Supporting Information

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SI Materials and Methods

Participants. In addition to the two dyslexic groups, 26 typically developing children (ages 8–13 y, 12 girls) participated in the same testing protocol as the control subjects with an average test–retest interval of 12.5 mo (SD = 1.77). All participants met the same hearing, intelligence quotient (IQ), and neurological criteria as described in *Materials and Methods*. Additionally, to be classified as typically developing, children had no family history of learning impairments, were not receiving special services in school, and had scores ≥95 on the Test of Oral Word Reading Efficiency (1). See ref. 2 for additional subject information.

Classroom Environment. The dyslexic children ranged from third to eighth grade, with most grades having independent classrooms. Sound-level measurements and reverberation estimates were made at the two campuses of the Hyde Park Day Schools, but not at other school districts. The two Hyde Park Day School buildings were traditional academic construction with tile or carpeted floors, windows, in-room projectors, window air-conditioning units, and acoustic tile ceilings. Classrooms were generally 25 feet × 25 feet × 9 1/2 feet with two chalk-board walls, one wall of windows with wooden cupboards below, and one wall of wood panels and masonry. Using the method and absorption coefficients described in ref. 3, reverberation was estimated at 0.3 s for rooms with carpeted flooring and 0.5 s for rooms with tile flooring. Acoustic measurements were taken with a Brüel and Kjær 2232 Sound Level Meter with A weighting and fast averaging in two classrooms of different grades at each of the campuses. Sound levels without students present were generally 35–45 dB sound pressure level (SPL). When fans or air-conditioning units were on, levels were ∼55 dB SPL. When students were present and quietly working, which did involve some conversation, levels reached an average of 65 dB SPL. These estimates are similar to a report by ref. 4 of classrooms in developed countries. The American Speech–Language–Hearing Association recommends a maximum of 35 dBA SPL of background noise and reverberation times of 0.7 s in unoccupied classrooms (5) and the slightly elevated levels obtained here likely reflect the acoustic conditions of most elementary classrooms.

SI Results

Children in the typically developing control group did not differ from those in the FM group in age (t_{43} = −1.375, P = 0.176); however, the typically developing control group had a slightly longer test–retest interval (mean difference, 1.01 mo; t_{43} = 2.124, P = 0.039). The typically developing group had an equivalent number of boys and girls (χ^2 = 0.037, P = 0.847). As was anticipated, typically developing children did have significantly higher IQ scores than dyslexic FM users (mean difference, 22.1 points; t_{43} = 5.242, $P < 0.001$).

The typically developing children improved in phonological awareness but had no change in reading. The children in the dyslexic control group improved in neither test (Table S1). Neither control group showed any change in neural response consistency for the formant transition or the vowel portions of the response (Table S1).

For both typically developing and dyslexic control groups, change in phonological awareness was predicted by pretest phonological awareness score (typically developing, ρ = −0.747, $P < 0.001$; dyslexic, ρ = −0.621, P = 0.005) and not by initial neural response consistency (typically developing, ρ = 0.006, P = 0.977; dyslexic, ρ = −0.118, P = 0.629), suggesting that changes in phonological awareness in these two groups reflected a regression toward the mean. There was not a significant correlation between pretest phonological awareness and change in phonological awareness for the dyslexic FM users (ρ = −0.323, P = 0.178), supporting that change in phonological awareness was due to active intervention with FM system use and not regression to the mean. Additionally, for the FM users, performance in phonological awareness at pretest did not predict improvement in response consistency with FM system use (ρ = 0.051, P = 0.835). In combination, these results support that only poor response consistency predicts behavioral gain with FM system use. This suggests that some children may have reading difficulties due to a specific auditory dysfunction, here inconsistent neural function, which can be assessed to predict their gains from auditory training.

Age and test–retest interval were also not mediating factors for neural and behavioral gains with FM system use. There were no relationships between age at pretest or test–retest interval and change in phonological awareness (ρ = 0.006, P = 0.981 and ρ = 0.267, P = 0.269, respectively) or response consistency (ρ = −0.045, P = 0.856 and ρ = 0.203, P = 0.404, respectively) for FM users. This is consistent with previous findings of stability of the response within this age range over 1 y in the absence of training (2).

1. Torgesen JK, Wagner RK, Rashotte CA (1999) *Test of Word Reading Efficiency (TOWRE)* (Pro-Ed, Austin, TX).
2. Hornickel J, Knowles E, Kraus N (2012) Test-retest consistency of speech-evoked auditory brainstem responses in typically-developing children. *Hear Res* 284:52–58.
3. Crandell CC, Smaldino JJ, Flexer C, eds (2005) *Sound Field Amplification: Applications to Speech Perception and Classroom Acoustics* (Thomson Delmar Learning, Clifton Park, NY), 2nd Ed.
4. Shield BM, Dockrell JE (2003) The effects of noise on children at school: A review. *Building Acoustics* 10:97–106.
5. American Speech-Language-Hearing Association (2005) *Acoustics in Educational Settings.* (ASHA: Rockville, MD).

Table S1. Participant characteristics, inclusion criteria, behavioral measures, and neural response consistency for each group

	Typically developing controls		Dyslexic controls		Dyslexic FM users	
Measure	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Participant characteristics						
Age in mo	131.23 (16.60)	143.77 (16.60)	125.95 (16.90)	136.68 (17.47)	139.21 (22.38)	150.89 (22.20)
ADHD diagnoses	0		9		9	
Inclusionary criteria						
IQ	122.08 (12.56)	124.65 (11.50)	105.21 (12.92)	107.68 (14.55)	100.00 (15.68)	102.32 (15.43)
Reading fluency						
(Test of Oral Word Reading Efficiency)	117.35 (12.44)	116.69 (13.24)	84.95 (9.00)	87.95 (9.39)	87.84 (17.64)	88.26 (14.79)
(Test of Silent Word Reading Fluency)	108.88 (11.30)	113.35 (10.87)	87.74 (12.71)	92.68 (15.16)	88.89 (11.77)	91.00 (14.19)
Behavioral and neural measures						
Reading ability	111.96 (16.69)	114.35 (9.59)	94.84 (10.07)	96.06 (10.74)	**97.00 (14.51)**	**101.56 (12.35)**
(Woodcock–Johnson basic reading cluster)					*−3.118* **(0.006)**	
Phonological awareness	**107.04 (12.06)**	**110.50 (6.96)**	98.42 (13.62)	101.42 (11.46)	**94.32 (16.49)**	**103.00 (15.23)**
(CTOPP phonological awareness cluster)	*−2.014* **(0.055)**				*−5.255* **(<0.001)**	
Brainstem response consistency (formant)	0.7681 (0.24)	0.7720 (0.27)	0.6723 (0.26)	0.6796 (0.28)	**0.6567 (0.26)**	**0.7639 (0.24)**
					−2.260 **(0.036)**	
Brainstem response consistency (vowel)	0.9169 (0.23)	0.9025 (0.30)	0.6696 (0.25)	0.6790 (0.30)	0.7603 (0.32)	0.8168 (0.28)

Statistics are mean (SD), *t* (italic type) (**p**) when applicable. Only statistics with $P < 0.1$ are included for visual clarity. Significant changes are in boldface type. ADHD, attention deficit hyperactivity disorder; CTOPP, Comprehensive Test of Phonological Processing.