

Work package 6

Case Study: Mathematics

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MOLTO review
Luxemburg, March 15th, 2011

- 1 WP general view
- 2 Ongoing work
- 3 Coming next
- 4 Dissemination

To have a **multilingual dialog system** able to help the students in solving **word problems**.

word problem: a type of textbook problem designed to help students apply abstract mathematical concepts to 'real-world' situations.

- A farm raises two kinds of animals: ducks and rabbits. In total there are 60 animals and 140 legs. How many ducks and rabbits are there in the farm?
- John is David's father. He is three times as old as his son, but in 10 years, he will be twice as old. How old are they now?

- mixture of text and formulas
- useful for teachers (PISA)

*In mathematics education, the term word problem is often used to refer to any math exercise where **significant background information** on the problem is **presented as text** rather than in mathematical notation.*

[http://en.wikipedia.org/wiki/Word_problem_\(mathematics_education\)](http://en.wikipedia.org/wiki/Word_problem_(mathematics_education))

L Verschaffel, B Greer, E De Corte (2000) *Making Sense of Word Problems*, Taylor & Francis

WP general view

Participants & PMs & Tasks

UPC

24

Grammar development, samples, lexicon

Ontotext

6

Semantic extraction and reasoning.

GOT

3

GF tuning, lexicon.

UHEL

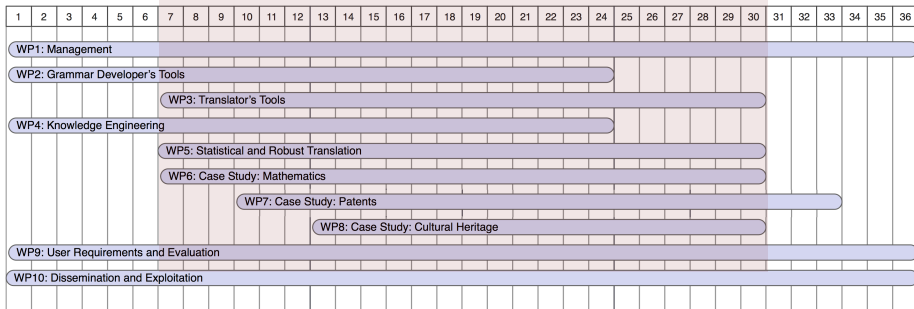
3

Terminology, evaluation, lexicon.

WP general view

Timeline

6 < month < 30



- D61** Simple drill grammar library (Month 15)
- D62** Prototype of commanding CAS (Month 23)
- D63** Assistant for solving word problems (Month 30)

- A GF grammar library for *simple* mathematical exercises.
- It started as part of the WebAL^T project (EDC-22253).
- Repository of exercises
 - Linear algebra
 - Calculus
 - Excluding *word problems*

- The Molto math library develops and symplifies the webALT library. It follows the OpenMath directives:



OpenMath is an extensible standard for representing the semantics of mathematical objects

- Organized into **Content Dictionaries**

For X in Bulgarian, Catalan, English, Finnish, French, German, Italian, Romanian, Spanish, Swedish:

Basic Logic1X, Quant1X, Relation1X, Set1X,
SetName1X;

Aritmetics Arith1X, Arith2X, Integer1X, Integer2X

Calculus Calculus1X, Complex1X, Fns1X, Interval1X,
Limit1X, MinMax1X, Nums1X, Rounding1X,
Transc1X;

Linear Algebra LinAlg1X, LinAlg2X, PlanGeo1X,
VecCalc1X;

Other SData1X.

The library is organized in 3 layers of increasing complexity:

Ground: For literal integers and variables

OpenMath: For *OpenMath* objects

Operations: Problems, verbalizations, ...

- For each language X we have a *concrete* and a *resource* module.
 - Lexicon X
 - Ground X and Variables X
 - OpenMath X
 - Operations X
- Common material is reused.

Ongoing work

Status

- Moving code from gf lib 1.4 (0.9) to 3.2.1
- Code cleaning and modularization
- Extension to other languages

Ongoing work

Statistics: Old and new

	webALT	MOLTO
Total lines	20,731	12,544
gf files	158	425
Abs lines		275
languages	7	10 + 1

Ongoing work

Statistics: By Language

Bulgarian	568	German	588
Catalan	595	Italian	628
English	614	Romanian	735
Finnish	693	Spanish	624
French	642	Swedish	559

- Notice all languages have a similar complexity
- Coming soon: Dutch and Polish

Comming next

Gold standard evaluation

- Set of productions covering CD's
- Parsing to abstract forms
- Linearize for each language
- Referee checking
- Final grammar corrections

- Mathematical Grammar Library technical report
- Poster and Demo at the JAEM days in Gijón (Spain)
- Mathematical Grammar Library (memoir).
- Demo/local
- Demo-html

<http://www.grammaticalframework.org/demos/minibar/mathbar.html>

Acknowledgements

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