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Impact of perceptual strength in a lexical decision task in the semantic form of primary progressive aphasia

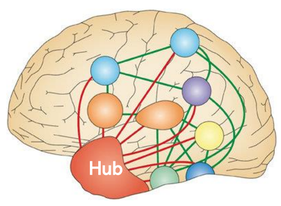
INTRODUCTION

Nowadays, it is well recognized that our sensorimotor processes have an influence on our conceptual system. To study this influence, the perceptual strength (PS) of a word could be particularly relevant.

AIM

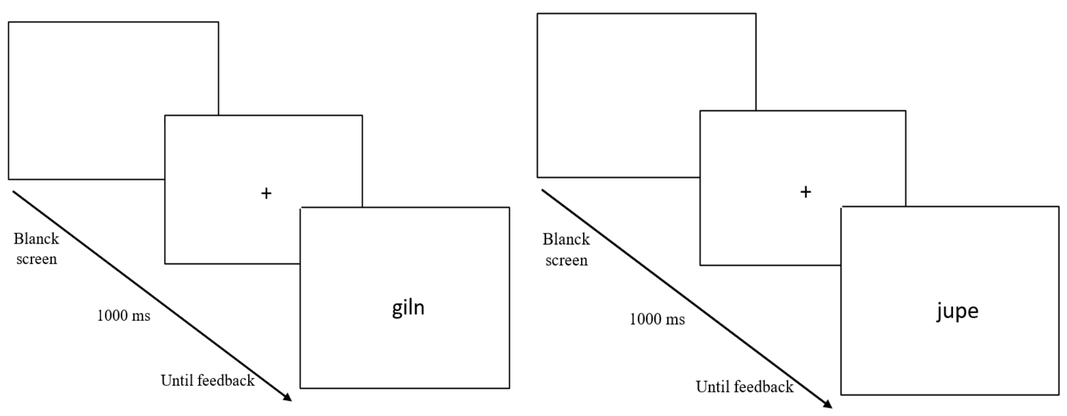
Exploring the impact of PS in the semantic form of primary progressive aphasia (Sf-PPA), a neurodegenerative disorder in which semantic knowledge is selectively deteriorated. This impact has been studied in relation to the Hub-And-Spoke hypothesis (Patterson & Lambon-Ralph, 2016).

↳ Knowledge emerges **in an amodal way** through a zone to which information converge, the **Hub**, but is initially activated in sensorimotor regions. The connections between these regions are called **Spokes**



METHOD

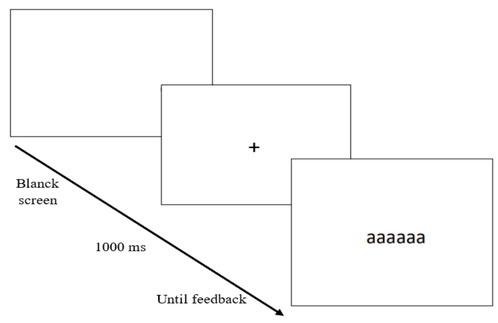
A **lexical decision task (LDT)** (Miceli et al., under review) with 28 words PS- and 28 words PS+ and 56 non-words.



Example of our lexical decision task

A **control motor task (CMT)** to obtain a more accurate reaction time regarding the lexical decision

↳ A set ranging from 3 to 10 possible letters, representing the "length" of the LDT items



Example of our control motor task

The words PS- & PS+ were matched on :	
Semantic properties	**Psycholinguistic properties**
AoA (p = .664)	**Number of letters** (p =.205)
Familiarity (p = .302)	**Number of phonemes** (p =.493)
Concretness (p = .053)	**Number of orthographic neighborhood** (p = .431)
Imageability (p = .254)	**Movie frequency** (p = .283)
Number of features (p = .752)	**Book frequency** (p = .466)
Emotional Valence (p = .204)	**OLD20** (p = .215)
Arousal (p = .078)	
BOI young (p = .152) **& BOI older** (p = .061)	

MEASURES & ANALYSIS

- Several neuropsychological tests & anxiety/depression scales to obtain data on the cognition and affects of our subjects
  ↘ GAI ; GDS ; MMS ; FAB ; 5 Words ; QCS ; Verbal Fluency ; PARIS
- **Accuracy in % (ACC)**
- **Reaction Time corrected by the CMT (RTc)**

POPULATION

Population	Age ; Gender	Inclusion criteria
3 patients Sf-PPA in different stages of pathology Sf-PPA1 : early stage Sf-PPA2 : moderate stage Sf-PPA3 : moderate/severe stage	Sf-PPA1 : 75yo ; Woman Sf-PPA2 : 74yo ; Male Sf-PPA3 : 74 yo ; Male	French speaker No sensory disturbances
47 healthy adults controls (>60 yo)	Mean age 73.49yo (±7.02) 22 Men – 25 Women	No neurological or psychiatric history

RESULTS

Neuropsychological test scores

Healthy controls & subjects Sf-PPA (Z score of Sf-PPA calculated on control group)

	GDS	GAI	MMS	FAB	5 words	Mini-QCS	Verbal Fluency P (raw)	Verbal Fluency Animals (raw)	PARIS
Control Mean (SD)	1.98 (1.71)	3.64 (4.27)	29.09 (0.80)	17.11 (1.15)	9.55 (0.88)	11.57 (0.68)	22.30 (8.09)	30.68 (8.14)	/
Sf-PPA1 (Z score)	3 (0.60)	5 (0.32)	27 (-2.60)	/	/	11 (-0.84)	23 (0.09)	21 (-1.19)	48
Sf-PPA2 (Z score)	2 (0.01)	6 (0.55)	24 (<-3)	/	/	6 (<-3)	2 (-2.51)	2 (<-3)	34
Sf-PPA3 (Z score)	2 (0.01)	2 (-0.38)	16 (<-3)	/	/	5 (<-3)	11 (-1.40)	4 (<-3)	34

Analysis for ACC (%)	*Scores PS-* *(n=28 items)*	*Scores PS+* *(n=28 items)*	Statistics & *p-value* *Mann-Whitney test [1] & Binomial test[2]*
ACC healthy group	99.70%	99.30%	U = 1002.50 ; p = .183[1]
ACC Sf-PPA1	100%	100%	/
ACC Sf-PPA2	100%	100%	/
ACC Sf-PPA3	78.57%	92.86%	p < .001[2]

Analysis for RT LDT RT – CMT = RT corrected	*Scores PS-* *(n=28 items)*	*Scores PS+* *(n=28 items)*	Statistics & *p-value* *Mann-Whitney test*
RTc healthy group	279.76 ms	274.8 ms	U = 1074 ; p = .818
RTc Sf-PPA1	96.68 ms	91.25 ms	U = 376.50 ; p = .80
RTc Sf-PPA2	588.38 ms	362.42 ms	U = 222.00 ; p <.001
RTc Sf-PPA3	-33.86 ms	-180.04 ms	U = 288.50 ; p = .09

Comparaison RTc	*T modified* (Crawford & Garthwaite, 2002)	*p-value & conclusion*	
Sf-PPA 1 vs healthy group	-0.404	p = .687	No difference for Sf-PPA1; Difference for Sf-PPA2 & 3
Sf-PPA 2 vs healthy group	-6.919	p < .001	
Sf-PPA 3 vs healthy group	-3.255	p < .001	

DISCUSSION

This study highlighted that **knowledge would keep an important part of sensorimotor information**.

Knowledge with more sensorimotor information could be accessible to patients **Sf-PPA in moderate stage** only because of the specific atrophy in this pathology.

Knowledge with more connections (i.e., Spokes) in the sensorimotor regions would be more robust for patients Sf-PPA.

Therefore, the model of a single Hub, as developed by Patterson and Lambon-Ralph (2016), would have little relevance explaining the process of knowledge creation, especially in explaining the particularities encountered in the Sf-PPA in this study.
Then, the Hub could not be completely amodal.

The non-effect encountered in healthy subjects and subject Sf-PPA1 could be related to a loss of sensitivity of our protocol due to the condition contrast between PS- and PS+ words.

Future research must be pursued

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