

# PersonLink: An Ontology Representing Family Relationships for the CAPTAIN MEMO Memory Prosthesis

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# AFFILIATION

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- Cedric Lab., Conservatoire National des Arts et Métiers (CNAM), Paris, France.
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## **Research objectives:**

- Design of Captain Memo: a Memory Prosthesis based on Semantic Web technologies to overcome the Memory Degeneration.
  - Project Leader: Pr. Elisabeth Métais

# OUTLINE

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- I. Introduction and Problem statement
- II. Related Works
- III. Paper Contribution:
  - i. The PersonLink Ontology Approach
  - ii. The Lace Ontology
  - iii. Experiments and Validation
- IV. Conclusion and Future Works

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# Introduction

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Scientific studies show that:

- In 2050, 30% of European people will be at least 65 years old (Salthouse /2009);
- Memory troubles as one of the major disabilities the elderly will suffer from (Salthouse /2009);
- Using a PDA helps at increasing the independency in daily tasks (Sainath /2007).

# Introduction

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## The CAPTAIN MEMO:

- A memory prosthesis;
- A Software based application;
- Intended to eventually work on several supports (e.g. Smartphones, Smart watches, Smart glasses, etc.) ;
- It's under development (Ongoing).

# Introduction

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## CAPTAIN MEMO's Goals:

- Acting as a memory-aid application for elderly people;
- Storing personal data and can be connected to the pervasive environment;
- Helping the elderly to “remember things about people“.

# Introduction

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- Captain Memo is a multilingual memory prosthesis;
- It can store and semantically organize the information;
- Captain Memo takes into consideration incomplete and inconsistent data;
- It deduces new facts from the given ones;

**→ The modeling is endorsed to an ontology of family and convivial links.**



# Problem statement

- Family links are completely dependent on the culture and the language (Barry /2008). :
  - Some concepts may not exist in certain cultures/languages (e.g. “*Godmother*”, “*Surrogate*”, etc.).
  - Some concepts could have another definition in the target culture/language.
  - The concept’s constraints may differ in some languages/cultures(e.g. “*spouse*” relationship).
- The accuracy of the concept’s definitions as it can change from one language/culture to another, e.g. the cousin relationship:
  - In English “*cousin*”;
  - In French: “*cousin*” for male and “*cousine*” for female;
  - In Arabic: “ابن خال”, “ابن عم”, “ابن خالة”, “ابن عمة”, “ابنة خال”, “ابنة عم”, “ابنة خالة”, “ابنة عمة”.

# Problem statement

→ An Ontology that represents family relationships in a precise manner?

- Existence of the concept in the culture/language;
- The right definition of each concept according to the culture/language;
- The concept's constraints in each culture/language;
- The accuracy of each concept;

→ and allows Captain Memo to switch between cultures/languages without using a simple translation?

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# Related Works

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Different Ontologies have been proposed to describe family relationships in the web:

- All the relationships are defined through only one predicate (FOAF)  
→ Unknown relationship's nature (e.g. family, friendship, etc.) .
- Provide some generic terms representing parenthood, childhood, siblinghood and marriage (Relationship, AgRelOn, etc....)  
→ Remain very generic, lack precision (e.g. gender, constraints, etc.) and don't support the multicultural aspect.

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# Paper Contribution

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- Ontology specification and development:
  - Based on family relationships;
  - Named PersonLink.
- Integration of the proposed ontology into Captain Memo platform.
- Validation of the PersonLink ontology via real world Linked Data:
  - Freebase ;
  - DBpedia.

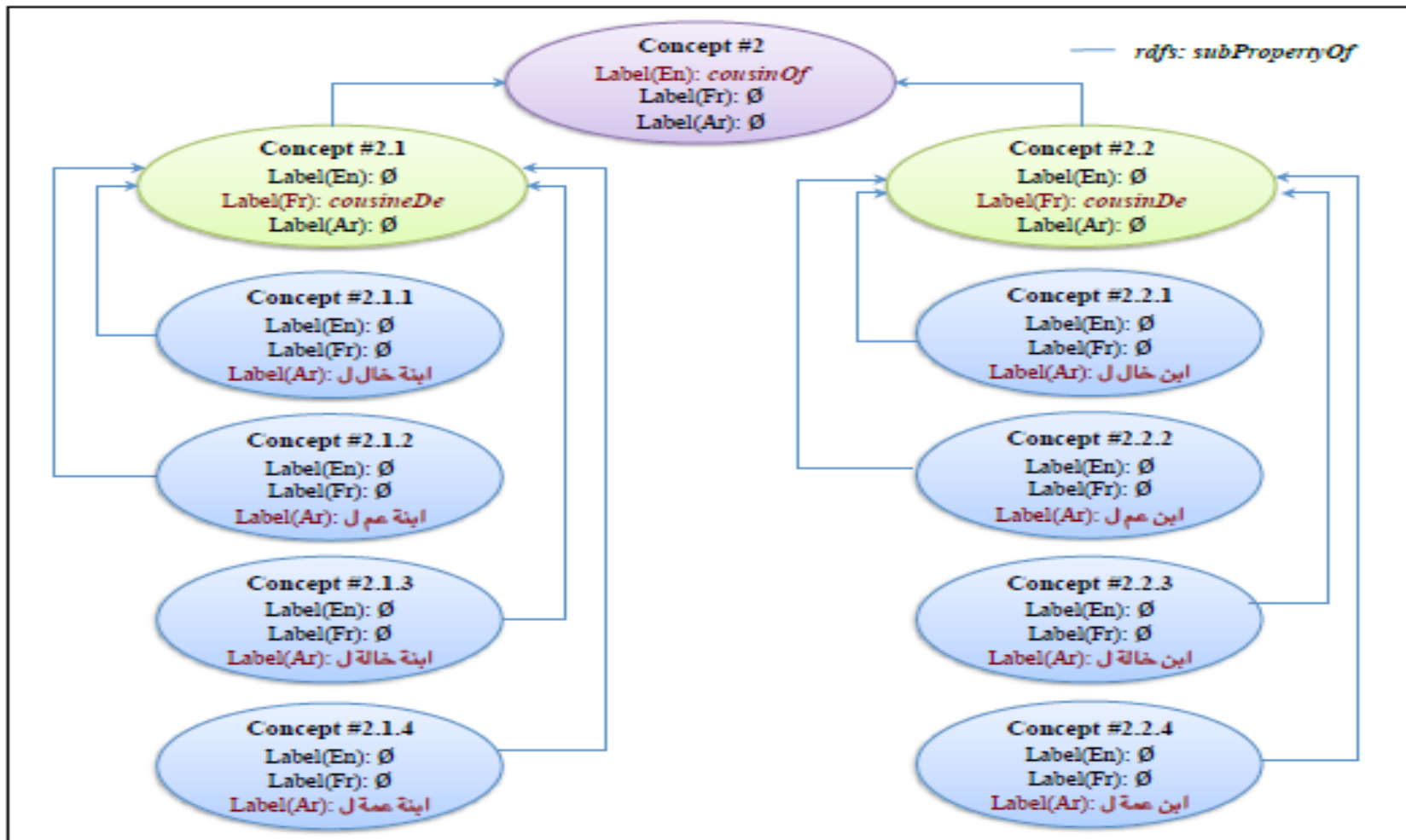
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# The PersonLink Ontology Approach

- PersonLink represents and defines concepts according to the considered culture, and expresses them using terms of the appropriate language:
  - Each concept is represented by a unique number;
  - The Concept exists in the culture → A definition in this culture to describe it;  
→ A term is assigned to it using the related language.
  - The Concept doesn't exist in the culture → A term is  $\emptyset$ .
  - A kind of sparse ontology ("*Lace Ontology*") is obtained.
- From this precise definition, a formal representation is done.
- Enrich these relationships by a set of SWRL (DL-safe) rules and constraints (To check inconsistencies and infer new links).



# The Lace Ontology



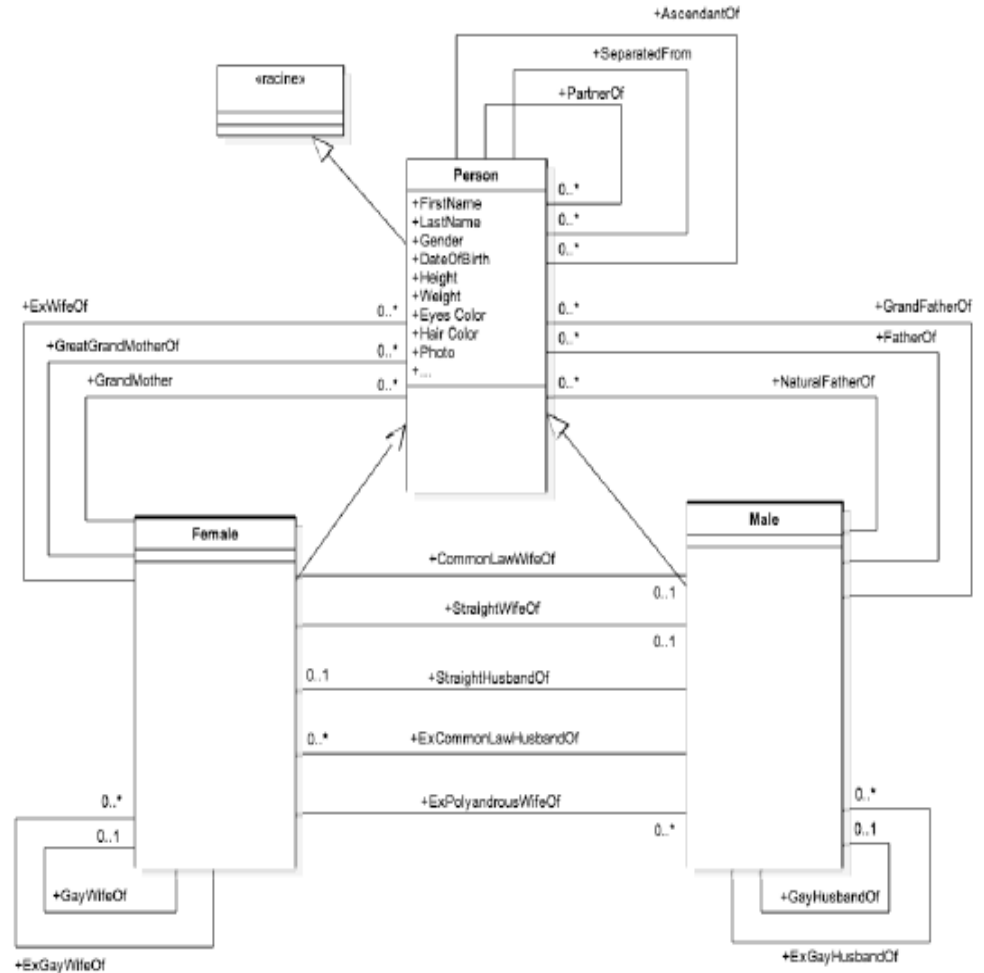
# The PersonLink Ontology

■ It represents interpersonal relationships in a precise manner :

- More precise model providing several links:
  - Gender (Male, Female);
  - Much more links (86 properties).

■ It allows checking inconsistency, and deducing new link :

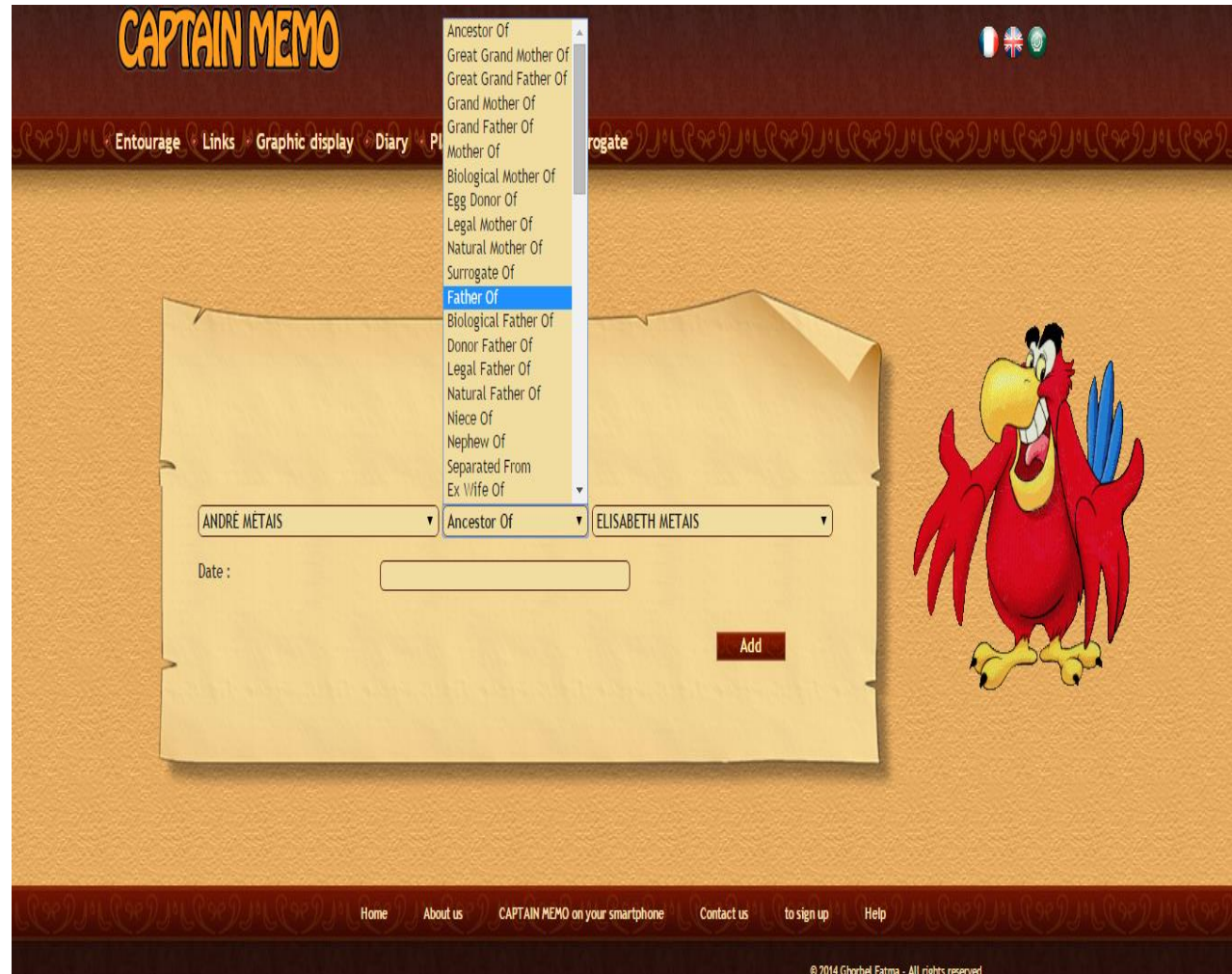
- (582 SWRL Rules).
- Constraints.



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# PersonLink Validation on Captain Memo

- PersonLink provides fine-grained relationships definitions to Captain Memo:
  - Inputs through menu containing PersonLink's properties.



# PersonLink Validation on Captain Memo

## ■ Graphic editor:

- Used for display and search;
- Shows an example of results (a person's relationships) using PersonLink.

The screenshot displays the 'CAPTAIN MEMO' website interface. At the top, there is a navigation bar with menu items: Entourage, Liens, Affichage graphique, Journal intime, Planning, Rechercher, and Interroger. Below the navigation bar, there is a search field labeled 'Nom et prénom :'. To the right, the search results for 'FRANÇOIS COURTOIS | 1936' are displayed, including the birth date 'Date de naissance : 1936'. The main content area shows a network diagram of relationships centered on 'FRANÇOIS COURTOIS | 1936'. The relationships are as follows:

- FRANÇOIS COURTOIS | 1936 is the brother (Frère) of JEAN COURTOIS.
- FRANÇOIS COURTOIS | 1936 is the spouse (Conjointe) of MICHELLE SIMARD.
- FRANÇOIS COURTOIS | 1936 is the father (Fils) of FRANÇOIS COURTOIS.
- FRANÇOIS COURTOIS | 1936 is the father (Fils) of SARAH COURTOIS.
- FRANÇOIS COURTOIS | 1936 is the father (Fils) of JAD CAPA.
- FRANÇOIS COURTOIS | 1936 is the niece (Niece) of ANNA DUCROS.
- FRANÇOIS COURTOIS | 1936 is the niece (Niece) of MARIE-MADÉLEINE COURTOIS.



# PersonLink Validation on Captain Memo

- The reasoning mechanism using PersonLink's SWRL Rules allows checking inputs and deducing new links:
  - Automatically deduce new links;
  - Suggest and confirm through a dialog these new links;
  - Prevent from wrong inputted links.



# Validation on large scale linked Data

- Inferring new relationships from the given ones in Freebase, e.g. cousin relationship:
  - Freebase doesn't provide any property expressing the cousin relationship;
  - Provides parental and sibling properties that could be used to express implicitly the cousin relationship;

| Relationship    | Freebase Relationship                       | Number of Entities |
|-----------------|---|--------------------|
| Parent          | <i>/people/person/parents</i>               | 2000               |
| Child           | <i>/people/person/children</i>              | 5155               |
| Sibling         | <i>/people/sibling_relationship/sibling</i> | 1815               |
| Sibling's child | -   | 0                  |
| Cousin          | -   | 0                  |



| PersonLink Relationship | Freebase Entities |
|-------------------------|-------------------|
| <i>cousinOf</i>         | 16426             |

# Validation on large scale linked Data

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- Specifying existing links using PersonLink relationships and the Freebase gender property :

| FreeBase Relationship   | Number of Entities | Inferred Relationship | Number of Entities | Null gender value |
|-------------------------|--------------------|-----------------------|--------------------|-------------------|
| /people/person/parents  | 2000               | motherOf              | 717                | 8                 |
|                         |                    | fatherOf              | 1275               |                   |
| /people/person/children | 5155               | daughterOf            | 2100               | 269               |
|                         |                    | sonOf                 | 2786               |                   |



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# Conclusion

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- ❑ Introduction and development of a new Ontology called PersonLink (available through a dereferenceable URI at:
  - ❑ <http://cedric.cnam.fr/~hamdif/ontologies/PersonLink.owl> ).
- ❑ Validation of PersonLink on Captain Memo memory prosthesis.
- ❑ Validation on large scale Linked Data.

# Future works

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Future works will be mainly devoted:

- ❑ To enrich the ontology with convivial links between people (neighbors, friends, care givers, etc.);
- ❑ To enhance deducing rules with context;
- ❑ To take into account time variance.

**Thank you for your attention**