RAQUEL FERNÁNDEZ, JONATHAN GINZBURG, HOWARD GREGORY AND SHALOM LAPPIN

SHARDS: FRAGMENT RESOLUTION IN DIALOGUE

1. Introduction

A major challenge for any grammar-driven text understanding system is the resolution of fragments. Basic examples include bare NP answers (1a), where the bare NP John is resolved as the assertion John saw Mary, and sluicing (1b), where the wh-phrase who is interpreted as the question Which student saw John.

(1) a. A: Who saw Mary?
   B: John

   B: Who?

Either the antecedent or the fragment (or both) may be embedded:

(2) a. A: Bill wonders who saw Mary.
   B: John. (John saw Mary)

b. A: Bill thinks a student saw John.
   B: Who? (Which student does Bill think saw John?)

c. A: Who saw Mary?
   B: John thinks Bill. (John thinks Bill saw Mary)

   B: Bill wonders who. (Bill wonders which student saw John)

2. Theoretical Background

2.1. Ellipsis Resolution: a theory of context and parallelism

The task of accounting for many ellipsis phenomena can be viewed as involving: (a) locating an element in the context (the source) parallel
to the ellipsis element (the target); and (b) computing from contextual 
information a property which, applied to the target, yields the resolved 
content. This view underlies work on Higher Order Unification (HOU) 
(Dalrymple et al., 1991; Pulman, 1997), and also the Dynamic Syntax 
approach of (Kempson et al., 1999). We adopt a similar approach in this 
paper. We extend our account to adjuncts, and we briefly consider an 
alternative approach to adjunct fragments. We also provide an explicit 
account of the relation between this parallelism and dialogue context 
(see section 5 below).

We adapt the situation semantics-based theory of dialogue context 
developed in the KOS framework (Ginzburg, 1996; Ginzburg, 1999; 
Cooper et al., 1999). This combines a structuring of the propositional 
common ground of conversation (Webber, 1991; Asher, 1993) with a 
modelling of discourse topic based on (Carlson, 1983). In (Ginzburg 
and Sag, 2001) this framework is integrated into recent work in Head 
Driven Phrase Structure Grammar (HPSG) (Pollard and Sag, 1994; 
Sag, 1997). Following (Ginzburg and Sag, 2001) we define two new 
attributes within the CONTEXT (CTX) feature structure: Maximal 
Question Under Discussion (MAX-QUD), whose value is of sort question, 
and Salient Utterance (SAL-UTT), whose value is a set of elements of 
type sign.

In this framework, questions are represented as semantic objects 
comprising a set of parameters—that is, restricted indices—and a propo-
sition PROP as in (3). This is the feature structure counterpart of the 
$\lambda$-abstract $\lambda \pi(\ldots \pi \ldots)$. In a wh-question the PARAMS set represents 
the abstracted INDEX values associated with the wh-phrase(s). For a 
polar question the PARAMS set is empty.

\[
\begin{align*}
\text{PARAMS} & \{ \pi, \ldots \} \\
\text{PROP} & \left[ \begin{array}{c}
\text{proposition} \\
\text{SIT} \\
\text{SOA} \left[ \text{soa}(\ldots \pi \ldots) \right] \\
\end{array} \right]
\end{align*}
\]

In general a number of such questions may be available in a given 
discourse context, of which one is selected as the value of MAX-QUD. An 
algorithm is given below for the simple cases discussed in the present 
system, but it will be apparent that the system is flexible enough to 
allow for extension to more complicated dialogues.
The feature \textsc{sal-utt} represents a distinguished constituent of the
utterance whose content is the current value of \textsc{max-qud}. In infor-
mation structure terms, \textsc{sal-utt} can be thought of as a means of
underspecifying the subsequent focal (sub)utterance or as a potential
parallel element. \textsc{max-qud} corresponds to the ground of the dialogue at
a given point.\footnote{For related notions concerning information structure see
(Vallduví, 1992; Krifka, 1992; Rooth, 1993; Grosz et al., 1995). In contrast to these works, the
notions we utilise here are applied directly within a computational theory of
dialogue.} Since \textsc{sal-utt} is a sign, it enables us to encode syntactic
categorial parallelism, including case assignment for the fragment.\footnote{We invoke
syntactic parallelism only for matching conditions between
an elliptical form and a prior utterance. Thus, our approach is compatible
with psycholinguistic work demonstrating the rapid decay of purely structural
information (Fletcher, 1994). Indeed, by relating \textsc{max-qud} and \textsc{sal-utt} in
the way we do, our approach enables us to make strong predictions about the
range of possible relations of categorial parallelism.}

\textsc{sal-utt} is computed as the (sub)utterance associated with the role
bearing widest scope within \textsc{max-qud}:

- For \textit{Wh}-questions, \textsc{sal-utt} is the \textit{wh}-phrase associated with the
  parameters set of the question.\footnote{More generally, the utterance associated with
  the \textsc{params} set when this is non-empty. An empty \textsc{params} set can arise when the
  antecedent is not an interrogative clause, for example in reprise or echo questions
  (mentioned in section 6; see Ginzburg and Sag, 2001 for detailed discussion). In such cases,
  \textsc{sal-utt} will be the utterance of the constituent to be clarified.}
- If \textsc{max-qud} is a question with an \textit{empty} \textsc{params} set, the context
  will be underspecified for \textsc{sal-utt}. Its possible values are either
  the empty set or the utterance associated with the widest scoping
  quantifier in \textsc{max-qud}. This will be invoked to resolve sluicing.\footnote{\textsc{sal-utt}
can also be a set containing more than one member in contexts
where \textsc{max-qud} is a multiple question, as in (i) below. We leave the analysis
of such phenomena to future research.}

Our grammar also includes the non-local feature \textsc{c(ontextual)-
param(eter)s}, introduced by (Ginzburg and Cooper, 2001). This feature
encodes the entire inventory of contextual parameters of an utter-
ance (proper names, indexicals and so on).\footnote{The presence of this feature allow signs to play a role similar to the role
traditionally associated with 'meanings', i.e. to function as abstracts with

(i) A: Who arrived when? B: Jo at 5, Mustafa at 7.
amalgamated via lexical heads and are propagated in the same way as other non-local features, such as \textsc{slash} and \textsc{wh}. The set of parameters is inherited from head daughter to mother within headed structures by the GHFP (see Ginzburg and Sag, 2001).

### 2.2. A Grammatical Framework for Fragments

We adopt a version of HPSG, following (Sag, 1997; Ginzburg and Sag, 2001), which encodes information about phrases 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 the informational dimension of \textsc{clausality}. Clauses are divided into \textit{inter alia} declarative clauses (\textsc{decl-cl}), which denote propositions, and interrogative clauses (\textsc{inter-cl}) denoting questions. Each maximal phrasal type inherits feature values from both these dimensions. This classification allows us to specify systematic correlations between clausal construction types and semantic content types.

In line with much recent work in HPSG and Categorial Grammar, we do not treat ellipsis by positing a phonologically null head. Rather, we assign fragments to a subtype of the phrasal type \textit{head-only-phrase}. We first deal with fragments that constitute arguments, and then turn to adjuncts in section 4. Bare argument phrases are analysed by means of the phrasal type \textit{headed-fragment-phrase} (\textit{hd-frag-ph}). The top-most constraint associated with this type is shown in (4).

\begin{equation}
(4) \text{hd-frag-ph:}
\end{equation}
This constraint has two significant effects. First, it ensures that the category of the head daughter (the fragment) is identical to that specified by the contextually provided SAL-UTT. 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. Thus, the (sub)utterance in the antecedent picked up by SAL-UTT links the bare phrase to the appropriate argument-role, and enforces categorial identity.

We define two types by means of which we analyse argument fragments. Both are subtypes of hd-frag-ph: decl-frag-cl (for “short answers”) and slu-int-cl (for sluices). These subtypes are also subtypes of decl-cl and inter-cl, respectively. As a result, their content is in the first case a proposition and in the second a question.

We start by considering decl-frag-cl. The only information, beyond that inherited from hd-frag-ph and decl-cl, which remains to be specified concerns the scoping of quantifiers and the semantic content. 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 (MAX-QUD). This provides the values for the situation and nucleus features of the phrase’s CONTENT. With respect to quantifier scoping, we assume the following:

- **Quantifier scoping.** If the bare phrase is (or contains) a quantifier Q, then Q is scoped in wider than the existing quantifiers, if any, in the contextually salient question (MAX-QUD).\(^7\)

The constraint particular to decl-frag-cl is, hence, as represented in (5). This constraint identifies the SIT and NUCLEUS values of the phrase’s CONTENT with those of the MAX-QUD. It also ensures that if the head daughter contributes a parameter to the store, due to the presence of a wh-phrase, that parameter remains stored, i.e. is included in the mother’s STORE value.

Turning to sluices (slu-int-cl), most existing linguistic work on sluicing has assumed (on the basis of embedded uses in monologue) that only existentially quantified propositions can serve as antecedents (see e.g. Chung et al., 1995; Reinhardt, 1997). However the examples in (6), taken from (Ginzburg and Sag, 2001), show that the context for sluicing crucially involves the QUD-maximality of a question of the

\(^7\) For motivation for this view see (Ginzburg, 1999; Ginzburg and Sag, 2001). In the latter work apparent exceptions to this are analysed on the basis of Skolem function interpretation of wh-phrases.
form \textit{whether} \(p\), where \(p\) is quantified and its widest-scoping quantifier is non-negative.\(^8\)

(5) \textit{decl-frag-cl}:

\[
\begin{array}{c}
\text{HEAD} \quad \text{IC} + \\
\text{proposition} \\
\text{SIT} \quad 6 \\
\text{SOA} \quad \text{QUANTS} \quad \text{order}(6) \oplus 6 \\
\text{NUCL} \quad 6 \\
\text{CONT} \\
\text{STORE} \quad \triangleleft 6 \\
\text{MAX-QUD} \\
\text{PROP} \quad \text{question} \\
\text{PARAMS} \quad \text{non-empty-eset} \\
\text{HD-DTR} \\
\text{STORE} \quad \triangleleft 6 \cup \triangleleft \text{set(param)}
\end{array}
\]

(6) a. A: Many dissidents have been released.
    B: Do you know who?

    b. A: Did anyone show up for class today?
    B: Yes.
    A: Who?

    c. A: Can anyone solve the problem?
    B: Gee, I wish I knew who.

\(^8\) (Singular) definites are an exception to this, allowing as they do only reprise/echo sluices:

(i) A: The murderer was obviously a vicious guy.
    B: #who?/WHO?/#You don’t know who?
(ii) # which murderer was obviously a vicious guy?

Our account will associate the non-reprise sluice (i) with a content essentially synonymous with the non-elliptical (ii), which is indeed infelicitous in this context (i.e. as a non-reprise sluice).
d. A: No student supported the proposal.
   B: hmm, # I wonder who (cf. I wonder who did.)

As with decl-frag-cl, the type slu-int-cl inherits a significant part of its specification through being a subtype of hd-frag-ph and inter-cl. The conditions that are specific to slu-int-cl pertains to content, which like decl-frag-cl is partially determined by the context, and quantifiers. We assume that:

- **Quantifier replacement.** The widest scoping quantifier \( Q \) in MAX-QUD’s QUANTS list is removed from the QUANTS list of the content of a slu-int-cl. Thus, the widest scoping quantifier, if any, in the open proposition of the question after resolution will be whichever quantifier, if any, was previously scoped just narrower than \( Q \).9

The constraint particular to slu-int-cl is shown in (8). The wh-phrase contributes a parameter to the STORE value of the head daughter, which is constrained to be a *non-empty set of parameters*. The parameter is then retrieved by identifying the head daughter’s STORE value with the clause’s PARAMS set.

This analysis can be extended to account for reprise sluices (7a) and elliptical literal reprises (7b).

(7) a. A: Mary sang.
   B: WHO?

b. A: Did Jo kowtow?
   B: JO?

---

9 (Lappin, 2002) points out that there are exceptions to this condition, as in (i).

(i) A: Each student will consult a supervisor.
   B: Which one?

The most natural interpretation of B’s utterance in (i) is *Which supervisor will each student consult?*. This reading takes the narrower scoped quantified NP ‘a supervisor’ as the SAL-UTT. We will be refining the scope conditions associated with decl-frag-cl and slu-int-cl, and the procedure for identifying the SAL-UTT in future work. (Ginzburg and Sag, 2001) discuss cases of this kind in terms of an analysis that uses Skolem functions.
The resolution of reprise sluices such as B’s utterance in (7a) is achieved by allowing a conversational participant to coerce a clarification question onto MAX-QUD. The reprise sluice is then analysed as a direct-insitu-int-cl, a phrasal type introduced by (Ginzburg and Sag, 2001) to analyse direct in-situ constructions like 'You gave the book to who?' and intonation questions such as 'You’re hungry?'. The head daughter of a construction like (7a) is a decl-frag-cl in which the parameter which constitutes the content of the wh-phrase WHO remains in storage. The retrieval of this parameter is effected by the type dir-is-int-cl, which allows a question to be constructed by retrieving from storage zero or more parameters from a proposition-denoting head daughter. This is achieved by identifying the PROP value of the mother with the CONTENT value of the head daughter. The parameter introduced by the wh-phrase is included in the clause’s PARAMS set.

Elliptical literal reprises like (7b) are also analysed by means of dir-is-int-cl. Again, a clarification question is coerced onto MAX-QUD, which allows us to analyse the fragment using the type decl-frag-cl as

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\footnotetext[1]{For a detailed account of these coercion mechanisms see (Ginzburg and Cooper, 2001)}
a head daughter of \textit{dir-is-int-cl}. The crucial difference is that in (7b) there is no parameter to retrieve from storage, leading to a question with an empty params set, in other words a polar question ('Are you asking if JO kowtows?').

3. **An Implemented System for Short Answers and Bare Sluiced Questions**

Our fragment interpretation system consists of four main components:

**I. An HPSG grammar.** This is a substantially modified version of the grammar employed by (Lappin and Gregory, 1997; Gregory and Lappin, 1999; Ginzburg et al., 2001), that has recently been extended (see (Fernández, 2002)) to cover a important part of the wide coverage grammar proposed in (Ginzburg and Sag, 2001). It uses the types and features specified in section 2 and is encoded in (Erbach, 1995)'s ProFIT system.

**II. A dialogue record.** When a clause has been parsed (and any ellipsis resolved as described below), its AVM is first converted into a transitive network of Mother-Daughter-Relations (MDR list) and then stored in a dialogue record paired with an index (counter).\footnote{In the simple dialogue sequences implemented so far, this indexing corresponds to a linear sequence of utterances, but the format can be enriched to capture more complicated dialogue structures.} A list of max-qud candidates is computed from the cont of each subclause and stored as a further component of the discourse record (the qud-list or candidate list).

**III. A CONTEXT resolution procedure.** This assigns values from the dialogue record to the max-qud and sal-utt features of the current clause C, according to the procedures specified in Section 2. The most recent element of the qud-list which is compatible with the type constraints imposed by the bare argument phrase is selected as the value of max-qud.\footnote{(Lappin, 2002) motivates the need for a more refined procedure to select the antecedent of a fragment phrase. He presents cases in which recency is overridden and more distant antecedents are preferred to type compatible candidates.} On the basis of the conditions indicated in section 2.1, the sal-utt is obtained from the sign whose content provides max-qud.
IV. A bare clause resolution procedure. This computes the cont of C as already described. The nucleus N is identified with that of the max-qud, and the index of the hd-dtr identified with that of the sal-utt, with the specified operations on the params set and on the quants list. If the hd-dtr is an argument, its cat is identified with that of sal-utt, enabling it to be assigned case.

The system as described produces AVMs for bare answers and reprise and non-reprise sluices corresponding to the structures argued for in the previous section.

An instructive case is the dialogue sequence in (9), where “cascaded” bare answers and sluices interact to give the specified interpretation of the final fragment Mary.

(9) A: Who saw John?
   B: A girl. (= A girl saw John.)
   A: Who? (= Which girl saw John?)
   B: Mary. (= A girl called Mary saw John)

The simplified AVM for this final bare answer (various contextual restrictions on indices are suppressed) is shown in (11). Note that the procedure for assigning the cat value to the fragment rules out cases of category mismatch such as those in (10):\[13\]

(10) a. A: Who saw Mo?
    B: #to Jo.

b. A: Whose book did you read?
    B: His/#He/#Him

Similarly the coindexation of the sal-utt and the hd-dtr in the cont of the bare clause, identifies cases of semantic mismatch between the source and target.

\[13\] This paper focuses on English. The existence of syntactic parallelism across utterances is far easier to demonstrate in case rich languages such as German, Russian, or Greek. For such data see e.g. (Ginzburg, 1999; Ginzburg and Sag, 2001).
4. **Adjunct Sluices**

Until now we have dealt with cases of bare answers and sluices corresponding to *arguments*. Our system also covers *adjunct* sluices. We assume the following general account of the semantics of adjuncts. An adjunct has a **CONT** of type *soa*, i.e. a relation (*adjunct-relation*) with a parameter corresponding to a property of a SOA, and a **ROLE** whose value is identified with the SOA of the modified head.

(12) \[
\begin{array}{c}
\text{CONT} \\
\text{PARAM} \quad \text{param} \\
\text{SOA-ROLE} \quad \text{soa}
\end{array}
\]

On this account, interrogative adjuncts are interpreted as abstraction over properties of SOAs. As shown in (13), if the adjunct is inter-
rogative, then its INDEX represents abstraction over the corresponding type of relation (e.g. temporal or causal).

(13) a. when:

\[
\begin{align*}
\text{CONT} & \quad \text{PARAM} \quad \begin{bmatrix} \text{INDEX} \ 1 \\ \text{RESTR} \ time(1) \end{bmatrix} \\
\text{SOA-ROLE} & \quad soa
\end{align*}
\]

b. When did John see Mary?

\[
\begin{align*}
\text{PARAMS} & \quad \begin{bmatrix} \text{INDEX} \ 2 \\ \text{RESTR} \ time(2) \end{bmatrix} \\
\text{SOA} & \quad \begin{bmatrix} \text{at-rel} \\ \text{PARAM} \ 1 \\
\text{SOA-ROLE} & \quad \begin{bmatrix} \text{see-rel} \ 4 \\ \text{SEE-ER} \ 6 \\ \text{SEE-EE} \ 11 \end{bmatrix} \end{bmatrix}
\end{align*}
\]

The framework sketched above already accommodates short answers to ‘adjunct’ questions such as (14):\(^\text{14}\)

(14) a. A: When did Jo leave?  
   B: At 2.

b. A: Why did Bo leave?  
   B: Because he was unhappy.

A bare answer to a question with an interrogative adjunct would take that adjunct as its SAL-UTT value and substitute its own relation for the latter’s INDEX. In similar fashion we can also accommodate sluicing where an antecedent exists:

\(^\text{14}\) An issue whose discussion we defer to future work concerns the categorial parallelism requirements associated with adjuncts, which appear to be somewhat freer than with arguments:

(i) A: When did Jo leave? B: At 2/Yesterday/Recently.
(15) a. A: Jo left at some point yesterday.
   B: When?

   b. A: Bo shot herself for a reason.
   B: Hmm. Why/What?

   There are, however, cases where there is no such antecedent, as in (16).

(16) a. A: John saw Mary.
   B: When?

   b. A: John likes Mary.
   B: Why?

   One approach we could adopt to deal with such cases is to subsume them under the analysis we give for (15). To do this, one needs to posit a mechanism of ‘existential adjunct accommodation’, which provides for the requisite existentially quantified antecedent. Such an approach has the advantage that it requires no extra grammatical apparatus as such, but it does involve an ‘adjustment’ of the content of the antecedent, which is computationally problematic in that it frequently relies on non-deterministic (specifically, abductive) principles of inference.  

   An alternative approach, which we adopt in our current system, is to take the SAL-UTT in such cases as empty (i.e. there is no parallel constituent to be picked up). Consequently, we posit an additional phrasal type bare-soa-mod-ph to support the constraints necessary for the interpretation of bare adjuncts. The specification for this type is as follows:

\[ \text{From the perspective of dialogue processing this ‘adjustment’ can be viewed as an inference initiated by the addressee of the original utterance. Hence, it need not be viewed as post hoc reanalysis. This requires an approach to context, such as that developed in KOS and implemented in the GODIS system at Gothenburg (see e.g. (Bohlin et al., 1999)), in which distinct dialogue participants can diverge in their view of what constitutes the contextual common ground. Our system as it stands does not accommodate such mismatches.} \]

\[ \text{See (Fernández and Ginzburg, 2002a) for a similar approach to bare adjuncts.} \]
We posit a type *slu-bare-adj-cl*, which is a subtype of *inter-cl* and of *bare-soa-mod-ph*. This entails that it denotes a question and that the information specified for *bare-soa-mod-ph* is inherited. The sole additional information required by *slu-bare-adj-cl* concerns semantic content of the clausal fragment and the retrieval of the index associated with the *wh*-phrase:

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

\[
\begin{array}{c}
\text{CONT} \\
\text{PARAMS} \{ Q \} \\
\text{PROP} \mid \text{SOA} \mid \text{NUCL} \{ 1 \} \\
\text{HD-DTR} \{ \text{SOA-ROLE} \{ 1 \} \} \\
\end{array}
\]

The clause’s nucleus is identified with the content of the head daughter and the parameter contributed by the *wh*-phrase is included in the clause’s params set.

The (truncated) AVM which our system generates for the adjunct sluice *when* in (16a) is as shown in (19):

Given this treatment of adjuncts, we can also accommodate adverbal answers to polar questions such as the following:

(19) a. A: Was Bo sent home?  
    B: Probably.

Such cases are analysed as instances of a type *bare-adj-cl*. This is a subtype of both *bare-soa-mod-ph* and *decl-cl*, which inherits its specification entirely from these two types.
5. Comparison with Other Approaches

The system described here shares many features with the Higher Order Unification (HOU) account of ellipsis resolution (Dalrymple et al., 1991; Pulman, 1997). However, it differs from HOU in three important respects.

First, while HOU does not indicate how the relation of parallelism between the fragment and a counterpart term in the antecedent clause is specified, we provide an explicit definition of the counterpart term (as the phrase that supplies the value of \textit{sal-utt} for the bare clause).\footnote{\cite{gardent1997}}

Second, unlike HOU, we impose a syntactic matching condition on the category of the fragment and its counterpart term. This permits us to rule out cases of categorial mismatch, as discussed above. Because

\cite{gardent1997} combine a version of HOU with an abductive calculus for computing parallel elements. This invokes relations defined over a hierarchical classification of the lexical semantics of the subconstituents, following the work of \cite{hobbs1991} on parallelism in discourse. To the best of our knowledge this system has not yet been implemented.
the entire AVM of an antecedent is recoverable from the discourse record, we can invoke additional syntactic constraints on fragment interpretation if these are required (cf. (Lappin and Gregory, 1997) for other cases of ellipsis resolution where additional syntactic matching conditions are invoked).

Third, HOU is not possible when the semantic type of the target is distinct from that of the source, as when the target denotes a question and the source is a proposition or vice versa. (Pulman, 1997) attempts to bypass this problem by associating propositional contents with interrogatives. However, as the formal semantic literature on interrogatives suggests (Groenendijk and Stokhof, 1997), such a move is not semantically viable. Our system can handle such mismatches in semantic type by using the SOA and QUANTS features of different clause types present in the discourse record to specify the MAX-QUD and SAL-UTT values of a bare clause.

(Lappin and Shih, 1996) propose a generalised algorithm for ellipsis resolution, which was implemented in (Lappin and Gregory, 1997). Bare NP fragments are treated as the NON-HD-DTRS of clauses with empty heads, which are replaced in ellipsis resolution by an antecedent head. Counterpart arguments are replaced by the overt fragment, while non-counterpart arguments (and adjuncts) are copied into the ellipsis site. The present model avoids the need for empty heads and full syntactic reconstruction.

6. Conclusions and Future Work

We have presented the main features of SHARDS, a dialogue system for resolving fragments within a typed feature structure grammar. The system provides a procedure for computing the content values of clausal fragments from contextual information contained in a discourse record of previously processed sentences.

The system has served as the basis for a variety of work on elliptical constructions. This includes work by Matthew Purver on the acquisition of new words through dialogue interaction. (Purver, 2002) describes an implementation of the different readings and forms of clarification requests within an HPSG/TrindiKit-based dialogue system which incorporates the ellipsis resolution capability of SHARDS, together with the dialogue move engine GoDiS ((Cooper et al., 2001; Larsonson, 2002)). SHARDS has also been used as the basis of a generation module. (Ebert et al., 2004) developed an algorithm which generates
full paraphrases for interpreted fragments in a dialogue management system.

The theoretical work on ellipsis resolution described in section 2 has supported two large scale corpus studies. One focuses on the available means for posing clarification requests, of which 40% turn out to be elliptical forms (Purver et al., 2001). The other attempts to characterise the entire class of fragmentary utterances in a conversational corpus (Fernández and Ginzburg, 2002a; Fernández and Ginzburg, 2002b; Fernández and Ginzburg, 2002c). This latter study proposes a taxonomic scheme consisting of 16 classes of fragmentary utterances, a substantial part of which can be analysed within the framework described in section 2.

Our current aim is to extend the system to cover a wider range of elliptical utterances. These include e.g. verb phrase ellipsis like (21) (see (Lappin and Gregory, 1997; Gregory and Lappin, 1999) for an analysis; also see (Nielsen, 2003) for a corpus-based study of VP ellipsis).

(21) a. A: Mary wants vodka.
   B: Rosa does too.

Our future research is concerned with the decision procedures required for choosing the antecedent of a fragment in dialogue. In this respect, the heuristics currently employed by SHARDS select the most recent clause which is compatible with the syntactic and semantic constraints imposed by the elliptical utterance. However, to account for dialogue sequences like (22) (where the fragment phrase to surprise you is a reply to A’s first question rather than the second), this recency measure needs to be refined.

(22) a. A: Why did Mary arrive early?
   B: I can’t tell you.
   A: Why can’t you tell me?
   B: Okay, if you must know, to surprise you.

One of our main concerns is to develop a robust computational procedure for identifying the antecedents of fragmentary utterances, with the aim of implementing a wide coverage system for fragments interpretation in dialogue.
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