Dyslexia: What is it and how to help?

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Understanding Minds

We understand all kinds of minds

The psychoanalytic view (please do not take this seriously!)

Dyslexia caused by intrapsychic conflicts

Reading problems attributed to identification with mother (oedipal conflict)

Mother represents "*auditory symbols*"

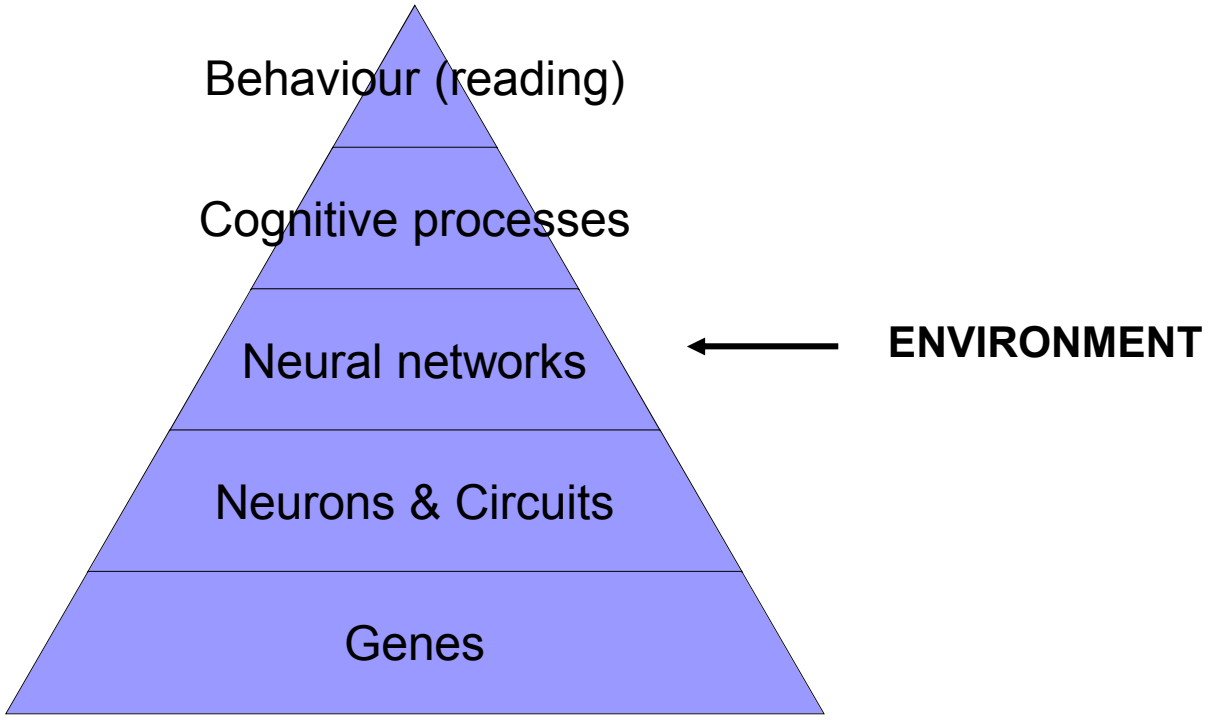
Father, with whom he is in competition, represents "*visual symbols*"

The dyslexic's primal scene fantasies (Mum & Dad 'together'), are disturbing and guilt producing.

Makes it impossible to imagine mother and father together.

Therefore dyslexics fail to synthesise information between auditory and visual modalities. [1]

A sophisticated view of reading



A simple model of reading

$$RC = WD \times (+)\ LC$$

RC = reading comprehension
WD = word-decoding
LC = linguistic (listening) comprehension

Dyslexia

- *Dys* = difficulty
- *Lexia* = words

Dyslexia = difficulty with words

(Yes, that's really all it means!)

- A formal definition of dyslexia:

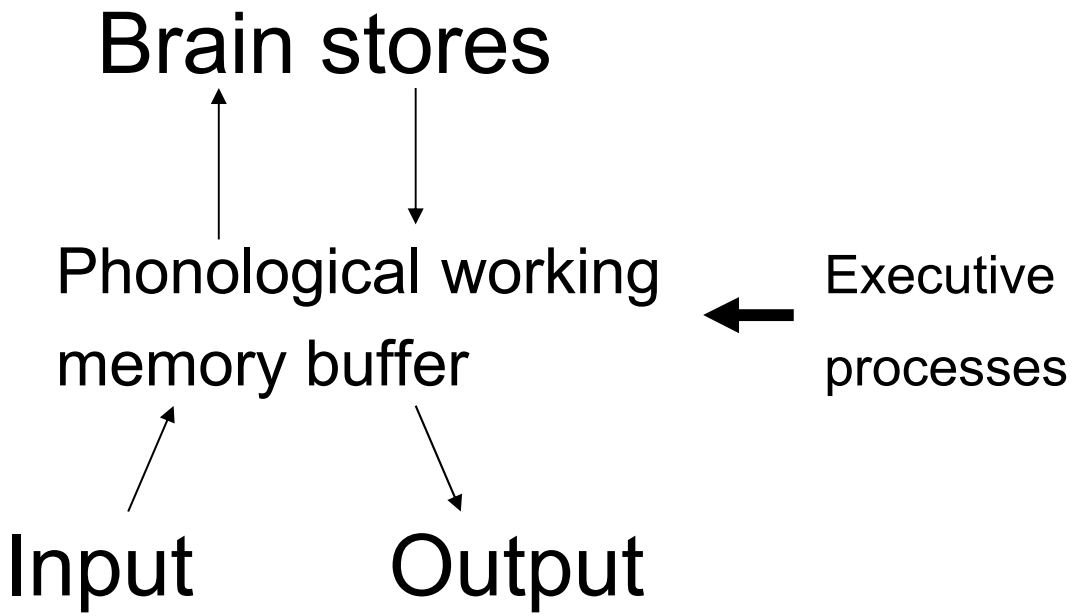
"A specific learning disability that is neurobiological in origin. It is characterised by difficulties in accurate and/or fluent word-level reading and is often accompanied by weaknesses in spelling and written expression. These difficulties are typically associated with core deficits in the phonological system.

As a secondary consequence of the word-level weakness, reading comprehension is usually affected and reduced reading volume impedes growth of vocabulary and other verbal/general knowledge over time.

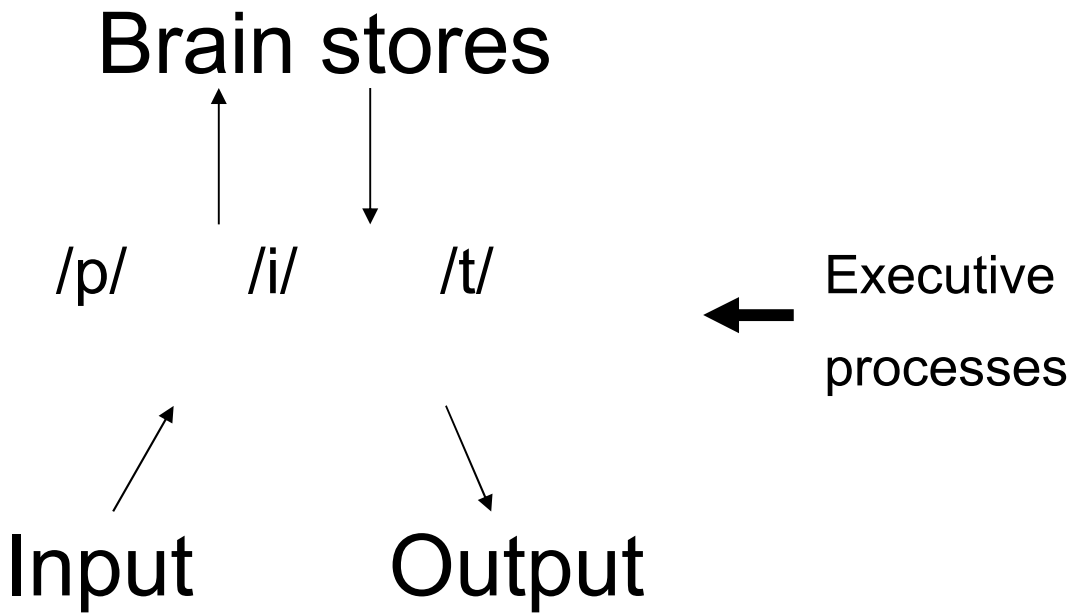
It is an anomaly of development because it occurs despite otherwise typical cognitive abilities and adequate instruction." [2,3]

Reading, or written language, is enabled by: the ability to accurately and fluently access speech sounds (phonological access); the ability to reflect explicitly on the sound structure of spoken words (phonological awareness), development of the alphabetic principle; and oral language skill [4-6].

Phonological access [17]

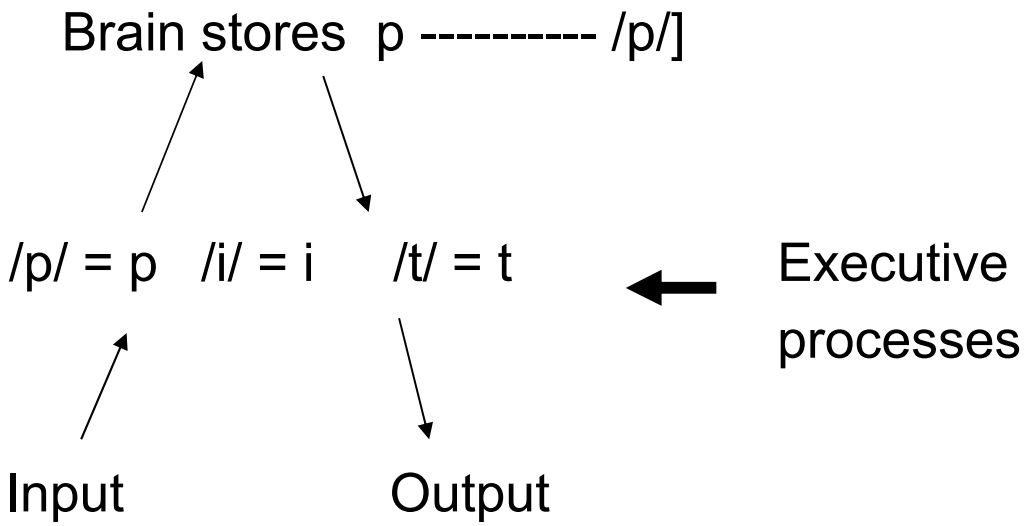


Phonological awareness [7]



Alphabetic principle

- The child's primary job in learning to read is to become aware of the alphabetic principle: that speech sounds in spoken words correspond to specific graphemes (letters/letter groups).



Phonological awareness & word-reading

s /s/ p /p/ t /t/ i /i/ a /a/

pit

sat

tap

sip

pat

The evidence for phonological deficits

- Dyslexic groups impaired regardless of type of phonological task [17].
- Phonological skill at pre-school predicts reading ability at age nine-ten [9].
- Phonological skill predicts reading in normal population during primary years [8-11].

Beyond phonology: Does anything else matter?

- Phonological access and awareness are one thing; but without exposure to written letters and letter-knowledge, the alphabetic principle cannot be grasped and reading cannot take place.

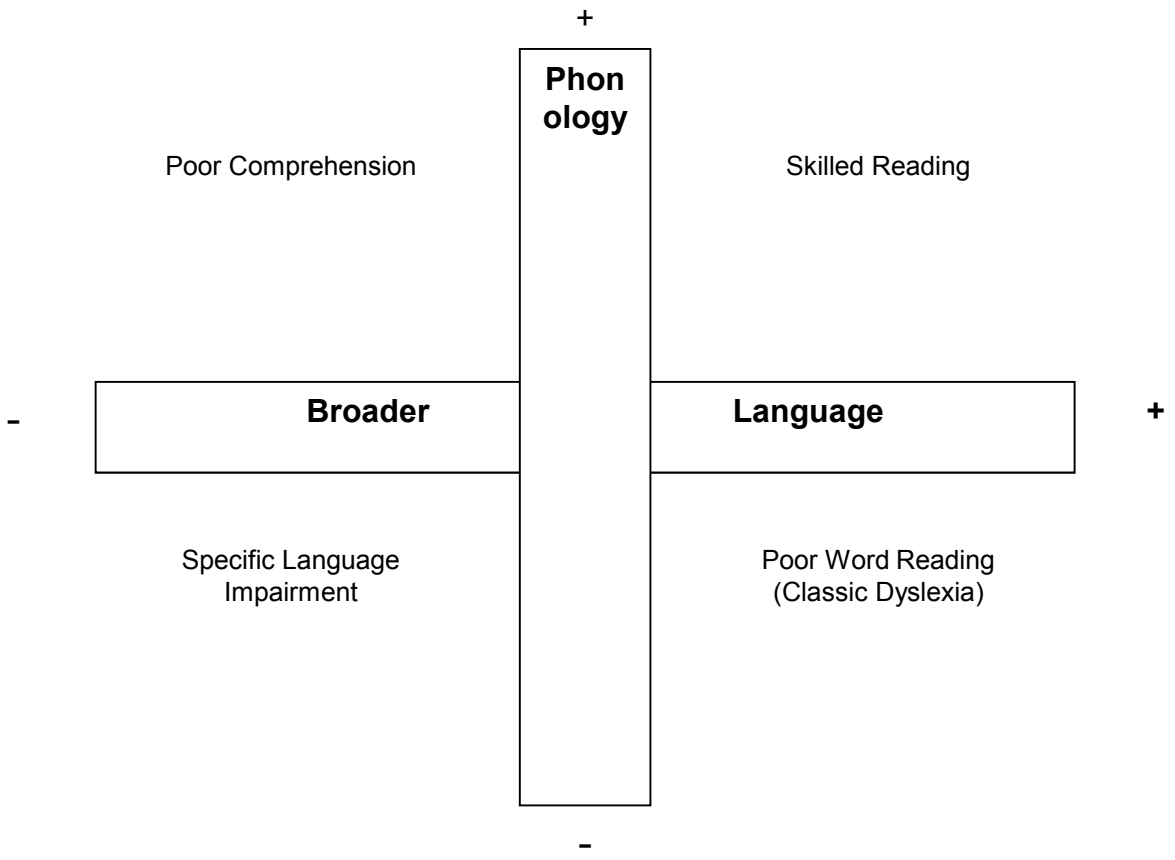
Beyond phonology: Does anything else matter?

- Remember that reading is not just about word-recognition.
- Broader language skill predicts reading comprehension [12,13].

- Double dissociation in early grades.
- Broader language skill becomes more important to word-reading as the child gets older [14].

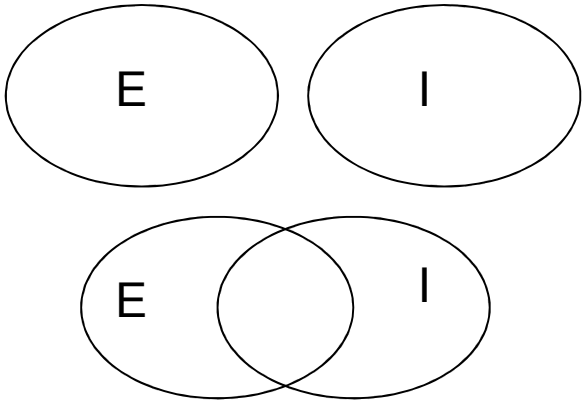
- Verbal / language skill can serve as an additional risk or protective factor.

The reading / language spectrum[15]

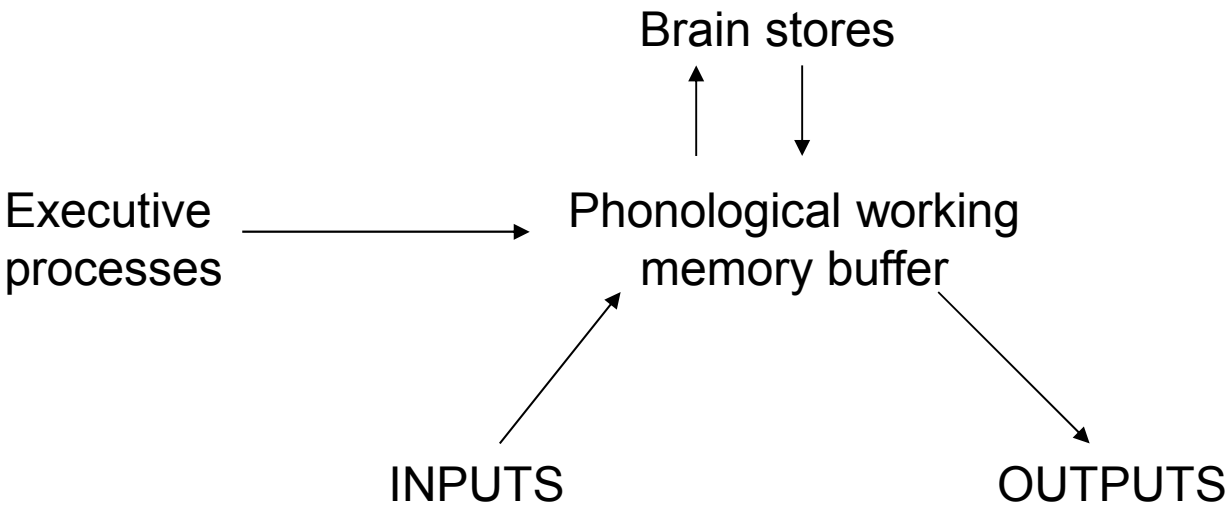


Cognitive processes

- The phonological representations hypothesis [16]



Phonological access



Visual domain

- Visual deficits: Samuel Orton [18]
- Vellutino: No differences on visual recognition of Hebrew letters [19].
- Reading-age vs. chronological-age matches.
- Copying/matching spatial designs BUT not universal or specific and no link to reading process [20].

Visual domain

- Transient or magnocellular deficits [21].
- Evidence for hypothesis is mixed [22, 23].
- Deficits occur in only 30% of dyslexics and some controls [23].
- May be due to the nature of the tasks rather than ‘visual processing’ [23, 24].
- May be a factor for some; but not clinically useful at present.

Visual domain

- Visual attention [25].
- Eye movements
- Differences in eye movements of dyslexics vs. controls (e.g. more regressions). However, poor reading creates differences. Ocular or visual processing problems do not cause the reading problem.
- Irlen-Meares Syndrome

- See [26].

Auditory domain: (central) auditory processing)

- Dozens of studies show *group* differences between dyslexics/SLI and controls on a range of speech and non-speech (auditory) tasks [23].
- Theory is that deficits in AP effect speech perception/phonology and therefore reading [27-29].
- Inconsistencies in data [22, 23, 65].

Auditory domain: (central) auditory processing)

- New evidence that dyslexics may be impaired across a broad range of 'auditory' tasks suggests problem may be with factors other than AP [23].
- Currently no plausible link between AP and reading/language and AP not highly correlated with reading/language after controlling for IQ [22,23].
- AP deficit neither necessary nor sufficient for dyslexia/SLI [22,23, 65].

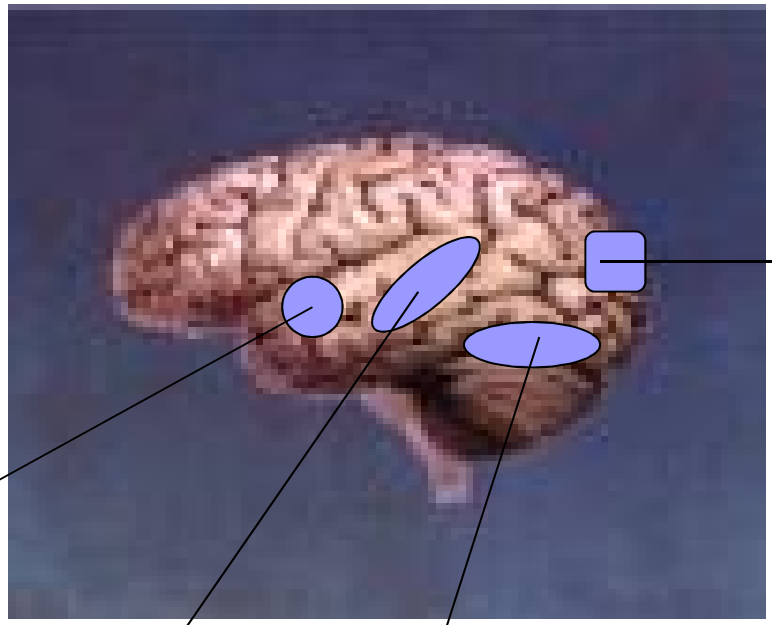
Auditory domain: (central) auditory processing)

- Clinically, most tests (e.g. SCAN-C) use speech stimuli & like research-based tasks are effected by cognitive factors such as attention & IQ.
- The (c)APD is most likely caused by the language or cognitive factors rather than the other way around.
- Cognitive training based on (c)APD sub-types or other AP deficits has not stood up to scientific investigation.

Motor deficits

- Some dyslexics children have motor/cerebellum ‘deficits’ [22].
- No causal link.
- No evidence that motor intervention improves reading or language.

Neurobiological factors 30, 31, 59



Angular gyrus
(relay station)

Broca's area
(articulation mapping)

Wernicke's area
(phonological/letter-sound processing)

Ventral occipital-temporal cortex
(word-form area)

Neurobiological factors e.g. 60,61

Genes & Environment

- 11 regions across the genome.
- Some genes may be specific to particular sub-skills **e.g. 53.**
- No single gene; nor do genes tend to be specialists [54].
- Overlap with other developmental disorders **e.g. 55**

Genes & Environment

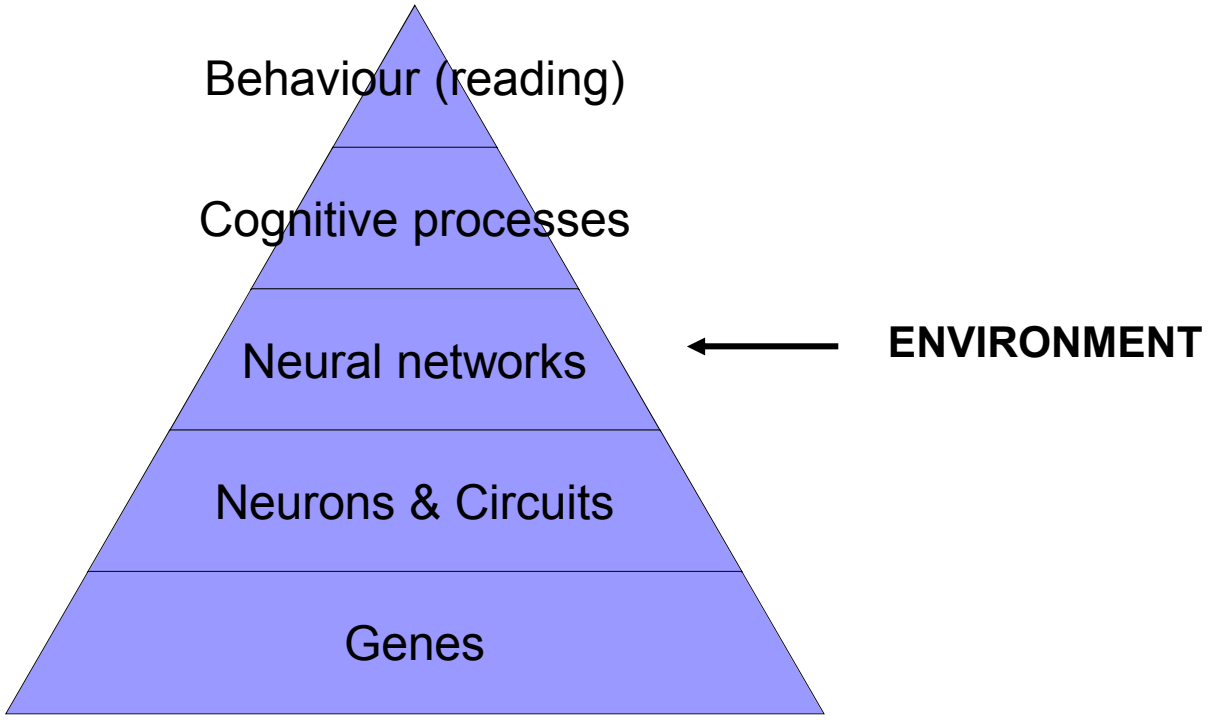
- Genes & environment seem to be important at young ages [56]. However, environmental effects diminish with age.

- i.e. Whatever negative effects there are of an early environment, these are all reversible with current school/life experience. By school-age and certainly adolescence much of the variation in ***word-reading ability*** is attributed to genetic factors (and presumably the interaction b/w genes & instruction) [e.g. 56-57.]

Genes & Environment

- Genetics research makes a mockery of these statements:
  - Reading to your kids is sufficient to evoke reading [51].
  - Never ever teach reading [52].
  - If we all read to our children we would wipe out illiteracy in a generation (Mem Fox).
- Maybe environment has a stronger effect on things such as vocabulary and comprehension?
- Not supported by the evidence.
- The pattern is the same as for word-reading. Family effects drop to zero at ~4-6 years. Genetic effects increase with age e.g. 58.

Summary


Behaviour (reading)
Cognitive processes
Neural networks
Neurons & Circuits
Genes
ENVIRONMENT

Developmental course

- *“For unto everyone that hath shall be given, and he shall have in abundance; but from him that hath not shall be taken away even that which he hath”* Matthew, XXV: 29)

Definition, identification, & assessment

- Definition of exclusion: attempt to exclude factors known to cause underachievement (sensory deficits, II, low SES, ESL, inadequate instruction).
- Discrepancy model: critical to LD/RD construct is the notion of *unexpected underachievement.*
- Historically, the primary approach has been to contrast academic achievement with a measure thought to measure ‘learning potential’ (i.e. IQ.)

Definition, identification, & assessment

- Intraindividual differences model.
- Assumption that identifying intraindividual differences in cognitive skills (e.g. visual learners) will lead to enhanced treatment outcomes.
- Training in cognitive skills without focus on content does ***not*** usually translate to enhanced academic achievement [62-64].

Definition, identification, & assessment

- Low achievement models
- Strong validity

- Response to intervention models.
- Low achievement in word-reading accuracy &/or fluency following intervention that is known to be effective for other children.

Definition, identification, & assessment

- Avoid ‘search for pathology’.
- Core assessment must focus on achievement in areas relating to parental/teacher/student concerns.
- Also assess skills related to the presenting problem that will effect response to intervention e.g. language.
- Focus on description of the problem; not on diagnosis.
- Focus on designing intervention; not on pathology.

- If an individual has poor word-reading &/or fluency & does not meet criteria for intellectual impairment they can usefully be called dyslexic.
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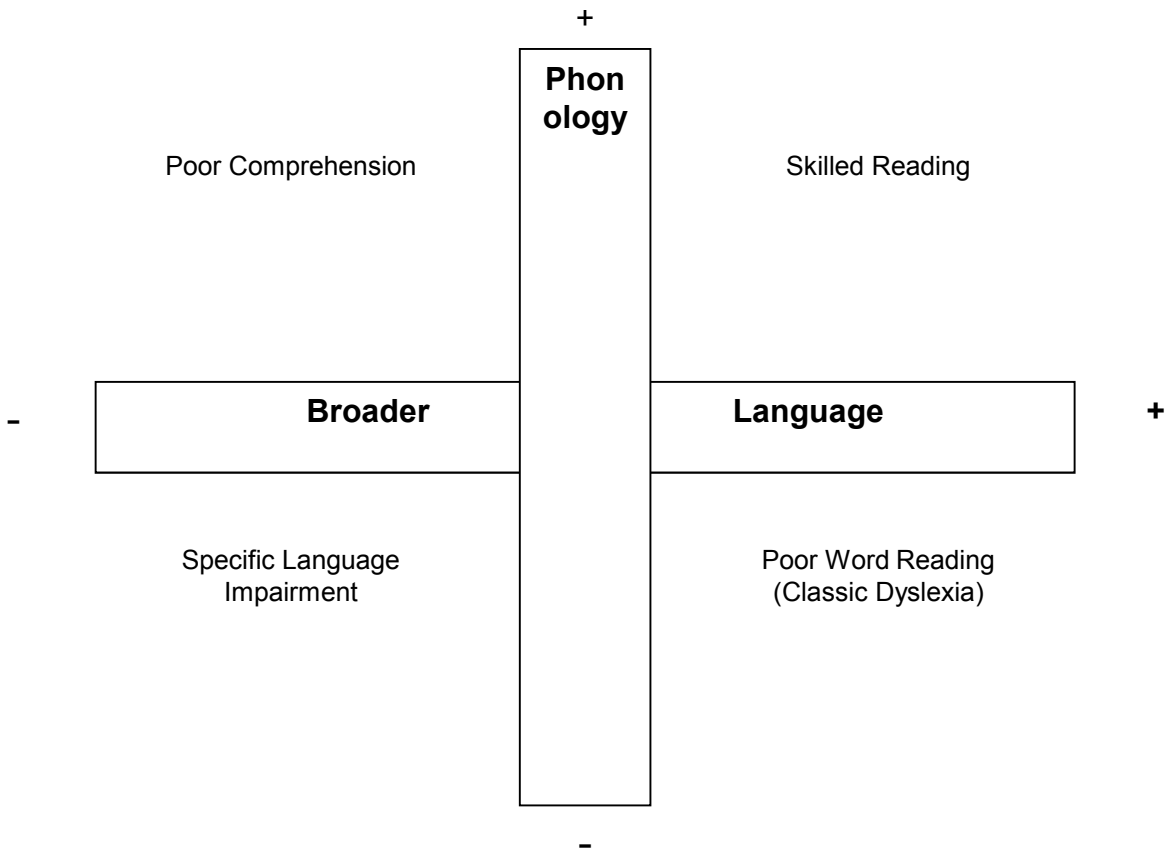
- Forget formal definitions and others involving IQ, inclusionary factors, exclusionary factors, and arbitrary criteria. If the student is a poor reader HELP THEM!

Dyslexia: the slippery fish evading diagnosis



Definition, identification, & assessment

- For clinical, not instructional purposes:
- Search for co-morbidity.
- Search for weaknesses relating to additional presenting concerns.
- Search for intact skills (strengths)
- Affinities and interests.
- Areas of expertise.

Treatment: Prevention and intervention

Evaluating a treatment

- Educational interventions should be subject to the same level of scrutiny and there should be the same requirement to prove the efficacy of educational interventions as there is for medical treatments. They are too important not to require this.
- So how do I evaluate a treatment?

Evaluating a treatment: Levels of evidence

- *Level 1.* Follows current theory and research. Treatment efficacy is supported by randomised control trials (RCTs).
- Example: Hatcher, Hulme & Ellis (1994).

- *Level 2.* Follows current theory and research but not supported by fully RCTs.
- Example: Wright (*in prep*).

Evaluating a treatment: Levels of evidence

- *Level 3.* Follows current theory and research. Supported by little or no empirical evidence.
- Example: THRASS.
- *Level 4.* Makes no conceptual sense in terms of current research and may claim empirical evidence for efficacy.
- Example: FastforWord, Cellfield, DORE, Reading Recovery.
- *Level 5.* Based on assumptions counter to substantial scientific evidence. Any data on efficacy should be viewed with considerable scepticism.
- Example: behavioural optometry.

Prevention

- Some controversy [e.g. 33], but phonological awareness instruction makes sense.
- Must be linked with teaching of letters and letter-sound correspondences [34]
- Effect sizes for phonological instruction
  - *d* = .38 (small)
- Effect sizes for letter-sound instruction & decoding
  - *d* = .67 (moderate) [35]

- General knowledge, life experiences, and exposure to written and oral language (without direct teaching) may *help* inoculate the child against word-reading deficits. However, in isolation there will be minimal effect.

Prevention: Reading Recovery (RR)

- Decoding and phonics taught ‘in context’ and stresses use of variety of cues.
- Studies of efficacy tend to be methodologically deficient and not subject to peer review [36].
- Outcomes often based on ‘taught skills’ rather than standardised reading measures [20].
- Typically ignores data from ‘early exiters’ [20].
- Gains for poorest readers often minimal [37].
- Outcome predicted by entry decoding and phonological skills.
- Gains greater when explicit alphabetic and decoding instruction added [34, 38, 39].
- Cost effectiveness; outcomes comparable for 1:2, 1:3 [37, 40, 41].
- Some argue for Level 1 rating. Others argue it meets criteria for a lower level of evidence.

Prevention

- Synthesis of methodological sound prevention studies that address the bottom 10-25% of (reading) students shows that early identification and intervention can reduce incidence of word-level reading disability to 2-6% [20].

Intervention

- Meta-analyses have shown that structured, explicit teaching of synthetic phonics coupled with meaningful reading works best *for this population* [46-48].
- Three national literacy enquiries [42, 49-50].
- The issue is not whether to provide phonics instruction, but how to integrate this instruction with other factors related to reading, including vocabulary, fluency, comprehension, background knowledge, reading volume and so on.

Intervention: Multi-sensory approaches

- Orton-Gillingham approach
- Lindamood
- Davis??
- (a) Phonological awareness, (b) sound-symbol association, (c) syllable instruction, (d) morphology, (e) syntax, (f) semantics.
- (1) simultaneous, multi-sensory teaching to all modalities, (2) systematic organisation of teaching material, (3) direct teaching, (4) diagnostic teaching with monitoring, (5) synthetic and analytic instruction.

- Despite popularity, the evidence for efficacy is mixed.
- Effects may be due to 2-5 rather than the ‘multisensory’ techniques 42-45.

Evaluating an intervention

- Targeted to the weakness.
- Intensive.
- Systematic, including ongoing assessment, monitoring, review and goal setting.
- Explicit teaching of alphabetic principle and synthetic phonics.
- Teaching of phonemic awareness (part. phoneme blending, segmentation, and manipulation) linked directly to letters.
- Explicit teaching in word identification strategies (with primary, but not sole, importance placed on decoding).
- Teach to mastery.
- Use of texts as vehicle to practice skills to mastery in real context.
- Attend to emotional aspects.

Running an effective intervention

- VIDEO here if possible.

Controversial/alternative '*treatments*'

- Motor/cerebellum activities
- Eye exercises (behavioural optometry)
- Irlen lenses or coloured overlays
- Cranial massage & manipulation
- Sensory processing training
- Computer programs.