Recuperación del lenguaje y funciones cognitivas tras un ictus: un estudio longitudinal

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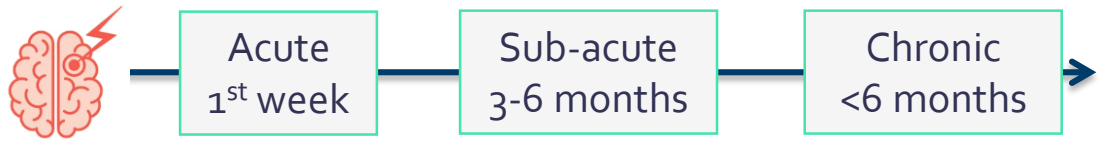
Relation between:

* Language comprehension and production:
  * How words are combined into sentences: grammar/syntax
  * The meaning of words and sentences: semantics
  * The sound of words and sentences: phonology/prosody
* Domain-general cognitive functions:
  * Selection and control of sensory information: Attention
  * How we maintain and manipulate information: Memory
  * Logic problem solving: Reasoning

Relation between language and DG abilities post stroke:

Variability

1) **Diverse post-stroke time of participants**



2) **Scope of language abilities tested**: either overall language abilities ("*aphasia quotient*") or one single ability ("*naming*")

3) **Type of tasks/instructions**: verbal output and comprehension of complex instructions are expected in DG tests

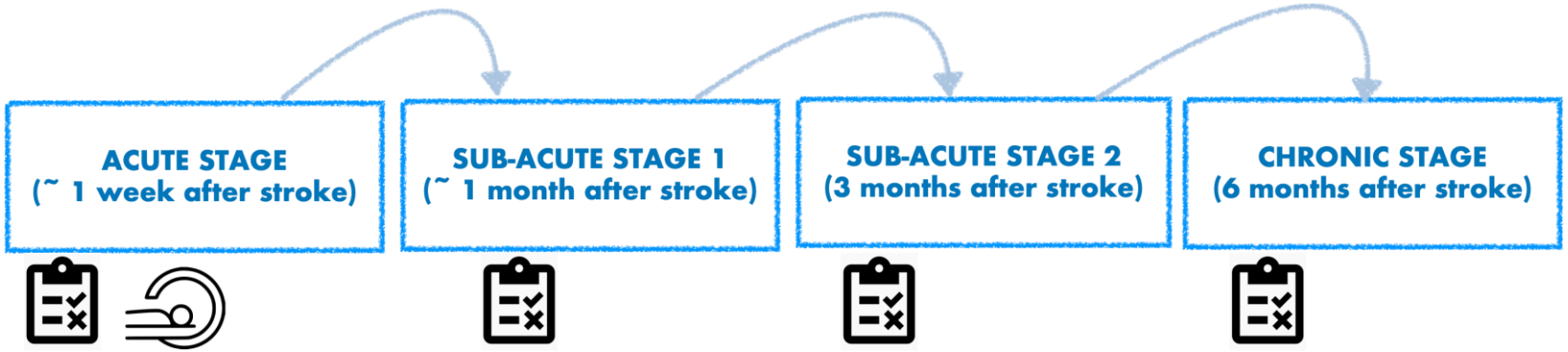
The current study

What is the relation between DG and linguistic functions during recovery from stroke?

* **Stable?** Language ~ DG functions at all times
* **Dynamic?** Language ~ DG functions at some but not all stages of recovery
* **Is it the same across linguistic domains?**

Relevance for the design of therapeutical plans

The current study

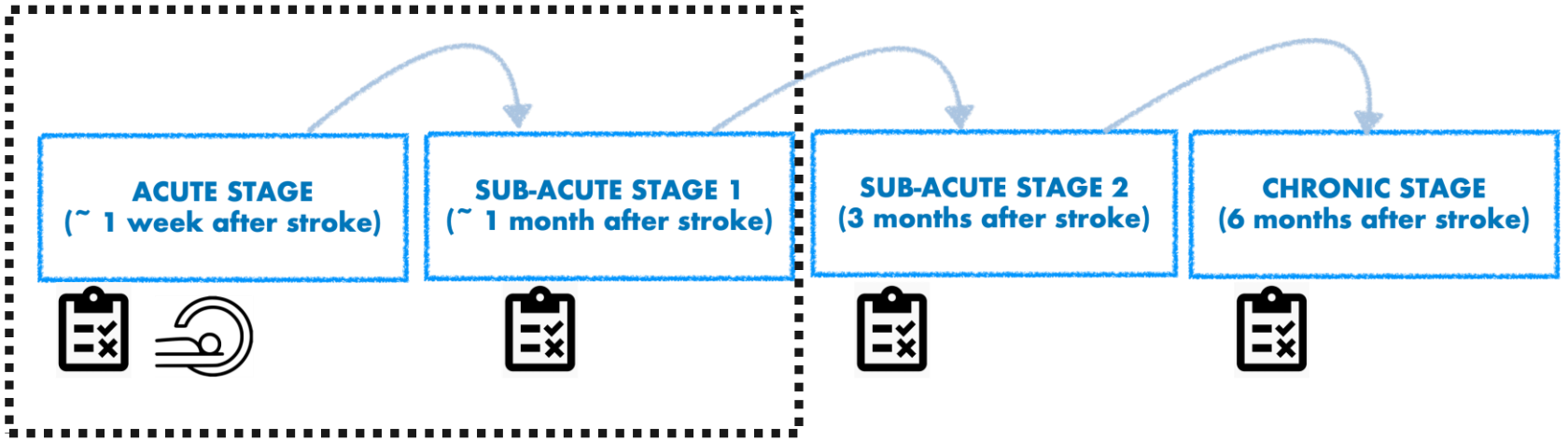


- **Inclusion criteria:**
  - LH or RH stroke
  - First ischemic stroke (left or right hemisphere)
  - Native Spanish speaker
- **Exclusion criteria:**
  - Any cognitive impairment before the event
  - Previous stroke
  - Severe aphasia, motor, hearing or visual deficits

90+ patients tested so far (LH + RH)

- 14 complete follow-ups
- Control group (non-brain damaged participants)

The current study: Today

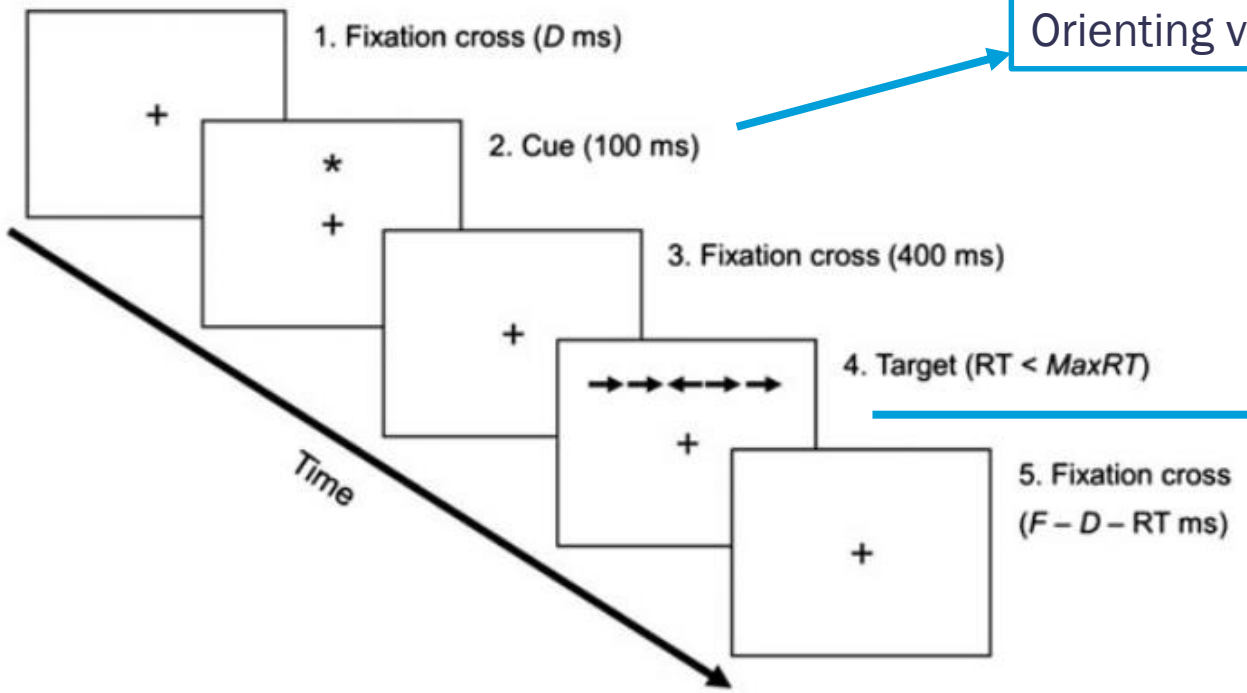


17 LH, 16 RH

- Comprehension / Production
- Attention network

Methods: attention network task (ANT)

Material



Cue vs.no-cue → **ALERTING NETWORK**

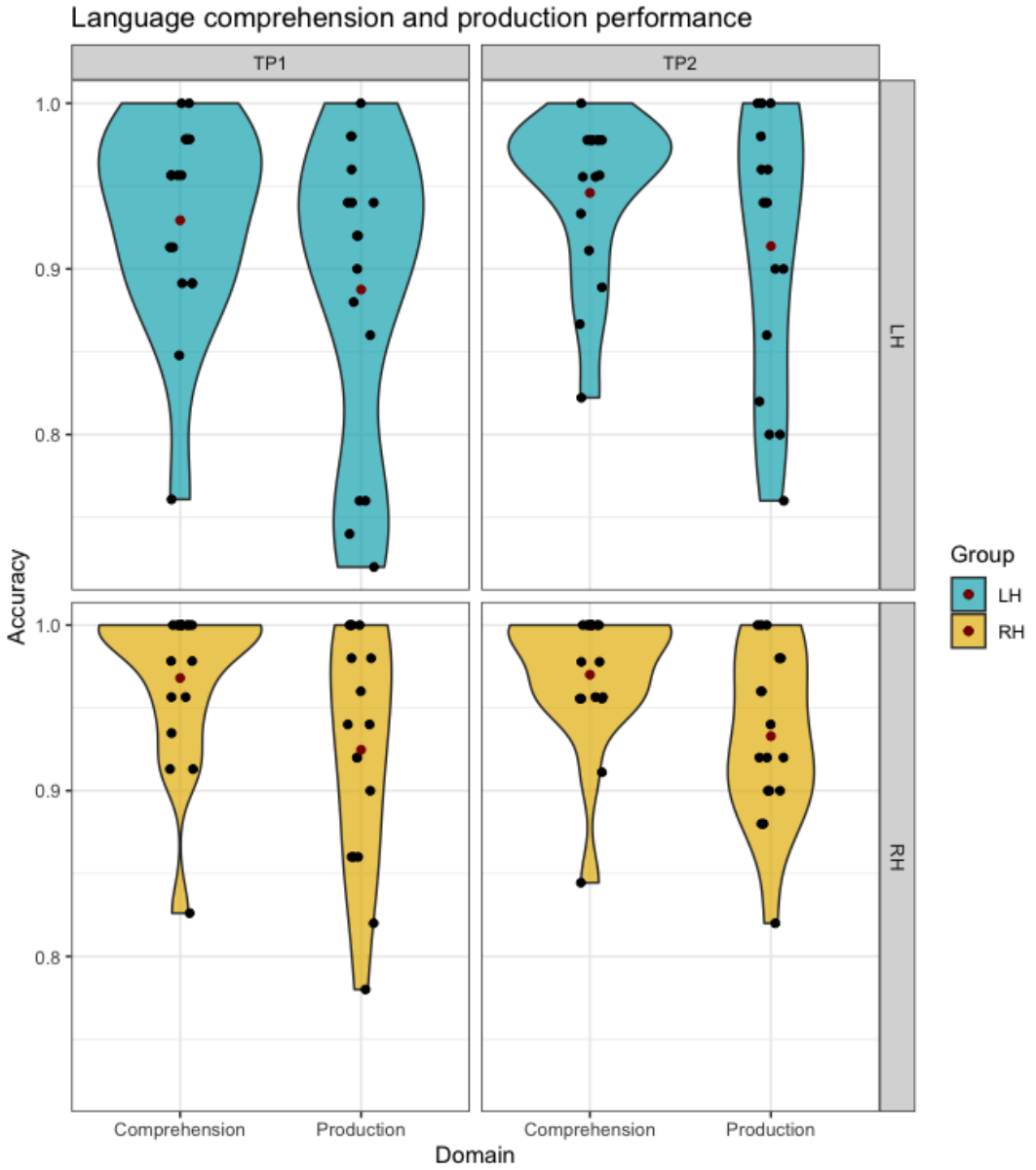
Orienting vs. non-orienting cues → **ORIENTING NETWORK**

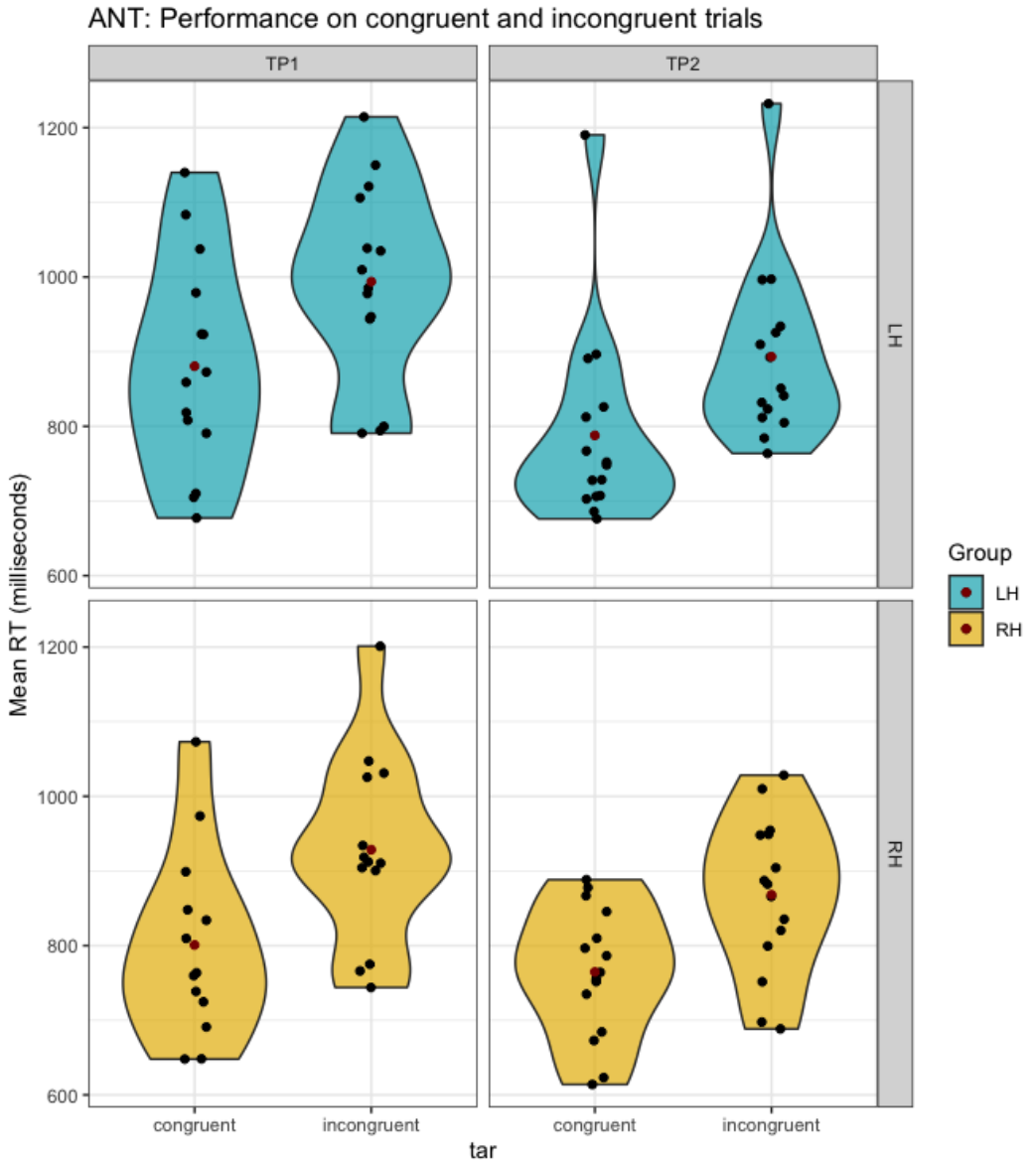
CONFLICT/EXECUTIVE ATTENTION NETWORK

Congruent trials:

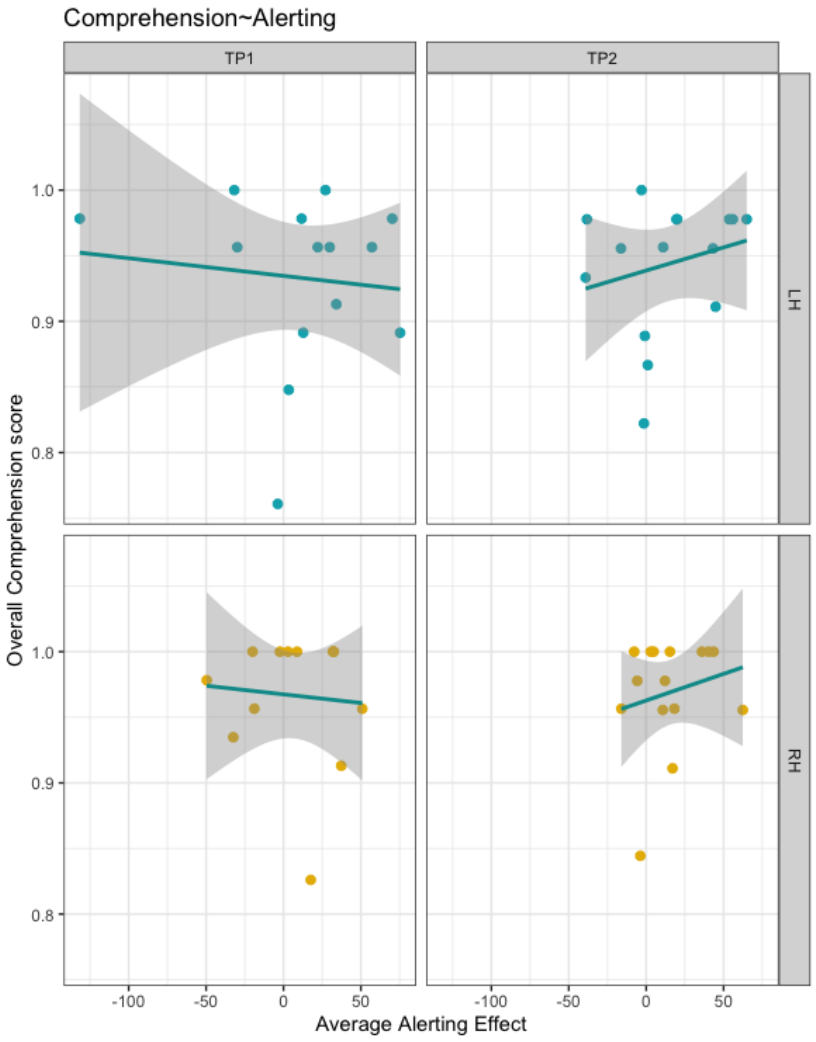
Incongruent trials

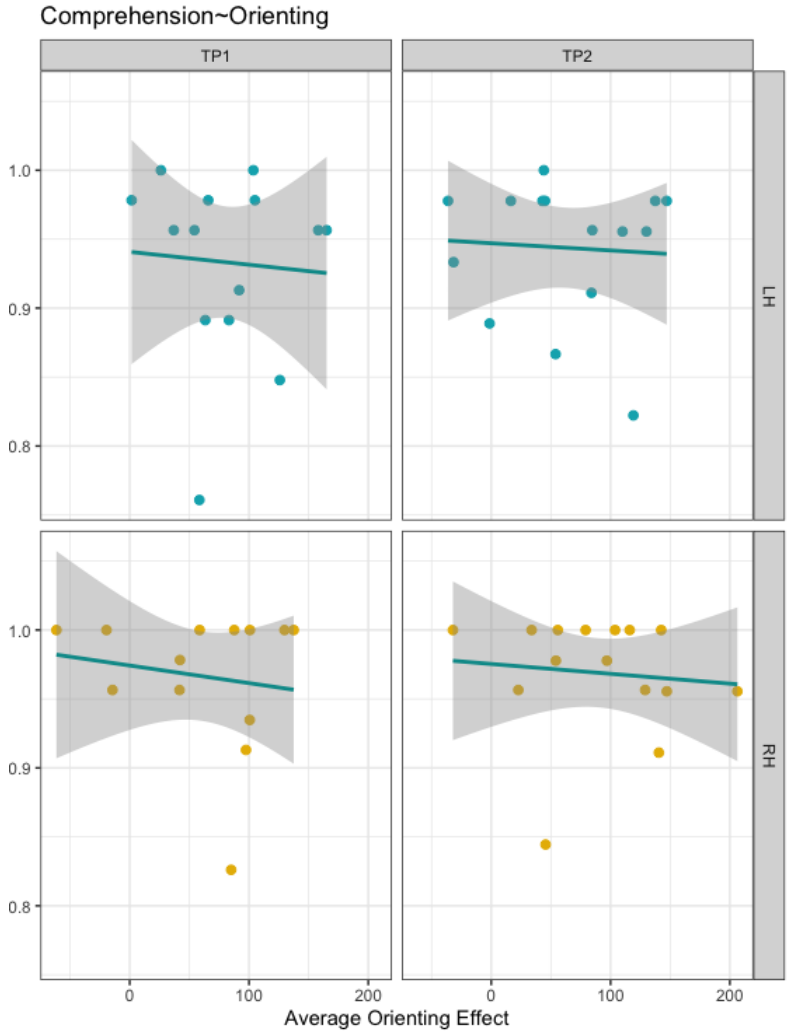
Results: overall performance

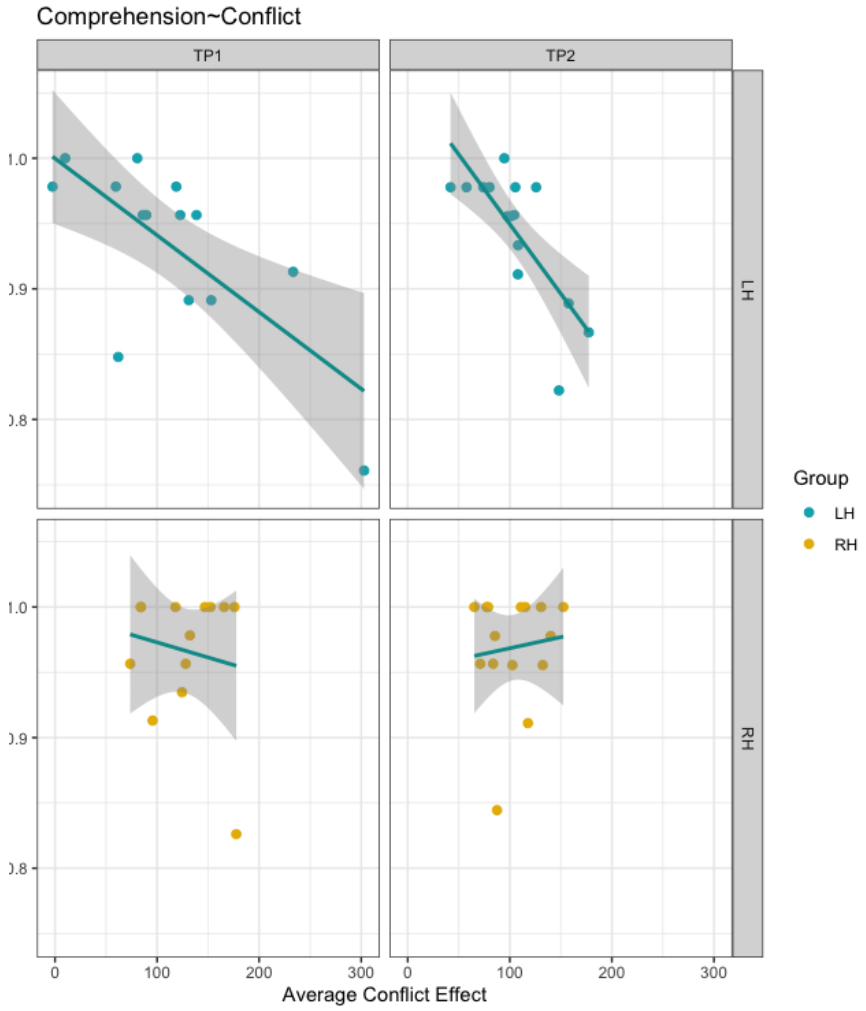




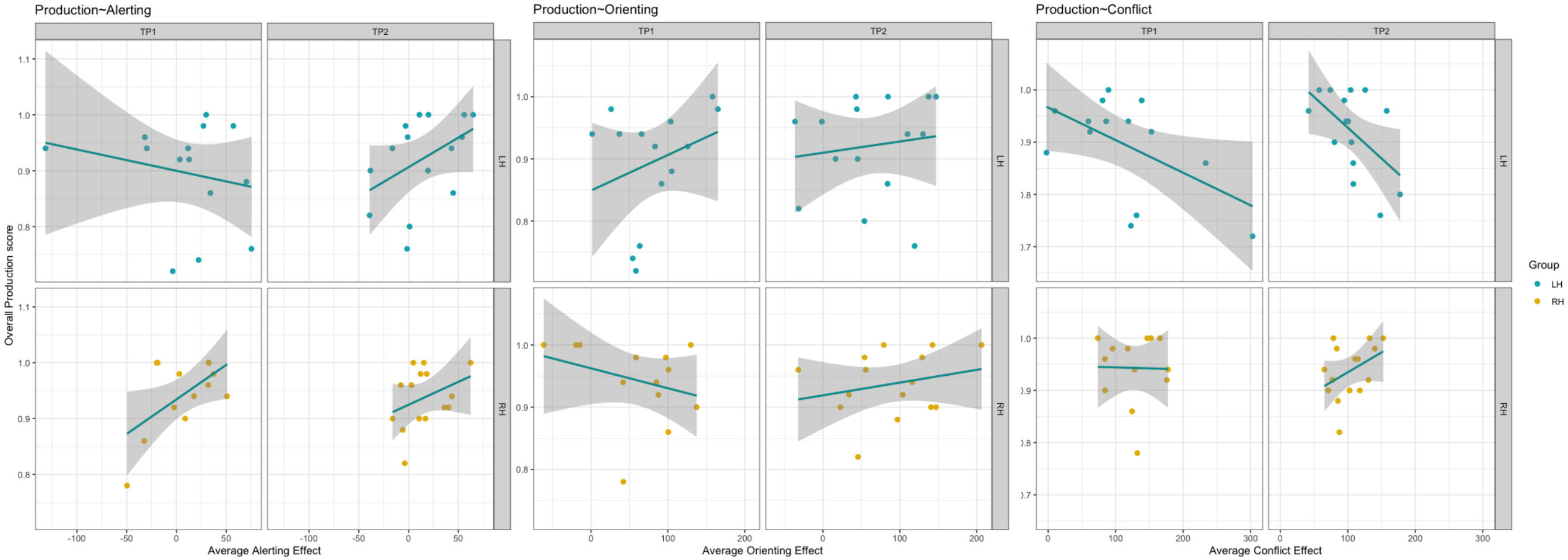
Results: comprehension and attention network







Results: production and attention



During the 1st month post stroke:

* Both language comprehension and production are associated with **executive control functions, especially after LH damage:**

  * Targeting executive control during therapy at early stages can enhance linguistic performance?

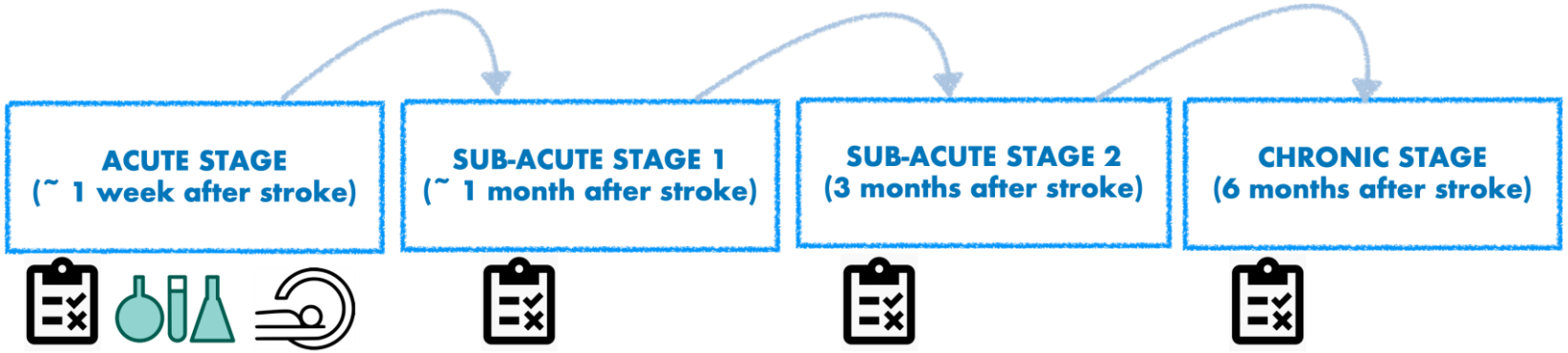
Limitations and future directions

* Small sample of LH patients with mild or no aphasia

* More information from testing at successive TPS (from 3 months post stroke) & DG functions

* Test association between attention network and spontaneous speech

Future directions



Role of molecular biomarkers and blood-brain barrier disruption in predicting language and cognitive impairment

With Abraham Martín (Achucarro) & Pedro Ramos (CIC biomaGUNE)

¡Gracias!

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Relation between language and DG abilities:

Controversial evidence:

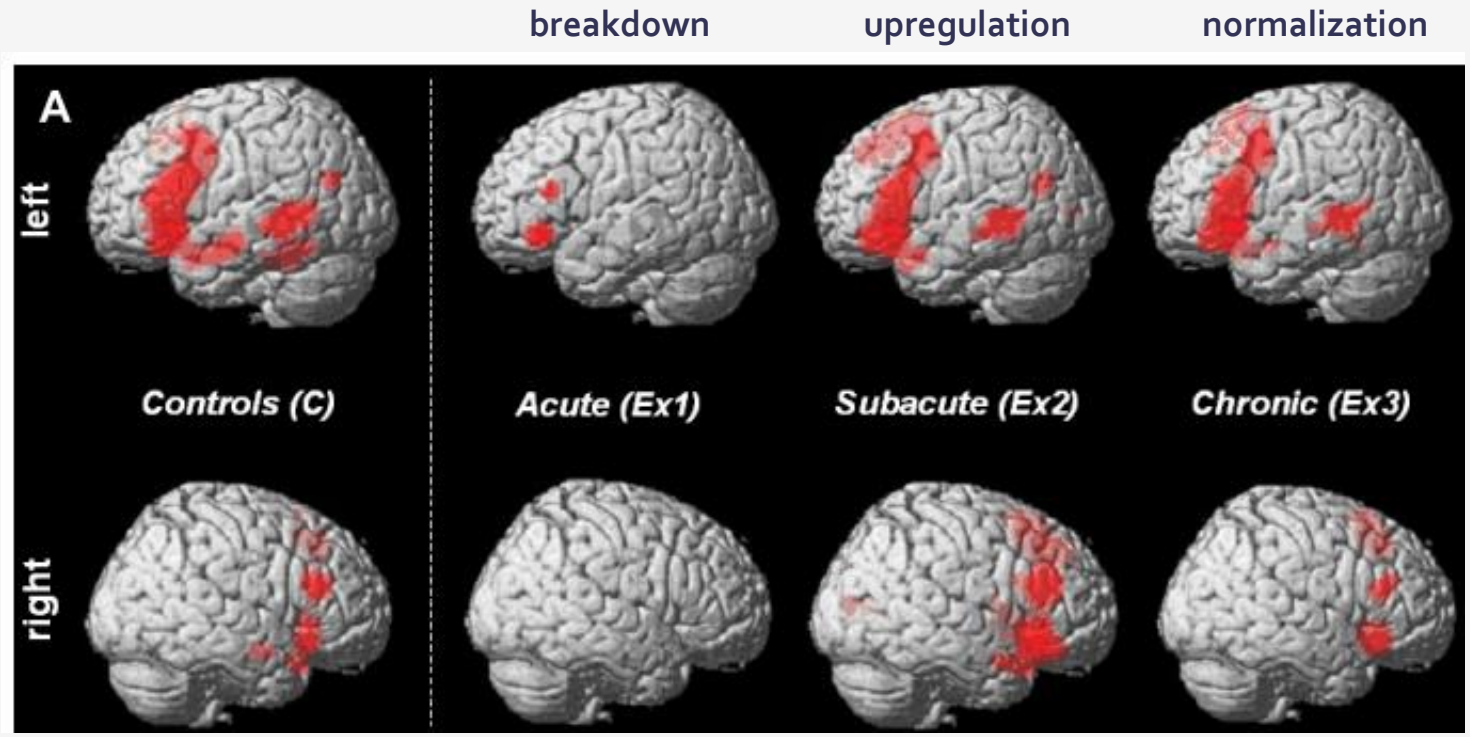
* Language **highly reliant** on DG mechanisms during language production but not comprehension

* Core linguistic functions (syntax) are **independent** from DG mechanisms

(Campbell et al. 2016; Diacheck et al. 2020 Fedorenko, 2014; Fedorenko & Thompson-Schill, 2014; Gerenmayeh et al. 2012, 2014)

Relation between language and DG abilities post stroke:

Dynamics of language reorganization over time



Impact of domain-general functions over linguistic functions during recovery might be **dynamic**.

(Saur et al., 2006)

Introduction

2) Scope of language abilities tested

Overall scores on language based on:

- Comprehensive Aphasia Test (CAT)
- Western Aphasia Battery (WAB)

→ Missing assessment of comprehension and production in each linguistic level.

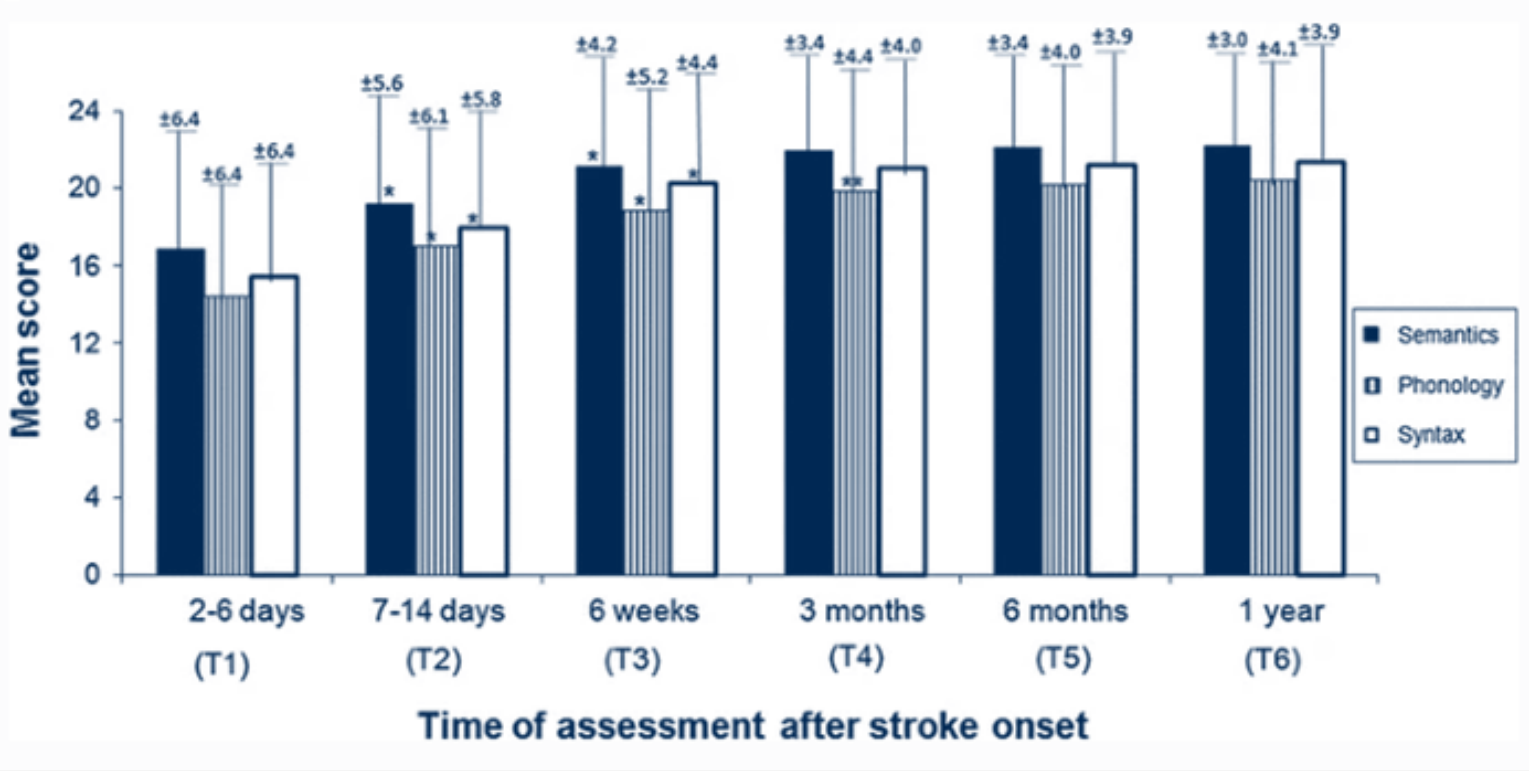
Narrow scope:

- Boston Naming Test

(e.g. Fucetola et al. 2009; Wall et al., 2017, Gonzalez et al., 2020, El Hachioui, 2013)

Introduction

2) Scope of language abilities tested



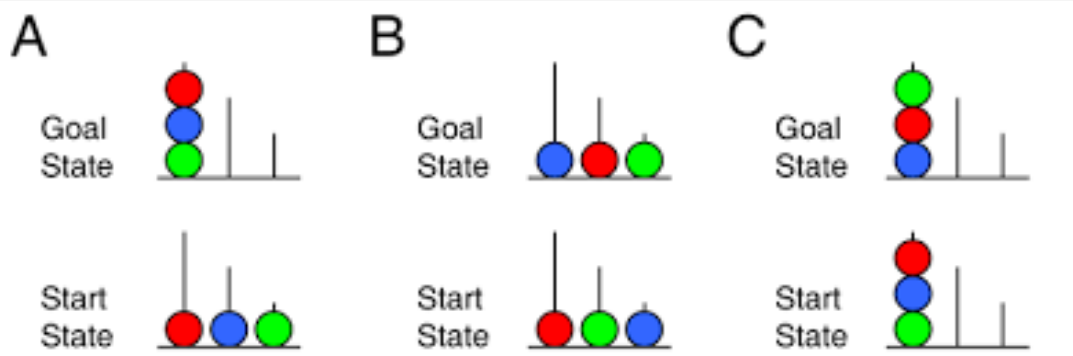
Linguistic levels may **differ** with respect to their underlying mechanisms and recovery rate

(e.g. El Hachioui, 2013)

Introduction

3) Verbal output and comprehension of complex instructions expected in DG tests

- Brixton Spatial Anticipation Test
- Tower of London Test



Linguistic impairments can elicit confounding effects.

- Animal fluency (language and executive functions)

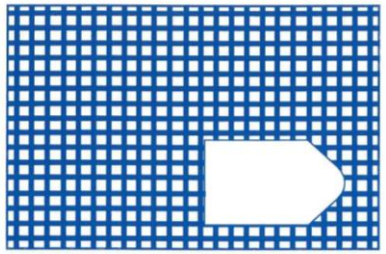
(Wall et al., 2017,)

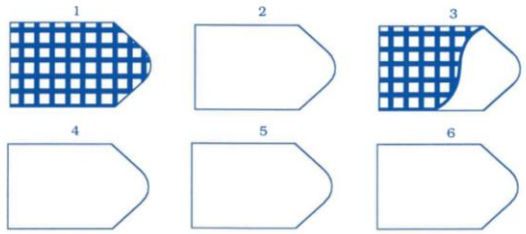
Methods

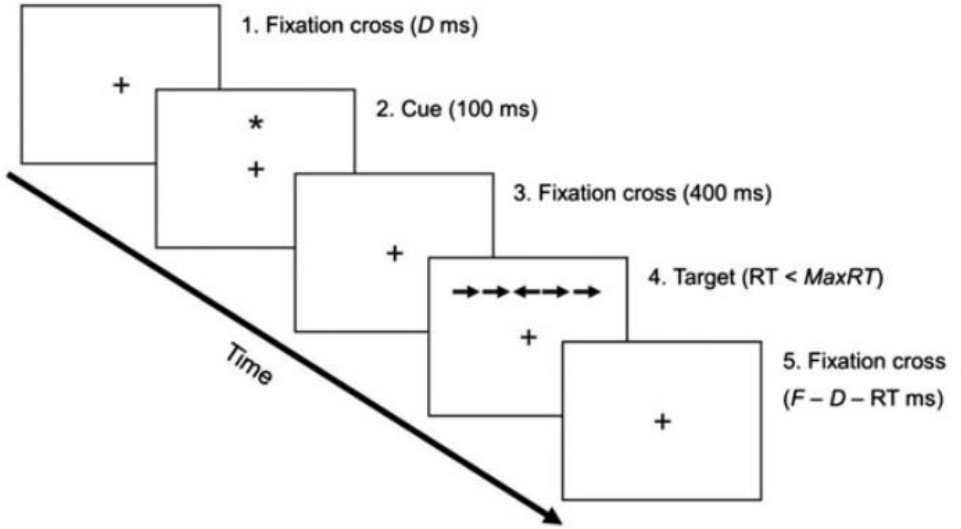
Material

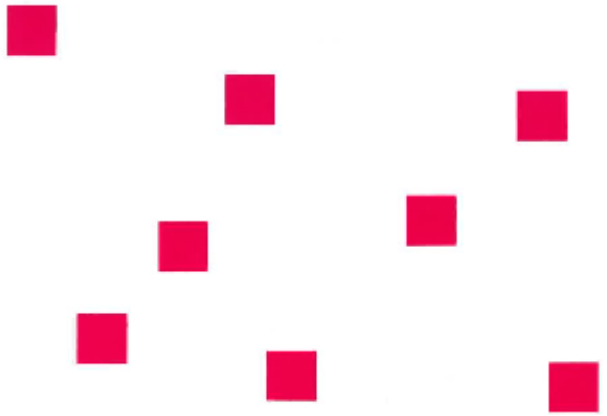
Domain-general tasks

- **Attention**: Attention Network Test
- **Short-term memory**: Digit and tap spans
- **Reasoning**: Raven Colored Progressive Matrices









Linguistic Tasks

Phonology

Discrimination task (words and pseudowords)

Estímulo	Palabra 1	Palabra 2	Tipo de palabra	¿Iguales?
0	edificio	edificio	word	yes
0	gimbre	nimbre	pseudoword	no
1	barro	barro	word	yes
2	gar	sar	pseudoword	no

Repetition (word-sentence)

Estímulo	Input
0	luz
0	los pies
1	bar
2	can
3	pulgón
4	carne
5	la ropa sucia
6	sonaja vendida
7	una caja muy grande
8	un cebollín muy ovado
9	Mi vecino siempre hace mucho ruido.

Linguistic Tasks

Syntax

Grammaticality Judgement Task

Estímulo	Enunciado	Gramatical
0	Las **mañana** en mi casa son muy complicadas.	no
0	El ordenador de mi oficina funciona muy bien.	yes
1	Durante la clase de mañana diré cosas importantes.	yes
2	El hombre **tiendes** la ropa mojada afuera.	no
3	La butaca **rojo** del cine es muy cómoda.	no
4	En la tienda grande, el patinete es rojo.	yes
5	Esta es una sartén de la casa de mi mamá.	yes
6	**La** cuevas cerca de la montaña son peligrosas.	no

Linguistic Tasks

Syntax

Phrase-sentence elicitation task

Number agreement
Examiner: La antorcha
Participant: las antorchas

altavoz

Gender agreement
Examiner: El altavoz negro
Participant: El baston negro

bastón

Predicative number agreement
Examiner: Este es un anillo
Participant: Estos son unos anillos

batidora

Predicative gender agreement
Examiner: La batidora es morada
Participant: La espada es morada

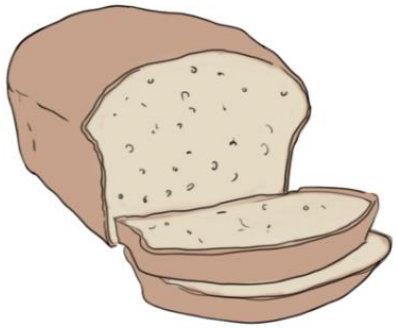
espada

Subject-verb-argument agreement
Participant: El gato persigue al raton.

Linguistic Tasks

Semantics

Picture verification



Examiner: PAN?

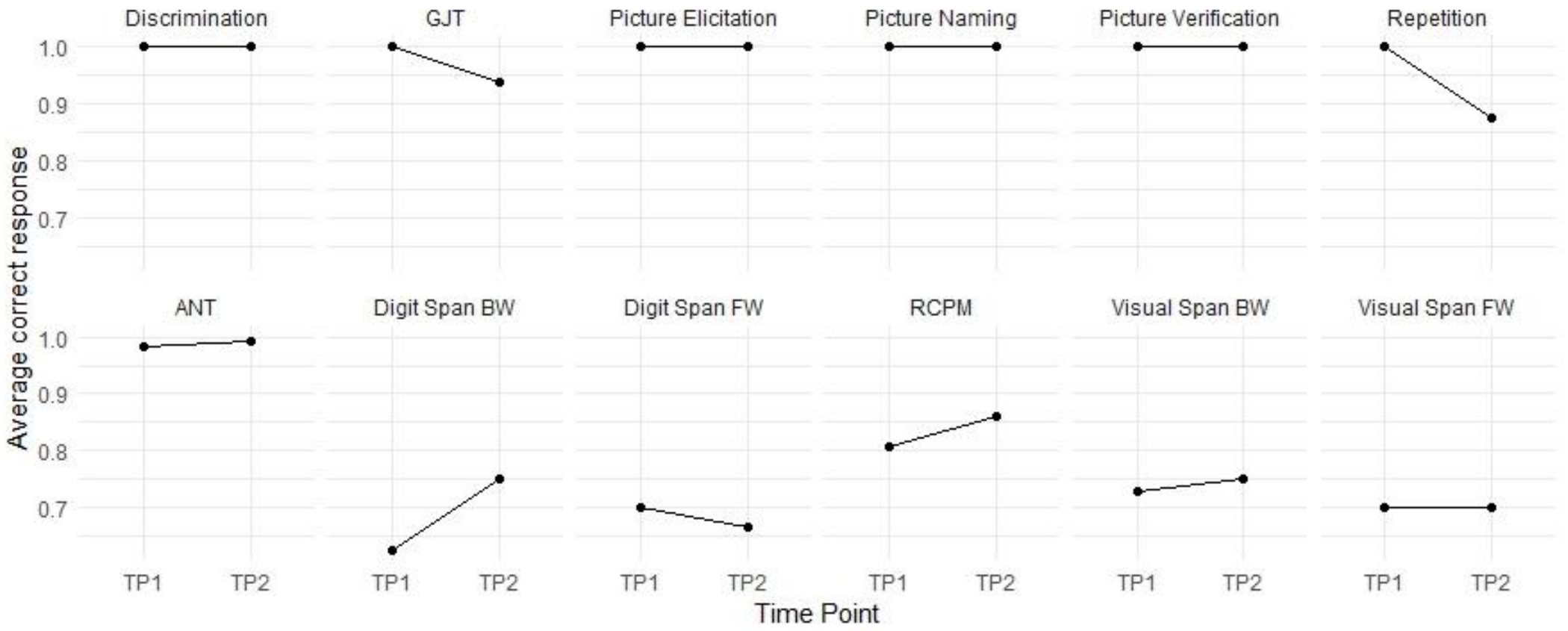
Participant: YES

Naming task

Table 1. Information of participants included

	Patients	NBD
Age, mean years (*SD*)	63.21 (9.26)	63.20 (9.15)
Gender Female/male	 4/13	 4/12
Handedness n Right-handed Left-handed	 16 1	 15 1
Education, mean years (*SD*)	11.51 (2.39)	13.16 (3.36)
Localization of stroke *n* Left hemisphere Right hemisphere	 8 9	 NA

Left-handed participant



Models of global scores

Model	df	df_diff	Chi2	*p* value
Global LNG ~ 1	2			
Global LNG ~ Global DG	3	1	3.45	0.063
Global LNG ~ Global DG + Group	4	1	6.89	0.009
Global LNG ~ Global DG * Group	5	1	0.80	0.372
Global LNG ~ Global DG * Group + TP	6	1	0.63	0.428
Global LNG ~ Global DG * Group + TP * Global DG	7	1	0.13	0.720
Global LNG ~ Global DG * Group + TP * Global DG + TP * Group	8	1	1.61	0.205
Global LNG ~ Global DG * Group * TP	9	1	2.54	0.111