Cognitive & Socio-Emotional Resilience in Dyslexia

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

Jack Horner, a paleontologist from Jurassic Park/World

NOW
Technical Advisor of Jurassic Park (= Dr. Alan Grant)
MacArthur Genius Award (’86)
Romer-Simpson Medal (’13)

THEN
Severely dyslexic
Graduated high school with D---
Failed college 7 times
Never graduated
GPA 0.06
(Honorary doctorate, ’06)

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)

Outline

• BACKGROUND
  – Dyslexia costly in many dimensions
  – Importance of an integrative approach

• TODAY'S FOCUS
  – The resilience framework of dyslexia
  – Cognitive resilience
  – Socio-Emotional resilience

• CONCLUSION, OTHER WORK (e.g. English Learners)
Neuroscience of Dyslexia

- Regions & circuits dysfunctional in dyslexia (function, structure, temporal dynamics, neurochemistry, relation with risk genes, etc)
  - Even when compared to reading-matched “normal” readers: Xia et al. (Neuropsychology 10), Reading 125
  - Regardless of writing system (Chinese): Xia et al. (Neuropsychologia 22), Reading 125
  - At-risk pre-readers (with family history): Black et al. (Neuropsychologia 22), Reading 125
  - Regardless of identification criteria: Tanelia et al. (Psychol Sci) '12
  - In “normal” readers with high IQ (gifted Dyslexics, 2e kids): Remond et al. (NC 27)

Cost of Dyslexia

- Poor Outcome: Reading Comprehension, Educational Attainment, Psychosocial Adjustment

- Developing dyslexia: up to 50% with family history, 4 times higher
- Cost to individual: >£100k less earning ($150k)
- Cost to (UK) society: >£1bn/year ($1.5bn)
- High School drop out: 2.5x
- Prison population: 32-46% (note low IQ and not SLD!)
- Anxiety disorder: 2.0x (5.0x severe test anxiety)
- Depression: 2.0x
- Substance abuse: 2.7x
- ADHD: 4.5x

Cost of Dyslexia is High

- Matthew Effect in Reading

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Latest Thinking on the Factors that Contribute to Dyslexia: Multiple Factors Impact Dyslexia

Cumulative Risk & Protection Model of Dyslexia

Multiple deficit model: Pennington, Cognition 106, Pennington et al., Abnorm Psychol ’12
Stress model: Resnick ed., “The German Quadruplets” ’84
Liability threshold model: Gottesman & Shields, PNAS ’87

TODAY’S TOPIC: Cognitive and Socio-Emotional Resilience in Dyslexia

Weaknesses vs. Relative strengths

Risk vs. Protective factors

Vulnerability vs. Resilience

Resilience

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

Background | Resilience Framework | Cognitive Resilience | Socio-Emotional Resilience | Conclusion

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

Resilience Framework of Dyslexia: Promoting Resilience & Optimizing Dyslexia Outcome

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The Neuroscience of Dyslexia

**Traditional View**

Focus on Weaknesses, Risks & Vulnerability

**Relative Weaknesses**

- Phonological processing
- (Visual/selective) attention
- Cognitive implicit procedural learning
- Short-term memory
- Information processing

**Background**

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- Cognitive Resilience
- Socio-Emotional Resilience
- Conclusion

**The Neuroscience of 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

**Emerging View**

Focus Also on Strengths, Protective Factors & Resilience

**Relative Strengths**

- Grit, Resilience, Mindset, Empathy
- Phonological processing
- (Visual/selective) attention
- Cognitive implicit procedural learning
- Short-term memory
- Information processing

**Protective Factors & Resilience**

- Which brain systems???
- What mechanism??
- Coincidence. Bryden MP. Laterality '87
- Compensatory. Lansdell MJ, Conger Potts Biological '89; Levy J, Nature '69
- Causal. Kosslyn SM, Psychol Rev '87; Cai et al., PNAS '13
- Evolutionary advantage. Geschwind N. Annals of Dyslexia '84

**Background**

- Resilience Framework
- Cognitive Resilience
- Socio-Emotional Resilience
- Conclusion

**Outline**

- **Background**
  - Dyslexia costly in many dimensions
  - Importance of an integrative approach
    (Geschwind Lecture 2014)

- **Today's Focus**
  - The resilience framework of dyslexia
    - Cognitive resilience
    - Socio-Emotional resilience

- **Conclusion, Other Work** (e.g., English Learners)
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 DYSGE MIA (Stanovich, 1980)

Implications for intervention.
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.

Cognitive resilience
- Prefrontal & fronto-parietal network
- Cognitive flexibility, learning network
- Related studies also point to prefrontal mechanisms
- May suggest importance of promoting activities to enhance cognitive flexibility & self-regulation early

Background |
Resilience Framework |
Cognitive Resilience |
Socio-Emotional Resilience |
Conclusion |

COGNITIVE RESILIENCE: Summary
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- Related studies also point to prefrontal mechanisms
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Resilience Model of LD:
SOCIO-EMOTIONAL RESILIENCE

SOCIO-EMOTIONAL RESILIENCE
Character traits critical for success
Grit (self discipline), more predictive than IQ (2x) & above and beyond achievement itself (Duckworth & Seligman, Psychol Sci ’05)

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Brain mechanisms of Grit vs. Growth Mindset
Multiple targets – Multiple routes to enhance learning

SOCIO-EMOTIONAL RESILIENCE

SOCIO-EMOTIONAL RESILIENCE

Background |
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Cognitive Resilience |
Socio-Emotional Resilience |
Conclusion |
“Stereotype threat is being at risk of confirming, as self-characteristic, a negative stereotype about one’s group.” – Steele and Aronson (1995)

Stereotype threat puts individuals at risk for learning. Why might individuals with learning disabilities (including dyslexics, but also ADHD etc) experience stereotype threat?

- Group identification - low achievement
- Aware of stereotype (Kelly and Aronson, 2004; Rashkind et al., 2006)
- Negative academic self-concept (Winer, 2000)
- 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)

Discordance leads to stereotype threat. Reduced attention. Stress & Anxiety. Fear & Threat. Reduced learning & memory, & performance. Everyone is prone.

Brain mechanism of stereotype threat?

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

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)
SOCIO-EMOTIONAL RESILIENCE
Strength-based approach may build resilience

Visuo-spatial processing show yin-yang relationship with reading

BEHAVIOR

BRAIN

• Reading vs. visuo-spatial

n=0.42

r < 0.05

dyslexics vs. non-dyslexics

Ken Pugh, von Kiedrowski et al., 2012; 2013; Dietf.; Manf.; Pugh - NeuroImage '14

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...

N=48

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

SOCIO-EMOTIONAL RESILIENCE:
Positive Impact on Learning-Related Brain Regions

Mentoring may build resilience

Self

Self
criticism

Self

Control

Mindset

Emotional

Response to

Stress

Error

Monitoring

Hypothalamus, Pituitary Gland

Amygdala, Hippocampus

Social Support

Positive Emotions

Coping

Depression

Self Esteem

Score

Score

Fall

Spring

SOCIO-EMOTIONAL RESILIENCE: Summary

- Socio-emotional character traits impact learning related brain mechanisms.
- Large individual differences. Understanding these differences are important (Learner Positional System [LPS]). Opportunity for personalized learning.
- Stereotype threat may exist that impede on learning but can be minimized in the classroom.
- Potential for taking a strength-based approach.
- Mentoring potentially builds resilience.

SOCIO-EMOTIONAL RESILIENCE:
Conclusion, Other Work (e.g. English Learners)

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CONCLUSION, OTHER WORK (e.g. English Learners)
CONCLUSION: Promoting Resilience

Haft, Myers, Hoeft.Curr Opin Beh Sci 2016

CONCLUSION: Promoting Resilience

Haft, Myers, Hoeft. Curr Opin Beh Sci 2016

CONCLUSION: Building Resilience

- Scaffold for positive reframing > Cognitive reappraisal, Sense of control, Cognitive control & self-regulation > Growth mindset, Motivation, Grit
- Strength based approach > Confidence, Optimism, Motivation
- Social support, role model, mentoring > Connection to community
- Reduce stereotype threat > Optimize learning environment & enhanced performance
- Stress inoculation (exposure to tolerable levels of stress & challenges)

CONCLUSION: Building Resilience

Can we help our children become more resilient?

Yes you can!
**WHO WE ARE** A new and cross-disciplinary ‘Precision Ed-Health’ center across the (6) UC campuses with expertise in (bilingual) education, sp-ed, cog psych, neuroscience, medicine, & policy.

**Mission and Goals**

**MISSION.** Tackle issues associated with education and health disparity with a particular emphasis on underrepresented populations.

**LONG-TERM GOAL.** To provide the best educational and health outcomes for ALL CHILDREN regardless of their background.

**SHORT TERM GOAL.** Early identification and intervention of children at risk for learning challenges, especially in English learners.

**Background | Resilience Framework | Cognitive Resilience | Socio-Emotional Resilience | Conclusion**

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**School Readiness & Personalized Learning App. Modules**

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**Star Model @ Silc**

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**Background: Education & Health Disparity in English Learners (ELs)**

- **Proportion of ELs in Public Schools**
  - US (1 in 10) vs CA (1 in 4)
  - Proportions are higher in the US vs CA.

- **Distribution of ELs within the US**
  - 1 in 3 in CA vs 2 in 3 in Other States

- **Native Languages**
  - Approx. 400 spoken in the US
  - English, Spanish, Other ELs

- **VICIOUS CYCLE OF INEQUALITY**
  - Poor Health → Poor Educational Attainment → Difficult to Predict Learning Challenges → Low English Proficiency → Els are 200% more likely to live in poverty

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**Background | Resilience Framework | Cognitive Resilience | Socio-Emotional Resilience | Conclusion**
Translational Research Program

1. IDENTIFY BEST WAY TO PREDICT FUTURE LEARNING CHALLENGES EARLY AND ACCURATELY [Learner Positional System (LPS)]

2. INDIVIDUALIZE INSTRUCTION/INTERVENTION: Computerized training programs, e.g., mA2i, GraphoGame

3. EVALUATE HEALTH OUTCOME: Obesity, immune function, telomerase, etc.

4. EVALUATE IMPACT OF ENVIRONMENT: e.g., toxin

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[Image of team members]

Thank you…

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