Working memory and vocabulary development in Greek preschool and primary school children

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Memory Contributions to Children’s Language Skills: …the case of *Vocabulary*

**Vocabulary knowledge** reflects adequacy of word acquisition processes & plays a **central role** in children’s development.

Supported by several cognitive mechanisms, with **STM** being of great importance.
Vocabulary & STM: Developmental route

Native vocabulary knowledge and STM (non-word repetition):
- strong relationship in the early years,
- relationship declines in strength by 8 yrs (yet, still significant) (see Gathercole et al., 1992).

Why decline?
Decrease in phonological awareness/ sensitivity variations (affecting both types of tasks) with age and growing linguistic experience (Morra & Camba, 2009).

With age, children rely more on permanent phonological & lexical records (i.e., LTM system; Dollaghan, 1994) vs on short-lived traces (i.e., phonological storage)

Vocabulary increases => word representations more segmental-fine-grained & greater phoneme awareness => superior speech perception & easier lexical access => vocabulary acquisition & performance (Walley et al., 2003).
BUT in English:
Developmental continuity for relationship between STM (recall tasks) & vocabulary: equally significant from early yrs (Gathercole et al., 1992) to adolescence (14 yrs, Gathercole et al., 1999; Baddeley et al., 1998).
**Vocabulary & WM: Developmental route**

WM: a mental workspace (being mentally *on-line*), determined by one’s capacity to temporarily store & manipulate info. WM might be critically involved in interpreting semantic characteristics of new words.

- Preschool years: Scarce, often unclear relevant evidence for WM (Adams *et al.*, 1999; Engel de Abreu *et al.*, 2011).

- Older children, vocabulary related to verbal WM:
  - *English*: at 7.5 yrs (Leather & Henry, 1994) up to 10.5 yrs (Cain *et al.*, 2004).
  - *French*: at 8 yrs, but not at 7 & 9 yrs (Seigneuric & Ehrlich, 2005)/ related at 10 yrs (Seigneuric *et al.*, 2000).
Value of a study in a different language:

- Greek (8 syllable types) is a syllable-timed language, and it is easier to discriminate between segments and syllable types vs
- English (16 syllable types), a stress-timed language, with greater variability in type of segments/ syllable (consonants) & in syllable duration (due to vowel length; see Nespor, 1990).
Greek language:
- highly inflectional and derivational,
- nominal system: 4 grammatical cases/3 genders (masculine–feminine–neuter),
- verbal system, even more complex: marking person, number, tense, aspect and voice features on morphological suffixes,
- various derivational affixes responsible for word- and category-formation processes, and
- large number of multi-syllabic compound words (see Holton et al., 1997).
Thus, learning lengthy Greek words or their several parallel forms, may require sophisticated auditory analysis => heavy STM demands, at least during the early learning stages.

With age & acquired linguistic-grammatical knowledge => STM maybe less important (earlier?*) in Greek.
* Regularities guide word modifications in relation to grammatical functions, supporting short-lived representations of new words (Gathercole et al., 1992).

e.g. tense on Greek verbs: acquired much earlier than English (Mastropavlou, 2010; Tsimpli, 2001).
- Greek past tense: regular phonological stress shift to the anti-penultimate syllable (e.g. milaw – milisa) vs English: change only morphological (e.g., play – played) and often irregular (e.g., write–wrote).

...lack of relevant evidence limits further discussion.
Aim of present study

The present research aimed at investigating the relative contributions of verbal STM and WM to vocabulary development in the early years among Greek-speaking children.

Method

Participants:
5.5-, 7.5-, 8.5- & 9.5-year-olds (N = 216)
Method – cont.

Tasks:
- **Receptive vocabulary:** Peabody Picture Vocabulary Test
- **Memory:** *WMTB-C* (Pickering & Gathercole, 2001)
- **Verbal STM tasks:**
  - 3 serial recall tasks (stimuli varying in terms of familiarity, i.e. digits, words or non-words),
  - Word list matching task (*wlm*): serial recognition task.
- **Verbal WM tasks:** temporary storage & processing
  - Listening recall, counting recall, backward digit recall (complex span tasks).
Bootstrap correlation coefficient estimates between the vocabulary and the composite verbal short-term memory and working memory measures for the whole group and across the four age groups

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<tr>
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<th>Voc-STM</th>
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<th>Voc-WM</th>
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<tbody>
<tr>
<td>Whole Group</td>
<td>.52 (.43–.61)</td>
<td>.000</td>
<td>.66 (.57–.74)</td>
<td>.000</td>
</tr>
<tr>
<td>5.5 years</td>
<td>.26&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>.062</td>
<td>.32 (.11–.51)</td>
<td>.007</td>
</tr>
<tr>
<td>7.5 years</td>
<td>.43 (.23–.62)</td>
<td>.004</td>
<td>.21&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>.087</td>
</tr>
<tr>
<td>8.5 years</td>
<td>.36 (.13–.58)</td>
<td>.004</td>
<td>.34 (.03–.65)</td>
<td>.024</td>
</tr>
<tr>
<td>9.5 years</td>
<td>−.13&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>.248</td>
<td>.13&lt;sup&gt;ns&lt;/sup&gt;</td>
<td>.375</td>
</tr>
</tbody>
</table>

Note: Values in parentheses represent a 95% confidence interval. <sup>ns</sup> = non-significant.
Results - Discussion

✓ In Greek:
  - Vocabulary associated with verbal STM at 7.5 and 8.5 yrs
  - But only with verbal WM at 5.5 yrs.

✓ Shorter periods of dependence on STM and WM in Greek:
  STM by 8.5 yrs (vs English: until adolescence – 14 yrs),
  WM by 9.5 yrs (vs English, at least until 10.5 yrs).

* Greek children enter elementary school about a year later than their English peers.
Results - Discussion

Certain characteristics - regularities of Greek language => favoured earlier independence from STM/ WM resources:

- Fewer syllable types => fewer demands for auditory analysis and phonological storage (STM).
- Regularities => fewer demands on STM/ WM for new words.
- Faster/easier reading acquisition => greater vocabulary growth in early yrs (vs opaque English orthography, Seymour et al., 2003)
Future (cross-cultural, developmental) research

Direct cross-linguistic/cultural comparisons:

- Languages with different **orthographies** (e.g. English vs French vs Greek vs Italian, etc.).
- **Characteristics unique** in each language influence performance.
- Different age groups.
Directions for future research

e.g. Vocabulary development might also be affected by phonological sensitivity, existing vocabulary (see Morra & Camba, 2009), reading acquisition, motives, or content of reading material children are exposed to.
Directions of future research – cont.


Relatively unexplored; theoretical-educational implications (Sesma et al., 2009).

Informative about CE too (see Baddeley, 1996, 2007):
- single, unitary central executive,
- set of executive functions (Miyake et al., 2000),
- set of constructs (activation, inhibition resources, executive schemes - Morra, 1994; Pascual-Leone & Johnson, 2011).
...on-going research

European Union & Greek Ministry of Education (THALIS Research Grant: 2012-2015)

BALED project (Bilingual acquisition & bilingual education: the development of linguistic & cognitive abilities in different types of bilingualism)

- Research Team 2:
  WM, executive functions, metacognitive skills in relation to different Bilingualism types and at different ages.
  * Vocabulary measures in bilingual’s both languages.
  Data analysis in progress.
Directions of future research – cont.

Cross-linguistic comparisons of memory contributions to children’s language skills

* Mediating roles of vocabulary in the relations between WM and specific oral comprehension skills,


WM: indirect, but also direct predictions. With age, WM involvement restricted to more demanding, higher-order oral comprehension skills (comprehension control).
Mediating roles of vocabulary in the relations between WM and specific reading comprehension skills


Reading fluency* and, on several occasions, vocabulary knowledge in Greek did not mediate the relationships between WM & comprehension skills in 8-10 year-olds.

(* Reading fluency: weak links with STM, WM, and comprehension skills => value of cross-linguistic research!).
This line of (cross-cultural) research could eventually:

- Enrich our knowledge regarding vocabulary and language development in different contexts (linguistic-educational).
- Inform identification of children at risk to develop relevant difficulties (preventing poor educational attainment).
- Enable children with poor WM compensate for vocabulary acquisition difficulties (see Gathercole & Alloway, 2008).
- Empower educators in helping children learn effectively, facilitate language development, and benefit the most from linguistic activities, see Block et al., 2004).

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...thank you

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