



HAL
open science

Data Category Registry: Morpho-syntactic and Syntactic Profiles

Gil Francopoulo, Thierry Declerck, Virach Sornlertlamvanich, Éric Villemonte de La Clergerie, Monica Monachini

► **To cite this version:**

Gil Francopoulo, Thierry Declerck, Virach Sornlertlamvanich, Éric Villemonte de La Clergerie, Monica Monachini. Data Category Registry: Morpho-syntactic and Syntactic Profiles. LREC-2008 Workshop on Uses and usage of language resource-related standards, 2008, Marrakech, Morocco. inria-00553563

HAL Id: inria-00553563

<https://inria.hal.science/inria-00553563>

Submitted on 7 Jan 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Data Category Registry: Morpho-syntactic and Syntactic Profiles

Gil Francopoulo, Thierry Declerck, Virach Sornlertlamvanich,

Eric de la Clergerie, Monica Monachini

affiliation of first author: Tagmatica, 126 rue de Picpus, 75012 Paris, France

gil.francopoulo@wanadoo.fr, declerck@dfki.de, virach@tcllab.org,
Eric.Clergerie@inria.fr, monica.monachini@ilc.cnr.it

Abstract

After a brief presentation of the data model, we describe a work in progress to define an initial set of morpho-syntactic and syntactic data categories dedicated to NLP applications. The aim is to improve interoperability among language resources and to optimize the process leading to their integration in applications. The main point is to be sure that when a language resource makes use of a value, the other language resources and programs have the same interpretation for this given value. From a practical point of view, these values are collected from existing lists, discussed, extended, and then recorded within a freely accessible data base: the ISO Data Category Registry.

1. Introduction

Data associated with language resources are identified and stored in a wide variety of environments like terminological data collections and NLP resources. With this respect, we believe that the production of a family of consensual ISO specifications and data can be a useful aid for the NLP actors.

In this paper, after a brief presentation of the data model, we describe a work in progress within ISO-TC37 whose aim is to gather and record data categories (Ide et al, 2004; Wright, 2004).

2. Context

The TC37 standards are currently elaborated as high level specifications and deal with word segmentation (ISO 24614), annotations (ISO 24611, 24612 and 24615), feature structures (ISO 24610), and lexicons (ISO 24613). These standards rely on low level specifications dedicated to constants, namely data categories (revision of ISO 12620), language codes (ISO 639), scripts codes (ISO 15924), country codes (ISO 3166) and Unicode (ISO 10646).

This bi-level approach will form a coherent family of standards with the following common and simple rules:

- 1) The high level specifications provide structural elements that are **decorated by the standardized constants**;
- 2) The low level specifications provide these standardized constants.

This decoupling is offered in order to provide a fine flexibility with regard to language and practice diversity. To be more concrete, for instance, in a high level structure such as a lexicon, different elements like a Lexical Entry and a Sense will be defined and linked

together in order to allow the definition of different senses for a word, as follows:

```
<LexicalEntry>
  <feat att="partOfSpeech" val="noun"/>
  <Lemma>
    <feat att="writtenForm" val="bank"/>
  </Lemma>
  <Sense id="bank1">
    <Definition>
      <feat att="text" val="Business that keeps and lends money"/>
    </Definition>
  </Sense>
  <Sense id="bank2">
    <Definition>
      <feat att="text" val="Land along the side of a river"/>
    </Definition>
  </Sense>
</LexicalEntry>
```

In this example, LexicalEntry, Lemma, Sense, and Definition belong to high level specifications, more precisely: LMF. In contrast, partOfSpeech, noun, writtenForm, and text belong to low level specifications, more precisely: the Data Category Registry.

The usage of each of these high level elements is specified, together with their cardinality. The precise combination of high level elements and low level ones is not specified: this is left to the user. In other terms, the user selects the structural elements he needs, and provided that a suitable set of data categories is available, the user is able to decorate the structural elements for a given language.

3. Variations

For the high level specifications, a consensus must be found among what is to be considered as "the best

practices" of our field. Implicitly, a mixed strategy based on "coherent union" of structures and a meta-model approach is often taken, depending on the agreement among the community.

The main criteria are:

- the various theoretical approaches;
- the languages covered;
- the type of resources (syntax, semantics ...)

These three criteria apply on the data category side as well.

4. General objectives

The main objective of TC37 is interoperability and our work is done in the context of the revision of ISO-12620. The most frequently encountered problem is "how to merge data?" whereby the hardest sub-challenge is "how to compare data?".

To address these issues, first, the use of a uniform policy should contribute to system coherence and functionality. And secondly, each data category (DC) must be well defined in order to allow elementary operations like: "is DC-A the same notion as DC-B ?", "is DC-C more general (or more specific) than DC-D ?", or "is DC-E related somehow to DC-F ?".

5. Specific objectives

With this respect, we have two distinct objectives:

- 1) Test the current specification of the revision of ISO-12620 as a proof of concept ;
- 2) Concretely record an initial set of data for morpho-syntax and syntax.

The goal is not to create a rich network of links between data categories.

6. History of ISO-12620

The ISO standard 12620 was published in 1999. The document specifies the content of data categories and presents a long list of values, whose primary aim was to be used in terminological data collections.

The revision of ISO-12620 is somehow different. The work started in 2003. The document is currently in Final Draft for International Standard (FDIS) stage¹, and the schedule is to reach International Standard (IS) publication in 2009. The development is twofold. The revised version specifies how the data categories will be described and managed, but in contrast to the initial version, the values will not be presented in the ISO document. The values will be managed within a database endorsed by ISO that is called the Data Category Registry (DCR).

Another point to mention is the type of high level

¹ For a reader who is interested in reading the FDIS document, it may be accessed through the National Body channel: ASCII for US, DIN for Germany etc.

structure that is addressed by the new set of data categories. The old version targeted only terminological data collections but the new version target is much broader. The coverage is all TC37 activities, which means that NLP applications are concerned, hence largely increasing the number of values. For instance, the old ISO-12620 had only three values for part of speech, namely: **noun**, **adjective** and **verb**, but now because of NLP data structures, values like **preposition** and **punctuation** are needed. So, instead of only three values, the list contains now one hundred values.

7. Current registry

As cited earlier, the 12620 revision work started in 2003, and a lot of energy has been spent along the years in various meetings and document writings, in order to find an operational consensus. The two tasks (DC specification and DC recording) were conducted in parallel with frequent interactions.

This model has been implemented in a system called "Syntax²" which is currently running and is located at <http://syntax.inist.fr> where about a dozen people have entered values, mainly in the domain of terminology, morpho-syntax, and syntax. The list of the current values is presented in Annex-B, with an indentation for the broader link information.

8. Data model

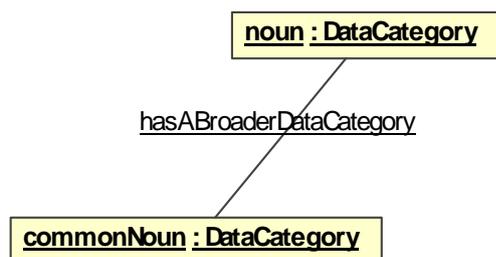
The current model allows a lot of options but we limit ourselves to a subset of features, as presented in the UML class diagram in Annex-A.

The registry is divided into profiles. A profile is a set of data categories. Each profile is associated with a team of experts with a convenor, who collectively represent a community of practice in the area of language resources. There are currently about ten profiles and as many or more sub-activities, such as terminology, metadata etc, covering all activities of ISO-TC-37. The current paper focuses on two profiles dedicated to NLP, namely the morpho-syntactic and syntactic profiles.

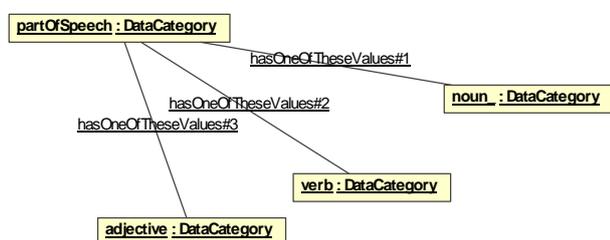
Many times, a data category belongs to only one profile, but a small number of them belongs to several profiles (e.g. part of speech).

We differentiate between the notion of broader relation and the notion of value domain. The broader link allows a hierarchy of constants that forms an ontology. Example: a **common noun** is a more specialized value than **noun**.

² The name is not very well chosen and does not mean that the system deals only with syntactic descriptions.



The notion of value domain is different. A value domain allows a set of valid values to be identified. In other terms, a value domain that is attached to a data category X provides a set of potential values for X and these values are themselves data categories. Example: **noun** is a value for **partOfSpeech**.



9. Data: methodology

We proceeded in three phases:

- Phase-1:** collating of candidates data categories
- Phase-2:** grouping, structuring, and redaction of a first draft of the definitions
- Phase-3:** revision

For the morpho-syntactic profile, a long initial list of data categories has been collected from:

- Current ISO-12620:1999
- Eagles and Multext-East
- Some values for Semitic languages coming from Sfax University

For the syntactic profile, an initial list was collected based on:

- Eagles
- Tiger (German project)
- Technolangue/Easy (French project)

Let us add that some values needed from TC37 standards like MAF (ISO-24611), SynAF (ISO-24615) (Declerck et al, 2006) and LMF (ISO-24613) (Francopoulo et al, 2006) have been added to the two profiles.

Each data category has an identifier that is English based. The name does not contain any spaces, and if more than one word is needed, it is expressed in

so-called *camel case* (e.g. **commonNoun**) as specified in the revision of ISO-12620.

Currently each DC has a definition in English and French. Let us note that a lot of time has been devoted to write rigorous definitions, taking into account the various stable sources in our field. A definition may be complemented by a note.

A DC may be linked through a broader link to another DC. A DC may have a value domain.

Each DC has, at least, a name in English and one in French, which may be used directly for display without any transformation (e.g. **common noun**).

Currently, the ontology of values (through the broader link) is rather flat and does not exceed three levels. There are no constraints between DCs.

There is currently no indication concerning the use of a given DC for a specific language, but the new version will include a linguistic section that will enable some further constraints on value domains that may reflect specific usage in different object languages.

Thus, to reply to the question: "Is DC-A, the same notion as DC-B?", the user needs to compare identifier of DC-A to identifier of DC-B. If an explanation is needed to understand why two DCs are different, each DC has a precise definition for this purpose.

10. Data: organization

The number of values is rather huge, so in order to facilitate management, a series of directories³ has been created within the two following profiles.

³ A directory is equivalent to a sub-profile.

Morpho-syntactic profile:

Basics	These are general purpose linguistic constants, like: comment , derivation , elision , foreignText , and label .	61	items
Cases	Examples of values: ablativeCase or dativeCase .	33	
FormRelated	These are constants for the specifications of forms like: spokenForm , writtenForm , abbreviation , expansionVariation , transliteration , romanization , transcription , script .	36	
Morphological Features excluding cases	Attributes include for instance grammaticalGender , mood and tense . Values include, for instance, feminine , indicative , present .	82	
Operations	Constants include for instance, addAffix , addLemma .	29	
Part of speech	Part of speech values are structured with a top level set composed of 10 values like noun or verb . A very precise ontology is specified for grammatical words. Most of parts of speech are common to lexicons and annotations but two set of values (i.e. punctuation and residual) are specific to annotation and are not usually used in lexical descriptions ⁴ .	120	
Register, dating and frequency	Constants include, for instance, slangRegister or rarelyUsed .	19	
Total		380	items

In contrast to the values of the morpho-syntactic profile, which mainly concern the lexicon, most values in the syntactic profile deal with annotation.

Syntactic profile:

Basics	These are general purpose annotation constants, like: tagging , standoffNotation , embeddedNotation . A few of them like negation or contiguous concern lexicons.	29	items
Constituency	These comprise constants used to annotate constituency elements. Examples of values are: chunk , declarativeClause , verbNucleus , nounPhrase . Usual abbreviations like NP for nounPhrase are declared in the name section of the data category.	27	
Dependency	These comprise constants used to annotate relation between syntactic elements. Examples of values are: verbModifier , modifier , syntacticHead , subject , introducer , directObject , coordination , adjunct . Let us note that a certain freedom is left to the user concerning the level of detail and the type of target: for instance, both verbModifier and modifier are proposed.	32	
Total		88	items

11. Problems encountered

As said earlier, we started from existing lists that are rather stable like those for Eagles or Multext-East. The problems that we encountered were that we had to write definitions. We searched in various sources and found some definitions that looked fine in isolation for some data categories, but they did not constitute a coherent set of definitions.

Linguistics is not a field with a common agreement on basic terms. As a matter of example, the entry

"morphology" in Wikipedia, gives us a good view of these divergences. In linguistics, terms like "paradigm", "collocation", "morpheme", "ergative" have so many interpretations in the different theories that they are almost impossible to use in a normative context where a precise meaning is required.

Another problem we faced was that we had to write definitions that are valid for lexicons and annotation, and an important term like "word" does not have the same meaning in both contexts. A word in a lexicon is lexical entry that is associated with a lemma. A word in an annotation is an occurrence of an inflected form (in

⁴ For the people working in terminology and lexicons, punctuation is usually not considered as a part of speech. The situation is rather different when the objective is to represent text specific structures like coordination in the context of syntactic annotation, in this case, a punctuation mark is usually considered as a plain word, and as such, needs a part of speech tagging.

an inflected language). These notions are rather different.

To deal with this problem, we carefully avoided dangerous terms and we delimited a secure set of terms. When needed, we formed multi-word expressions from secure components. This is the strategy that has been adopted in the DCR and in general within the ISO-TC37 family of standards.

12. Forthcoming data

The current database records values for West/East European languages and, to a certain extent, for Semitic languages. The rationale for such a strategy is that, first, it was easier for us to begin by these values because stable lists already existed for these languages. Secondly, we faced a "chicken and egg" situation: we rely on ISO voluntaries and no one will describe minority languages if the well-known languages were not covered.

We know that it is clearly not enough

Two other parallel tasks are currently being conducted. One task deals with Asian values within the NEDO project (Takenobu et al, 2006; Charoenporn et al, 2007; Shirai et al, 2008). A small set of values has been entered in the database. The other task deals with African values, and a study is being conducted by the ISO South African delegation, but the values have not been entered yet in the database.

Each value is associated with a version number to allow a stable compliance in case of modification. The rules for management and usage are defined in the ISO-12620 revision.

13. Forthcoming registry

The current system is rather simple. It permits to make simple interactive queries, to download the result of a query, to download a data category, a directory or a profile. The available formats are XML and HTML.

The registry has been populated with numerous data categories, but different users (including ourselves) asked for an upgrade with improved interface features and fully developed functionalities.

An improved model is currently being designed (2007-2008) in order to address two important issues namely the distinction between the language section (working language) and linguistic section (object language) and the ability to record constraints and richer relations. Another difference is that the relation "broader" has been renamed into "IsA".

The new model will be implemented in a system called "ISOcat" at <http://www.isocat.org>. This new system is currently in beta version and will be presented during LREC-2008 and described in (Kemps-Snijders et al,

2008; Wittenburg et al, 2007).

Instead of being based on traditional synchronized PHP programs, the new software is based on Java/Ajax technologies and promises to be more user friendly. The operational switch from Syntax to ISOcat is scheduled for the end of 2008.

14. Conclusion

The registry is far from being complete but it begins to be used within different ISO-TC37 based standard applications in order to be tested. The idea is to progressively increase the number and coverage of these data categories. The ambition is that the registry will become the reference point when using linguistic terms and data elements in lexicons and annotations in NLP context.

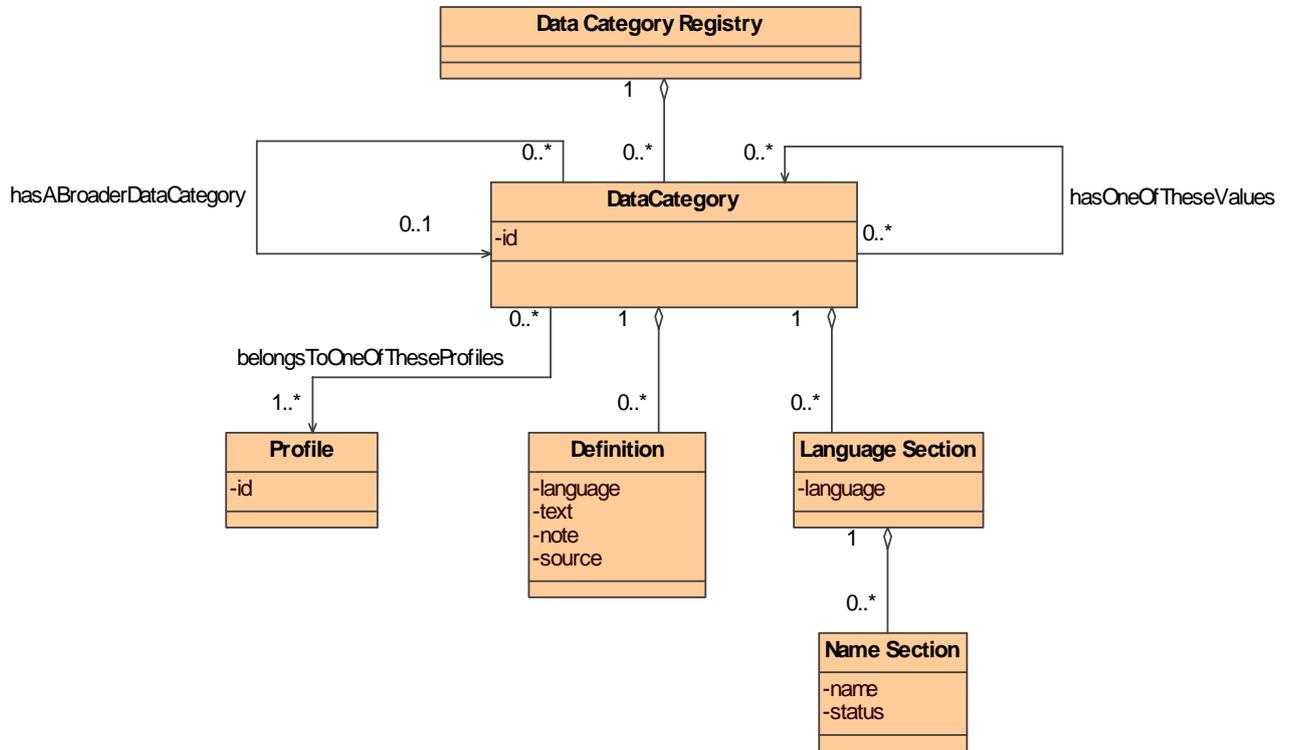
15. Acknowledgements

The work presented here is partially funded by the EU eContent-22236 LIRICS project and in part by the French ANR-Passage project (Action ANR-06 MDCA-013).

16. References

- Charoenporn T., Thoongsup S., Sornlertlamvanish V., Isahara H. (2007) Thai Lexicon. SEALS Conference, Univ of Maryland, College Park. US
- Declerck T. (2006) SynAF: Towards a standard for syntactic annotation. LREC Genoa.
- Francopoulo G., George M., Calzolari N., Monachini M., Bel N., Pet M., Soria C. (2006) Lexical Markup Framework (LMF). LREC Genoa.
- Ide N., Romary L (2004) A Registry of Standard Data Categories for linguistic Annotation. LREC Lisboa.
- ISO-12620:1999, Computer application in terminology - Data categories, ISO Geneva
- Kemps-Snijders M., Windhouwer M., Wittenburg P., Wright S.E. (2008, forthcoming) A revised Data Model for the ISO Data Category Registry, submitted to TKE-2008, Copenhagen.
- Shirai K., Tokunaga T., Huang CR., Hsieh SK, Kuo TY., Sornlertlamvanich, Charoenporn T. (2008) Constructing Taxonomy of Numerative Classifiers for Asian Languages IJCNLP Hyderabad, India
- Takenobu T., Sornlertlamvanich V., Charoenporn T., Calzolari N., Monachini M., Soria C., Huang CR., Hao Y., Prevot L., Kiyooki S. (2006) Infrastructure for standardization of Asian language resources COLING/ACL Sydney, Australia
- Wittenburg P., Wright S.E. (2007) Infrastructure note on registry databases: technical note at http://www.tc37sc4.org/new_doc/iso_tc37_sc4_N43_6_ontology_memo_peter_Sue_busan2007.pdf
- Wright S.E. (2004) A global data category registry for interoperable language resources: technical note at http://www.tc37sc4.org/new_doc/ISO_TC_37-4_N175_SEW-A_Global_Data_Category_Registry.pdf

Annex-A: UML class diagram of the portions of the current registry that we use



Annex-B: current set of values

Morpho-syntax: Basics

agreement
 any
 approximate
 be
 coding
 characterCoding
 countryCoding
 dateCoding
 languageCoding
 scriptCoding
 comment
 creationDate
 definition
 direction
 domain
 exact
 example
 expletive
 externalReference
 externalSystem
 have
 id
 image
 impossible
 label
 language
 leftEnvironment
 lexeme
 logicalOperator
 logicalAnd
 logicalNot
 logicalOr
 logicalValue
 no
 yes
 macron
 namedEntity
 numValue
 pluralType
 position
 possible
 quotative
 rank
 reduplicationFunction
 reduplicationType
 required
 restriction
 rightEnvironment
 scope
 sound
 source
 space
 stringValue
 text
 type
 unspecified
 utterance
 value
 variation
 view
 word

Morpho-syntax: Cases

case
 abessiveCase
 ablativeCase
 absolutiveCase
 accusativeCase
 adessiveCase
 aditiveCase
 allativeCase
 benefactiveCase
 causativeCase
 comitativeCase
 dativeCase
 delativeCase
 elativeCase
 equativeCase
 ergativeCase
 essiveCase
 genitiveCase
 illativeCase
 inessiveCase
 instrumentalCase
 lativeCase
 locativeCase
 nominativeCase
 obliqueCase
 partitiveCase
 prolativeCase
 sociativeCase
 sublativeCase
 superessiveCase
 terminativeCase
 translativeCase
 vocativeCase

Morpho-syntax: Form Related

affix
 infix
 prefix
 suffix
 affixRank
 allomorph
 apocope
 componentRank
 conjugated
 contextualVariation
 expansionVariation
 geographicalVariant
 graphicalSeparator
 homograph
 homonym
 homophone
 lemma
 lexicalType
 morpheme
 etymologicalRoot
 native
 orthographyName

patternType
 phoneticForm
 phoneticSeparator
 pinyin
 nonSpacedPinyin
 spacedPinyinAndTone
 reduplication
 root
 script
 stem
 stemRank
 symbol
 token
 writtenForm

Morpho-syntax: Morphological Features

Excluding Cases

activeVoice
 animate
 aorist
 bound
 cessative
 collective
 commonGender
 comparative
 conditional
 definite
 dual
 elInclusion
 elative
 feminine
 finite
 firstPerson
 fullArticle
 future
 gerundive
 honorific
 imperative
 imperfect
 imperfective
 inanimate
 inchoative
 indefinite
 indicative
 indifferent
 infinitive
 intensity
 masculine
 masdar
 middleVoice
 morphologicalFeature
 animacy
 aspect
 cliticness
 definiteness
 degree
 finiteness
 grammaticalGender

grammaticalNumber
 grammaticalTense
 modificationType
 negative
 ownedNumber
 ownerGender
 ownerNumber
 ownerPerson
 person
 objectPerson
 subjectPerson
 syntacticType
 verbFormMood
 voice
 zuInclusion
 neuter
 nonFinite
 otherAnimacy
 participle
 passiveVoice
 past
 paucal
 perfective
 personal
 plural
 brokenPlural
 positive
 possessive
 postModifier
 preModifier
 present
 quadrial
 referentType
 secondPerson
 shortArticle
 singular
 subjunctive
 superlative
 thirdPerson
 trial
 unaccomplished

Morpho-syntax: Operations

abbreviation
 elision
 location
 operation
 add
 addAffix
 addAfter
 addBefore
 addComponentLemma
 addComponentStem
 addFirstConsonant
 addFirstVowel
 addLemma
 addLowerCaseComponentLemma
 copy
 derivation
 remove

removeAfter
 removeBefore
 substitute
 operator
 graphicalOperator
 phoneticOperator
 romanization
 rule
 scheme
 transcription
 transformType
 transliteration

Morpho-syntax: Part of speech

adjective
 ordinalAdjective
 participleAdjective
 pastParticipleAdjective
 presentParticipleAdjective
 qualifierAdjective
 adposition
 circumposition
 postposition
 preposition
 compoundPreposition
 fusedPreposition
 simplePreposition
 adverb
 generalAdverb
 particleAdverb
 classifier
 conjunction
 coordinatingConjunction
 subordinatingConjunction
 determiner
 article
 definiteArticle
 indefiniteArticle
 partitiveArticle
 demonstrativeDeterminer
 exclamativeDeterminer
 indefiniteDeterminer
 interrogativeDeterminer
 possessiveDeterminer
 reflexiveDeterminer
 relativeDeterminer
 interjection
 noun
 commonNoun
 countableNoun
 diminutiveNoun
 massNoun
 properNoun
 numeral
 numeralApprox
 numeralBoth
 numeralDigit
 numeralLetter
 numeralMForm
 numeralRoman

partOfSpeech
 particle
 affirmativeParticle
 comparativeParticle
 conditionalParticle
 coordinationParticle
 distinctiveParticle
 futureParticle
 infinitiveParticle
 interrogativeParticle
 modalParticle
 negativeParticle
 possessiveParticle
 relativeParticle
 superlativeParticle
 unclassifiedParticle
 pronoun
 affixedPersonalPronoun
 allusivePronoun
 conditionalPronoun
 demonstrativePronoun
 emphaticPronoun
 exclamativePronoun
 impersonalPronoun
 indefinitePronoun
 interrogativePronoun
 negativePronoun
 personalPronoun
 strongPersonalPronoun
 weakPersonalPronoun
 possessivePronoun
 reciprocalPronoun
 reflexivePronoun
 relativePronoun
 punctuation
 closePunctuation
 closeBracket
 closeCurlyBracket
 closeParenthesis
 mainPunctuation
 declarativePunctuation
 exclamativePoint
 point
 semiColon
 suspensionPoints
 interrogativePunctuation
 questionMark
 invertedQuestionMark
 openPunctuation
 openBracket
 openCurlyBracket
 openParenthesis
 secondaryPunctuation
 bullet
 colon
 comma
 hyphen
 invertedComma
 quote

slash
 unclassifiedPunctuation
 relationNoun
 residual
 foreignText
 foreignWord
 formula
 letter
 unclassifiedResidual
 verb
 auxiliary
 copula
 mainVerb
 modal
 voiceNoun

Morpho-syntax: Register Dating
 Frequency

benchLevelRegister
 commonlyUsed
 dating
 dialectRegister
 facetiousRegister
 formalRegister
 frequency
 inHouseRegister
 infrequentlyUsed
 ironicRegister
 modern
 neutralRegister
 old
 rarelyUsed
 register
 slangRegister
 tabooRegister
 technicalRegister
 vulgarRegister

Syntax: Basics

annotation
 morphosyntacticAnnotation
 syntacticAnnotation
 annotationDeepness
 annotationStyle
 annotationType
 clitic
 enclitic
 proclitic
 constituency
 constituencyAndDependency
 contiguous
 deepParsing
 dependency
 doubleNegation
 embeddedNotation
 first
 mixedNotation
 negation
 next
 predicate
 previous

propagation
 shallowParsing
 standoffNotation
 syntacticFeature
 tagging
 whType
 yesNoType

Syntax: Constituency

grammaticalUnit
 chunk
 adjectiveChunk
 adpositionChunk
 adverbChunk
 nounChunk
 postpositionChunk
 prepositionChunk
 verbNucleus
 clause
 declarativeClause
 imperativeClause
 interrogativeClause
 relativeClause
 phrase
 adjectivePhrase
 adpositionPhrase
 adverbPhrase
 comparativePhrase
 coordinatedPhrase
 nounPhrase
 postpositionPhrase
 prepositionPhrase
 prepositionVerbPhrase
 superlativePhrase
 verbPhrase
 sentence

Syntax: Dependency

adjunct
 apposed
 apposition
 attribute
 auxiliary
 complementizer
 coordination
 coordinator
 directObject
 function
 head
 introducer
 juxtaposition
 leftCoordinated
 modifier
 adverbModifier
 nounModifier
 postnominalModifier
 prenominalModifier
 prepositionModifier
 verbModifier
 relation
 comparativeRelation

genitive
 relativeRelation
 superlativeRelation
 rightCoordinated
 subject
 syntacticArgument
 syntacticHead
 verbComplement