A description of pragmatics rhetorical structure and its evaluation in computational linguistics

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Outline

1. Introduction
   - Aims
   - RS-structure in Basque studies and in CLs

2. Methodology
   - Preparation phase
   - Segmentation
   - Central unit
   - Rhetorical relations
   - Signaling the RRs
   - Delivery phase

3. Results
   - Segmentation
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4. Delivery phase

5. Conclusions and future work
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About me

- I can understand Portuguese, if you speak slowly
- Undergraduate in Basque Language and Communication
  - Topic: Discourse analysis and evaluation
- Professor and researcher at University of the Basque Country
  - Member of Ixa group for NLP (mostly Basque)
    - Researchers from: Computer Science (32), Linguistics (8)
    - 23 Ph-D thesis, 60 research projects, 20 applications for NLP and 300 papers
Basque language (from Wikipedia 2012)

- Native speakers 720,000 out of 3,000,000
- A language isolate (indigenous to the Basque Country 42°52′55″N 1°55′01″W). Listen my Basque dialect

Language Families in Europe
Discourse structure phenomena in CL

- CL works on discourse structure:
  - Referential: co-reference disambiguation (Mitkov, 2002; Recasens et al., 2010) in Basque (IXA group) (Goenaga et al., 2012; Ceberio et al., 2009)
  - Relational: rhetorical annotation (Asher and Lascarides, 2003; Mann and Thompson, 1988) in Basque (Barrutieta et al., 2002, 2001) and in IXA group (Iruskieta et al., 2013b, 2011b)

- Can we explain discourse structure with only explicit and semantic relations? Examples from van Dijk (1980b)

1. Tiketa erosi dut eta nire aulkira joan naiz.
   I bought a ticket and went to my seat. (Macro-structure)

2. #Peter zinemara joan zen. Berak begi urdinak ditu.
   #Peter went to the cinema. He has blue eyes. (Improvable)

   John is sick. He has the flu. (Semantic)

   John can’t come. He is sick. (Semantic, Pragmatic)
Introduction

Theories of discourse structures in CL (Stede, 2008a)

a. Strong formalization based on syntactic or semantic theories
   ▶ Based on sentence level and few analysis of corpus with real texts
     • SDRT (Asher and Lascarides, 2003)
     • D-LTAG (Forbes et al., 2003)
     • LDM (Polanyi, 1988)

b. Real text corpora and analysis of different phenomena
   ▶ Shortcomings in formalization
     • RST (Mann and Thompson, 1987)
     • PDTB (Miltsakaki et al., 2004)
Why an RST TreeBank for Basque?

- General reasons (Taboada and Mann, 2006)
  - Linguistic description
  - Real texts in different languages
  - Several applications based on RST:
    - automatic text creation (Bouayad-Agha, 2000),
    - automatic text summarization (Marcu, 2000b),
    - machine translation (Ghorbel et al., 2001),
    - assessment of written texts (Burstein et al., 2003),
    - information retrieval (Haouam and Marir, 2003),

- Specific to our work:
  - No annotation needed at other linguistic levels
  - Free and available tools for annotation and evaluation
    - (RSTTool, RhetDB, RSTeval)
  - Building (automatically) (Marcu, 2000b) and evaluating RS-trees is easier than graphs
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   - Delivery phase

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4 **Delivery phase**

5 **Conclusions and future work**
Main goals

Three main goals:

\( i \) To describe a rhetorical structure of Basque texts by means of corpus annotation

\( ii \) To establish an annotation method

\( iii \) To validate the annotation method and analyze typical cases of annotators’ disagreement
Other aims

• Methodological decisions:
  – to analyze influence of the macro-structure (Central Unit, CU) in micro-structure (rhetorical relations, RR)
  – to avoid circularity (i. segmentation/RS-structure and ii. relations/signals)
  – to study a qualitative evaluation
  – to propose some guidelines for the resolution of annotation disagreements

• Gold Standard:
  ▶ in segmentation:
    – for a Basque segmenter
  ▶ in macro-structure:
    – to analyze indicators
  ▶ in rhetorical relations:
    – to signal annotation

• Disseminating the results
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Rhetorical structure in Basque

<table>
<thead>
<tr>
<th></th>
<th>Explicit RRs</th>
<th>Implicit RRs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discourse</td>
<td>Esnal (2008); Alberdi and Landa (2013); García (2010); Ibarra (2013); Lerringan (1995)</td>
<td></td>
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</tbody>
</table>

- Little attention to implicit RRs in Basque
  - Implicit RRs are necessary to describe RS and carry out some tasks in CLs
    - Most of the RRs are implicit (Taboada, 2006)
      - 66.67% implicit RRs in the following example (GMB0401)
- In CLs is very important to describe all the RRs to apply in several applications (main goal of IXA group)
RESUMEN

El número de asistencias urgentes crece constantemente, en España el ritmo de crecimiento se ha establecido en torno al 4% anual. Se ha observado que el 80% de los usuarios acuden por iniciativa propia a los servicios de urgencia y que el 70% de las consultas son consideradas leves por el personal sanitario. Realizar estudios epidemiológicos que describan las características de los usuarios y los motivos de la sobreutilización de los servicios de urgencia hospitalarios pueden resultar interesante desde el punto de vista de la planificación sanitaria. Por lo que hemos estimado oportuno realizar un estudio para conocer el perfil del usuario de urgencias del hospital de Galdakao.

Resultados: El perfil del usuario sería el de un varón (51,4%) de mediana edad (43,2 años) que consulta por patología traumática (50,5%) y procedente de la comarca sanitaria cercana al hospital.

PALABRAS CLAVE: Usuarios de urgencias, sobreutilización, perfil de usuario.

SUMMARY

The number of urgent cares grows continuously, the rate of growth in Spain has been set around the 4% annually. According to the estimates, the 80% of the users, go by their own initiative to the emergency department, and the 70% of the surgeries are considered slight by the health staff. It could be interesting from the sanitary planning point of view, to carry out epidemiological studies which describe the users characteristics, and the reasons for the overse of the hospital emergency department. We have seen convenient to archieve a study to know the profile of the users from the emergency department from Galdakao’s Hospital.

Results: The general profile of users would be, man (51.4%) of middle age (43.2%) who consults because of traumatologic pathologies (50.5%) and who comes from the sanitary area near the hospital.

Key words: Emergency department users, overuse, users profile.
Larrialdi zerbitzuetako asistentzia medikuen kopurua gehituz doa etengabe, estatu españolean igoera hau urteko %4an kokatzen da. Erabiltzaileen %80ak bere kabuz erabakitzen dute larrialdi zerbitzu batetara jotzea eta kontsulta hauen %70a larritasun gutxikotzar poten ditzue zerbitzu hauetako medikuek. Zerbitzu hauen perfil azaltzen duten ikerketa epidemiologikoak egitea baliagarria izan daiteke osasun planifikazioaren aldetik, hau dela eta, Galdakaoko ospitaleko larrialdi zerbitzuaren erabiltzaileen perfil deskriptibo bat egitea aproposa iruditu zaigu.

Emaitzak: Erabiltzaileen perfil orokorra ondoko dela esan daiteke: gizonezkoa (%51,4), heldua (43,2 urteko media) eta patologia traumatologikoagatik kontsultatzen duena (%50,5). Galdakao inguruko herrietatik datorrelarik gehiengoa.

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Adjunct verb clause-based segmentation (Tofiloski et al., 2009)
• A modular and incremental annotation (Pardo, 2005)
• Is there any correlation between the CU and the RRs?
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Problems and solutions for RS annotation

- Discourse annotation is complex (Hovy, 2010)
  - Solution in CL: corpus annotation
    - Consistent: enough to support machine learning
    - Descriptive: enough to work with NLP advanced applications
Methodology

Preparation phase

The corpus

- The Basque RST TreeBank (Iruskieta et al., 2013a):
  - Short texts, but with complex RS
  - Abstracts: structured texts (Swales, 1990; Ripple et al., 2011)
  - Different domains
  - Parallel texts (da Cunha and Iruskieta, 2010; Iruskieta and da Cunha, 2010b) and Multilingual RST TreeBank (Iruskieta et al., 2014a)

<table>
<thead>
<tr>
<th>Domain</th>
<th>Sub-corpus</th>
<th>Texts</th>
<th>Sentences</th>
<th>Words</th>
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<tbody>
<tr>
<td>Medicine</td>
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<td>3010</td>
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<tr>
<td>Terminology</td>
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<td>5664</td>
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<tr>
<td>Science</td>
<td>ZTF</td>
<td>20</td>
<td>352</td>
<td>6892</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
<td><strong>803</strong></td>
<td><strong>15566</strong></td>
<td></td>
</tr>
</tbody>
</table>
4 linguists who had experience annotating texts at other language levels (morphologic, syntactic and semantic)

- RST and RSTTool were introduced to 3 linguists
- No previous training phase and no manual provided based on signals
  - To avoid circularity between RS and signaling
  - Because qualitative description was more important than reliability
  - Triple- (80%) and double-annotated (20%) corpus

Is there any way to gain reliability if previous training and manuals are avoided?

- A “super-annotator” (Hovy, 2010)
  - Experienced in RST
  - Criteria to harmonize annotations were established
Description of the annotators and the super-annotator

- 4 linguists who had experience annotating texts at other language levels (morphologic, syntactic and semantic)
  - RST and **RSTTool** were introduced to 3 linguists
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- **Is there any way to gain reliability if previous training and manuals are avoided?**
  - A “super-annotator” (Hovy, 2010)
    - Experienced in RST
    - Criteria to harmonize annotations were established
**Different interpretations of GMB0401**

**Methodology**

**Preparation phase**

1. **Preparation**
   - Galdakao ospitaleko larrialdi zerbitzuak erabilzaileen perfila

2. **Background**
   - Diferentes interpretaciones de GMB0401

3. **Elaboration**
   - Zerbitzu hauen perfila azaltzen duten ikertea epidemiologikoak eta kontsulta hauen %70a larriasun gutxiotzat jotzen dituzte zerbitzu hauetako medikuak.

4. **Evidence**
   - Erabilzaileen %80ak bere kabuz erabatzen duten %4an kokatzen da.

5. **Elaboration**
   - Eta kontsulta hauen %70a larriasun gutxiotzat jotzen dituzte zerbitzu hauetako medikuak.

6. **Purpose**
   - Hau dela eta, Galdakao ospitaleko larrialdi zerbitzuak erabilzaileen perfil deskriptibo bat egitea proposa iruditu zuigu.

7. **Elaboración**
   - Erabilzaileen perfile askotan zaitemen deskiritu hori, esan daiteke: gizonezkoak (%5,14), heldua (%43,2 urteko media) eta patologia traumatologikoak gatik komunitatearen duena (%50,5).
Our annotation method

Key:
- RST annotation
- Our proposal

- Harmonization of EDUs
- Harmonization of CU
- Identification of the Macro-structure (CU)
- Harmonization of relations
- Harmonization of signals
- Segmentation (EDU)
- Rhetorical structure
- Signals
- Morphosyntactic analysis

Basque RST TreeBank
Web service
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Segmentation guidelines and problems:

- Segmentation proposals follow three basic concepts:
  1. Linguistic “form” (or category). **Problem:** segmented elements would not be EDUs
  2. “Function” (the function of the syntactical components) (Mann and Thompson, 1987). **Problem:** imprecise segmentation criteria
  3. “Meaning” (the coherence relation between propositions). **Problem:** circularity (segmentation/relations)

- Or some combinations:
  - Form, function and meaning (Carlson and Marcu, 2001)
  - Form and function (Tofiloski et al., 2009; da Cunha et al., 2010b; Iruskieta, 2014)
Segmentation guidelines: RST

Function
(Mann and Thompson 1987)

Form-Function
(Tofilosky et al. 2009)

Form-Function-Meaning
(Carlson and Marcu 2001)

Function-Meaning

Form

Form-Meaning

Meaning
Segmentation guidelines: Basque

- Segmentation guidelines conflate RST and Basque clause combining (Tofiloski et al., 2009; Salaburu, 2012; Artiagoitia et al., 2003)

<table>
<thead>
<tr>
<th>Clause type</th>
<th>EDU</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perpaus independent-tea 'an independent sentence'</td>
<td>Yes</td>
<td>[Whipple (EW) gaixotasunak hesteei eragiten die bereziki.]&lt;sub&gt;1&lt;/sub&gt; GMB0503</td>
</tr>
<tr>
<td>Perpaus nagusi koordinatua 'a main clause, part of sentence'</td>
<td>Yes</td>
<td>[pT1 tumoreko 13 kasuetan ez zen gongoila inbasiorik hauteman;]&lt;sub&gt;1&lt;/sub&gt; [aldiz, pT1 101 tumoretatik 19 kasutan (18.6%) inbasioa hauteman zen, eta pT1c tumoreen artetik 93 kasutan (32.6%).]&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
<tr>
<td>Aditz jokatudun adjuntu perpausa ‘finite adjunct clauses’</td>
<td>Yes</td>
<td>[Haien sailkapena egiteko hormona hartzailen eta c-erb-B2 onkogenearen gabeiaz baliatu gara,]&lt;sub&gt;1&lt;/sub&gt; [ikerketa anatomopatologikoetan erabili ohi diren zehaztapenak direlako.]&lt;sub&gt;2&lt;/sub&gt; GMB0702</td>
</tr>
<tr>
<td>Aditz jokatugabedun adjuntu perpausa ‘non-finite adjunct clauses’</td>
<td>Yes</td>
<td>[Ohiko tratamendu motek porrot eginez gero,]&lt;sub&gt;1&lt;/sub&gt; [gizentasun erigarriaren kirurgia da epe luzera egin daitekeen tratamendu bakarra.]&lt;sub&gt;2&lt;/sub&gt; GMB0502</td>
</tr>
<tr>
<td>Erlatibo ez-murritzalaiea ‘non-restrictive relative clause’</td>
<td>Yes</td>
<td>[Dublin Hiriko Unibertsitateko atal bat da Fiontar,]&lt;sub&gt;1&lt;/sub&gt; [zeinak Ekonomia, Informatika eta Enpresa-ikasketetako Lizentziatura ematen baitu, irlanderaren bidez.]&lt;sub&gt;2&lt;/sub&gt; TERM23</td>
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   • **Central unit**
   • Rhetorical relations
   • Signaling the RRs
   • Delivery phase

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Central unit, indicators and RST

- Central unit(s) (CU) (Stede, 2008b)
  - Central proposition (Pardo et al., 2003), thesis statement (Burstein et al., 2001), and thematical sentence(s) (van Dijk, 1980a)
- Indicators of CU: nouns (paper, article, presentation, investigation, method, result...), verbs (discuss, introduce, present, examine, analy-, stud-...), demonstratives (this, the, a, some...) and pronouns (we, I)... (Paice, 1980)
  - Ambiguity: some of them are very vague, it could refer also to micro-structure (Paice, 1980, 179)
- Following van Dijk (1980a) texts ought to be coherent at
  - local level: (between words and) between clauses (or RRs)
  - global level: main topic (CU) with other thematic events (RRs)
- But the coherence of CU with other units (or RRs) is not considered in RST
  - not in the annotation guidelines (Carlson et al., 2001)
  - not in the evaluation method (Marcu, 2000a)
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Different Central units in RS-structure (GMB0203)
Harmonization of Central unit and its indicators

- CU annotation guidelines for scientific abstracts
  1. Topic or thesis statement
  2. Purpose
  3. Method
  4. Results
  5. Conclusions

- Description of some CU indicators
  - Verb clustering with SUMO-category from MCR synset
  - Noun clustering with the WordNet synset
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Our evaluation method: qualitative by Iruskieta et al. (2014a)

• Quantitative RS-tree evaluation method (Marcu, 2000a) by means of EDUs, spans, nuclearity and RRs
  ▶ Shortcomings
    • Evaluated factors (nuclearity and RRs) are not independent (van der Vliet, 2010)
    • RRs are not (well) compared (Iruskieta et al., 2013b)
      ▶ But well formalized (automated by Maziero and Pardo (2009))
  • Appropriate qualitative measurement
    ▶ Independent factors
    ▶ Qualitative description of
      • agreement (RCA, RA, RC and R)
      • disagreement (annotators interpretations and language forms)
  • Measurement of RS
    ▶ with the same language: Basque-Basque (Iruskieta et al., 2013a)
    ▶ in parallel texts: Basque-Spanish (da Cunha and Iruskieta, 2010) and Basque-English-Spanish (Iruskieta et al., 2014a)
Our evaluation method: decision trees

- Qualitative agreement
- Qualitative disagreement
RR harmonization guidelines: a proposal

Relation by relation

- Distinguish annotators, search consistency
- But cannot edit the RRs
- Cannot decide nuclearity

Text by text

- Top-down revision (CU and nuclearity)
- First, the RRs linked to CU
- Then, incremental and modular

• From confusion matrix\(^{(3)}\)
  ▶ Scale of informativeness: ELABORATION 47.21%
  ▶ Scale of informativeness is necessary (Kortmann, 1991)
  ▶ Not all the relations needed (Mol, 2005) and some of them were adapted

<table>
<thead>
<tr>
<th>RR</th>
<th>ANTITHESIS</th>
<th>CONCESSION</th>
<th>CONTRAST</th>
<th>CONDITION</th>
<th>MEANS</th>
<th>ENABLEMENT</th>
<th>PURPOSE</th>
<th>MOTIVATION</th>
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<tr>
<td>most informative</td>
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<td>CAUSE</td>
<td>RESULT</td>
<td>SEQUENCE</td>
<td>SOLUTIONHOOD</td>
<td>JUSTIFY</td>
<td>INTERPRETATION</td>
<td>EVALUATION</td>
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<td>RR</td>
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**Signaling the RRs**

- Signaling in Portuguese (Pardo and Nunes, 2004), in Spanish (da Cunha, 2013) and in English (Taboada and Das, 2013)
- Annotation tool: Rhetorical Data-Base (Pardo, 2005)
  - Relation by relation
  - Searches can be done to maintain consistency
- **What is signaling?**
  1. DM annotation
  2. Annotation of the frequent forms (Taboada and Das, 2013)
     - to distinguish volitional/non-volitional relations of cause with the verb tense (Antonio, 2012)
- If signals can be from any language form, is annotation more reliable?
Signaling the RRs

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- If signals can be from any language form, is annotation more reliable?
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1. Introduction
   - Aims
   - RS-structure in Basque studies and in CLs

2. Methodology
   - Preparation phase
   - Segmentation
   - Central unit
   - Rhetorical relations
   - Signaling the RRs
   - Delivery phase

3. Results
   - Segmentation
   - Central unit
   - Rhetorical relations
   - Signaling the RRs

4. Delivery phase

5. Conclusions and future work
Delivery phase (Iruskieta et al., 2013a)

• First rhetorical structure annotated corpus in Basque
• The Basque RST TreeBank’s delivery phase (Ide and Pustejovsky, 2010)
• Innovations: a number of operations can be carried out with this annotated corpus
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### Segmentation results

<table>
<thead>
<tr>
<th>Measure</th>
<th>State of the Art</th>
<th>Basque</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual annotation</strong></td>
<td>Kappa</td>
<td>&gt; 0.8</td>
</tr>
<tr>
<td><strong>Segmenter</strong></td>
<td>F-score</td>
<td>73% - 85%</td>
</tr>
</tbody>
</table>

- **Discourse parsers: EDUs ($F_1$)**
  - Machine learning (French): 73% (Afantenos et al., 2010)
  - **DiSeg**, rule based (Spanish): 80% (da Cunha et al., 2010a)

- **Preliminary results in Basque: end boundaries ($F_1$)**
  - Transformed segmenter: 66.94% (Iruskieta et al., 2011a)
  - Constraint Grammar-based rules: 69.69%
  - Syntactic dependency based heuristics: 80.68%
Granularity and RR agreement

- Less agreement at intra-sentential than at sentential agreement ($-13.74\%$), but more agreement in RRs ($+14.19\%$) and more robust (RCA $+9.5\%$) (Irusieta et al., 2011b)
  
  - Parallelism: syntax-discourse (Marcu and Echihabi, 2002)
  - Some RRs can be derived from syntax (Soricut and Marcu, 2003)
  - Simpler constituents (C) and fewer attachment points (A)
  - Parsers are more reliable (Pardo and Nunes, 2008; Soricut and Marcu, 2003)
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CU annotation results (Iruskieta et al., 2014b)

<table>
<thead>
<tr>
<th>Texts</th>
<th>Annotators</th>
<th>Measure</th>
<th>Results</th>
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<td>Basque</td>
<td>60</td>
<td>4 non-professionals</td>
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</table>

- CU annotation by 2 non-professionals:
  - Extracted from RS-tree: 65% (GMB)
  - First CU: 85% (TERM and ZTF)

- When CU is the same, bigger agreement in RRs (+5.04%, T-test: 0.013)
- When RR is linked to CU, bigger agreement (+17.29% T-test: 0.001)
Within the RRs linked to the CU, those with an IMRaD structure appear most frequently (unless ELABORATION).

<table>
<thead>
<tr>
<th>RRs</th>
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Diagram: Preparation → Background → Result → Means → Interpretation → Purpose

Diagram: Preparation → Background → Result → Means → Interpretation → Purpose

Diagram: Preparation → Background → Result → Means → Interpretation → Purpose
Verb and noun indicators of the CU and their strength

- Different verb group and indicator’s strength in each domain

- Some nouns’ synsets are good indicator

<table>
<thead>
<tr>
<th>SUMO</th>
<th>GMB %</th>
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<th>ZTF %</th>
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<th>GMB %</th>
<th>TERM %</th>
<th>ZTF %</th>
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**A list of indicators for Basque (verbs and nouns)**

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<td>helburu&lt;sub&gt;2&lt;/sub&gt;</td>
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</table>

- **New indicators from our corpus in gray for an automatic detection of the CU in Basque**
  - New indicators (Paice, 1980) in gray
  - Good indicators in blue (≥50.00%)
  - But analysis of other categories are needed to detect the CU
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### RR annotation results

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<tr>
<th></th>
<th>N</th>
<th>RCA</th>
<th>RC</th>
<th>RA</th>
<th>R</th>
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<td>5.88%</td>
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- The **Basque RST TreeBank** (Iruskieta et al., 2013a)
  - $0.568 \kappa$ or $61.47\%$ $F_1$ (2 annotators, 60 texts: 1470 EDUs)
- The **Dutch TreeBank** (van der Vliet et al., 2011)
  - $0.57 \kappa$ (2 annotators, 4 texts)
- The **RST TreeBank** (Carlson et al., 2001)
  - from $0.5973$ to $0.7921 \kappa$ (2 annotators, 30 texts: 1918 EDUs)
  - from $0.6017 \kappa$ to $0.7555 \kappa$ (3 trained professionals, 4/5 texts 515/343 EDUs)
- The **Spanish RST TreeBank** (da Cunha et al., 2010b)
  - $77.64\%$ $F_1$ (2 trained annotators: 84 texts, 694 EDUs)
### RR confusion matrix

<table>
<thead>
<tr>
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<th>ENABLEMENT</th>
<th>ANTITHESIS</th>
<th>SOLUTIONHOOD</th>
<th>CONDITION</th>
<th>JOINT</th>
<th>RESTATEMENT</th>
<th>DISJUNCTION</th>
<th>EVALUATION</th>
<th>EVIDENCE</th>
<th>ELABORATION</th>
<th>UNCONDITIONAL</th>
<th>PURPOSE</th>
<th>INTERPRETATION</th>
<th>JUSTIFY</th>
<th>CAUSE</th>
<th>CONJUNCTION</th>
<th>CONTRAST</th>
<th>CONCESSION</th>
<th>SUMMARY</th>
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<th>MOTIVATION</th>
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- To go back to RR’s harmonization(4)
# Results

## Rhetorical relations

Reliability of RRs, agreement: Fleiss (1971) Kappa

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<th>RRs</th>
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<td>&gt;0.001</td>
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<tr>
<td>PREPARATION</td>
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<tr>
<td>CIRCUMSTANCE</td>
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<td>CONCESSION</td>
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<td>CONDITION</td>
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<td>LIST</td>
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<td>DISJUNCTION</td>
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<td>SEQUENCE</td>
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</table>

- **Strong agreement (above average)** in 9 RRs
- **Weak agreement (below average)** in 7 RRs
- **Bad agreement** in 5 RRs (with red color)
- **No enough data** for 6 RRs
### Relevant RR disagreement: confusion matrix

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- One of them is the most widely used RR: 47.21% (ELABORATION-$X$)
- Similar RRs: 4.1% (LIST-CONJUNCTION, JUSTIFY-CAUSE, INTERPRETATION-RESULT)
  - Different nuclearity: 0.54% (CAUSE-RESULT)
- Not used by one of annotators: 0.7% (SOLUTIONHOOD-BACKGROUND)
Confusion matrix by pairs: Multilingual RST TreeBank
Translation strategies: Multilingual RST TreeBank

1) Relation signaling has a different configuration: Marker Change (MC)
   i) inclusion of a marker,
   ii) exclusion of a marker, and
   iii) changing a marker.

2) The use of a distinct language configuration: Clause Structure Change (CSC):
   i) hierarchical downgrading, and
   ii) hierarchical upgrading.

3) Punctuation is used differently: Unit Shift (US):
   i) an independent sentence is integrated in another sentence, and
   ii) a clause is translated in an independent sentence. We detail some of them below.

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<tr>
<th></th>
<th>ENG&gt;SPA</th>
<th>ENG&gt;BSQ</th>
<th>SPA&gt;ENG</th>
<th>SPA&gt;BSQ</th>
<th>BSQ&gt;ENG</th>
<th>BSQ&gt;SPA</th>
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<tbody>
<tr>
<td>MC</td>
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<td>–</td>
<td>4.35%</td>
<td>7.25%</td>
<td>10.14%</td>
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<td>68.12%</td>
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Open questions for the qualitative evaluation

- Different measures for:
  - RR linked to CU and RR not linked to CU?
  - RRs inside the sentence and RRs at the top of the RS-tree?
  - Least frequent RRs and more frequent RRs?

- Should evaluation method (and measures) be determined by the task?
Outline

1. Introduction
   • Aims
   • RS-structure in Basque studies and in CLs

2. Methodology
   • Preparation phase
   • Segmentation
   • Central unit
   • Rhetorical relations
   • Signaling the RRs
   • Delivery phase

3. Results
   • Segmentation
   • Central unit
   • Rhetorical relations
   • Signaling the RRs

4. Delivery phase

5. Conclusions and future work
CAUSE subgroup signaling agreement

- If signals can be from any language form, is annotation more reliable?

<table>
<thead>
<tr>
<th>Annotators</th>
<th>CAUSE%</th>
<th>RESULT%</th>
<th>PURPOSE%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁-A₂</td>
<td>71.43</td>
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<td>A₁-A₄</td>
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<tr>
<td>A₁-A₂-A₄</td>
<td>58.93</td>
<td>37.31</td>
<td>75.45</td>
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</table>

- Signal annotation is more ambiguous than DM annotation
  - DMs’ disagreement 15.27%
  - Other signals’ disagreement 68.13%
## Results of the RR\textsubscript{s} and their signals

<table>
<thead>
<tr>
<th>Rhetorical relations</th>
<th>Signal%</th>
<th>DU\textsubscript{1}</th>
<th>DU\textsubscript{2}</th>
<th>DU\textsubscript{1/2}</th>
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<tr>
<td><strong>Total</strong></td>
<td>1315</td>
<td>783</td>
<td>59.54</td>
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<td>532</td>
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</table>

**Multinuclear**

<table>
<thead>
<tr>
<th>Rhetorical relations</th>
<th>Signal%</th>
<th>DU\textsubscript{1}</th>
<th>DU\textsubscript{2}</th>
<th>DU\textsubscript{1/2}</th>
<th>N</th>
<th>S</th>
<th>S/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST</td>
<td>166</td>
<td>87</td>
<td>52.41</td>
<td></td>
<td>3</td>
<td>53</td>
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<td>32</td>
<td>21</td>
<td>65.63</td>
<td></td>
<td>2</td>
<td>15</td>
<td>4</td>
</tr>
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<td>CONJUNCTION</td>
<td>50</td>
<td>38</td>
<td>76.00</td>
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<td>37</td>
<td>1</td>
<td></td>
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<tr>
<td>CONTRAST</td>
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<td>33</td>
<td>82.50</td>
<td></td>
<td>2</td>
<td>23</td>
<td>8</td>
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<tr>
<td>DISJUNCTION</td>
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<td>2</td>
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<td><strong>Total</strong></td>
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<td></td>
<td>180</td>
<td>532</td>
<td>71</td>
</tr>
</tbody>
</table>
RRs and signals: interpretation of the results

• Signaling tendencies:
  ▶ Low signaling (≤ 25%):
    ● PREPARATION, BACKGROUND
  ▶ Middle signaling (≥ 25% eta ≤ 75%):
    ● EVIDENCE, RESTATEMENT, SUMMARY, ELABORATION, LIST, SEQUENCE
  ▶ High signaling (≥ 75%):
    ● ENABLEMENT, MOTIVATION, JUSTIFY, ANTITHESIS, CONCESSION, MEANS, CIRCUMSTANCE, CONDITION, SOLUTIONHOOD, UNCONDITIONAL, INTERPRETATION, EVALUATION, CAUSE, RESULT, PURPOSE, CONTRAST, CONJUNCTION, DISJUNCTION

• The 4 most annotated RRs 48.44%, only signaled at 29.20%
  ▶ ELABORATION, LIST, PREPARATION, BACKGROUND
  ● General RRs (not very informative)

• The signaling of other 22 RRs has a high frequency 86.28%
## Signaling and RR ambiguity (≥3 occurrences)

<table>
<thead>
<tr>
<th>Ambiguous signals</th>
<th>Non-ambiguous signals and RRs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>Translation</td>
</tr>
<tr>
<td>eta</td>
<td>and</td>
</tr>
<tr>
<td>-nez</td>
<td>given</td>
</tr>
<tr>
<td>-tuz</td>
<td>-ing</td>
</tr>
<tr>
<td>baina</td>
<td>but</td>
</tr>
<tr>
<td>bait-</td>
<td>because</td>
</tr>
<tr>
<td>ba-</td>
<td>if</td>
</tr>
<tr>
<td>bestalde</td>
<td>moreover</td>
</tr>
<tr>
<td>era berean</td>
<td>likewise</td>
</tr>
<tr>
<td>izan ere</td>
<td>in fact</td>
</tr>
<tr>
<td>gainera</td>
<td>futhermore</td>
</tr>
<tr>
<td>berriz</td>
<td>whereas</td>
</tr>
<tr>
<td>alde batetik</td>
<td>on the one hand</td>
</tr>
<tr>
<td>-ta</td>
<td>-ed</td>
</tr>
<tr>
<td></td>
<td>lortutako emaitzek</td>
</tr>
<tr>
<td></td>
<td>baiezatzen dute</td>
</tr>
<tr>
<td></td>
<td>hau da</td>
</tr>
</tbody>
</table>

- Detection of some RRs based on non-ambiguous signals

Results
Outline

1 Introduction
   • Aims
   • RS-structure in Basque studies and in CLs

2 Methodology
   • Preparation phase
   • Segmentation
   • Central unit
   • Rhetorical relations
   • Signaling the RRs
   • Delivery phase

3 Results
   • Segmentation
   • Central unit
   • Rhetorical relations
   • Signaling the RRs

4 Delivery phase

5 Conclusions and future work
Importance of the delivery phase

• Delivery phase is of paramount importance (Hovy, 2010), to provide place for interesting studies
  ▶ But often forgotten
  ▶ Not in the RST Spanish Treebank (da Cunha et al., 2011b)
    • Extract RRs from the corpus (to analyze the RRs patterns)

• Is there any place for improvements?

1. The SEARCH section based on word-form, lemma and POS features

<table>
<thead>
<tr>
<th>Doc.</th>
<th>EDU Id</th>
<th>Word</th>
<th>CU</th>
<th>EDU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TERM50</td>
<td>sent2</td>
<td>BAI</td>
<td>YES</td>
</tr>
<tr>
<td>2</td>
<td>ZTF13</td>
<td>sent1</td>
<td>BAI</td>
<td>YES</td>
</tr>
<tr>
<td>3</td>
<td>ZTF13</td>
<td>sent17</td>
<td>EZ</td>
<td>NO</td>
</tr>
<tr>
<td>1</td>
<td>ZTF15</td>
<td>sent7</td>
<td>EZ</td>
<td>NO</td>
</tr>
</tbody>
</table>

1. Hitzaldi honek azken hiru urteotan lau unibertsitate hauen taldeek egindako ikerkuntzaren ondorioetako batzuk azaltzeko helburua izango luke.
2. The aim of this talk is to present some of the results of the research carried out by groups from these four universities over the last three years.
3. Alor honetan, gure ikerkuntza taldeen helburu nagusiak bidira.
4. In this field, our research group has two main aims.
5. [...]. bestelako galdera zailagoei ere erantzutea dute helburu, hala nola, espezieen biogeografia, taldeen filogenia, eta abar. [...] the aim is to answer other such difficult questions, such as species biogeography, group phylogeny, etc.
**Importance of the delivery phase**

- Delivery phase is of paramount importance (Hovy, 2010), to provide place for interesting studies
  - But often forgotten
  - Not in the **RST Spanish Treebank** (da Cunha et al., 2011b)
  - Extract RRs from the corpus (to analyze the RRs patterns)

**Is there any place for improvements?**

1. **The SEARCH section** based on word-form, lemma and POS features

<table>
<thead>
<tr>
<th>Doc.</th>
<th>EDU Id</th>
<th>Word</th>
<th>CU</th>
<th>EDU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TERM50</td>
<td>sent2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ZTF13</td>
<td>sent1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ZTF13</td>
<td>sent17</td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>ZTF15</td>
<td>sent7</td>
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<tr>
<th>Doc.</th>
<th>EDU Id</th>
<th>Word</th>
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<tr>
<td>1</td>
<td>TERM50</td>
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<td>2</td>
<td>ZTF13</td>
<td>sent1</td>
<td>BAI</td>
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<td>1</td>
<td>ZTF15</td>
<td>sent7</td>
<td>EZ</td>
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</table>

- Hitzaldi honek azken hiru urteotan lau unibertsitate hauen taldeek egindako ikerkuntzaren ondorioetako batzuk azaltzeko helburua izango luke.
- The aim of this talk is to present some of the results of the research carried out by groups from these four universities over the last three years.
- Gure ikerkuntza taldearen helburu nagusia, [...] Our research group’s principal aim, [...] In this field, our research group has two main aims.
- Alor honetan, gure ikerkuntza taldearen helburu nagusiak bidira. [...]
- The aim is to answer other such difficult questions, such as species biogeography, group phylogeny, etc.
- **Extra advanced functionalities:**
  2. CU and RRs linked to CU
  3. Annotator’s info

<table>
<thead>
<tr>
<th>EDU</th>
<th>Segment</th>
<th>GMB0301-GS.rs3 (7)</th>
<th>Annotator</th>
<th>CU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Estomatitis Aftosa Recurrente (I): Epidemiologia, etiopatogenia eta aspektu klinikopatologikoak. Recurrent aphthous stomatitis (I): epidemiologic, etiologic and clinical features.</td>
<td>GS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>“Estomatitis aftosa recurrente” deritzon patologia, ahoan agertzen den ugarienetako bat da. “Recurrent aphthous stomatitis” is one of the most frequent oral pathologies.</td>
<td>GS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>tamainu, kokapena eta iraunkortasuna aldakorra izanik. having a variable size, location and duration.</td>
<td>GS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Honen etiologia eztabaidagarria da. It has a controversial etiology.</td>
<td>GS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ultzera mingarri batzu bezela agertzen da, It is characterized by the apparition of painful ulcers,</td>
<td>GS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hauek periodiki beragertzen dira. These ulcers appear recurrently.</td>
<td>GS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lan honetan patologia arrunt honetan ezaugarri epidemiologiko, etiopatogeniko eta klinikopatologiko garrantitsuenak analizatzen ditugu. In this paper we analyze the most important epidemiological, etiological, pathological and clinical features of this common oral pathology.</td>
<td>GS</td>
<td>See</td>
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</table>
• Extra advanced functionalities:

4. Specific RR\textsuperscript{s} and the search of their signals

<table>
<thead>
<tr>
<th>Left span</th>
<th>NS</th>
<th>Right span</th>
<th>Relation</th>
<th>Ref.</th>
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</thead>
<tbody>
<tr>
<td>Aurrek o hamarkadetan, serbierako zientzia-arloko ikertzaila askok joera bat nabaritu dute eta horren berri eman dute: ingelesek unita [...]</td>
<td>Izan ere, iritzi ezberdinetako zientzialari serbiarrek adostasuna lortu dute eta aurrek o hamarkadetan ingelezari eman diote [...]</td>
<td>Cause</td>
<td>TERM18</td>
<td></td>
</tr>
<tr>
<td>In recent decades, many Serbian researchers working in different scientific fields have noticed a tendency and this is outlined here: the English unit [...]</td>
<td>Indeed, Serbian scientists from different schools of thought have reached a consensus and have given English [...]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminologiak berak ere, uztartu egin behar ditu joera orokor horiek, eransten zaizkien beste batzuekin batera, hala nola: teknologien [...]</td>
<td>gizartearekin lotuta dagoen jarduera den ez,</td>
<td>Cause</td>
<td>TERM19</td>
<td></td>
</tr>
<tr>
<td>Terminology itself must seek to unite these general trends, along with others related to them, for example: technology</td>
<td>since it is an activity linked to society,</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Extra advanced functionalities:**

5. To search in which RR is the specific signal

<table>
<thead>
<tr>
<th>Signal: <strong>baina</strong> 'but'</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gainerakoan, prokasu adierazle egokiak daude,</strong></td>
</tr>
<tr>
<td>With respect to the other aspects, the indicators of process are good</td>
</tr>
<tr>
<td><strong>Bestalde, Euskaltzaindiak hitz elkartuen bidea (1995eko urtarrilaren 27an onartutako araua) proposatzen du adjektibo erreferentzialak itzultzeko,</strong></td>
</tr>
<tr>
<td>Euskaltzaindia proposed a mechanism of compound words (in a standard approved on January 27th 1995) for the translation of referential adjectives.</td>
</tr>
</tbody>
</table>
Outline

1. Introduction
   - Aims
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2. Methodology
   - Preparation phase
   - Segmentation
   - Central unit
   - Rhetorical relations
   - Signaling the RRs
   - Delivery phase

3. Results
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   - Central unit
   - Rhetorical relations
   - Signaling the RRs

4. Delivery phase

5. Conclusions and future work
Goal 1: describe the RS of a Basque corpus

- **The Basque RST TreeBank** (1,315 RR, 783 signals)
- Adjunct verb clause-based segmentation (81.14% $F_1$ in pairs)
  - A prototype of intra-sentential discourse segmentation (57.81% $F_1$)
- CU decision tree (61.42% $F_1$ in threes) and indicators (verbs and nouns) for CU detection
- RR (61.81% $F_1$ in pairs) and signal (76.82% $F_1$ in pairs) description
  - 22 RRs (51.16%) signaled with a high frequency 86.28%
  - Signals in DU$_2$ (67.94%) and in satellite unit (91.36%)
  - IMRaD structure was observed in RRs frequency linked to CU
  - Consistent cause subgroup harmonization for their detection
Goal 2: to establish an annotation method

- A new annotation phase (global coherence before local)
- A new method to gain reliability avoiding circularity (harmonizing RRs)
- A qualitative evaluation method for RS-trees
- A robust and innovative delivery phase to different theoretical studies (consistency, patterns, ambiguity)
Goal 3: validate annotation method and analyze disagreement cases

- Incremental annotation: intra-sentential segmentation was 13.74% lower than sentential but 14.19% higher for RRs.
- Macro-structure (CU) before, micro-structure (RRs)
  - Higher CU agreement (from 10% to 30%), even though the probability was smaller
  - Higher RR agreement when same CU is annotated (6.17%, t-test: $p < 0.013$)
  - Higher RR agreement when RRs are linked to CU (11.52%, t-test: $p < 0.001$)
- Signaling RRs to avoid implicit RRs, is more ambiguous than marking with DMs
  - Then, it is necessary to put more attention in signal evaluation
- Relevant disagreements in RR confusion matrix:
  - Most widely user RR (ELABORATION) in 47.21%
  - Not well understood RRs: EVIDENCE, INTERPRETATION, ANTITHESIS, EVALUATION and SUMMARY
  - Not used RR: SOLUTIONHOOD
Future work

- To measure the adequacy of the segmentation criteria and of the RRs harmonization criteria
- To extend the corpus to other genres and domains
  - The Reference Corpus for the Processing of Basque (EPEC) (Aduriz et al., 2006) manually-annotated at different language levels
  - From the abstracts to their full articles: summarization (da Cunha, 2008)
- To apply in advanced applications
  - Discourse segmenter
  - Detection of CU via indicators: summarization
  - IMRaD structure detection: assessment of written abstracts
  - Qualitative evaluation of RS-trees
  - Detection of the cause subgroup: discourse structure analysis
  - Re-annotate the signals of some RRs with more annotators, to gain reliability and detect RRs
## Publications

<table>
<thead>
<tr>
<th>Papers</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Iruskieta (2012)</td>
<td>Explanation of RST</td>
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<tr>
<td>Iruskieta et al. (2011a)</td>
<td>Automatic segmentation</td>
</tr>
<tr>
<td>Iruskieta et al. (2014b)</td>
<td>Central unit</td>
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<td>Iruskieta et al. (2013b)</td>
<td>The drawbacks of quantitative evaluation</td>
</tr>
<tr>
<td>Iruskieta et al. (2011b)</td>
<td>Relation and segmentation levels</td>
</tr>
<tr>
<td>da Cunha and Iruskieta (2010)</td>
<td>Qualitative evaluation of relations</td>
</tr>
<tr>
<td>Iruskieta et al. (2014a)</td>
<td>Qualitative evaluation of relations</td>
</tr>
<tr>
<td>Iruskieta et al. (2009)</td>
<td>DM for signals</td>
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<tr>
<td>Iruskieta and da Cunha (2010b)</td>
<td>DM for signals (Spanish and Basque)</td>
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<tr>
<td>Iruskieta and da Cunha (2010a)</td>
<td>Using DMs and RRs to discriminate domains</td>
</tr>
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<td></td>
<td>(medicine and terminology)</td>
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<tr>
<td>Iruskieta et al. (2008)</td>
<td>Study of DM and its ambiguity</td>
</tr>
<tr>
<td>Garcia and Iruskieta (2013)</td>
<td>DMs of reformulation</td>
</tr>
<tr>
<td>Iruskieta et al. (2013a)</td>
<td>The RST Basque TreeBank</td>
</tr>
</tbody>
</table>

Annotated Basque corpus:  
http://ixa2.si.ehu.es/diskurtsoa/

Annotated multilingual corpus (English, Spanish, Basque):  
http://ixa2.si.ehu.es/rst/

More info in the abbreviated translation of the thesis-report in English:  
http://ixa2.si.ehu.es/~jibquirm/tesia/tesi_txostena_itzulita.pdf
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A description of pragmatics rhetorical structure and its evaluation in computational linguistics

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University of the Basque Country (UPV/EHU)

April 7, 2014


References II


Conclusions and future work

References


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