

Psychology: the Journal of the Hellenic Psychological Society

Vol 28, No 2 (2023)

Special Section: Nous: A powerful machine



The role of working memory in the comprehension of syntactically complex sentences in children with and without developmental language disorder: A literature review

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doi: [10.12681/psy_hps.32457](https://doi.org/10.12681/psy_hps.32457)

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To cite this article:

Karavasilis, G., Diakogiorgi, K., & Papadopoulou, D. (2023). The role of working memory in the comprehension of syntactically complex sentences in children with and without developmental language disorder: A literature review. *Psychology: The Journal of the Hellenic Psychological Society*, 28(2), 205–222. https://doi.org/10.12681/psy_hps.32457

Table 1*Verbal short-term – complex sentence comprehension*

Study	N (Age in years)	vSTM measure	Results
TLD			
Boyle et al., 2013	56 (4;0 – 6;6)	NWR	NWR X OR, passives
Kas & Lukacs, 2012	43 (4;11 – 7;2 & 8;2 – 11;4)	NWR FDS	NWR -> SR+OR (CE) FDS -> SR+OR (CE)
Montgomery et al., 2008	52 (6 – 12)	NWR	NWR X passives, pronominals, reflexives
Bentea et al., 2016	61 (5;0 – 11)	FDS	FDS -> object wh-, OR
Haendler et al., 2015	47 (5.0 – 5.11)	FDLS	FDLS -> OR
Arosio et al., 2012	48 (7;0)	FDS	FDS X SR/ vSTM -> OR
Arosio et al., 2011	51 (9;3)	FDS	FDS X SR, OR
Booth et al., 2000	45(8;8), 50(10;0), 30 (11;0), 25(12;4)	FDS	FDS X SR, OR/ vSTM->MC
TLD vs DLD			
Roesch & Chondrogianni, 2021	16 DLD (4-year-olds) 17 TLD (4-year-olds) 15 DLD (5-year-olds) 15 TLD (5-year-olds)	NWR	DLD (4+5): NWR -> subject wh-, object wh- TLD (4+5): NWR -> subject wh-, object wh-
Ladanyi et al., 2017	30 DLD (8.93) 30 TLD (8.93)	NWR	DLD: NWR X pronominals, reflexives TLD: NWR X pronominals, reflexives
Girbau, 2017	11 DLD (8;3-10;11) 11 TLD (8;7-10;8)	NWR	DLD + TLD: NWR -> OR (direct object pronoun)
Montgomery & Evans, 2009	24 DLD (6 – 12) 18 TLD (6 – 12) 16 TLD (4;5 – 8;6)	NWR	DLD: NWR X passives, pronominals, reflexives TLD: NWR X passives, pronominals, reflexives
Montgomery, 2004	12 DLD (6;4-10;5) 12 TLD (6;5-10;5) 12 TLD (6;3-7;10)	NWR	DLD: NWR X cSC total (semantically reversible with one RC[SR], & two RCs[SR,OR]) TLD: NWR X cSC total (semantically reversible with one RC[SR], & two RCs[SR,OR])

Table 2
Verbal working memory - complex sentence comprehension

Study	N (Age in years)	vWM measure	Results
TLD			
Wu et al., 2022	91 (8;0 - 14;11)	BDS	BDS -> OR
MacDonald et al., 2020	EXP1: 48 (4;5-6;4) EXP2: 45 (4;5-6;9)	FDS+BDS	EXP1: FDS+BDS X OR EXP2: FDS+BDS X OR
Schouwenaars et al., 2018	36 (7;05-10;09)	BDS	BDS -> object wh-
Bentea et al., 2016	61 (5;0 - 11)	BDS	BDS X object wh-
Haendler et al., 2015	47 (5.0 - 5.11)	BDLS	BLDS X OR
Boyle et al., 2013	56 (4;0 - 6;6)	BDS	BDS -> OR, passives
Kas & Lukacs, 2012	43 (4;11 - 7;2 & 8;2 - 11;4)	BDS	BDS -> SR+OR (CE) BDS X SR+OR (RB)
Finney et al., 2014	44 (7;0 -11;11)	listening span high tones/low tones counting	listening span -> OR high tones/low tones counting -> OR
Arosio et al., 2011	51 (9;3)	listening span	listening span X SR, OR
Weighall & Altmann, 2011	32 (6 - 8)	listening span	listening span -> SC total (SR-CE + SR-RB)
Montgomery et al., 2008	52 (6 - 12)	listening span	listening span -> passives, pronominals, reflexives
Roberts et al., 2007	46 (5.9-7.0)	listening span	listening span -> OR with dislocated object
Felser et al., 2003	29 (6;2-7;5)	listening span	listening span -> RC attachment
Booth et al., 2000	45(8;8), 50(10;0), 30 (11;0), 25(12;4)	listening span	listening span X SR+OR
Poulsen et al., 2022	86 (12;10)	vWM = BDS + number- sequencing + letter- number sequencing	vWM -> SC total (actives + passives + sentences with premodified NPs + sentences with embedded RCs + SVO + OVS)
TLD vs DLD			
Montgomery et al., 2018	117 DLD (7-11) 117 TLD (7-11)	word & digit recall + high tones/low tones counting	DLD: vWM -> passives, OR TLD: vWM -> passives, OR
Ladanyi et al., 2017	30 DLD (8.93) 30 TLD (8.93)	BDS n-back	DLD: BDS -> pronominals, reflexives n-back -> pronominals, reflexives TLD: BDS -> pronominals, reflexives n-back X pronominals, reflexives
Rakhlin et al., 2016	22 DLD (5.08 - 15.83)	FDS+BDS	DLD+TLD: vWM -> cSC (SR[CE/RB]+OR[CE/RB])

	22 TLD (7.08 - 15.25)		
Sasaki et al., 2021	16 DLD (5;8-10;6) 52 TLD (5;5-9;9)	listening span nonword backward rep.	DLD+ TLD: listening span -> cSC (RC[SR+OR]+MC) DLD+ TLD: backward nonword rep. -> cSC (RC[SR+OR]+MC)
Montgomery & Evans, 2009	24 DLD (6 - 12) 18 TLD (6 - 12) 16 TLD (4;5 - 8;6)	listening span	DLD: listening span -> passives, pronominals, reflexives TLD: listening span X passives, pronominals, reflexives

Table 3
vSTM/vWM-LTM - complex sentence comprehension

Study	N (Age in years)	LTM-WM measure	Results
TLD			
Poulsen et al., 2022	86 (12;10)	sent. rep.*	sentence rep. ->cSC total (actives + passives + sentences with premodified NPs + sentences with embedded RCs + SVO + OVS)
Boyle et al., 2013	56 (4;0 - 6;6)	sent. rep.	sentence rep. -> OR, passives
Rusli & Montgomery, 2017	53 (9.0 - 11.8)	word & digit recall	word & digit recall -> OR
TLD vs DLD			
Sasaki et al., 2021	16 DLD (5;8-10;6) 52 TLD (5;5-9;9)	sent. rep.*	DLD+ TLD: sentence rep.-> cSC (RC[SR+OR]+MC)
Montgomery et al., 2009	26 DLD (6;10 - 10;8) 26 TLD (6;10 - 10;8)	word recall (no-load, dual-load)**	DLD: word recall -> cSC total (semantically reversible with one RC, & two RCs) TLD: word recall X cSC total (semantically reversible with one RC, & two RCs)
Montgomery, 2000a	12 DLD (8;6) 12 TLD (8;7) [12 TLD (6;8)]	word recall (no-load, single-load, dual-load)**	DLD: word recall X cSC total (semantically reversible with one RC[SR], & two RCs[SR,OR]) TLD: word recall X cSC total (semantically reversible with one RC[SR], & two RCs[SR,OR])
Montgomery, 2000b	12 DLD (9;1) 12 TLD (8;11) [12 TLD (7;2)]	word recall (no-load, single-load, dual-load)**	DLD: word recall -> cSC total (semantically reversible with one RC[SR], & two RCs[SR,OR]) TLD: word recall -> cSC total (semantically reversible with one RC[SR], two RCs[SR,OR])
Montgomery et al., 2018	117 DLD (7-11) 117 TLD (7-11)	LTM-LK = Test of Narrative Language (comprehension/production)	DLD: LTM-LK ->(vWM) -> SR + actives TLD: LTM-LK ->(vWM)-> OR + passives

*Note. NWR = nonword repetition; FDS = forward digit span; BDS = backward digit span; FDLS = forward digit/ letter span; BDLS = backward digit/ letter span; sent. rep. = sentence repetition; "X" indicates "no significant correlation" ($p > .05$); "->" indicates "significant correlation" ($p \leq .05$); "+" indicates the composite score of two measures or a mixed group of TLD and DLD participants., * sentence repetition was used as a measure of language skills (in: Poulsen et al., 2022; Sasaki et al., 2021). , ** Word recall task, in its single- and dual-load condition, was used as a measure of "complex working memory span" (in: Montgomery, 2000a, 2000b; Montgomery et al., 2009). In results and discussion sections, these two conditions are interpreted as measures of vSTM/vWM - LTM (/Episodic Buffer).