



**HAL**  
open science

## Cognitive disorders as sources of variation in dialogues

Caterina Petrone, Elisa Sneed, Simona Schiattarella, Giovanna de Bellis, Tim Mahrt, Noémie Moreau, Laurent Renié

► **To cite this version:**

Caterina Petrone, Elisa Sneed, Simona Schiattarella, Giovanna de Bellis, Tim Mahrt, et al.. Cognitive disorders as sources of variation in dialogues. AISV 2017, Jan 2017, Pisa, Italy. halshs-01459699

**HAL Id: halshs-01459699**

**<https://shs.hal.science/halshs-01459699v1>**

Submitted on 7 Feb 2017

**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.

# Cognitive disorders as sources of variation in dialogues



C. Petrone<sup>1</sup>, E. Sneed German<sup>1</sup>, S. Schiattarella<sup>2</sup>, G. De Bellis<sup>2</sup>, T. Mahrt<sup>1</sup>, N. Moreau<sup>3</sup> and L. Renié<sup>3</sup>  
<sup>1</sup>Laboratoire Parole et Langage, CNRS, Aix-en-Provence,  
<sup>2</sup>Università "Federico II" Napoli, <sup>3</sup>Centre hospitalier du Pays d'Aix



## INTRODUCTION

### Multiple Sclerosis (MS)

• Neurodegenerative disorder including physiological, motor, cognitive and psychological impairments [1]

Cognitive impairment (CI) in up to 65% patients with MS : deficits in planning and decision making, working memory, attention and speed of processing [2]

### • Read speech and CI :

- Articulation rate slower with low working memory capacity and slower processing speed [3, 4]

- Planning strategy -> longer time needed to plan the upcoming speech material

→ Comparison of healthy vs MS

populations to get insight into cognitive constraints on speech planning

### Interpersonal coordination

• Turn-taking is quick, but latencies in planning language production are longer [5]

• Question-answer (Q-A) pairs interesting for turn-taking coordination, because questions make a floor transfer relevant [6]

• Prosodic adaptation: similar prosodic patterns [7]

## Research questions

(1) Is turn-taking timing differently adjusted in MS patients with/without cognitive deficits?

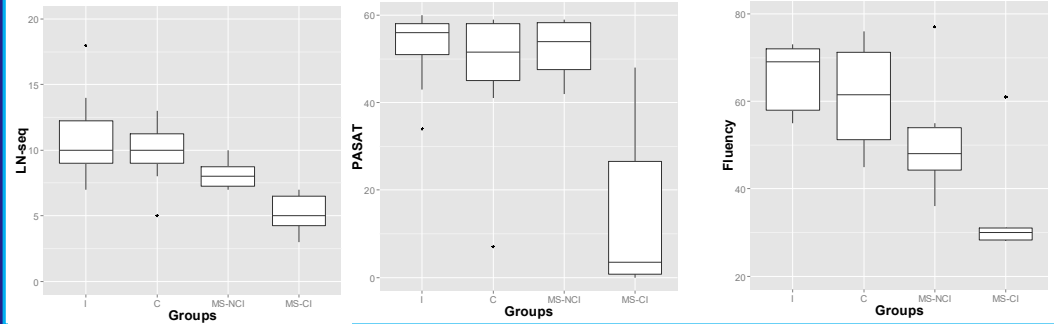
(2) Is prosodic adaptation related to cognitive deficits in MS?

## PARTICIPANTS

	MS-CI*	MS-NCI*	Controls (C)**	Interlocutors (I)***
N	6	6	12	12
Age	50.6 (6.3)	44 (11.4)	36.9 (16.1)	23.4 (3.4)
Gender	5F/1M	5F/1M	10F/2M	10F/2M
EDSS	5 (1.18)	3.2 (1.25)	--	--

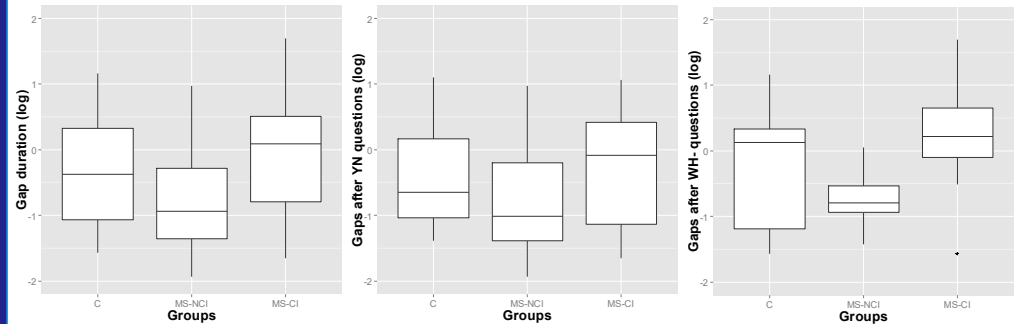
\*Relapsing remitting form; Exclusion criteria: therapy with antidepressant; dyslexia; dysarthria; history of alcohol or drug abuse; history of psychiatric disorder; hearing disorders; \*\* Matched in gender and education level with MS; \*\*\* Speech therapists or neuropsychologists;

### Neurocognitive scores

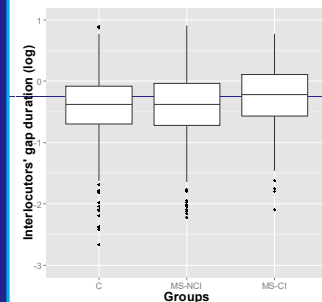


## RESULTS & DISCUSSION

### Speakers' Gaps



### Interlocutors' adaptation



• Strategies in interpersonal coordination depend on cognitive abilities: MS-CI vs. MS-NCI [ $\beta = 0.85$ ,  $SD = 0.23$ ,  $t = 3.6$ ]; MS-NCI = C

• Longer gaps in Q-A -> more time preparation for MS-CI

• Wh-questions slower than polar questions -> greater cognitive complexity of response involved [9]

• Interlocutors adapt their gaps to MS-CI [ $\beta = 0.38$ ,  $SD = 0.13$ ,  $t = 2.8$ ]

## METHODS

### Neurocognitive tests [3,4]

• Working memory : Letters and number sequencing task; SDMT

• Speed of processing : PASAT-3s

• Phonemic and Semantic fluency tests

→ Extreme group approach: MS-CI vs. MS-NCI [4]

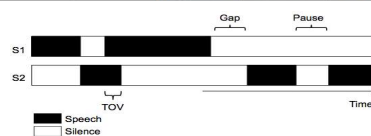
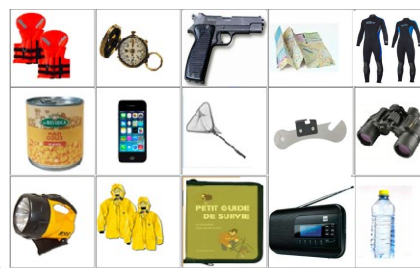
### Linguistic task

• Shipwreck scenario game [8]

• Dyads : MS vs. C / C vs. I (see table)

• Labeling of Interpausal Units and gaps in Q-A pairs (PRAAT)

• Adaptation by interlocutors



## CONCLUSION

• Cognitive constraints as source of variability in dialogues -> speech planning as flexible? [10]

• Speech-based technologies to complement CI screening and monitoring + training therapists

• Future work: finer-grained analysis of different question types.

## References

- [1] Benito-León, J., Manuel Morales, J., Rivas-Navarro, J., & Mitchell, A. J. (2003). A review about the impact of multiple sclerosis on health-related quality of life. *Disability and Rehabilitation*, 25(23), 1291-1303.
- [2] Chiaravalloti, N. D., & DeLuca, J. (2005). Cognitive impairment in multiple sclerosis. *The Lancet Neurology*, 7(12), 1139-1151.
- [3] Rodgers, J. D., Tjaden, K., Feereaghty, L., Weinstock-Guttman, B., & Benedict, R. H. (2013). Influence of cognitive function on speech and articulation rate in multiple sclerosis. *Journal of the International Neuropsychological Society*, 19(02), 173-180.
- [4] Deloaze, C., Ghis, A., Moreau, N., Renié, L., Rizo, A., Audoin, B., F. Viallet, J. Pelletier and Péronne, C. (subm.) Prosodic parameters of speech planning in Multiple Sclerosis. *J Neuropsychology*.
- [5] Sivers, T., Enfield, N. J., Brown, P., Englert, C., Hayashi, M., Heinemann, T., Hoymann, G., Rosamo, F., de Ruiter, J., Yoon, K.-E., Levinson, S. C. (2009). Universal and cultural variation in turn-taking conversation. *PNAS*, 106(26), 10557-10562.
- [6] Biçgele, S., Magyar, L., & Levinson, S. C. (2015). Neural signatures of prosodic planning occur midway through an incoming question in conversation. *Scientific Reports*, 5, 12881.
- [7] De Looze, C. et al. (2013). Investigating automatic measurements of prosodic accommodation and its dynamics in social interaction. *Speech Comm.*, Vol 28, 11-34.
- [8] De Looze, C., Yamashvskaya, I., Murphy, A., O'Connor, E., and Göbb, C. (2015) Pitch declination and reset as a function of utterance duration in conversational speech data. *Interspeech* 2015.
- [9] Kriska, M., 2001. For a structured meaning account of questions and answers. In: Fery, C., Stemberd, W. (Eds.), *Audiatu vox sapientia. A Festschrift for Armin von Stechow*. Akademie Verlag, Berlin pp. 287-319.
- [10] Swets, B., Desmet, T., Hambrick, D. Z., & Ferrera, F. (2007). The role of working memory in syntactic ambiguity resolution: A psychometric approach. *Journal of Experimental Psychology: General*, 136, 64-81.

Statistics: Mixed models ( $p < .05$ )