

# Working memory, phonological awareness and developing language skills

## Evidence from a latent variable longitudinal study

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ability to store & manipulate information in mind for a brief period of time in the course of ongoing cognitive activities (Baddeley & Hitch, 1974)

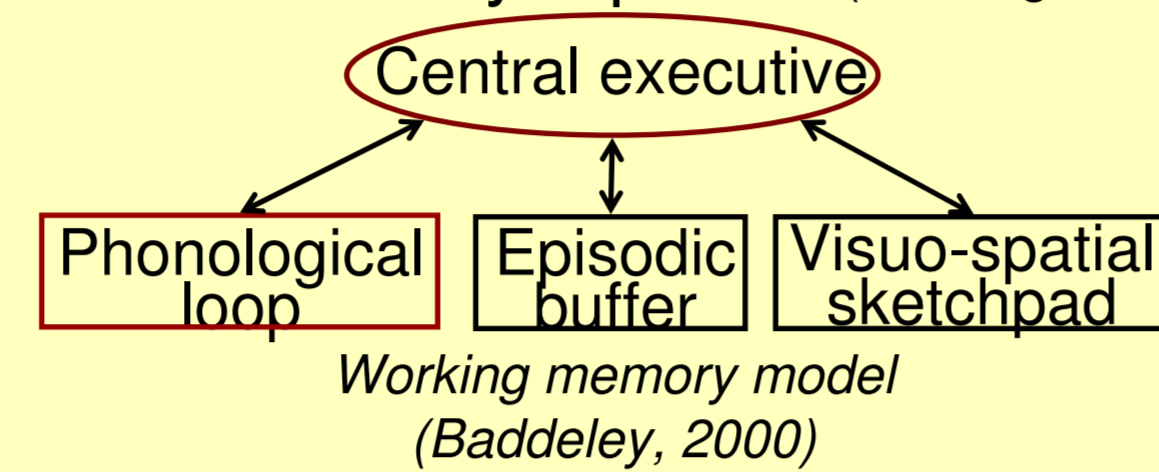
ability to perceive & manipulate the sounds of spoken words (Goswami & Bryant, 1990)

1

### Introduction

Links between **working memory** and **phonological awareness** with vocabulary acquisition, language comprehension and reading have been widely reported (de Jong & van der Leij, 1999; Gathercole & Alloway, 2008; Gupta, 2003).

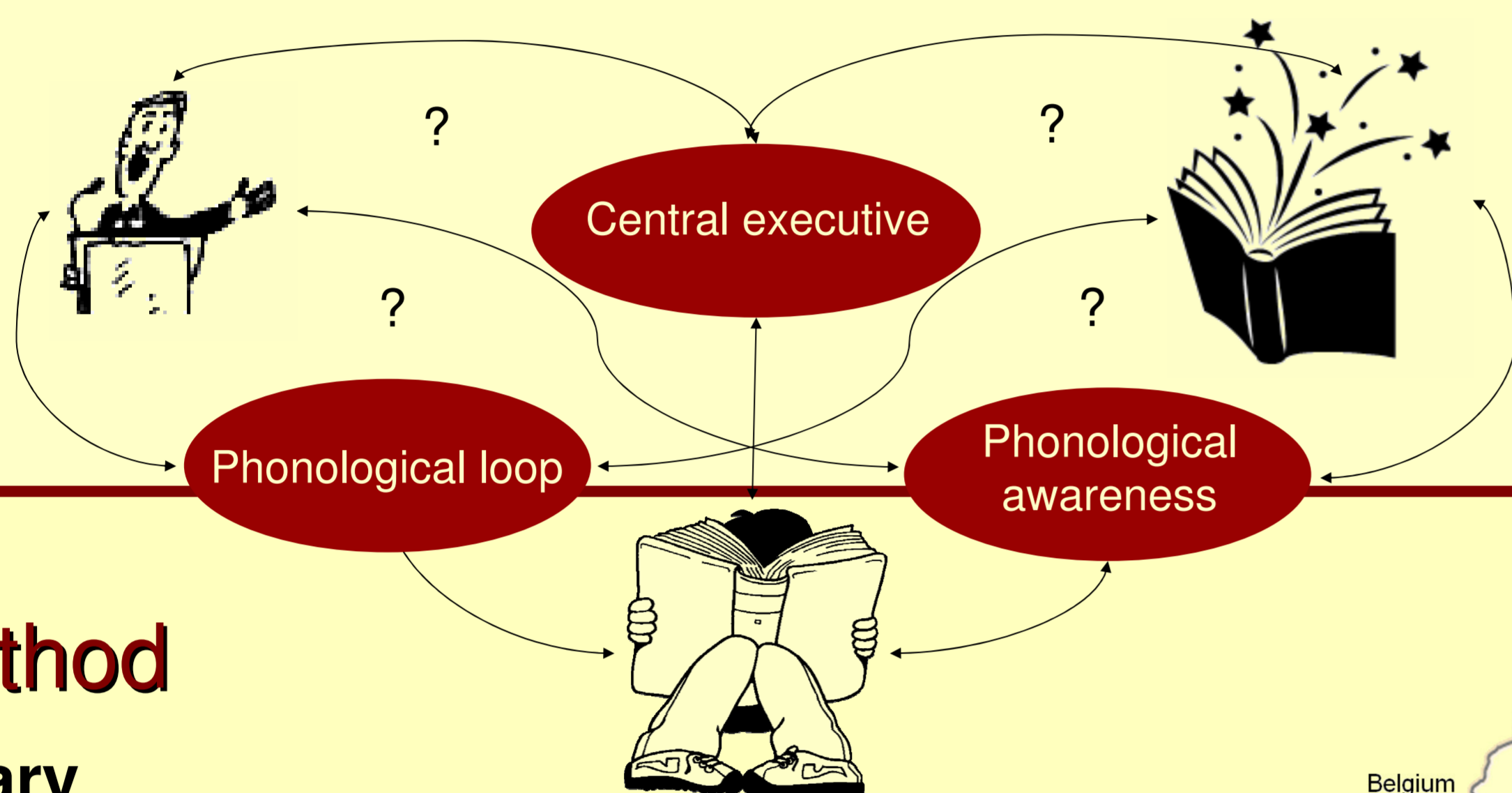
The **central executive** and the **phonological loop** components of the **working memory model** have been found to make significant contributions to language learning.



Despite extensive research in the area, the specific associations between working memory, phonological awareness and language are not fully understood and remain the subject of debate

### AIM

Assess working memory and phonological awareness in young children exposed to multiple languages in order to explore their relationship with developing language skills in the areas of vocabulary, comprehension and reading.



2

### Method

#### Summary

Central executive, phonological loop, phonological awareness, native and foreign vocabulary knowledge, language comprehension, and reading were investigated **longitudinally** in a population of children growing up in **Luxembourg** - a country in which **Luxembourgish** is mainly used in social interactions, and **German** and **French** are instructed in schools.

#### Participants

**119 Luxembourgish speakers** with both parents speaking Luxembourgish. Children were assessed in **Kindergarten** and in **1st Grade** of 15 Luxembourgish schools.

#### Kindergarten

- 6 years old
- Emphasis on Luxembourgish
- Pre foreign language learners
- Pre readers and writers

#### 1st Grade

- 7 years old
- Luxembourgish: 1 hour / week
- German: 8 hours / week
- Reading and writing in German

3

### Material

		Kinderg.	1st Grade
Central executive	Counting recall	X	X
	Backwards digit recall	X	X
Phonological loop	Digit recall	X	X
	Nonword repetition	X	X
Phonological awareness	Rhyme detection	X	X
	Alliteration	X	X
	Spoonerism	X	X
Syntactic comprehension	Luxembourgish	X	X
	German	X	X
Expressive vocabulary	Luxembourgish	X	X
	German	X	X
Reading	Letter decision	X	X
	Word detection	X	X
	Single word reading	X	X
	Text reading	X	X

4

### Analyses

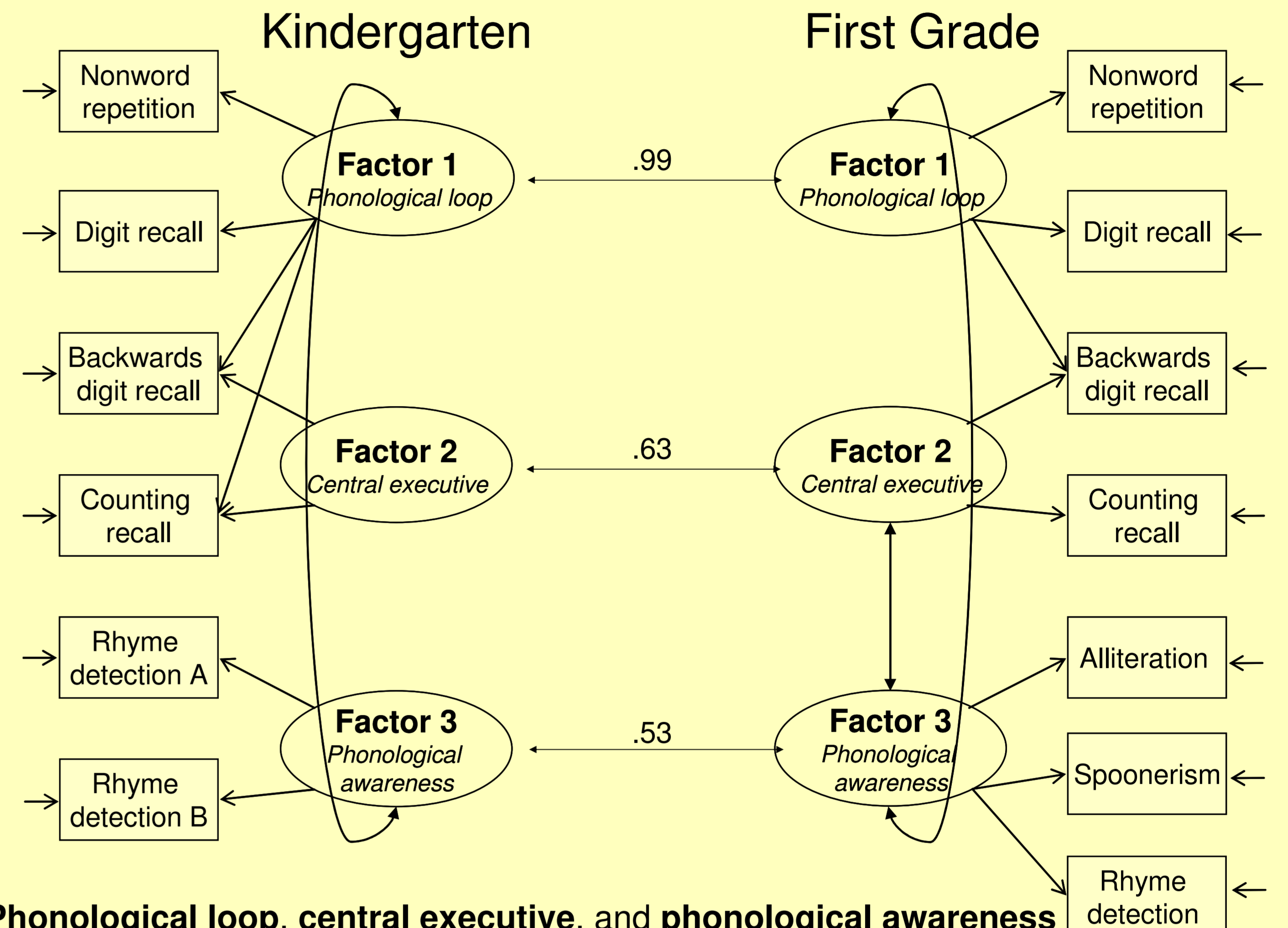
Structural Equation Modeling

Model relationships between **latent constructs** that are not directly observed but relate to observed variables

**Reduce measurement error** by having multiple indicators per latent variable

5

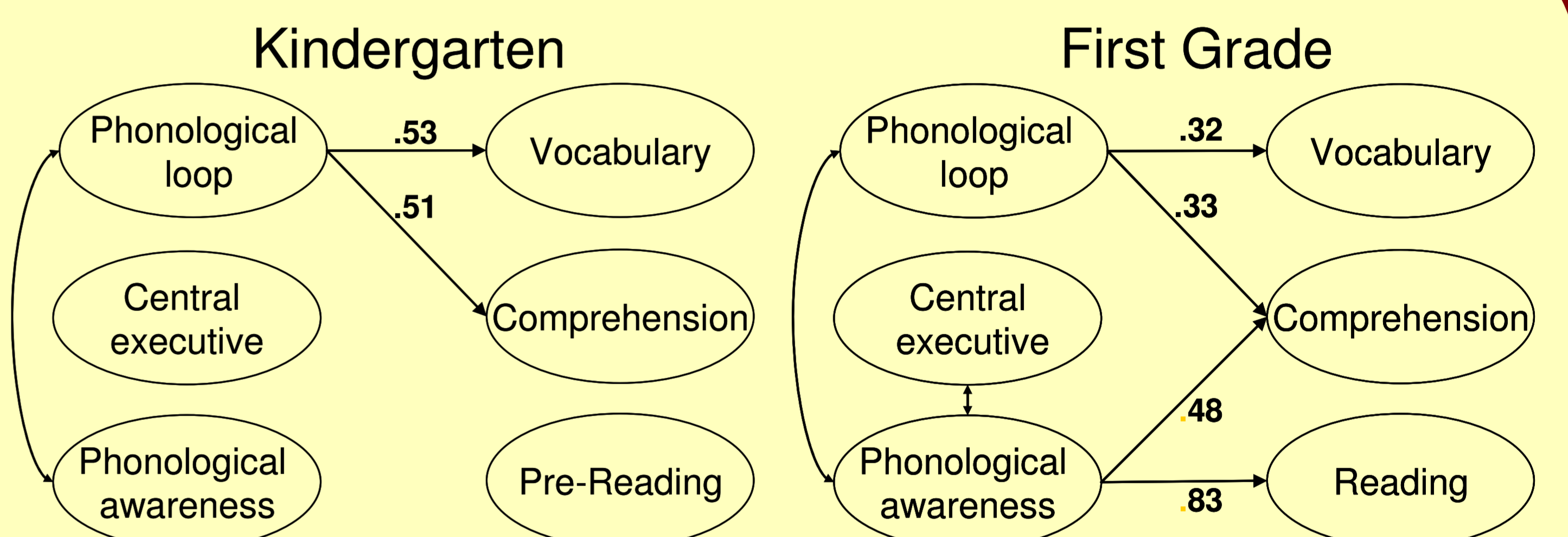
### Result 1



**Phonological loop, central executive, and phonological awareness** - separate but correlated latent constructs in children from 6 to 7 years  
 Continuity/ stability between the constructs over time

6

### Result 2



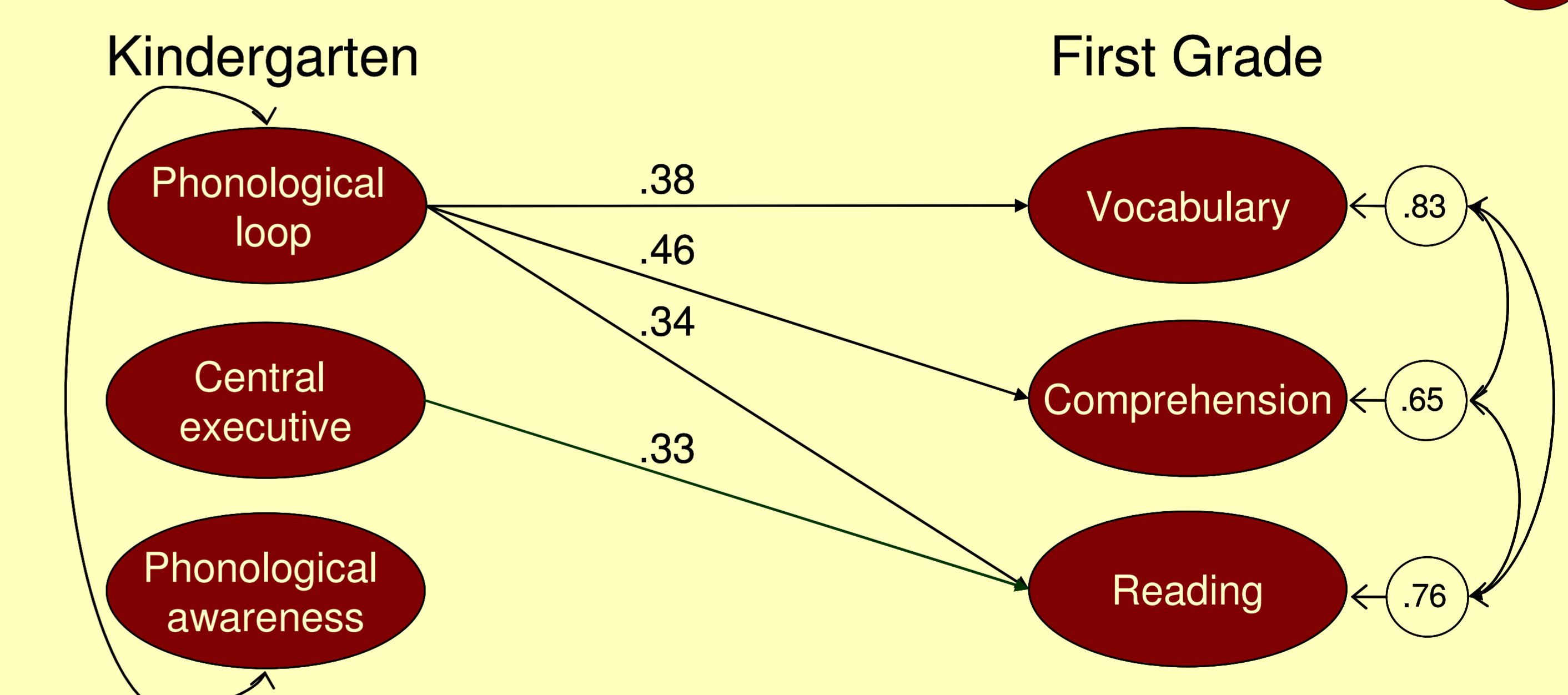
Knowledge of native and foreign **vocabulary** and language **comprehension** abilities - strongly **associated** with the **phonological loop**

Reduction of this association over the year: previous language knowledge might become increasingly important (Gathercole et al. 1992)

**Phonological awareness** and **reading**: strong link in 1st Grade but not in Kindergarten  
 Cause or consequence of developing reading skills?

7

### Result 3



**Phonological loop** assessments in Kindergarten significantly predicted **vocabulary** knowledge and **comprehension** in native and foreign languages one year later.

**Central executive** and **phonological loop** measures in Kindergarten - significantly associated with **reading** in 1st Grade

**Phonological awareness**, indexed by **rhyme detection**, did **not predict** any of the **language** constructs one year later.

8

### Discussion

The findings lend strong support to the position that the **phonological loop is one of the main contributors to new word learning** in both native and non-native languages by supporting the formation of stable phonological representations of new words in long-term memory.

The **phonological loop also seems to play a significant role in the syntactic comprehension of sentences**. The heard material might be kept active in the phonological loop while the child is listening to the sentence and processing it for comprehension. Finally the **central executive appears to make significant contributions to reading development**. One explanation of these findings is that literacy classroom activities often impose heavy demands on the central executive, the capacity of which therefore has a direct effect on the frequency of task failure or success in these classroom activities which consequently influences the rate of learning.

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