Validation of the *Brief Evaluation of Receptive Aphasia* (BERA) in minimally conscious and emerging patients after coma

Journée GCPN

November 29st, 2024

Aubinet, C., Regnier, A., Gillet, A., Cardone, P., Fritz, P., Gosseries, O. & Majerus, S.

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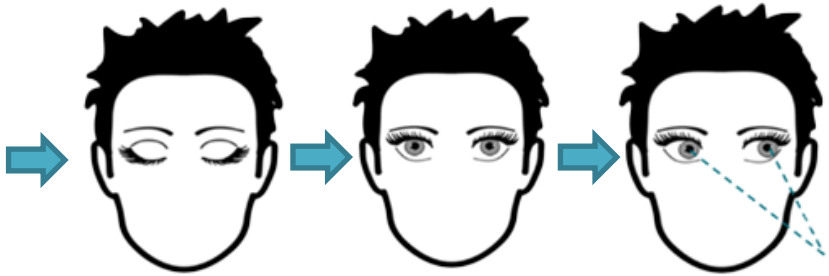
Consciousness disorders after severe brain injury

Recovery of consciousness after coma

Trauma
Anoxia
Hemorrhage
Metabolic
Infection
Inflammation



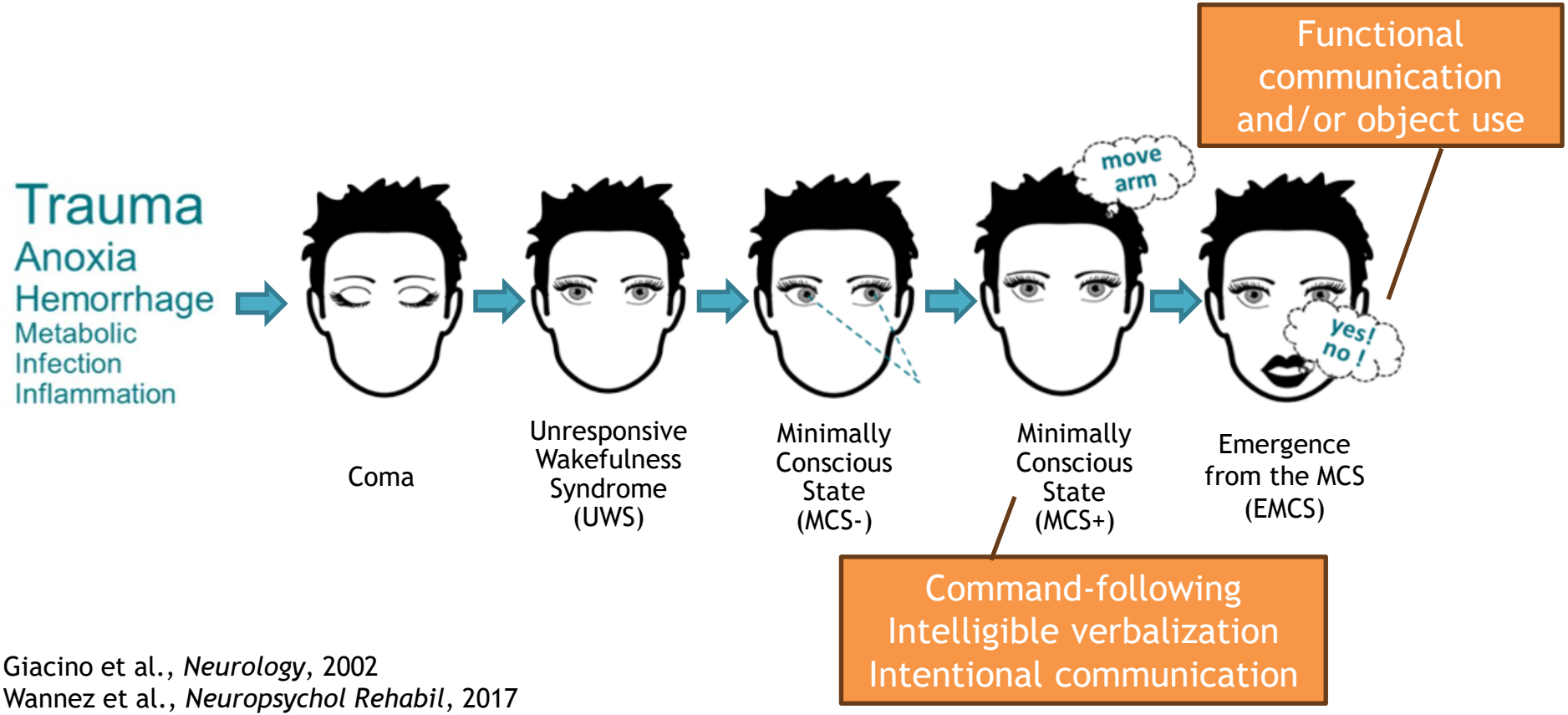
Coma

Unresponsive Wakefulness Syndrome (UWS)

Minimally Conscious State (MCS-)

Giacino et al., *Neurology*, 2002
Wannez et al., *Neuropsychol Rehabil*, 2017

Recovery of consciousness after coma

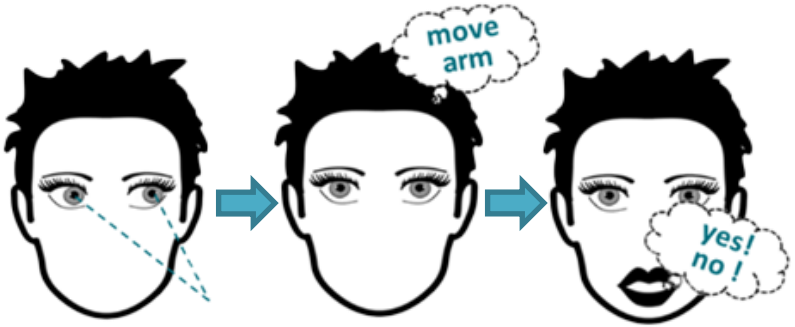


Giacino et al., *Neurology*, 2002
Wannez et al., *Neuropsychol Rehabil*, 2017

30-40% risk of consciousness misdiagnosis

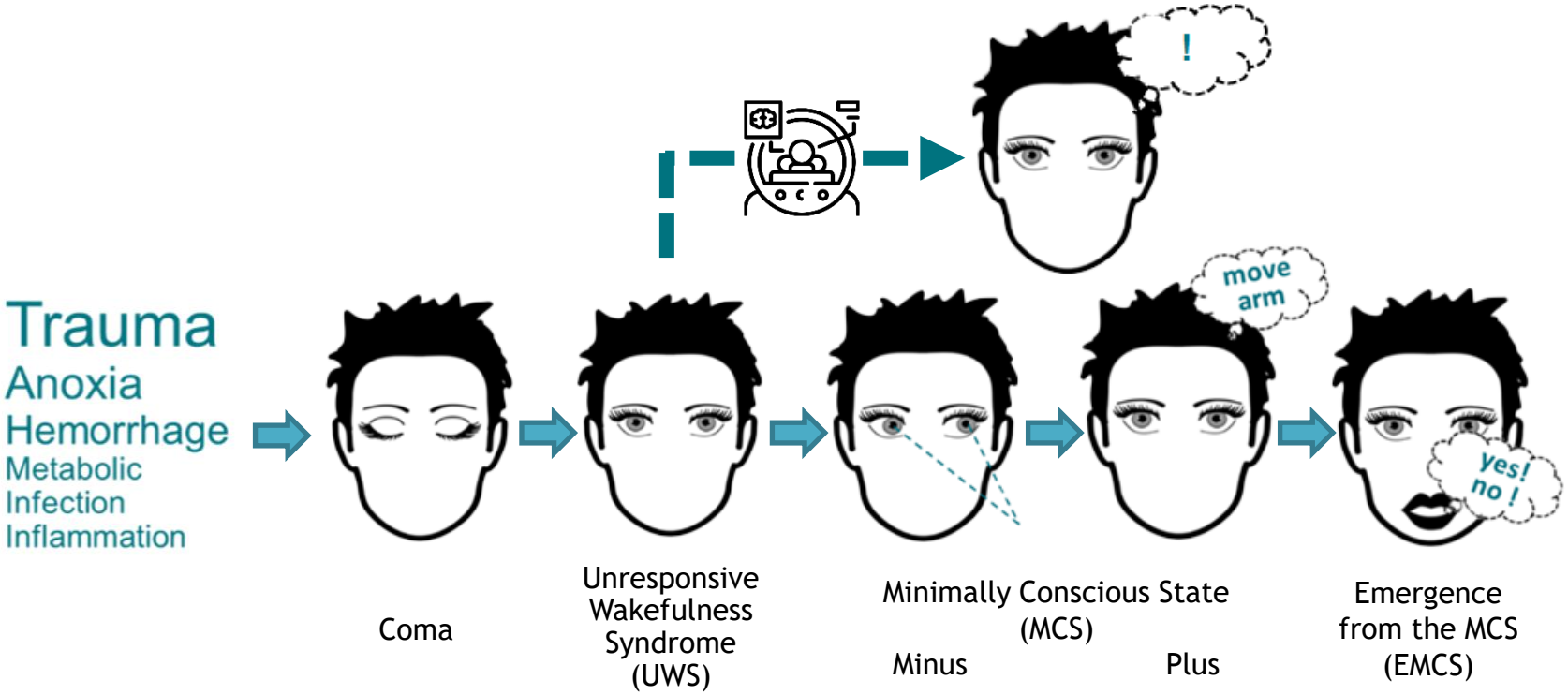
Deafness
Blindess
Motor impairment
Aphasia
…

Underestimated consciousness!!!



Schnakers et al., *BMC Neurol*, 2009
Schnakers et al., *NNR*, 2015

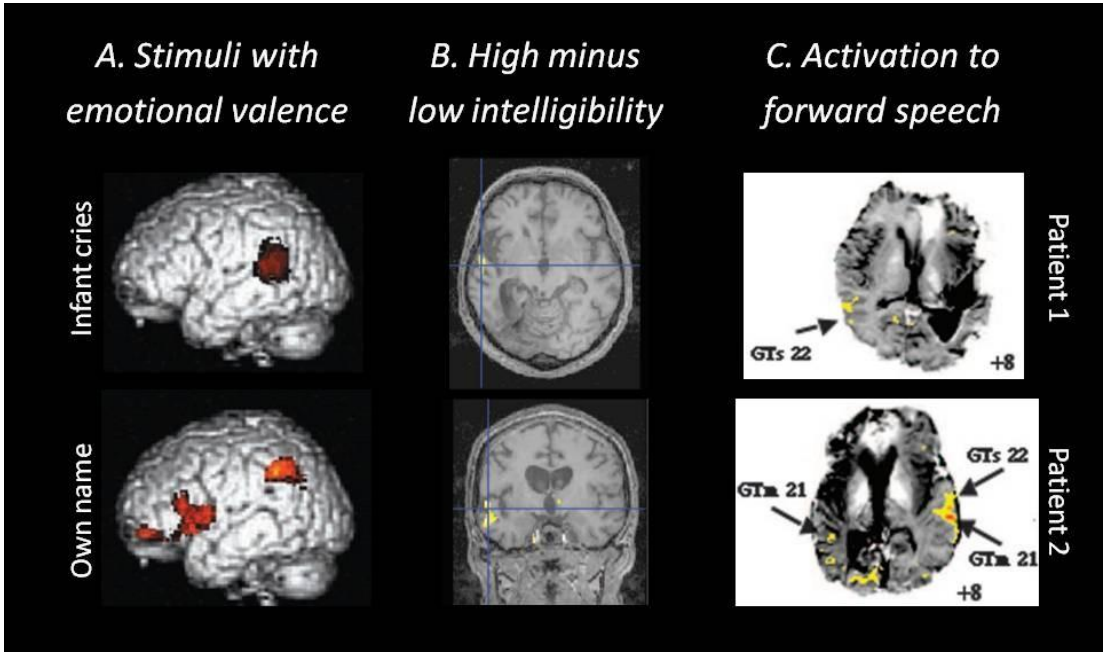
Neuroimaging paradigms to detect covert consciousness



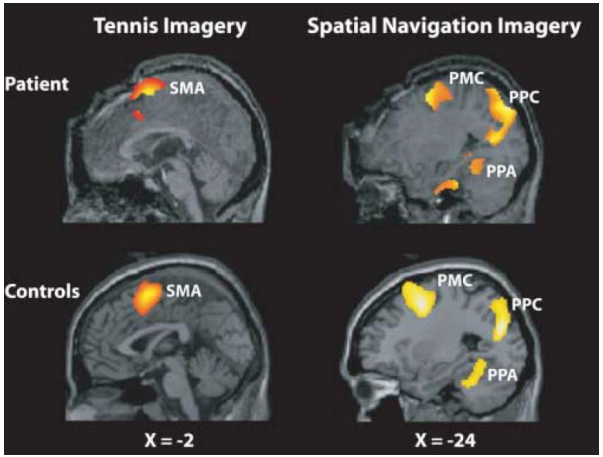
Thibaut et al. *Ann Neurol*, 2021

Neuroimaging paradigms to detect covert consciousness

Passive tasks



Active tasks



Laureys et al., 2004
Owen et al., 2005
Schiff et al., 2005
Monti et al., 2010

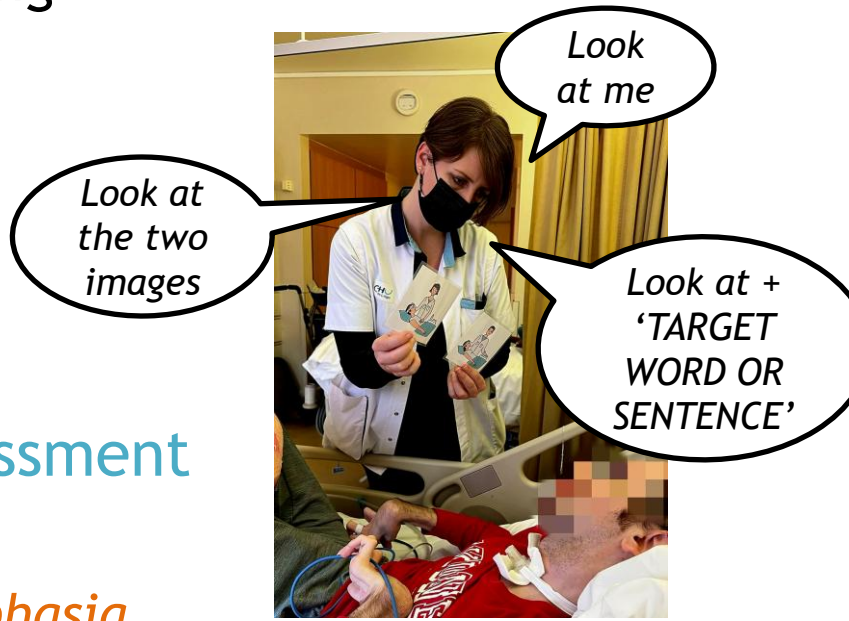
→ Reliance on residual language processing

Behavioral assessment scales to diagnose consciousness levels

CRS-R, SECONDs: command-following and communication items

BUT no language assessment…

→ Language components?
→ Psycholinguistic variables?



Towards a language-specific assessment

Elaboration of the
Brief Evaluation of Receptive Aphasia
(BERA)

Aubinet et al. (2021), *Brain Inj.*

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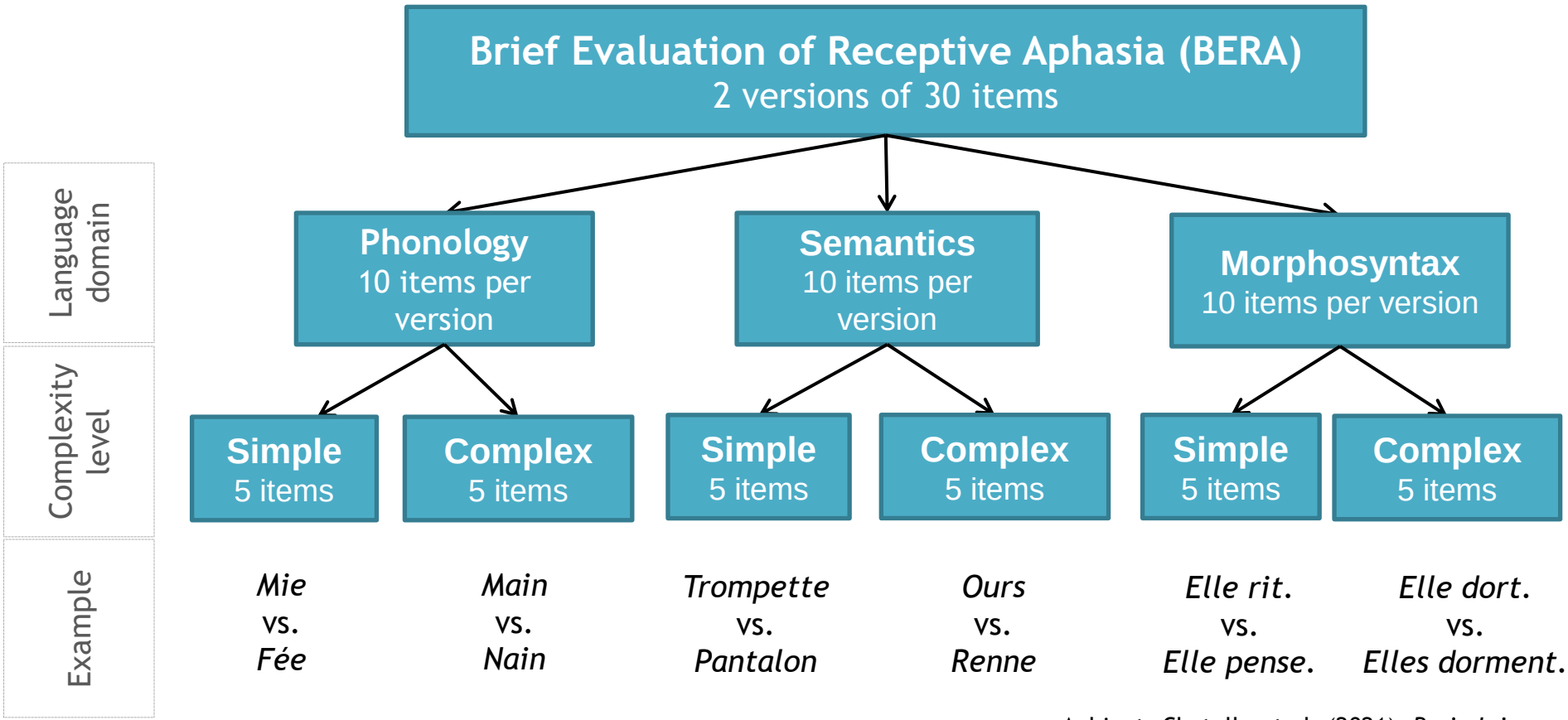
Development of the BERA tool

Elaboration of the BERA language-specific tool

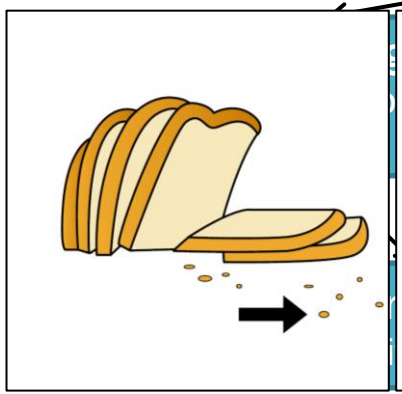


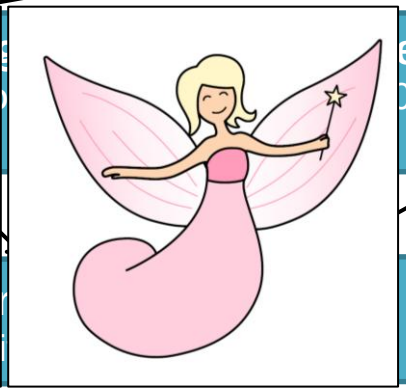
Aubinet, Chatelle et al. (2021), *Brain Injury*

Elaboration of the BERA language-specific tool

Brief Evaluation of Receptive Aphasia (BERA)
2 versions of 30 items

Language domain		**emantics** 0 items per version		**Morphosyntax** 10 items per version	
Complexity level			**Complex** 5 items	**Simple** 5 items	**Complex** 5 items
Example	*Mie* vs. *Fée*	*Main* vs. *Nain*	*Trompette* vs. *Pantalon*	*Ours* vs. *Renne*	*Elle rit.* vs. *Elle pense.*	*Elle dort.* vs. *Elles dorment.*





Aubinet, Chatelle et al. (2021), *Brain Injury*

Elaboration of the BERA language-specific tool

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2 versions of 30 items

Morphosyntax
10 items per version

Language domain					
Complexity level	Sim… 5 ite…		…Complex 5 items	Simple 5 items	Complex 5 items
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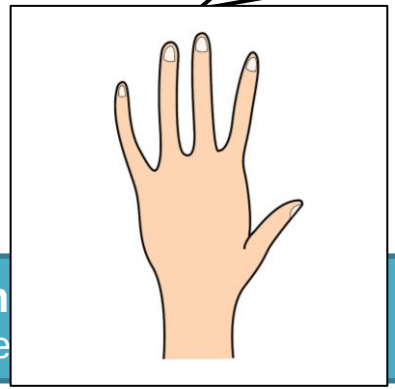
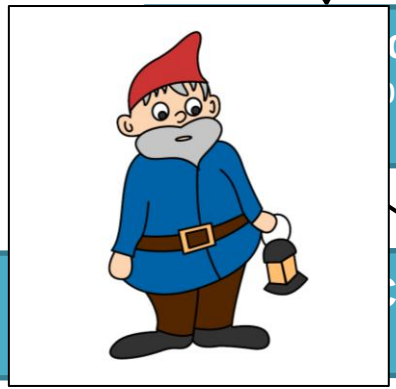


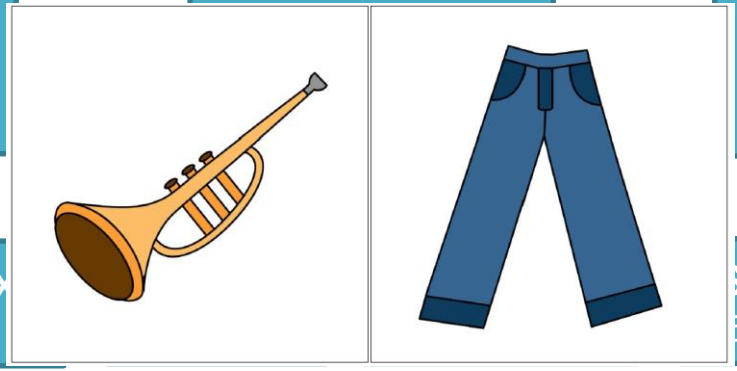


Aubinet, Chatelle et al. (2021), *Brain Injury*

Elaboration of the BERA language-specific tool

Brief Evaluation of Receptive Aphasia (BERA)
2 versions of 30 items

Language domain	Complexity level	Example
Phonology 10 items per version	**Simple** 5 items	*Mie* vs. *Fée*
	Complex 5 items	*Main* vs. *Nain*
		Trompette vs. *Pantalon*
		Ours vs. *Renne*
Morphosyntax 10 items per version	**Simple** 5 items	*Elle rit.* vs. *Elle pense.*
	Complex 5 items	*Elle dort.* vs. *Elles dorment.*



Aubinet, Chatelle et al. (2021), *Brain Injury*

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Complexity level	**Simple** 5 items	**Comple** 5 items			**Simple** 5 items	**Complex** 5 items
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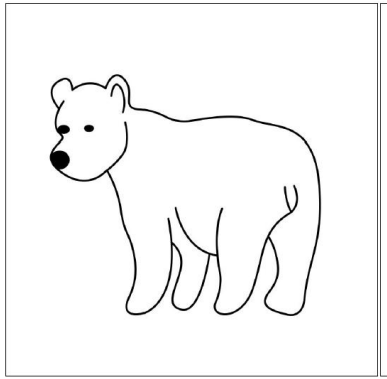

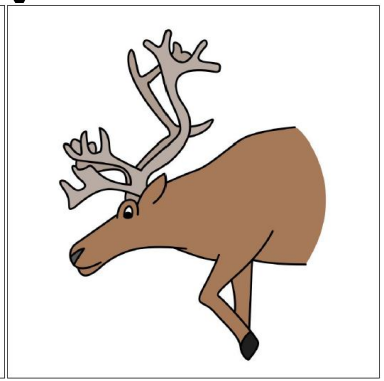

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Language domain	**Phonology** 10 items per version					**ax** sion
Complexity level	**Simple** 5 items	**Complex** 5 items	**Simp** 5 item			**mplex** items
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Elaboration of the BERA language-specific tool

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2 versions of 30 items

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Aubinet, Chatelle et al. (2021), *Brain Injury*

Administration and scoring of the BERA tool

- Word comprehension (= phonology and semantics) then sentence comprehension **if** the patient succeeds at least for half of word targets
- For each item, indicate whether the fixation was:
  - Correct (C)
  - Incorrect (E) = towards the distractor
  - Hesitant (H) = from one image to the other one
  - Random (A) = elsewhere, anywhere
- Words /20 + Sentences /10
  - Subscales /10 → simple /5 vs. complex /5
  - + Semantics: /10 → frequent /5 vs. non-frequent /5
  - Left /10 or /15 vs. right /10 or /15
- Stop criterion : no visual fixation (either correct or incorrect) for 5 consecutive items

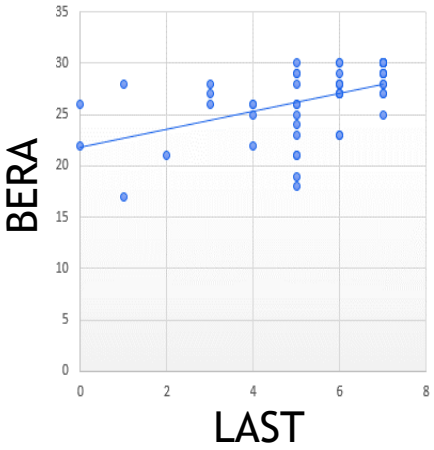
Pre-validation of the BERA tool

Validation in 52 aphasic conscious patients

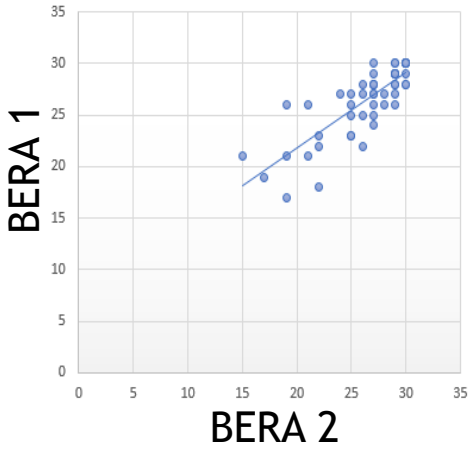
Content validity

	V1	V2	V3
V2	r = 0,858* p = 0,003	/	/
V3	r = 0,945* p < 0,001	r = 0,833* p = 0,020	/
V4	r = 0,677* p = 0,045	r = 0,935* p < 0,001	r = 0,670* p = 0,049

Concurrent validity



Intra-rater reliability



Inter-rater reliability: α=0,919*

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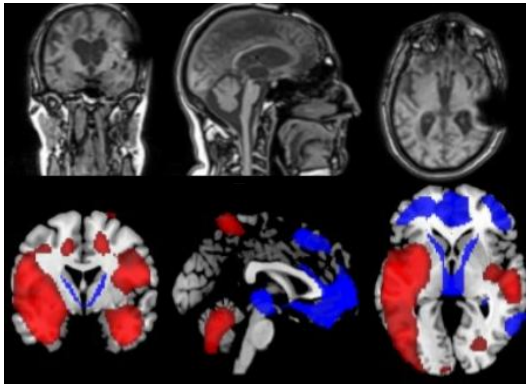
Pre-validation of the BERA tool

Feasibility in post-comatose patients

EMCS

BERA: 22/30
Phonology: 7/10
Semantics: 8/10
Morphosyntax: 7/10

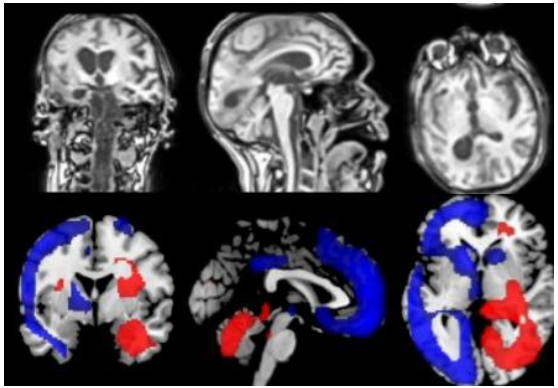
CRS-R: 23/23



MCS-

BERA: 16/30
Phonology: 7/10
Semantics: 6/10
Morphosyntax: 3/10

CRS-R: 9/23



- Feasible in this population
- Complementary to other scales (CRS-R, SECONDs)
- Refined cognitive and language profiles

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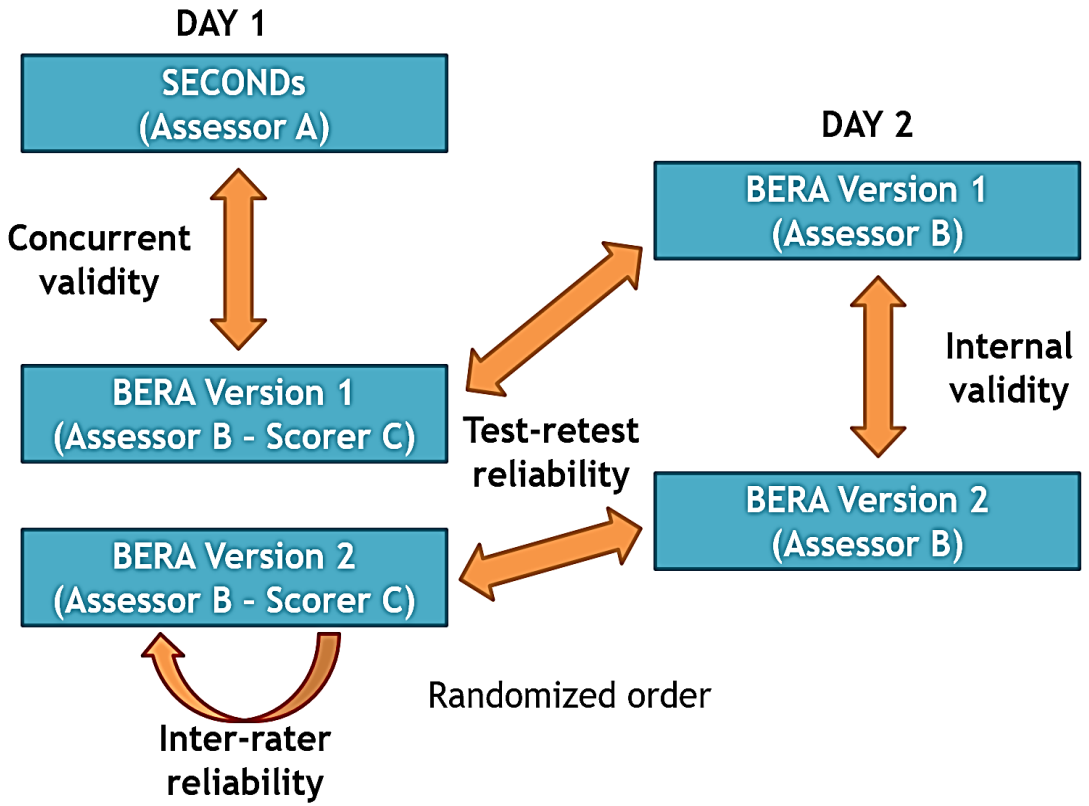
Validation in post-comatose patients

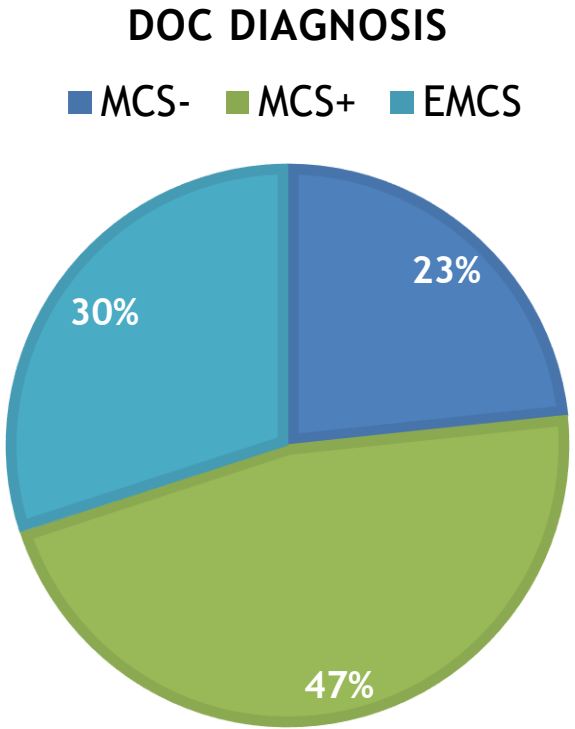
Inclusion criteria and validation procedure

n = 48 patients

- Coma following severe brain injury
- Time post-onset: > 28 days
- Age: 18-80 y.o.
- French-speakers
- Preserved visual fixation or pursuit



Preliminary results in post-comatose patients



30 included patients

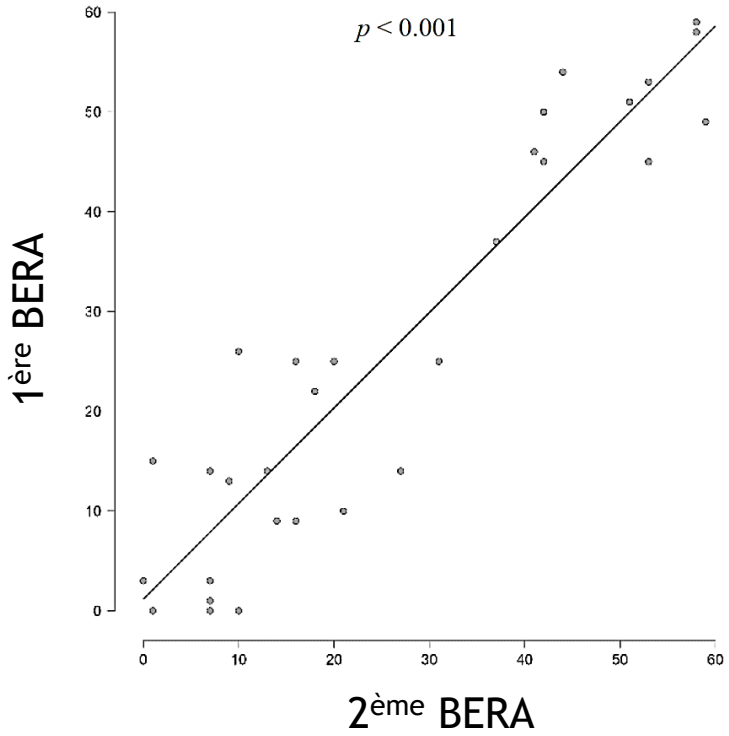
- Duration mean for one version: 13,9 ± 4,7 min
- 12/30 patients could perform the morphosyntax subscale
  - 4 MCS+
  - 8 EMCS

Preliminary results in post-comatose patients

Psychometric data (n = 30)

Inter-rater reliability:

ICC = 0.996*



Test-retest reliability

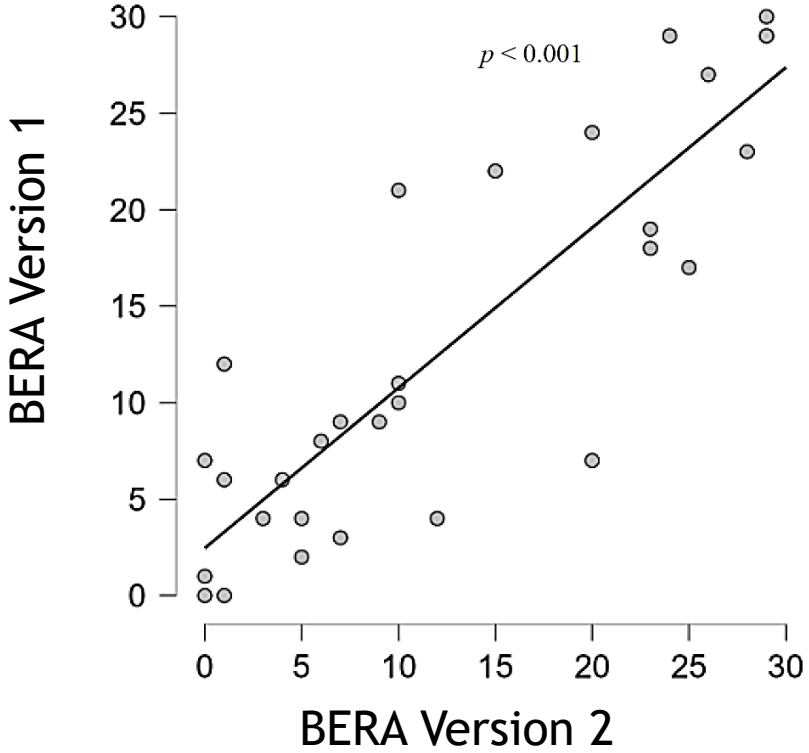
ρ=0.86*

Preliminary results in post-comatose patients

Psychometric data (n = 30)

Internal validity

ρ=0.83*



Preliminary results in post-comatose patients

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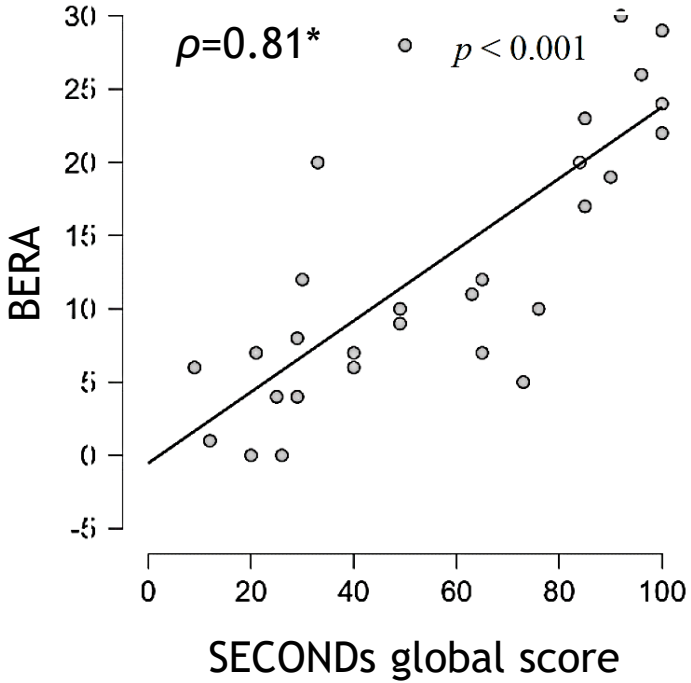
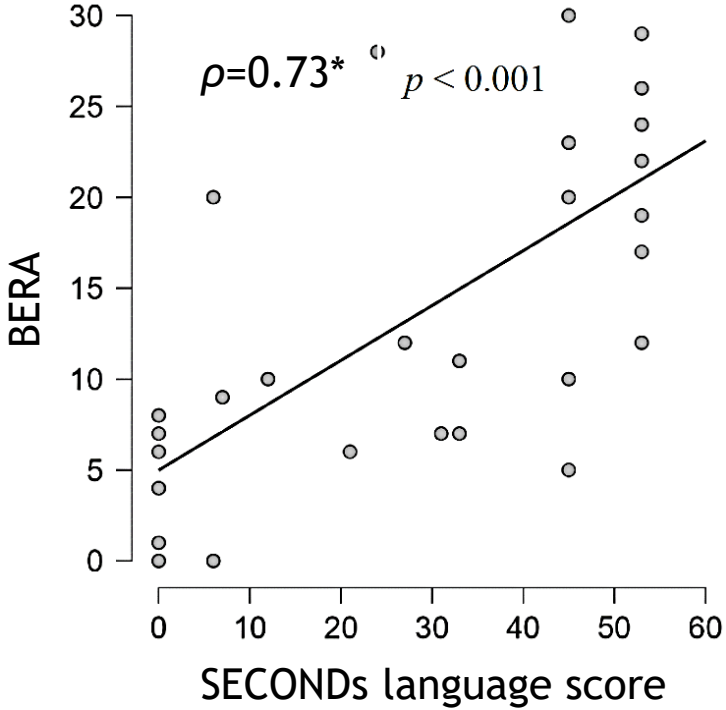


Concurrent validity



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Conclusion

Language assessment in post-comatose patients

- Residual language processing in many patients… probably more than expected
- Importance to detect and characterize them:
  - To improve/optimize speech-language therapies
  - To avoid the underestimation of consciousness levels
- BERA: Promising tool
  - Valid in aphasic conscious and post-comatose patients
  - Complementary to other tools (CRS-R, SECONDs,…)
  - Refined cognitive/language profiles
  - Better disentangle language and consciousness disorders

BERA tool: other perspectives

- Development and validation of a computerized BERA tool using an eye-tracker
- Ongoing adaptation/validation in English, Italian, Spanish, German and Polish languages
- Potential new insights regarding:
  - Prognosis
  - Neural correlates of language impairments after coma
  - Treatment effect on language recovery

MSCA-SE DoCBox project

Thank you!

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BERA tool available here: