A Unified Annotation Scheme for the Semantic/Pragmatic Components of Definiteness

Archna Bhatia∗ Mandy Simons† Lori Levin∗ Yulia Tsvetkov∗ Chris Dyer∗ Jordan Bender‡

∗Language Technologies Institute, Carnegie Mellon University, Pittsburgh, PA
{archna, lsl, ytsetko, cdyer}@cs.cmu.edu
†Department of Philosophy, Carnegie Mellon University, Pittsburgh, PA
simons@andrew.cmu.edu
‡Department of Linguistics, University of Pittsburgh, Pittsburgh, PA
jab311@pitt.edu

Abstract
We present a definiteness annotation scheme that captures the semantic, pragmatic, and discourse information associated with noun phrases, which we call communicative functions. A survey of the linguistics literature suggests that definiteness does not express a single communicative function but is a grammaticalization of many such functions, for example, identifiability, familiarity, uniqueness, and specificity. Our annotation scheme unifies ideas from previous research on definiteness while attempting to remove redundancy. The scheme encodes the communicative functions of definiteness rather than the grammatical forms of definiteness. We assume that the communicative functions are largely maintained across languages while the grammaticalization of this information may vary. Corpora that are annotated using communicative functions can be used to train classifiers, offering data-driven insights into the grammaticalization of definiteness in different languages. We release our annotated corpora for English and Hindi as well as sample annotations for Hebrew and Russian, together with an annotation manual.

Keywords: definiteness, annotation scheme, communicative functions

1. Introduction
We follow Lyons (1999) in that definiteness is a mor-
phosyntactic category which represents the grammat-
icalization of some category of meaning. The differ-
ence in meaning in (1) and (2) illustrates the meaning
associated with definiteness. While it appears that (1)
with the indefinite article a would be uttered in a con-
text where the addressee is not aware of the referent
of the noun phrase (NP) a car, in fact he is being intro-
duced to it here, (2) with the definite article the
would be used in a context where the knowledge about
the referent of the NP the car is shared by both discourse
participants, the speaker as well as the addressee.

(1) I bought a car this morning.
(2) I bought the car this morning.

The use of articles in English NPs indicates to the ad-
dressees what the intended referent might be (a refer-
ent already known to the addressee or a new one being
introduced). These articles, which are considered to
be expressing definiteness in English, thus denote se-
matic, pragmatic, and discourse information related
to the NPs which helps the discourse participants in
identifying appropriate referents for the NPs from all
the possible referents available in the discourse con-
text. We use the term communicative functions of
definiteness to refer to such semantic, pragmatic, and
discourse information. It should be noted, however,
that the articles are not the only grammatical construc-
tions in English that express the communicative func-
tions (or their combinations); there are other construc-
tions as well, such as bare plurals (dinosaurs), pos-
sessives (John’s daughter), and pronouns (she), all of
which express various communicative functions asso-
ciated with definiteness.

In addition to the variability within a language with
respect to the grammatical form of various commu-
nicative functions, there can also be variability
across languages to express the same communicative
functions. For example, Czech, Hindi, Indonesian,
Russian do not have articles; the same communicative
functions that English articles express have to be conve-
3These communicative functions include the functions
assiated with known discourse entities (definites) such
such as uniqueness, and familiarity, as well as functions asso-
ciated with new entities being introduced (indefinites) such
as nonanaphoricity. See §2 and §3 for more details.

1In §2 we explore what this category of meaning is.
2We use the term article to refer to non-deictic deter-
minders like English the and a.
gies (if the language expresses those communicative functions formally)\textsuperscript{4}. This creates a problem for the machine translation systems since the languages on the source side and the target side may be using different grammatical strategies. For example, \cite{Isvetkov2013, Syme2009} have observed that translating from an article-language to an article-less language is problematic. Furthermore, the communicative functions or their combinations that are selected to be expressed formally may differ across languages. For example, \cite{Schwarz2013} shows that Hausa expresses the distinction between an entity that has been previously mentioned in the discourse (\textsc{Basic-Anaphora} in fig. \ref{fig:example}) and an entity that is inerrable but is not mentioned previously (\textsc{Unique-Physical-Copresence} in fig. \ref{fig:example} as illustrated in (3) and (4) respectively. English, on the other hand, does not seem to make this distinction formally and uses the same form (\textit{the}) to denote both situations.

\begin{verbatim}
(3) yáááá gári-n.  (Hausa)
  'how's the town [that you've visited]?'
  (There is a prior discussion of the town in the discourse and the speaker asks the addressee this question.)

(4) yáááá gári-n.  (English)
  'how's the town?'
  (The speaker arrives at the addressee's place, and first asks him this. Note here \textit{the town} is the first mention but its referent is inerrable from common ground, they are talking about the town in which the place is located.)
\end{verbatim}

To add yet another complication for the MT systems, the same grammatical form across languages may not express (exactly) the same communicative functions in these languages. \cite{Croft1991} points out many differences in article usage between English and French depending on the meanings (communicative functions) that are being expressed. However, for machine translation, a target language sentence ideally expresses the same meaning/communicative functions as the source language sentence.\textsuperscript{5} Hence, if we know the mapping between the communicative functions and the grammatical constructions in the source language as well as in the target language, this knowledge can be leveraged to help the MT system select the correct grammar in the target language (e.g., by assigning more weight to the target language constructions that express the relevant communicative function).

We therefore have two goals: to identify the communicative functions of definiteness that are preserved across translations, and to correlate those meanings with the grammatical constructions that express them in the source and target languages. This paper addresses the first goal via the creation of an annotation scheme to express the communicative functions of definiteness. The second goal will be the target of future work. §\textsuperscript{2} provides theoretical background on functions of definiteness. We operationalize the semantic, pragmatic, and discourse components of definiteness with a novel taxonomy and an annotation scheme presented in §\textsuperscript{3}. Our annotated corpus and details of the annotation process are described in §\textsuperscript{4}. We conclude in §\textsuperscript{5} with suggestions for future research, and discuss how the annotated corpus that we release can be used in downstream applications.

All the annotated materials, along with the annotation manual, are available at \url{http://www.cs.cmu.edu/~ytsvetko/definiteness_corpus}

\section{The Notion of Definiteness}

A survey of the literature on definiteness suggests notions such as uniqueness, familiarity, identifiability, anaphoricity, specificity, and referentiality as being related to definiteness \cite{Birner1994, Condoravdi1992, Evans1977, Evans1980, Gundel1988, Gundel1993, Heim1990, Kadmon1987, Kadmon1990, Lyons1999, Prince1992, Roberts2003, Russell1905}. Collectively, the literature on definiteness covers a wide range of uses of definite descriptions with the communicative functions mentioned above, such as uniqueness, and correlates them with many types of NPs and various constructions. However, different papers may employ different theoretical perspectives and cover slightly different ranges of data.

To formalize the communicative functions related to definiteness, many studies propose to reduce it to one or two overarching communicative functions. For example, \cite{Kadmon1987} and \cite{Evans1980} explain definiteness in terms of semantic uniqueness. In that account, definite noun phrases refer to entities that are unique for all practical purposes, such as \textit{the sun} when

\textsuperscript{4}Some other grammatical strategies languages use to express definiteness are: differential object marking \cite{Ispets2011}, existential constructions for indefinite subjects \cite{Chen2004}, alternative word orders, and special constructions such as the \textit{ba} construction in Chinese \cite{Chen2004}.

\textsuperscript{5}If, for example, an entity is identifiable in one language in a context, it is identifiable in the other language too even if English shows identifiability using the definite article, Hindi may denote it using an accusative postposition, or
speaking non-astronomically in our solar system, or the biggest mountain in West Virginia (Roberts, 2003). Other entities become unique in context, by constraining their reference with modifiers and adding facts about them. Books are not unique, but the blue book on the table can be unique in a given discourse context, and the book can become unique in a discourse, referring to the book that we are talking about. However, definite discourse referents are not always unique. In the famous donkey sentence—Every man who owns a donkey beats it—the pronominal it does not have a unique referent. It refers to all of the donkeys that are owned.

Roberts (2003) accounts for definiteness in terms of a combination of uniqueness and a presupposition of familiarity. However, it is difficult to apply this approach to possessive definite descriptions (John’s daughter) and the weak definites (Poesio, 1994) (My aunt got attacked by the parent of a student whom she had failed), which are neither unique nor necessarily familiar to the hearer before they are uttered. John’s daughter can be felicitously uttered when John is known to the addressee. In many discourse contexts his daughter does not need to be previously mentioned and, in fact, he may have more than one daughter. We will return to this type of reference later when we discuss bridging, i.e., using a known discourse referent to anchor the reference of another.

Poesio and Vieira (1998) found in their experiments that the two predominant communicative functions, uniqueness and familiarity, could account for only about half of their data. We take such linguistic observations to suggest that definiteness is not as homogeneous a category as many previous studies have assumed, and hence it cannot be reduced to just one or two of the aforementioned communicative functions. Instead, it should be seen as a grammaticalization (Hopper and Traugott, 2003; Chen, 2004) of many such communicative functions. In our investigation, we have devised a composite annotation scheme, combining ideas from previous taxonomies, such as Hawkins (1978; Prince, 1981; 1992), attempting to capture most of the notions covered in the theoretical literature and eliminating the redundancies. This scheme was revised through a number of iterations by annotating texts from various genres in two languages (English and Hindi). Henceforth, we will refer to the scheme as an annotation scheme for the communicative functions of definiteness (CFD). Below, we present the CFD annotation scheme and describe its operationalization.

3. The Annotation Scheme for the Communicative Functions of Definiteness

The CFD annotation scheme, organized around the taxonomy in fig. 1, is a unified compilation of communicative functions related to definiteness studied previously in the literature, as well as some new functions.

The CFD annotation scheme annotates for the communicative functions associated with Anaphoricity, (Basic and Extended/Bridging), Genericity, Familiarity (i.e., being Listener-Old), Predicativity, Referentiality, Specificity, and Uniqueness. Below we traverse through the annotation scheme and describe the distinctions that it makes.

The first main distinction the CFD annotation scheme makes is with respect to Anaphoricity: whether an NP is Anaphoric or Nonanaphoric—i.e., whether the entity is old in the discourse or not. The anaphoric NPs include personal pronouns such as I, you, she, and it; proper names; and NPs with the, demonstratives or possessives are treated as definites generally (Prince, 1992).

Note that personal pronouns such as I, you, she, and it; proper names; and NPs with the, demonstratives or possessives are treated as definites generally (Prince, 1992).


- **Anaphora** 
  - **Basic Anaphora** 
    - *Same_Head*
    - *Different_Head*
  - **Extended Anaphora** 
    - *Bridging_Nominal* 
    - *Bridging_Event* 
    - *Bridging_Restrictive_Modifier* 
    - *Bridging_Subtype_Instance* 
    - *Bridging_Other_Context*
- **Nonanaphora** 
  - **Unique** 
    - *Unique_Hearer_Old* 
    - *Unique_Hearer_New* 
  - **Nonunique** 
    - *Nonunique_Hearer_Old* 
    - *Nonunique_Hearer_New* 
  - **Generic** 
    - *Generic_Kind_Level* 
    - *Generic_Individual_Level*
- **Miscellaneous** 
  - **Pleonastic** 
  - **Quantified** 
  - **Predicative_Equative_Role** 
  - **Part_of_Noncompositional_MWE** 
  - **Measure_Nonreferential** 
  - **Other_Nonreferential**

Figure 1: CFD (Communicative Functions of Definiteness) annotation scheme. The non-leaf labels are in bold. +/− values are shown for ternary attributes Anaphoric, Bridging, Familiar, Generic, Predicative, Referential, Specific, and Unique; these are inherited from supercategories, but otherwise default to 0. Thus, for example, the full attribute specification for **Unique_Philosophical_Copresence** is \([−A, −B, +F, −G, OP, +R, +S, +U]\).

entity in the real world or in the discourse representation structure (as defined in Discourse Representation Theory), but to a part of the prior discourse. For example, This in a sentence This is entirely true., referring to the story a speaker has just narrated to his addressee, is annotated with this label.

Nonanaphoric NPs are entities that have not been mentioned or are not evoked by something that was mentioned. The next main distinction CFD makes is within this class of Nonanaphoric NPs, namely **Uniqueness**. Some Nonanaphoric nominals get a unique interpretation semantically as there is only one referent corresponding to that description, e.g., the sun; others receive a unique interpretation in a context where the corresponding referent is the most salient entity associated with that description, e.g., the tab-

ble when uttered in a physical context where there is just one table present, even though there may be millions of tables present in the world. Proper names are treated as Unique entities as well. Nonunique NPs are the descriptions which do not get a unique referent semantically or situationally.

For the Unique and Nonunique NPs, another distinction is made with respect to **Familiarity**: whether the NP is hearer-old (familiar) or hearer-new (unfamiliar). An NP may be considered hearer-old due to (a) its referent being perceptually present (**Unique_Philosophical_Copresence**, or **Nonunique_Philosophical_Copresence**), or (b) the discourse participants having common knowledge about the larger situation as a result of being part of a community (**Unique_Larger_Situation**, **Nonunique_Larger_Situation**), or (c) the discourse participants having common knowledge about **Familiarity** due to (a) its referent being perceptually present (**Unique_Philosophical_Copresence**, or **Nonunique_Philosophical_Copresence**), or (b) the discourse participants having common knowledge about the larger situation as a result of being part of a community (**Unique_Larger_Situation**, **Nonunique_Larger_Situation**).
or \textit{Nonunique\_Larger\_Situation}). For \textit{Unique\_Larger\_Situation}, let’s consider the following examples. When the NP \textit{the President} is uttered in USA contemporarily, the discourse participants associate it with Barack Obama as the referent, but when it is uttered in India, the discourse participants take Pranab Mukherjee as the referent. Other examples for NPs with common-knowledge referents are \textit{the Empire State Building}, \textit{Taj Mahal}, \textit{Barack Obama}, and \textit{Gandhi}. For \textit{Nonunique\_Larger\_Situation}, consider the following situation. One can talk about the \textit{hotel} or the \textit{program chair} at a conference even when those things have not been previously mentioned. This is possible due to the conference participants having common knowledge about conferences. \textit{Unique\_Predicative\_Identity} and \textit{Nonunique\_Predicative\_Identity} are also considered hearer-old. The hearer-new NPs are further distinguished for specificity. Thus, we may get a specific interpretation (\textit{She wants to marry an Irishman. His name is Paul.}) or a non-specific interpretation (\textit{She wants to marry an Irishman. She should go and find one.}).

Another distinction is made for the Nonanaphoric NPs with respect to \textit{Genericity}: whether an NP is generic or not. The generic NPs are the NPs that appear with a predicate or in a context where they refer to the kind or the whole class, rather than a selected set of members from that class. For example, \textit{Dinosaurs in Dinosaurs are extinct}. (\textit{Generic\_Kind\_Level}) and \textit{Cats} in \textit{Cats have fur}. (\textit{Generic\_Individual\_Level}). Additionally, a number of miscellaneous cases are also identified, which mostly represent various types of Nonreferential NPs (\textit{Referentiality}). For some of these cases, if it is their first mention, they are labelled as the Miscellaneous category, e.g., \textit{Quantified}, and \textit{Measure\_Nonreferential}. However, if they have appeared earlier in the discourse, they are marked as anaphoric as the subsequent mentions can be taken to refer to the first mention itself. Others, however, are marked as Miscellaneous category only, such as \textit{Pleonastic}.

An important property of the CFD scheme is that it is hierarchical in nature. This hierarchical organization does not necessarily represent how these classes are grouped in natural languages. Instead, it serves to reduce the complexity of decisions (selecting out of 24 classes vs. out of only a few classes) that an annotator needs to make for better speed and consistency. We, however, map our categories to eight attributes, such as \textit{Anaphoric}, \textit{Familiar}, and \textit{Unique}, which represent formal groupings based on relevant semantic/pragmatic notions. As shown in fig. 1, we have identified values for each of our classes corresponding to these attributes. The + value suggests the presence of an attribute (e.g. \textit{Nonunique\_Hearer\_New\_Specific} is + \textit{Referential}), the - value suggests the absence (e.g. \textit{Nonunique\_Hearer\_New\_Specific} is - \textit{Familiar}, and - \textit{Unique}), and 0 value is used as a default when the presence or absence of an attribute is not associated with/ specifiable for a class. This information enables us to manipulate the annotated data in formal groupings which are not expressed in the hierarchy (CFD scheme) necessarily but may turn out to be useful for an understanding of definiteness.

4. Definiteness Corpus

In this section, we briefly describe our data, and the annotation procedure. We also provide an evaluation of the annotations in terms of inter-annotator agreement.

4.1. Data

We have primarily annotated data from two languages: English and Hindi. However, a few sample annotations using the CFD annotation scheme are also provided for Hebrew and Russian. It should be noted that all of these four languages have different grammatical expressions of definiteness. English has both definite and indefinite articles. Hebrew has an explicit marker for definiteness but not for indefiniteness. Hindi, on the other hand, uses \textit{ek} (one) which sometimes can act as an indefinite article. It does not have any unmarked definite article. Russian does not have definite or indefinite articles.

We have selected four genres: TED talks, presidential addresses, published news articles, and fictional narratives. The parallel data from the TED talks corpus is in all four languages. There are sixteen TED talks annotated in both English and Hindi, two of which also have been annotated for Hebrew and Russian. In addition, for English, we have one presidential address, two newspaper articles, and two fictional narratives. The size of the English corpus is 13,860 words, containing 868 sentences, which contain 3422 noun phrases. The breakdown of the corpus is as follows: the TED talk genre represents about 75% of the corpus; the presidential address represents about 16%; fictional narratives about 5%; and news articles 4%.

\footnote{\textit{Komen} (2013) has also proposed a hierarchy with similar leaf nodes, but different internal organization.}

\footnote{These TED talks were obtained from a large parallel corpus. \url{http://www.ted.com/talks/}}
The Hindi corpus contains the same 16 TED talks that were annotated for English.

4.2. Annotation Procedure

The annotatable units for CFD are noun phrases (NPs). NPs containing embedded NPs are annotated from the inside out, borrowing insights from Discourse Representation Theory on how the discourse representation structure is incrementally updated as new information is added to the discourse (van Eijck and Kamp [1997]).

Annotators use the browser-based brat annotation software [Stenetorp et al., 2012] as follows: The annotator selects the span (an NP) that is to be annotated. This opens a dialog box with the hierarchical label inventory of fig. 1 from which the annotator selects the appropriate label. The annotations are stored as a text file. Each line in the annotation file contains information about one NP annotation: a unique ID, the annotation label, the character offsets of the annotated unit in the document, and the annotated NP itself.

Figure 2 is an excerpt from a news article “Cops: Burglar leaves his car, iPad at scene of the crime” annotated using the CFD scheme.

Figure 2: An excerpt from a news article “Cops: Burglar leaves his car, iPad at scene of the crime” annotated using the CFD annotation scheme.

4.3. Inter-annotator Agreement

To measure inter-annotator agreement, we looked at the agreement in annotation labels assigned given an NP as the annotatable unit[13]. Two English annotators independently annotated the same two texts from different genres (one text from the TED talks genre and one text from the fictional narratives) as part of their training on the annotation scheme. These annotators then began rounds of reconciling their annotations in order to reach consensus, updating the annotation scheme as necessary. Once they reached consensus, they annotated four new texts without discussion and measured inter-annotator agreement. We found strong agreement with Cohen’s \( \kappa = 0.88 \) over a total of 1202 annotated units from the four texts. The confusion matrix is presented in table 1. On individual genres, the inter-annotator agreement scores are: Cohen’s \( \kappa = 0.89 \) for TED (502 annotated NPs), 0.85 for the presidential speech (492 annotated NPs), 0.95 for narratives (129 annotated NPs), 0.83 for news articles (79 annotated NPs).

5. Conclusions and Future Work

We have developed an annotation scheme for the communicative functions of definiteness, and have used this scheme to create a definiteness corpus which encodes semantic, pragmatic, and discourse functions of definiteness. We are releasing this corpus for English and Hindi, along with sample annotations using the same scheme for two other languages, Hebrew and Russian. We also provide an annotation manual to help other annotators produce similar corpora for definiteness.

The annotation scheme is somewhat stable, however, there are issues about which we are still deliberating. For example, our approach to coordinate structures is not finalized. Currently we do not analyze coordinated phrases internally. Shoes or boots is taken as one annotatable unit instead of analyzing it as two separate annotatable units shoes and boots. However, sometimes internal analysis of conjuncts is needed, for example if both conjuncts repeat some modifier (end-use electricity and end-use of all energy).

Looking at the table 1 the UNIQUE_LARGER_SITUATION seems to be a class that is slightly confusing between the annotators. For example, both annotators confused this class with NONUNIQUE_LARGER_SITUATION.

[13] We had also looked at the boundary disagreements between the annotators, we found there were very few cases, less than 1%, where the two annotators did not agree on what constituted an NP.
for about 6-7% of the cases. This suggests that we need to have better criteria to determine whether an entity is unique or nonunique. Similarly, for GENERIC_INDIVIDUAL_LEVEL and NONUNIQUE_LARGER_SITUATION, it would be helpful to have clearer tests to identify NPs with these communicative function labels.

This corpus could be used for building classifiers to learn grammaticalization strategies based on the CFD annotations. In principle, knowledge about the shared semantic and pragmatic information across languages and the knowledge of how that information is expressed in each of the languages (source and target) should help improve MT across languages. For example, the source language could be transformed to mirror the target language in terms of grammatical expression of the annotated semantic features. The target-like source language can then be used to train a machine translation system. Another option is to provide CFD labels as auxiliary information to the MT system.

This paper is an attempt at the first step in the process—building a corpus that lets us determine the relevance of the communicative functions of definiteness and the corresponding grammaticalization strategies. In our future work, we plan to use the CFD annotation scheme and the definiteness corpus described in §4.1 to build classifiers for predicting the communicative functions and for learning grammaticalization corresponding to the communicative functions. We plan on expanding the corpus further and in all the four languages, and revising the annotation scheme further to cover more communicative functions as well as additional Nonreferential categories. Finally, we plan on using the classifiers we build to aid machine translation systems in ways described above. The classifier output can also be used for other downstream applications, for example to aid the coreference resolution systems, and the information retrieval systems.

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