figure 3 and Figure 4, both of them include the category `Other`. The total number and distribution of NSUs that did not fall in any of the considered categories and therefore were tagged as `Other` is shown in Table 1. Following the decision trees, however, we counted all NSUs classified as `Other` separately, the results being that none of them was an answer and only 1 of them was a query.

Similarly, the category `PropMod` that appears in Table 3 makes reference to propositional modifiers used as answers (2 instances), whereas the total number of propositional modifiers appears in Table 1 (i.e. 5 `PropMod` in total, two of them being answers).

Note, furthermore, that in Table 1 we distinguish between argumental short answers (`ShortAns`[*arg*]) and adjunct short answers (`ShortAns`[*adj*]), although for the sake of simplicity both categories are keep together under a general `ShortAns` tag in the decision trees. A similar distinction could have been established between argument and adjunct sluices. In the current investigation, however, the 5 instances of sluices we found where instances of adjunct sluices, so there is no need to split the category in this case.

6. See the BNC web site (`http://www.hcu.ox.ac.uk/BNC/`) for an explanation of how sentences are identified in the corpus.

NSU Class	Total Number	% of the Total
`Ack`	464	55.17
`CE`	72	8.56
`AffAns`	59	7.01
`ShortAns`[*arg*]	51	6.06
`RepAck`	37	4.40
`RepAffAns`	24	2.85
`BareModPh`	22	2.61
`CheckQu`	17	2.02
`ShortAns`[*adj*]	16	1.90
`FactMod`	15	1.78
`Reject`	13	1.54
`Fillers`	13	1.54
`Conj+frag`	8	0.95
`HelpReject`	12	1.42
`PropMod`	5	0.59
`Sluice`	5	0.59
`Other`	8	0.95
Total	841	100

Table 1. *Distribution of all NSU classes*

Queries	Total Number	% of Queries	% of the Total
`CE`	72	75.79	8.56
`CheckQu`	17	17.89	1.66
`Sluice`	5	5.26	0.59
`Other`	1	1.05	0.11
Total	95	100	11.29

Table 2. *Distribution of Queries*

4.1. *Distribution*

The results of our investigation show that the proportion of NSUs in a corpus of dialogue is highly significant. NSUs were found to make up more than 11% of sentences. The most common class can be seen to be Acknowledgements (55.17% plain acknowledgements and 4.4% repeated acknowledgements), followed by Clarification Ellipsis (8.44%) and Short Answers (6.06% argumental short answers and 1.90% adjunct short answers).

Answers	Total Number	% of Answers	% of the Total
`ShortAns`	67	38.95	7.96
`AffAns`	59	34.30	7.01
`RepAffAns`	24	14.03	2.85
`Reject`	13	7.55	1.54
`HelpReject`	12	6.77	1.42
`PropMod`	2	1.16	0.23
`Other`	0	0	0
Total	177	100	21.04

Table 3. *Distribution of Answers*

4.2. *Coverage*

One of the most important things concerning a classification scheme is its coverage. In this respect, we believe that the taxonomy of NSUs we have presented is satisfactory. The NSUs not covered by the current classification only make up 0.95% (8 utterances) of all NSUs found.

It has to be stressed that most of the utterances classified as `Other` were not entirely comprehensible utterances. In a dialogue fragment like (14), for instance, it is not possible to know what is going on due to the amount of utterances transcripted as *unclear*. The NSU "Public sector" was therefore classified as `Other`.

(14) A: I'm not quite sure, I think most organisations have a certain amount of sum of money if I can remember from the workshops <*unclear*>.
B: Other than <*unclear*>.
A: <*unclear*>
C: Public sector.
A: That's right.
B: Yeah they get financed. [G4X, 74–78]

B's utterance in (15) is also an uncertain case. It could not be classified as `CE` given that it is not a question. On the other hand, understood as an acknowledgement, it would have been considered a "special" instance of `RepAck`, special in the sense that the parallelism with the previous utterance it is not phonological but semantic parallelism. In any case, however, the *unclear* part of the utterance does not allow to make any decision and the fragmentary utterance was therefore classified as `Other` as well.

(15) A: [..] I got married and we moved into this address here and then that was the day after war was declared that I got married.
B: <*unclear*> thirty, thirty nine.
A: Yes, yeah fourth of September nineteen thirty nine [..] [HDL, 11–13]

5. Resolving NSUs: theoretical background

In this section we provide a theoretical grounding for our taxonomy. We consider briefly some theoretical proposals to explain how the content of the different classes in our taxonomy is resolved. The main aim of this sketch is to indicate the basic contextual parameters which are needed for a theory of the resolution of NSUs. Our analysis is based on a theory of context in dialogue, the KOS framework [GIN 96, GIN , COO 01, LAR 02], together with the HPSG grammar presented in [GIN 01c].

Very briefly, in the KOS framework each dialogue participant informational state can be schematically represented by the following attributes:

$$\begin{bmatrix} \text{FACTS} & \textit{set of facts} \\ \text{LATEST-MOVE} & \textit{(illocutionary) fact} \\ \text{QUD} & \textit{p.o.set of questions} \end{bmatrix}$$

Where QUD (questions under discussion) is a partial ordered set representing the issues currently under discussion, FACTS represents conversationally presupposed information and LATEST-MOVE represents the (content of the) most recent conversational move.

In their HPSG grammar, Ginzburg & Sag [GIN 01c], following the account developed in the framework of KOS, assume that the CONTEXT (CTXT) attribute contains two additional features: Maximal Question Under Discussion MAX-QUD, whose value is of type *question* and represents the question currently maximal in the QUD partial order, and Salient Utterance SAL-UTT, which takes as its value sets of elements of type *sign* and represents the focal (sub)utterance or the potential *parallel element* in the sense of [DAL 91]. SAL-UTT is computed as the (sub)utterance associated with the role bearing widest scope within MAX-QUD. Since SAL-UTT is of type *sign*, it enables one to encode syntactic parallelism, such as categorial parallelism and case assignment, as well as phonological parallelism.

5.1. *Short answers and sluicing*

Ginzburg & Sag [GIN 01c] offer an analysis of short answers and sluices, as well as some cases of Clarification Ellipsis; their analysis is restricted to NP and PP NSUs. The analysis is couched in terms of an approach, initiated in [SAG 97], wherein information about phrases is encoded by cross-classifying them in a multi-dimensional type hierarchy. Phrases are classified not only in terms of their phrase structure schema or X-bar type, but also with respect to a further informational dimension of CLAUSALITY. Clauses are divided into *inter alia* declarative clauses (*decl-cl*), which denote propositions, and interrogative clauses (*inter-cl*) denoting questions.

In line with much recent work in HPSG and Categorial Grammar, Ginzburg & Sag [GIN 01c] do not treat ellipsis by positing a phonologically null head. Rather, to account for elliptical constructions such as short answers, sluicing, and CE they posit a phrasal type *headed-fragment-phrase* (*hd-frag-ph*) governed by the constraint in (16). The various fragments they analyse are all subtypes of *hd-frag-ph* or else contain such a phrase as a head daughter.

(16) *hd-frag-ph*:

$$\left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{l} v \\ \text{VFORM } \textit{fin}\end{array}\right] \\ \text{CTXT}|\text{SAL-UTT} & \left\{\left[\begin{array}{l}\text{CAT } \boxed{1} \\ \text{CONT}|\text{INDEX } \boxed{2}\end{array}\right]\right\} \\ \text{HD-DTR} & \left[\begin{array}{l}\text{CAT } \boxed{1}\left[\text{HEAD } \textit{nominal}\right] \\ \text{CONT}|\text{INDEX } \boxed{2}\end{array}\right]\end{array}\right]$$

This constraint has two significant effects. First, it ensures that the category of the head daughter—restricted to be *n*(*oun*) or *p*(*reposition*), the two subtypes of *nominal*—is identical to that specified by the contextually provided SAL-UTT. The mother is specified to be of the same category as finite verbs, which will allow such phrases to serve as stand-alone clauses, i.e. to be embedded as the daughter of *root*-clauses, and also to function as the complement of a verb that selects for finite sentential clauses, but not for NPs.[7] Second, the constraint coindexes the head daughter with the SAL-UTT. This will have the effect of 'unifying in' the content of the former into a contextually provided content. It also enforces categorial parallelism between the head daughter and the SAL-UTT (instantiated by the *wh*-phrase in short answers, the wide scoping quantifier in sluicing, and the to-be-clarified phrase in CE).

Short answers (and one class of CE) are analysed by means of a subtype of *hd-frag-ph*, *declarative-fragment-clause* (*decl-frag-cl*). In addition to inheriting the information in (16), this latter type is governed by the constraint in (17):

7. A prototypical example where a sluice functions as the complement of a verb like *wonder* is illustrated in the following dialogue:

A: Apparently someone called.

B: I wonder who.

(17) *decl-frag-cl*:

$$\begin{bmatrix}
\text{HEAD} & \begin{bmatrix}\text{IC} & +\end{bmatrix} \\
\text{CONT} & \begin{bmatrix} \textit{proposition} & \\ \text{SIT} & \boxed{2} \\ \text{SOA} & \begin{bmatrix} \text{QUANTS} & \texttt{order}(\boxed{\Sigma_3}) \oplus \boxed{A} \\ \text{NUCL} & \boxed{5} \end{bmatrix} \end{bmatrix} \\
\text{STORE} & \boxed{\Sigma_1} \\
\text{MAX-QUD} & \begin{bmatrix} \textit{question} & \\ \text{PARAMS} & \textit{neset} \\ \text{PROP} & \begin{bmatrix} \textit{proposition} & \\ \text{SIT} & \boxed{2} \\ \text{SOA} & \begin{bmatrix} \text{QUANTS} & \boxed{A} \\ \text{NUCL} & \boxed{5} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\text{HD-DTR} & \begin{bmatrix}\text{STORE} & \boxed{\Sigma_3} \cup \boxed{\Sigma_1} \textit{set(param)}\end{bmatrix}
\end{bmatrix}$$

The content of this phrasal type is a proposition: whereas in most headed clauses the content is entirely (or primarily) derived from the head daughter, here it is constructed for the most part from the contextually salient question. This provides the concerned situation and the nucleus, whereas if the fragment is (or contains) a quantifier, that quantifier must outscope any quantifiers already present in the contextually salient question.

According to this approach, B's utterance in exemple (1) is an instance of the phrasal type *decl-frag-cl*. In such dialogue, A's sub-utterance of *who* provides the SAL-UTT, while the content of A's full utterance provides the value of MAX-QUD. The value of the feature PARAMS, which in (17) is constrained to be a *non-empty set of parameters*, is instantiated by the parameter of the *wh*-phrase *who* in A's utterance, corresponding to the entity that gets abstracted away in the question.

Similarly, to deal with direct sluices they posit an additional subtype of *hd-frag-ph* called *sluiced-interrogative-clause*, that like *decl-frag-cl* has its content partially determined by the dialogue context. They argue that the context for sluicing involves QUD-maximality of a polar question $\lambda\{\}p$, where *p* is a quantified proposition.

As mentioned above Ginzburg & Sag's analysis accommodates NP fragments or case-marking PPs (i.e. fragments whose content is of type *param*), but it cannot account for cases like (18):

(18) A: Whereabouts did it fall?
B: Outside the picture place. [HDH, 96–97]

Although here we will not enter into a detailed analysis of the semantics of adjuncts, we will sketch how an account of non-sentential adjuncts could be developed.[8] Thus, to accommodate cases like (18) we need to posit novel types that can deal with bare adjuncts. The following constraint describes the type *bare-soa-modifier-phrase*. The head daughter is a modifier and the nucleus of the modified sign (i.e. the one which is the value of the feature MOD) is identified with the nucleus of the proposition in MAX-QUD.

(19) *bare-soa-mod-ph*:

$$\begin{bmatrix} \text{CAT} & \textit{verb} \\ \text{MAX-QUD} & \left[\text{PROP} \mid \text{SOA} \mid \text{NUCL}\ \boxed{1}\right] \\ \text{HD-DTR} & \begin{bmatrix} \text{CAT}\ \textit{adv} \\ \text{MOD}\ \left[\text{CONT} \mid \text{SOA} \mid \text{NUCL}\ \boxed{1}\right] \\ \text{CONT}\ \left[\text{SOA-ARG}\ \boxed{1}\right] \end{bmatrix} \end{bmatrix}$$

In general, this constraint applies to bare adjuncts modifying the SOA of some contextual proposition (i.e. verb or VP modifiers). Now we need to distinguish between sluices and short answers. In order to do that, we propose two subtypes of *bare-soa-mod-ph*: *sluice-bare-adjunct-clause* (20) whose content is a question, and *decl-bare-adjunct-clause* (21) whose content is a proposition.

(20) *slu-bare-adj-cl*:

$$\begin{bmatrix} \text{CONT} & \begin{bmatrix} \textit{question} \\ \text{PARAMS}\ \left\{\boxed{2}\right\} \\ \text{PROP}\ \begin{bmatrix} \text{SIT}\ s \\ \text{SOA}\ \boxed{1} \end{bmatrix} \end{bmatrix} \\ \text{MAX-QUD} & \left[\text{PROP} \mid \text{SIT}\ s\right] \\ \text{HD-DTR} & \begin{bmatrix} \text{CONT}\ \boxed{1} \\ \text{STORE}\ \left\{\boxed{2}\right\} \end{bmatrix} \end{bmatrix}$$

(21) *decl-bare-adj-cl*:

$$\begin{bmatrix} \text{CONT} & \begin{bmatrix} \textit{proposition} \\ \text{SIT}\ s \\ \text{SOA}\ \boxed{1} \end{bmatrix} \\ \text{MAX-QUD} & \begin{bmatrix} \text{PARAMS}\ \textit{neset} \\ \text{PROP} \mid \text{SIT}\ s \end{bmatrix} \\ \text{HD-DTR} & \left[\text{CONT}\ \boxed{1}\right] \end{bmatrix}$$

The constraints in (20) and (21) describe sluices like *Where?* or *When?* in non reprise uses and short answers to *wh*-questions like the following:

8. For a similar approach see [GIN 01a].

(22) A: Where did you meet him?
B: In the main entrance.

As an example, we will consider an instantiation of the type *sluice-bare-adj-cl*. Given the above constraints, we can analyse B's utterance in a dialogue like (23) with the very simple analysis shown in (24):

(23) A: Toni left.
B: When?

(24)

$$
\begin{bmatrix}
\textit{slu-bare-adj-cl} & \\
\text{CAT} & \textit{verb} \\
\text{CONT} & \begin{bmatrix} \textit{question} & \\ \text{PARAMS} & \left\{\boxed{2}\right\} \\ \text{PROP} & \begin{bmatrix}\text{SIT } s \\ \text{SOA } \boxed{1}\end{bmatrix}\end{bmatrix} \\
\text{MAX-QUD} & \begin{bmatrix}\text{PROP} & \begin{bmatrix}\text{SIT } s & \\ \text{SOA} \mid \text{NUCL } \boxed{3} & \begin{bmatrix}\textit{leave-rel} \\ \text{LEAVER } \boxed{4}\end{bmatrix}\end{bmatrix}\end{bmatrix} \\
\text{BCKGRD} & \left\{\textit{named}(\boxed{4},\textit{Toni})\right\} \\
\text{HD-DTR} & \begin{bmatrix} \text{CAT } \textit{adv} & \\ \text{MOD} & \left[\text{CONT} \mid \text{SOA} \mid \text{NUCL } \boxed{3}\right] \\ \text{CONT } \boxed{1} & \begin{bmatrix}\textit{at-rel}\\ \text{SOA-ARG } \boxed{3} \\ \text{IND } t\end{bmatrix} \\ \text{STORE} & \left\{ \boxed{2} \begin{bmatrix}\textit{param} \\ \text{IND } t \\ \text{REST } \left\{\textit{time}(t)\right\}\end{bmatrix}\right\}\end{bmatrix}
\end{bmatrix}
$$

The content that arises is a question where the temporal parameter has been abstracted away. That is, the content of B's utterance is a question asking when the relation expressed by the nucleus of A's utterance took place.

So far, we have posited phrasal types that can deal with SOA modifiers. Although we cannot enter into this here, there are a variety of arguments for the need to distinguish such modifiers from fact/proposition modifiers such as *Why?* for instance. We return to these latter when we discuss stand-alone modifiers like factual adjectives and modal adverbs.

5.2. *Fragments as answers to yes/no questions*

We have already seen that polar questions can be answered by fragments. We will first discuss affirmative answers using a repeated phrase, like the examples in (2a/2b). What seems characteristic of these responses is that it is not possible to repeat any sub-utterance of the query. What then makes the elliptical answer felicitous?

(25) a. A: Does your sister live IN BARCELONA?
B: Yes, in Barcelona.
B': #Yes, my sister.

b. A: Does YOUR SISTER live in Barcelona?
B: #Yes, in Barcelona.
B': Yes, my sister.

As shown in (25), affirmative fragment responses to polar questions seem to require the constituent to be focused. However, for us to test such hypothesis is not an easy task given that to determine what is the focus of an utterance mostly depends on the intonation[9] and the BNC does not contain intonational information. That usually makes difficult or even impossible to identify the focus constituent, if any such exists. We argue, however, that when an utterance is ambiguous in the sense that it is not possible to determine which is the intended focus-ground articulation solely by the form, (i.e. one and the same form can be associated with several distinct focus-ground partitions), this depends on the context or more precisely on the information state of the dialogue participants.

Thus, following [VAL 96], we assume that every utterance can be partitioned into two components, the ground and the focus, and that all utterances contain focus, although the ground can be empty. We furthermore assume that all elliptical answers contain focal material.

With these assumptions in place, we are now prepared to analyse fragment responses to yes/no queries. As has often been suggested in past work, a focused constituent in a polar question creates a context which allows to provide an utterance in which only the focus is realized. In terms of KOS, this can be formulated as follows: an utterance with a certain focus-ground partition requires for its felicity the maximality in QUD of a particular question obtained by λ-abstracting over the content corresponding to the focused constituent.[10] Thus, assuming that (2a) is an utterance

9. At least in English. Some other languages use syntactic or morphological strategies or combinations of all three.
10. For more discussion see [GIN 99, ENG 00].

with focal accent on the complement, it presupposes QUD-maximality of the following question: *Where does the 1363 go?*, i.e. (s ? λx $\langle$GO, role1:i, role2:$x\rangle$). The presence of this question in QUD explicates the felicity of the phrasal answer in a dialogue like (2a).

Given this proposal, help rejections can be accommodated entirely analogously. If a yes/no question *q* which focally presupposes a *wh*-question *q'* is answered positively, both *q* and *q'* are removed from QUD. However, if *q* is answered negatively, *q'* will remain on QUD and the most felicitous negative answer is thus one that answers *q'*.[11]

We can similarly deal with corrective responses to assertions like the ones in (3). Since these phrasal utterances are obviously focused, from the previous assumptions we can conclude that they presuppose QUD-maximality of a question obtained by λ-abstracting the content corresponding to the parameter associated with the focused element. The content of the fragment uttered to perform the correction would then be resolved as a substitution instance of the proposition conveyed by the previous utterance.

5.3. *Clarification Ellipsis*

We now turn to Clarification Ellipsis (CE), as analyzed in [GIN 01b], since it involves additional theoretical machinery. In order to analyse CE, [GIN 01b] make two modifications in the HPSG representation of utterances. They revamp the feature C(ONTEXTUAL)-INDICES to encode the entire inventory of contextual parameters of an utterance, renaming it C(ONTEXTUAL)-PARAM(ETERS) and, secondly, they posit a set valued feature CONSTIT(UENT)S whose value is the set of all constituents immediate or otherwise of a given sign. Note that this second modification concerning the encoding of phrasal constituency is necessary also to deal with corrections, given that in principle any semantically meaningful sub-utterance can be corrected.

[GIN 01b] suggests that a conversationalist who requests a clarification needs to do at least the following: (i) perform a partial update of the existing context with the successfully processed components of the utterance, (ii) pose a clarification question that involves reference to the sub-utterance u_i from which i emanates. Since the original speaker can coherently integrate a clarification question once she hears it, it follows that, for a given utterance, there is a predictable range of $<$ partial updates + consequent clarification questions$>$. These they take to be specified by a set of *coercion operations* on utterance representations. Such operations have the following form:

11. For more discussion of such cases see also [LAR 98].

(26)
$$
\left[\begin{array}{ll}
\textit{root-cl} & \\
\text{C-PARAMS} & \left\{\ldots \boxed{i} \ldots\right\} \\
\text{CONSTITS} & \left\{\ldots \boxed{2}\left[\begin{array}{ll}\text{CONT} & \boxed{i}\end{array}\right]\ldots\right\} \\
\text{CONT}|\text{SOA} & \left[\begin{array}{ll}\textit{illoc-rel} & \\ \text{SPKR} & \mathrm{j} \\ \text{ADDR} & \mathrm{k} \\ \text{MSG-ARG} & \ldots\end{array}\right] \\
\ldots &
\end{array}\right]
$$
$$\Rightarrow$$
$$
\left[\begin{array}{ll}
\textit{root-cl} & \\
\text{CONT}|\text{SOA} & \left[\begin{array}{ll}\textit{ask-rel} & \\ \text{ASKER} & \mathrm{k} \\ \text{ADDRESSEE} & \mathrm{j} \\ \text{MSG-ARG} & \left[\begin{array}{ll}\textit{question} & \\ \text{PROP} & \boxed{1}\end{array}\right]\end{array}\right] \\
\text{CTXT} & \left[\begin{array}{ll}\text{SAL-UTT} & \boxed{2} \\ \text{MAX-QUD} & \left[\begin{array}{ll}\textit{question} & \\ \text{PROP} & \boxed{1}\end{array}\right]\end{array}\right]
\end{array}\right]
$$

This is to be understood as the following recipe for a clarification request by k of utterance u: given u uttered by CP j (whose associated sign is one) which satisfies the specification in the RHS of the rule, the other CP, k, may respond with any utterance which satisfies the specification in the LHS of the rule.[12] More specifically, the input of the rules singles out a contextual parameter $\boxed{\mathrm{i}}$, which is the content of an element of the daughter set of the utterance $\boxed{2}$. Intuitively, $\boxed{\mathrm{i}}$ is a parameter for which the CP either lacks or is dubious about its value. The sub-utterance $\boxed{2}$ is specified to constitute the value of the feature SAL-UTT associated with the context of the clarification utterance cu_0. The descriptive content of cu_0 is a question and it is constrained to share its open proposition with the question which is specified by the rule to constitute MAX-QUD. Where the coercion rules posited for CE differ is with respect to how MAX-QUD gets calculated on the basis of the input. Two coercion rules have been proposed: in parameter focussing, MAX-QUD associated with the clarification is a question whose open proposition is the content of the to–be clarified utterance and whose PARAMS set consists of the ‘problematic’ contextual parameter. Whereas, in parameter identification, MAX-QUD involves a question that queries

12. The fact that both the RHS and the LHS of the rule are of type *root-cl* ensures that the rule applies only to signs associated with complete utterances.

what the speaker intended to convey with the sub-utterance singled out for clarification. Informally, an utterance of (27a) could give rise to MAX-QUDs glossed as in (27b,c) respectively:

(27) a. Did Bo leave?

b. Who$_i$ are you asking if i left?

c. Who do you mean when you say *Bo*?

These would then be exploited in analyzing the two readings associated with 'Bo?' in (28a) and similarly with reprise sluices:

(28) a. A: Did Bo leave? B: Bo?

b. **Clausal reading**: Are you asking if BO (of all people) left?

c. **Constituent reading**: Who is Bo?

The grammatical analysis of CE makes use of two types. One is the type *dir(ect)-i(n)s(itu)-int-cl*, introduced in [GIN 01c] to analyze non-reprise in-situ constructions (including 'You gave the book to who' and, as here, 'intonation questions' such as 'You're hungry?'). The other type used to analyze CE is the type *constit-clar-int-cl*, introduced in [GIN 01b] specifically to analyze the readings associated with the coercion operation parameter identification.

5.4. *Modifiers*

We turn now to non-sentential modifiers. We have already seen that propositional adverbs like *probably* or *usually* can function as NSUs conveying a complete message. In these stand-alone uses, such adverbs take as an argument a contextual proposition, either from a declarative sentence or from a polar question in the context. We propose (29) as a possible analysis of a modifier like *probably*:

(29) $$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{adv} \\ \text{IC} \quad + \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \textit{proposition} \\ \text{SOA} \begin{bmatrix} \textit{probably-rel} \\ \text{PROP-ARG} \ \boxed{1} \end{bmatrix} \end{bmatrix} \\ \text{MAX-QUD} & \begin{bmatrix} \text{PARAMS} \ \{\} \\ \text{PROP} \ \boxed{1} \end{bmatrix} \end{bmatrix}$$

As shown in (11), another class of modifiers with stand-alone uses are adjectives like *great, pathetic, amazing, good, lovely, excellent*. We propose to analyse these adjectives as modifiers that take as an argument a contextually provided fact.[13]

(30)
$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{adj} \\ \text{IC} \quad + \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \textit{proposition} \\ \text{SOA} \begin{bmatrix} \textit{excl-adjective-rel} \\ \text{FACT-ARG } \boxed{1}\, \textit{fact} \end{bmatrix} \end{bmatrix} \\ \text{BCKGRD} & \left\{ \ldots \boxed{1} \ldots \right\} \end{bmatrix}$$

Apparently, given a certain question under discussion q maximal in QUD a dialogue participant can always utter a phrasal modifier that will be resolved as an adjunct of the proposition in q. This is also the case with bare adjuncts phrases like (31) and the previous example in (12).

(31) A: We should have a meeting.
B: This Thursday.
A: Yes, in 23D.

We suggest to analyse this kind of bare modifier phrases with a subtype of *bare-soa-mod-ph*, introduced in (19), closely related with the type *decl-bare-adj-cl* posited to analyse short answers to *wh*-adjunct questions.

(32) *bare-adj-cl*:

$$\begin{bmatrix} \text{CONT} & \begin{bmatrix} \textit{proposition} \\ \text{SIT } s \\ \text{SOA } \boxed{1} \end{bmatrix} \\ \text{MAX-QUD} & \begin{bmatrix} \text{PARAMS} \{\} \\ \text{PROP} \mid \text{SIT } s \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \text{CONT } \boxed{1} \end{bmatrix} \end{bmatrix}$$

13. In fact, in a way analogous to demonstrations by [WEB 91, ASH 93] with respect to propositional anaphora in texts, there are severe restrictions on which contextually presupposed facts can serve as the arguments of such modifiers. See [GIN 97] for a proposal as to how such restrictions can be accounted for.

5.5. *Acknowledgements and check questions*

Acknowledgements and check questions are phenomena that typically characterise interaction in dialogue. As the conversation proceeds, acknowledgements/acceptances signal (and check questions try to make sure) that the issues under discussion are grounded by the dialogue participants.

According to [GIN], an assertion *p* raises the issue *whether p* for discussion. In terms of KOS, this means that the question *p?* becomes maximal in QUD. At this point the addressee has two options, either to accept *p* or discuss the issue *whether p*. An acknowledgement or an acceptance of *p* can thus be analysed as involving two steps:

(i) both speaker and addressee add *p* to their FACTS[14] and

(ii) *p?* is downdated from QUD

Similarly, check questions can be understood as checking whether *p* is accepted, i.e. whether it can be added to FACTS and *p*? be downdated from QUD.

5.6. *Implementation*

Some of the analyses discussed in the previous subsections have already received a computational implementation. SHARDS [GIN 01a], an implemented system which provides a procedure for computing the interpretation of clausal fragments, handles *short answers*, *sluices*, as well as plain affirmative responses to polar queries. The system, which comprises an HPSG-based grammar and a resolution procedure (see [FER 02] for a detailed description), uses a context record to resolve the content of phrasal utterances assigning appropriate values to the MAX-QUD and SAL-UTT features. As a result of the research described in this paper, we are in the process of implementing our existing analyses for rejections and modifiers.

In addition, [PUR 02a] describes an implementation of the different readings and forms of clarification requests within an HPSG/TrindiKit-based dialogue system which also incorporates the ellipsis resolution capability of SHARDS, together with the dialogue move engine GoDiS ([COO 01, LAR 02]).

6. Conclusions

In this paper, we have proposed a comprehensive, semantically grounded taxonomy of non-sentential utterances (NSUs) that occur in dialogue. The taxonomy is based on manual tagging of a random sample of the BNC.

We have sketched a theoretical analysis of most of the NSU classes found in the corpus study, based on the KOS framework and the HPSG grammar presented in

14. More precisely, FACTS is incremented with FACT(*p*), that is the fact that must hold iff *p* is true.

NSU Class	Grammatical Type
`ShortAns`[*arg*]	*declarative-fragment-clause*
`ShortAns`[*adj*]	*declarative-bare-adjunct-clause*
`Sluice`[*arg*]	*sluice-interrogative-clause*
`Sluice`[*adj*]	*sluice-bare-adjunct-clause*
`CE`	*dir-is-int-cl*
`CE`	*constit-clar-int-cl*
`BareModPh`	*bare-adjunct-clause*
`PropMod`	*propositional-lexeme*
`FactMod`	*factual-lexeme*

Table 4. *Correspondence between NSU Classes and Grammatical Types*

[GIN 01c]. As a summary, Table 4 shows the correspondence between NSU classes in our taxonomy and grammatical types. On the other hand, we have only presented an intuitive analysis of answers to polar questions, acknowledgements and check questions. We do not as yet have a worked out proposal to analyse fragments introduced by connectives nor fillers. They are the subject of ongoing investigation.

Perhaps the most striking result that emerges from this work concerns the nature of ellipsis resolution involved in the interpretation of NSUs. On the one hand, it is clear that this must involve a combination of syntactic and semantic information associated with a source utterance. The basic strategy we invoke for resolution is to use utterance dynamic tools, i.e. by means of keeping track of a limited dialogue record of entities that get introduced into context as a result of utterances or that arise as a consequence of attempts to elicit clarification. Phenomena such as CE require a highly structured utterance representation to be available in the resolution process. However, the relative complexity of the contents involved rules out the viability of simple operations such as copying or even more complex ones such as higher order unification as catch all methods for resolution.[15] And yet, our results also indicate that, *with the context as given*, the principles by means of which NSU content is resolved do not involve complex domain sensitive reasoning (for the suggestion that this is required see e.g. [ALL 80] and in particular [CAR 91]). In other words, the principles we employ involve entirely domain independent methods of constructing a context on the basis of which NSU content resolution takes place. We do need to reiterate that our approach does not as yet offer means of determining which of a number of possible antecedents is preferred and this aspect might very well involve domain-based reasoning. Moreover, we do not of course wish to claim that domain-based reasoning has no role to play in dialogue understanding. Nor even that there do not exist NSUs where such reasoning might need to be appealed to. We simply observe that the role

15. For a detailed evaluation of how copying or HOU cope with CE see [GIN 01b].

of such reasoning seems relatively insignificant in the corpus we have investigated, a significant proportion of which is free, unrestricted conversation.[16]

This suggests that using an utterance dynamics approach, combined with a relatively intricate grammar can serve as a viable basis for a comprehensive NSU resolving module in a dialogue system. As discussed in Section 5.6, we have in collaboration with colleagues, begun work on prototype systems that employ such a strategy. Whether this will be viable on a larger scale is still very much an open question.

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16. All three anonymous reviewers are troubled by the fact that much of our data come from free, unrestricted conversation and suggest this somehow weakens our basic claim about the insignificant role of domain-based reasoning. As one reviewer puts it: '...Moreover, the kinds of dialogues chosen do not appear to have a strong underlying plan/task structure (unlike the kinds of dialogues in most spoken dialogue applications), so it may be unsurprising if there is little evidence of the need for domain based reasoning.' We find this objection somewhat strange: free, unrestricted conversation is in general more difficult to process than task oriented conversation, where interpretation is more circumscribed, fewer syntactic constructions are used etc. Hence, our results, limited as they of course are by sample size etc, show the potential for domain-independent interpretation in a more complex to process domain. It is after all not the case that in free, unrestricted conversation domain-specific reasoning is not employed (knowledge particular to adolescents, academics, parents and their children, etc). What might be the case is that in a task oriented conversation there is *more* potential for NSUs, given the more stereotypical nature of interpretation. As should be clear from our remarks in the text, we remain open both to this possibility and to its negation.

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