Effect of Cognitive Load on Fatigue Induction in Stroke Survivors

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Introduction

- Stroke survivors show a high propensity to fatigue, with estimates of 40 to 90% complaining of cognitive fatigue (3).
- Cognitive fatigue is known to impact performance (1), as well as the ability of stroke survivors to return to their day-to-day life (3).
- Yet, few studies tried to evaluate fatigue in stroke population outside the acute phase (> 6 months) by inducing it, and its mechanisms are not well understood.

Goals of the study

➔ Evaluate how increased cognitive load during a fatiguing task influences post-stroke patients outside of the acute phase (> 6 months) fatigue levels, measured with different objective measures (task response time and accuracy) in a subsequent working memory task and with subjective scales before and after each task.

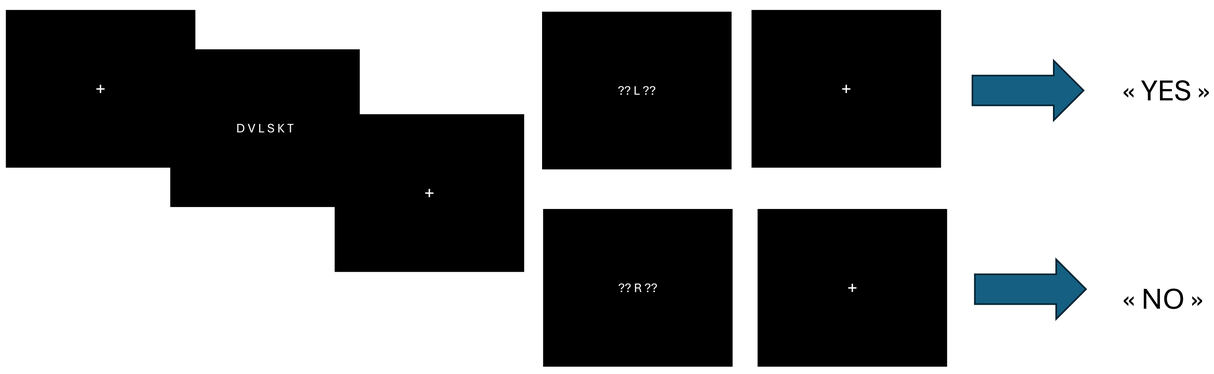
➔ Examinate differences in fatigue patterns between groups, and whether post-stroke patients show greater vulnerability to an increase in cognitive load.

Material and method

Procedure

Fatigue induction task followed by a working memory task (Sternberg)

- **Personnalized Time Load dual Back** : Calibrated to max speed (>85% accuracy), with two repeated and counterbalanced conditions:
  - **High Cognitive load (HCL)**: 32 minutes at « max » speed
  - **Low Cognitive Load (LCL)**: 16 minutes slowed by 50%
- **Sternberg Task** for accuracy and response time measures
  - Using set sizes of 2 to 7 letters



- **VAS for fatigue evaluation**

→ Before (1) and after (2) the fatigue induction task, after the Sternberg Task (3)

« How were you feeling while you were realizing the task ? »

Fresh ▯ **Extremely Fatigued**

Participants

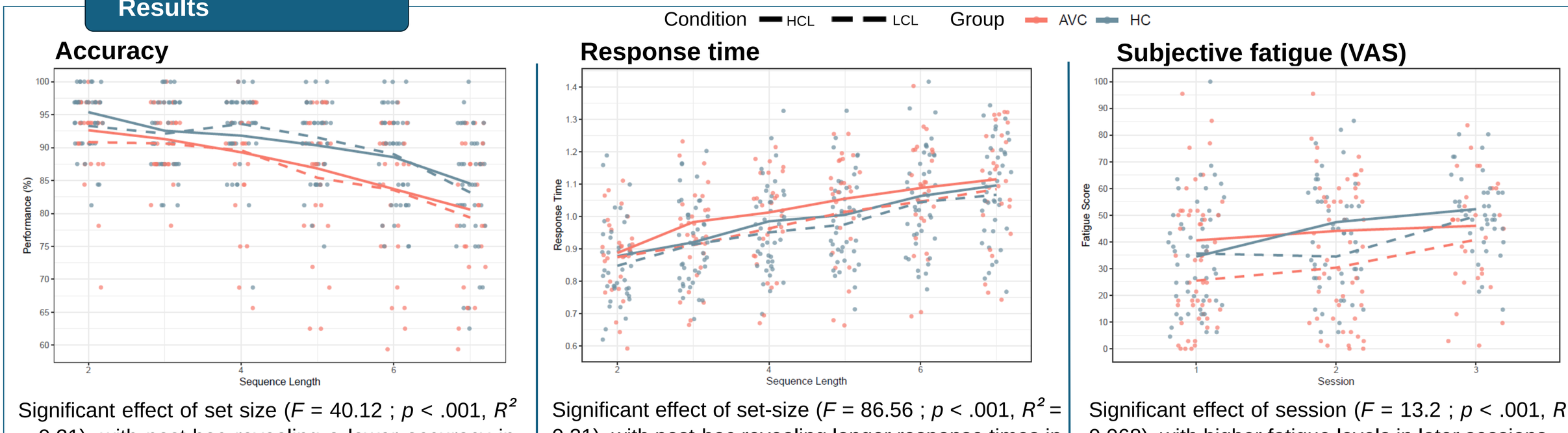
Age and sex matched – Total expected sample : 32/group

	Stroke patients n = 29	Healthy controls = 25
Age Mean (sd)	65.5 (7.65)	65.8 (6.44)
Sex	15F (51.72%)	13F (52%)

Statistical analyses

GLMEMs were used on the **accuracy** and **response time** of the Sternberg task, and for the **fatigue score** of the VAS.
Fixed effects : **group, condition**, **sequence length** (only for behavioral metrics), and **assessment time** (only for VAS fatigue)
Random effects : **ID** (all), **condition** for the accuracy model
Post hoc tests : Helmert contrasts were applied on the set-size variable.

Results



Significant effect of set size (F = 40.12 ; p < .001, R^2 = 0.21), with post-hoc revealing a lower accuracy in higher set-sizes (5 and onwards) compared to previous ones.

Significant effect of set-size (F = 86.56 ; p < .001, R^2 = 0.21), with post-hoc revealing longer response times in higher set-sizes (3 and onwards) compared to previous ones. Significant effect of condition (F = 21.1 ; p < .001, R^2 = 0.01), with longer response times in the high load condition.

Significant effect of session (F = 13.2 ; p < .001, R^2 = 0.068), with higher fatigue levels in later sessions.
Significant effect of condition (F = 18.35 ; p < .001, R^2 = 0.055), with higher fatigue levels in the high load condition.

Conclusion

In contrast with our hypothesis, we did not manage to reveal a **distinct pattern of fatigue between stroke patients and healthy controls**.

However, fatigue has been induced, as revealed by **longer reaction times** and **subjective sensation of fatigue.** Accuracy did not show this trend. This effect might be due to a form of **compensation**, in the term of **slower reaction times** to maintain **accuracy** (Speed-Accuracy Trade-Off).

These findings could be due to several factors, including our stroke patients not being in the acute phase of the stroke anymore, the adaptation to the individual's cognitive capacities which might have prevented cognitive overload, or too much fatigue induced in both conditions to differentiate them.

In conclusion, our findings **do not** support the hypothesis of a greater vulnerability to fatigue under higher cognitive load in stroke patients compared to controls.

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