

Lezione n 17 del 1 Dicembre 2020

Nps svi e riabil

- Action video games (AVG) come prevenzione della dislessia?!?!
- Perceptual learning magnocellulare
 - AVG + stimolazione elettrica transcranica
 - AVG e discalculia

Perceptual noise exclusion mechanism is improved by action video games training in developmental dyslexia

Sara Bertoni¹, Sandro Franceschini¹, Martina Mancarella¹, Giovanna Puccio¹, Simone Gori² and Andrea Facoetti¹

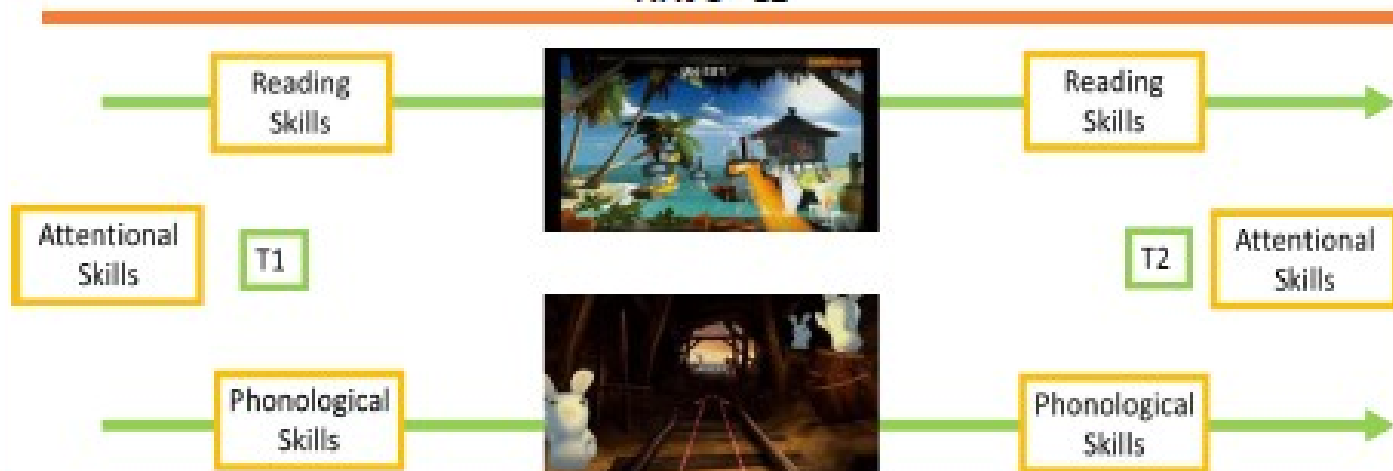


PARTICIPANTS

N= 14, years: 9

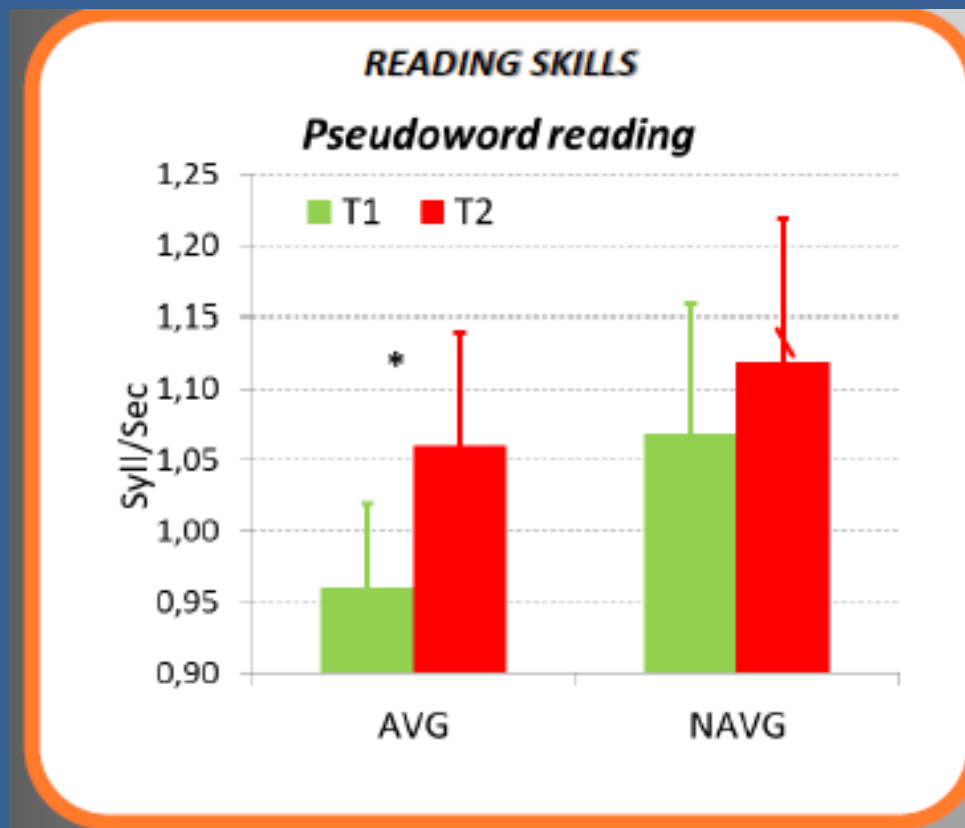
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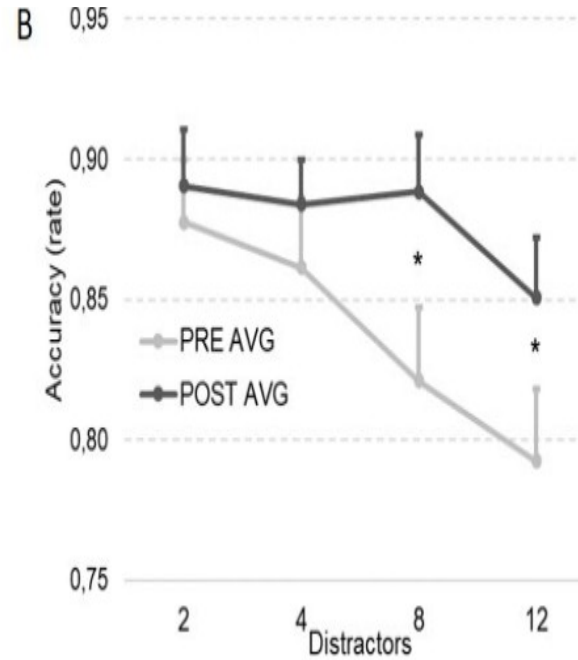
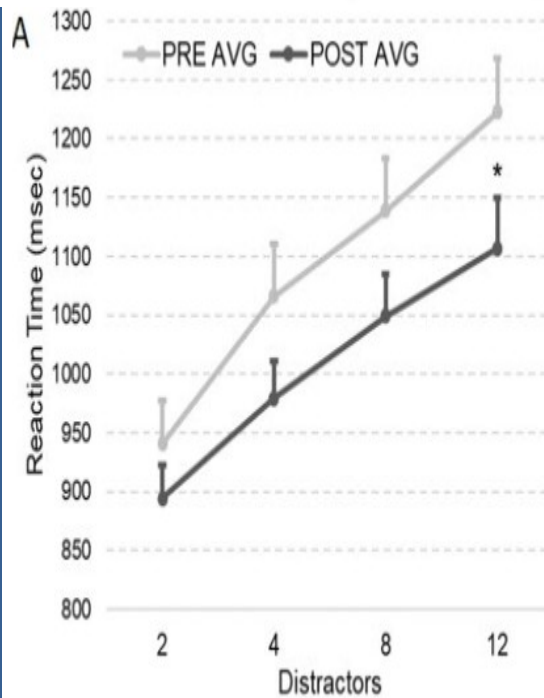
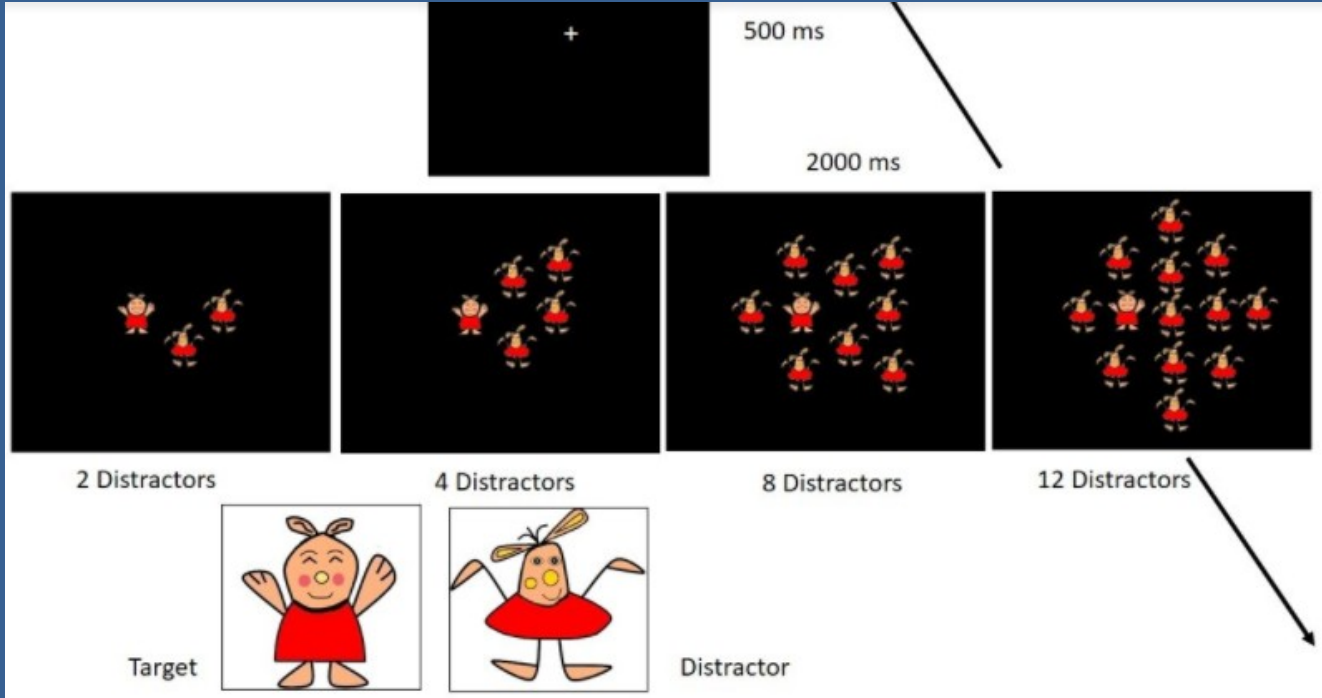
NAVG= 12



Perceptual noise exclusion mechanism is improved by action video games training in developmental dyslexia

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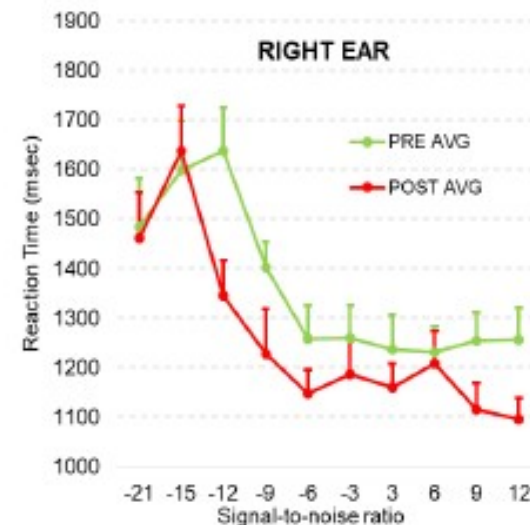
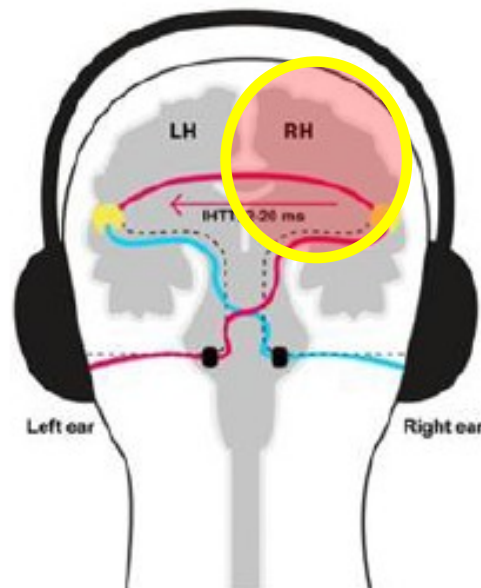
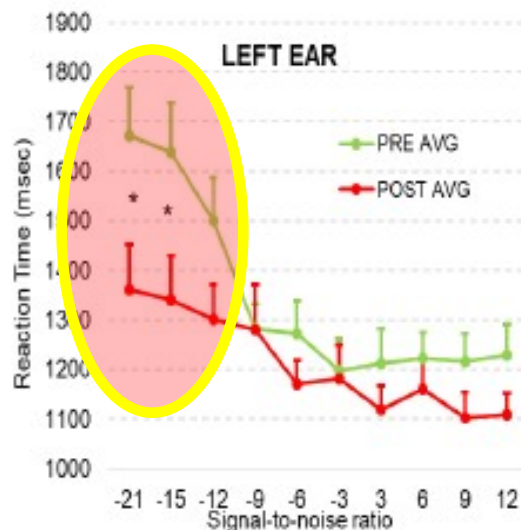




Perceptual noise exclusion mechanism is improved by action video games training in developmental dyslexia

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ATTENTIONAL SKILLS: Auditory attentional noise exclusion



PRE-LETTURA

Scuola dell'infanzia

ACQUISIZIONE DELLA LETTURA

Primaria Secondaria Università

Sviluppo tipico della lettura

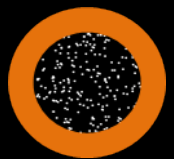
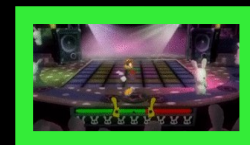
ABILITA' DI LETTURA

Abilità del circuito M-D
Abilità visuo-attenzionale
Denominazione rapida automatizzata
Abilità uditive-fonologiche

Environmental
by
Gene
Interactions

Dislessia evolutiva

Addestramento visuo-attenzionale e M-D



T I M E

C. Prevenzione della Dislessia

Training con video giochi d'azione in bambini a rischio di dislessia:

- **Attenzione visiva spaziale** e **discriminazione fonemica**
(Studio 1 e 2)
- **Attenzione visiva spaziale** e **discriminazione fonemica** e
le loro basi neurobiologiche (Studio 3)
- **Attenzione visiva spaziale** e **discriminazione fonemica**
nei bambini con Disturbo Specifico del Linguaggio (Studio
4)

Disegno sperimentale

71 bambini prescolari (5-6 anni):

- **41 a basso rischio** = nessun deficit nei predittori della lettura;
- **30 ad alto rischio** = uno o più disturbi nei predittori della lettura.

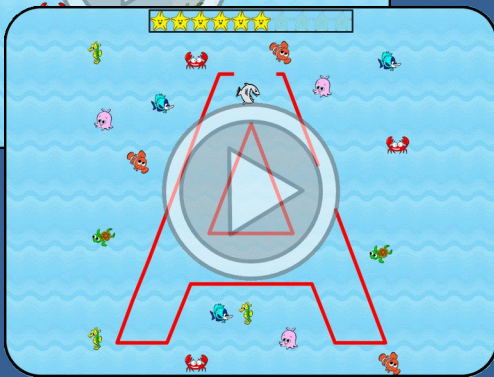
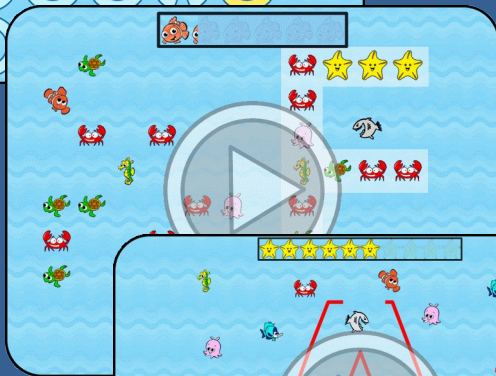
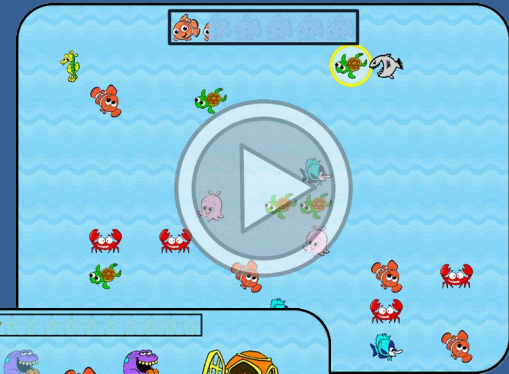
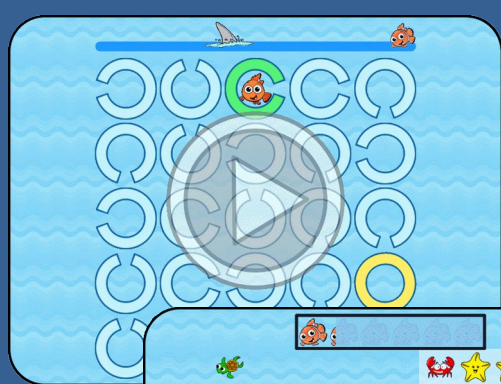
30 bambini pre-lettori ad

alto rischio: Uno o più disturbi: (i) Riconoscimento Lettere, (ii) Denominazione di colori, (iii) Discriminazione Fonemica e/o (iv)

Ricerca visiva:

- 16 “Action” video games
(20 hours);
- 14 “Serious” video games
(20 hours).

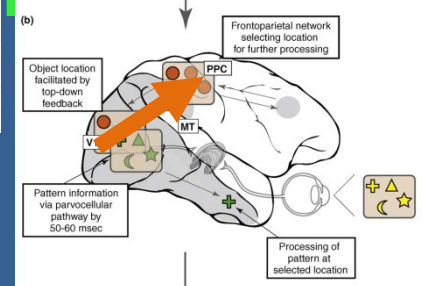
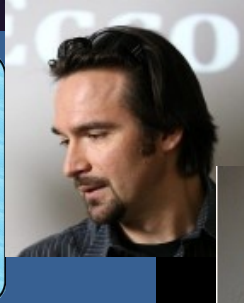
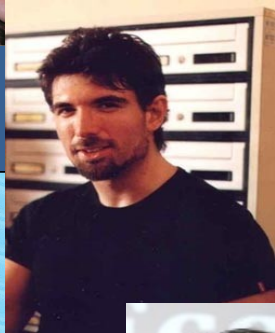
**“Serious” video games (mediante tablet) = training
attenzione visiva (i.e., ricerca visiva e orientamento),
rapida elaborazione uditiva (i.e., suoni del linguaggio)
e corrispondenza grafemo-fonema.**



“Action” video games training (mediante Nintendo DS®)



Visuo-spatial attention and phoneme discrimination (Study 1 and 2)

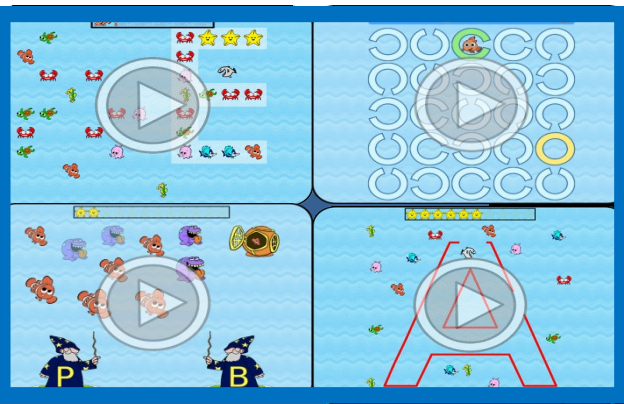
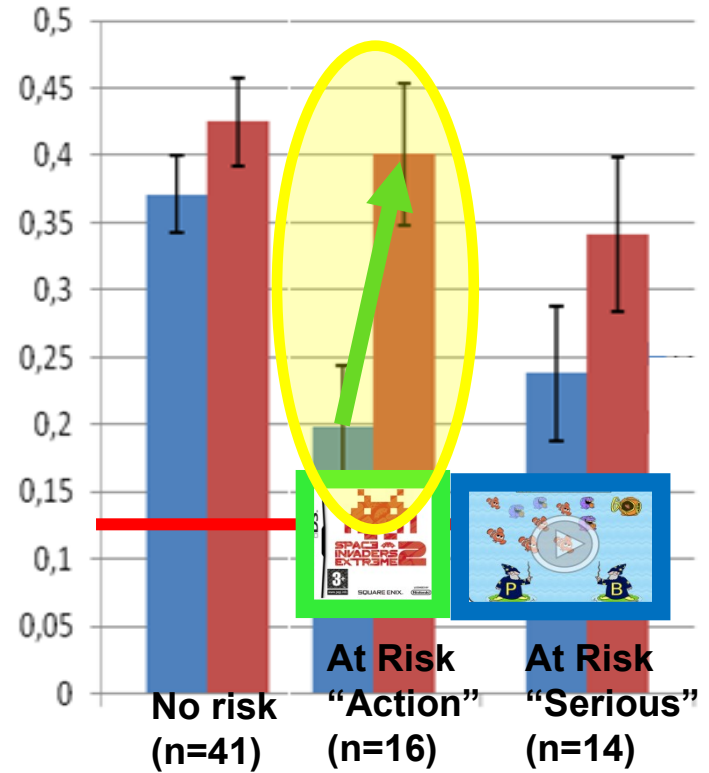
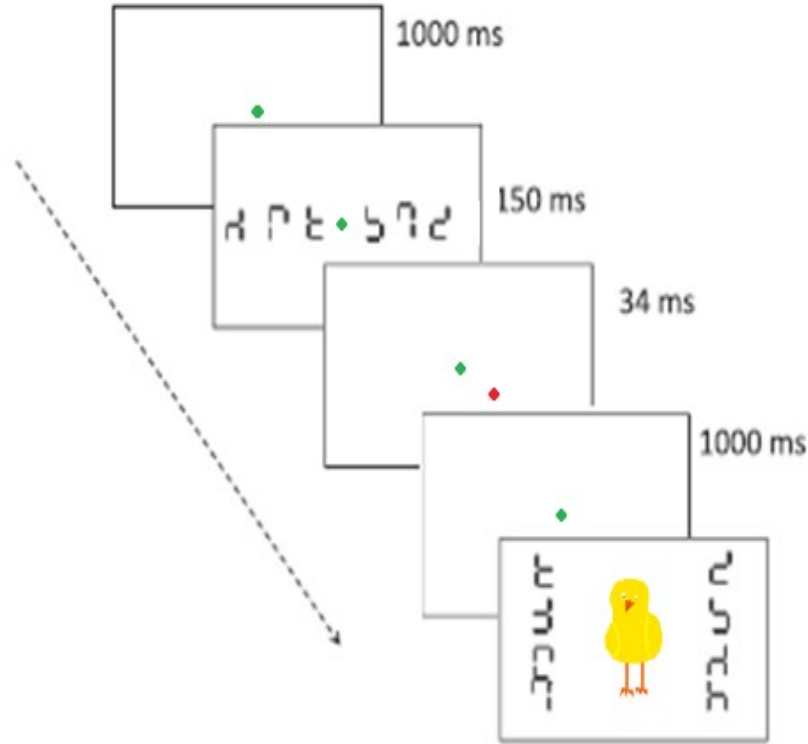


Serious Games for Early Identification of Developmental Dyslexia

OMBRETTA GAGGI and CLAUDIO ENRICO PALAZZI, Dept. of Mathematics, Univ. of Padua, Italy
 MATTEO CIMAN, Institute of Services Science - University of Geneva, Switzerland
 GIORGIA GALIAZZO, Dept. of Mathematics, Univ. of Padua, Italy
 SANDRO FRANCESCHINI, Developmental and Cognitive Neuroscience Lab, Dept. of General Psychology, Univ. of Padua, Italy
 MILENA RUFFINO, Psychopathology Unit, Scientific Institute IRCCS Eugenio Medea, Lecco, Italy
 SIMONE GORI and ANDREA FACOETTI, Developmental and Cognitive Neuroscience Lab, Dept. of General Psychology, Univ. of Padua, Italy, Child Psychopathology Unit, Scientific Institute IRCCS Eugenio Medea, Lecco, Italy

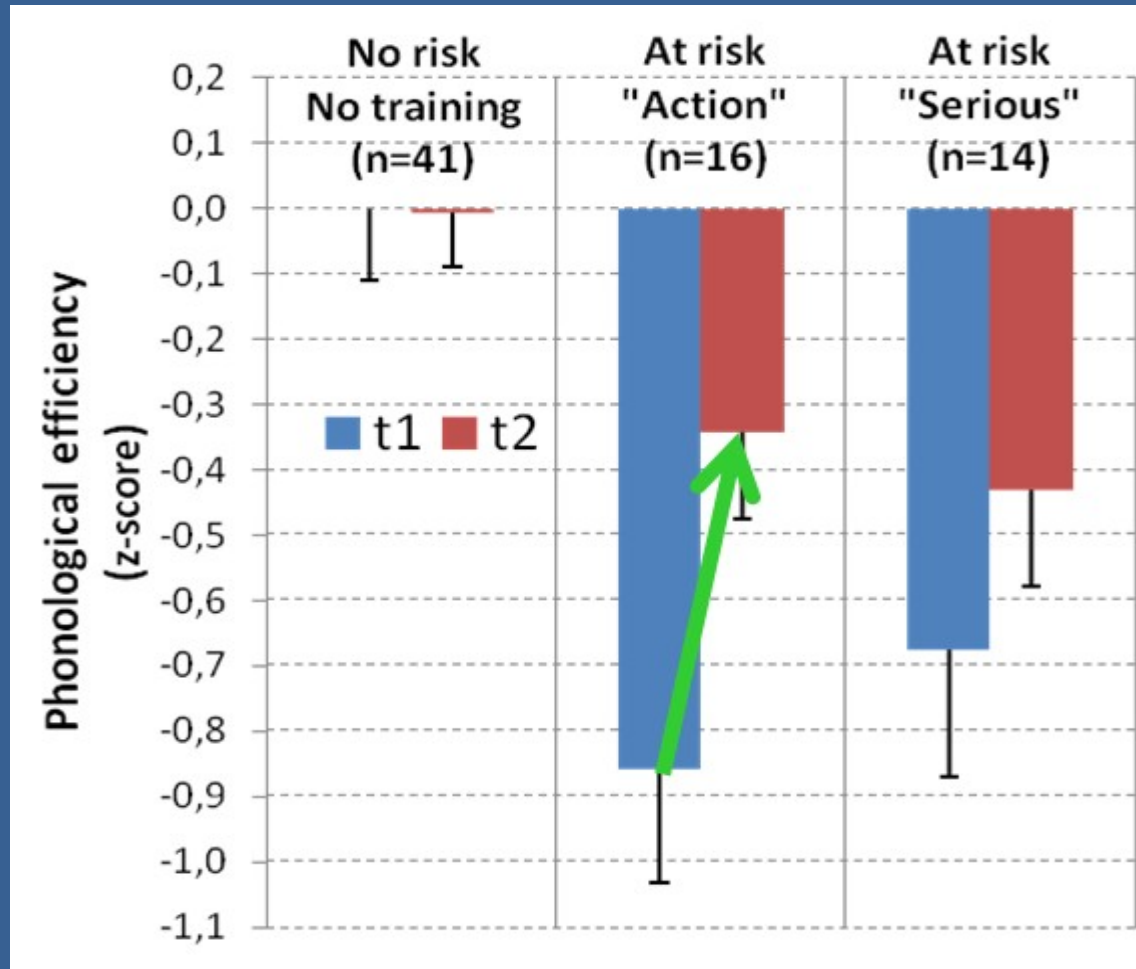
Visuo-spatial attention and phoneme discrimination
(Study 1 and 2)

PREVENIRE la dislessia nei bambini pre-lettori con un TRAINING del circuito attenzionale (Studio 1)



5. Dyslexia prevention

Indice fonologico globale (riconoscimento lettere, denominazione di colori e discriminazione fonemica)

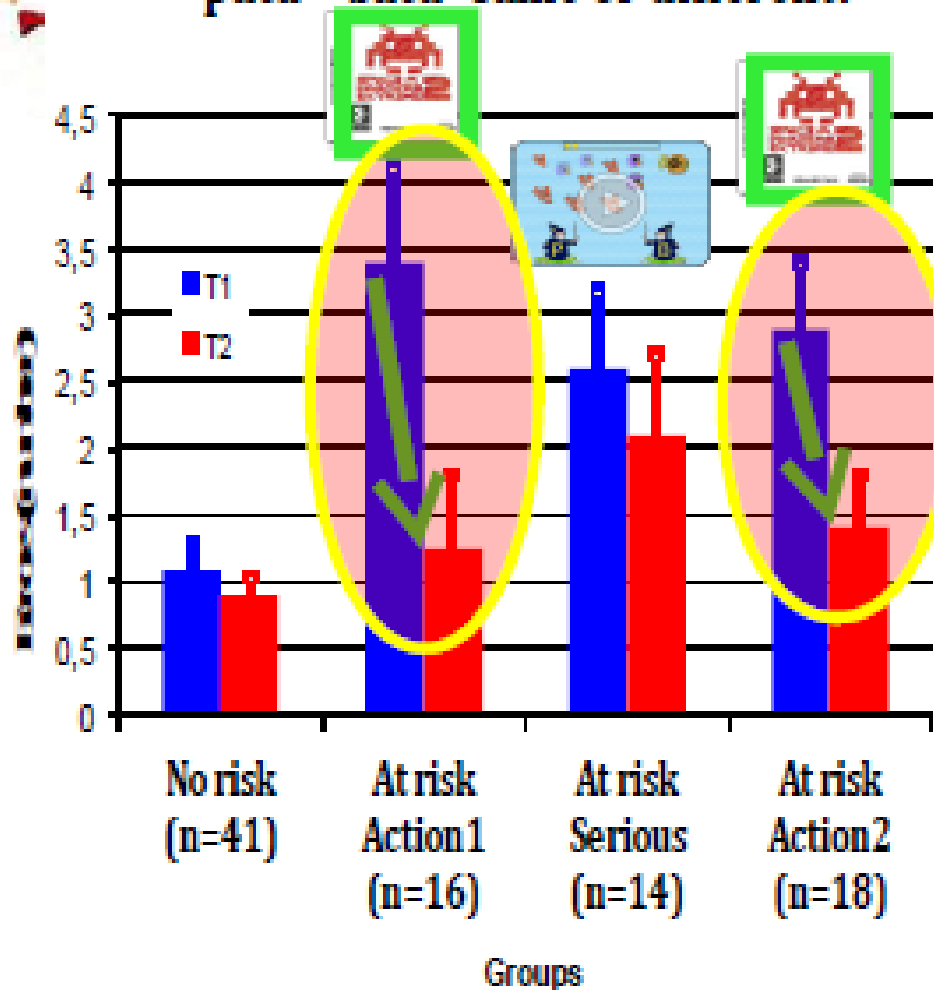


Visuo-spatial attention and
phoneme discrimination
(Study 1 and 2)

PREVENTING dyslexia in pre-readers by TRAINING the attentional network (Study 1 and 2)

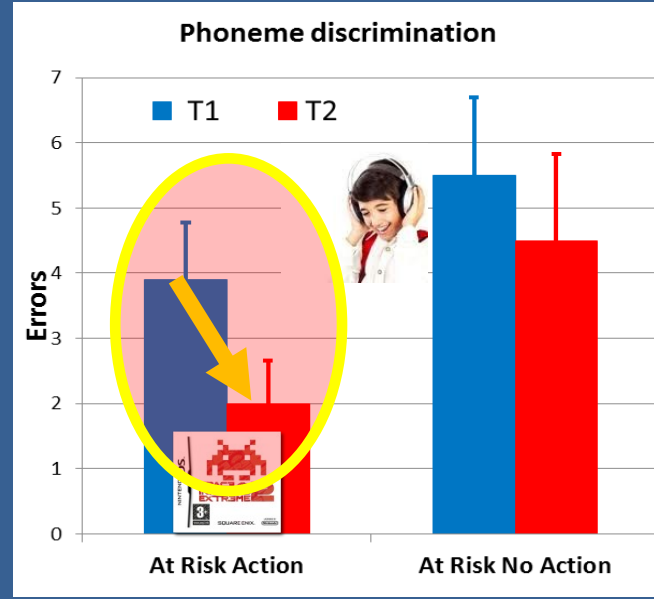
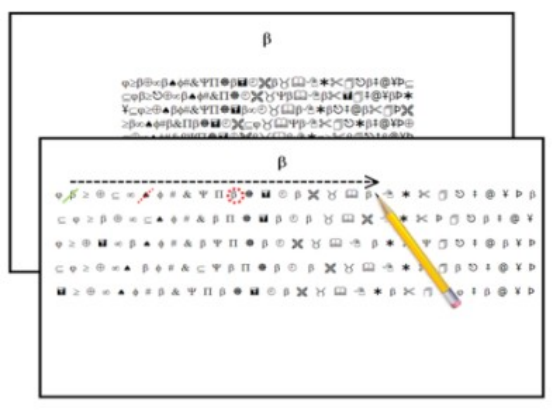
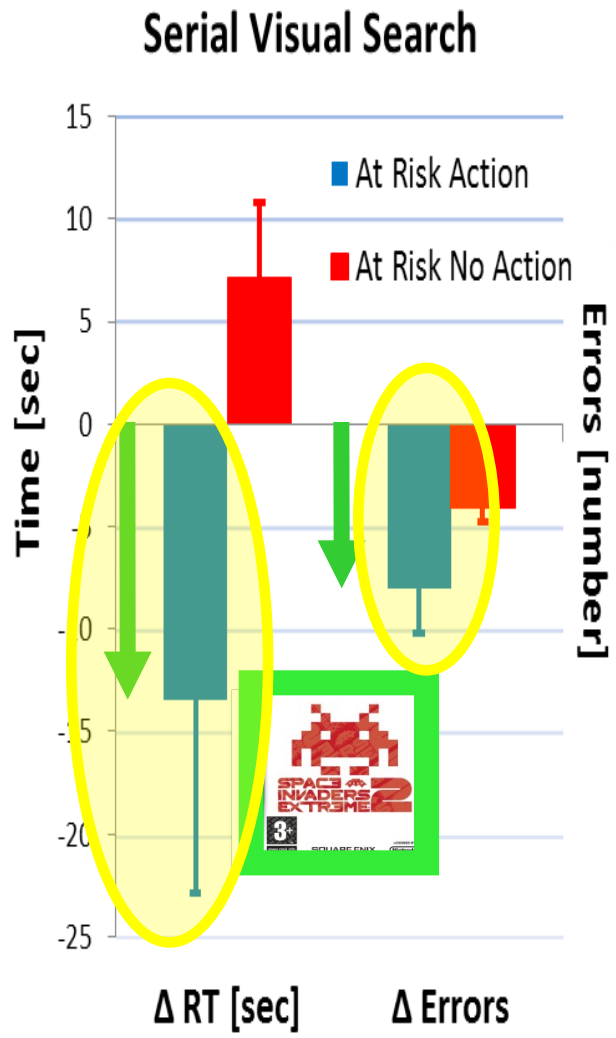


Phoneme discrimination task:
"paca" "baca" same or different?

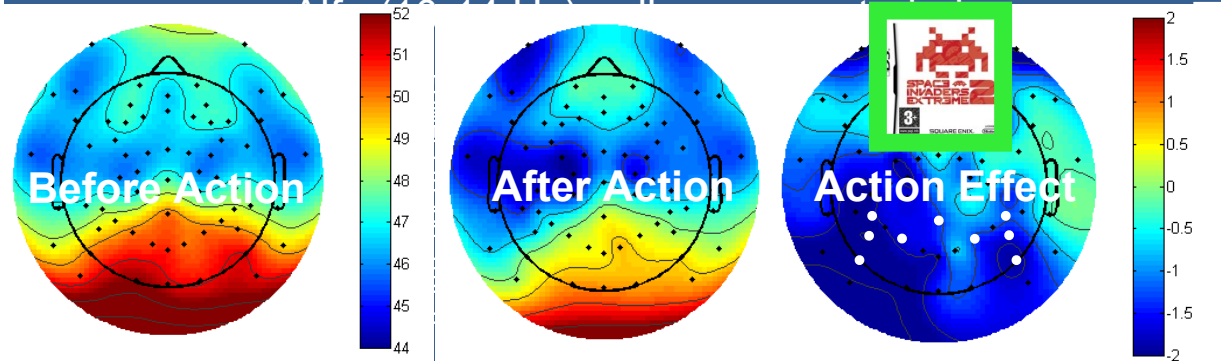


Visuo-spatial, phoneme discrimination and their neurobiological basis (Study 3)

PREVENIRE la dislessia nei bambini pre-lettori con un TRAINING del circuito attenzionale (Studio 3)

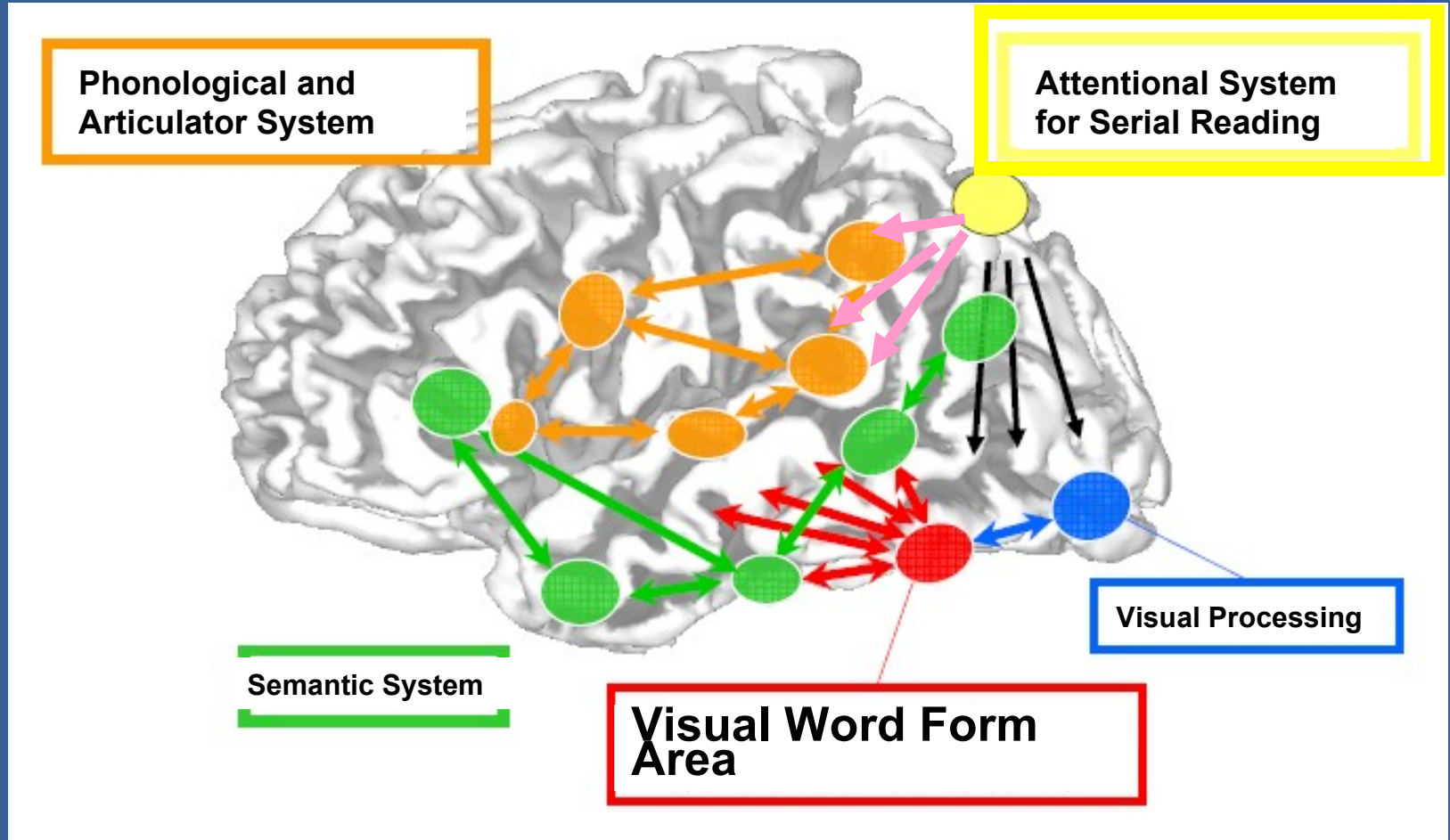


Basi Neurali del training con video giochi d'azione nei bambini a rischi di dislessia:
 Un studio di "resting state" con dense-array EEG
 Una riduzione dell'attività oscillatoria nella banda delle onde



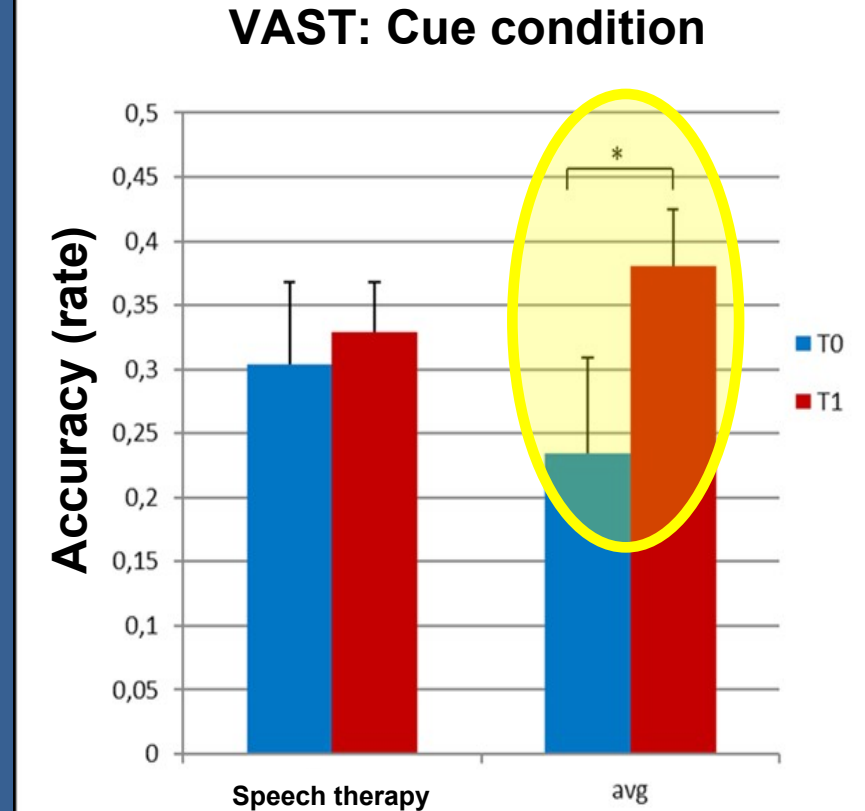
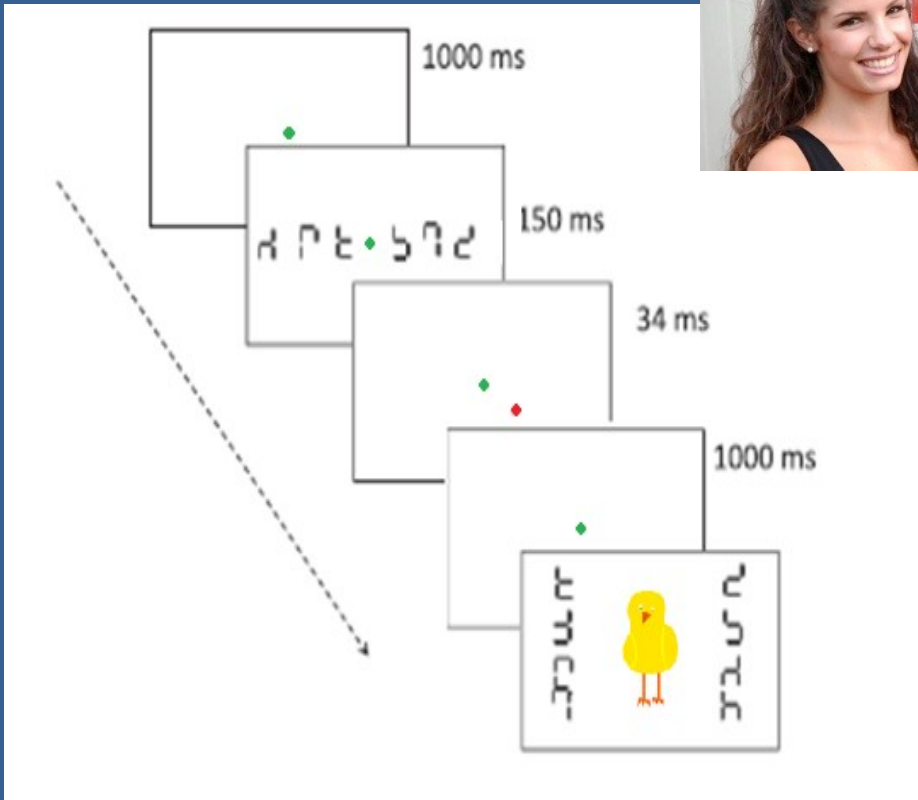
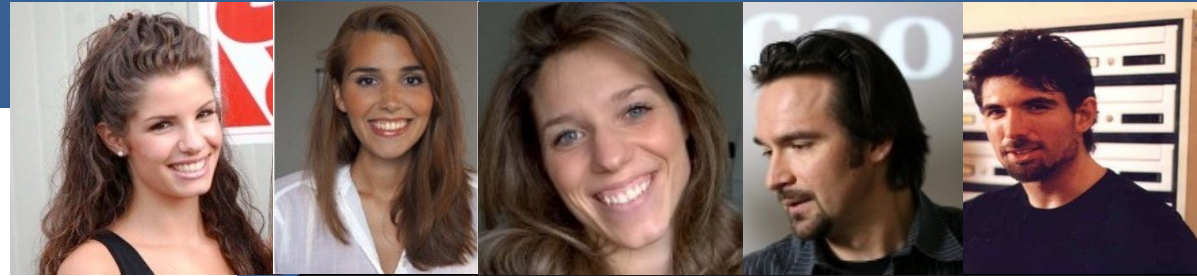
Il Nuovo Orizzonte!

Il modello di Dehaene MODIFICATO, Cohen & coll.



Visuo-spatial attention and phoneme discrimination in pre-readers with SLI (**Study 4**)

PREVENIRE la dislessia nei bambini con **Disturbo Specifico del Linguaggio** mediante un **TRAINING** del circuito attenzionale (Studio 4)

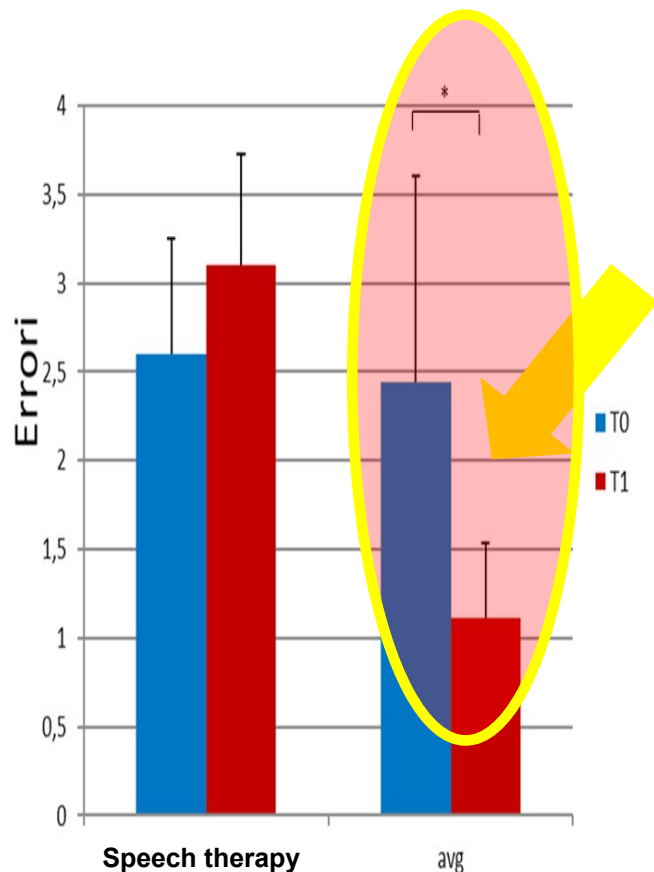


Attenzione visiva spaziale nei bambini con **Disturbo Specifico del Linguaggio**

Visuo-spatial attention and phoneme discrimination in pre-readers with SLI (Study 4)

PREVENIRE la dislessia nei bambini con Disturbo Specifico del Linguaggio mediante un TRAINING del circuito attenzionale (Studio 4)

Phoneme discrimination



Ascoltami bene: ora ti dirò delle parole che non esistono e tu dovrai dirmi se sono uguali o no. Facciamo un esempio: se io ti dico PADE-FADE, sono uguali, sì o no? E se ti dico ZANE-ZANE? Hai capito bene? Iniziamo.

1. PACA	BACA	
2. BATA	PATA	
3. PASE	PASE	
4. FAMI	VAMI	
5. VALA	VALA	
6. LETA	LEDA	
7. TOCO	DOCO	
8. CILA	GILA	
9. GIPI	GIPI	
10. MUNO	NUNO	
11. CANO	CAMO	
12. LACO	RACO	
13. SALU	SALU	
14. SEBA	ZEBA	
15. RAVE	SAVE	



Discriminazione fonemica nei bambini con Disturbo Specifico del Linguaggio

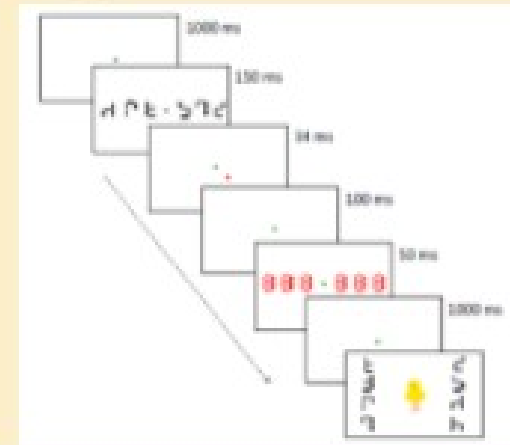
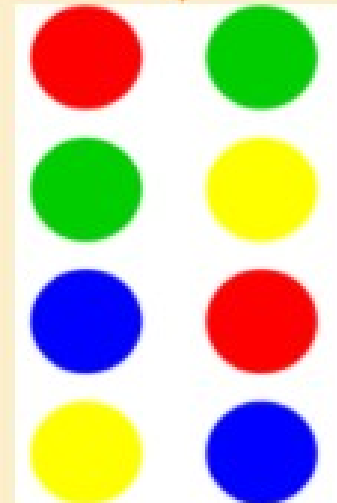
Procedura e materiali

Valutazione pre (T1) e post (T2) trattamento

Ascolti bene: sei o ti di delle parole che non esistono o che devoti dire di sono uguali o no.
 Esempio: sei o ti di due PAZI-TRIZI, sono uguali, o ti di? E ora di due ZAZZ-LEZZI?
 Ho capito bene? Immagina.

1. BACA	BACA	
2. BADA	PAZA	
3. BAZE	PAZE	
4. BAME	VAME	
5. YALA	YALA	
6. LEYA	LEZA	
7. DOZO	DOZO	
8. OELA	OELA	
9. GIFI	GIFI	
10. MUNO	MUNO	
11. CANO	CANO	
12. LACO	BACO	
13. SALU	SALU	
14. ZIBA	ZIBA	
15. SAVI	SAVI	

N.	Stimolo	Stimolo	Risposta (s)
1	BACA	PAZA	
2	BADA	PAZA	
3	BAZE	PAZE	
4	BAME	VAME	
5	YALA	YALA	
6	LEYA	LEZA	
7	DOZO	DOZO	
8	OELA	OELA	
9	GIFI	GIFI	
10	MUNO	MUNO	
11	CANO	CANO	
12	LACO	BACO	
13	SALU	SALU	
14	ZIBA	ZIBA	
15	SAVI	SAVI	
16	VERACAZIONE	VERACAZIONE	
17	VERACAZIONE	VERACAZIONE	
18	VERACAZIONE	VERACAZIONE	
19	VERACAZIONE	VERACAZIONE	
20	VERACAZIONE	VERACAZIONE	
21	VERACAZIONE	VERACAZIONE	
22	VERACAZIONE	VERACAZIONE	
23	VERACAZIONE	VERACAZIONE	
24	VERACAZIONE	VERACAZIONE	
25	VERACAZIONE	VERACAZIONE	
26	VERACAZIONE	VERACAZIONE	
27	VERACAZIONE	VERACAZIONE	
28	VERACAZIONE	VERACAZIONE	
29	VERACAZIONE	VERACAZIONE	
30	VERACAZIONE	VERACAZIONE	
31	VERACAZIONE	VERACAZIONE	
32	VERACAZIONE	VERACAZIONE	
33	VERACAZIONE	VERACAZIONE	
34	VERACAZIONE	VERACAZIONE	
35	VERACAZIONE	VERACAZIONE	
36	VERACAZIONE	VERACAZIONE	
37	VERACAZIONE	VERACAZIONE	
38	VERACAZIONE	VERACAZIONE	
39	VERACAZIONE	VERACAZIONE	
40	VERACAZIONE	VERACAZIONE	
41	VERACAZIONE	VERACAZIONE	
42	VERACAZIONE	VERACAZIONE	
43	VERACAZIONE	VERACAZIONE	
44	VERACAZIONE	VERACAZIONE	
45	VERACAZIONE	VERACAZIONE	
46	VERACAZIONE	VERACAZIONE	
47	VERACAZIONE	VERACAZIONE	
48	VERACAZIONE	VERACAZIONE	
49	VERACAZIONE	VERACAZIONE	
50	VERACAZIONE	VERACAZIONE	



Procedura e materiali

- Di 25 bambini con DSL e a rischio DE è stata registrata l'attività elettroencefalografica tramite resting state di 5 minuti.

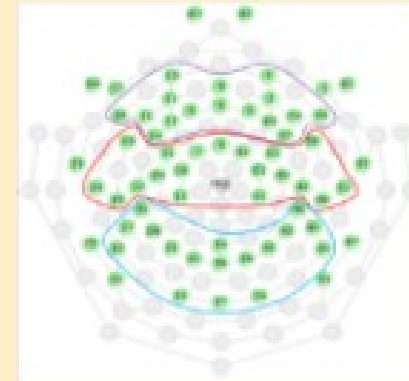
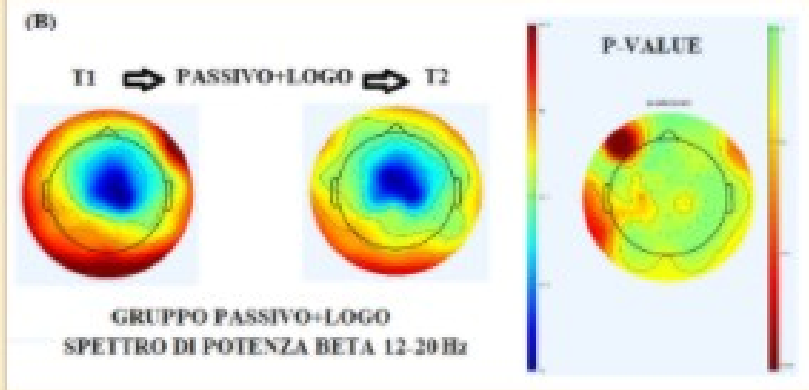
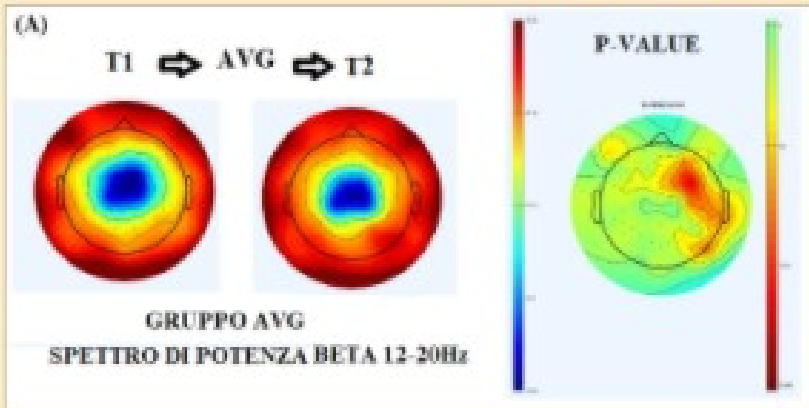
12 con DSL appartenenti al gruppo AVG

10 a rischio DE che non aveva ricevuto trattamento e
3 con DSL che avevano fatto logoterapia

**Valutazione EEG Resting State pre (T1) e post (T2)
trattamento**

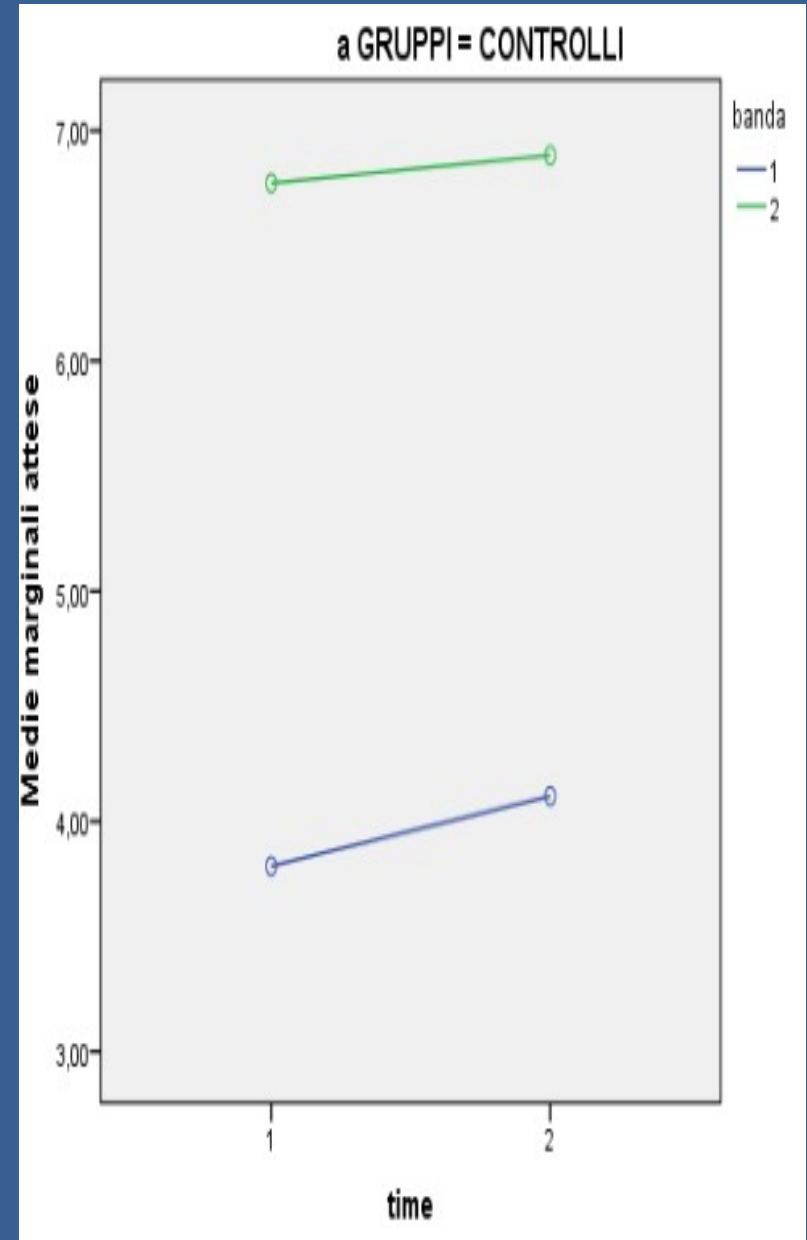
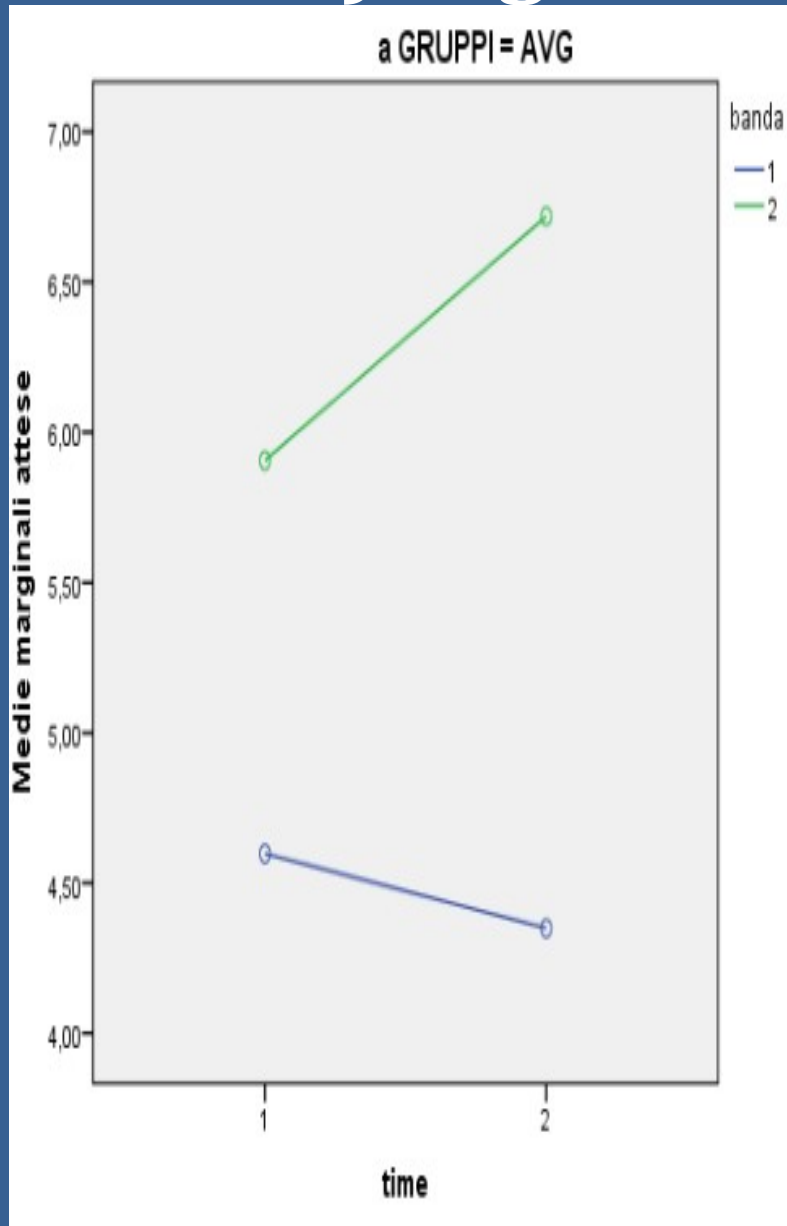


Analisi dei risultati EEG



- Incremento statisticamente significativo nello spettro di potenza della banda beta bassa (12-20 Hz) nel cluster di elettrodi frontali solo per il gruppo AVG tra T1 e T2.

Effetti degli AVG: Oscillazioni Beta bassa (12-20 Hz) regioni frontali = Attenzione

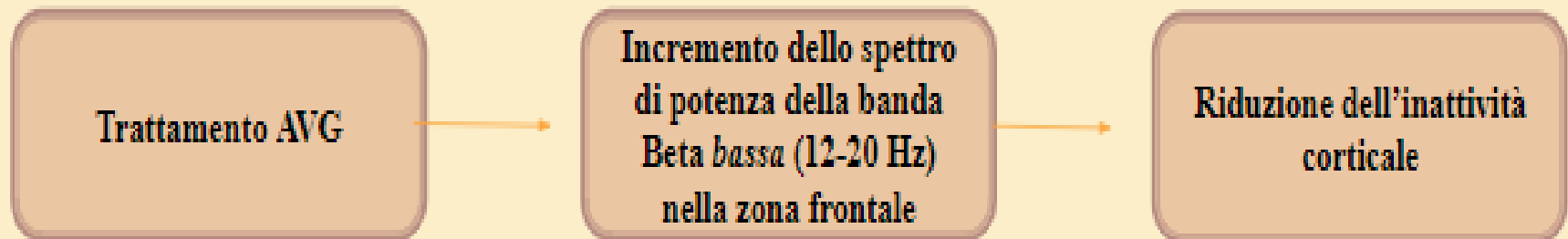


Discussione e conclusioni

Risultati comportamentali



Risultati EEG



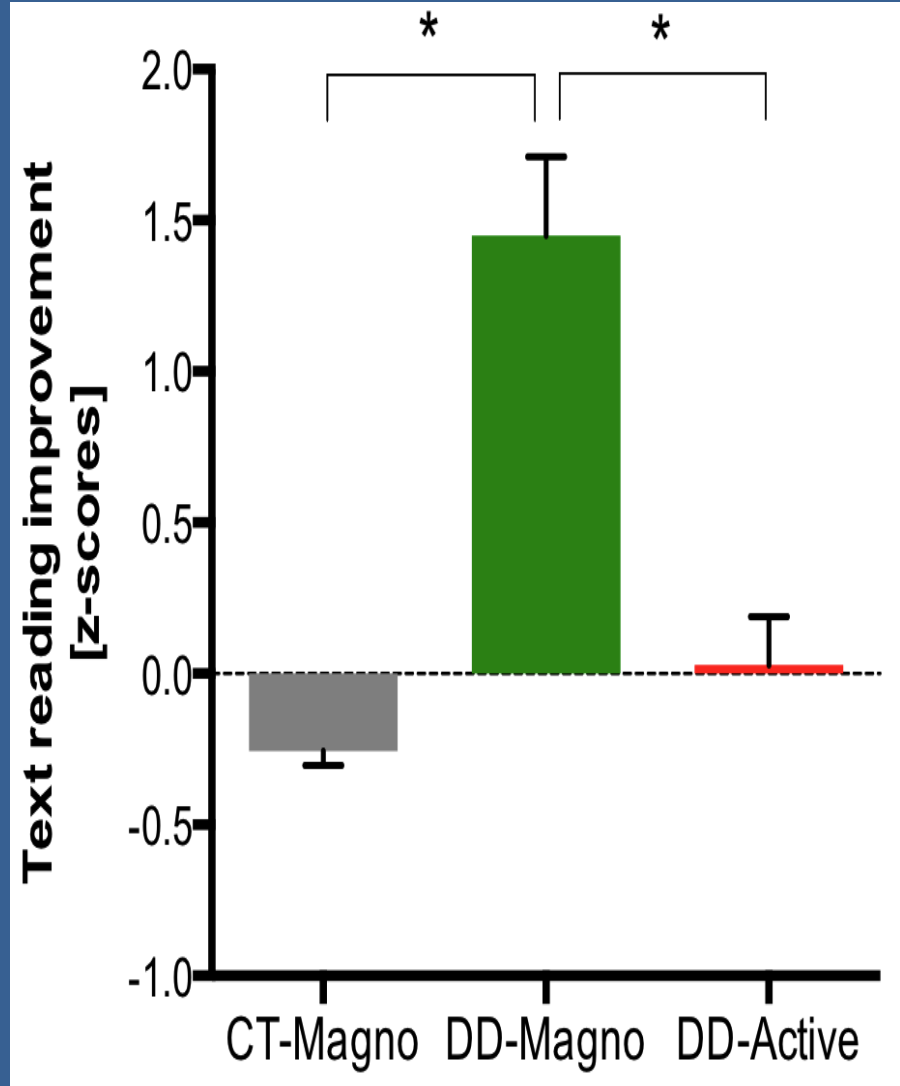
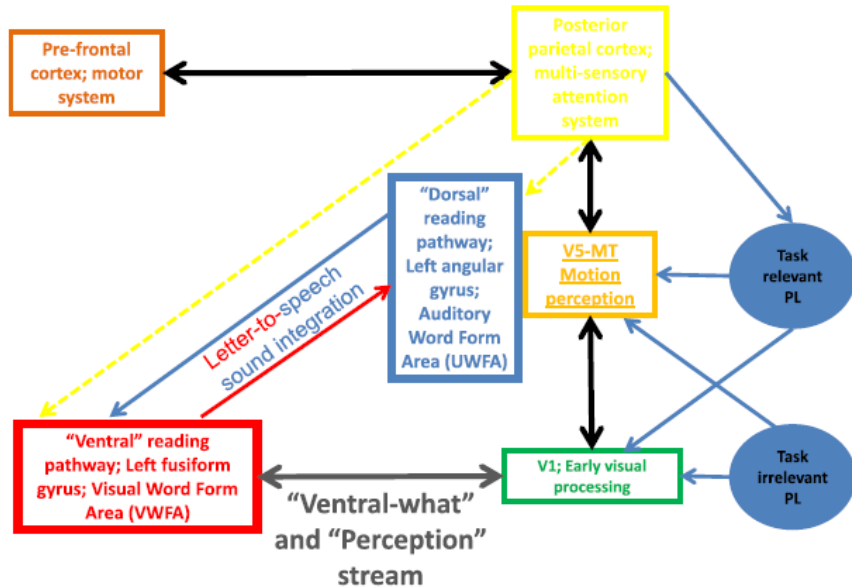
C. Neuroplasticità nei adulti con dislessia

- 1. Perceptual learning MD;**
- 2. AVG training + Trans-cranial
Electrical Stimulation.**

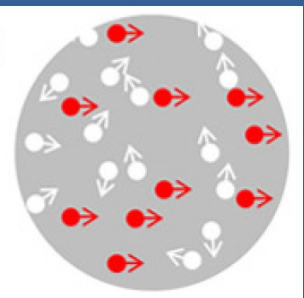
Multiple causal links between magnocellular-dorsal pathway deficit and developmental dyslexia



(a) "Dorsal-where" and "Action" stream



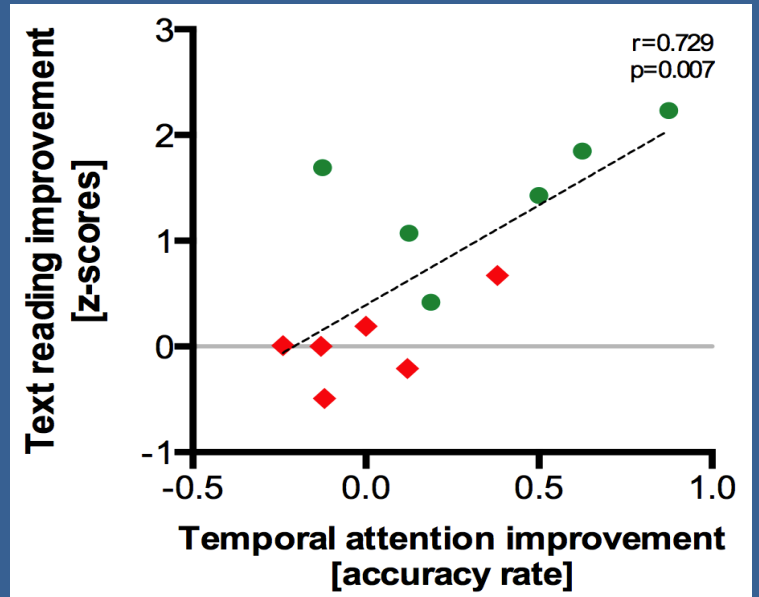
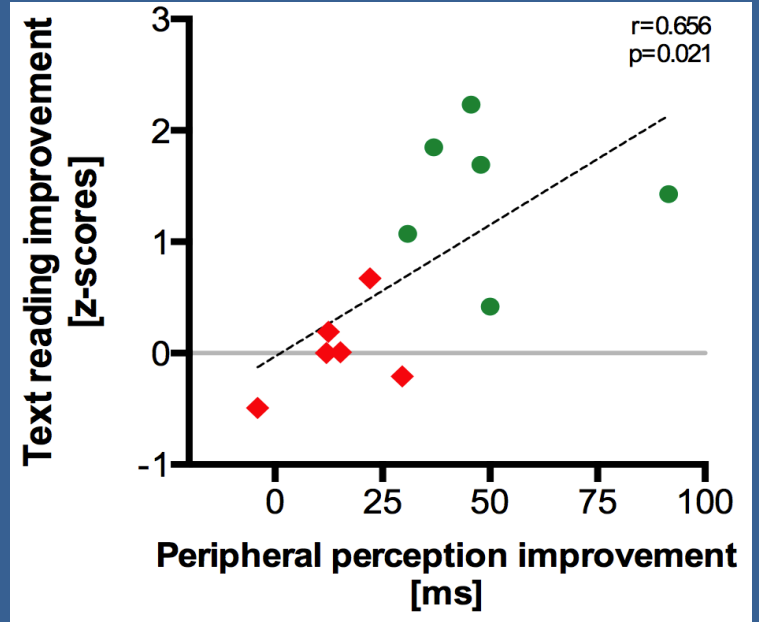
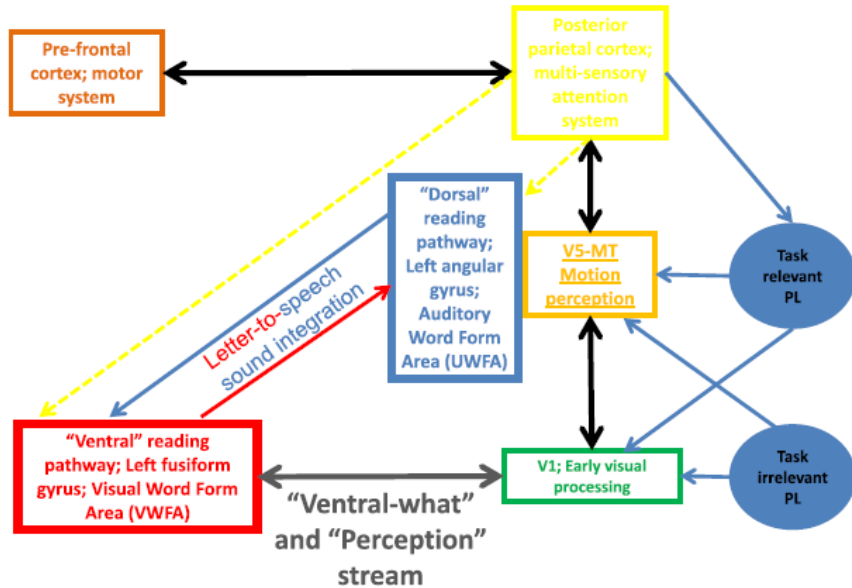
Possiamo migliorare la lettura con un training diretto del sistema dorsale? (studio con perceptual learning)



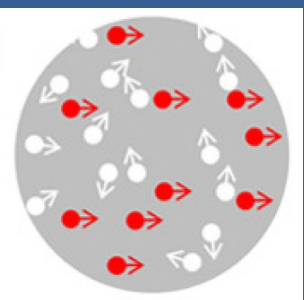
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(a) "Dorsal-where" and "Action" stream

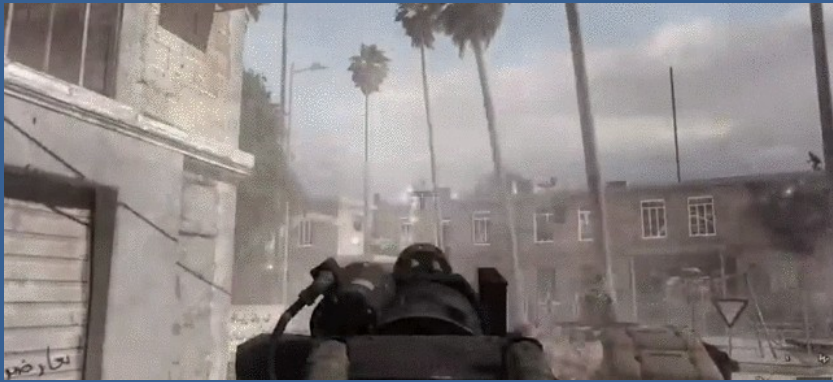
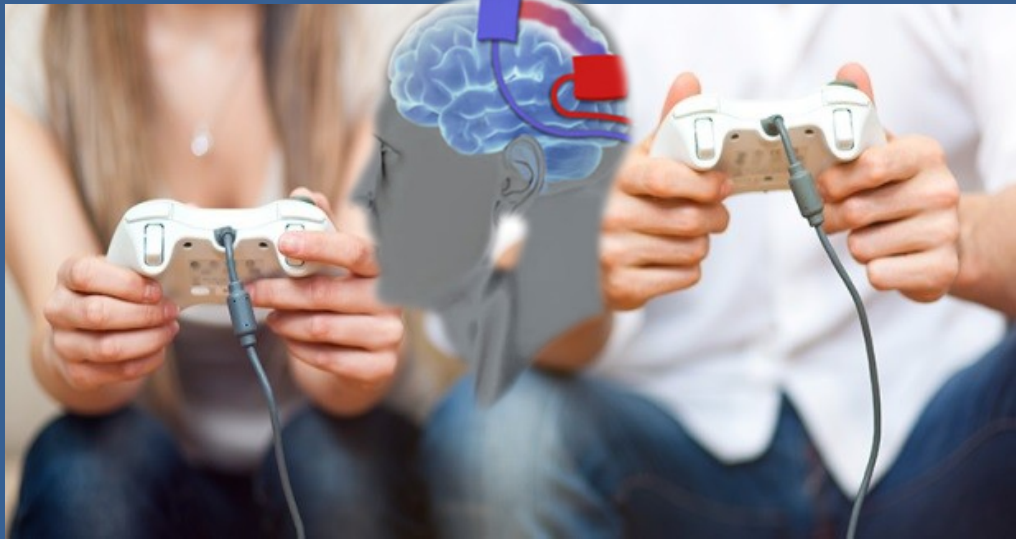


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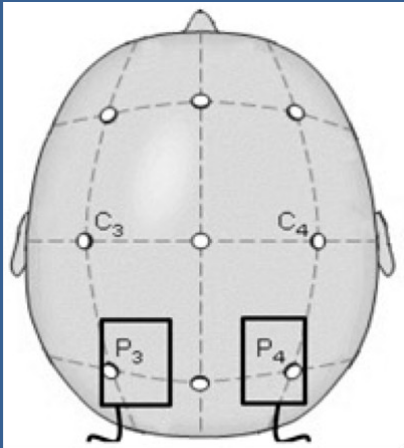




AVG & tRNS

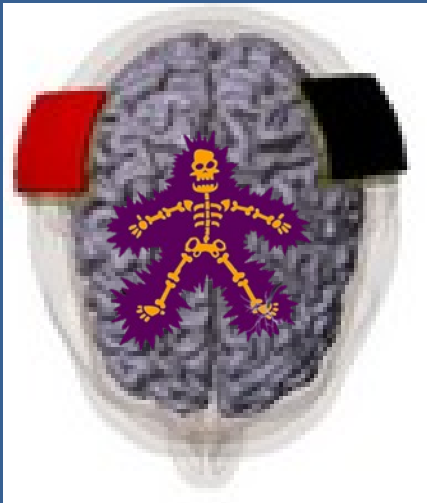


**HIGH
FREQUENCY
tRNS in P3
and P4**



(Cappelletti et al., 2013)

AVG & tRNS



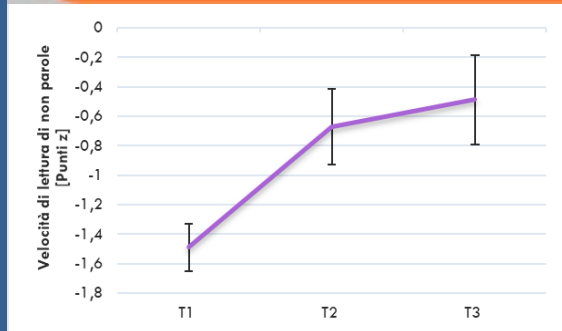
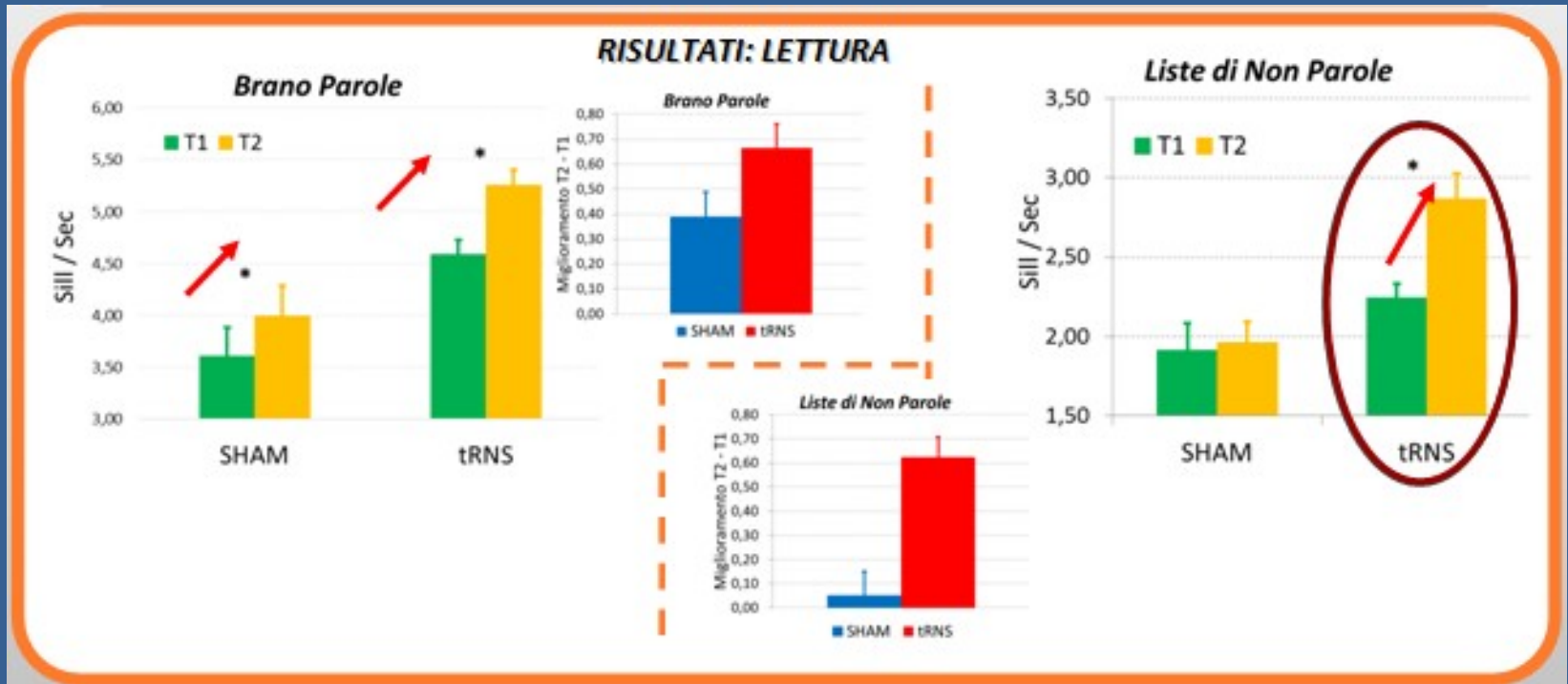
N = 10
tRNS



N = 10
SHAM



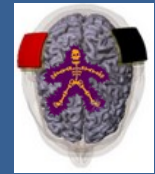
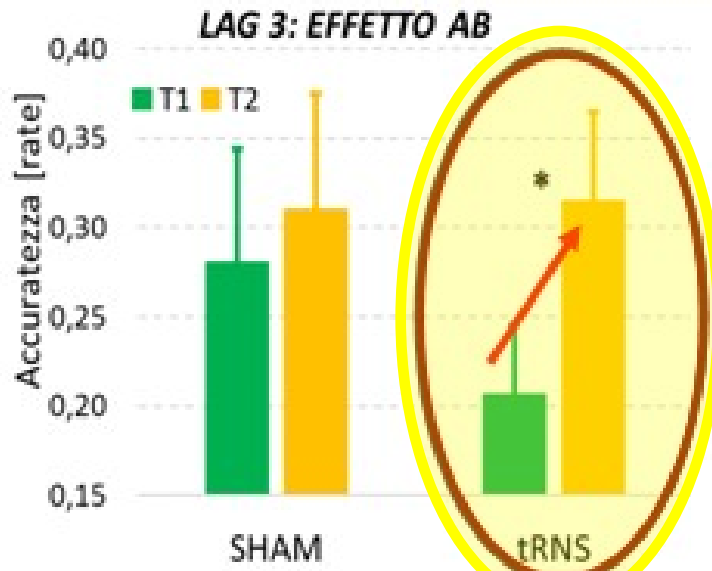
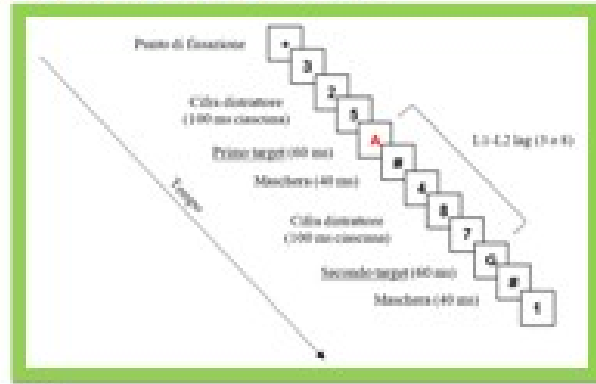
Reading speed: Training effects



Improvement in phonological decoding

Temporal attention: Training effects

RISULTATI: ATTENZIONE

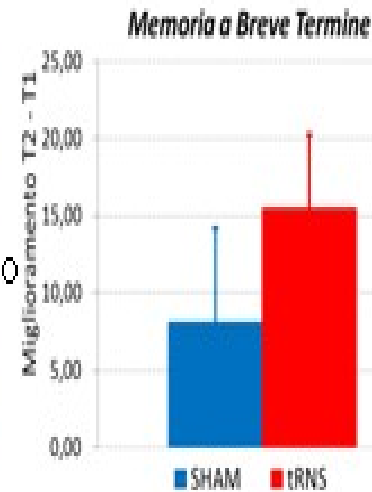
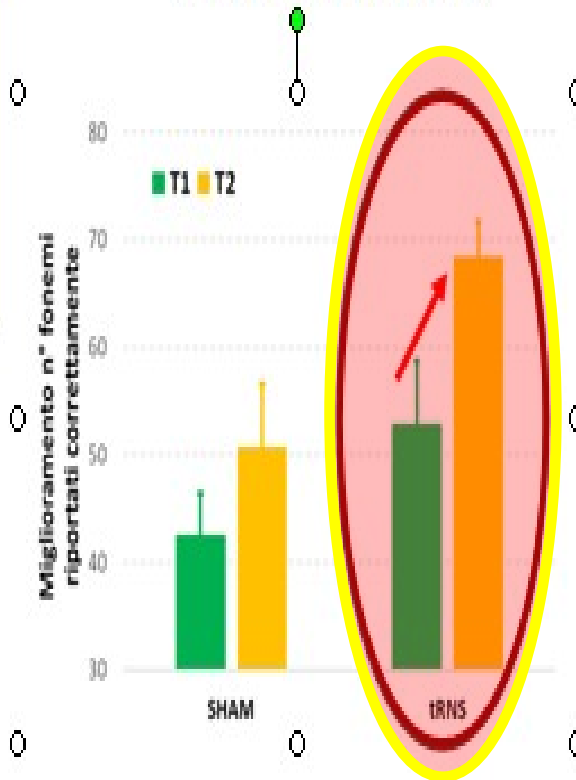


Improvement
in temporal
attention

Phonological Short-Term Memory: Training effects

RISULTATI: FONOLOGIA

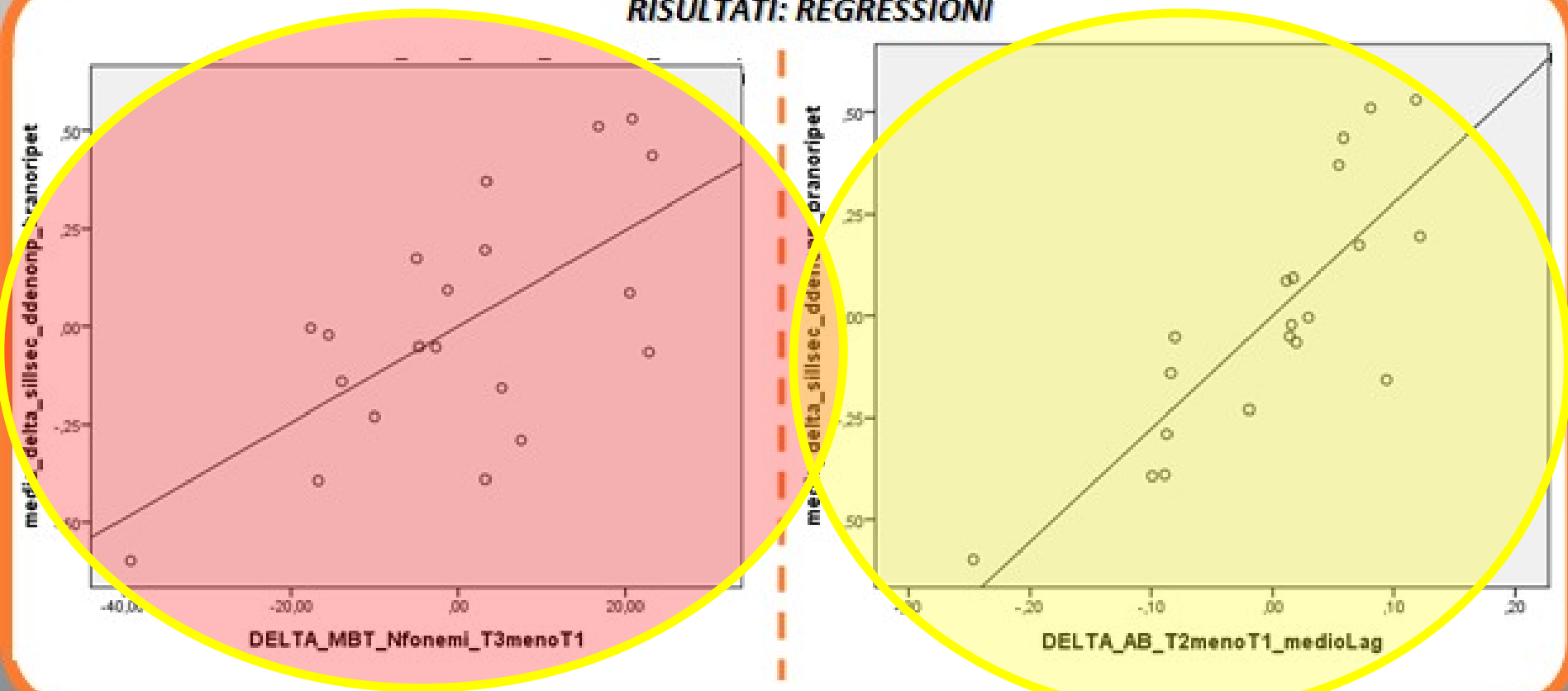
Non parole	Numero fonemi corretti
1 cat - gas	
2 cat - rat	
3 cat - rat - gas	
4 cat - rat - gas - rat	



Improvement in
phonological
short-term
memory

Is there a relationship between Reading speed, Phonological and Visuo-attentional improvements?

RISULTATI: REGRESSIONI



Presentazione dello studio

T1

Training

T2

Valutazione
comportamentale

Valutazione
elettrofisiologica

Letture di non-parole

Attentional Blink

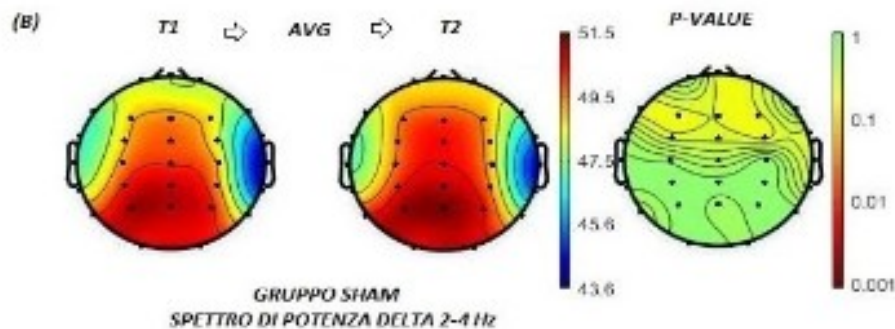
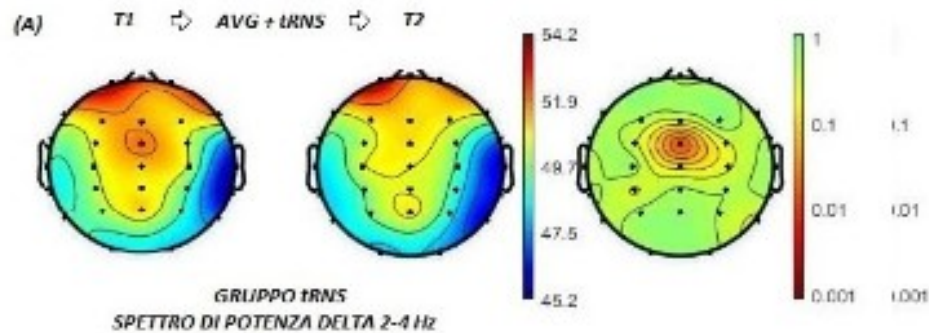
Memoria a breve termine
fonologica



Item	Wash
1	Wash
2	Wash
3	Wash
4	Wash
5	Wash
6	Wash
7	Wash
8	Wash
9	Wash
10	Wash
11	Wash
12	Wash
13	Wash
14	Wash
15	Wash
16	Wash
17	Wash
18	Wash
19	Wash
20	Wash
21	Wash
22	Wash
23	Wash
24	Wash
25	Wash
26	Wash
27	Wash
28	Wash
29	Wash
30	Wash
31	Wash
32	Wash
33	Wash
34	Wash
35	Wash
36	Wash
37	Wash
38	Wash
39	Wash
40	Wash
41	Wash
42	Wash
43	Wash
44	Wash
45	Wash
46	Wash
47	Wash
48	Wash
49	Wash
50	Wash
51	Wash
52	Wash
53	Wash
54	Wash
55	Wash
56	Wash
57	Wash
58	Wash
59	Wash
60	Wash
61	Wash
62	Wash
63	Wash
64	Wash
65	Wash
66	Wash
67	Wash
68	Wash
69	Wash
70	Wash
71	Wash
72	Wash
73	Wash
74	Wash
75	Wash
76	Wash
77	Wash
78	Wash
79	Wash
80	Wash
81	Wash
82	Wash
83	Wash
84	Wash
85	Wash
86	Wash
87	Wash
88	Wash
89	Wash
90	Wash
91	Wash
92	Wash
93	Wash
94	Wash
95	Wash
96	Wash
97	Wash
98	Wash
99	Wash
100	Wash



Analisi dei risultati elettrofisiologici



Il confronto statistico ha mostrato un **decremento statisticamente significativo** nello spettro di potenza della banda **delta 2-4 Hz** soltanto per il gruppo tRNS tra T1 e T2.

Development itself is the key to understanding developmental disorders

Annette Karmiloff-Smith



Review

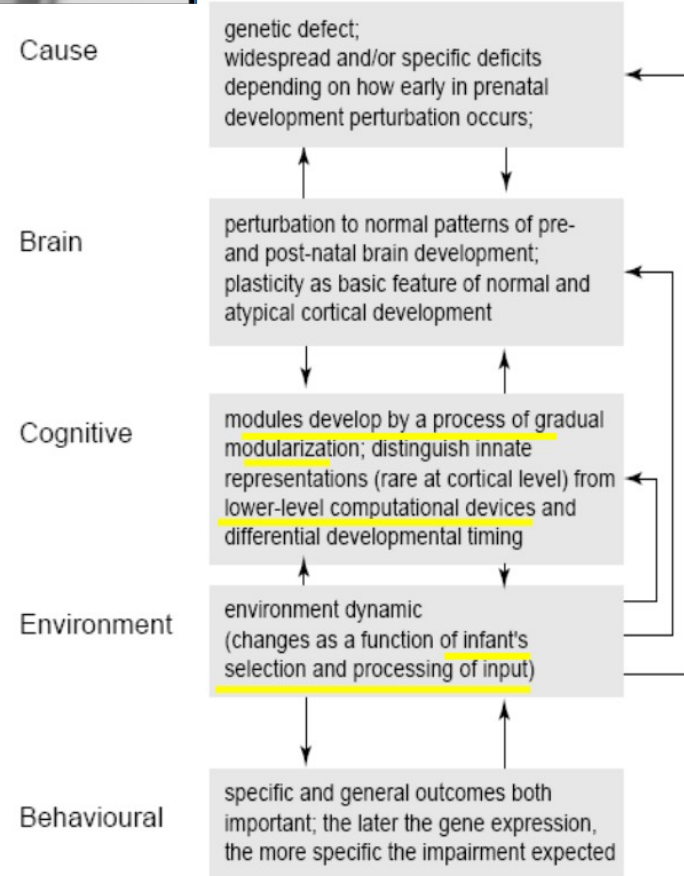
TRENDS in Cognitive Sciences Vol.6 No.12 December 2002

Atypical trajectories of number development: a neuroconstructivist perspective

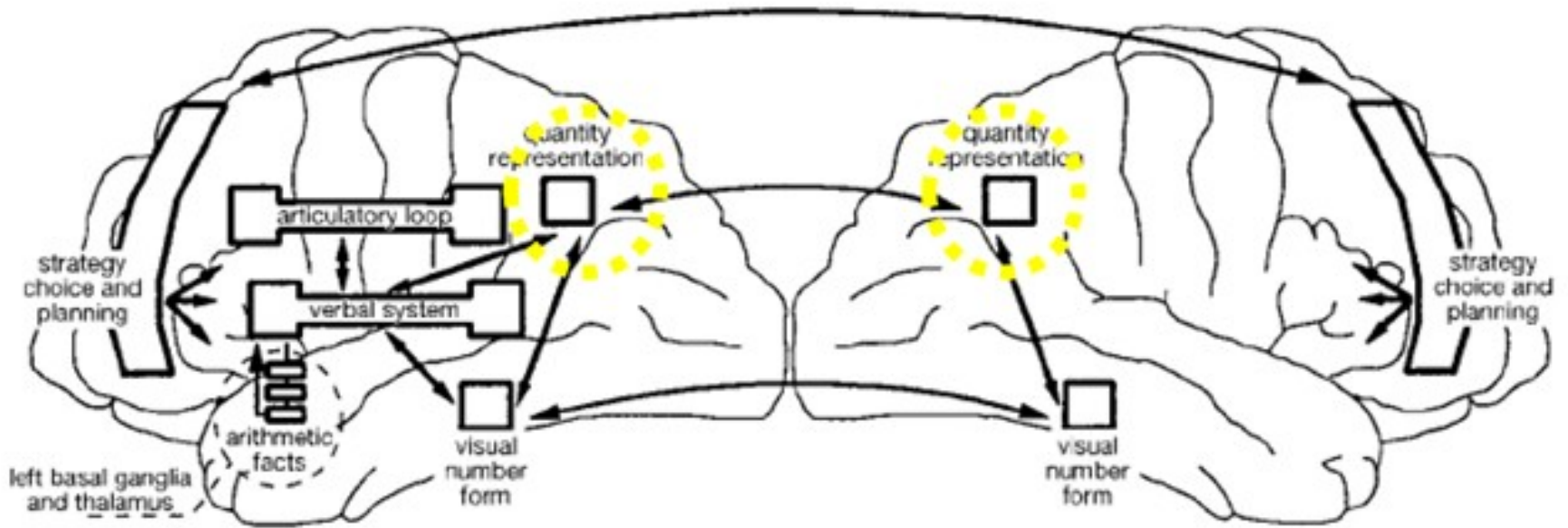
Daniel Ansari and Annette Karmiloff-Smith

Theoretical assumptions

Neuroconstructivist



Numbers and math in the developing Brain (IPS *IntraParietal Sulcus* & PPC *Posterior Parietal Cortex*)



C. Dyscalculia remediation by AVGs?

Aims of studies

Methods

- Participants
- Procedure and stimuli

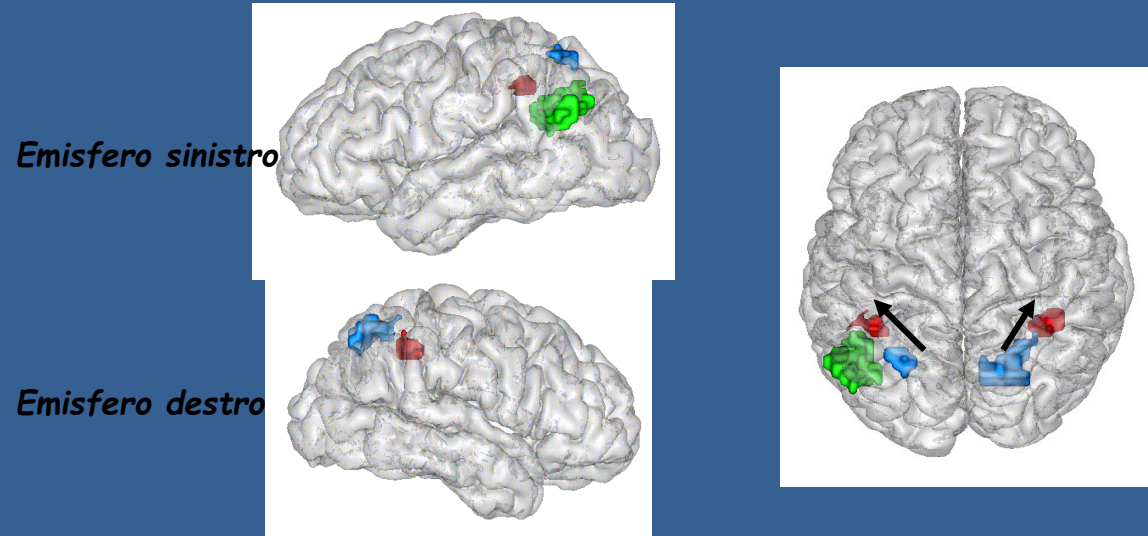
Results and discussion

Conclusion

Vi è una relazione tra **attenzione visiva spaziale** e "**senso del numero**???"

Dal modello neuropsicologico Dehaene e coll. (2003)

I 3 distinti sistemi parietali per l'elaborazione del numero



Solco intra-parietale bilaterale (SIP): Senso del numero=LNM?

Corteccia parietale posteriore (CPP): Attenzione visiva spaziale

Giro angolare sinistro (GAS): Decodifica verbale dei numeri

Ipotesi: L'efficienza dell'**attenzione visiva spaziale** influenza lo sviluppo del **senso del numero**.

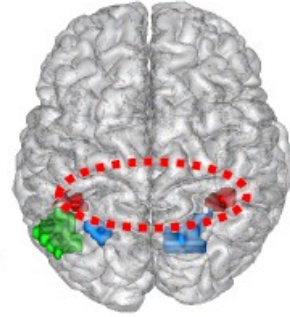
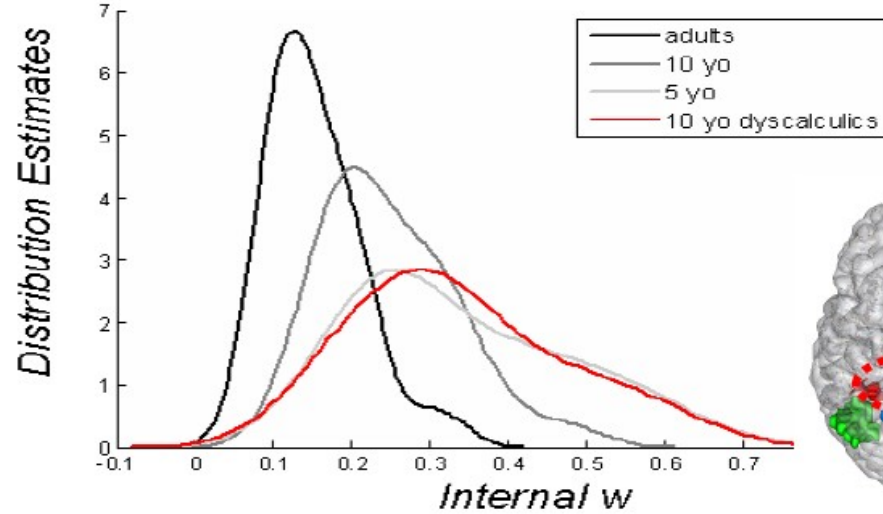
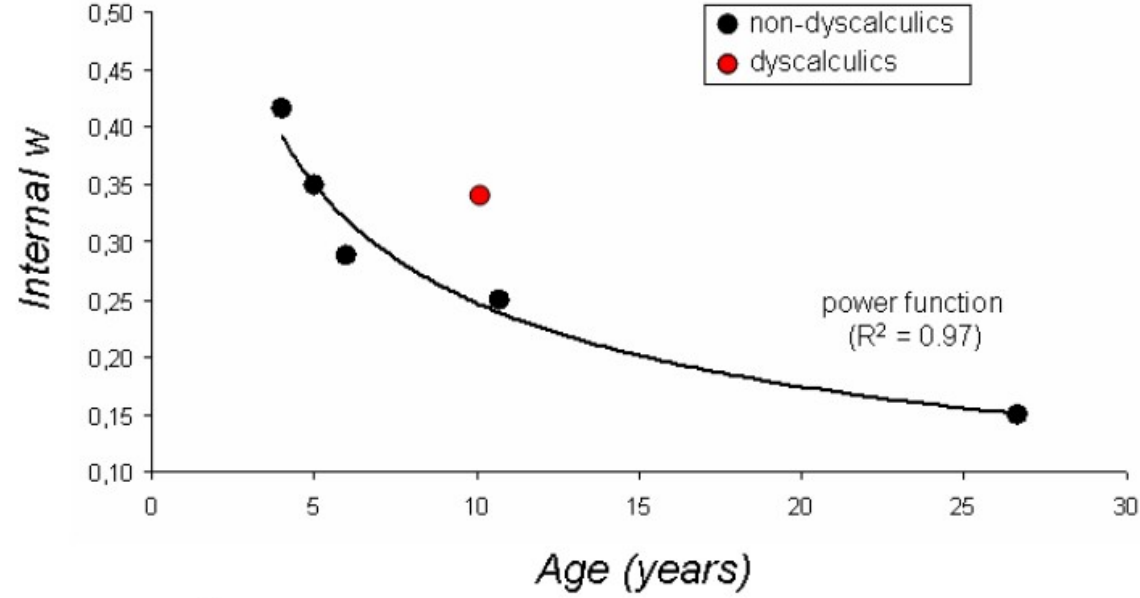
Developmental trajectory of number acuity reveals a severe impairment in developmental dyscalculia

Manuela Piazza^{a,b,*}, Andrea Facoetti^{c,d}, Anna Noemi Trussardi^{c,e}, Ilaria Berteletti^c, Stefano Conte^e, Daniela Lucangeli^c, Stanislas Dehaene^a, Marco Zorzi^{c,*}

^aINSERM, UPA, CNRS, Université de Strasbourg, France; ^bUniversité de Strasbourg, France; ^cUniversità Ca' Foscari, Venezia, Italy; ^dUniversità Ca' Foscari, Venezia, Italy; ^eUniversità Ca' Foscari, Venezia, Italy

Giudizio di Numerosità: Risultati

SIP: Codice Analogico di Grandezza (LNM)



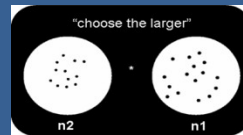
Aims of studies

(i) Bambini con discalculia evolutiva

Methods

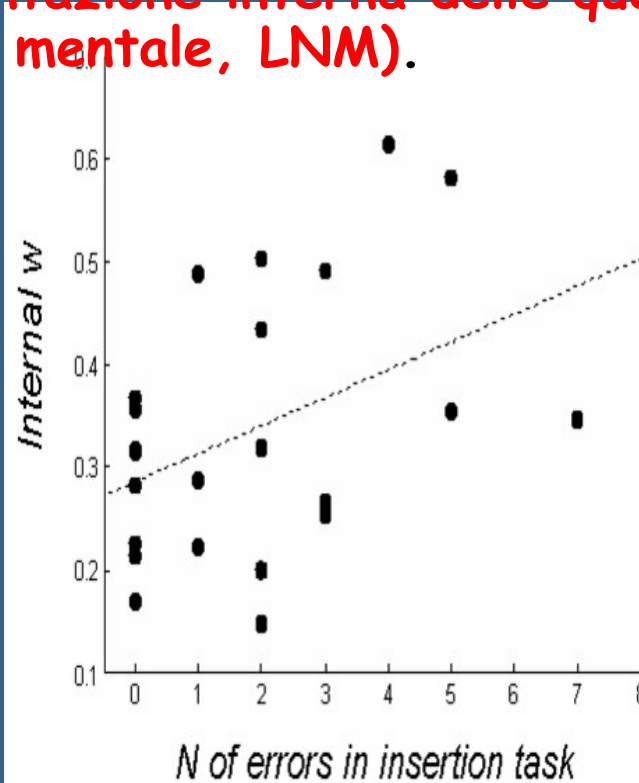
- Participants
- Procedure and stimuli

Results and discussion



Conclusion

Il "compito delle inserzioni" misura i meccanismi di accesso e di esplorazione della rappresentazione interna delle quantità (linea numerica mentale, LNM).



Nei discalculici, l'acuità numerica predice le prestazioni nella inserzione (24%) quando età e QI verbale erano controllati.

CODIFICA SEMANTICA (INSERZIONI)

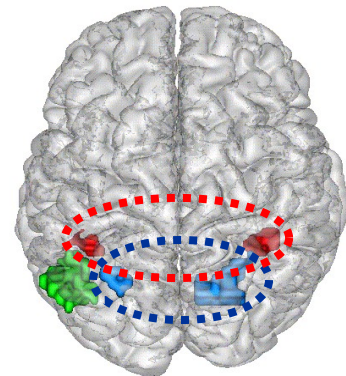
(Prova 9; tutte le classi)

Esempio: 10

..... 5 8 15

Esempio: 90

..... 20 32 84



Aims of studies

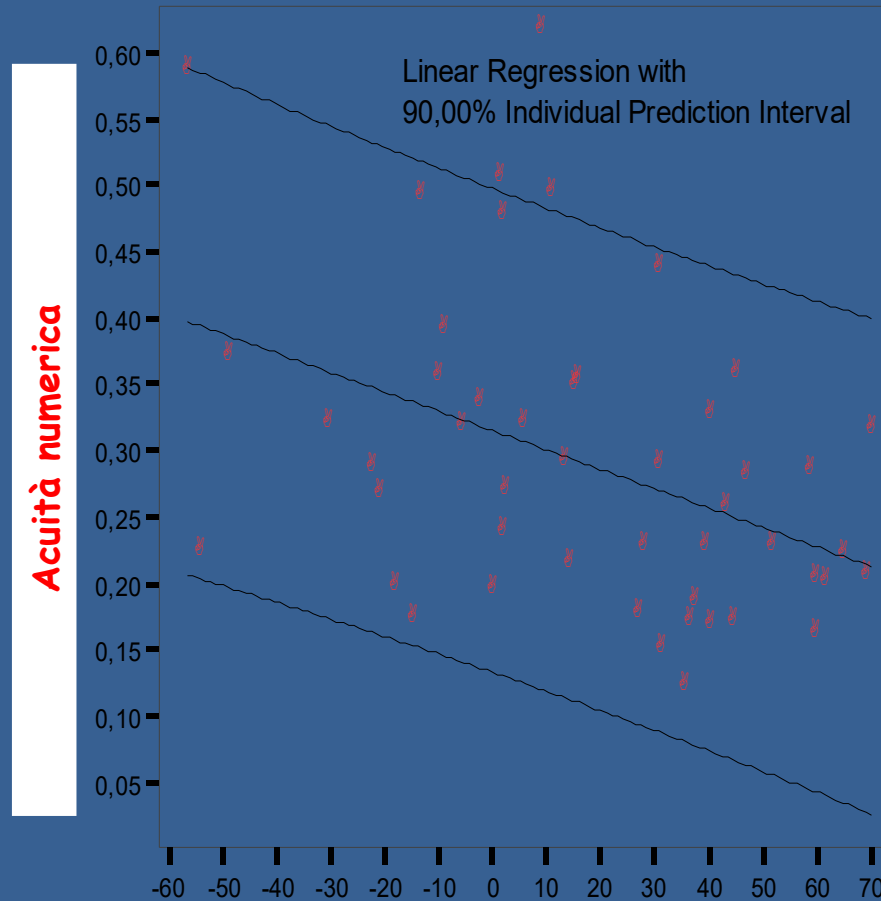
Methods

- Participants
- Procedure and stimuli

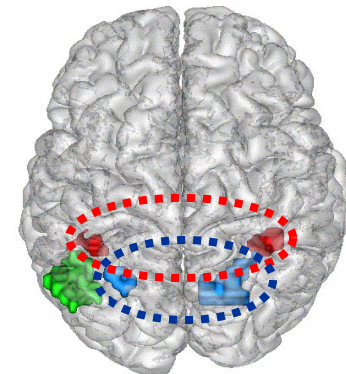
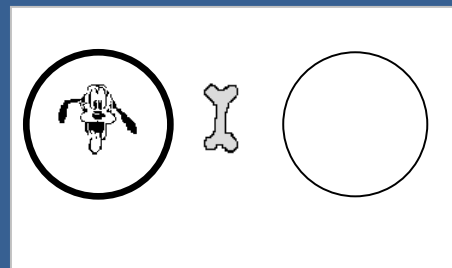
Results and discussion

Conclusion

(i) Bambini con discalculia evolutiva



L'efficienza dell'attenzione visiva spaziale (i.e., l'effetto di validità al SOA di 100ms) predice l'acuità numerica (16%) quando età e QI erano controllati.

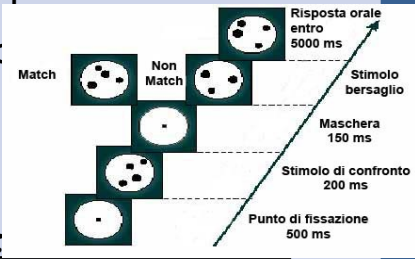


Aims of studies

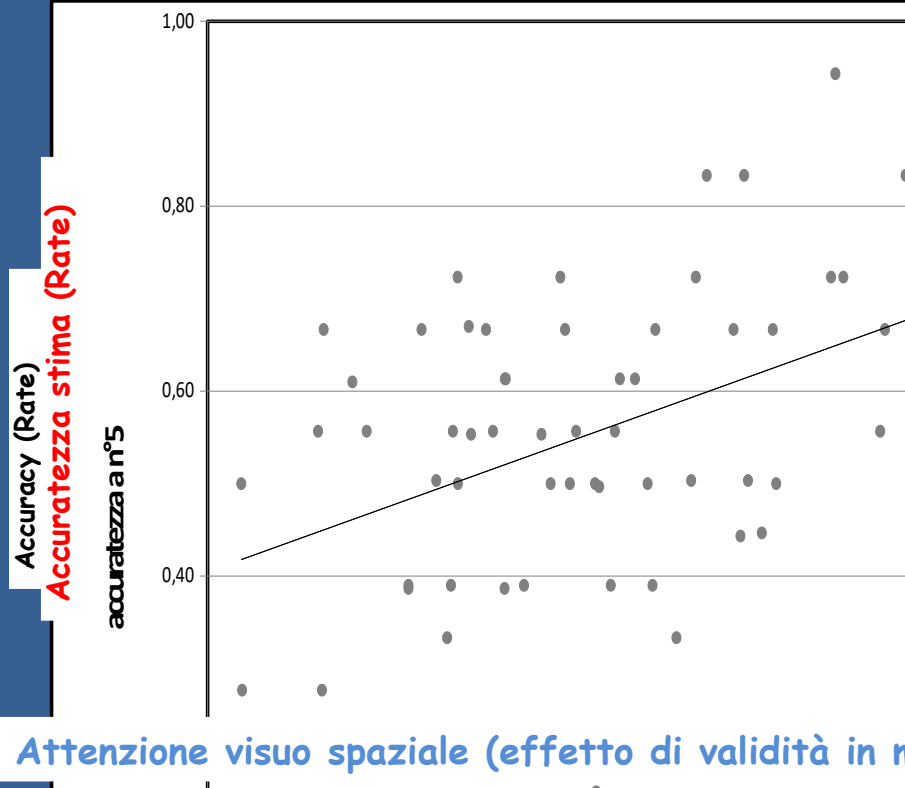
Methods

- Participants
- Procedure

Result



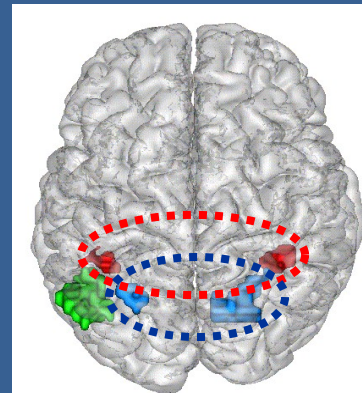
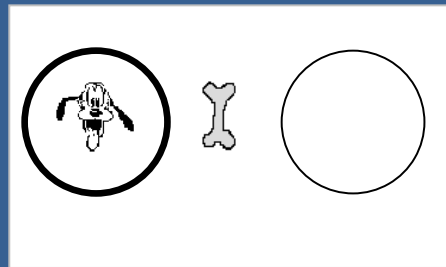
(ii) Bambini prescolarizzati



L'efficienza dell'attenzione visiva spaziale (i.e., effetto di validità al SOA 100ms) in T1 predice la stima di piccole numerosità (16%) quando età e QI erano controllate.

Attenzione visuo spaziale (effetto di validità in ms)

Conclusion



Action video games help children with developmental dyscalculia in doing math

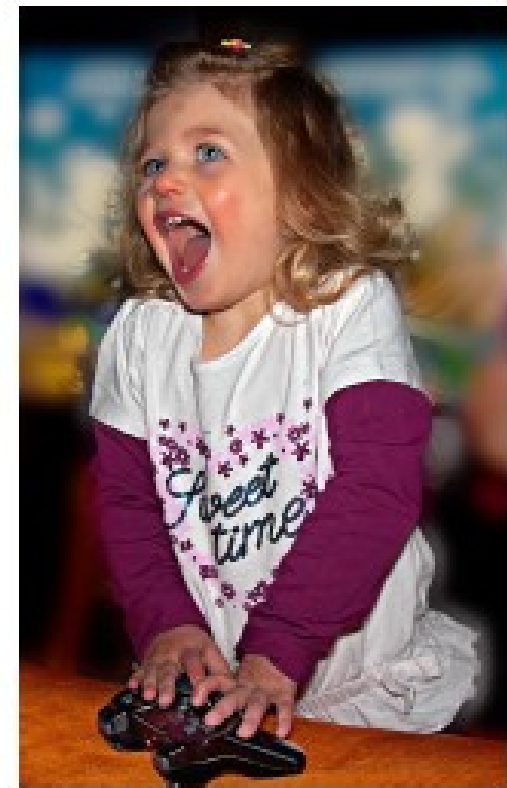
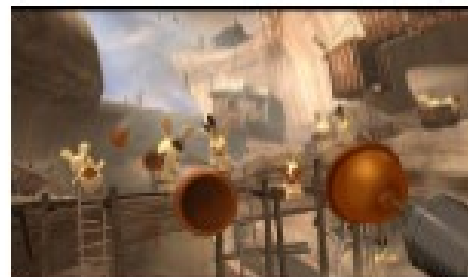
M. Tait¹, S. Franceschini^{2,3}, E. Casagrande⁴, C. Robino⁵,
C. De'Sperati⁵, A. Facoetti^{2,3} & S. Gori^{2,6*}

Children with Dyscalculia = “Action” training
(n=20).

Children with Dyscalculia = “Non Action”
training (n=13).



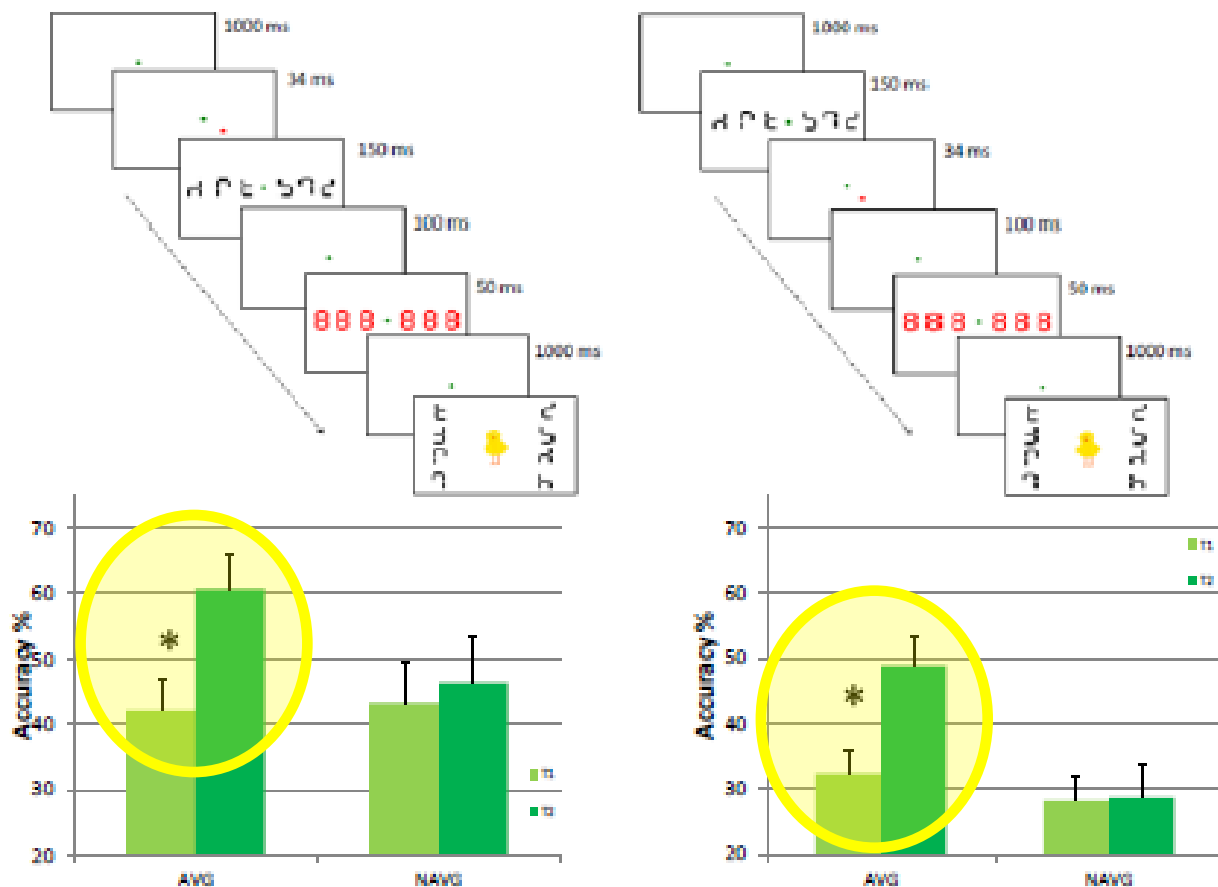
School grade	AVG= 4.55 (1.23)
	NAVG= 4.23 (1.09)
Age (months)	AVG= 128.56 (19.85)
	NAVG= 123.93 (11.83)



Action video games help children with developmental dyscalculia in doing math

M. Tait¹, S. Franceschini^{2,3}, E. Casagrande⁴, C. Robino⁵,
C. De'Sperati⁵, A. Facoetti^{2,3} & S. Gori^{2,6*}

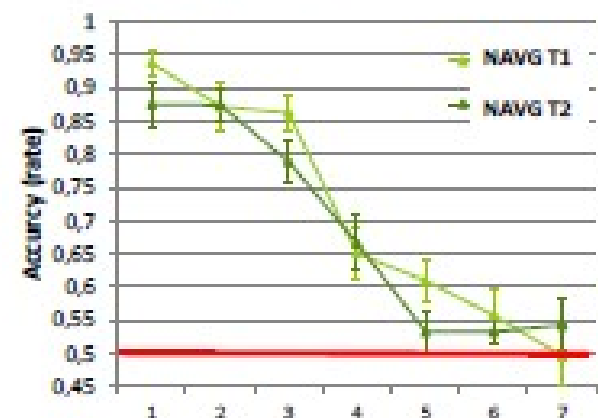
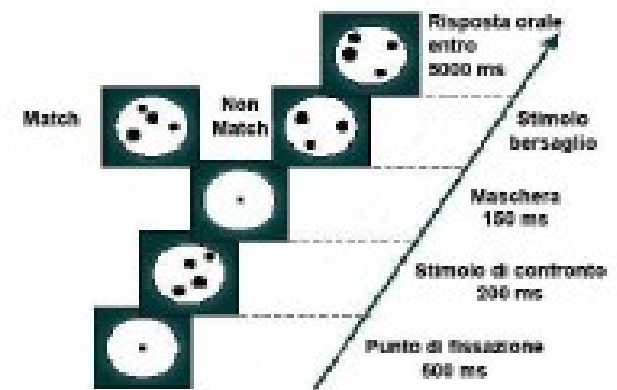
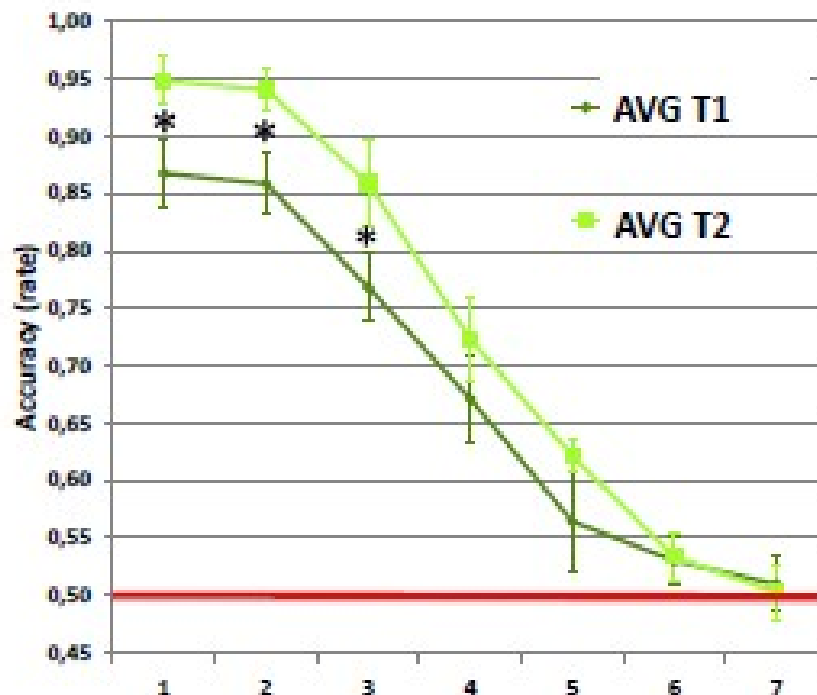
Spatial Attention



Action video games help children with developmental dyscalculia in doing math

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C. De'Sperati⁵, A. Facoetti^{2,3} & S. Gori^{2,6*}

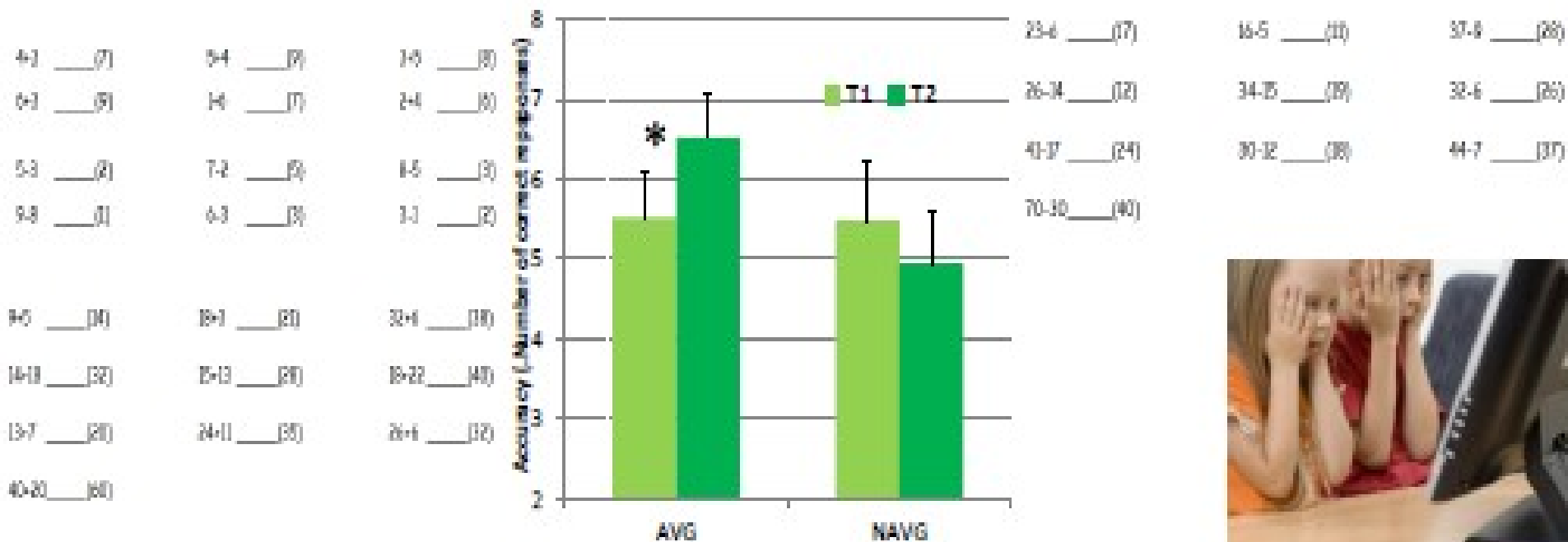
Estimation of small quantities (number sense=intraparietal sulcus):



Action video games help children with developmental dyscalculia in doing math

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Addition and subtraction



Action video games help children with developmental dyscalculia in doing math

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Arithmetic facts (left angular gyrus?)

