



HAL
open science

NLP Tools for Mental Hearth – French experience

Maxime Amblard, Michel Musiol

► **To cite this version:**

Maxime Amblard, Michel Musiol. NLP Tools for Mental Hearth – French experience. French-Sweden Scientific Day, Nov 2021, stockholm, Sweden. hal-03619164

HAL Id: hal-03619164

<https://inria.hal.science/hal-03619164>

Submitted on 27 Mar 2022

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.

NLP Tools for Mental Health – French experience

Maxime Amblard - Michel Musiol
November 15th 2021



- **Complete** the classic paradigm of Language and Thought Disorders (LTD)

Main Objectives

- **Complete** the classic paradigm of Language and Thought Disorders (LTD)
- **By** a semantic-formal model of Speech Disorders (SDD)

- **Complete** the classic paradigm of Language and Thought Disorders (LTD)
- **By** a semantic-formal model of Speech Disorders (SDD)
- **Develop** computerized tools of **aids in the diagnosis of schizophrenia**

Main Objectives

- **Complete** the classic paradigm of Language and Thought Disorders (LTD)
- **By** a semantic-formal model of Speech Disorders (SDD)
- **Develop** computerized tools of **aids in the diagnosis of schizophrenia**
- Adapt and use these tools to address the problem of **screening for the onset of the illness** and **follow-up of the pathology**

1. Formalize
2. Compare with real data

Understanding language data : semantics and dialogue

1. Formalize

- Logical representations (Montagovian tradition)

$$\exists x. (\exists y. (\text{farmer } x \wedge \text{donkey } y \wedge \text{own } x y) \rightarrow \text{beat } x y)$$

[Qian, de Groote, Amblard LiLT 2016]

[Boritchev, Amblard, LCM 2021, SemDial 2020, 2019]

- Define calculations for semantics (λ)

[Marsik, Amblard, de Groote TCS 2021]

2. Compare with real data

1. Formalize

- Logical representations (Montagovian tradition)

$$\exists x.(\exists y.(\text{farmer } x \wedge \text{donkey } y \wedge \text{own } x y) \rightarrow \text{beat } x y)$$

[Qian, de Groote, Amblard LiLT 2016]

[Boritchev, Amblard, LCM 2021, SemDial 2020, 2019]

- Define calculations for semantics (λ)

[Marsik, Amblard, de Groote TCS 2021]

2. Compare with real data

- Failure to understand : schizophrenic patients

G82 l'an dernier euh... j'savais pas comment faire j'étais **perdue**

V87 Vous savez ça arrive à tout le monde d'avoir des moments biens et des moments **où on est perdu**

G88 Oui j'ai **peur de perdre tout le monde**

[Amblard, Musiol, Rebuschi LCM 2021]

1. Formalize

- Logical representations (Montagovian tradition)

$$\exists x.(\exists y.(\text{farmer } x \wedge \text{donkey } y \wedge \text{own } x y) \rightarrow \text{beat } x y)$$

[Qian, de Groote, Amblard LiLT 2016]

[Boritchev, Amblard, LCM 2021, SemDial 2020, 2019]

- Define calculations for semantics (λ)

[Marsik, Amblard, de Groote TCS 2021]

2. Compare with real data

- Failure to understand : schizophrenic patients

G82 l'an dernier euh... j'savais pas comment faire j'étais **perdue**

V87 Vous savez ça arrive à tout le monde d'avoir des moments biens et
des moments **où on est perdu**

G88 Oui j'ai **peur de perdre tout le monde**

[Amblard, Musiol, Rebuschi LCM 2021]

Understanding language data : semantics and dialogue

1. Formalize

- Logical representations (Montagovian tradition)

$$\exists x.(\exists y.(\mathbf{farmer} \ x \wedge \mathbf{donkey} \ y \wedge \mathbf{own} \ x \ y) \rightarrow \mathbf{beat} \ x \ y)$$

[Qian, de Groote, Amblard LiLT 2016]

[Boritchev, Amblard, LCM 2021, SemDial 2020, 2019]

- Define calculations for semantics (λ)

[Marsik, Amblard, de Groote TCS 2021]

⇒ Wide coverage (semantic calculation and data)

2. Compare with real data

- Failure to understand : schizophrenic patients

G82 l'an dernier euh... j'savais pas comment faire j'étais **perdue**

V87 Vous savez ça arrive à tout le monde d'avoir des moments biens et des moments **où on est perdu**

G88 Oui j'ai **peur de perdre tout le monde**

[Amblard, Musiol, Rebuschi LCM 2021]

⇒ Tooling the analysis, developing resources

Understanding language data : semantics and dialogue

1. Formalize

- Logical representations (Montagovian tradition)

$$\exists x.(\exists y.(\mathbf{farmer} \ x \wedge \mathbf{donkey} \ y \wedge \mathbf{own} \ x \ y) \rightarrow \mathbf{beat} \ x \ y)$$

[Qian, de Groot, Amblard LiLT 2016]

[Boritchev, Amblard, LCM 2021, SemDial 2020, 2019]

- Define calculations for semantics (λ)

[Marsik, Amblard, de Groot TCS 2021]

⇒ Wide coverage (semantic calculation and data)

2. Compare with real data

- Failure to understand : schizophrenic patients
G82 l'an dernier euh... j'savais pas comment faire j'étais **perdue**
V87 Vous savez ça arrive à tout le monde d'avoir des moments biens et des moments **où on est perdu**
G88 Oui j'ai **peur de perdre tout le monde**

[Amblard, Musiol, Rebuschi LCM 2021]

⇒ Tooling the analysis, developing resources

3. Integrate digital models (DNN, RNN, transformer, etc.) :

- identification of the structure of the interaction

[Li, Amblard, Braud TALN 2020]

Cognitive processes and mental pathology

- Identify patients' cognitive difficulties
 - Important clinical issue
 - Difficulty : to access the disorder
 - Discourse as a natural place for the expression of disorder

Cognitive processes and mental pathology

- **Identify patients' cognitive difficulties**
 - Important clinical issue
 - Difficulty : to access the disorder
 - Discourse as a natural place for the expression of disorder
 - **Methodology**
 - Finely isolating a cognitive disorder using semantic models
 - Link between cognitive and neuro-psychological defects
 - SLAM : explain the decisive breaks with the SDRT
- ⇒ Tools for analyzing the disorder through discourse management processes

Cognitive processes and mental pathology

- **Identify patients' cognitive difficulties**
 - Important clinical issue
 - Difficulty : to access the disorder
 - Discourse as a natural place for the expression of disorder
- **Methodology**
 - Finely isolating a cognitive disorder using semantic models
 - Link between cognitive and neuro-psychological defects
 - SLAM : explain the decisive breaks with the SDRT

⇒ Tools for analyzing the disorder through discourse management processes

⇒ Hypothesis : link between semantic-pragmatic and neuro-pathological disorders
- **Contributions**

- Original theory of the disorder
- Identification of objectivable multimodal clues.
- Digital tools : transfer to the world of psychiatry



- SLAM - Schizophrenia and Language : Analyze and Modelling 2010-2017
 - constitution of a corpus - Lyon (18 patients + control corpus)
 - use of formal models
 - automatic analysis of disfluencies

- **SLAM - Schizophrenia and Language : Analyze and Modelling**
2010-2017
 - constitution of a corpus - Lyon (18 patients + control corpus)
 - use of formal models
 - automatic analysis of disfluencies

- **Action Exploratoire Inria ODiM** 2019-2021
 - constitution of a corpus - Aix en Provence (20 patients + control corpus)
 - analysis of dialogical transactions (model and parsing)
 - articulation of neuropsychological and eye-trackers

- **SLAM - Schizophrenia and Language : Analyze and Modelling** 2010-2017
 - constitution of a corpus - Lyon (18 patients + control corpus)
 - use of formal models
 - automatic analysis of disfluencies

- **Action Exploratoire Inria ODiM** 2019-2021
 - constitution of a corpus - Aix en Provence (20 patients + control corpus)
 - analysis of dialogical transactions (model and parsing)
 - articulation of neuropsychological and eye-trackers

- **MePheSTO - Inria-DFKI** 2020-2022
 - creation of a Franco-German corpus
 - consideration of multimodality
 - use of AI methods

SLAM : Rejouer des ambiguïtés linguistiques

B₁₂₄ Oh ouais et pis compliqué et c'est vraiment très très compliqué la politique c'est quelque chose quand on s'en occupe faut être gagnant parce qu'autrement quand on est perdant c'est fini quoi

A₁₂₅ Oui

B₁₂₆ J. C. D. est mort, L. est mort, P. est mort euh (...)

A₁₂₇ Ils sont morts parce qu'ils ont perdu à votre avis

B₁₂₈ Non ils gagnaient mais si ils sont morts, c'est la maladie quoi c'est c'est

A₁₂₉ Ouais c'est parce qu'ils étaient malades, c'est pas parce qu'ils faisaient de la politique

B₁₃₀ Si enfin

A₁₃₁ Si vous pensez que c'est parce qu'ils faisaient de la politique

B₁₃₂ Oui tiens oui il y a aussi C. qui a accompli un meurtre là il était présent lui aussi qui est à B. mais enfin c'est encore à cause de la politique ça

SLAM : Rejouer des ambiguïtés linguistiques

B₁₂₄ Oh ouais et pis compliqué et c'est vraiment très très compliqué **la politique** c'est quelque chose quand on s'en occupe **faut être gagnant** parce qu'autrement quand on est perdant c'est fini quoi

A₁₂₅ Oui

B₁₂₆ J. C. D. **est mort**, L. **est mort**, P. **est mort** euh (...)

A₁₂₇ Ils sont morts parce qu'ils ont perdu à votre avis

B₁₂₈ Non ils gagnaient mais **si ils sont morts, c'est la maladie** quoi c'est c'est

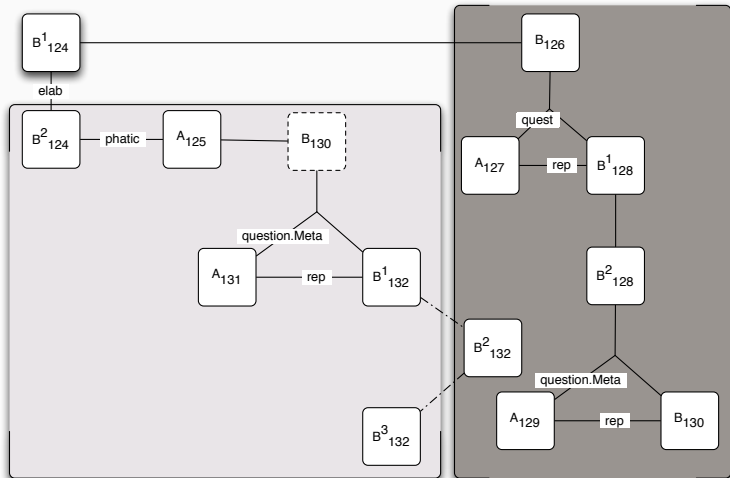
A₁₂₉ Ouais c'est parce qu'ils étaient malades, c'est pas parce qu'ils faisaient de la politique

B₁₃₀ **Si enfin**

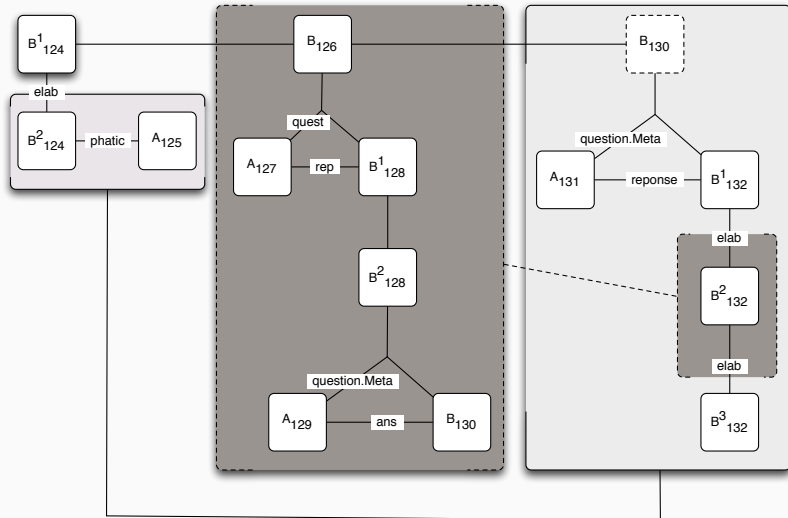
A₁₃₁ Si vous pensez que c'est parce qu'ils faisaient de la politique

B₁₃₂ Oui tiens oui il y a aussi **C. qui a accompli un meurtre là** il était présent lui aussi qui est à B. mais enfin c'est encore à cause de la politique ça

SLAM : Point de vue du schizophrène



SLAM : Point de vue du psychologue







ODiM.

 [CRÉER UN COMPTE](#)

SLODiM [Tableau de bord](#) > [Dossier patient](#) > [Entretien](#) > [Analyse syntaxique](#) SLO

STATISTIQUES EXPLORER

Options

Début 0 9 / 519 Fin 20 2 / 519

Schéma CONLLU

- 1 / 519 - Y |> esula
- 1 / 519 - R |> non
- 2 / 519 - R |> si
- 3 / 519 - R |> justement
- 4 / 519 - R |> [tre]
- 5 / 519 - Y |> 9
- 6 / 519 - R |> 9
- 7 / 519 - Y |> 9 |jai du bois

```

graph TD
    root --> nsubj[ NUM 9 ]
    root --> obj
    obj --> VERB[ VERB jai ]
    obj --> det
    det --> DET[ DET du ]
    det --> NOUN[ NOUN bois ]
    
```

- 8 / 519 - Y |> 2 bois
- 9 / 519 - Y |> pour moi et l'autre 9
- 10 / 519 - R |> et (0.2s) moi (j) |jai 2 (0.2s) pattes
- 11 / 519 - R |> euh 2 blÃ©s
- 12 / 519 - Y |> oh tu veux pas faire des Ã©changes ROUGE
- 13 / 519 - R |> |jai |ai |j |
- 14 / 519 - R |> (xxx) peut-Ãªtre commencer Ã songer aux Ã©changes hein



SLAM

adresse
slam@slam.fr



RAPPORT GLOBAL

Affichage

Résumé

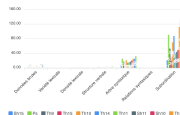
Résumé



● 0114 ● P4 ● T04 ● T011 ● T114 ● T111 ● 0111 ● 0113 ● T012 ● 0114 ● T111 ● 0111 ● 0113 ● T012 ● 0114 ● T111

EXTRAITIENS

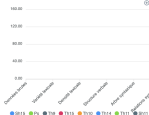
Mesures globales



● 0114 ● P4 ● T04 ● T011 ● T114 ● T111 ● 0111 ● 0113 ● T012 ● 0114 ● T111 ● 0111 ● 0113 ● T012 ● 0114 ● T111

TESTS NEUROCOGNITIFS

Historique



● 0114 ● P4 ● T04 ● T011 ● T114 ● T111 ● 0111 ● 0113 ● T012 ● 0114 ● T111 ● 0111 ● 0113 ● T012 ● 0114 ● T111

Mesures globales

Item	Moyenne	Total
designation	0.01	0.17
spatiotemporal	0.01	0.16
epreuveTakensAble	0.02	0.54
other	0.02	0.36
lennaxTakensRatio	0.03	0.6
add	0.04	0.79
aveprogQuestions	0.14	3.11
stopwordRatio	0.33	7.25
lexicaDensity	0.45	9.87
atpy	3.07	67.51
aveprogLength	4.24	93.92
flow	8.5	187
average	12.04	264.82
longestDependencyString	21.68	477
questions	32.77	721
subwords	81.45	1792
verbalFormRatio	92.41	2033
turns	263.89	5788
words	3193.45	70258

Search

	identic	low	medium	high
020MOut_new.tst	0.00	0.00	0.00	0.00
017T1Out_new.tst	0.00	0.00	0.00	0.00
018N1Out_new.tst	0.00	0.00	0.00	0.00
016FAOut_new.tst	0.00	0.00	0.00	0.00
015H0Out_new.tst	0.00	0.00	0.00	0.00
014SR1Out_new.tst	0.00	0.00	0.00	0.00
013D1Out_new.tst	0.00	0.00	0.00	0.00
012PEOut_new.tst	0.00	0.00	0.00	0.00
011HAOut_new.tst	0.00	0.00	0.00	0.00
010BLOut_new.tst	0.00	0.00	0.00	0.00
009BAOut_new.tst	0.00	0.00	0.00	0.00
007THOut_new.tst	0.00	0.00	0.00	0.00
006MAOut_new.tst	0.00	0.00	0.00	0.00
005AUOut_new.tst	0.00	0.00	0.00	0.00
008MAOut_new.tst	0.00	0.00	0.00	0.00
004KAOut_new.tst	0.00	0.00	0.00	0.00
003DCOut_new.tst	0.00	0.00	0.00	0.00
002LAOut_new.tst	0.00	0.00	0.00	0.00
001PEPOut_new.tst	0.00	0.00	0.00	0.00
022FEOut_new.tst	0.00	0.00	0.00	0.00
021MCOut_new.tst	0.00	0.00	0.00	0.00
020CEOut_new.tst	0.00	0.00	0.00	0.00
009FROut_new.tst	0.00	0.00	0.00	0.00
007TEOut_new.tst	0.00	0.00	0.00	0.00
004MAOut_new.tst	0.00	0.00	0.00	0.00
025FIOut_new.tst	0.00	0.00	0.00	0.00
028MAOut_new.tst	0.00	0.00	0.00	0.00
002STOut_new.tst	0.00	0.00	0.00	0.00
020MAOut_new.tst	0.00	0.00	0.00	0.00
008BEOut_new.tst	0.00	0.00	0.00	0.00
001FIOut_new.tst	0.00	0.00	0.00	0.00
003FEOut_new.tst	0.00	0.00	0.00	0.00
004BAOut_new.tst	0.00	0.00	0.00	0.00
003RPOut_new.tst	0.00	0.00	0.00	0.00
002CFOut_new.tst	0.00	0.00	0.00	0.00
003VQOut_new.tst	0.00	0.00	0.00	0.00
008BAOut_new.tst	0.00	0.00	0.00	0.00
005BCOut_new.tst	0.00	0.00	0.00	0.00
004NICOut_new.tst	0.00	0.00	0.00	0.00
014SAOut_new.tst	0.00	0.00	0.00	0.00
042SROut_new.tst	0.00	0.00	0.00	0.00
043RPOut_new.tst	0.00	0.00	0.00	0.00
041AGOut_new.tst	0.00	0.00	0.00	0.00
040W1Out_new.tst	0.00	0.00	0.00	0.00
039C1Out_new.tst	0.00	0.00	0.00	0.00
038BAOut_new.tst	0.00	0.00	0.00	0.00
037FCOut_new.tst	0.00	0.00	0.00	0.00
036DEOut_new.tst	0.00	0.00	0.00	0.00
035T1Out_new.tst	0.00	0.00	0.00	0.00
034BAOut_new.tst	0.00	0.00	0.00	0.00
033MAOut_new.tst	0.00	0.00	0.00	0.00
032T1Out_new.tst	0.00	0.00	0.00	0.00
031T1Out_new.tst	0.00	0.00	0.00	0.00
030BAOut_new.tst	0.00	0.00	0.00	0.00
029T1Out_new.tst	0.00	0.00	0.00	0.00
028T1Out_new.tst	0.00	0.00	0.00	0.00
027T1Out_new.tst	0.00	0.00	0.00	0.00
026T1Out_new.tst	0.00	0.00	0.00	0.00
025T1Out_new.tst	0.00	0.00	0.00	0.00
024T1Out_new.tst	0.00	0.00	0.00	0.00
023T1Out_new.tst	0.00	0.00	0.00	0.00
022T1Out_new.tst	0.00	0.00	0.00	0.00
021T1Out_new.tst	0.00	0.00	0.00	0.00
020T1Out_new.tst	0.00	0.00	0.00	0.00
019T1Out_new.tst	0.00	0.00	0.00	0.00
018T1Out_new.tst	0.00	0.00	0.00	0.00
017T1Out_new.tst	0.00	0.00	0.00	0.00
016T1Out_new.tst	0.00	0.00	0.00	0.00
015T1Out_new.tst	0.00	0.00	0.00	0.00
014T1Out_new.tst	0.00	0.00	0.00	0.00
013T1Out_new.tst	0.00	0.00	0.00	0.00
012T1Out_new.tst	0.00	0.00	0.00	0.00
011T1Out_new.tst	0.00	0.00	0.00	0.00
010T1Out_new.tst	0.00	0.00	0.00	0.00
009T1Out_new.tst	0.00	0.00	0.00	0.00
008T1Out_new.tst	0.00	0.00	0.00	0.00
007T1Out_new.tst	0.00	0.00	0.00	0.00
006T1Out_new.tst	0.00	0.00	0.00	0.00
005T1Out_new.tst	0.00	0.00	0.00	0.00
004T1Out_new.tst	0.00	0.00	0.00	0.00
003T1Out_new.tst	0.00	0.00	0.00	0.00
002T1Out_new.tst	0.00	0.00	0.00	0.00
001T1Out_new.tst	0.00	0.00	0.00	0.00

MEPHESTO



Johannes Tröger, DFKI

"The vision of MEPHESTO is to help breaking the scientific ground for next generation precision psychiatry through AI-based social interaction analysis."



MEPHESTO

Real-world social interactions |
Measuring clinical evidence where it
really matters

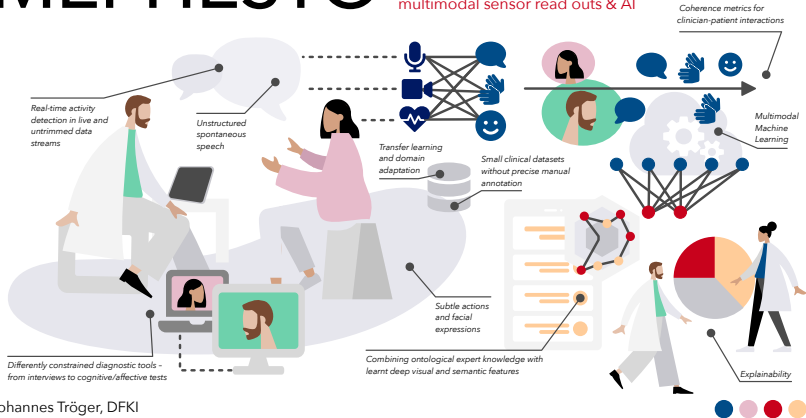


Johannes Tröger, DFKI



MEPHESTO

Digital phenotyping |
Modelling clinical symptoms through
multimodal sensor read outs & AI



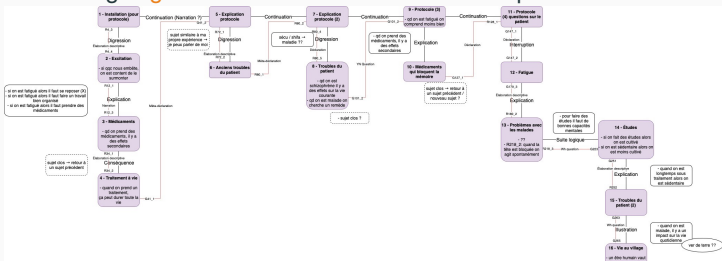
Johannes Tröger, DFKI



- Treatment of the French language
- Tool for experts
 - Early detection,
 - Help with diagnosis,
 - Relapse prediction,
 - Help with therapy
- Definition of language profiles
- Implementation of tools for the identification of cognitive processes
- Collaborative cycle : data collection - models - production of implementations

French Swedish cooperation

- Works on **transcripts of interviews** with patients :
 - spontaneous interview (Nancy)
 - balloon task (Göteborg)
- Combining **linguistic** and **meta-conversational** aspects

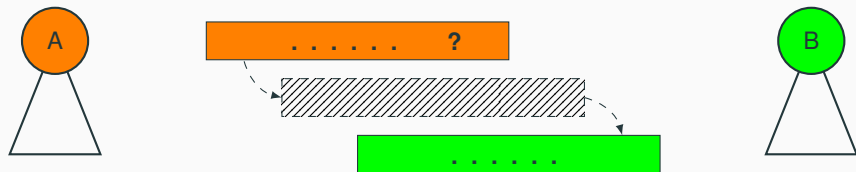


- Use of both **formal linguistics** and **AI tools**
 - SDRT
 - tops

Thank you!

- Démarches administratives lourdes :
 - CPP de la région de l'institution médicale
 - CNIL
- Les données ne doivent pas être utilisées pour/contre le patient.
- Participation des patients (pertes importantes de participation)
- Protocole lourd

Studying dialogue



- What is a question ?
- What is an answer ?
- Where is the question ?
- Where is the answer ?
- Data is scarce (oral ? French ? non constrained ?)
- Ethics : open access ? anonymity ?

Calculs automatiques

In Logical_form:

```
CLOS (AGENT (SOME STUDENT) (TIME MIDNIGHT
  (LOCATION (THE PARK) (PATIENT (EVERY TEACHER)
MEET)))) : s
```

Interpreted by semantics in Semantics as:

```
!
  (Ex x.
    (student x) &
    (All x'.
      (teacher x') >
      (! (Exv e. (meet e) & ((patient e x') &
        ((location e (the park)) & ((time e midnight) &
          ((agent e x) & T))))))
    )
  )
: t
```

Questions

Forms (main, mutually exclusive)	Secondary forms	Functions
Yes/no (polar questions)	Disjunctive (alternative)	Ask (confirmation, feature, performance)
Wh	Interro-neg	
Dialogue management Auxiliary (deontic/epistemic)	Completion suggestion	BC - simple w/ questions
Assertion	Reported/quoted speech	<ul style="list-style-type: none">● Phatic
Question tags	Complexity (ID)	<ul style="list-style-type: none">● Clarification request
	Focus	<ul style="list-style-type: none">● Turn

Réponses

Forms (main, mutually exclusive)	Secondary forms	Functions
Simple answer	Reported speech	Refuse, accept
Strongly exhaustive answer	Yes/no	● Deny the assumption (presupposition)
Question/question	Non Sentential Utterances	BC
Potentially resolving answer		● Phatic
Aboutness	Deflective	Give
		● Uncertain
		● Unknown
		● Unrelated
		● Feature
		Perform