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NLP Tools for Mental Health – French experience

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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)

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- **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]

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- 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**

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⇒ 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
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 - SLAM : explain the decisive breaks with the SDRT
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- ⇒ 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



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 - constitution of a corpus - Aix en Provence (20 patients + control corpus)
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 - articulation of neuropsychological and eye-trackers

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- **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

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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

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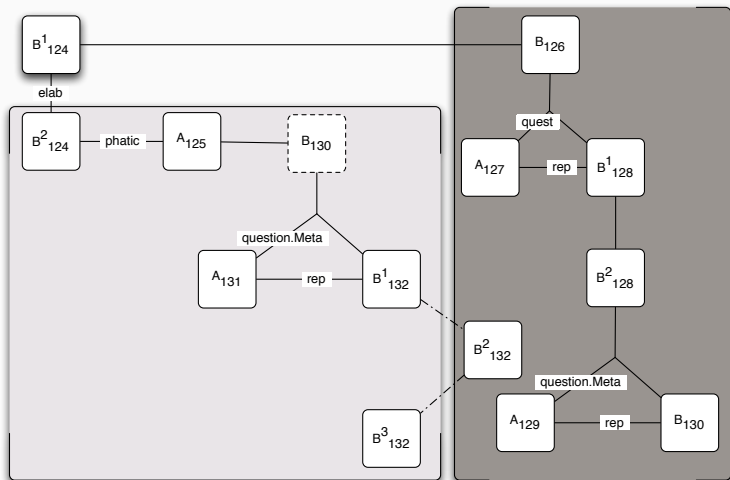
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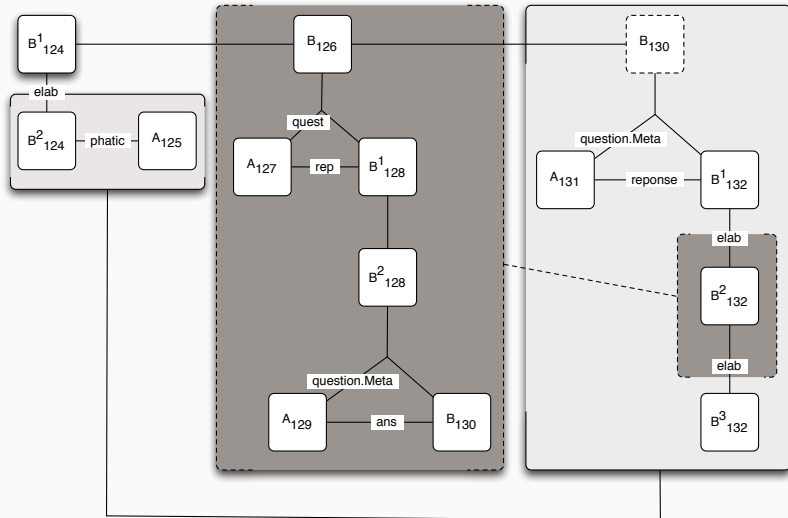
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SLAM : Point de vue du schizophrène



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 | 0 | esala
- 2 / 519 - R | 1 | non
- 3 / 519 - R | 2 | si
- 4 / 519 - R | 3 | justement
- 5 / 519 - R | 4 | [tre]
- 6 / 519 - Y | 5 | 9
- 7 / 519 - R | 6 | 9
- 8 / 519 - Y | 7 | 9 |ai du bois

```

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

- 9 / 519 - Y | 8 | 2 bois
- 10 / 519 - Y | 9 | pour moi et l'autre 9
- 11 / 519 - R | 10 | et (0.2s) moi (j) |ai 2 (0.2s) pattes
- 12 / 519 - R | 11 | euh 2 blÃ©s
- 13 / 519 - Y | 12 | oh tu veux pas faire des Ã©changes ROUGE
- 14 / 519 - R | 13 | |ai |ai |j |
- 15 / 519 - R | 14 | (xxx) peut-Ãªtre commencer Ã songer aux Ã©changes hein



SLAM

adresse
slam@slam.fr



RAPPORT GLOBAL

Affichage

Résumé

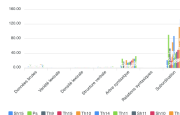
Résumé



● 0114 ● P4 ● T04 ● T011 ● T114 ● T111 ● 0111 ● 0113 ● T013 ● 0114 ● T111 ● 0111 ● 0113 ● T013

EXTRAITIENS

Mesures globales



● 0114 ● P4 ● T04 ● T011 ● T114 ● T111 ● 0111 ● 0113 ● T013 ● 0114 ● T111 ● 0111 ● 0113 ● T013

TESTS NEUROCOGNITIFS

Historique



● 0114 ● P4 ● T04 ● T011 ● T114 ● T111 ● 0111 ● 0113 ● T013 ● 0114 ● T111 ● 0111 ● 0113 ● T013

Mesures globales

Donnée	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	93.32
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
020MAOut_new.tst	0.00	0.00	0.00	0.00
017TJOut_new.tst	0.00	0.00	0.00	0.00
018NGOut_new.tst	0.00	0.00	0.00	0.00
016FAOut_new.tst	0.00	0.00	0.00	0.00
015FHOut_new.tst	0.00	0.00	0.00	0.00
014SRUOut_new.tst	0.00	0.00	0.00	0.00
013DUOut_new.tst	0.00	0.00	0.00	0.00
012PEOut_new.tst	0.00	0.00	0.00	0.00
011HAIOut_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
002LHOut_new.tst	0.00	0.00	0.00	0.00
001PEOut_new.tst	0.00	0.00	0.00	0.00
022FEOut_new.tst	0.00	0.00	0.00	0.00
021MCOOut_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
031FROOut_new.tst	0.00	0.00	0.00	0.00
033FEOut_new.tst	0.00	0.00	0.00	0.00
034BAOut_new.tst	0.00	0.00	0.00	0.00
035RROut_new.tst	0.00	0.00	0.00	0.00
036CFOut_new.tst	0.00	0.00	0.00	0.00
037VQOut_new.tst	0.00	0.00	0.00	0.00
038BAOut_new.tst	0.00	0.00	0.00	0.00
039BCOut_new.tst	0.00	0.00	0.00	0.00
040NICOut_new.tst	0.00	0.00	0.00	0.00
041SAOut_new.tst	0.00	0.00	0.00	0.00
042SROut_new.tst	0.00	0.00	0.00	0.00
043RQOut_new.tst	0.00	0.00	0.00	0.00
044ACOut_new.tst	0.00	0.00	0.00	0.00
046CCOut_new.tst	0.00	0.00	0.00	0.00
048VCOOut_new.tst	0.00	0.00	0.00	0.00
049FACOut_new.tst	0.00	0.00	0.00	0.00
050FECOut_new.tst	0.00	0.00	0.00	0.00
051TROut_new.tst	0.00	0.00	0.00	0.00
052BACOut_new.tst	0.00	0.00	0.00	0.00
053MAOut_new.tst	0.00	0.00	0.00	0.00
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057TEOut_new.tst	0.00	0.00	0.00	0.00
058MAOut_new.tst	0.00	0.00	0.00	0.00
059VCOOut_new.tst	0.00	0.00	0.00	0.00
060ACOut_new.tst	0.00	0.00	0.00	0.00
061VCOOut_new.tst	0.00	0.00	0.00	0.00
062VCOOut_new.tst	0.00	0.00	0.00	0.00
063VCOOut_new.tst	0.00	0.00	0.00	0.00
064VCOOut_new.tst	0.00	0.00	0.00	0.00
065VCOOut_new.tst	0.00	0.00	0.00	0.00
066VCOOut_new.tst	0.00	0.00	0.00	0.00
067VCOOut_new.tst	0.00	0.00	0.00	0.00
068VCOOut_new.tst	0.00	0.00	0.00	0.00
069VCOOut_new.tst	0.00	0.00	0.00	0.00
070VCOOut_new.tst	0.00	0.00	0.00	0.00
071VCOOut_new.tst	0.00	0.00	0.00	0.00
072VCOOut_new.tst	0.00	0.00	0.00	0.00
073VCOOut_new.tst	0.00	0.00	0.00	0.00
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075VCOOut_new.tst	0.00	0.00	0.00	0.00
076VCOOut_new.tst	0.00	0.00	0.00	0.00
077VCOOut_new.tst	0.00	0.00	0.00	0.00
078VCOOut_new.tst	0.00	0.00	0.00	0.00
079VCOOut_new.tst	0.00	0.00	0.00	0.00
080VCOOut_new.tst	0.00	0.00	0.00	0.00
081VCOOut_new.tst	0.00	0.00	0.00	0.00
082VCOOut_new.tst	0.00	0.00	0.00	0.00
083VCOOut_new.tst	0.00	0.00	0.00	0.00
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087VCOOut_new.tst	0.00	0.00	0.00	0.00
088VCOOut_new.tst	0.00	0.00	0.00	0.00
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091VCOOut_new.tst	0.00	0.00	0.00	0.00
092VCOOut_new.tst	0.00	0.00	0.00	0.00
093VCOOut_new.tst	0.00	0.00	0.00	0.00
094VCOOut_new.tst	0.00	0.00	0.00	0.00
095VCOOut_new.tst	0.00	0.00	0.00	0.00
096VCOOut_new.tst	0.00	0.00	0.00	0.00
097VCOOut_new.tst	0.00	0.00	0.00	0.00
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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

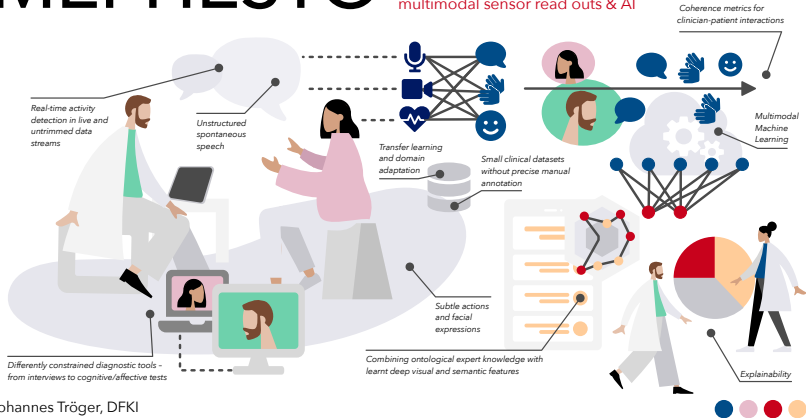


Johannes Tröger, DFKI



MEPHESTO

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

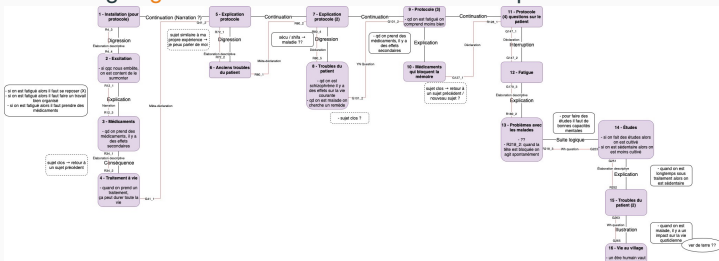


Johannes Tröger, DFKI

- 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

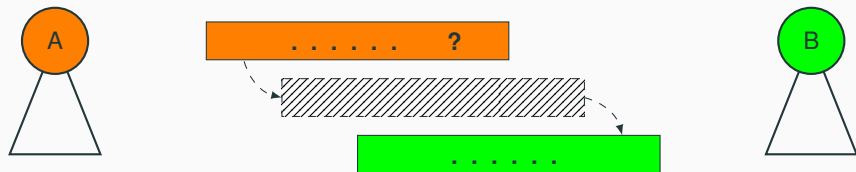


- Use of both formal linguistics and AI tools
 - SDRT
 - topos

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