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Neurophysiological studies of reading fluency

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Appendix

A. Appendix to Chapter 1: General introduction

A.1 Behavioural tests used in the Diagnosis of Dyslexia study

Reading fluency: A standardized word-reading test in Dutch, the Drie Minuten Toets [Three Minutes Test] (DMT; Verhoeven, 1995), was used to assess general reading skills. The participants were shown three lists of words of increasing length and difficulty, and were asked to read out the words as fast and accurately as possible. Raw score was determined on the basis of the number of words read correctly within one minute, which was subsequently converted to a categorical score (A To E) indicating the level of reading fluency (with age taken into consideration) compared to the population used for the DMT norms.

Phonological awareness: A phoneme deletion task was used to assess the ability to access and manipulate speech sounds (see Appendix A.2). For this task, the participants heard pronounceable pseudowords; they were first asked to repeat the pseudoword and then to reproduce a pseudoword with a particular sound deleted from the original pseudoword. The task gradually became more difficult as the number of syllables that the pseudo words consisted of increased. A total number of 12 experimental items and 5 practice items were included. The score consisted of a point for each item that was correctly produced.

Naming speed: A standardized Rapid Automatized Naming (RAN) test of colours, letters and digits (Denckla & Rudel, 1976) was used to assess the children's naming speed and time needed to retrieve verbal information. The test consisted of a sheet with five rows of nine items in various colours/letters/digits. The children were asked to name the items one by one as accurately and quickly as possible. The score for each naming category (i.e., colours/letters/digits) was determined by subtracting the amount of items named incorrectly from the total amount of items, and dividing the outcome from the amount of time taken. A mean RAN score was then computed by averaging the scores for each naming category.

Orthographic knowledge: An orthographic choice task was used to assess orthographic knowledge (see Appendix A.3 for a sample of the test items). The test consisted of a list of words spelled in three different ways, one correct and two incorrect. The children were asked to underline the word that was spelled correctly. A total number of 70 items were included. Scoring was based on a point received for each correct item.

Nonverbal intelligence: The Matrix Reasoning subtest of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) test (Wechsler & Naglieri, 2008) was administered to assess nonverbal intelligence. The participants were asked to select the image that would complete an incomplete matrix or series out of five options. The raw score was converted to a T-score (with age of the participant taken into consideration). Children with a T-score of or above 40 are considered to have normal nonverbal intelligence.

A.2 Phoneme deletion task

<u>Oefenitems</u>		Goed of fout?
A. DROOM	zonder /d/ → ROOM	
B. SEP	zonder /s/ → EP	
C. TRAL	zonder /r/ → TAL	
<u>Testitems</u>		
1. SKOOM	zonder /k/ → SOOM	
2. TESP	zonder /p/ → TES	
3. SMIEF	zonder /s/ → MIEF	
4. FRAL	zonder /f/ → RAL	
5. MEMSLOS	zonder /l/ → MEMSOS	
6. SERBLET	zonder /b/ → SERLET	
7. BINWULS	zonder /l/ → BINWUS	
8. MUNSEPT	zonder /p/ → MUNSET	
<u>Oefenitems</u>		
D. GEPGRAL	zonder /g/ → EPRAL	
E. URPGAAP	zonder /p/ → URGAA	
<u>Testitems</u>		
9. GRIESGLAAK	zonder /g/ →	
10. STISNALT	zonder /t/ → SISNAL	
11. ZIRKVULK	zonder /k/ → ZIRVUL	
12. PORSVUST	zonder /s/ → PORVUT	

A.3 Orthographic Choice Task

Part. Nr:	Datum:	
1. voet	voed	foet
2. haut	hout	houd
3. swart	zward	zwart
4. vruit	fruit	fruid
5. schaads	sgaats	schaats
6. schelp	schelup	sgelp
7. zwaard	zwaard	swaard
8. draai	draaj	draaij
9. bloej	bloeij	bloei
10. kwarek	kewark	kwark
11. bochd	bogt	bocht
12. nieuw	neuw	niew
13. buleg	beleg	bleg
14. verkeer	vekeer	verkir
15. sneuw	sneew	sneeuw
16. irste	eerste	eerstu
17. vla	fla	vlaa
18. gluk	guluk	geluk
19. sieke	zieku	zieke
20. zagte	zachte	sachte
21. reusen	ruezen	reuzen
22. dieven	diefen	dievun
23. aardug	aardig	aardeg

A.4 Behavioural measurements of Dutch children participating in the ERP studies

Table A.4.4: Behavioural measurements of Dutch children participating in ERP studies

Participant	DMT raw score [categorical score]	Phoneme Deletion	Mean RAN (time in sec)	Orthographic Choice	Matrix Reasoning (T-score)
NO. 1	60 [C]	8	1.57	37	64
NO. 2	51 [D]	8	1.27	32	47
NO. 3	67 [B]	8	1.18	53	47
NO. 4	46 [D]	8	1.35	41	60
NO. 5	30 [E]	4	1.67	41	51
NO. 6	35 [E]	7	1.29	30	53
NO. 7	52 [C]	6	1.42	25	55
NO. 8	48 [D]	6	0.99	32	53
NO. 9	36 [E]	6	1.26	24	64
NO. 10	64 [C]	6	1.16	55	63
NO. 11	50 [D]	2	1.36	38	80
NO. 12	46 [D]	10	1.48	30	63
NO. 13	100 [A]	8	1.14	59	53
NO. 14	98 [A]	8	0.92	47	54
NO. 15	82 [A]	11	1.03	54	57
NO. 16	78 [B]	6	1.09	45	58
NO. 17	31 [E]	7	1.30	9	50
NO. 18	74 [B]	6	0.99	42	75
NO. 19	68 [B]	9	0.87	43	NA
NO. 20	34 [E]	2	1.04	21	NA
NO. 21	32 [E]	6	1.67	22	NA

DMT: The categorical scores (A to E) presented in parentheses indicate the level of reading fluency of the child being tested compared to the population used for DMT norms. A: percentile score of 75% or higher; B: percentile score between 50% and 75%; C: percentile score between 25% and 50%; D: percentile score between 10% and 25%; E: percentile score below 10%.

Phoneme Deletion: the number of correctly produced items (out of 12 items).

Mean RAN: calculated by averaging naming speed for RAN colours, RAN letters and RAN digits.

Orthographic Choice: the number of correctly produced items (out of 70 items).

Matrix reasoning: T-score of 40 or above indicates normal nonverbal intelligence. Because of time constraints, the Matrix Reasoning test was not administered to the three children tested in the dyslexia center in the city of Zwolle. Earlier data collected by the center suggested that they all had normal intelligence.

B. Appendix to Chapter 2: Fast visual specialization or print and reading fluency

B.1 Dutch words used in the repetition detection task

Table B.1.1: Dutch words used in the repetition detection task














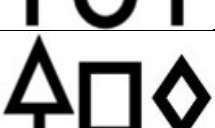






Dutch word	Translated word	Dutch word	Translated word	Dutch word	Translated word	Dutch word	Translated word
bal	ball	kar	cart	boek	book	deur	door
pap	dad	koe	cow	doek	picture	glas	glass
oom	uncle	zon	sun	stok	stick	noot	nut
mus	sparrow	das	tie	poes	cat	vaas	vase
kam	comb	hok	pen	reep	stripe	dier	animal
kat	kat	mes	knife	kast	cabinet	neus	nose
jas	coat	tak	branch	huis	home	riem	belt
zak	bag	mat	mat	muis	mouse	zeep	soap
bos	forest	vin	fin	reus	giant	lepel	spoon
hek	fence	ruit	window	voet	foot	tafel	table
kop	cup	hond	dog	hout	wood	emmer	bucket
sok	sock	maan	moon	mond	mouth	paard	horse
ijs	ice	buik	belly	bijl	axe	krent	currant
tas	bag	bril	glasses	koek	cake	stuur	steering wheel
bel	bell	keel	throat	fles	bottle	vogel	bird
rem	brake	doos	box	raam	window	trein	train
zus	sister	geit	goat	haan	rooster	fiets	bicycle
pak	package	roos	rose	duif	pigeon	taart	pie
juf	teacher	tuin	garden	vuur	fire	stoel	chair
oog	eye	veer	feather	boer	farmer	broer	brother

B.2 Dutch pseudowords used in the repetition detection task

Table B.2.2: Dutch pseudowords used in the repetition detection task

Dutch Pseudoword	Dutch Pseudoword	Dutch Pseudoword	Dutch Pseudoword
kal	Zor	loet	noop
tat	Zok	zeet	glaf
ool	Fas	poeg	seun
fum	Mel	reem	rier
kab	Tar	pask	zeel
sal	Mef	huik	saaf
jaf	Vig	suim	kaaf
zaf	Mog	seur	emmel
bog	Voe	voek	lemel
hep	Joek	dous	kremp
kog	Don't	nomp	stuul
ijg	kaam	bijn	govel
taf	Buim	koef	keber
gol	Brol	tuip	sieks
mer	keem	slef	kaark
vog	doon	raal	paark
pab	Feik	haam	stoek
jub	Soor	duil	kroer
oof	Nuit	vuul	lasel
zar	Veef	doer	deul

B.3 Symbol strings used in the repetition detection task

♀○◇	♀○□
♀□◇	△□◇
○○♀	♀□○
♀□◇	♀○◇
♀□♀	◇○♀
♀♀□◇	♀□□△
♀○□◇	◇○○□
♀○○△	♀○○◇
♀○□♀	♀○○◇
♀○△♀	♀○□♀

♀ □ ♀ ◇	♀ ○ ○ △
□ □ ○ ◇	♀ □ □ ◇
♀ □ □ ◇	△ ○ □ □
♀ □ □ ♀	♀ □ ◇ □
♀ ○ □ ◇	♀ ○ □ ◇
◇ □ ○ ◇	♀ □ □ ◇
△ ○ ○ ◇	♀ □ ○ ◇
♀ ◇ ○ ♀	△ □ □ ◇
◇ ○ ○ ♀	♀ ○ △ ♀
◇ □ □ ♀	♀ ○ □ ♀

◇ ○ □ ◇	◇ □ ○ △
◇ □ □ △	◇ ○ ○ □
△ □ □ ◇	△ □ □ ◇
□ □ ○ ◇	○ ○ △ △
□ □ ◇ □ □	◇ □ □ ◇ □
◇ ○ □ □ □	◇ □ □ □ ◇
◇ □ ○ ◇ □	◇ □ ◇ ○ □
○ □ □ ○ ◇	○ □ ◇ □ ◇
□ ○ ○ ◇ ○	□ ○ ○ □ □
△ □ ○ □ □	□ △ ○ □ △

C. Appendix to Chapter 4
The underlying mechanism of fast visual specialization for print:
A cross-linguistic ERP study

C.1 Chinese words used in the repetition detection task

Table C.1.1: Chinese words used in the repetition detection task

Chinese word	Translated word	Chinese word	Translated word
汽车	car	身份证	identity card
杂志	magazine	救护车	ambulance
钥匙	key	救火车	fire truck
狐狸	fox	录像带	videotape
花园	garden	葡萄酒	wine
眼镜	glass	发动机	engine
面粉	flour	保险柜	coffer
苹果	apple	大理石	marble
篮球	basketball	萤火虫	firefly
树枝	branch	缝纫机	sewing machine
空调	air conditioner	打火机	lighter
袖子	sleeve	胡萝卜	carrot
柚子	grapefruit	灭火器	fire extinguisher
楼梯	stair	方向盘	steering wheel
地毯	carpet	矿泉水	mineral water
地图	map	电灯泡	bulb
戒指	ring	手风琴	accordion
手表	watch	羽毛球	badminton
农民	peasant	旅行箱	suitcase
名片	business card	拖拉机	tractor
相片	photo	排水系统	sewerage system
窗帘	curtain	营业执照	business license
桌子	table	航空母舰	aircraft carrier
嘴唇	lip	毕业证书	graduate diploma
蜂蜜	honey	五星红旗	national flag
蜜蜂	bee	民间艺术	folk art
斧头	hammer	络腮胡子	whisker
蝴蝶	butterfly	摩天大楼	skyscraper
珍珠	pearl	高速公路	highway
邮箱	mailbox	手提电脑	laptop
厕所	bathroom	水利工程	hydraulic engineering
电视	television	医疗设施	healthy facility

Chinese word	Translated word	Chinese word	Translated word
电脑	computer	瓢泼大雨	downpour
玫瑰	rose	机动车辆	automotive
枕头	pillow	智能手机	smart phone
指甲	nail	旋转木马	carousel
袜子	sock	家用电器	home electronics
面包	bread	高压电线	power line
飞机	aircraft	保险公司	insurance company
书签	bookmark	水果拼盘	fruit platter

C.2 Pinyin⁴ strings used in the repetition detection task

Table C.2.2: Pinyin strings used in the repetition detection task

Pinyin string	Translated word	Pinyin string	Translated word
qì chē	car	shēn fèn zhèng	identitidy card
zá zhì	magazine	jiù hù chē	ambulance
yào shì	key	jiù huǒ chē	fire truck
hú li	fox	lù xiàng dài	videotape
huā yuán	garden	pú táo jiǔ	wine
yǎn jìng	class	fā dòng jī	engine
miàn fěn	flour	bǎo xiǎn guì	coffer
píng guǒ	apple	dà lǐ shí	marble
lán qiú	basketball	yíng huǒ chóng	firefly
shù zhī	branch	féng rèn jī	sewing machine
kōng tiáo	air conditioner	dǎ huǒ jī	lighter
xiù zi	sleeve	hú luó bo	carrot
yòu zi	grapefruit	miè huǒ qì	fire extinguisher
lóu tī	stair	fāng xiàng pán	steering wheel
dì tǎn	carpet	kuàng quán shuǐ	mineral water
dì tú	map	diàn dēng pào	bulb
jiè zhǐ	ring	shǒu fēng qín	accordion
shǒu biǎo	watch	yǔ máo qiú	badminton
nóng mǐn	peasant	lǚ xíng xiāng	suitcase
míng piàn	business card	tuō lā jī	tractor
xiàng piàn	photo	pái shuǐ xì tong	sewerage system
chuāng lián	curtain	yíng yè zhí zhào	business license
zhuō zi	table	háng kōng mǔ jiàn	aircraft carrier
zuǐ chún	lip	bì yè zhèng shū	graduate diploma
fēng mì	honey	wǔ xīng hóng qí	national flag
mì fēng	bee	mín jiān yì shù	folk art
fǔ tóu	hammer	luò sāi hú zi	whisker
hú dié	butterfly	mó tiān dà lóu	skyscraper
zhēn zhū	pearl	gāo sù gōng lù	highway
yóu xiāng	mailbox	shǒu tí diàn nǎo	laptop
cè suǒ	bathroom	shuǐ lì gōng chéng	hydraulic engineering
diàn shì	television	yī liáo shè shī	health facility

⁴ Pinyin is a phonetic system for transcribing Chinese logographic characters into Latin alphabet. The pinyin strings presented in Table C.2.2 are phonetic transcriptions of the logographic characters presented in Table C.1.1.

Pinyin string	Translated word	Pinyin string	Translated word
diàn nǎo	computer	piáo pō dà yǔ	downpour
méi guī	rose	jī dòng chē liàng	automotive
zhěn tóu	pillow	zhì néng shǒu jī	smart phone
zhǐ jiǎ	nail	xuán zhuàn mù mǎ	carousel
wà zi	sock	jiā yòng diàn qì	home electronics
miàn bāo	bread	gāo yā diàn xiàn	power line
fēi jī	aircraft	bǎo xiǎn gōng sī	insurance company
shū qiān	bookmark	shuǐ guǒ pīn pán	fruit platter

C.3 Symbol strings used in the repetition detection task

The symbol strings used in the repetition detection were the same as presented in Appendix B.