

# Annotating abstract pronominal anaphora in the DAD project

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## Abstract

In this paper we present an extension of the MATE/GNOME annotation scheme for anaphora (Poesio, 2004) which accounts for abstract anaphora in Danish and Italian. By abstract anaphora it is here meant pronouns whose linguistic antecedents are verbal phrases, clauses and discourse segments. The extended scheme, which we call the DAD annotation scheme, allows to annotate information about abstract anaphora which is important to investigate their use, see i.a. (Webber, 1988; Gundel et al., 2003; Navarretta, 2004; Navarretta, 2007) and which can influence their automatic treatment. Intercoder agreement scores obtained by applying the DAD annotation scheme on texts and dialogues in the two languages are given and show that the information proposed in the scheme can be recognised in a reliable way.

## 1. Introduction

In this paper we describe an extension of the MATE/GNOME annotation scheme for (co)reference (Poesio, 2004) which allows the annotation of information which is relevant to the study and the automatic treatment of abstract anaphora. Abstract anaphora in the paper indicate third-person singular pronouns whose interpretation depends on linguistic expressions such as verbal phrases, clauses and discourse segments (henceforth, the antecedents). An example of abstract anaphora in English is in 1 where the demonstrative pronoun *that* has as antecedent the infinitive clause "to book a seat close to the aisle wings, where the exit windows are located".

(1)

*At the airport try to book a seat close to the aisle over the wings, where the exit windows are located. If that is not possible, choose an aisle seat near other exits ...*

(British Financial Times, 1993).

In the paper we also present the results of the application of the extended scheme, called the DAD scheme, to Danish and Italian data by different annotators in terms of inter-coder agreement. The described work is done under the ongoing DAD project funded by the Danish Research Councils<sup>1</sup>. One of the main aims of the project is to provide reliable annotated data to be used for studying and automatically treating abstract anaphora in Danish and Italian. To investigate the use of abstract anaphora is important because they are quite frequent in both written and spoken language, see i.a. (Byron and Allen, 1998; Navarretta, 2004a), but they differ in many aspects from individual anaphora, i.e. anaphora which have nominal phrase antecedents. One important particularity of abstract anaphora is they do not co-refer with their antecedents, while many individual anaphora do. Furthermore the same antecedent can evoke different abstract objects depending on the context in which the abstract anaphora occurs, see (Webber,

1991).

Because most studies and theories on abstract anaphora are based on English data, see i.a. (Asher, 1993; Hegarty, 2003; Gundel et al., 2004; Hedberg et al., 2007), they do not account completely for the use of abstract anaphora in other languages, see i.a. (Fraurud, 1992; Navarretta, 2002; Navarretta, 2004).

Co-reference annotation schemes such as the one proposed by Hirschman (1998) cannot be used to annotate abstract anaphora. Poesio (2004) has presented a more general scheme for annotating anaphora, the MATE/GNOME scheme which reflects the assumption that a shared discourse model is built up during discourse interpretation. The scheme accounts for the annotation of discourse entities and of the relations holding between them and for the fact that abstract anaphora do not have nominal antecedents. We have extended this scheme so that it includes information which we believe is relevant to the study and the resolution of abstract anaphora in Danish and Italian, (Navarretta, 2002; Navarretta, 2004; Navarretta, 2007).

In the following we first present preceding work on abstract anaphora by which we are inspired (section 2.), then we account for information which we believe is relevant to study the use of these anaphora (section 3.). In section 4. we explain how we have integrated this information in the MATE/GNOME scheme and in section 5. we review the data annotated until now. In section 6. we present the inter-coder agreement obtained on these data and finally in section 7. we make some conclusions and discuss work that still needs to be done.

## 2. Background and related work

There are only few studies describing the annotation of abstract anaphora in English. These studies have been done with different purposes, thus focussing on different types of information. Gundel et al. (2003), Gundel et al. (2004) and Hedberg et al. (2007) in their work focus on the investigation of the salience state of abstract entities in discourse and on their relation to the types of referring pronoun as proposed by Gundel et al. (1993) in their *Givenness Hierar-*

<sup>1</sup>The English home page of the project is <http://www.cst.dk/dad/uk>.

chy. Hedberg et al. (2007) use XML as annotation format. Eckert and Strube (2001) and Müller (2007) annotate third person singular anaphors and their antecedents as a basis for their automatic recognition and "resolution". They do not focus on the format of their annotation.

Müller (2007) lets non experts identify the antecedents of abstract anaphora according to very general instructions and reports low inter-coder agreement.

Fraurud (1992) and Navarretta (2002) annotate occurrences of abstract anaphora in Swedish and Danish respectively to investigate the characteristics of abstract pronominal reference in these languages. Their results indicate that there are differences in the way abstract anaphora are used in these two languages respect to English. Navarretta (2007) investigates the occurrences of abstract anaphors in a parallel corpus of fairy tales (Danish, English and Italian) and also her data indicate that there are language specific characteristics in the way abstract anaphora are used in these three languages, both for what regards their frequency, the contexts in which they are used and the types of pronoun used in similar contexts. In Fraurud's and Navarretta's studies only one person (the respective authors) made the annotation following different annotation conventions and focussing on different phenomena.

In the DAD project we include much of the information which has been used by i.a. Hedberg et al. (2007) for English and by Navarretta (2007) for Danish and Italian and integrate it in the existing MATE/GNOME scheme for anaphora. Apart from the fact that we use the MATE/GNOME scheme, the main difference between the work by Hedberg et al. (2007) and our work is that we do not include the annotation of the cognitive status of the antecedents ("in focus" and "activated"), but instead we provide more detailed information about the syntactic type of non nominal antecedents and mark information such as the anaphoric distance. Furthermore we work with abstract anaphora in Danish and Italian which involve more types of pronoun than they do in English.

### 3. The type of information and the data annotated

The first step when studying and treating abstract anaphora is to distinguish them from other types of anaphoric and non anaphoric uses of the involved pronouns, see i.a. (Eckert and Strube, 2001; Navarretta, 2002; Müller, 2007). To facilitate the automatic recognition of abstract anaphors we decided to annotate all the occurrences of singular third-person personal and demonstrative pronouns which potentially can be abstract anaphora in Danish and Italian. These include pronouns in neuter gender in Danish and in masculine (inanimate) gender in Italian. We also mark the function of these pronouns. The functions we distinguish are the following:

- pleonastic as in *det regner* (it rains), *jeg har det fint* (lit. I have it fine) (I am fine);
- cataphoric, i.e. the pronoun precedes the linguistic expression necessary to his interpretation in discourse as in 2.  
(2)

*Det at han kom for sent til mødet, skabte alvorlige problemer for hans kollegaer.*

(lit. It that he came too late to the meeting gave problems to his colleagues) (the fact that he came too late to the meeting gave problems to his colleagues);

- deictic. The pronoun refers to something in the physical world as in the utterance  
*Hvad er det her?*  
(What is this?)  
accompanied by a pointing gesture to an object in the world;
- individual anaphoric;
- individual vague anaphoric, the antecedent of the pronoun is implicit in discourse;
- abstract anaphoric;
- textual deictic (Lyons, 1977), as in 3.  
(3)  
*"Livet er dejligt" - Det gentog han tre gange*  
(“Life is wonderful”- He repeated that three time);
- abstract vague anaphoric- the abstract antecedent is implicit in the discourse
- abandoned: the pronoun occurs in an utterance which is left unfinished and where it is not possible to infer the context:  
*det er - de er forskellige*  
(it is - they are different)

Because different pronominal types signal different cognitive statuses of the referred entities, see i.a. (Prince, 1981; Ariel, 1988; Gundel et al., 1993) the individuation of the pronominal type is important when studying anaphora. In English only the three pronouns *it*, *this* and *that* can be abstract anaphors, thus their individuation is not problematic. The situation is much more complex for Danish, where information about stress must be included, and in Italian where clitics and zero anaphors (Italian is a subject PRO-drop language and we have chosen to call subjects which are implicit in a verb “zero anaphors”) occur as abstract anaphora. It is thus useful to mark explicitly the type of pronoun in the data.

In Danish texts only two pronouns are relevant as abstract anaphors, *det* (it/this/that) whose pronominal type cannot be determined, and the demonstrative pronoun *dette* (this). In spoken language it is possible to distinguish between the personal pronoun *det* (it) which is unstressed and the demonstrative pronoun *det* (this/that) which is stressed. Thus information about stress, when available, must be included in the annotation. In spoken Danish the stressed demonstrative *det* can also occur with two adverbials *det her* (this) and *det der* (that) and also this must be annotated. In Italian both clitics and zero anaphora are involved in abstract reference. The pronouns which can be abstract anaphora in Italian are: the personal pronouns *lo*, *ne* and *ci*, which can all occur as clitic particles or as independent pronouns, the demonstrative pronouns *questo* (this) *quello*

(that) and *ciò* (this/that) and zero anaphors<sup>2</sup>. An example of “abstract zero anaphor” is in 4<sup>3</sup>.

(4)

*Non le sembra che il balzo dei tassi sia di portata straordinaria?*

*È vero, ma bisogna anche qui andare al fondo del problema.*

(Don't you think that the jump of the interest rate is of extraordinary range?

(lit. Ø is true) This is true, but also here you must analyse the problem thoroughly.)

(Il Sole Ventiquattr'ore, 1993)

When a pronoun is an anaphor (individual or abstract) and when it is a textual deictic it is relevant to mark its antecedent and the relation between the anaphor and its antecedent. We only distinguish between two types of relation between anaphora and antecedents: “identity” (the case of coreference) and “non-identity” (the remaining cases).

Webber (1988) and Gundel et al. (2004) notice that in English normally only demonstrative pronouns can be used when the antecedents are clauses. Navarretta (2004) notices that this is not always the case in written Danish where the most frequent abstract pronoun *det* is ambiguous regarding its pronominal type. Navarretta (2007) reports that both personal and zero anaphora can have clausal antecedents in Italian in contexts where a demonstrative pronoun is used in English. Navarretta notices also that the demonstrative pronoun *dette* is often used in Danish texts to mark the antecedent is the latter subclause and not the whole preceding clause. To study further whether there is a relation between the syntactic type of antecedent and the type of pronoun used we have decided to annotate the syntactic type of the antecedent including different types of clause. We distinguish the following types of non nominal antecedent, see i.a. (Navarretta, 2004; Navarretta, 2007): *predicates in copula constructions*<sup>4</sup>, *verbal phrases*, *simple main clauses*, *matrix clauses*, *subordinate clauses*, *complex clauses*, *discourse segments*. *Complex clauses* are main clauses with all their subordinate clauses and/or coordinated clauses. The clausal types we use are inspired by the classification of clauses proposed by Kameyama (1998) in a completely different context.

Because the anaphoric distance (the distance between anaphor and antecedent) is one of the factors influencing saliency of entities, see i.a. (Ariel, 1988; Givón, 1976), we also decided to annotate it for abstract anaphors. In this case we measure anaphoric distance in terms of clauses in-between the abstract anaphor and its antecedent.

We have also decided to annotate the semantic type of the referent. The individuation of the semantic type of the referent is necessary for the identification of the referent. However most work on the automatic resolution of abstract anaphora only focusses on the individuation of

the antecedent, following the approach used for coreference resolution, see i.a. (Grosz et al., 1995). Most of the semantic types we have used are taken from the middle layer of the hierarchy of abstract objects proposed by Asher (1993). These types include *eventualities* comprising states and events, *fact-like entities* which comprise facts, situations and possibilities and *propositions*. To these types we have added *questions*, *speech-acts* and *other entities*. The latter type is i.a. used for predicates in copula constructions. Many of these types have also been used by i.a. Hedberg et al. (2007) in their annotation of English abstract anaphora. For textual deictic pronouns only information about the anaphoric distance is given, while for vague abstract anaphora only the semantic type of the referent must be annotated.

Because there are cases where anaphors have more than one possible antecedent/referent, these should be marked. In the project we have decided that the annotators must choose a preferred antecedent and mark it, but they must also annotate alternative interpretations in a special “comment” element.

#### 4. The annotation scheme

We have extended the MATE/GNOME annotation scheme for anaphora (Poesio, 2004) with the information presented in section 3. because this scheme, as previously described, also accounts for the annotation of anaphora in general.

The central elements in the MATE/GNOME scheme are the following: *de* (discourse entities) used to mark nominal expressions, *link* used to mark the relation between an anaphor and its antecedent and *seg* used to mark non nominal antecedents. All these elements contain an ID attribute with a unique value.

In our extension of the coding scheme we have added attributes to the *de* and *seg* elements. We have also introduced an element *pleonastic* to mark pleonastic pronouns which do not introduce a discourse entity in the discourse model.

In cases where the attributes we have defined are not relevant for the marked words, their value is set to *non-applicable*. In cases where the attributes are relevant for the marked words, but they are not annotated in the current project (we only annotate some pronouns) the values of the attributes are set to *none*.

The attribute ATYPE, in which the pronominal function is annotated, is for example defined for the *de* elements. If the nominal phrase marked by the *de* element is not a pronoun, the value of ATYPE is automatically set to “non-applicable”, if the element marked is a pronoun, but not a relevant third person singular pronoun, the value of the attribute is set to “none”.

The attribute PTYPE for the element *de* is used to indicate the type of pronoun if the marked words are pronouns. In Danish the attribute may have one of the following values *det*, *dette*, *stressed\_det*, *unstressed\_det*, *det.her*, *det.der*. In Italian the values of the PTYPE attributes are the following: *lo*, *clitic\_lo*, *ne*, *clitic\_ne*, *questo*, *quello*, *codesto*<sup>5</sup>. For *de*

<sup>2</sup>In older language also the demonstrative pronoun *codesto* occurs.

<sup>3</sup>The zero anaphor is marked with a “Ø” in the literary translation.

<sup>4</sup>In some cases the predicates of copula constructions are nominal phrases.

<sup>5</sup>Because in Italian more pronouns can occur in the same word form, one pronoun being a clitic, as in *glielo* (to him it) we mark such occurrences with two different *de* elements.

elements marking abstract anaphors the following attributes are marked:

- **DIST**: indicates the anaphoric distance in terms of clauses. The values of this attribute are integers. The value 0 indicates that the antecedent is in the clause that immediately precedes the clause in which the abstract anaphor occurs, 1 indicates that there is a clause in-between the anaphor and its antecedents and so on;
- **REF\_TYPE**: indicates the semantic type of the referent. It takes the following values *eventuality*, *fact-like*, *prop-l*, *question*, *other*;
- **REFERENT**: in this attribute the coders annotate in free words the referent (this attribute is mainly used when comparing the annotations as help for the coders).

In Italian verbal forms may include an implicit subject and/or a clitic pronoun. Following the proposal by Poesio et al. (forthcoming) *seg* elements are used to mark verbal forms that contain clitic pronouns and/or include an implicit subject (an anaphor or a pleonastic pronoun). In these cases the *seg* elements will be filled in with the same attributes/values as pronouns. As an example the **PTYPE** attribute is assigned the value *zero* if the verbal form includes an implicit subject or it is assigned the value corresponding to a clitic pronoun.

*seg* elements contain also an attribute **SYN-TYPE** which can take one of the following values: *cl* (simple clause), *scl* (subordinate clause), *ccl* (complex clause), *mcl* (matrix clause), *vp*, *v*, *other*.

The *link* element links an anaphor to its antecedent and has an attribute **LTYPE** which can take one of the two values *identity* and *no\_identity*.

The **DAD** annotation scheme for Italian is much more complex than the scheme used for Danish, but in both cases the basic elements are the same as in the original **MATE/GNOME** scheme.

To annotate our corpora we have used the encoding tool, **PALinkA** (Orasan, 2003). Two different preference files (corresponding to the two annotation schemes) have been made for the Danish and Italian data. The **PALinkA** tool requires a particular XML format and most of the corpora we have used contain also **POS** (Part of Speech) and lemma information.

It must be noted that because we use **PALinkA** there are few differences from the the original **MATE/GNOME** proposal, the main difference being that the link elements are encoded in the same file as the anaphors and their antecedents.<sup>6</sup>

An example of the annotation of an abstract anaphor and its antecedent is given in 5.

(5)

```
<seg ID="s5" SYN-TYPE="scl">
  <W id="w19.277">at</W>
  <W id="w19.278">tr{\ae}et</W>
  <W id="w19.279">er</W>
```

<sup>6</sup>Thus there is no need for the anchor element described by Poesio (2004).

```
<W id="w19.280">delamineret</W>
</seg>
<W id="w19.281">.</W>
<de ATYPE="abstr-ana" ID="a4"
  PTYPE="dette" DIST="0"
  REF="det faktum at tr{\ae}et
  er delamineret"
  REF-TYPE="fact-like">
  <link LTYPE="no_identity"
    POINT-BACK="s5" />
```

We had problems finding a way to annotate discontinuous antecedents in dialogues. We could choose to use multi-links (a discontinuous antecedent is then considered as being more antecedents) or to make a link from one part of the antecedent to the other and link the anaphor to the nearest antecedent part. We have adopted this provisory solution.

## 5. The data annotated

At present we have annotated the following Danish data:

- dialogue transcriptions from the DanPASS corpus (Grønnum, 2006), consisting of 52,145 running words
- monologue transcriptions from the same DanPASS corpus: 21,224 running words
- translations of three stories by Pirandello (1922 1937): 11,280 running words
- EU texts: 24,389 running words
- law texts: 11,600 running words
- part of the **PAROLE** corpus (Keson and Norling-Christensen, 1998) consisting i.a of extracts of newspaper and journal articles and novel extracts: 12,570 running words

The Italian data which we have annotated until now are the following:

- transcription of dialogues from the **AVIP** corpus (<ftp://ftp.cirass.unina.it/cirass/>): 70,054 running words
- three stories by Pirandello: 11,139 running words
- EU texts: 25,303 running words
- newspaper articles: 18,045 words.

The Danish DanPASS corpus and the Italian AVIP corpus have been built up as the dialogues in the **MapTask** project. In the annotation of the Danish dialogues we have used the prosodic transcription in order to distinguish between the stressed and the unstressed versions of the pronoun *det*.

A subset of the written texts which we have annotated are parallel. They include the EU texts and the three stories by Pirandello.

corpus	pronouns	abstract	indiv
Danish dialogues	643	204	331
Danish monologues	282	51	181
Danish texts	687	200	179
Italian dialogues	319	55	215
Italian texts	571	59	487

Table 1: Number of annotated pronouns

## 6. Results

The number and type of pronoun encoded in the project are given in table 1.

The Danish texts, monologues and dialogues have been annotated independently by two annotators, following the project’s coding manual (Navarretta, 2007a). Then the independently annotated data have been checked and the inter-coder agreement has been calculated for each file. An agreed upon version is made for the checked data. The Italian data have been annotated by only one annotator, with the exception of three texts and two dialogues which have been annotated by two persons.

In the following we give the inter-coder agreement obtained for the main information types in texts and dialogues which have been checked until now, i.e. in Danish: twelve texts and ten dialogues and in Italian: three texts and two dialogues. The annotations of each text and dialogue have been compared and the agreement scores for each type of pronoun, antecedent and attribute value have been calculated in terms of  $\kappa$  score, as proposed by Carletta (1996). However, as discussed in i.a. (Passonneau, 2004),  $\kappa$  score does not account for the fact that the encoding of antecedents which are partially overlapping should not be considered as completely mismatching. Thus we are considering to supply evaluation by  $\kappa$  score with other methods, such as Krippendorff (1995)’s  $\alpha$  as has been suggested by Passonneau (2004). However we have not decided yet how to weight partially mismatching encoding.

The  $\kappa$  scores for both Danish and Italian are given in table 2. A “-” in the table indicates that the category was not used. As it can be seen intercoder agreement is quite high for what regards the classification of the pronominal functions and in the case where the pronouns are anaphors for what regards the identification of the antecedents.

The  $\kappa$  scores obtained in the identification of abstract anaphors and their antecedents are much higher than those reported by Müller (2007). The reasons for this could be that we used expert annotators and that the DAD coding manual is quite detailed. I

It must also be noted that the  $\kappa$  scores for the identification of different pronominal types and of the antecedents, in the case the pronouns are anaphors, are in most cases higher in the texts than in the dialogues, while the  $\kappa$  scores for the classification of the semantic types of the referents are slightly higher in the dialogues than in the texts.

Some of the errors in distinguishing pronominal types in Italian were due to the fact that the annotators missed to mark up a number of pronouns (both clitics and zero). The main reasons for this is that the annotators had only to mark

up pronouns with masculine referents and that only explicit non-clitic pronouns had been automatically marked, before the annotation started. The same problem does not exist in Danish where all the involved pronouns have been automatically identified.

The intercoder agreement shows that the annotators did not always agree in the assignation of the two semantic types “eventuality” and “fact-like” and of the two semantic types “fact-like” and “speech-act” in contexts involving causality and in determining whether a pronoun is pleonastic or cataphoric. The latter error was caused by the decision to classify as pleonastic those pronouns occurring as cataphors in constructions where the postponement of a clause is the most common construction in Danish, as in 6<sup>7</sup>. In these cases the annotators did not always agree in deciding whether the given postponed construction was prototypical.

(6)

*Det vil næppe volde rivalerne i Dansk Supermarked og Aldi finansielle problemer at komme med et modspil i samme størrelsesorden.*

(lit. It will hardly cause the rivals from Dansk Supermarked and Aldi financial problems to react with an action on the same scale)

(Reacting with an action on the same scale will hardly cause the rivals from Dansk Supermarked and Aldi financial problems)

Danish PAROLE corpus

Although the annotators could mark ambiguities, they had to choose a preferred interpretation. Different preferred interpretations have been counted as different annotations in the present evaluation.

## 7. Concluding remarks and ongoing and future work

In the paper we have presented an extension of the MATE/GNOME scheme for anaphora annotation (Poesio, 2004). The extended scheme accounts for information which is relevant for the study and treatment of abstract anaphora in Danish and in Italian. The work described in the project has been done under the DAD project whose main aims were to provide reliable annotated data to study and automatically treat abstract anaphora in Danish and Italian.

In the paper we have presented the types of information annotated in the project and we have described how this information has been integrated in the MATE/GNOME coding scheme.

<sup>7</sup>This decision is in line with the encodings in the Danish computational lexicon STO(Braasch et al., 2005).

Annotation	Danish		Italian	
	texts	dialogues	texts	dialogues
expletive	0.83	0.77	0.84	0.82
cataphor	0.73	0.72	0.9	0.81
individual	0.90	0.88	0.82	0.8
individual vague	0.92	0.92	0.9	0.93
abstract	0.89	0.84	0.85	0.78
abstract vague	0.8	0.84	0.89	0.82
textual deictic	0.91	0.89	0.92	0.9
NP antecedents	0.91	0.93	0.92	0.95
non-NP antecedents (seg)	0.81	0.79	0.89	0.87
eventuality	0.72	0.78	0.81	0.89
fact-like	0.71	0.76	0.83	0.86
speech-act	-	0.72	-	-
question	1	-	1	-
proposition	0.8	0.81	0.9	0.92

Table 2: The intercoder agreement

In the paper we have also presented the intercoder agreement obtained by applying the DAD coding scheme to Danish and Italian texts and dialogues. The intercoder agreement has been calculated in terms of  $\kappa$  scores (Carletta, 1996). The obtained scores indicate that intercoder agreement is satisfactory for all categories (over 0.7%) although the chosen agreement measure does not account for partially overlapping antecedents and objective ambiguities. Currently we are annotating more texts and dialogues, and we plan to annotate different dialogue types in the future. Regarding the annotation some work is being done to define degrees of disagreement in the inter-coder annotation and then supply the current evaluation with other agreement measures. We are also working on the production of an agreed upon corpus. Other ongoing work regards the analysis and study of the annotated material and the use of it in the automatic treatment of anaphora.

The first analysis of the annotated data indicates that there are regular differences in the way abstract anaphora are used in Danish and Italian respect to English. Some of the most interesting results regard the use of demonstrative pronouns in spoken Danish which have not been studied before. The data indicate that differing from English, Danish demonstrative pronouns are more often used when the antecedents are verbal phrases than clauses. The annotated data also show that the relation between type of pronoun and type of antecedent in Italian is quite different from data reported for English by i.a. Gundel et al. (2004).

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