Discalculia e Autismo

Lezione n 21 del 16 Dicembre 2020

Neuropsicologia della discalculia e dell'asd

-Base neurobiologiche del numero

-I 3 circuiti parietali

-Attenzione e cognizione numerica

-AVG: training attentivo = riduzione difficoltà matematiche

-A TUTTO AUTISMO...

Review

Development itself is the key to understanding developmental disorders

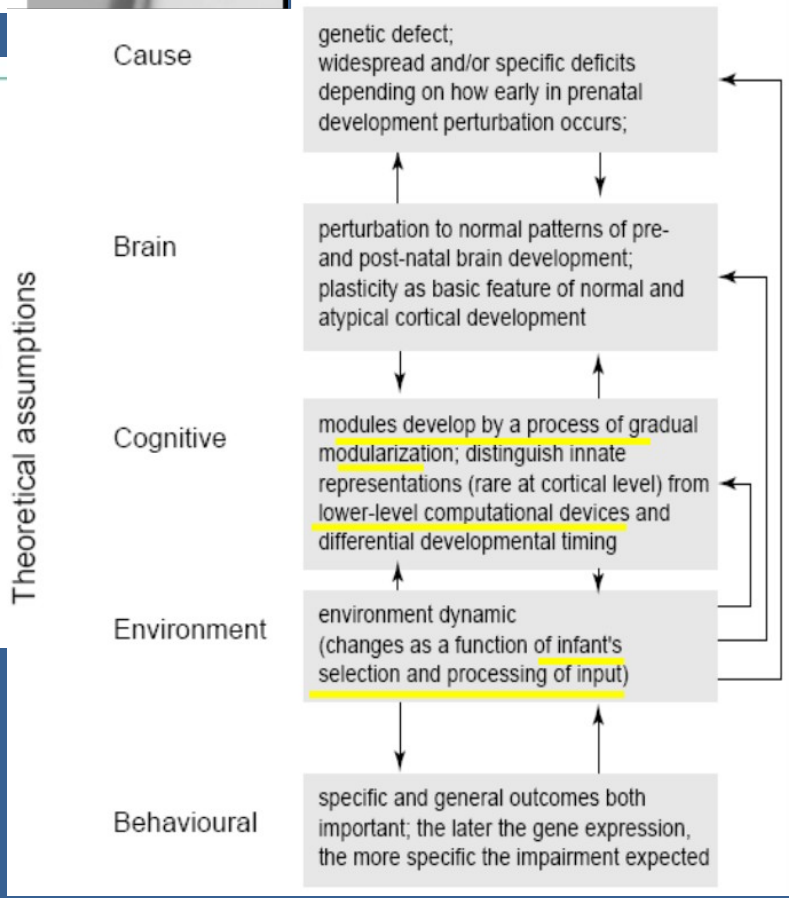
Annette Karmiloff-Smith

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

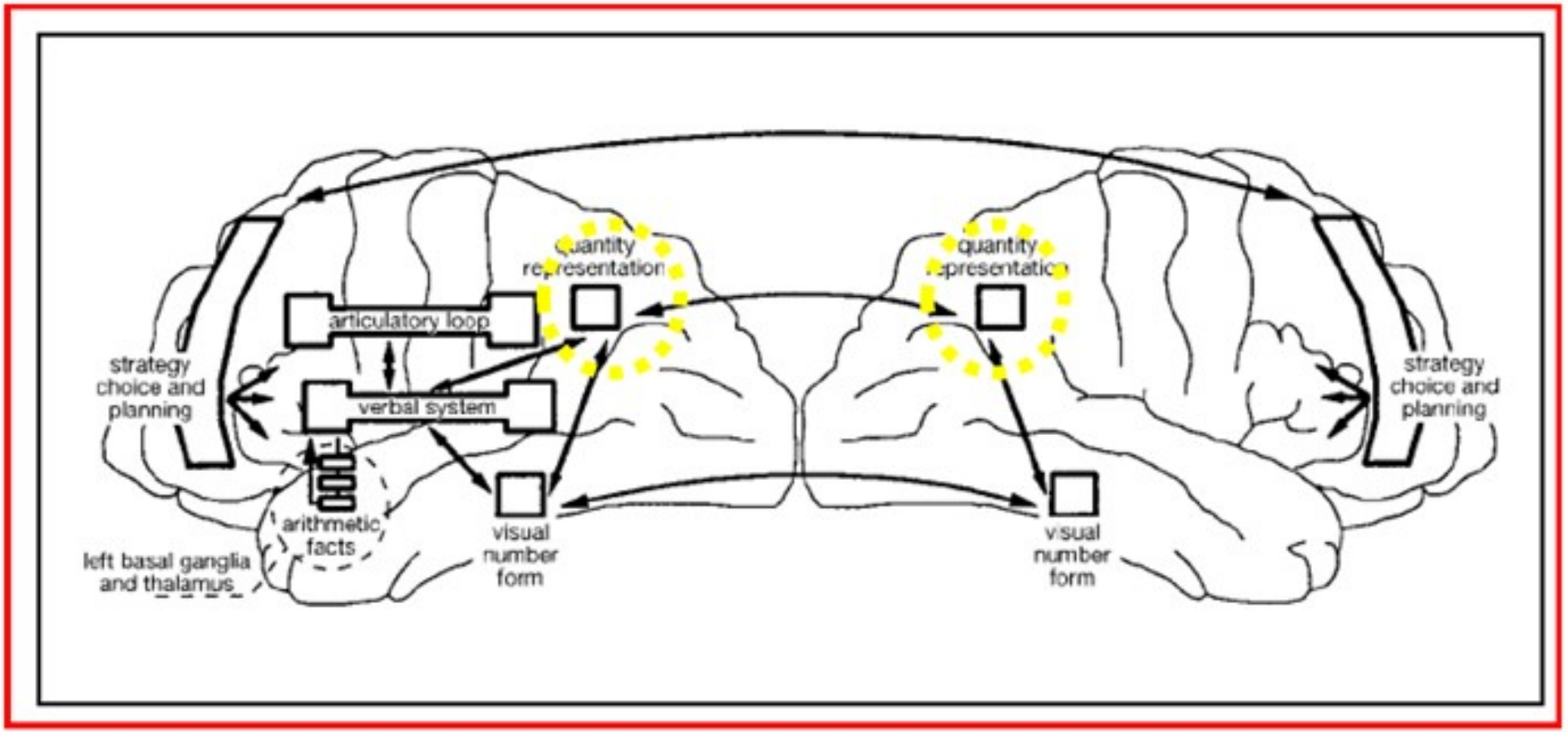
Atypical trajectories of number development: a neuroconstructivist perspective

Daniel Ansari and Annette Karmiloff-Smith

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

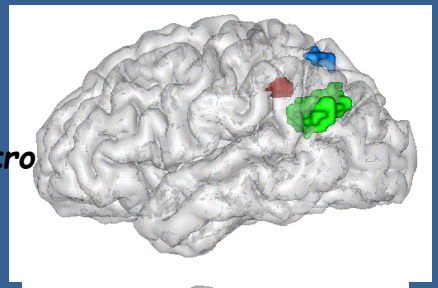
Conclusion

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

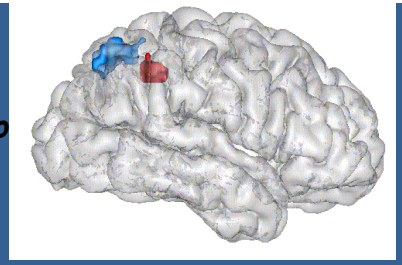
Dal modello neuropsicologico Dehaene e coll. (2003)

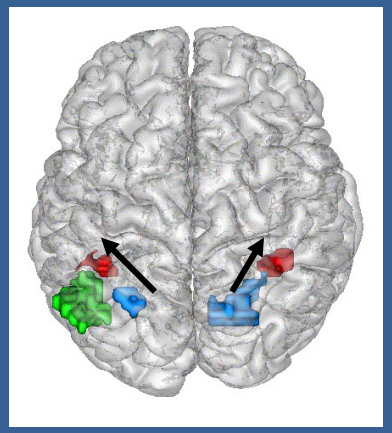
I 3 distinti sistemi parietali per l'elaborazione del numero

Emisfero sinistro



Emisfero destro





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

Corteccia parietale posterione (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.

COGNITION

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

Cognition 116 (2010) 33–41

ELSEVIER

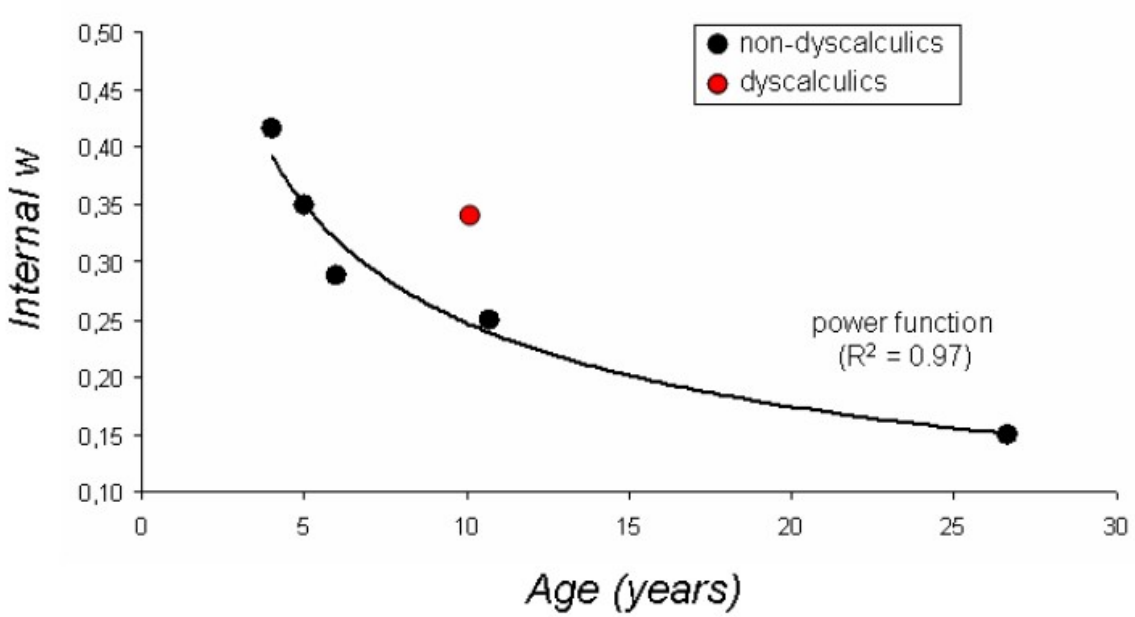
Developmental trajectory of number acuity reveals a severe impairment in developmental dyscalculia

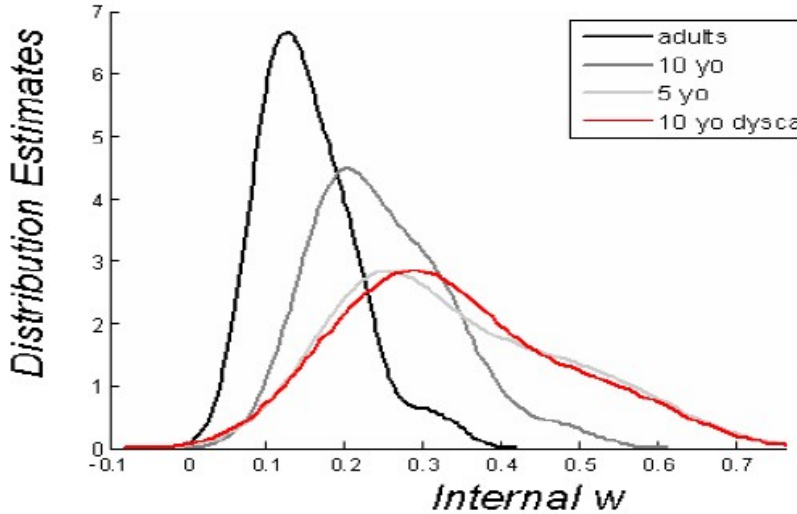
Manuela Piazza [a,b,*,1], Andrea Facoetti [c,d], Anna Noemi Trussardi [c,e], Ilaria Berteletti [c], Stefano Conte [e], Daniela Lucangeli [c], Stanislas Dehaene [a], Marco Zorzi [c,*,1]

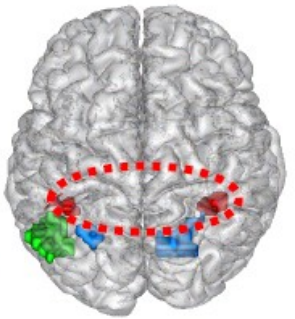
[a] INSERM-CEA Cognitive Neuroimaging Unit, Gif-sur-Yvette, France

SIP: Codice Analogico di Grandezza (LNM)

Giudizio di Numerosità: Risultati







Aims of studies

Methods

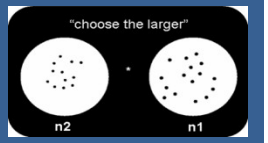
- Participants
- Procedure and stimuli

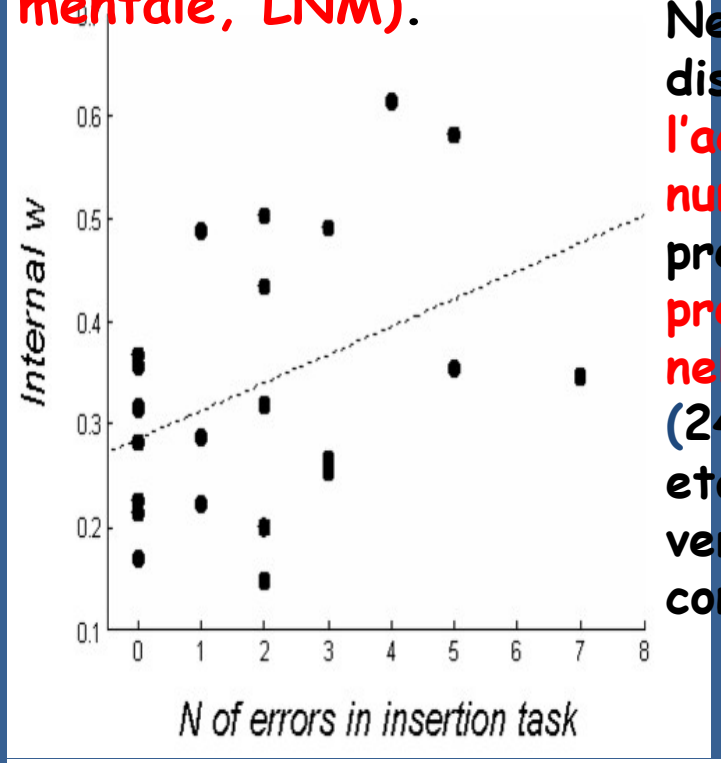
Results and discussion

Conclusion

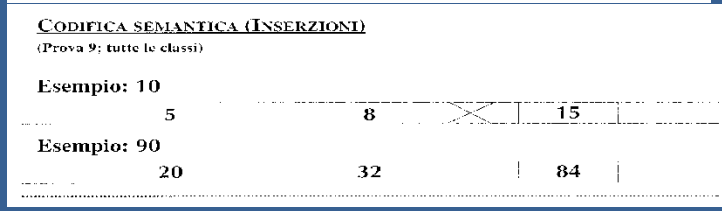
(i) Bambini con discalculia evolutiva

Il "compito delle inserzione" 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.

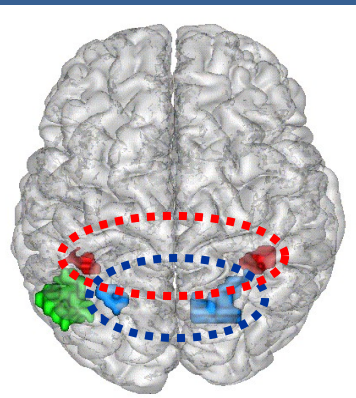

CODIFICA SEMANTICA (INSERZIONI)
(Prova 9; tutte le classi)

Esempio: 10

5 8 15

Esempio: 90

20 32 84



Aims of studies

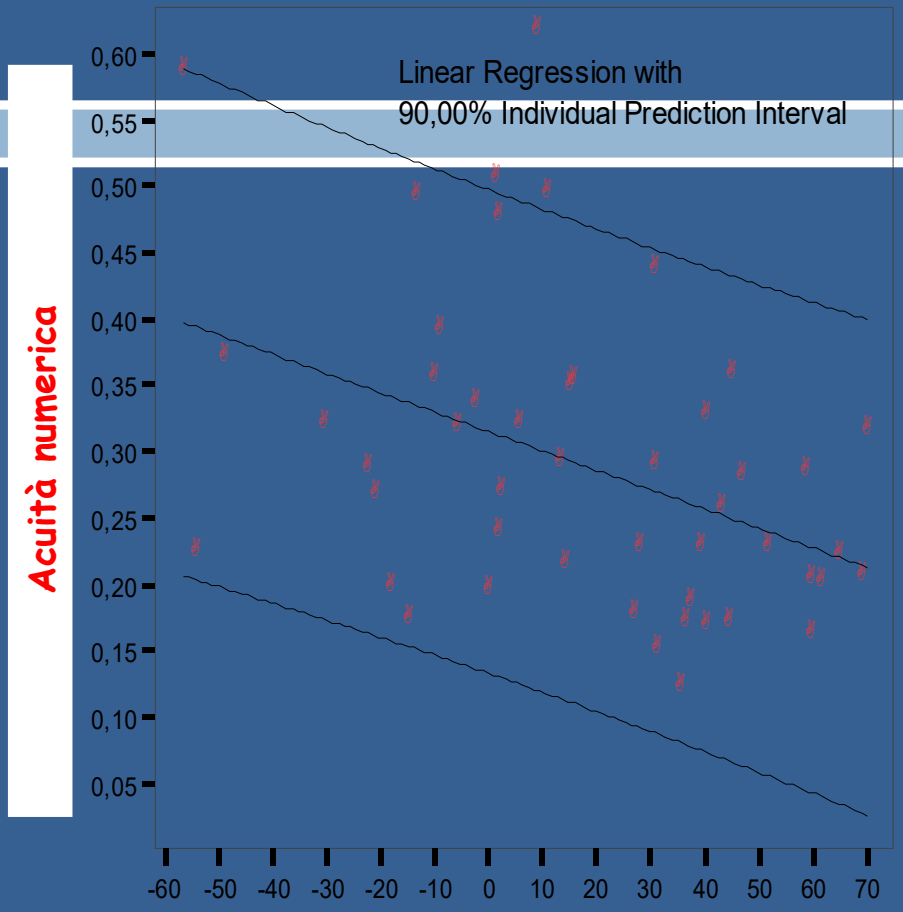
Methods

- Participants
- Procedure and stimuli

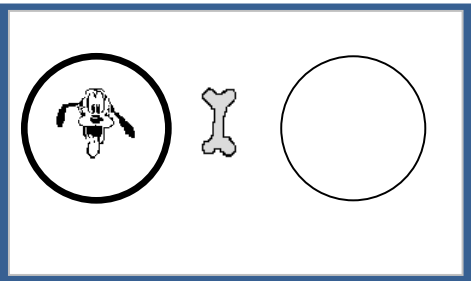
Results and discussion

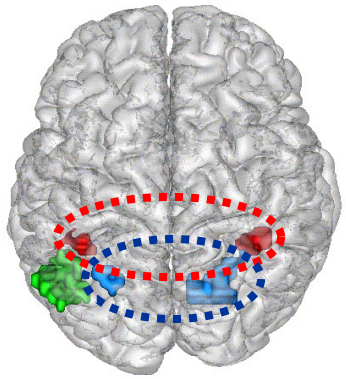
Conclusion

(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.

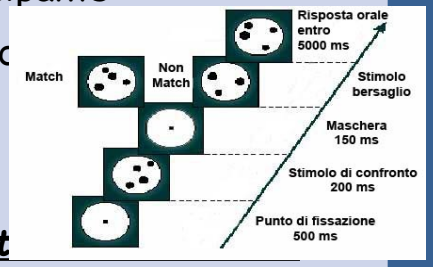




Aims of studies

Methods

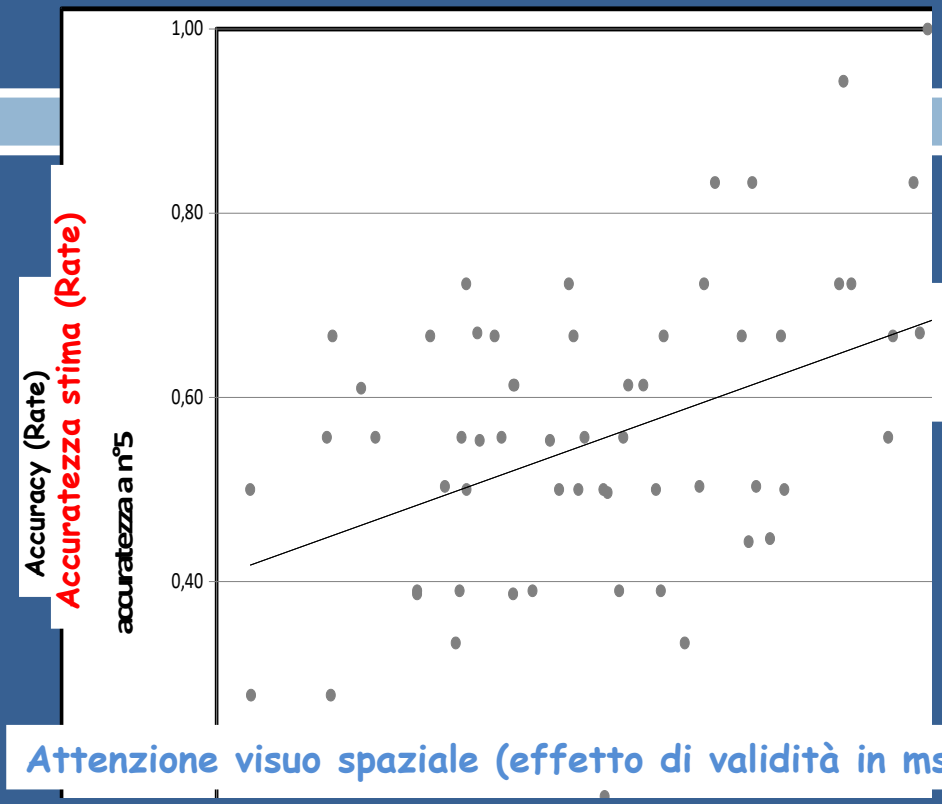
- Participants
- Proced



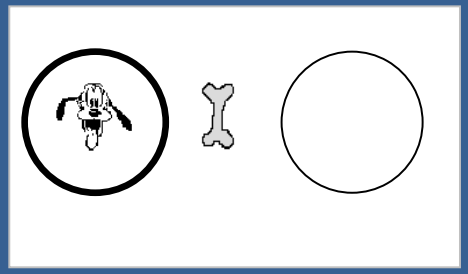
Result

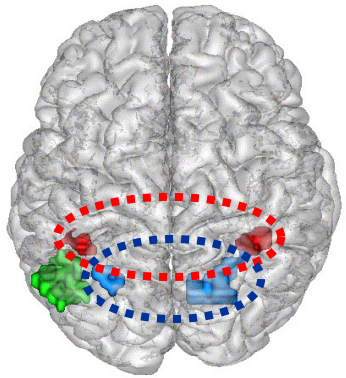
Conclusion

(ii) Bambini prescolarizzati



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





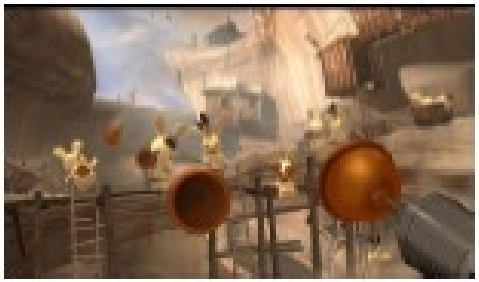
Action video games help children with developmental dyscalculia in doing math

M. Tait[1], S. Franceschini[2,3], E. Casagrande[4], C. Robino[5], C. De'Sperati[5], 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)



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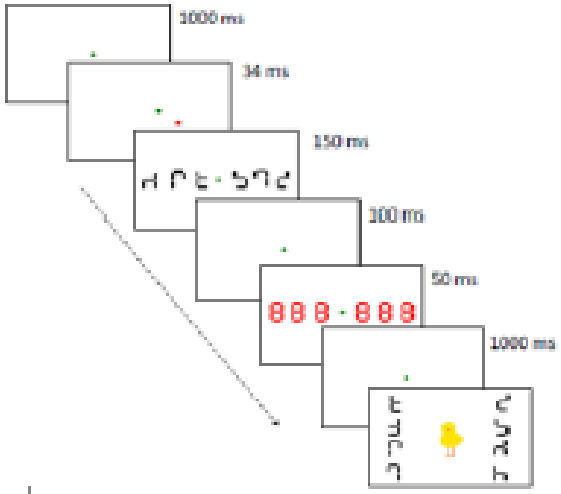
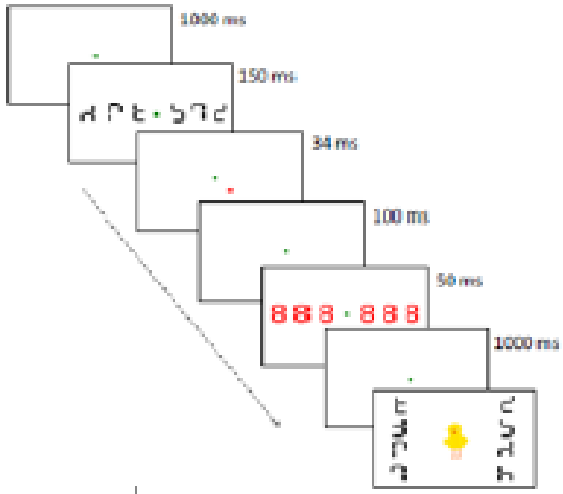
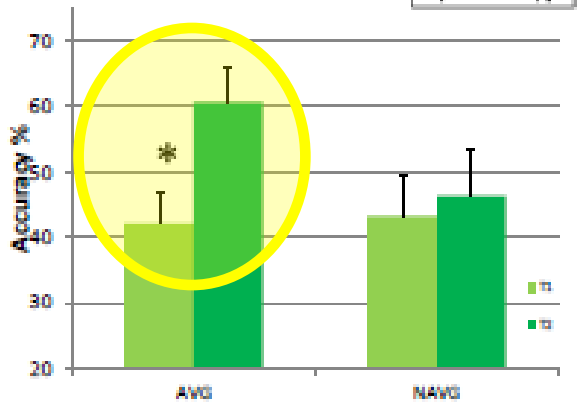
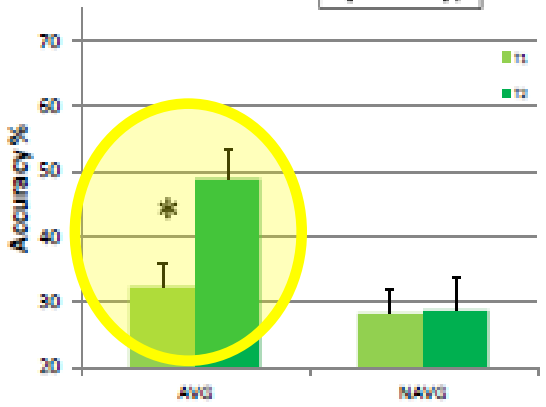
Spatial Attention









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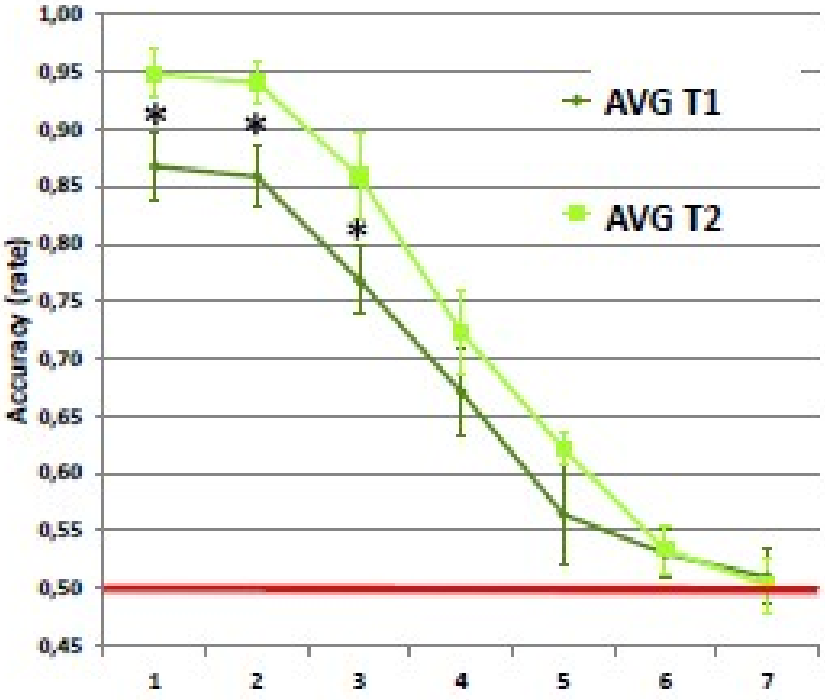
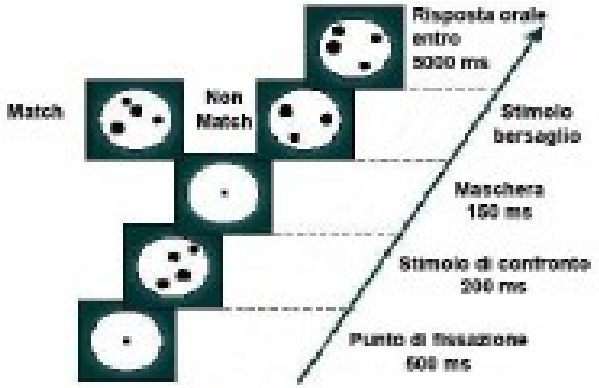
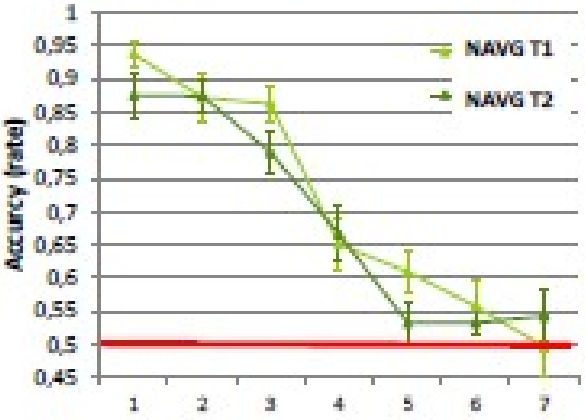
Estimation of small quantities
(number sense=intraparietal sulcus):







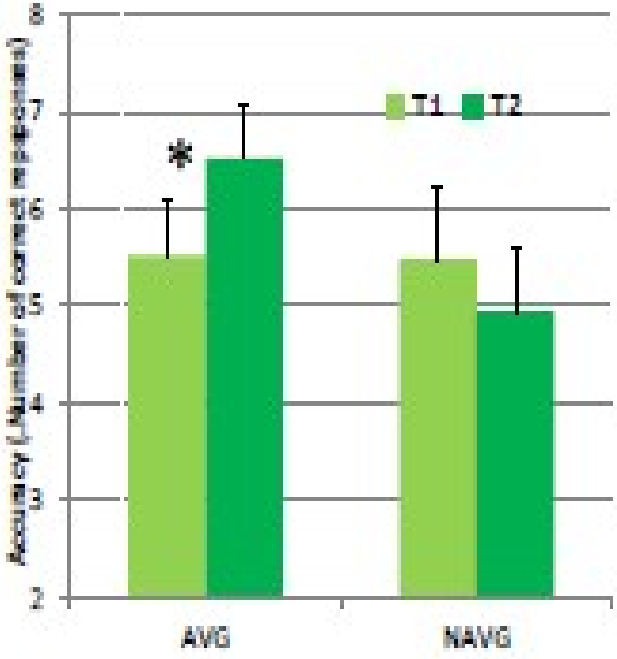
Action video games help children with developmental dyscalculia in doing math

M. Tait[1], S. Franceschini[2,3], E. Casagrande[4], C. Robino[5], C. De'Sperati[5], A. Facoetti[2,3] & S. Gori[2,6*]

Addition and subtraction

4+3 ____(7) 5+4 ____(9) 3+5 ____(8)
6+1 ____(5) 1+6 ____(7) 2+4 ____(6)
5-3 ____(2) 7-2 ____(5) 8-5 ____(3)
9-8 ____(1) 6-3 ____(3) 3-1 ____(2)

9+5 ____(14) 18+3 ____(21) 32+6 ____(38)
14-10 ____(32) 15+13 ____(28) 18+22 ____(40)
13+7 ____(20) 24+11 ____(35) 26+6 ____(32)
40+20 ____(60)

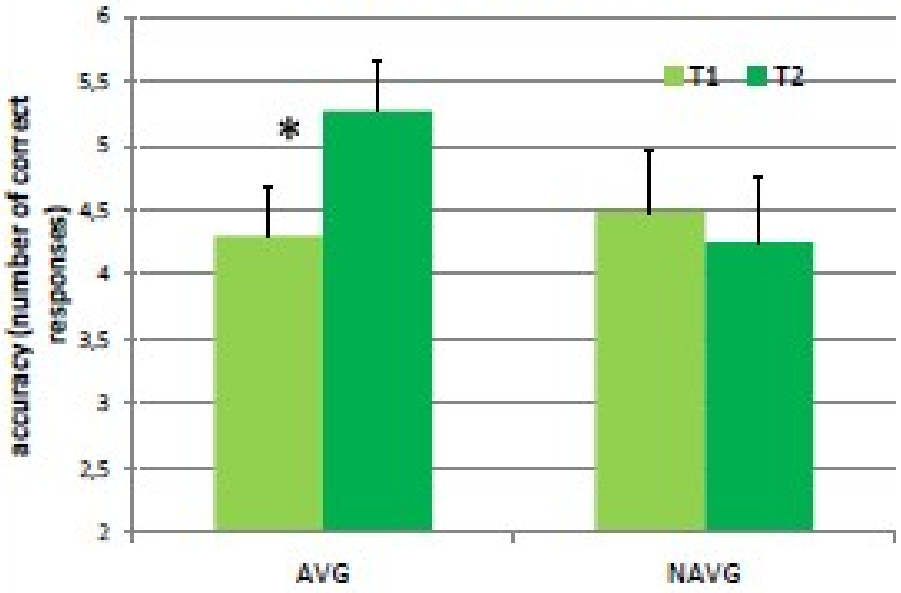


23+6 ____(17) 16+5 ____(11) 37+8 ____(26)
26+14 ____(12) 34+15 ____(19) 32+6 ____(26)
41+17 ____(24) 30+12 ____(18) 44+7 ____(37)
70+10 ____(40)

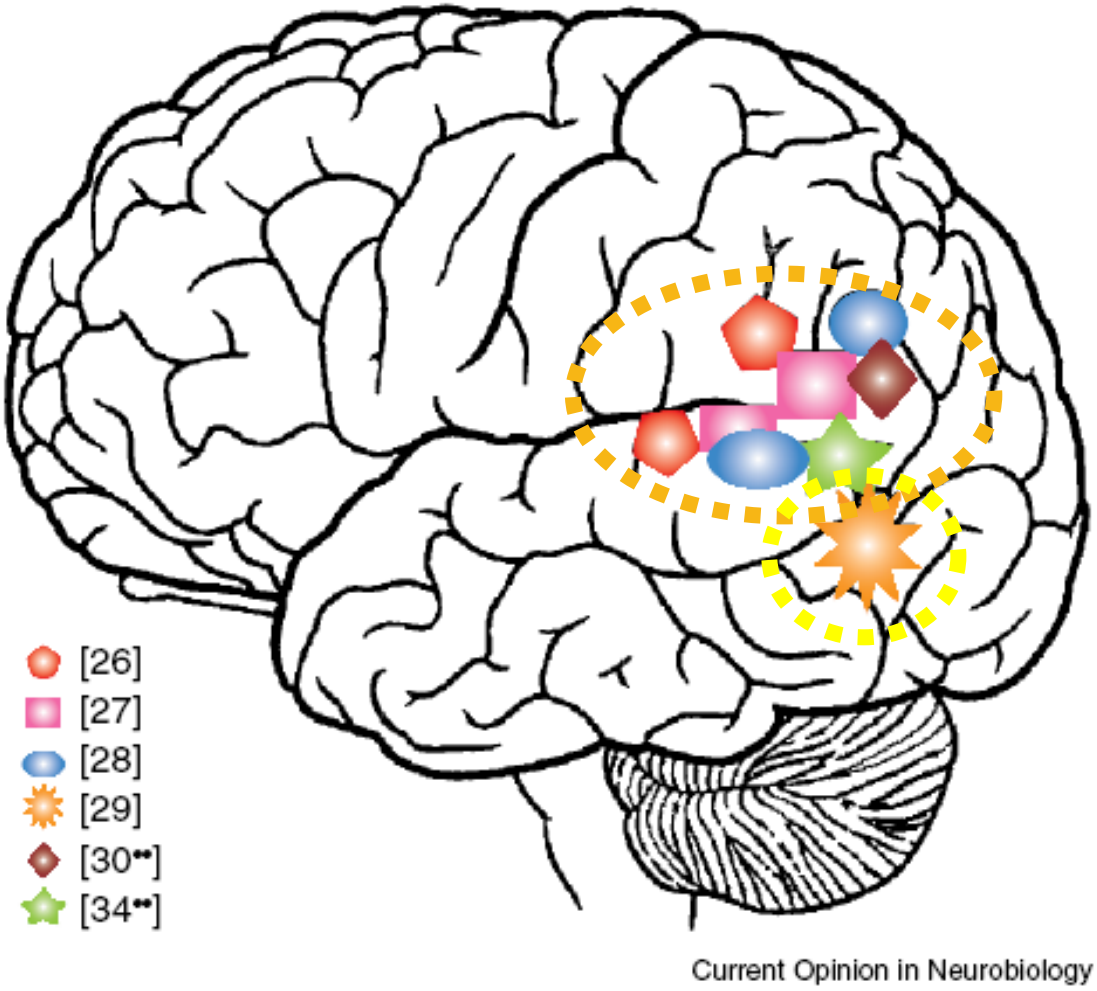
Action video games help children with developmental dyscalculia in doing math

M. Tait[1], S. Franceschini[2,3], E. Casagrande[4], C. Robino[5],
C. De'Sperati[5], A. Facoetti[2,3] & S. Gori[2,6*]

Arithmetic facts (left angular gyrus?)



Neuropsicologia dello Sviluppo: modelli mutuati dalla neuropsicologia dell'adulto (esempio DE)



Tratto da Temple (2002)

La neuro-plasticità come base dell'apprendimento e della riabilitazione

How Learning to Read Changes the Cortical Networks for Vision and Language

Stanislas Dehaene,[1,2,3,4]* Felipe Pegado,[1,2,3] Lucia W. Braga,[5] Paulo Ventura,[6] Gilberto Nunes Filho,[5] Antoinette Jobert,[1,2,3] Ghislaine Dehaene-Lambertz,[1,2,3] Régine Kolinsky,[7,8] José Morais,[7] Laurent Cohen[9,10,11]

Does literacy improve brain function? Does it also entail losses? Using functional magnetic resonance imaging, we measured brain responses to spoken and written language, visual faces, houses, tools, and checkers in adults of variable literacy (10 were illiterate, 22 became literate as adults, and 31 were literate in childhood). As literacy enhanced the left fusiform activation evoked by writing, it induced a small competition with faces at this location, but also broadly enhanced visual responses in fusiform and occipital cortex, extending to area V1. Literacy also enhanced phonological activation to speech in the planum temporale and afforded a top-down activation of orthography from spoken inputs. Most changes occurred even when literacy was acquired in adulthood, emphasizing that both childhood and adult education can profoundly refine cortical organization.

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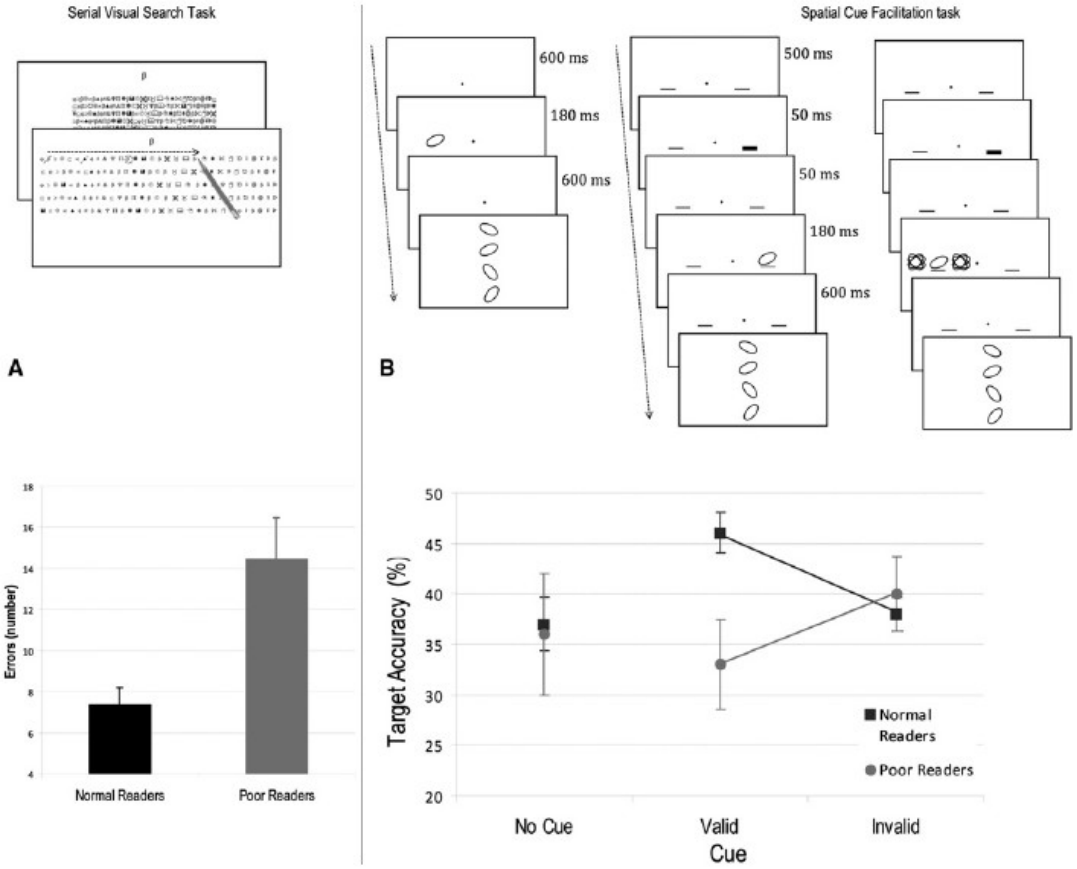
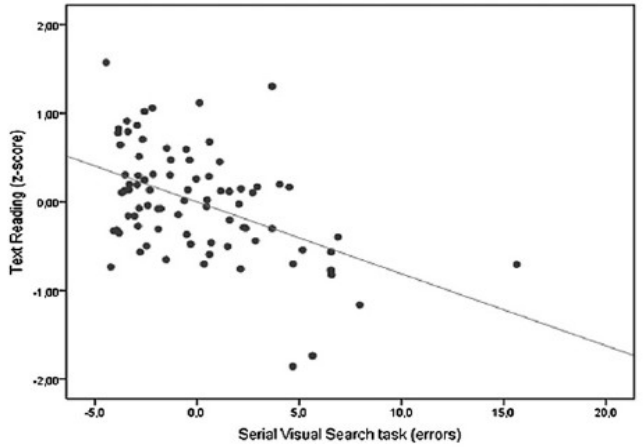
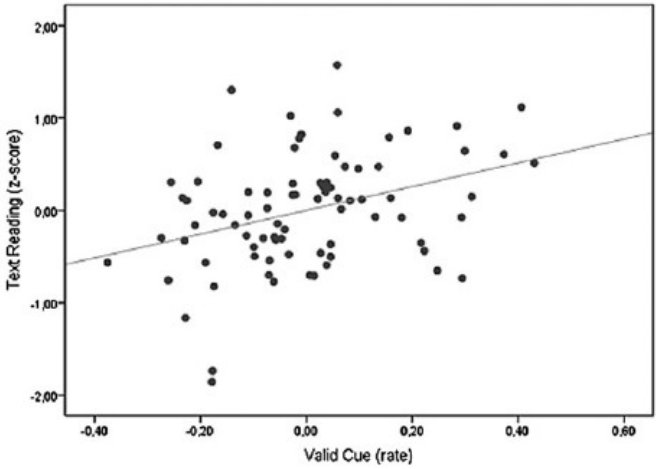
Report

A Causal Link between Visual Spatial Attention and Reading Acquisition

Sandro Franceschini,[1,3] Simone Gori,[1,2] Milena Ruffino,[2] Katia Pedrolli,[1] and Andrea Facoetti[1,2,3,*]
[1]Developmental and Cognitive Neuroscience Lab, Department of General Psychology, University of Padua, Padova 35131, Italy
[2]Developmental Neuropsychology Unit, Scientific Institute "E. Medea," Bosisio Parini, Lecco 23842, Italy





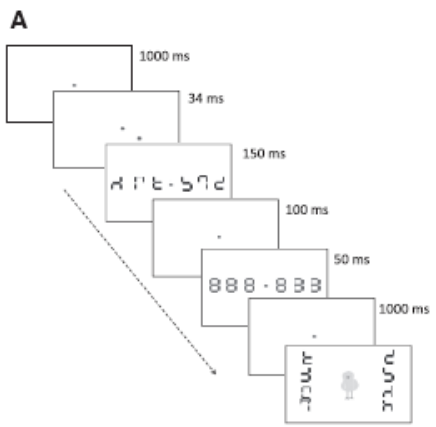


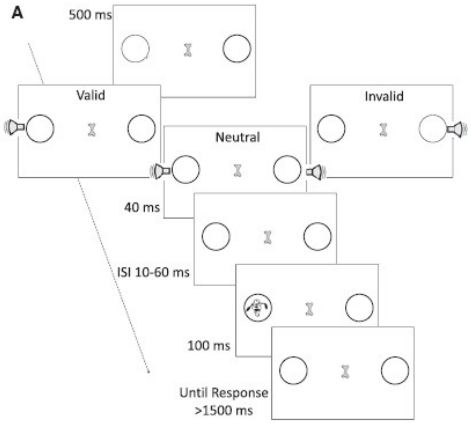
Current Biology 23, 462–466, March 18, 2013 ©2013 Elsevier Ltd All rights reserved http://dx.doi.org/10.1016/j.cub.2013.01.044

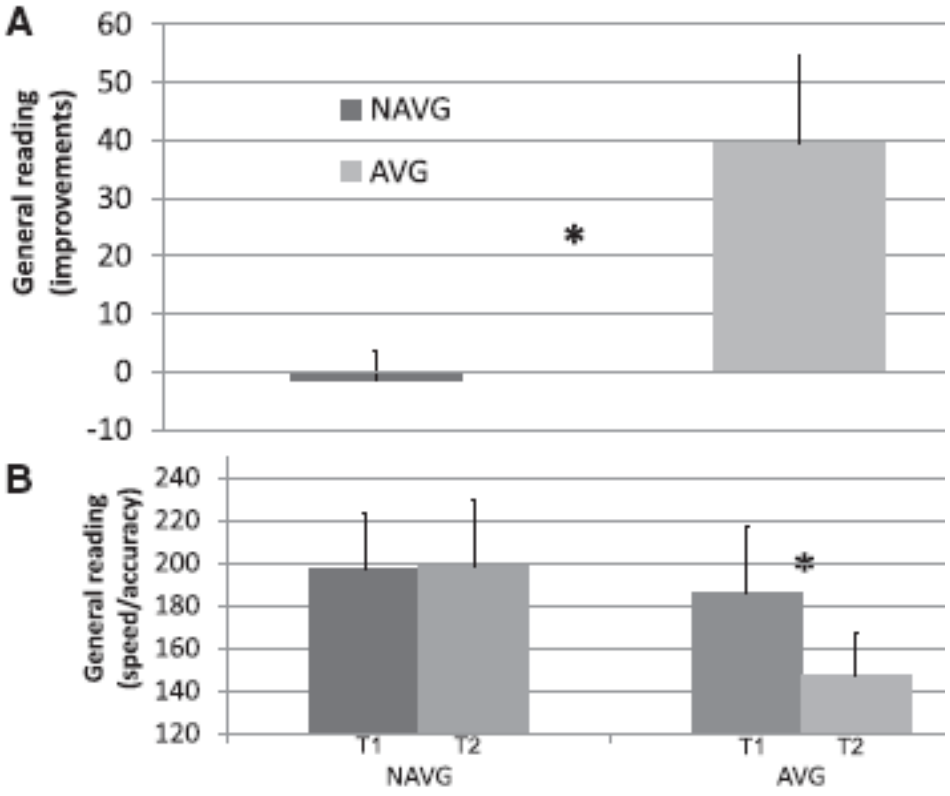
Report

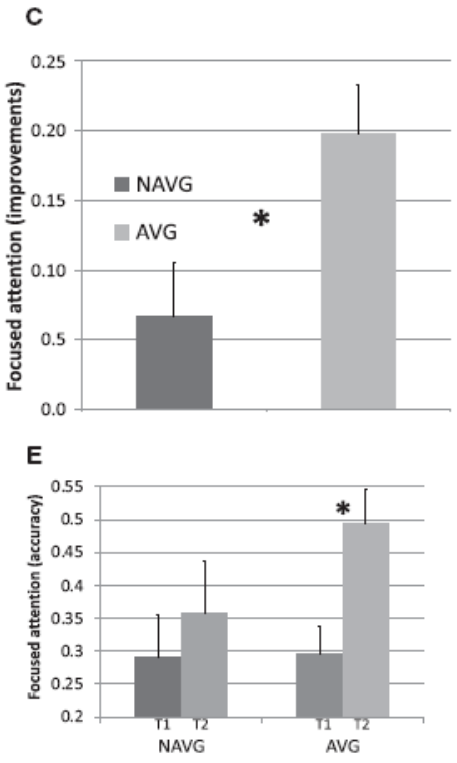
Action Video Games Make Dyslexic Children Read Better

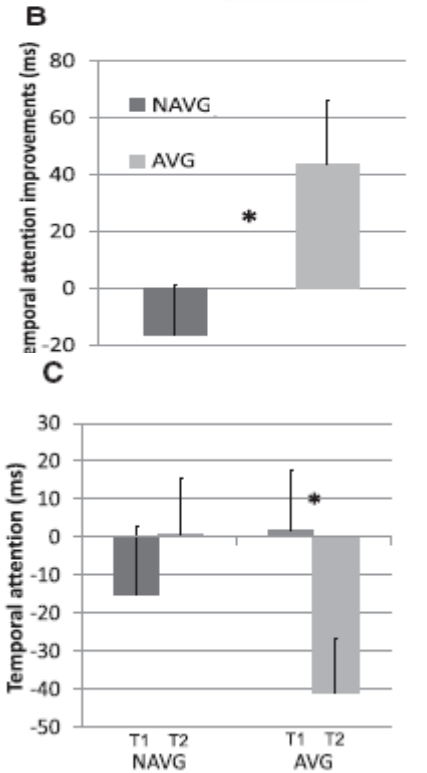
Sandro Franceschini,[1,3] Simone Gori,[1,2,3] Milena Ruffino,[2] Simona Viola,[1] Massimo Molteni,[2] and Andrea Facoetti[1,2,3,*]
[1]Developmental and Cognitive Neuroscience Lab, Department of General Psychology, University of Padua, Padua 35131, Italy
[2]Developmental Neuropsychology Unit, Scientific Institute E. Medea, Bosisio Parini, Lecco 23842, Italy











Rovereto Attention Workshop

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Can Action Video Game Training Prevent Future Reading Disabilities?

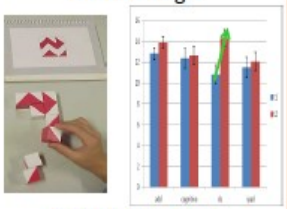
Simone Gori,[1,2] Milena Ruffino,[2] Maria Enrica Sali,[2] Massimo Molteni,[2] & Andrea Facoetti[1,2]

1. Department of General Psychology, University of Padua & 2. Scientific Institute E. Medea, Bosisio Parini (LC) Italy

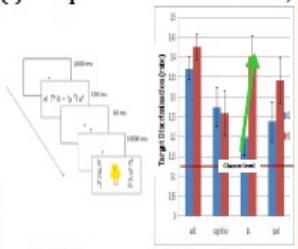
Learning to read is extremely difficult for about 10% of children across cultures; they are affected by a neurodevelopmental disorder called dyslexia. The neurocognitive causes of dyslexia are still hotly debated (Gabrieli, 2009; Peterson & Pennington, 2012). To date, dyslexia prevention is only a dream far from being achieved.

Pre-reading children (n=86):
-ADCL= No risk (n=41);
-Cognitivo = At risk no training (n=15);
-ds = At risk "Action" training (n=16);
-Ipad = At risk "Serious" training (n=14).

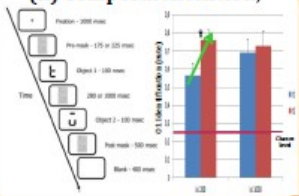
Visuo-spatial Improvement: Block Design



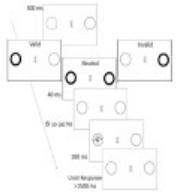
Visual Attention Improvements:
(i) Peripheral Discrimination;

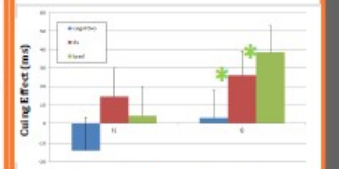


(ii) Temporal Attention;



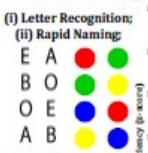
(iii) Rapid spatial cuing.



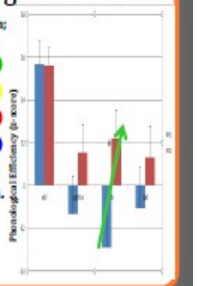


Early Language Predictors of Future Reading Abilities

(i) Letter Recognition;
(ii) Rapid Naming;



(iii) Phoneme Discrimination.



It has been demonstrated that action video games efficiently improve attention (Green & Bavelier , 2003, 2012) and reading abilities in children with dyslexia (Franceschini et al., 2013); our results showed, for the first time, that these attentional improvements can directly translate into better language and reading-related abilities, providing a new, fast and fun potential prevention training for dyslexia that has theoretical relevance in unveiling the causal role of attention in reading acquisition.

AUTISMO, ASD verso la prevenzione?

I. Caratteristiche cliniche del disturbo dello spettro dello spettro autistico (ASD)

II. Accenno principali ipotesi neuropatologiche («un fallimento totale» ☹)

III. Percezione ("bias locale") e attenzione nell'ASD (deficit disancoraggio e nello "zoom-out")

IV. Neurocostruttivismo: Indicatori precoci dell'ASD

V. Meccanismi neurofisiologici dei disturbi percettivi-attenzionali nell'ASD

ASD: Caratteristiche Cliniche

- L'Autismo è un disturbo neuro-evolutivo pervasivo che compromette: (i) **interazione sociale**, (ii) **il linguaggio e la comunicazione** e che (iii) comporta **interessi ristretti e comportamenti stereotipati**.
- Diagnosi a 2 anni
- Prevalenza stimata 1% (maggiore incidenza nei maschi 3:1).
- Meglio definito in: *Disturbi dello spettro autistico (ASD)*
  - Autismo a basso funzionamento (con RM)
  - Autismo ad alto funzionamento (no RM)
  - Sindrome di Asperger (no disturbo linguaggio)
  - Disturbo Pervasivo dello Sviluppo - N.A.S. (mostra «hand flapping»)

Strumenti diagnostici

1. **Autism Diagnostic Observation Scale (ADOS; Lord et al., 1999):**

   scala di osservazione da somministrare al bambino/a, permette di ottenere punteggi suddivisi in due aree: i) Comunicazione e ii) Interazione Sociale (punteggi più alti = maggior gravità). I comportamenti associati al ASD sono valutati tramite giochi, conversazioni e compiti.

2. **Autism Diagnostic Interview (ADI-R; Lord et al., 1994):**

   Intervista semi-strutturata per i caregivers (madre, padre o altri), indaga tre aree chiave: comunicazione, interazione sociale e interessi ristretti/stereotipie. Dai 18 mesi in su.

3. Altri, e.g. **Childhood Autism Rating Scale (CARS; Schopler et al, 1980)**

N.B.

Strumenti da usare in supporto alla diagnosi, che non devono prescindere l'osservazione clinica!

Disturbi **Primari** e **Associati**

- Da Kanner (1943) gli autistici vengono descritti sulla base di 3 primari disturbi:

(1) nell'interazione sociale reciproca;

(2) anormale sviluppo ed uso del linguaggio (verbale e non-verbale);

(3) comportamenti ripetitivi e ritualizati con ridotti e specifici ambiti di interesse.

- Diversi disordini neurologici in comorbidità:

(1) 60% di ritardo mentale (RM) nell'autismo idiopatico anche se preso globalmente (disturbo dello spettro autistico) il RM scende al 30%;

(2) Epilessia spesso frequente sebbene larga variabilità dal 5-44% (dipendente dal tipo?!);

(3) Ansia e disturbi dell'umore sono spesso associati.

Autismo e disturbi dello spettro autistico (ASD)

DSM-IV

- ✓ Autismo basso funzionamento
- ✓ Autismo alto funzionamento
- ✓ Sindrome Asperger
- ✓ PDD-NOS

CRITERI DIAGNOSTICI
I. Interazione sociale;
II. Comunicazione;
III. Interessi ristretti e comportamenti stereotipati.

DSM-5

- ✓ **Disturbi dello spettro autistico (ASD)**
- ✓[Disturbo della comunicazione sociale]

CRITERI DIAGNOSTICI
I. Comunicazione e interazione sociale (mostra «Enciting Alex»)
II. Interessi ristretti e comportamenti stereotipati.
(mostra «early sign of ASD»)

(3 livelli progressivi di gravità)

http://www.autismspeaks.org/what-autism/diagnosis/dsm-5-diagnostic-criteria

Autism

Meng-Chuan Lai, Michael V Lombardo, Simon Baron-Cohen

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Autism is a set of heterogeneous neurodevelopmental conditions, characterised by early-onset difficulties in social communication and unusually restricted, repetitive behaviour and interests. The worldwide population prevalence is about 1%. Autism affects more male than female individuals, and comorbidity is common (>70% have concurrent conditions). Individuals with autism have atypical cognitive profiles, such as impaired social cognition and social perception, executive dysfunction, and atypical perceptual and information processing. These profiles are underpinned by atypical neural development at the systems level. Genetics has a key role in the aetiology of autism, in conjunction with developmentally early environmental factors. Large-effect rare mutations and small-effect common variants contribute to risk. Assessment needs to be multidisciplinary and developmental, and early detection is essential for early intervention. Early comprehensive and targeted behavioural interventions can improve social communication and reduce anxiety and aggression. Drugs can reduce comorbid symptoms, but do not directly improve social communication. Creation of a supportive environment that accepts and respects that the individual is different is crucial.

	Features
Core features in DSM-5 criteria*	
Persistent deficits in social communication and social interaction across multiple contexts	Deficits in social–emotional reciprocity Deficits in non-verbal communicative behaviours used for social interaction Deficits in developing, maintaining, and understanding relationships
Restricted, repetitive patterns of behaviour, interests, or activities	Stereotyped or repetitive motor movements, use of objects, or speech Insistence on sameness, inflexible adherence to routines, or ritualised patterns of verbal or non-verbal behaviour Highly restricted, fixated interests that are abnormal in intensity or focus Hyper-reactivity or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment
Associated features not in DSM-5 criteria	
Atypical language development and abilities	Age <6 years: frequently deviant and delayed in comprehension; two-thirds have difficulty with expressive phonology and grammar Age ≥6 years: deviant pragmatics, semantics, and morphology, with relatively intact articulation and syntax (ie, early difficulties are resolved)
Motor abnormalities	Motor delay; hypotonia; catatonia; deficits in coordination, movement preparation and planning, praxis, gait, and balance
Excellent attention to detail	..

For version with full references, see appendix. DSM-5=Diagnostic and Statistical Manual of Mental Disorders, 5th edition. *Information reproduced from DSM-5,[4] by permission of the American Psychiatric Association.

Table 1: **Behavioural characteristics of autism**

	Proportion of individuals with autism affected	Comments
Developmental		
Intellectual disability	~45%	Prevalence estimate is affected by the diagnostic boundary and the definition of intelligence (eg, whether verbal ability is used as a criterion) In individuals, discrepant performance between subtests is common
Language disorders	Variable	In DSM-IV, language delay was a defining feature of autism (autistic disorder), but is no longer included in DSM-5 An autism-specific language profile (separate from language disorders) exists, but with substantial inter-individual variability
Attention-deficit hyperactivity disorder	28–44%	In DSM-IV, not diagnosed when occurring in individuals with autism, but no longer so in DSM-5 Clinical guidance available
Tic disorders	14–38%	~6·5% have Tourette's syndrome
Motor abnormality	≤79%	See table 1
General medical		
Epilepsy	8–30%	Increased frequency in individuals with intellectual disability or genetic syndromes Two peaks of onset: early childhood and adolescence Increases risk of poor outcome Clinical guidance available
Gastrointestinal problems	9–70%	Common symptoms include chronic constipation, abdominal pain, chronic diarrhoea, and gastro-oesophageal reflux Associated disorders include gastritis, oesophagitis, gastro-oesophageal reflux disease, inflammatory bowel disease, coeliac disease, Crohn's disease, and colitis Clinical guidance available
Immune dysregulation	≤38%	Altered immune function, which interacts with neurodevelopment, could be a crucial biological pathway underpinning autism Associated with allergic and autoimmune disorders
Genetic syndromes	~5%	Collectively called syndromic autism Examples include fragile X syndrome (21–50% of individuals affected have autism), Rett syndrome (most have autistic features but with profiles different from idiopathic autism), tuberous sclerosis complex (24–60%), Down's syndrome (5–39%), phenylketonuria (5–20%), CHARGE syndrome (coloboma of the eye; heart defects; atresia of the choanae; retardation of growth and development, or both; genital and urinary abnormalities, or both; and ear abnormalities and deafness; 15–50%), Angelman syndrome (50–81%), Timothy syndrome (60–70%), and Joubert syndrome (~40%)
Sleep disorders	50–80%	Insomnia is the most common Clinical guidance available
Psychiatric		

Psychiatric		
Anxiety	42–56%	Common across all age groups Most common are social anxiety disorder (13–29% of individuals with autism; clinical guidance available) and generalised anxiety disorder (13–22%) High-functioning individuals are more susceptible (or symptoms are more detectable)
Depression	12–70%	Common in adults, less common in children High-functioning adults who are less socially impaired are more susceptible (or symptoms are more detectable)
Obsessive-compulsive disorder	7–24%	Shares the repetitive behaviour domain with autism that could cut across nosological categories Important to distinguish between repetitive behaviours that do not involve intrusive, anxiety-causing thoughts or obsessions (part of autism) and those that do (and are part of obsessive-compulsive disorder)
Psychotic disorders	12–17%	Mainly in adults Most commonly recurrent hallucinosis High frequency of autism-like features (even a diagnosis of autism spectrum disorder or pervasive developmental disorder) preceding adult-onset (52%) and childhood-onset schizophrenia (30–50%)
Substance use disorders	≤16%	Potentially because individual is using substances as self-medication to relieve anxiety
Oppositional defiant disorder	16–28%	Oppositional behaviours could be a manifestation of anxiety, resistance to change, stubborn belief in the correctness of own point of view, difficulty seeing another's point of view, poor awareness of the effect of own behaviour on others, or no interest in social compliance
Eating disorders	4–5%	Could be a misdiagnosis of autism, particularly in females, because both involve rigid behaviour, inflexible cognition, self-focus, and focus on details
Personality disorders*		
Paranoid personality disorder	0–19%	Could be secondary to difficulty understanding others' intentions and negative interpersonal experiences
Schizoid personality disorder	21–26%	Partly overlapping diagnostic criteria Similar to Wing's loners subgroup
Schizotypal personality disorder	2–13%	Some overlapping criteria, especially those shared with schizoid personality disorder
Borderline personality disorder	0–9%	Could have similarity in behaviours (eg, difficulties in interpersonal relationships, misattributing hostile intentions, problems with affect regulation), which requires careful differential diagnosis Could be a misdiagnosis of autism, particularly in females
Obsessive-compulsive personality disorder	19–32%	Partly overlapping diagnostic criteria
Avoidant personality disorder	13–25%	Could be secondary to repeated failure in social experiences

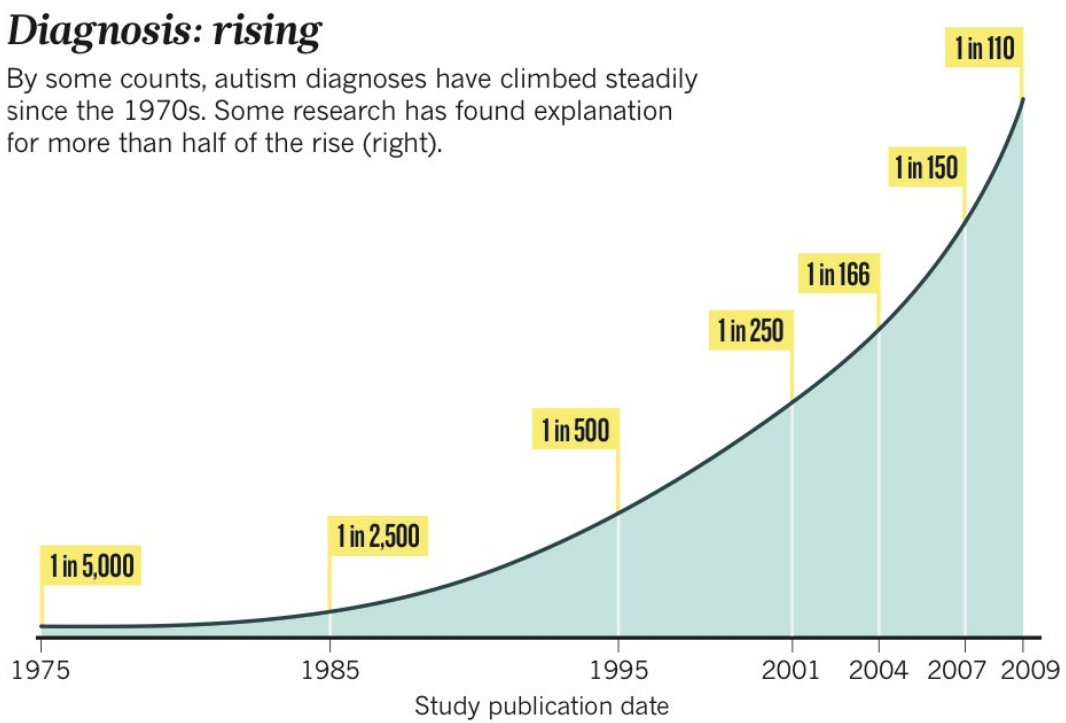
(Continues on next page)

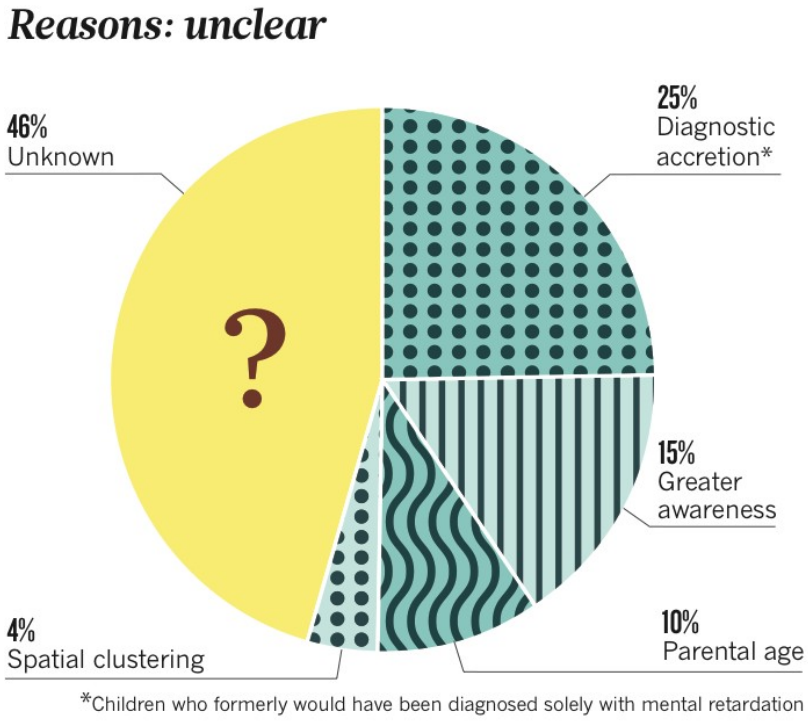
	Proportion of individuals with autism affected	Comments
(Continued from previous page)		
Behavioural		
Aggressive behaviours	≤68%	Often directed towards caregivers rather than non-caregivers Could be a result of empathy difficulties, anxiety, sensory overload, disruption of routines, and difficulties with communication
Self-injurious behaviours	≤50%	Associated with impulsivity and hyperactivity, negative affect, and lower levels of ability and speech Could signal frustration in individuals with reduced communication, as well as anxiety, sensory overload, or disruption of routines Could also become a repetitive habit Could cause tissue damage and need for restraint
Pica	~36%	More likely in individuals with intellectual disability Could be a result of a lack of social conformity to cultural categories of what is deemed edible, or sensory exploration, or both
Suicidal ideation or attempt	11–14%	Risks increase with concurrent depression and behavioural problems, and after being teased or bullied

For version with full references, see appendix. DSM-IV=Diagnostic and Statistical Manual of Mental Disorders, 4th edition. DSM-5=Diagnostic and Statistical Manual of Mental Disorders, 5th edition. *Particularly in high-functioning adults.

Table 2: **Common co-occurring conditions**

Prevalenza in crescita…quali sono le ragioni?





Weintraub K., (2011) Autism Count. *Nature*