Cognitive & Socio-Emotional Resilience in Children with Dyslexia

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UCSF Dept of Psychiatry | Weill Institute for Neurosciences | Yale Haskins Labs

FUNDING

Dennis & Shannon Wong – DSEA '88 Foundation
Toney & Potter Family

Liebe Patterson

NSF1540854 SL-CN (Gazzaley/Uncapher, UCSF)

R01HD078351 (Hoeft, UCSF)
R01HD086168 (Hoeft/Pugh, UCSF/Haskins)
R01HD065794 (Pugh, Haskins)
P01HD001994 (Rueckl, Haskins/UConn)
R01MH104438 (Nordahl, UCDavis/MIND)
R01MH103371 (Amaral, UCDavis/MIND)

Why is each child so different?
How can we ensure success in each child?

KAITO
"STORY MAN"
"3D MAN"

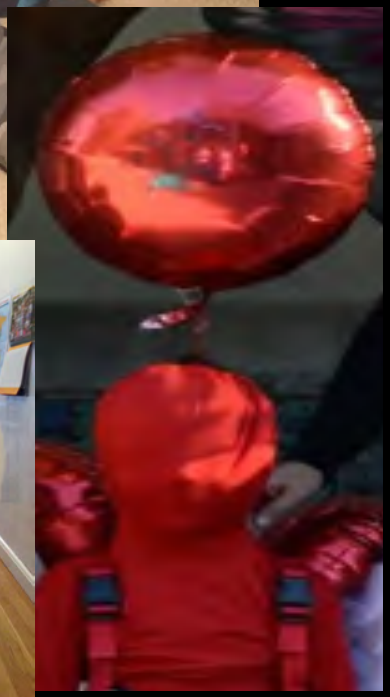
Avoids reading

TAIGA
"INFORMATION SEEKER"

Avid reader

Empathic

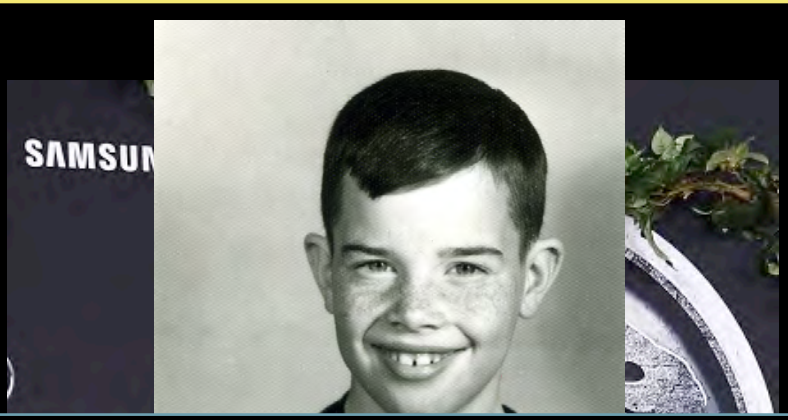
Spiderman
- Halloween



Analytic

Red/White
blood cell
- Halloween

Jack Horner, a paleontologist from Jurassic Park/World



Importance of resilience

Importance of environment & community

Importance of looking at an individual as a whole (including literacy but also other cognitive and socio-emotional aspects)

Resilience

The ability to adapt to stressors in the environment (adversity) by “bending” but not “breaking”

(Karatsoreos & McEwen F1000Prime Reports 2013)

- Socio-emotional resilience
- Cognitive resilience

Outline

- IMPORTANCE OF AN INTEGRATIVE APPROACH
  - Reading & dyslexia are complex.
  - Multiple factors impact dyslexia & success.
- THE NEW NEUROSCIENCE OF DYSLEXIA
- COGNITIVE RESILIENCE
- SOCIO-EMOTIONAL RESILIENCE
- CONCLUSION

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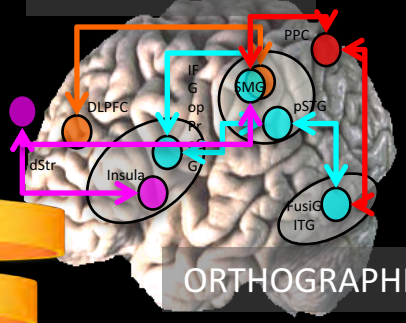
Cost of Dyslexia

SUSCEPTABILITY GENES

Risks

1) There is no enjoyment in reading
2) Doesn't get enough practice
3) Doesn't develop automaticity
4) Reading becomes unpleasant
5) Poor vocabulary growth
6) Poor attitude toward school
7) Affects motivation to read

PHONOLOGICAL



ORTHOGRAPHIC

Downward spiral

POOR OUTCOME: Reading Comprehension, Educational Attainment, Psychosocial Adjustment

Cost of Dyslexia

Pennington & Lefly. Child Develop 2001; Cosden JLD 2001; Wilson et al. JLD 2009; Foresight Mental Capital and Wellbeing Project. 2008 ; DuPaul et al. JLD 2012;

Stephanie Haft

Resilience Model of LD: Promoting Resilience & Optimizing LD Outcome

Haft, Myers, Hoeft. Curr Opin Beh Sci 2016

INTERNAL
- Growth mindset
- Hopeful thinking
- Sense of coherence
- Locus of control
- Self determination

FAMILY
- Family cohesion
- Maternal affect
- Strong parental attachment
- Parental support & understanding of RD

PEER/SCHOOL
- Peer relationships
- Mentorship by teachers
- Teacher support
- Small class-size

Risks

- Oral language skills
- Motor skills
- Task-focused behavior
- Executive functions
- Interpersonal relationships

Socio-Emotional Protect. F.

Less Severe Dyslexia

Cognitive Protective Factors

- Morphological awareness
- Vocabulary
- Verbal reasoning
- Executive functions
- Grammar

Positive Outcome

Importance of an Integrative Approach to Maximizing Children's Learning Potential

Weaknesses vs. Relative strengths

Risk vs. Protective factors

Vulnerability vs. Resilience

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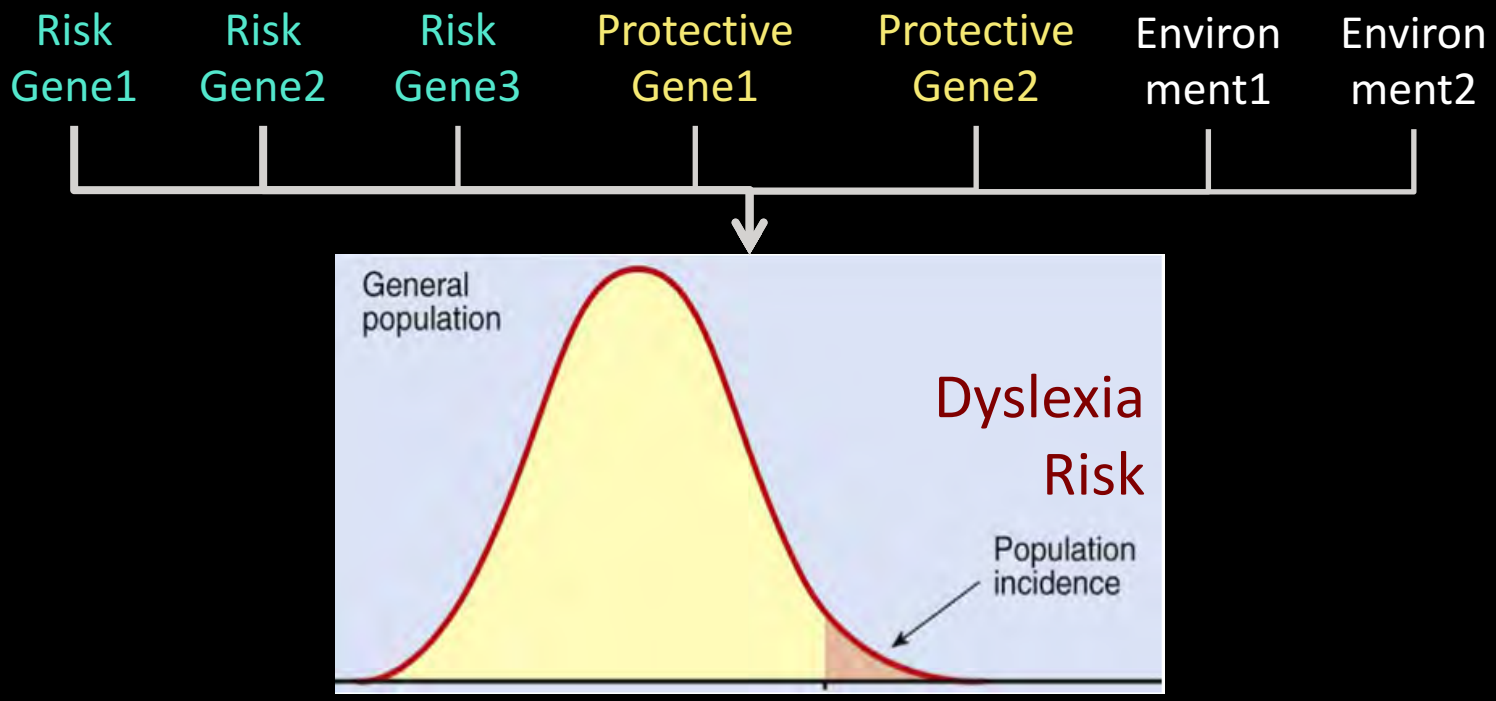
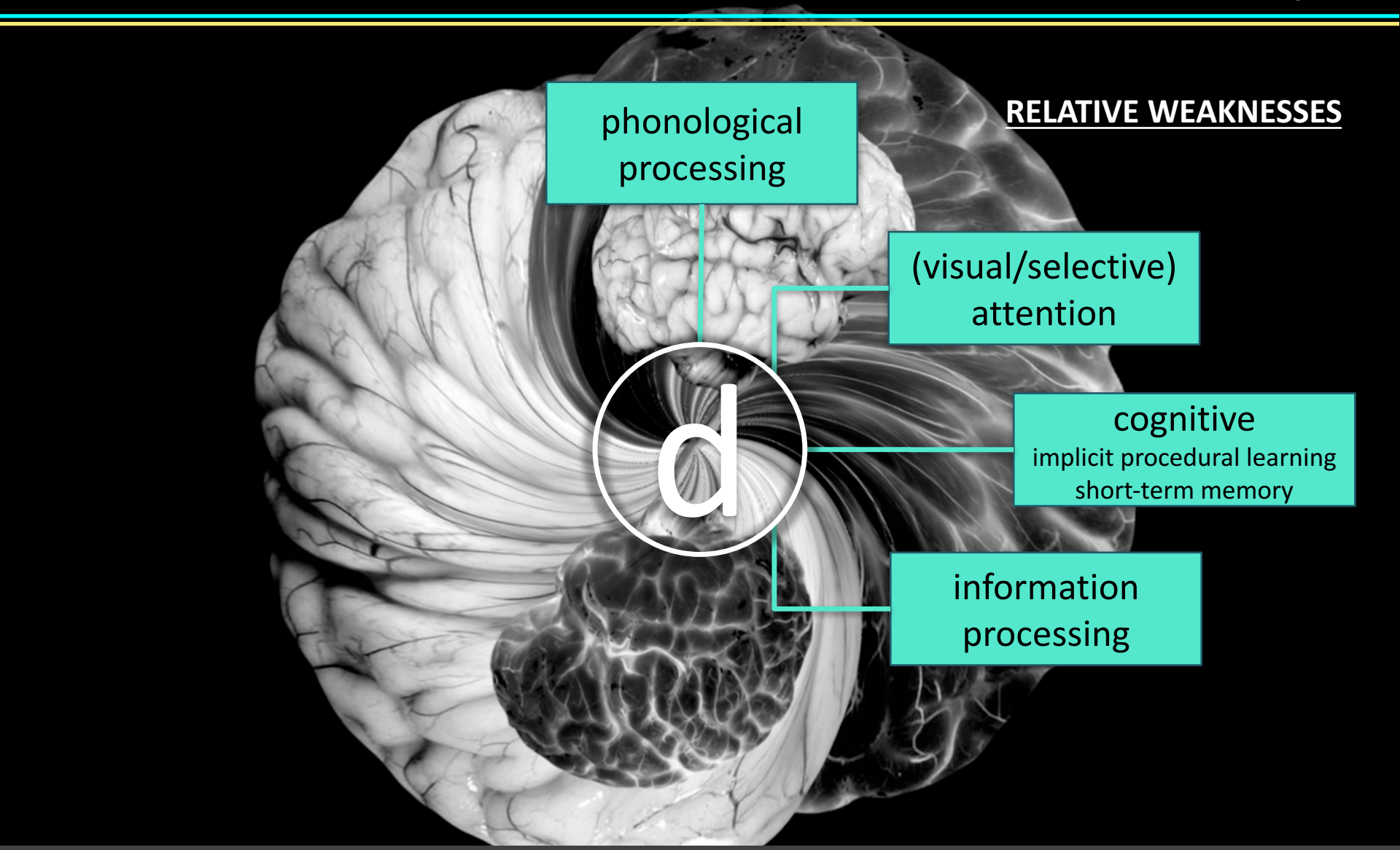
Multiple Factors Contribute to Dyslexia



Pennington. Cognition 2006. Pennington et al. J Abnorm Psychol 2012. – Multiple deficit model

Diathesis-stress model: *Rosenthal ed. "The Genain Quadruplets" '64*
Liability threshold model: *Gottesman & Shields. PNAS '67*

The Neuroscience of Dyslexia – Traditional View
Focus on Weaknesses, Risks & Vulnerability

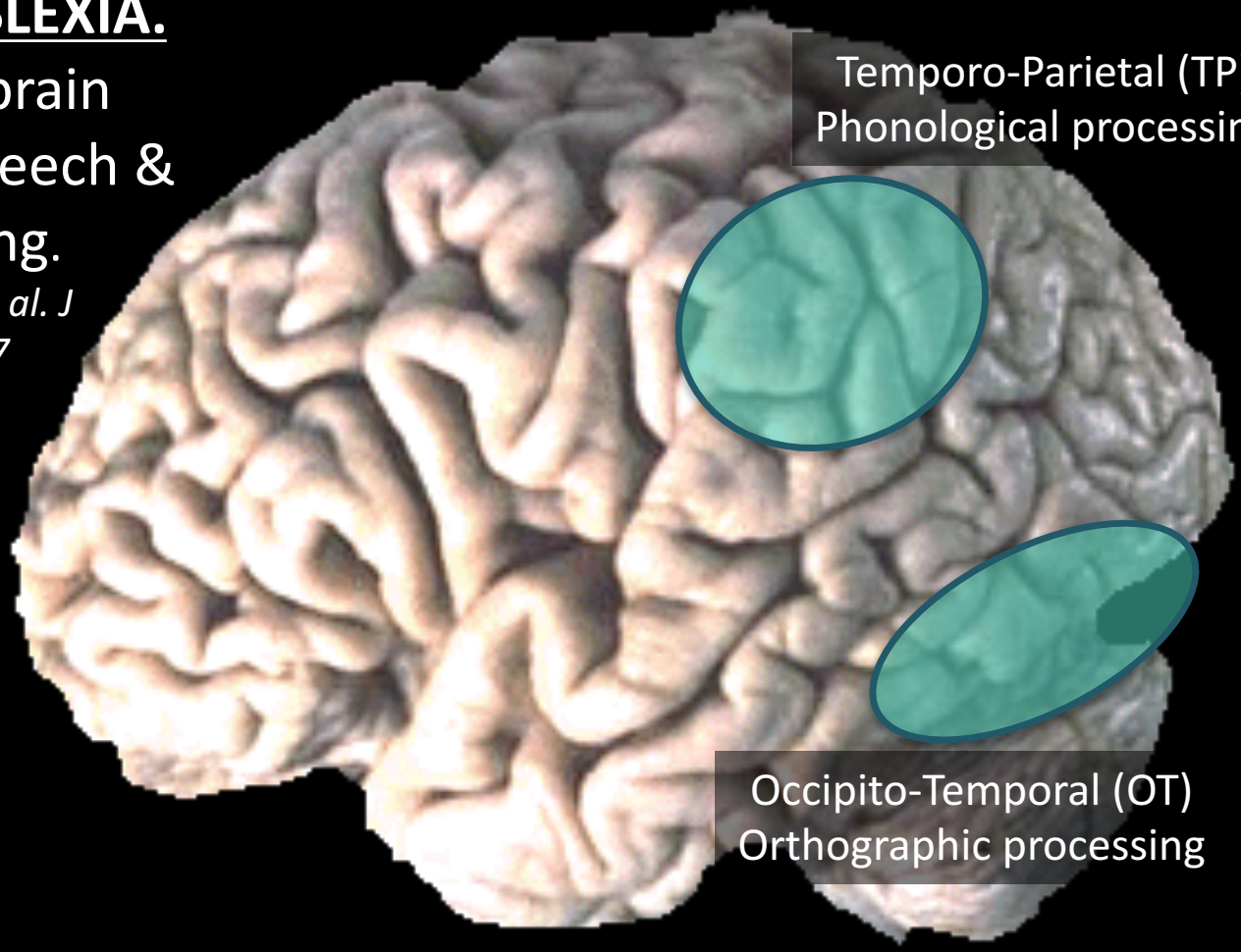


The Neuroscience of Dyslexia – Traditional View
Focus on Weaknesses, Risks & Vulnerability

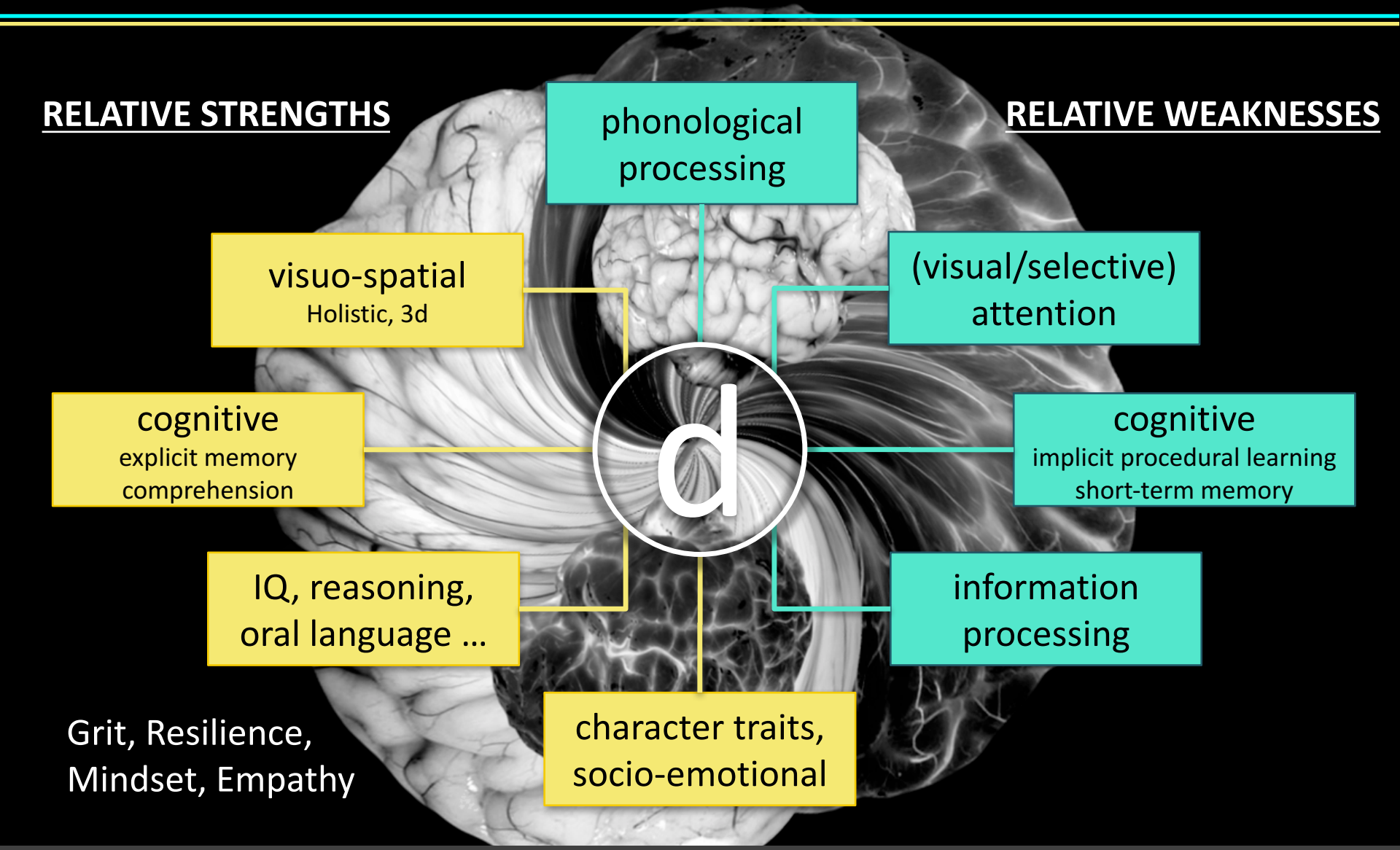
POOR READERS & DYSLEXIA.

Reduced efficiency in brain networks related to speech & visual aspects of reading.

Shaywitz et al. NEJM '98; Hoeft et al. J Neurosci '06. Hoeft et al. PNAS '07



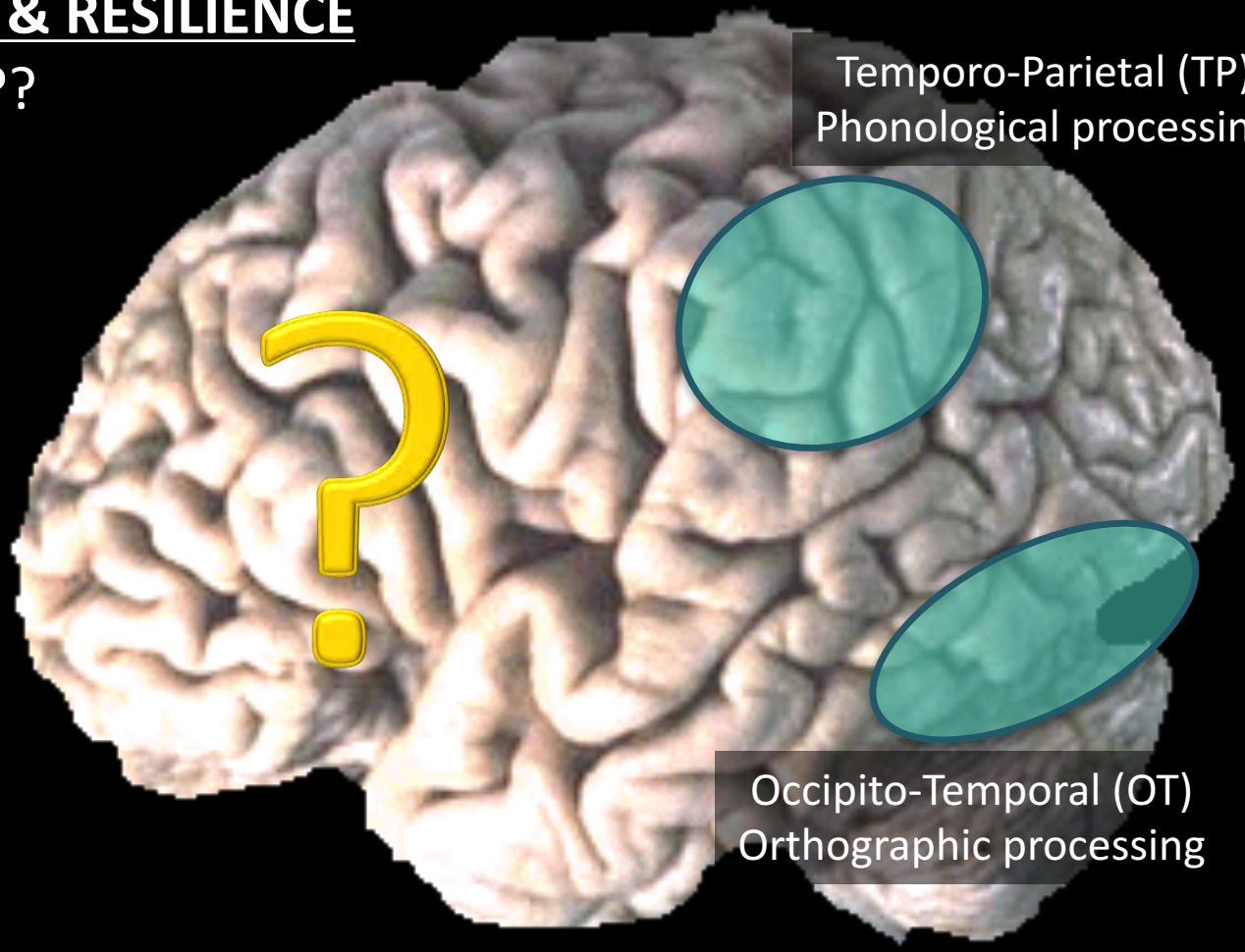
The Neuroscience of Dyslexia – Emerging View
Focus Also on Strengths, Protective Factors & Resilience



The Neuroscience of Dyslexia – Emerging View
Focus Also on Strengths, Protective Factors & Resilience

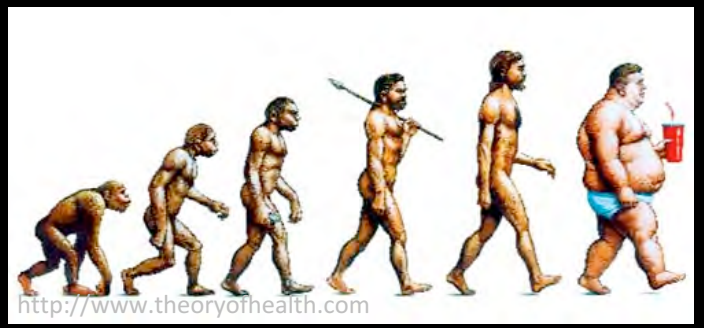
PROTECTIVE FACTORS & RESILIENCE

Which brain systems???

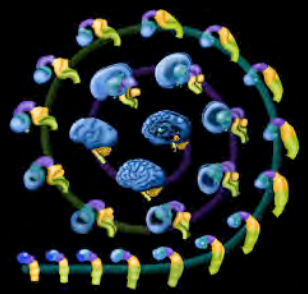


Strengths, Protective Factors & Resilience: Coincidence, Compensatory or Meant to be?

- Coincidence Bryden MP. Laterality ’87
- Compensatory Lansdell HJ. Comp Physio Psychol ‘69, Levy J. Nature ’69
- Causal Kosslyn SM. Psychol Rev ’87, Cai et al. PNAS ’13 Evolutionary advantage Geschwind N. Annals of Dyslexia ‘84

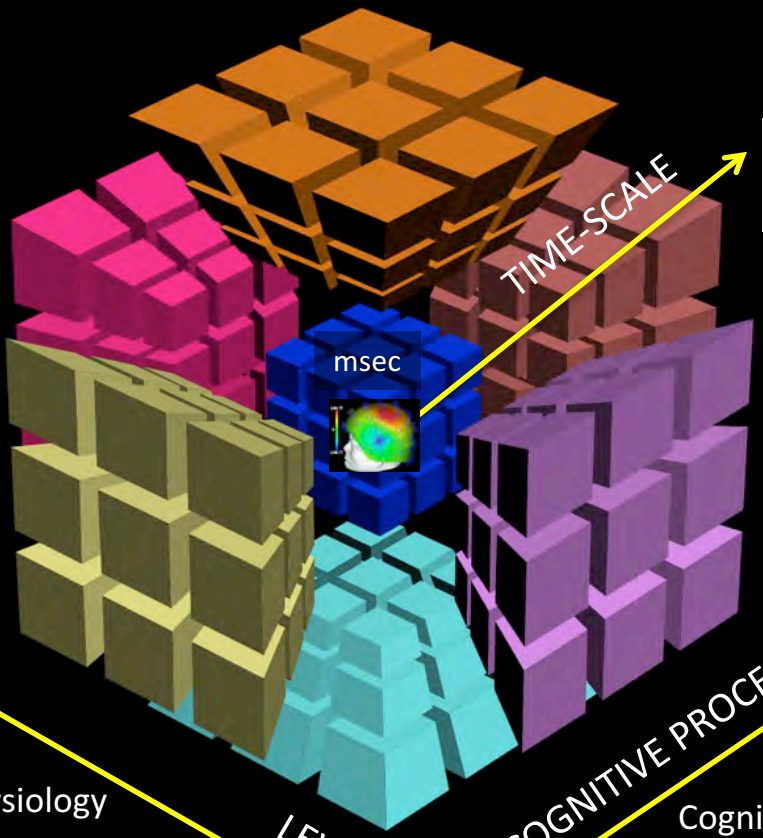


Integrative Approach to Dyslexia Research



Adult
Adolescent
Child
Postnatal
Prenatal
Preconception

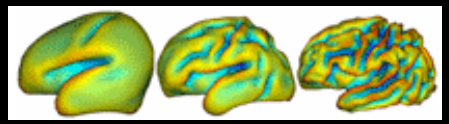
DEVELOPMENTAL STAGE

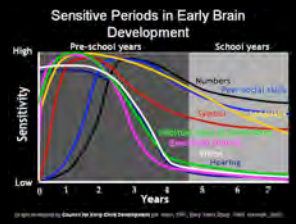


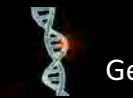
TIME-SCALE

msec

years







Gene
Neurochemistry

Physiology
Neuroanatomy

LEVEL

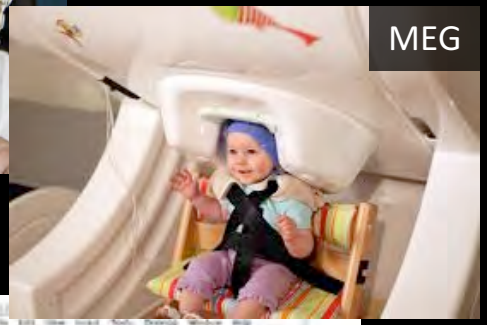
Behavior

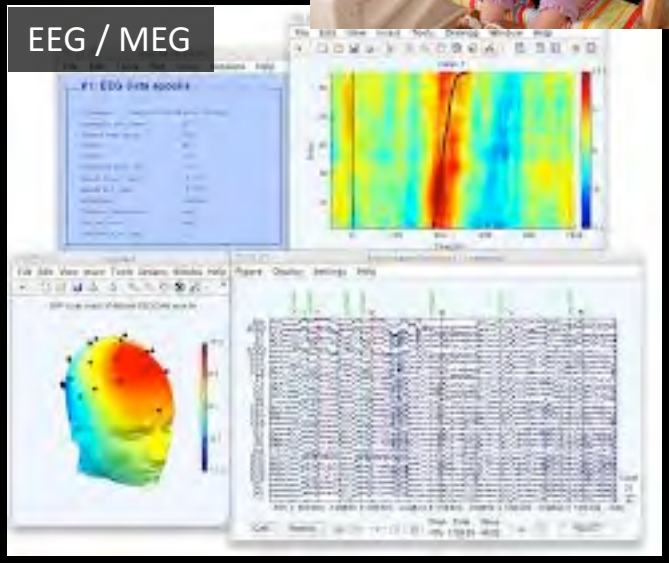
COGNITIVE PROCESSES

Perception
Learning
Cognition
Reading, Math
Socio-emotional

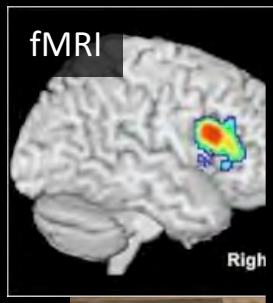
Integrative Approach to Dyslexia Research

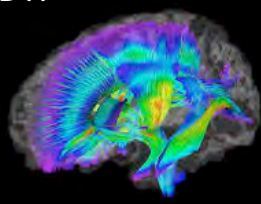
Brain electrical activity

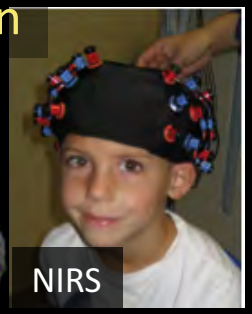




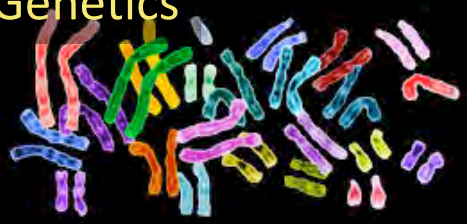
Brain structure & function







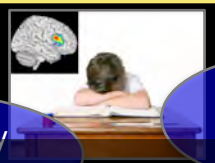
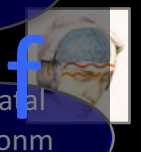
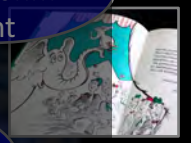
Genetics

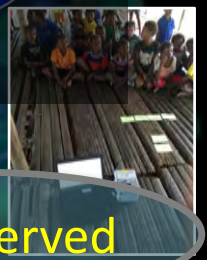


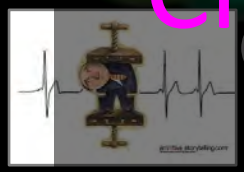
Brain stimulation

Our Work @ UCSF brainLENS .

HOEFT Laboratory for Educational NeuroScience





growth chart

protective factors

risk

compensatory factors

brain imaging

Early school readiness & risk

I-Screener

UCSF Dyslexia Center

prenatal environment

intervention/prevention

biomarker

LD/dyslexia

autism

mechanism

Mechanism of reading & learning

early identification

genetics

bilingual

learning

Socio-emotional, Character traits

motivation/ grit/mindset /stereotype threat

character traits

resilience

brain LENS

URLI

environment

underserved

US /CA Dept of Ed

White House

UNESCO

community

CENTER ON CHILDHOOD CREATIVITY

museums

schools

Community

EYE TO EYE

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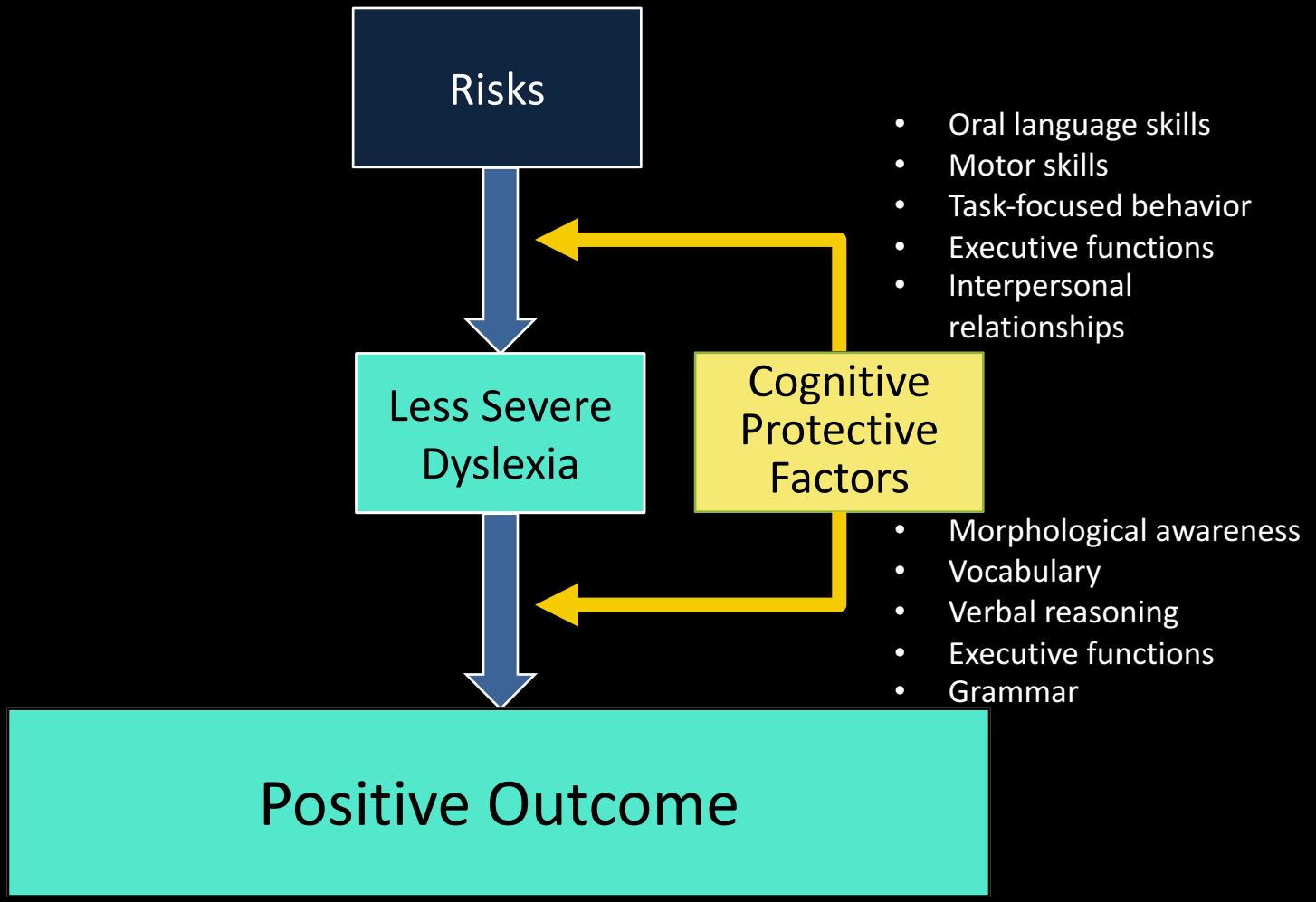
Resilience Model of LD: COGNITIVE RESILIENCE

Haft, Myers, Hoeft. Curr Opin Beh Sci 2016



Smadar Patael PhD

Laurie Cutting PhD

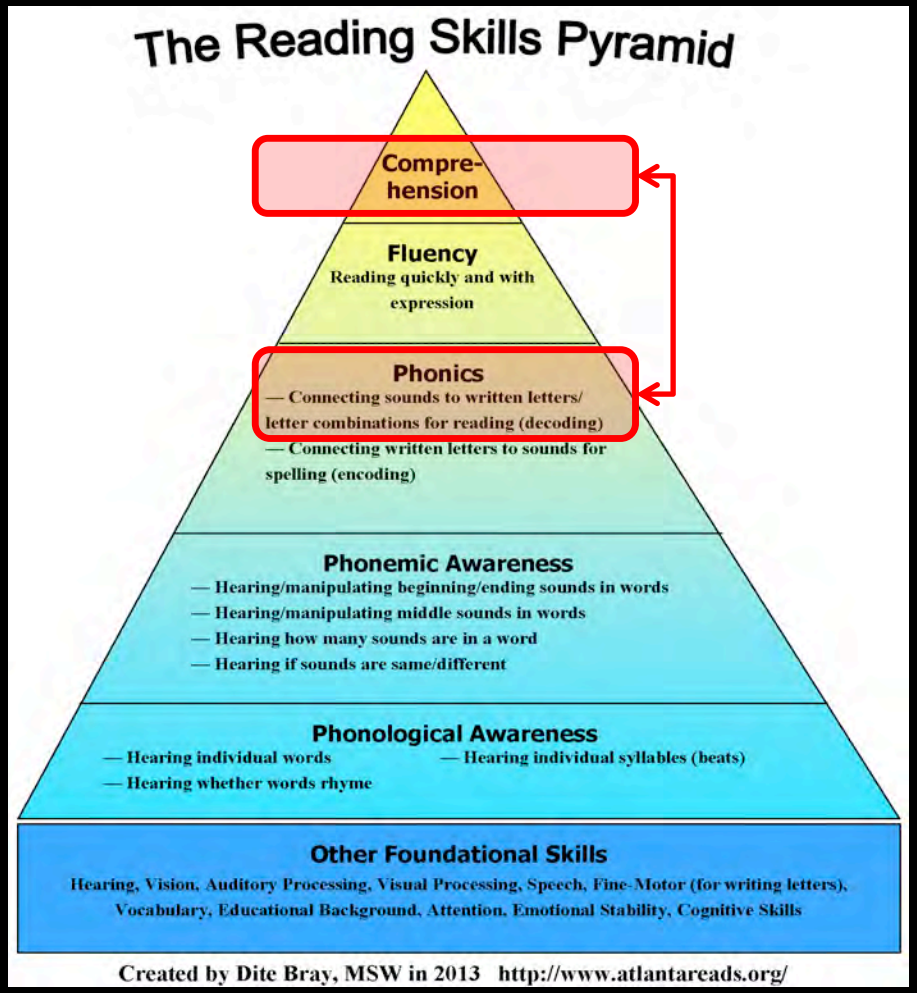
THE NEW YORKER

COGNITIVE RESILIENCE
Resilient Dyslexics

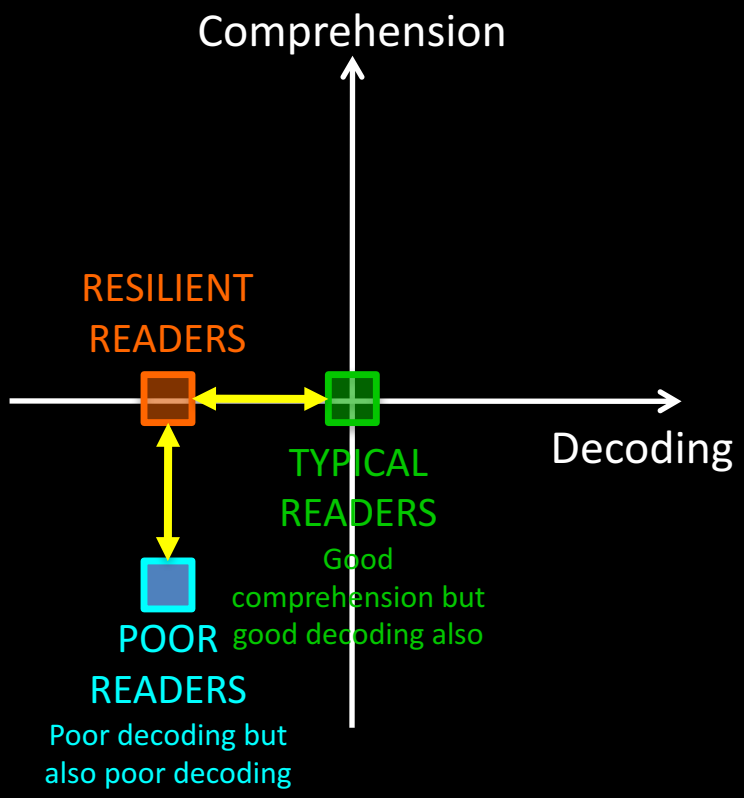
RESILIENT READERS: Those with good comprehension despite poor decoding.

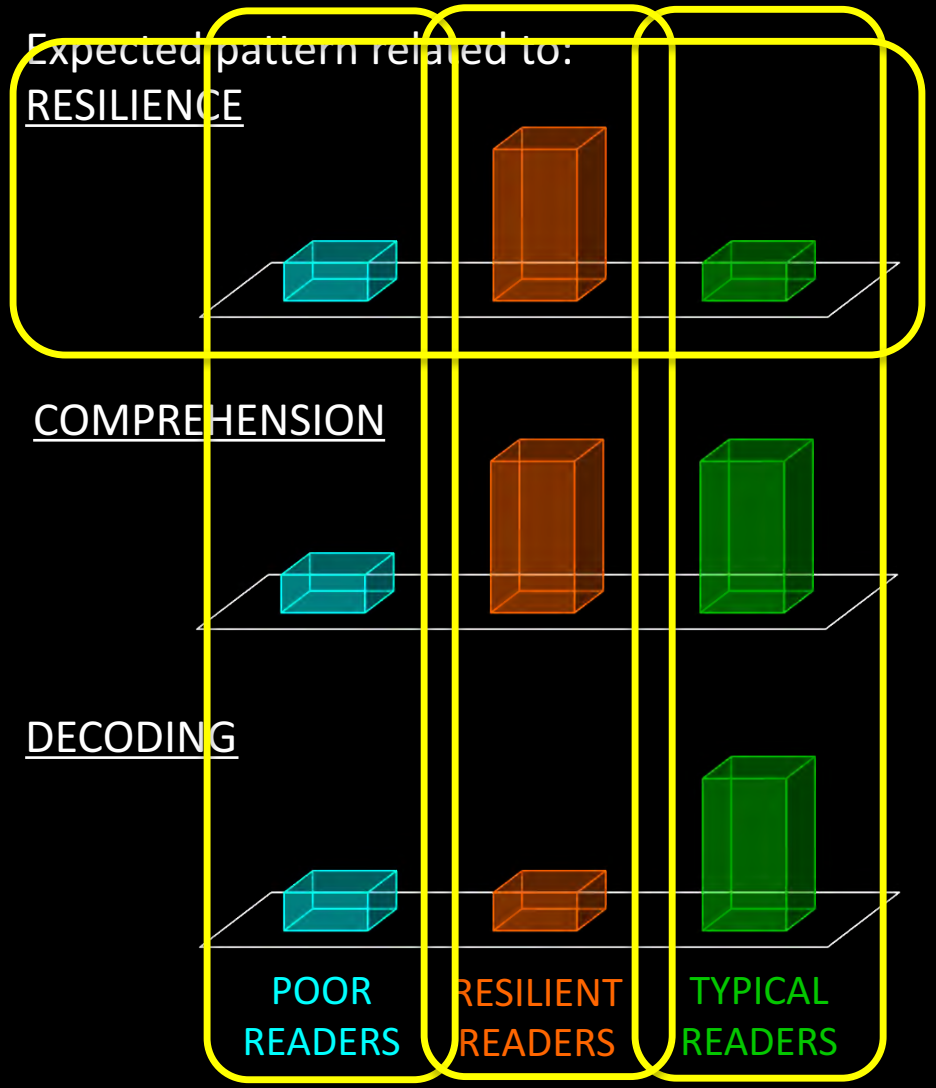
Those with decoding difficulties rely more on contextual information to be able to read successfully. INTERACTIVE COMPENSATORY MODEL OF DYSLEXIA *(Stanovich, 1980)*

Implications for intervention.



COGNITIVE RESILIENCE
Brain Mechanism?



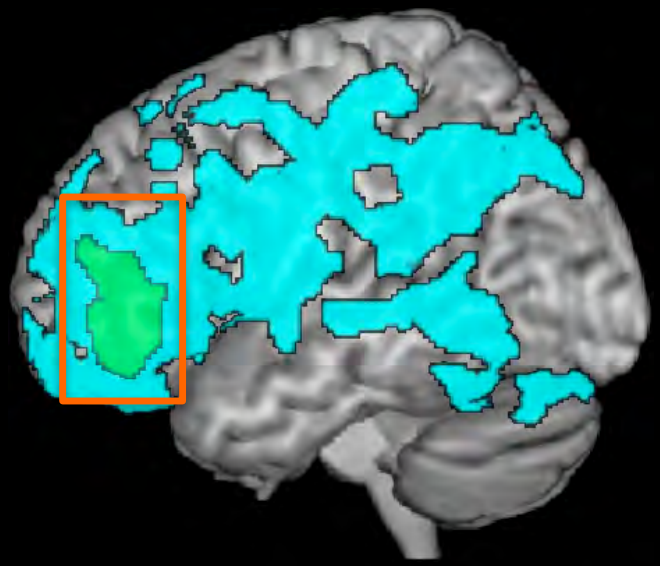


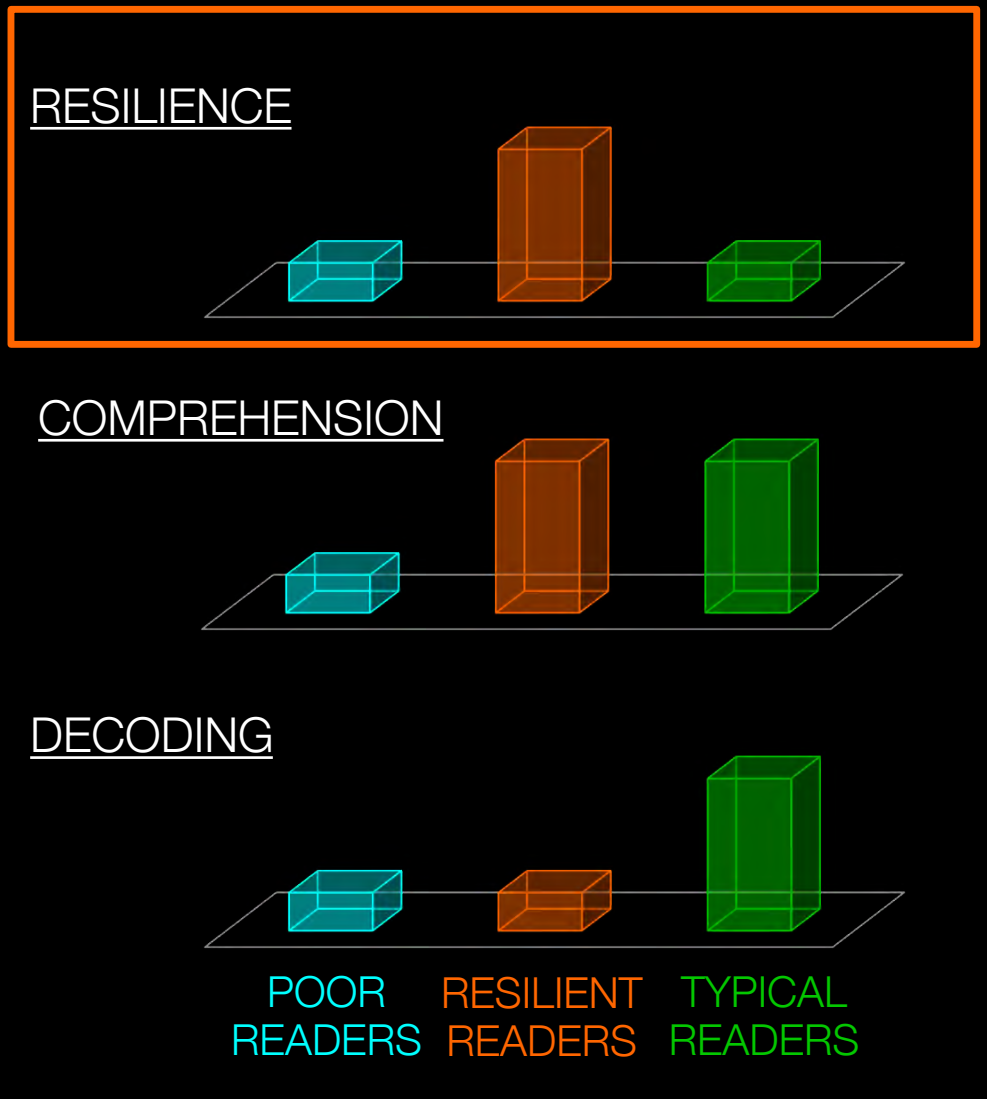
COGNITIVE RESILIENCE

Left Dorsolateral Prefrontal Cortex (DLPFC)

Resilient > Poor readers

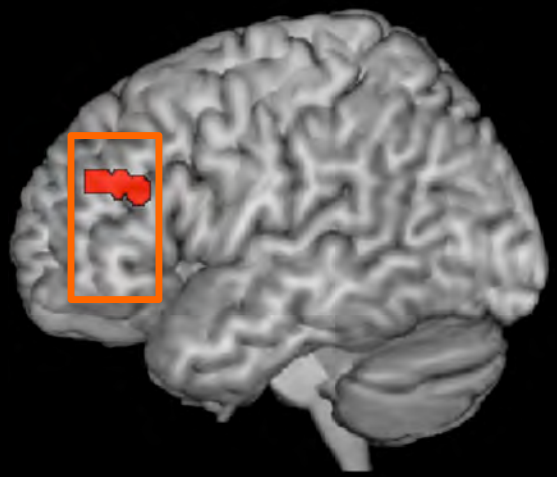
Resilient > Typical readers

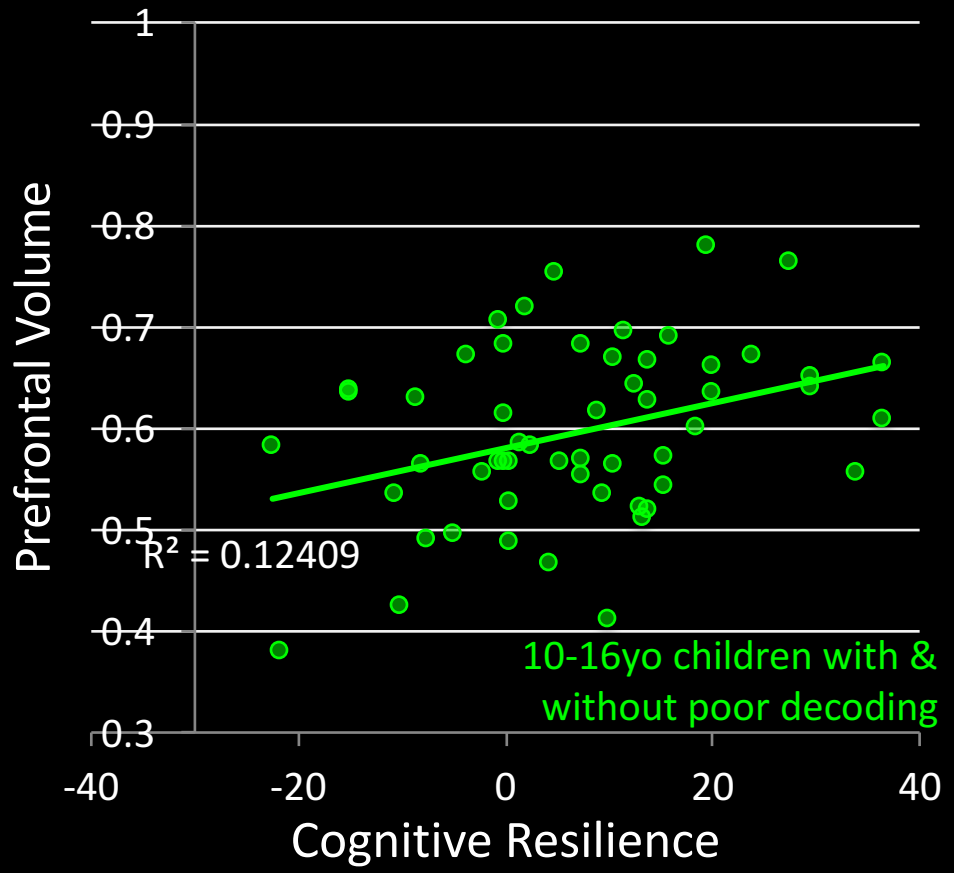




COGNITIVE RESILIENCE

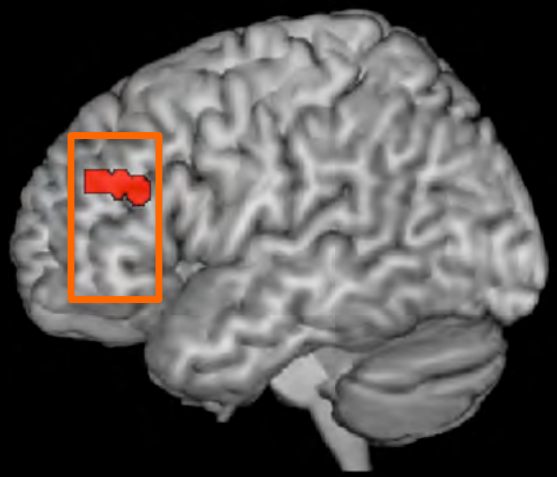
Not just dyslexics but anyone can have it.

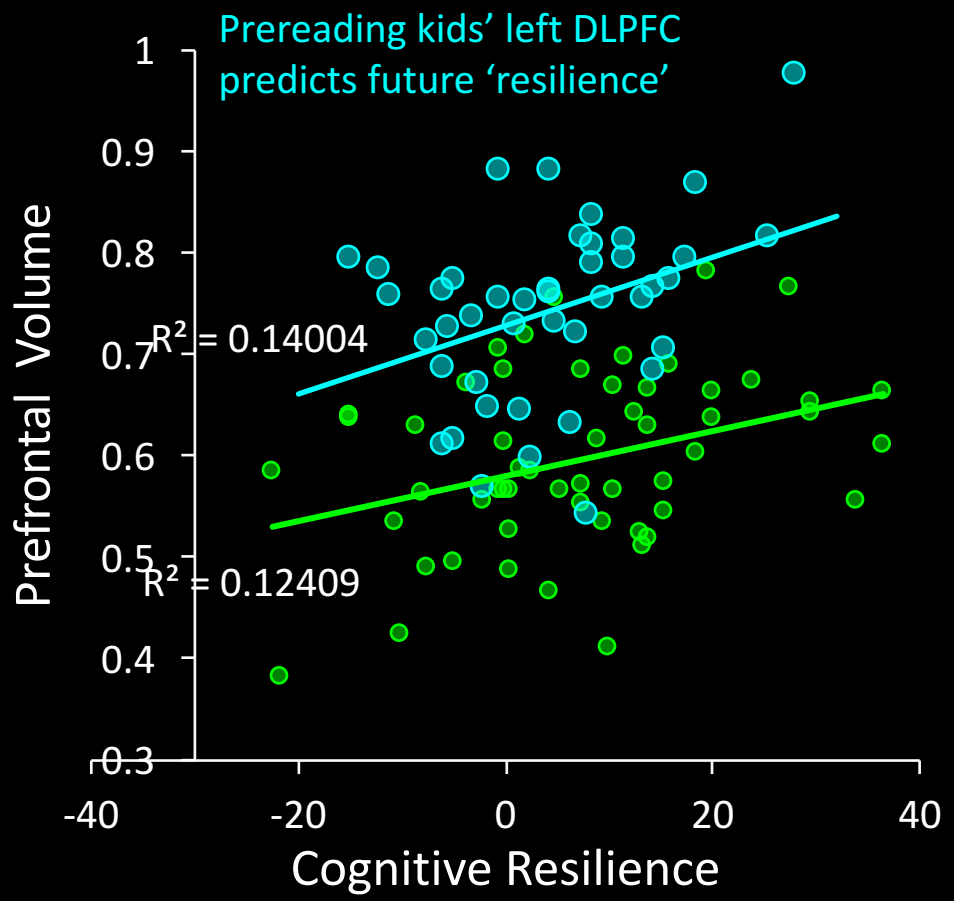




COGNITIVE RESILIENCE

Chicken or egg? Show signs BEFORE reading failure.

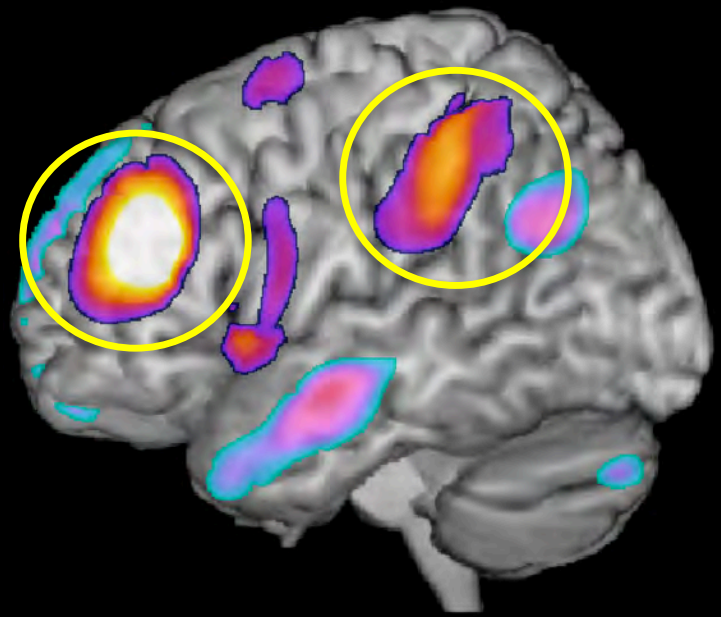


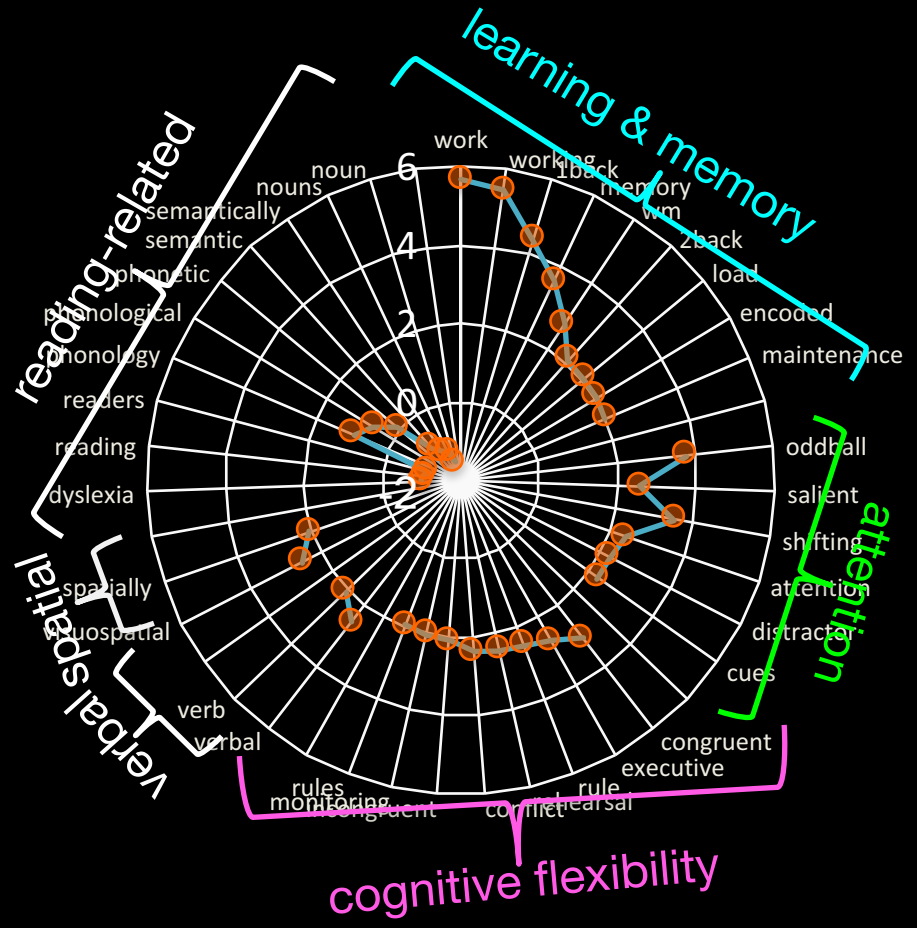


COGNITIVE RESILIENCE
Role of DLPFC Network?

Related to learning, attention, & cognitive flexibility

Fronto-parietal network





1000 Functional Connectome. Neurosynth.org

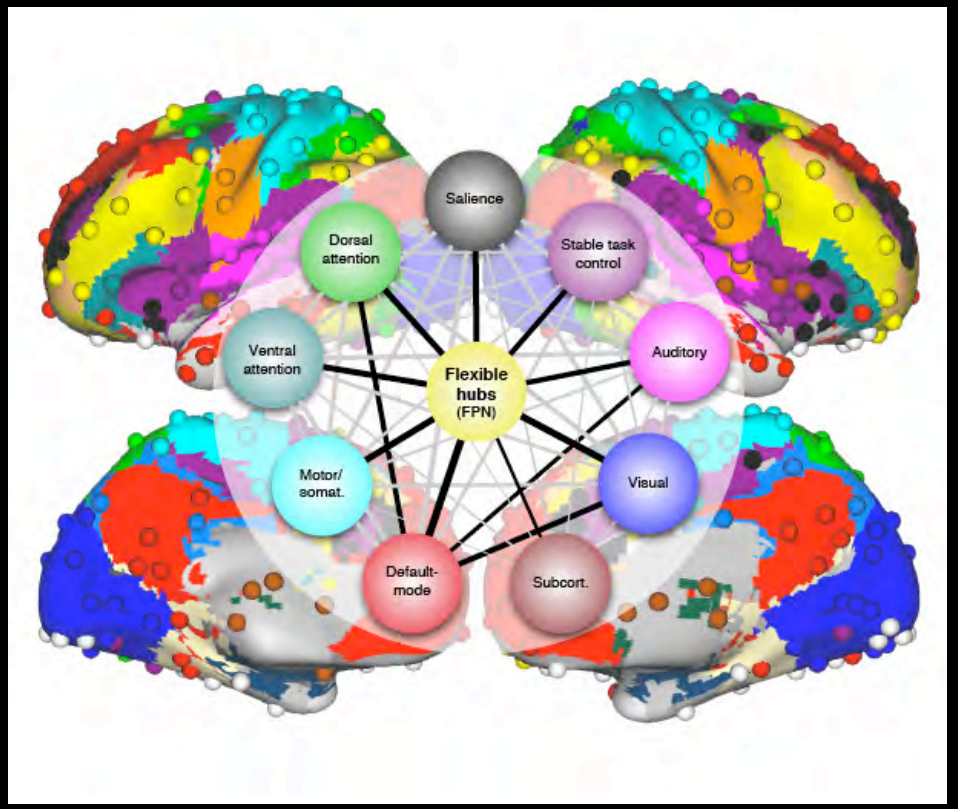
COGNITIVE RESILIENCE

Fronto-parietal network “flexible learning hub”.

Dynamically changes how it connects to other key networks based on current goals.

Critical for learning new skills and building mental rules.

Allows immediate & flexible transfer of skills.



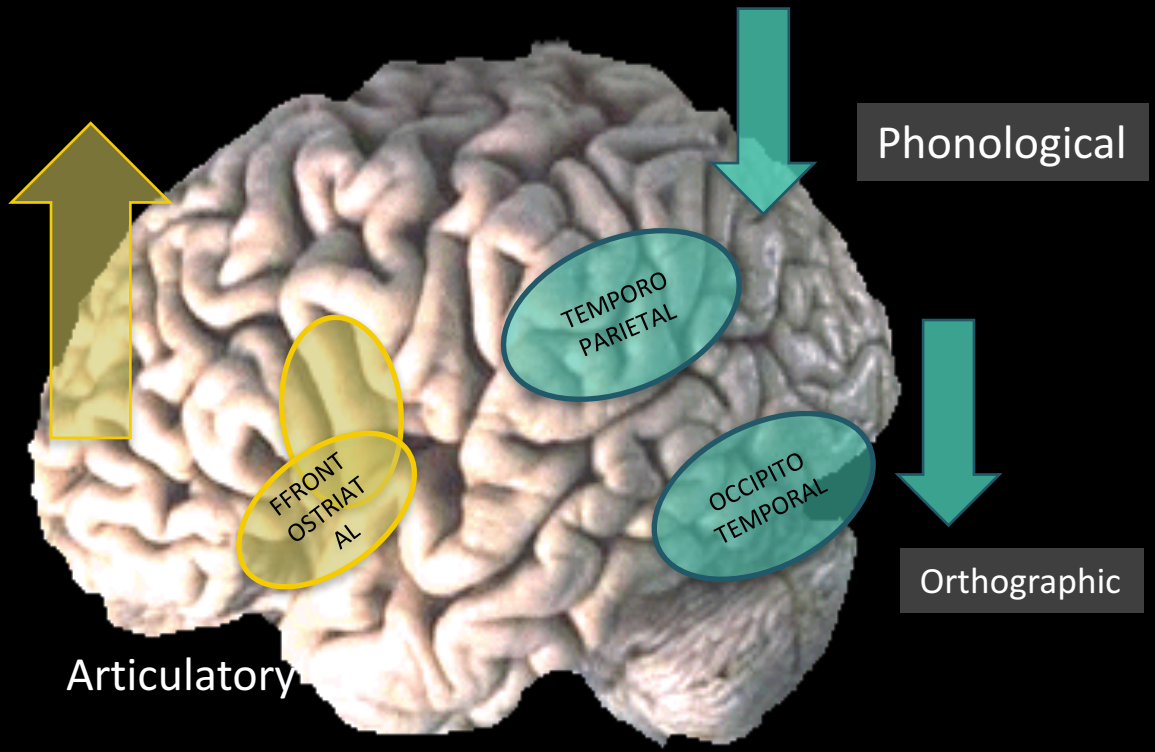
Cole et al. Nat Neuroscience ’13

Roeland Hancock PhD

COGNITIVE RESILIENCE?
Other Frontal Mechanisms

Hoeft et al. PNAS '07; Hancock Richlan Hoeft. Neurosci Beh Rev
Hoeft et al. PNAS '11

Left Fronto-Striatal Network – Articulation
Right Inferior Frontal & Fronto-Parietal White Matter – Predict outcome

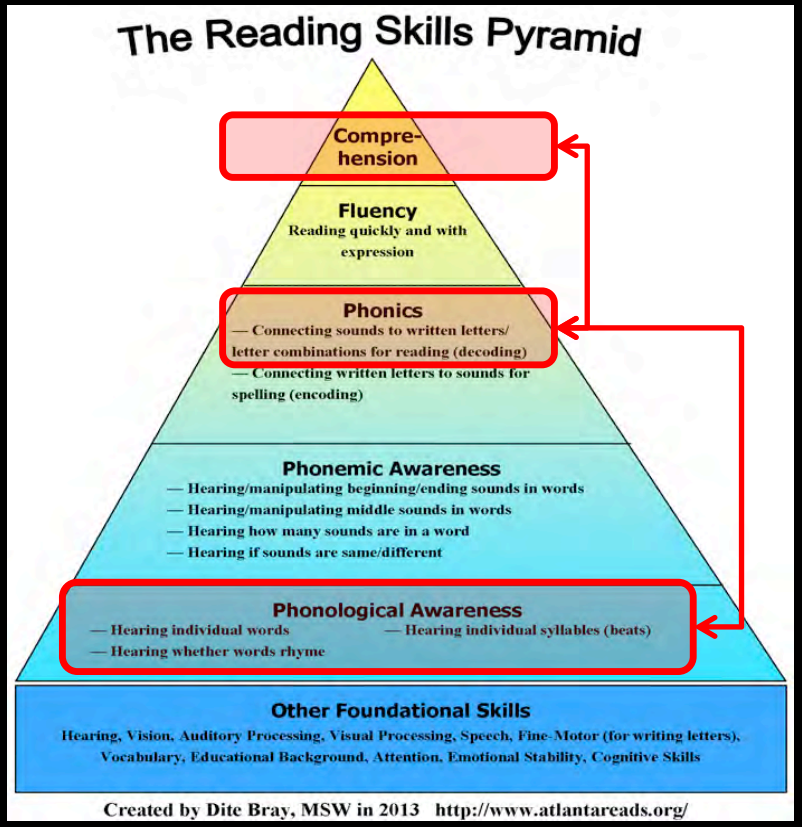


COGNITIVE RESILIENCE: Summary

Prefrontal & fronto-parietal network

Cognitive flexibility, learning network

Importance of promoting activities to enhance cognitive flexibility & self-regulation early



Outline

- IMPORTANCE OF AN INTEGRATIVE APPROACH
  - Reading & dyslexia are complex.
  - Multiple factors impact dyslexia & success.
- THE NEW NEUROSCIENCE OF DYSLEXIA
- COGNITIVE RESILIENCE
- SOCIO-EMOTIONAL RESILIENCE
- CONCLUSION

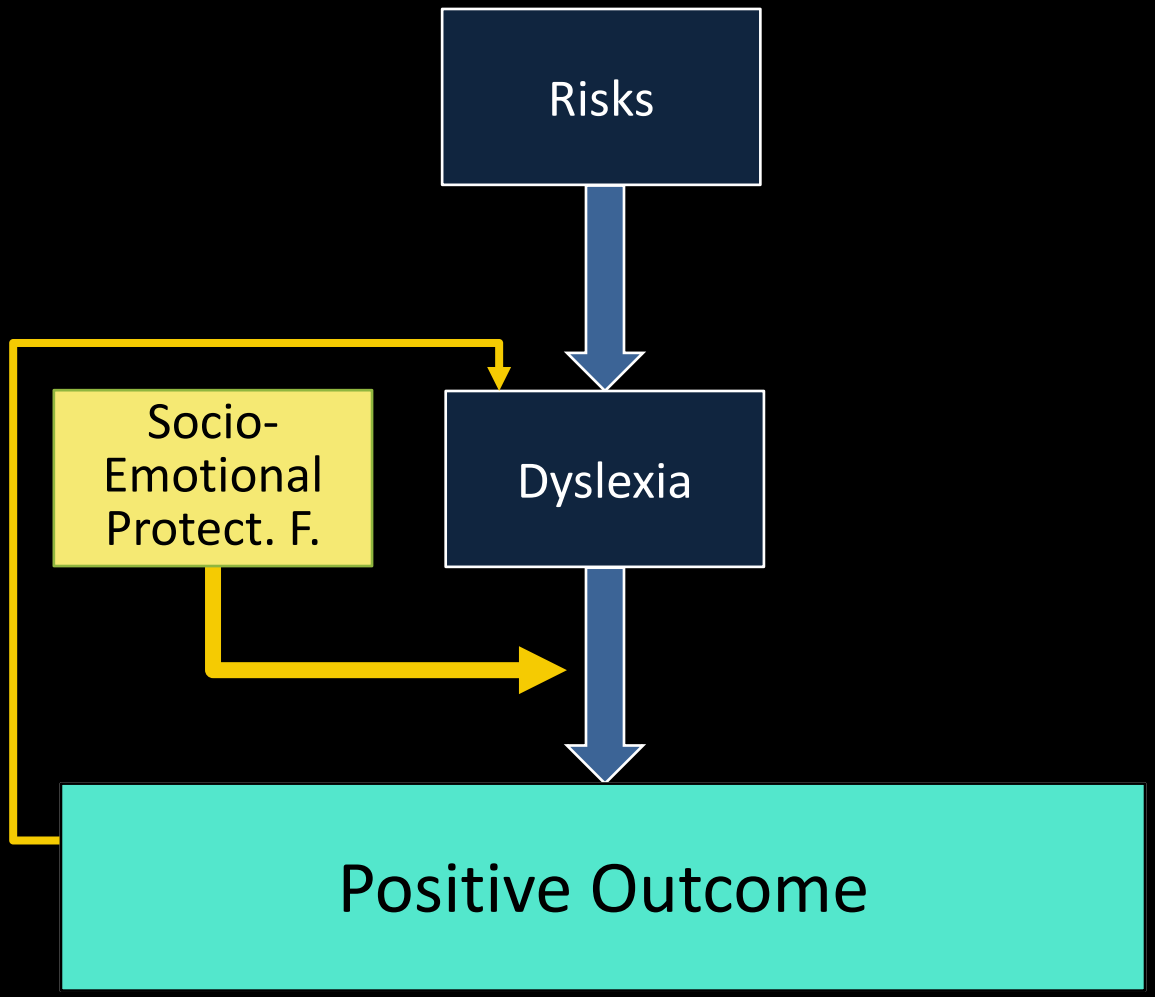
Resilience Model of LD: SOCIO-EMOTIONAL RESILIENCE

Haft, Myers, Hoeft. Curr Opin Beh Sci 2016

INTERNAL
- Growth mindset
- Hopeful thinking
- Sense of coherence
- Locus of control
- Self determination

FAMILY
- Family cohesion
- Maternal affect
- Strong parental attachment
- Parental support & understanding of RD

PEER/SCHOOL
- Peer relationships
- Mentorship by teachers
- Teacher support
- Small class-size



SOCIO-EMOTIONAL RESILIENCE
Character traits critical for success

Self discipline, more predictive than IQ (2x) & above and beyond achievement itself

(Duckworth & Seligman, Psychol Sci '05)

2x

Academic-performance variable	Study 2 (N = 164)	
	Self-discipline	IQ
First-marking-period GPA	.66***	.34***
Final GPA	.67***	.32***
Spring achievement test	.43***	.36***
Selection to high school	.56***	.26**
School absences	−.26**	−.07
Homework hours	.35***	−.09
Television hours	−.33***	−.06
Time of day homework is begun	−.26**	.18*

Note. GPA = grade point average.
*p < .05. **p < .01. ***p < .001.

Above & beyond IQ & achievement

Variable	B	$SE\ B$	β
Study 1			
First-marking-period GPA	0.96	0.04	.87***
Self-discipline	0.95	0.39	.10*
Study 2			
IQ	0.01	0.01	.01
First-marking-period GPA	0.84	0.04	.89***
Self-discipline	0.76	0.33	.08*

*p < .05. ***p < .001.

Chelsea Myers

SOCIO-EMOTIONAL RESILIENCE
Brain mechanisms

Myers et al. SCAN 2016

Multiple targets – Multiple routes to enhance learning

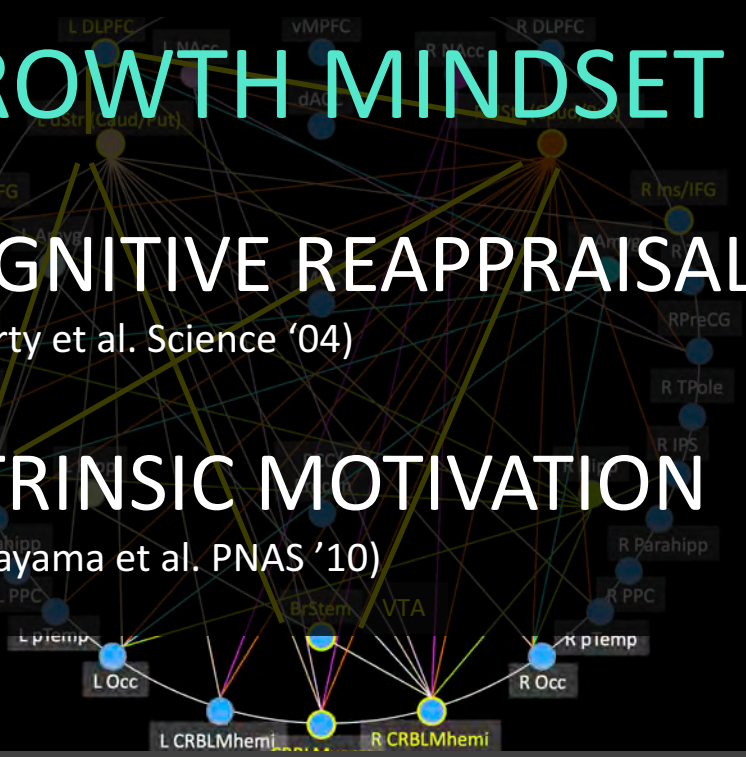
GROWTH MIND-SET:
Belief that ability is effort based

GRIT:
Perseverance toward a long term goal

GROWTH MINDSET

COGNITIVE REAPPRAISAL
(Doherty et al. Science '04)

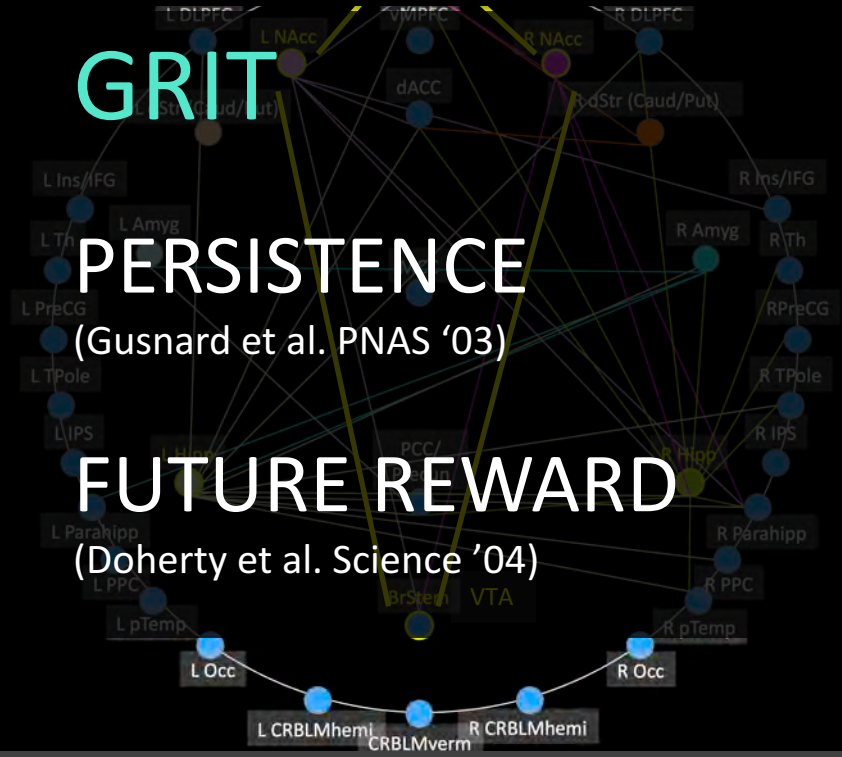
INTRINSIC MOTIVATION
(Muyrayama et al. PNAS '10)



GRIT

PERSISTENCE
(Gusnard et al. PNAS '03)

FUTURE REWARD
(Doherty et al. Science '04)

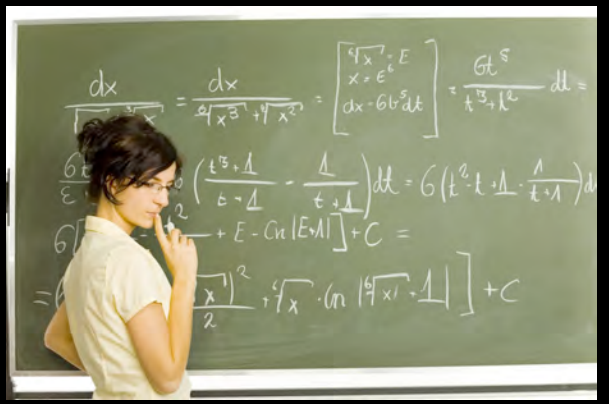


SOCIO-EMOTIONAL RESILIENCE

Stereotype threat may put individuals at risk

"Stereotype threat is being at risk of confirming, as self-characteristic, a negative stereotype about one's group." –Steele and Aronson (1995)

"White men can't jump."



"Women are not good at math."

reducingstereotypethreat.org, Whistling vivaldi by Claude Steele

SOCIO-EMOTIONAL RESILIENCE

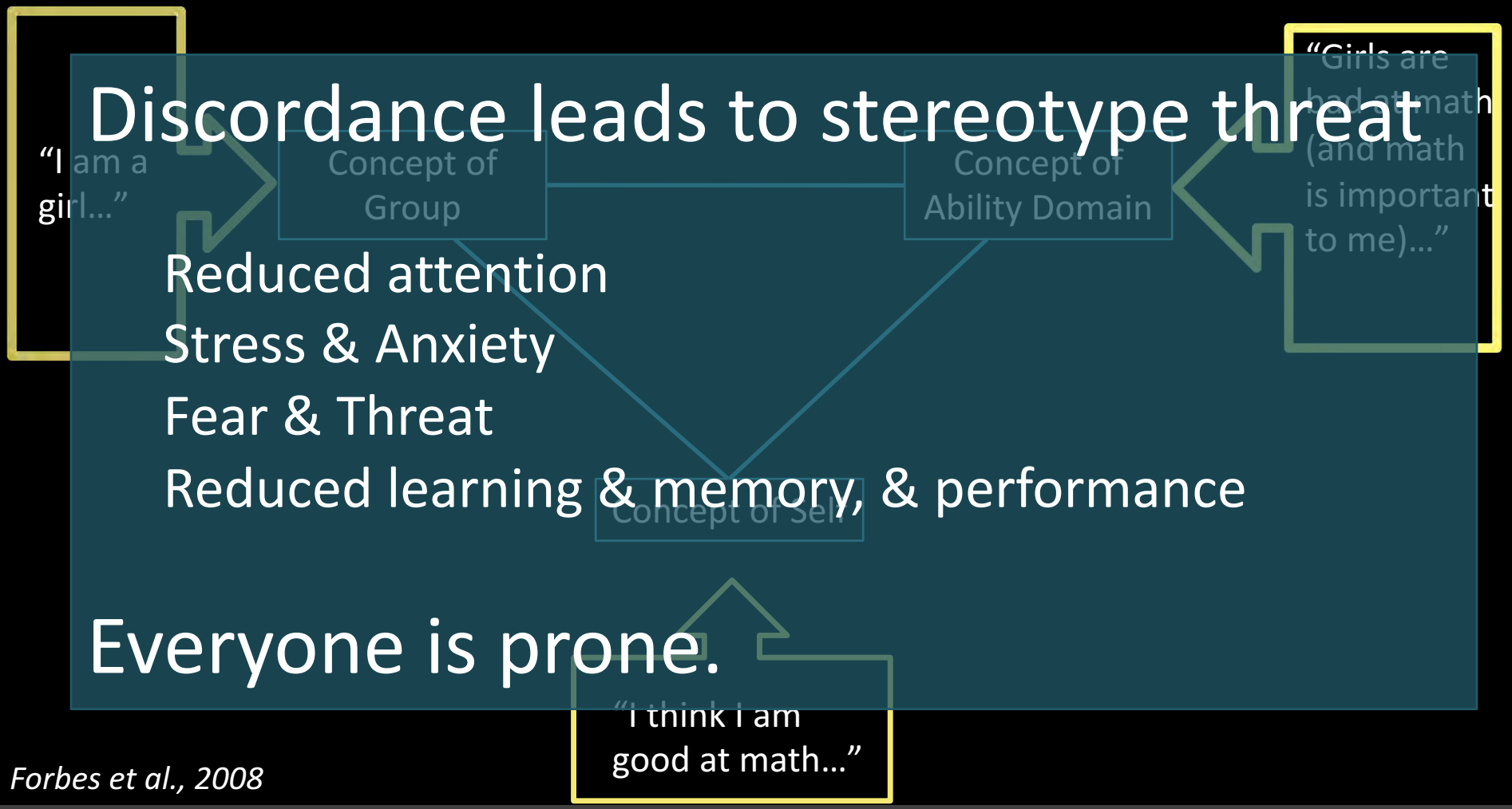
Stereotype threat MAY exist in LDs

Why might individuals with learning disabilities (including dyslexics, but also ADHD etc) experience stereotype threat?

- Group identification - low achievement
- Aware of stereotype *(Kelly and Norwich, 2004; Rashkind et al., 2006)*
- Negative academic self-concept *(Zeleke, 2004)*
- Low self-esteem, negative affect, anxiety, and depression when faced with performance-avoidance goals (the desire to perform less poorly than others) *(Sideridis, 2007; Aquino, 2011)*

SOCIO-EMOTIONAL RESILIENCE

An Integrated Process Model of Stereotype Threat



Discordance leads to stereotype threat

- Reduced attention
- Stress & Anxiety
- Fear & Threat
- Reduced learning & memory, & performance

Everyone is prone.

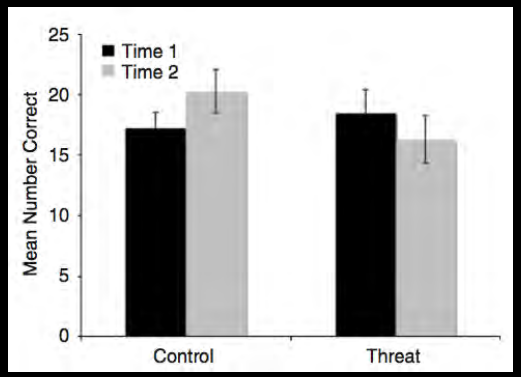
Forbes et al., 2008

SOCIO-EMOTIONAL RESILIENCE
Brain mechanism of stereotype threat?

Women & under-performance in math

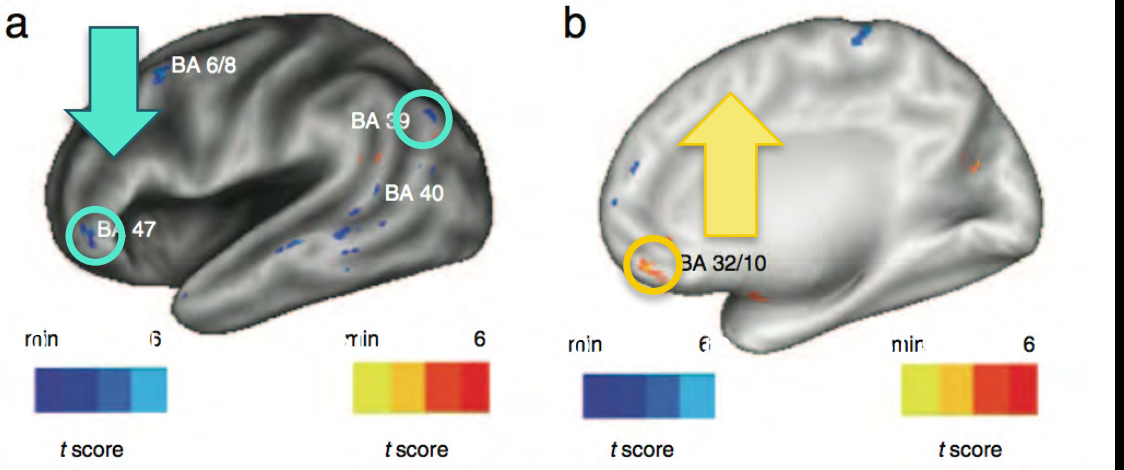
Krendl et al. Psychol Sci 2008

Lack of improvement in math performance over time under ST (interaction: p<.005)



Lack of MATH related activation under ST

Increase in EMOTIONal response under ST



Stereotype threat impacts key cognitive networks and emotion-related networks negatively

SOCIO-EMOTIONAL RESILIENCE
Building Resilience Against Stereotype Threat

- Reframing the task (e.g. Quinn & Spencer, 2001)
- De-emphasizing threatened social identities (e.g. Stricker and Ward, 2004)
- Role models (e.g. Blanton et al., 2000)
- External attributions for difficulty (e.g. Good et al, 2003)
- Self-affirmations (e.g. Schimel et al., 2004)
- Growth mindset (e.g. Aronson et al., 2002)

Ken Pugh

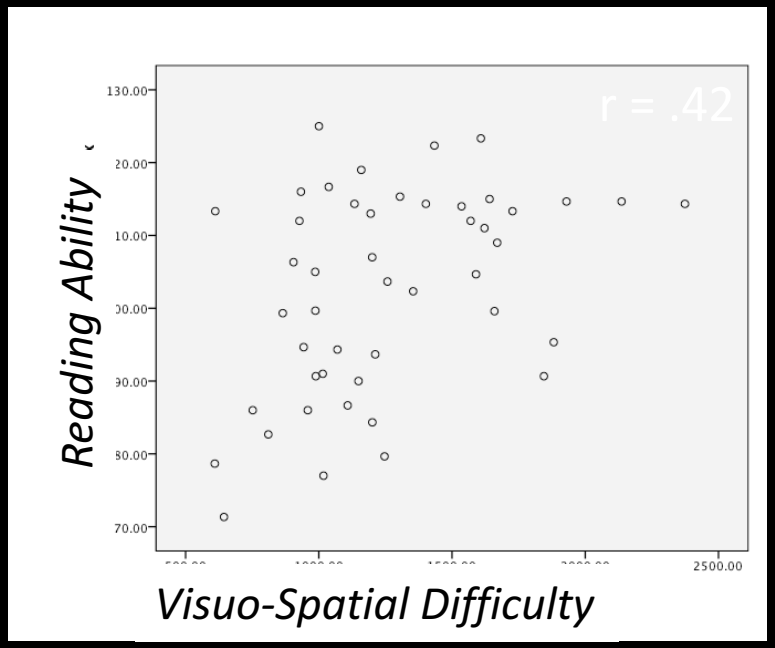
SOCIO-EMOTIONAL RESILIENCE

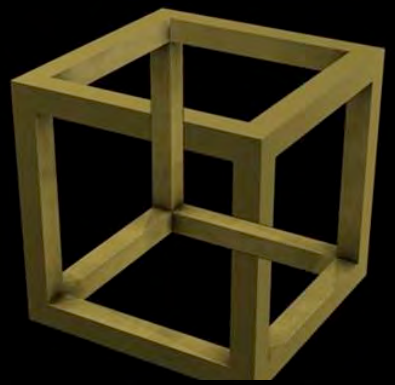
Strength-based approach may build resilience

Diehl … Hoeft … Pugh. NeuroImage '14

Visuo-spatial processing show yin-yang relationship with reading

Poorer the reading, better the visuo-spatial (configural) abilities *(von Károlyi et al., '01; '03)*.





SOCIO-EMOTIONAL RESILIENCE

Mentoring may build resilience

IMPROVEMENT IN:

SELF ESTEEM (12%)

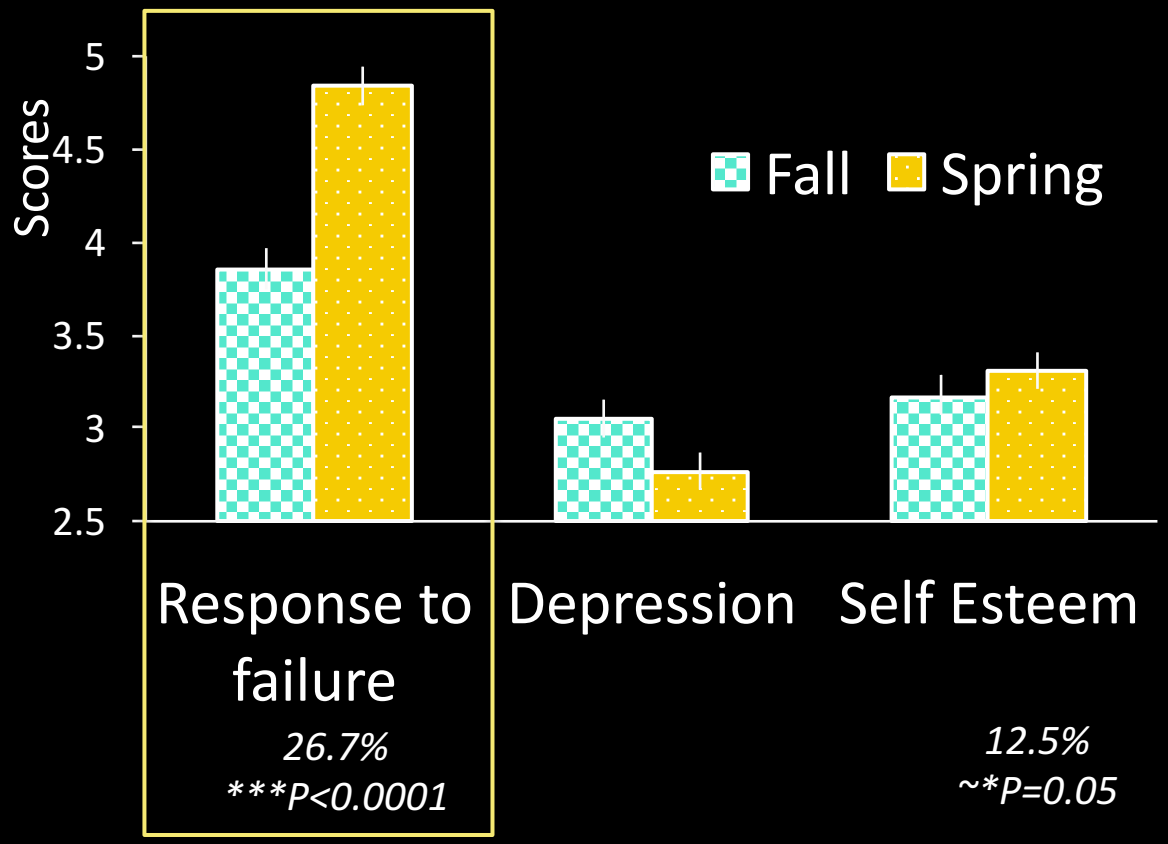
GRIT (value) (8-36%)

GROWTH MINDSET (14%)

LD IDENTITY (comfort, bond, importance) (24-52%)

READING SELF-CONCEPT (19%)

etc…

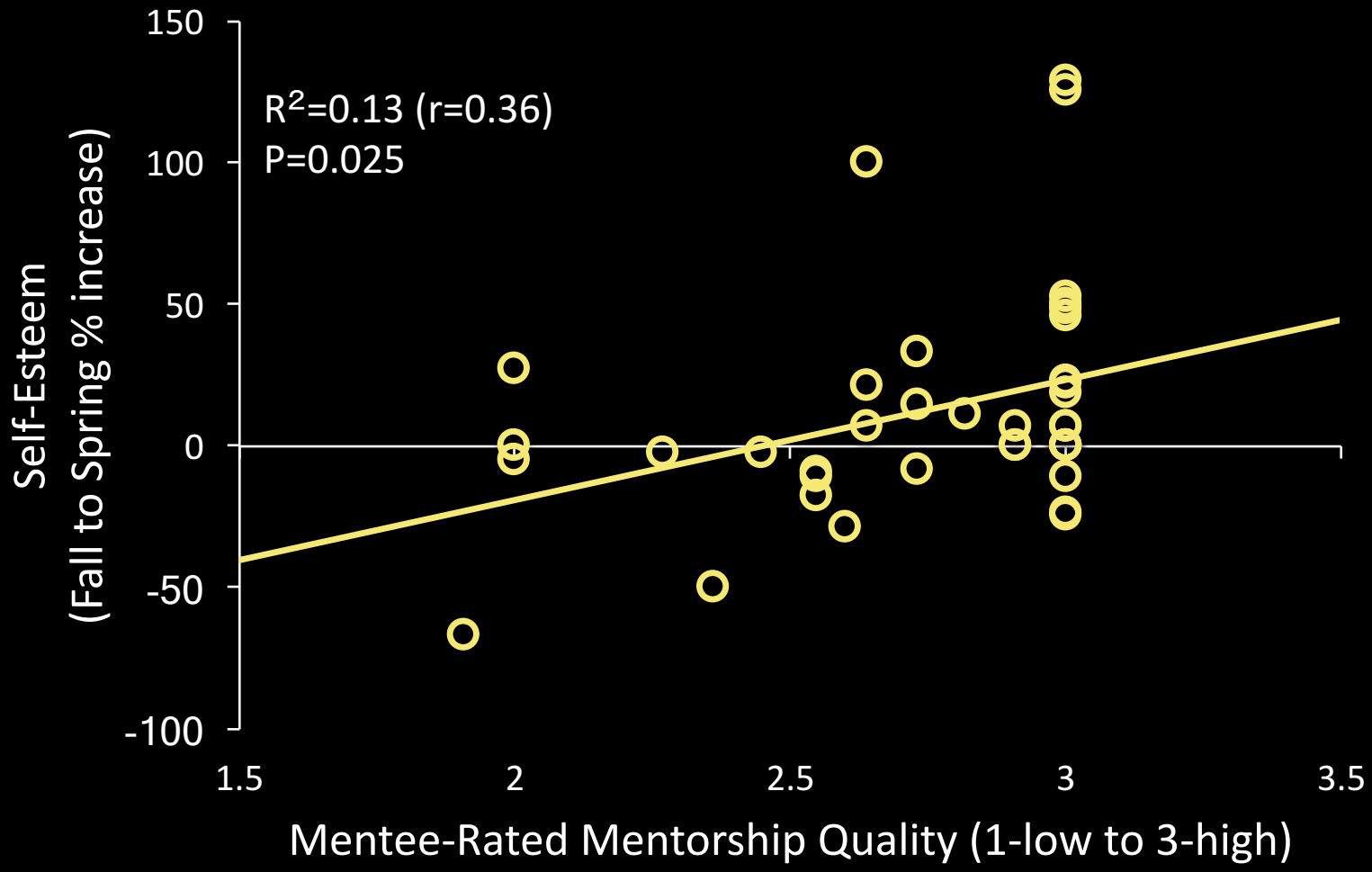


Display more positive emotions and effort-based strategies in the face of failure.

N=48

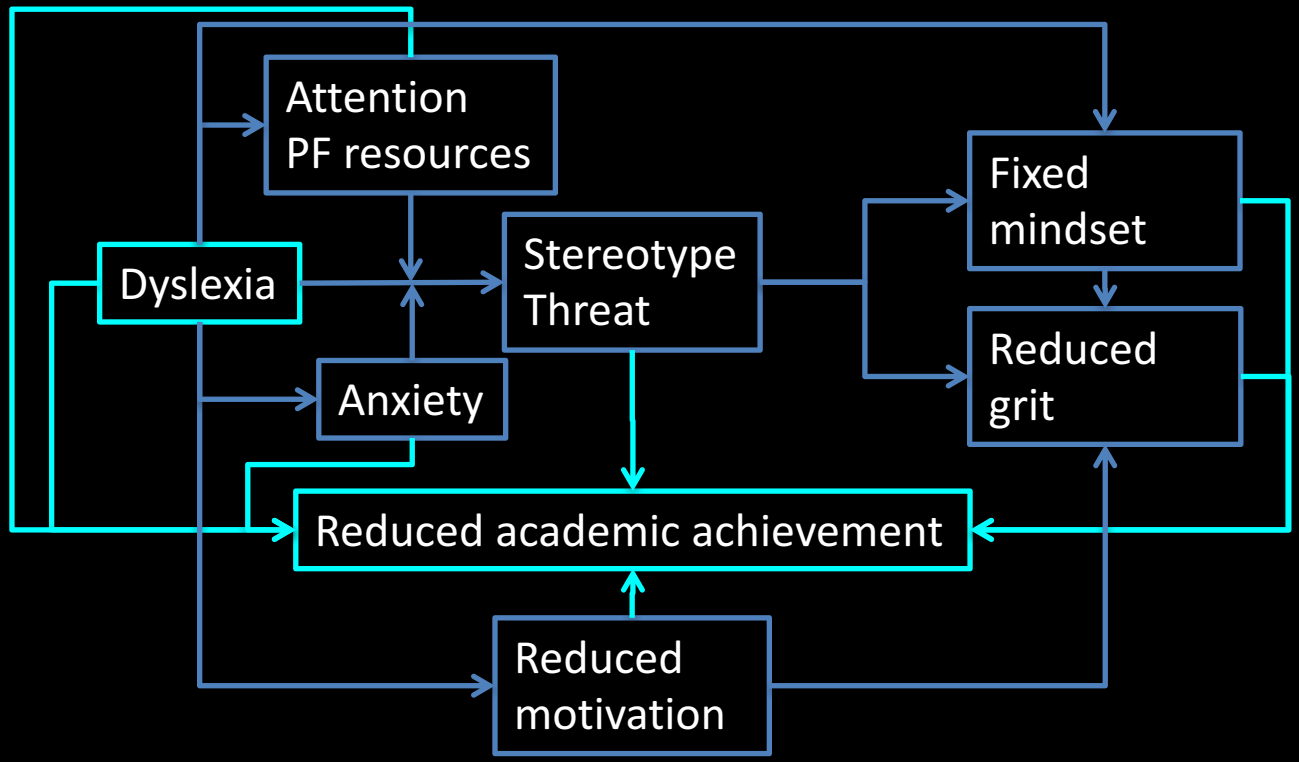
SOCIO-EMOTIONAL RESILIENCE

Mentoring may build resilience



SOCIO-EMOTIONAL RESILIENCE: Summary

- Stereotype threat & fixed mindset could be potential mechanisms underlying underperformance in those with learning challenges.
- Others such as anxiety, motivation and reduced grit likely interact with stereotype threat and fixed mindset, and result in further underperformance.



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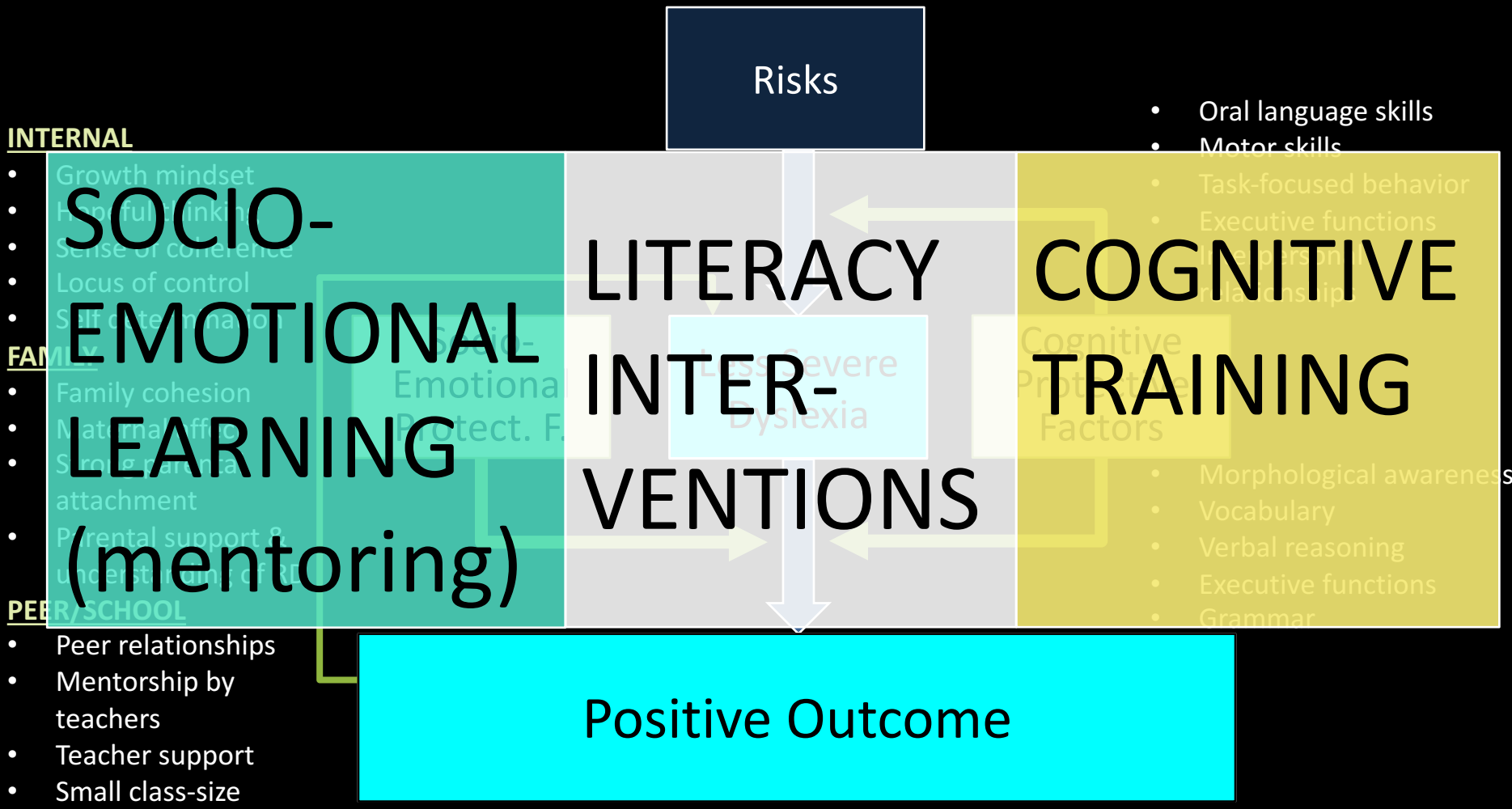
CONCLUSION: Promoting Resilience

Haft, Myers, Hoeft. Curr Opin Beh Sci 2016



CONCLUSION: Promoting Resilience

- Cognitive control, self-regulation – Cognitive reappraisal & positive reframing, Promotes grit
- Strength based approach – Confidence, Optimism
- Growth mindset – Active coping (sense of control), Optimism
- Social support, role model, mentoring – Connection to community
- Reduce stereotype threat – Optimize learning environment & enhanced performance
- Stress innoculation (exposure to tolerable levels of stress & challenges)

Charney. Nat Rev Neurosci 2009; Ken Ginsberg http://www.fosteringresilience.com/7cs.php

UCSF Dyslexia Center | UCSF brainLENS HOEFT Laboratory for Educational NeuroScience
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Dennis & Shannon Wong – DSEA '88 Foundation
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OAK FOUNDATION
Dyslexia Center (Charles Schwab, Kelly Gorman & Steve Carnevale, Flora Family Fndtn, Battery Powered, Thomas & Eva Fong Family Fndtn, Lori & Ray dePole, Dan & Stacey Case Family Fndtn)

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NIMH National Institute of Mental Health

NICHD National Institute of Child Health & Human Development

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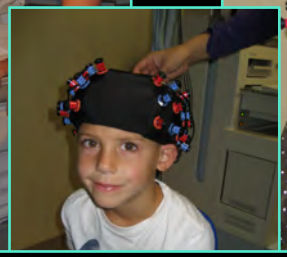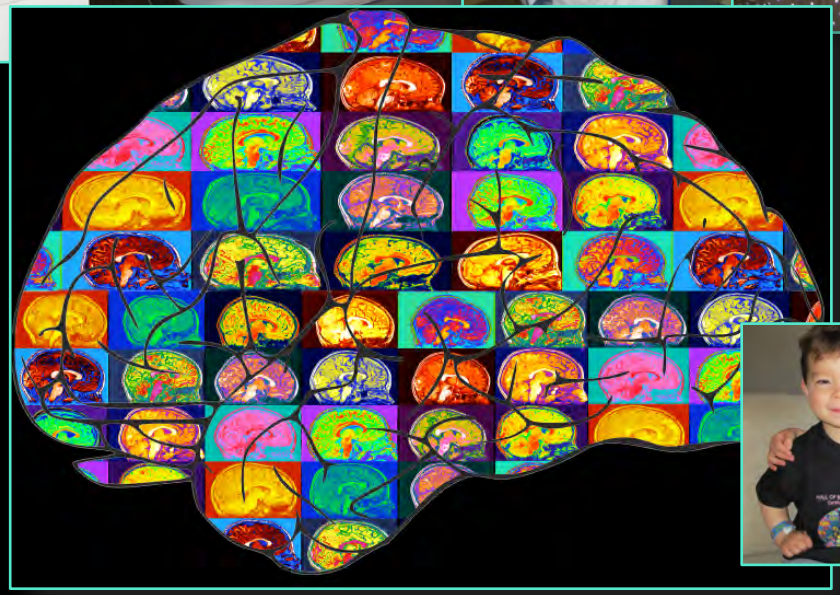
Thank you…