## Working memory and speech perception: evidence from transcranial magnetic stimulation and brain morphometry



LABORATOIRE DES NEUROSCIENCES DE LA PAROLE ET DE L'AUDITION SPEECH AND HEARING

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## Introduction

An influential model of verbal working memory (vWM) proposes that the maintenance of phonological information in vWM is carried by the phonological loop, which is composed of a phonological store and an articulatory rehearsal system [1]. A question that remains unanswered is whether the phonological loop is strictly phonological, or, alternatively, whether it also deals with non-verbal auditory information, as behavioural evidence suggests [2,3] and as proposed in Baddeley's most recent model of vWM [4]. In the current study, we tested the hypothesis that the phonological loop holds auditory verbal and non-verbal information. We used single pulse transcranial magnetic stimulation (TMS) combined to a delayed auditory discrimination task (same/different judgment) with speech and acoustically complex non-speech sounds to determine whether two core vWM regions (i.e. posterior inferior frontal gyrus and supramarginal gyrus) are involved in the maintenance of auditory verbal and non-verbal information.

## Method

#### Participants

- 18 participants (10 females, 17-35 years old)
- No contraindication to MRI or TMS
- Normal cognitive level (MOCA 29±0.9/30)
- Normal hearing (pure tone audiometry)

#### **Experimental task**

- Auditory discrimination task with two categories of sounds (bird songs and syllables; Fig. 1)
- Performance measured in terms of RTs and accuracy

#### **MRI and TMS equipment**

- A high-resolution anatomical scan was acquired for each participant
- Super Rapid2 stimulator (Magstim, UK) with neuronavigation
- system (Brainsight: Rogue Research)
- Surface EMG to the right FDI muscle

#### TMS protocol (Fig. 2)

- Passive motor threshold [(MT); FDI muscle; 50mV, 5/10 trials]
- Stimulation intensity for experiment = 110% of MT(59.7 $\pm$ 7.6%)
- Online single pulse TMS to two targets: pIFG and aSMG, at 2
- stimulation times (250ms, 500ms) during the discrimination task
- 384 trials in total including 192 on each site and 48 sham trials Analyses
- rANOVAs on RTs (i.e. difference between different and identical sequences) 📻 and accuracy with target (pIFG, aSMG), stimulation (SHAM, TMS@250, TMS@500) and auditory category (speech and non-speech) as the within subject factors were conducted
- The cortical thickness covariance network associated with the pIFG and aSMG was examined with Freesurfer

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## Method and results

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