ACQUISITION OF SPOKEN LANGUAGE

Children with Specific Language Impairment: Bridging the Genetic and Developmental Perspectives

Rice (2008)

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THE CONUNDRUM OF LANGUAGE LEARNABILITY

"In general, language acquisition is a stubbornly robust process; from what we can tell there is virtually no way to prevent it from happening short of raising a child in a barrel" (Pinker, 1984, p. 29)

Although less severe than total deprivation, environmental factors play a major role in language acquisition.

Exception:
Children with Specific Language Impairment (SLI)
- Grow up with natural environmental condition.
- Equal exposure to language as the normal children.

WHAT IS SLI?[1]

- Communication disorder that interferes with the development of language skills in children who have no hearing loss.
- Affects a child's speaking, listening, reading, and writing.
- Also called developmental language disorder, language delay, or developmental dysphasia.
- One of the common developmental disorder affecting approximately 7 to 10 percent of children in kindergarten.

SYMPTOMS OF SLI[1]

- Be late to form sentences using appropriate words.
- Trouble learning new words.
- Have difficulty following directions and instructions.
- Make grammatical mistakes frequently when speaking.

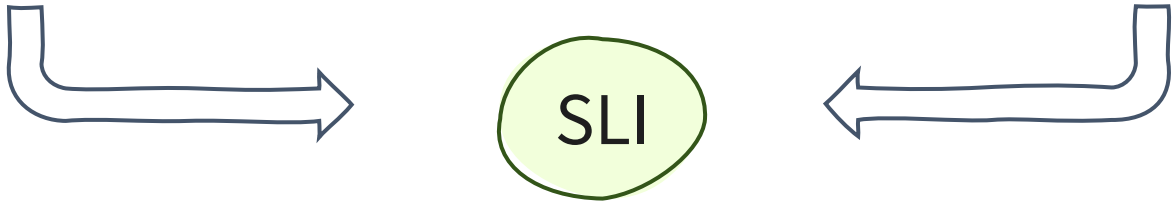
1 https://www.nidcd.nih.gov/sites/default/files/Documents/health/voice/specific-language-impairment.pdf

Inclusionary

- The children being considered meet a certain threshold of language impairment compared to their peers.
- Controlling for receptive versus expressive abilities (by means of pretests)

Exclusionary

- Excluding children whose impairments might be due to other developmental issues.
- Children with hearing loss, syndromes, mental retardation, neurological conditions are excluded.
- Often done via means of non-verbal IQ test



NOT SLI!

- X Williams Syndrome, Down Syndrome, fragile X syndrome
- X Autism
- X Dyspraxia
- X Aphasia
- X ADHD
- X Speech Sound Disorder

Observations:

1. More prevalent in the population than assumed.
2. Easy to confuse with other developmental deficits.
3. Often undiagnosed.

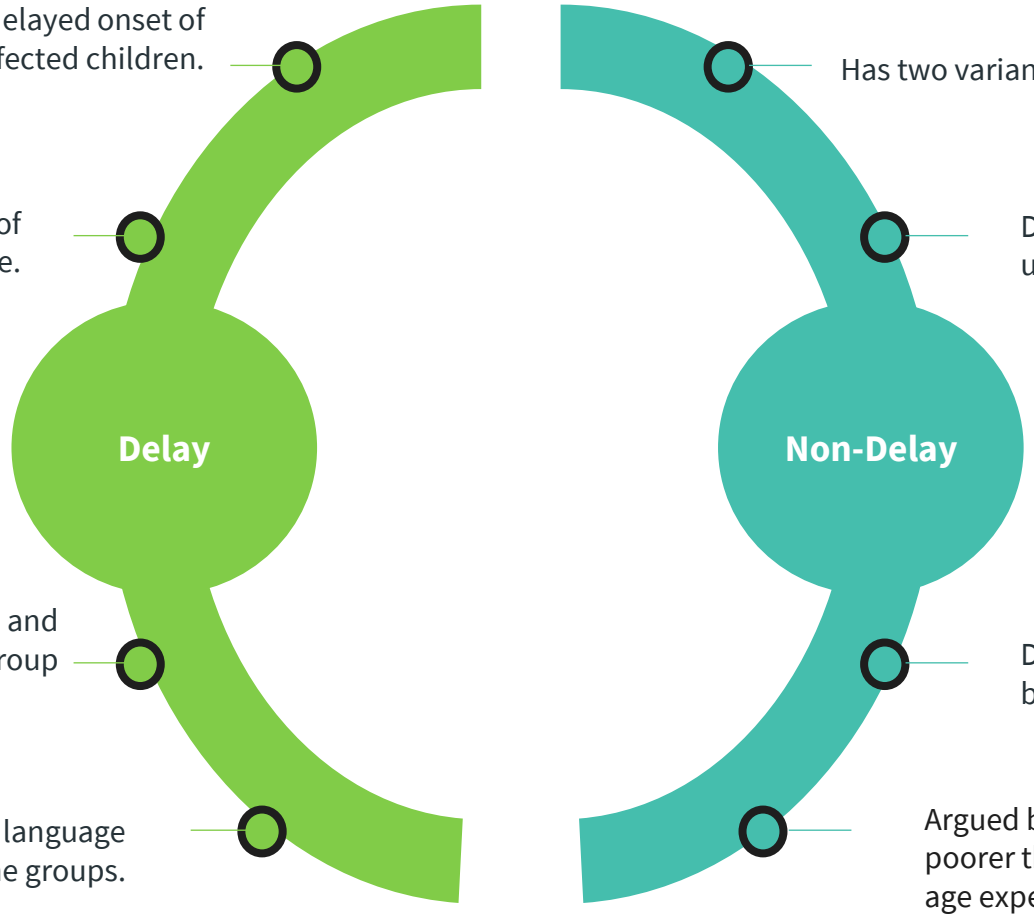
CLINICAL, GENETIC, AND DEVELOPMENTAL PERSPECTIVES

- Early observations revolving around the speech and language impairment surrounding the family hinting some genetic connections.
- Current research shows that genetic influences vary across various linguistic dimensions.
- Emphasis is on identifying and describing the behavioural phenotypes.
- Current methods relies on comparing the affected children with their age-level, unaffected children.
- Advantageous because:
  - Provides grounds for establishing the levels of sensitivity and selectivity.
  - Provides quantitative accounts to describe the acquisition trajectory and/or age of asymptote.

"They (behavioural phenotypes) can be defined as comprising behaviours – including cognitive processes and social interaction style – that are consistently associated with, and specific to, a syndrome that has a chromosomal or genetic aetiology."
Skuse, S. (2008) [1]

1 Skuse, S. (2008). Behavioural phenotypes. Psychiatry, 7, 308

LANGUAGE ACQUISTION MODELS FOR SLI



Assumes that children with SLI have delayed onset of language acquisition system than unaffected children.

Uses Mean Length of Utterance.

3 groups i.e., Affected, Age comparison and Language equivalent group

The outcome is used to analyze the language competencies of the groups.

Has two variants i.e., Deviant and Disruption

Deviant approaches for a different system in unaffected and affected children.

Disruption assumes that there is out-of-sync behavior between various language elements.

Argued based on the observation that SLI groups are poorer than expected for a general immaturity relative to age expectations.

LATE TALKERS AND SLI

- Late onset of speech usually implies language impairment.
- From the sample of 1766 children of 24-months old, whopping 13% (230) children met the definition of “late talker”. (Zubrick, Taylor, Rice, and Slegers).
- Parents were asked to report about the child’s vocabulary and first word combinations and a six-item scale to grade the general communication abilities.
- Other similar studies are also done but the criterion used to select the affected children is different. So, on estimate, children with late talking classified for SLI is in the range of 17-25% (cf. Paul, 1996; Rescorla, 2002)

SIGNIFICANT FACTORS

- ✓ Gender (Boys with more risk)
- ✓ Family history of speech and language delays (2.11x risk)
- ✓ No. of children (2x risk for family with 2+ children)
- ✓ Perinatal status (1.8x risk)
- ✓ Early Neuromotor skills (> 2x risk)

AND NOT!

- X Mother’s education
- X Family income
- X Socio-economic status
- X Parental Mental health
- X Parental style
- X Family functioning

LANGUAGE GROWTH TRAJECTORIES AND SLI

MLU STUDY

Participants: 21 five-year-old children with expressive/receptive SLI, 20 MLU equivalent children who were two years younger.

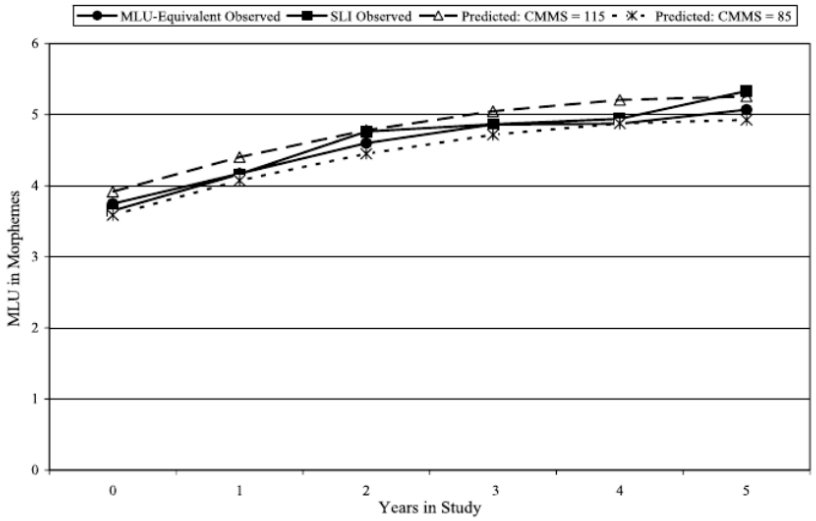
Method: Assessing the MLU at 6-month interval for a total of 9 data points over 5 years.

Observation:

- Equivalent levels of MLU at each time of measurement for both groups, ranging from ~3.7 to ~5.2 from the first to last time of measurement.
- Similar growth trajectories seen in growth curve modelling.
- Each group showed linear and quadratic growth, with negatively accelerating growth such that at the later times of measurement there was no steady increase in the MLU between different times of measurement.

Conclusion: There is strong implication of a delayed onset of the system of combining words into phrases and clauses for affected children.

Figure 2. Predicted and actual growth in MLU morphemes for SLI and MLU-equivalent groups by year in study (SLI: 5–9 years; MLU matches: 3–7 years).



Rice, Mabel & Redmond, Sean & Hoffman, Lesa. (2006). Mean Length of Utterance in Children With Specific Language Impairment and in Younger Control Children Shows Concurrent Validity and Stable and Parallel Growth Trajectories. Journal of speech, language, and hearing research : JSLHR. 49. 793-808. 10.1044/1092-4388(2006/056).

RECEPTIVE VOCABULARY GROWTH STUDY

Participants: Same as the previous experiment.

Method: Assessing the receptive vocabulary at 1-year interval for over 3 years using raw score obtained in Peabody Picture Vocabulary Test-Revised.

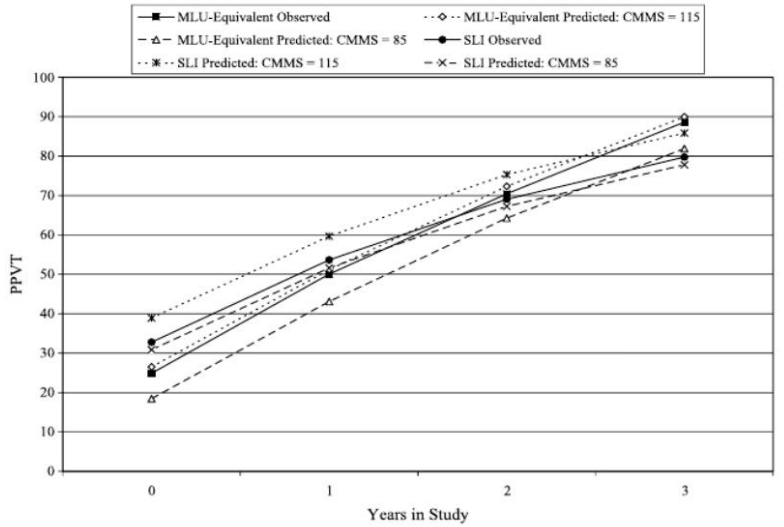
Observation:

- At the outset, the affected group had a small but statistically significant numerical advantage (M = 32 raw score vs. 25 for the MLU equivalent group).
- At the end, the MLU equivalent group had the small, statistical significance (M = 80 for the SLI group vs. 89 for the MLU equivalent group).
- The affected children benefited from the two years' age difference at the outset, but the MLU group caught up with them in intermediate years.

Conclusions:

- There is some "disruption" in the general growth of the affected group.
- Younger children in MLU group may be better in incidental learning which increased their receptive vocabulary levels.

Figure 3. Predicted and actual growth in PPVT–R raw scores for SLI and MLU-equivalent groups by year in study (SLI: 5-8 years; MLU matches: 3–6 years).



PPVT-R: Recorded Session

OTHER OBSERVATIONS

- MLU equivalent children, as a group, are somewhat better than affected children in using syntactic cues in their acquisition of new words (cf. Rice, Cleave, & Oetting, 2000), although they need frequency effect to store them in memory.
- Affected children use cues to interpret the meaning of verbs, but their ability to retain new verbs is comparatively less than the younger group.
- Some discrepancies in other researches regarding affected vs MLU group but this could be attributed to the different tasks and memory demands of these tasks.

CONSENSUS

- Longitudinal study of growth trajectories could help us uncover the differences between unaffected and SLI affected children.
- However, if MLU and receptive vocabulary is our scale of measure, then these differences may be subtle and hard to replicate .

FINITENESS MARKING, DISRUPTION IN LANGUAGE GROWTH AND SLI

- Tense, agreement, and case marking are tightly interrelated in the syntax of clause structure.
- Finiteness = Tense + Agreement
- Finiteness came to the attention of scholars with the observation that in many languages, children show an acquisition period in which they produce infinitival forms of verbs where finite forms are required in the adult grammar.
- Young children go through a period in which they seem to treat finiteness, marking as optional, although it is obligatory in the adult grammar; at the same time, they know many other properties of clausal construction
- "Extended Developmental Model" – Children with SLI have long delay in acquiring the verbal morphology because there is an extended period of grammatical development. Thus, unaffected and affected have similar language abilities but with the cost of extended period of incomplete acquisition of tense marking.

"Patsy runs home every day"
(Third person singular present tense –s)

"Patsy walked/ran home yesterday"
(Past tense -ed or irregular past tense)

"Patsy is happy" (Auxiliary BE)

*Runs Patsy home every day
*Patsy is runs home every day
*Does Patsy is happy?

“EXTENDED DEVELOPMENTAL MODEL” PREDICTIONS

- Computational requirements of finiteness marking is different from other syntactic and sematic properties and the extended developmental model allows for both delays and disruptions.
- Children's performance on surface morphemes will cluster based on the shared underlying function these morphemes have in adult grammar. Additionally, the relationship between morphemes can be used to calculate composite variables.
- Although weakness in the finiteness domain can be evident, at the same time other syntactic mechanisms can be unaffected. This translates to the expectation that affected children should be unlikely to make errors indicative of basic syntactic limitations.

VALIDATING THE PREDICTIONS

- The same participant set received the tasks for measuring the finiteness.
- Models of growth were the same for the two groups, indicating linear and quadratic components for both groups.
- The findings replicated for irregular past tense, when irregular accuracy was calculated as finiteness marking by regarding over-regularizations as finiteness marker.

VALIDATING THE PREDICTIONS (CONTD..)

- The replicated findings with judgment tasks establish that the effects are not restricted to production demands but also are evident in children's likelihood to accept utterances as well formed with the same kinds of omissions that they produce (Rice, Wexler, & Redmond, 1999).
- Children with SLI, as a group, are likely to perform less accurately than younger controls on morphemes associated with the finiteness marker. This corresponds with Prediction 1 and Prediction 2.

SIGNIFICANT FACTORS

✓ Initial MLU of the children

AND NOT!

X Mother's education
X Nonverbal intelligence
X PPVT-R score at the onset

⇓

Children with SLI, as a group, have delayed acquisition of finiteness marking and this could be a disruption rather than immaturity because their performance falls short even compared to their performance in MLU and PPVT-R. This part of the grammar is out-of-sync with other dimensions of language in the affected children.

VALIDATING THE PREDICTIONS (CONTD..)

- Children with SLI do not show very little to no problems with:
  - Morpheme usage that causes syntactic errors.
  - Subject-verb agreement.
  - Word order
  - Having just one finiteness marking within a main clause.
- Children with SLI produces grammatically correct sentences in that sentences like “she runs home” is much more likely than “*her runs home”. This shows association of pronoun case marking with finiteness marking.

⇒

Children with SLI, as a group, have language systems that are not impaired (but not necessarily robust).

SPECIFIC TO ENGLISH?

French-English Bilingual Children with SLI study uncovered:

- Grammatical impairments in both languages
- Problem with finiteness marking in both languages.
- There are no deficits attributable to the bilingualism; their performance was comparable to monolingual French- or English-speaking children with SLI

PHENOTYPES AND SLI

- Chromosomes 16q and 19q are attributed to SLI but findings are complicated due to too many variables and possible confounds.
- FOXP2 gene discovery on chromosome 7, first documented in a large extended family in English. However, as of today, there is no substantial evidence to conclude that it is directly involved in human language. Some researchers hold the opinion that it is not the "language gene" but a part of regulatory mechanism for the speech externalization. [1]
- Disrupted development in the finiteness-marking element of grammar is predicted to be related to underlying genetic factors.
- Bishop et al. (2005) found that phonological STM and the verb tense measures were poor with twins with SLI and that both are heritable. However, there was minimal phenotypic and etiological overlap between the two deficits, implying that different genes are involved with these two difficulties. [2]

"Our findings are also in agreement with predictions made by Rice and colleagues, in confirming that deficits in use of verb inflections commonly persist beyond the age of 4 years in children with language impairments and are heritable. Most crucially, this study reveals that impairments in use of verb inflections have distinctive genetic origins and cannot be explained away as secondary consequences of limitations of phonological short-term memory." **Bishop et al. (2005)**

1. Berwick RC, Chomsky N (2016). *Why Only Us?*. Cambridge, MA: The MIT Press. p. 76
2. Bishop DV, Adams CV, Norbury CF. Distinct genetic influences on grammar and phonological short-term memory deficits: evidence from 6-year-old twins. Genes Brain Behav. 2006 Mar;5(2):158-69. doi: 10.1111/j.1601-183X.2005.00148.x. PMID: 16507007.

WRAPPING IT UP…

- Genetics to address the SLI is all fancy, but it fails to:
  - Explain how both unaffected and affected children share similar linguistic systems.
  - Discover how inheritance can influence the growth trajectories.
  - Shed light on less synchronized linguistic system in SLI affected kids.
- Developmental (Maturational) perspective, however, can be a suitable alternative.
- Maturation framework can be stated as below:
  - Once the language onset is activated, in close interaction with the environmental input, the language subsystems synchronize.
  - However, the delayed onset can be attributed more towards the inherent weaknesses than the environmental input deficits.
  - The model also predicts that some lag can intrude into language subsystems.
- Maturational model can be beneficial in a way that delayed onset can be a symptom of a language impairment, which in turn could a result of some genetic malfunction.
- Observing the language-equivalent and the age-equivalent groups along with SLI group could also lead to uncovering any other kinds of language impairments that are not under the umbrella of SLI.