



Emergence of the Grammar from the Lexicon

Elizabeth Bates
Judith C. Goodman

By: Shruti Dube
Varun Sharma



Background: Approach to Child Language Acquisition

- n **Chomskian approach or the Nativist approach**
- n **Fodor's large and relatively undifferentiated language module**
- n **Emergentism or Constructivism**
 - e.g. Giraffe's Neck
 - Soap Bubbles.



Introduction

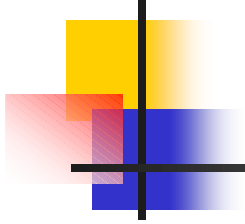
- n **A variant of the Emergentist approach.**
- n **Union between the grammar and the lexicon.**
- n **Incompatible with both Fodorian and Chomskian accounts.**

Acquisition and neural representation of grammar are accomplished by domain general mechanism that transcends the boundaries of language proper.



The Three Major Issues

- n Recent evidence between lexical development and the emergence of grammar in normally developing children between 8 and 30 months of age.**
- n Comparing results for a normal children with studies of early language development in several atypical population – late, early talkers, focal brain injury, Williams Syndrome, etc.**



- n Critical review of evidence for and against the idea of separate neural systems for the grammar and the lexicon in the brain.**



Grammar and the Lexicon in normally developing children

- n **Successive maturation of separate modules for phonology, lexicon and grammar.**
- n **Kinds of studies done**
 1. Longitudinal Studies
 2. Cross Sectional Studies



Graph: Word Comprehension, Word Production and Grammar

- n **Study of 27 children**
- n **Observed during 8-30 months of age**
- n **Comprehension and production estimates are based on a checklist of words**
- n **37 item scale for sentence complexity**

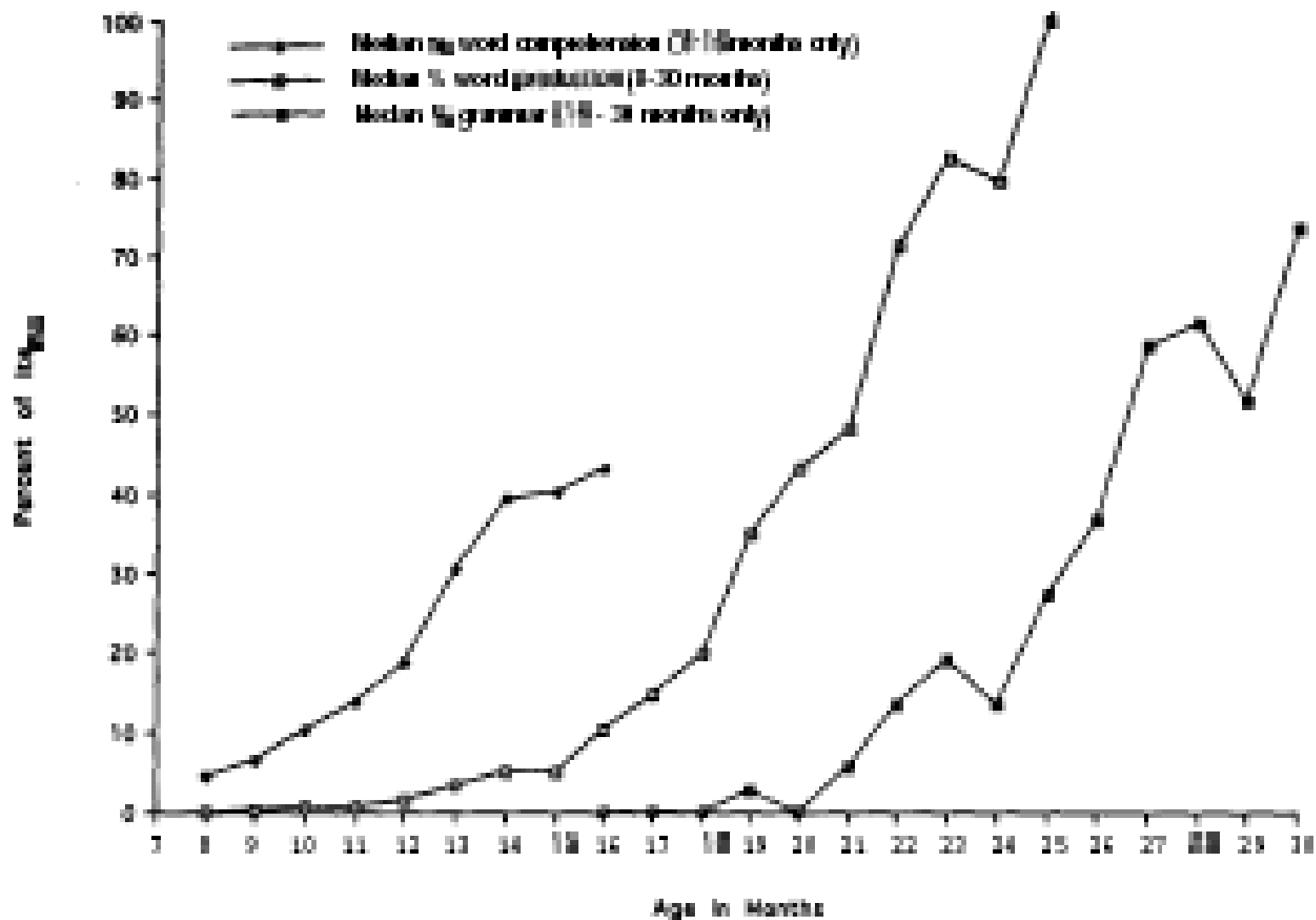
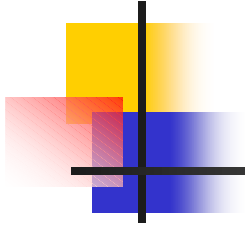


FIG. 24. Median growth scores for word comprehension, production, and grammar expressed as a percentage of available items.



The Real Question

- n How tight are the correlations between lexical and grammatical development an the 2nd and 3rd year of life?**
- n Are these components dissociable? If yes, to what extent?**
- n How much of the lexical matter is needed to build a grammatical system?**



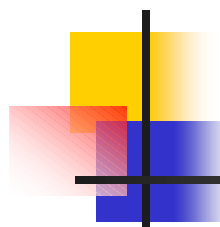
- n We shall see that there is a constant and lawful interchange between the lexical and grammatical development**
- n The function that governs the above reaches Fechner's Law in elegance and power**



Longitudinal Studies

n Assumptions:

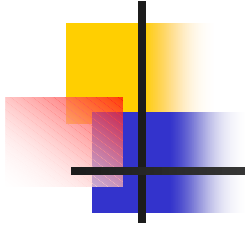
1. Study of 27 children observed at 10,13,20 and 28 months of age
2. Vocabulary size was assessed with a combination of video observation and parental report
3. Grammatical development was assessed by calculating mean length of utterance (MLU)



Relations Between Vocabulary Size and Mean Length of Utterance in Morphemes From 20 to 28 Months

	20-Month Vocabulary	20-Month MLU ^a	28-Month vocabulary	28-Month MLU ^a
20-month Vocabulary	—			
20-month MLU ^a	+ .54 ^{***}	—		
28-month Vocabulary	+ .64 ^{***}	+ .47 [*]	—	
28-month MLU ^a	+ .83 ^{***}	+ .48 [*]	+ .73 ^{***}	—

^aMean length of utterance in morphemes.



n Results:

The single best estimate of grammatical status at 28 months is the total vocabulary size at 20 months. The correlation coefficient is very high (near .70-.84). This implies that the two have something important in common.



Cross-Sectional Study : CDI

- n **The MacArthur Communicative Development Inventory (CDI) is used to study the relation between lexical and grammatical development**
- n **Assumptions:**
 1. Sample size = 1800
 2. Checklist format to assess word comprehension(8-16) and word production(8-30)
 3. Checklist contains 680 words for vocabulary
 4. Checklist has 37 pairs of sentences.
 5. Parents had to indicate which of the sentences was more like what their child spoke

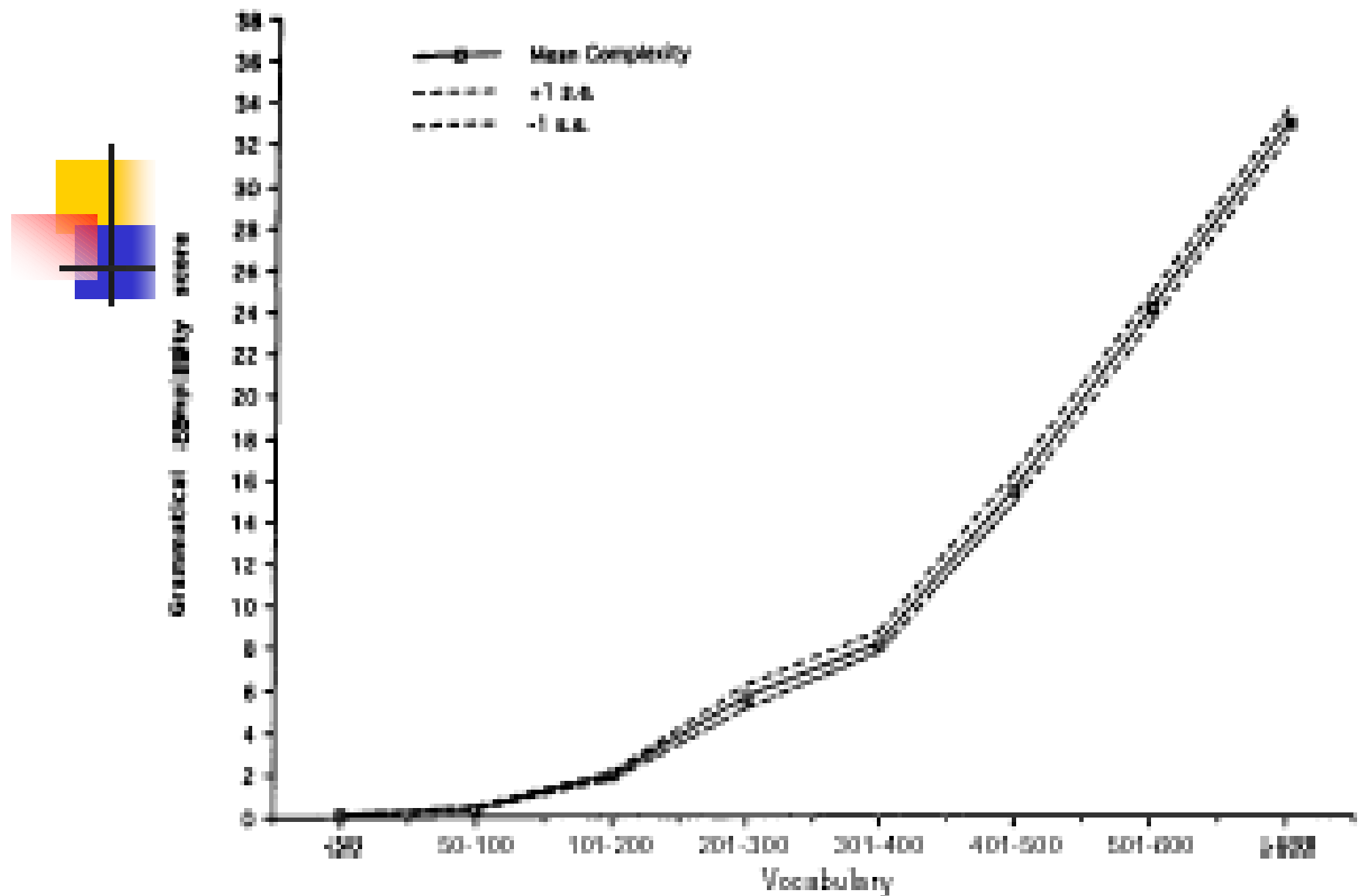


FIG. 2.5. Mean and standard errors for grammatical complexity in children at different vocabulary levels. From Bates and Goodman (1977).

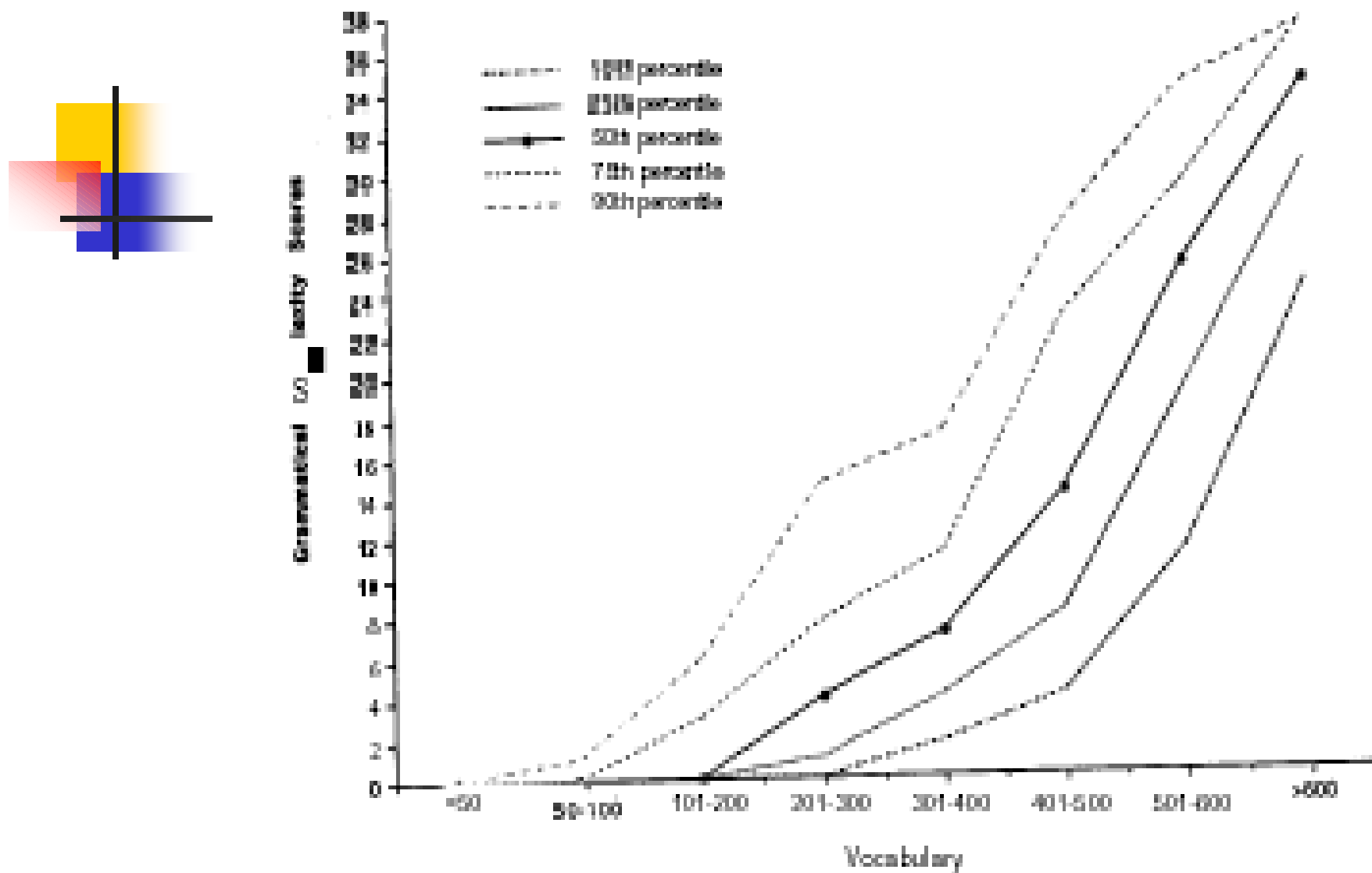
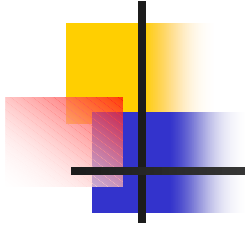
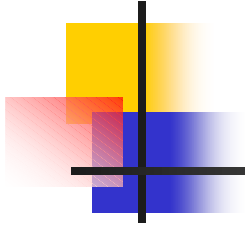


FIG. 2.6a. Relation between grammar and vocabulary size: variation within each vocabulary level.



n Observation:

1. Individual differences around the function is relatively small
2. The variance is consistent in magnitude at every point beyond 50-100 words



n Results:

A very high correlation was found again. The relation between grammatical complexity and vocabulary size in large cross sectional sample replicates and extends the powerful grammar-vocabulary relationship.

Graph: Expressive Vocabulary vs Receptive Vocabulary

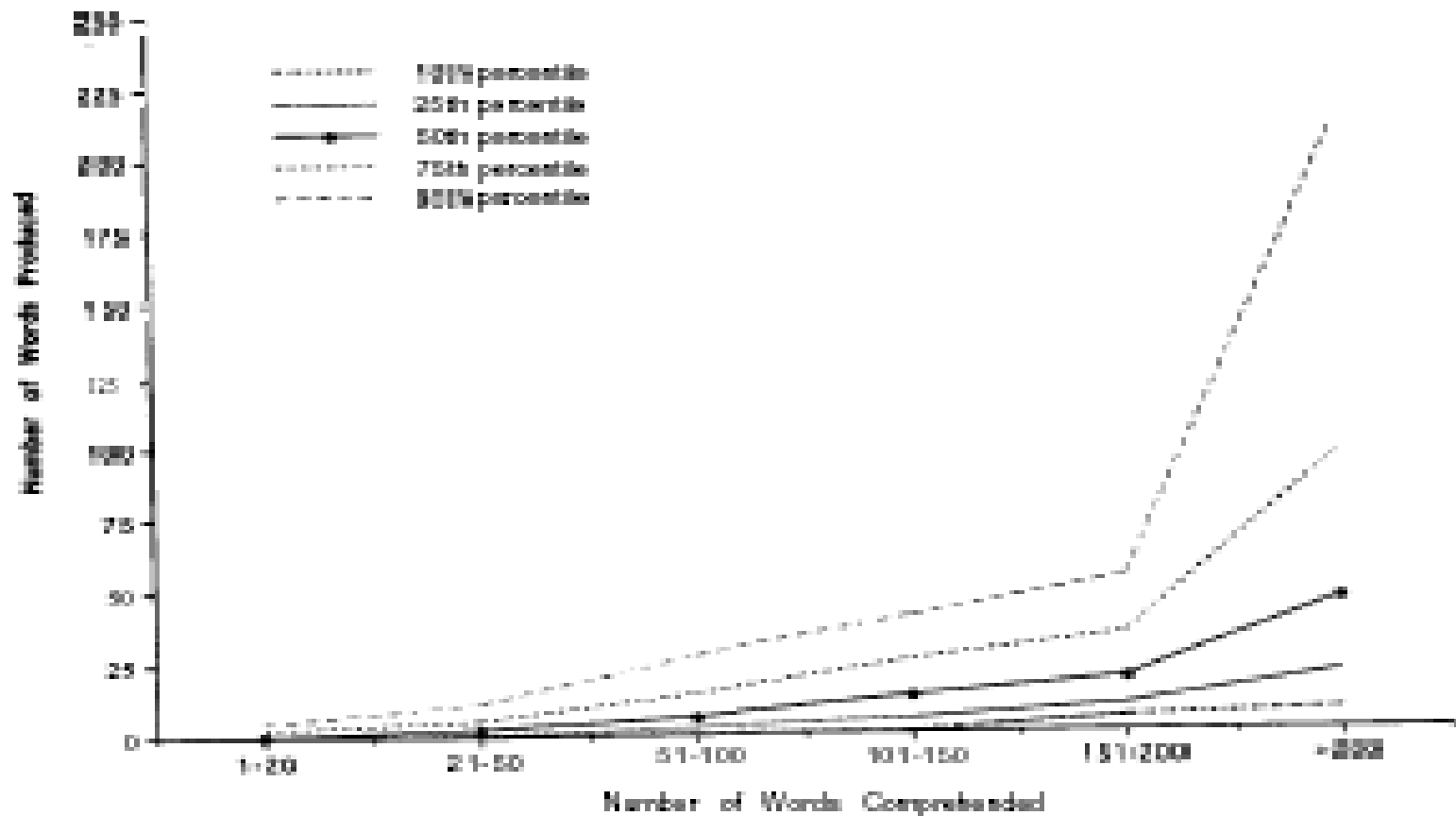
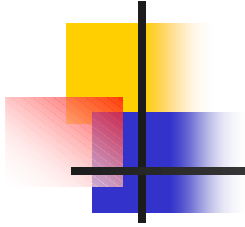


FIG. 2.6b. Variability in word production as a function of comprehension vocabulary size. From Fenson et al. (1994).

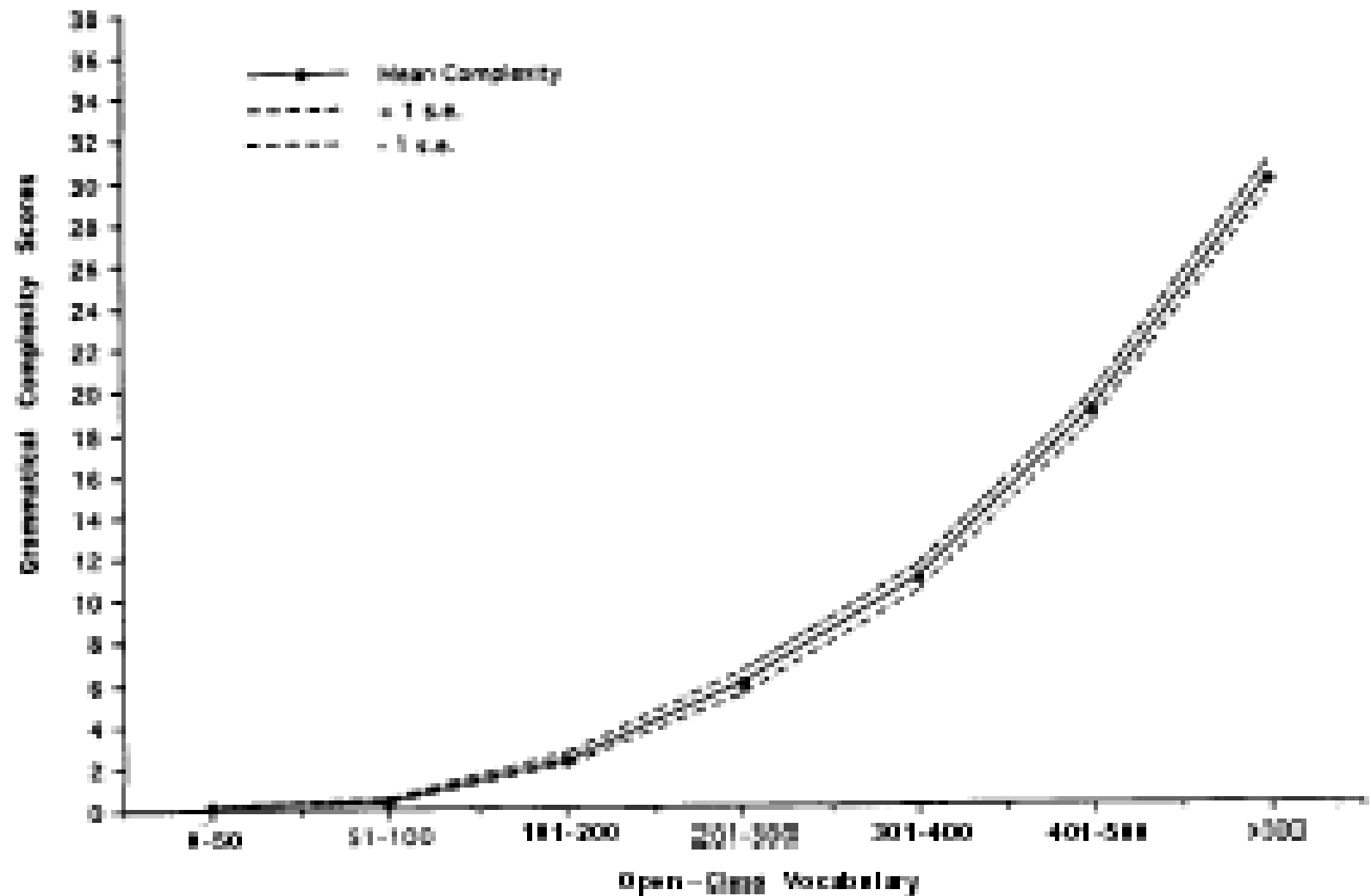


n Results:

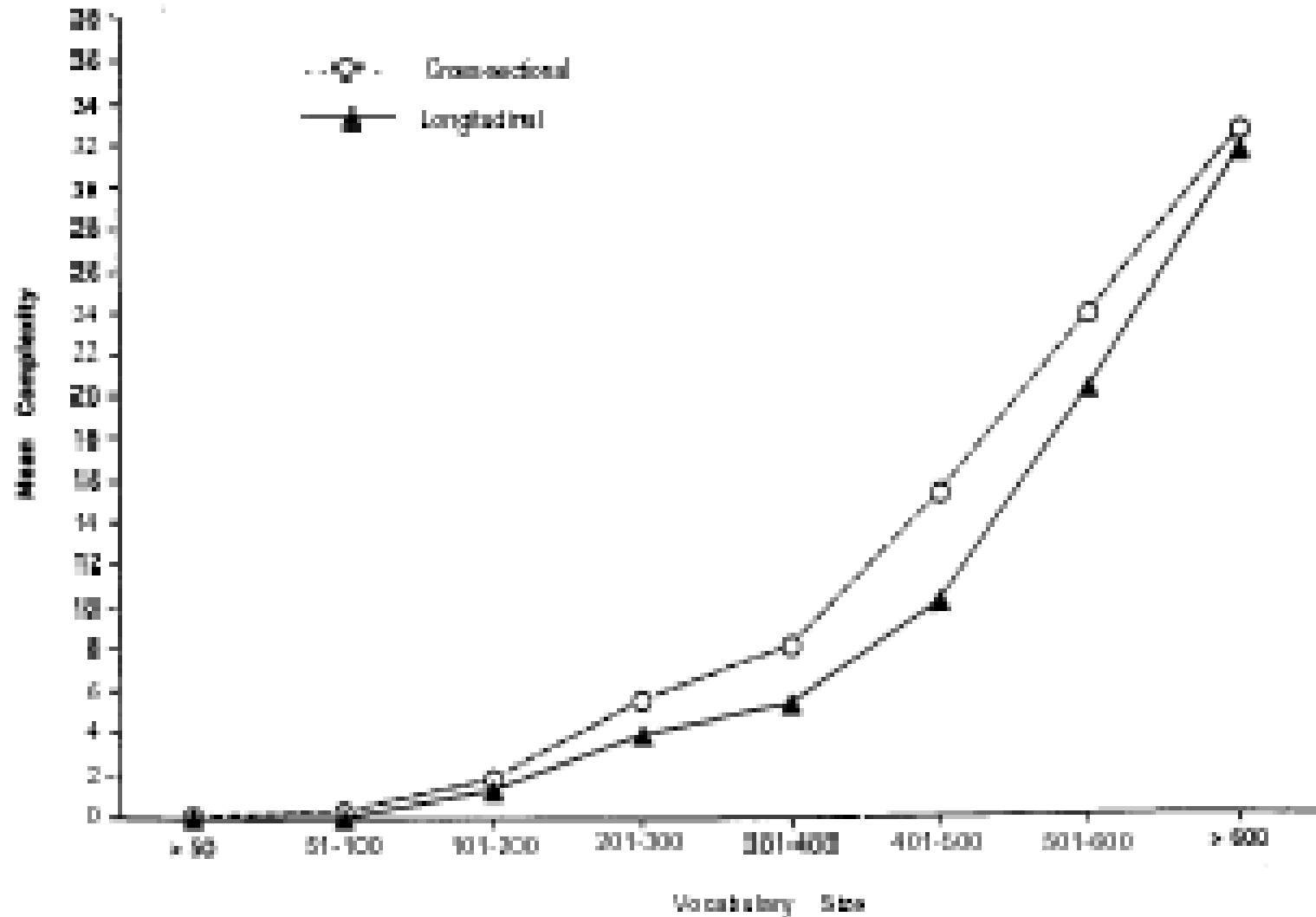
Children who produce virtually no meaningful speech despite receptive vocabulary of 200 words captures the well known CLA phenomenon

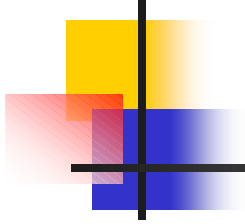
- Comprehension and production dissociate to a remarkable degree. A certain level of word comprehension is a pre-requisite for expressive language.

Most powerful graph: excludes tautology



Graph: compares the results of two modes of study





-
- n Another important extension: Casseli and Casadio developed MAC CDI for Italian.**
 - n It reiterates the observations made above**



Explaining the link

- n **Why is the relation between grammar and the lexicon so strong in this period of development?**
 - 1. Perceptual Bootstrapping**
 - 2. Logical Bootstrapping**
 - 3. Syntactic Bootstrapping**
 - 4. Non linear dynamics of learning in neural network**
 - 5. Lexically based grammar**



Grammatical Development and the Lexicon in Atypical Population

- n **Whether there are individual children or any specific pediatric population in which we can find a dissociation???**



Late and Early Talkers

- n **Late Talkers**
- n **Early Talkers**
- n **No case of dissociation has been observed at the far ends of continuum**
- n **Grammar-on-vocabulary for a very late talker and the other very early talker**

Graph showing the same non-linearity in Atypical learners

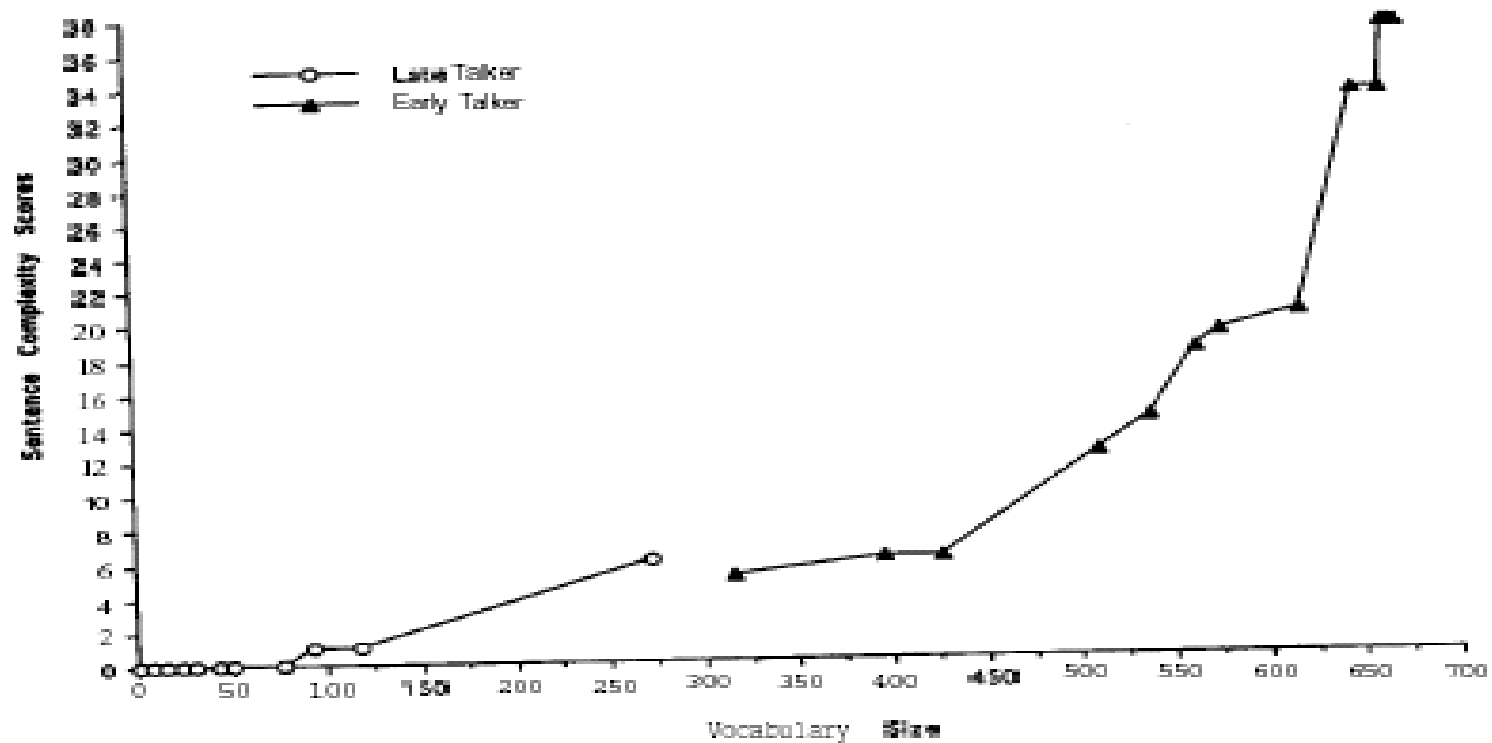


FIG. 2.11. Relation between grammatical complexity and vocabulary size for one late talker and one early talker. From Bates and Goodman (1997).



Early Focal Lesions

- n Based on the claims of adult aphasia**

Injury to left frontal area of brain (Broca's area) -
expected grammatical delay

Injury to the left posterior area of brain (Wernicker's area) – expected lexical delay

- n No evidence of the above claims and any kind of dissociation between the grammar and the lexicon**



Relevant Findings in support of the argument

- n **Absence of Left-Right differences**
- n **Surprise findings for Wernicker's area**
- n **Surprise findings for Broca's area**
- n **Disappearance of the left temporal effect**
- n **Relation between grammar and vocabulary size for 19 children with child lesions (Bates et al. and Reilly et al.)**

Graph showing the grammar-on-vocabulary for children with focal brain injury

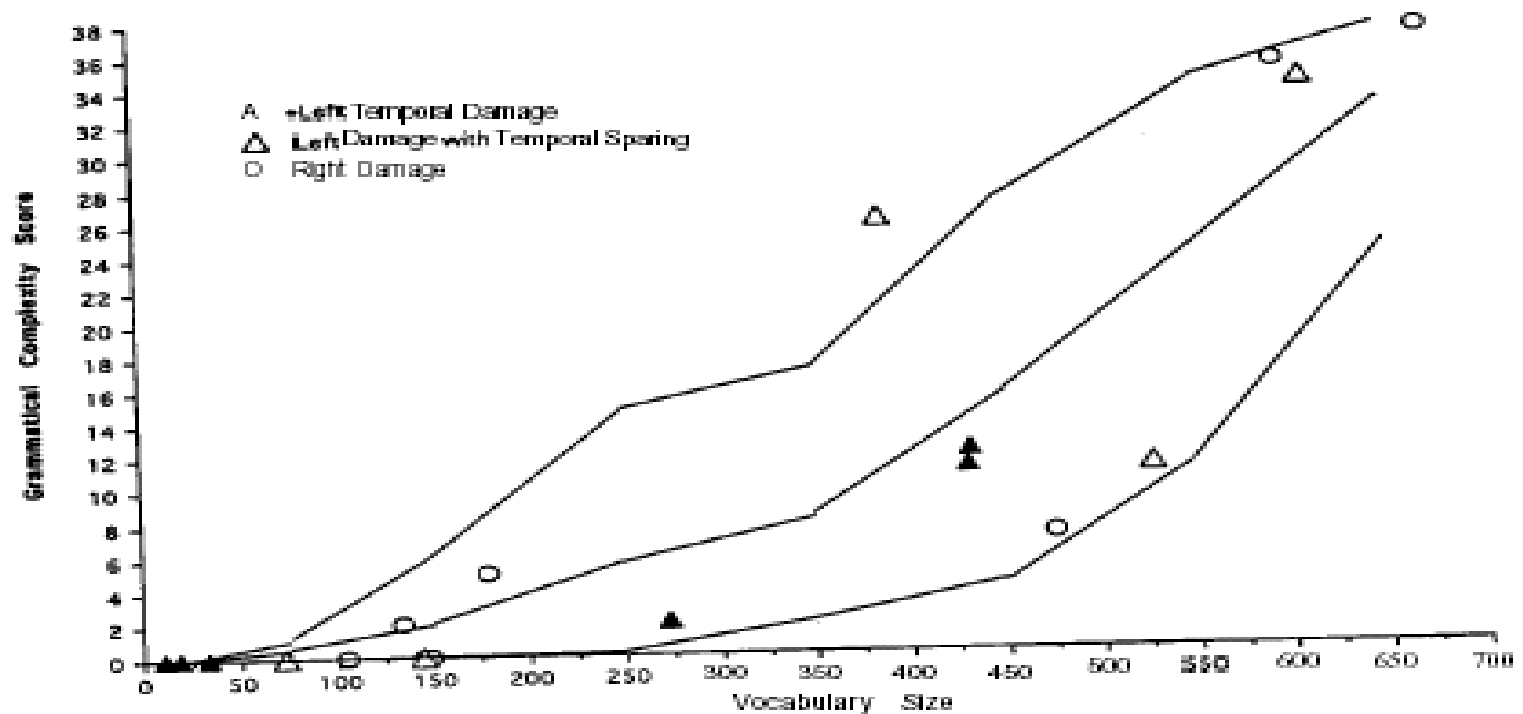


FIG. 2.12. Grammar as a function of vocabulary size in children with focal brain injury (lines = 10th, 50th, and 90th percentile for normals).



Williams Syndrome and Down Syndrome

- n Genetic forms of mental retardation**
- n Mean IQ between 40 and 60**
- n Represents a double dissociation between lexical and grammatical aspects of language**



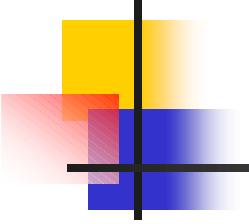
Down Syndrome (DNS)

- n Language abilities fall below the level we expect of a child of his age**
- n Impaired in the production of free and bound morphemes**
- n Word omissions and structural simplifications in richly inflected languages**



William Syndrome (WMS)

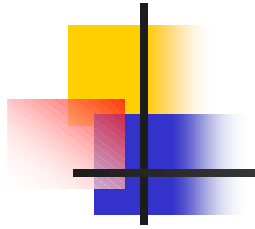
- n Good linguistic knowledge and language use as compared to performance in problem solving, reasoning , etc.**
- n Performance of WMS children fall well below their chronological age**
- n Most studies report performance close to mental age on test of vocabulary comprehension, sentence comprehension, sentence repetition**

- 
-
- n Studies suggest that both groups are severely and equally delayed on early language milestones**
 - n Between 8-16 months, delay in word comprehension and word production**
 - n Singer et al. found striking differences in the emergence of grammar (DNS disadvantage)**



Specific Language Impairment (SLI)

- n Defined as the delay in expressive language abilities that is at least 1 standard deviation below the mean for the child's chronological age.**
- n Expressive and linguistic abilities of children with SLI are qualitatively similar to those of younger and normal children**

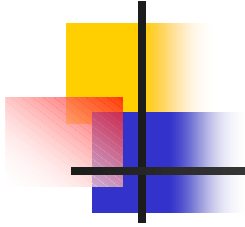


- n Specific Deviance detected across linguistic domain – grammatical morphology is delayed**
- n An initial deficit in perceptual level could create a cascade of deficits at higher levels of language processing, even though children do make progress and learning does occur**



Grammar and the Lexicon in the Adult Brain

- n **There may be a possibility of modular dissociation between grammar and lexicon emerging over time**
- n **Claim: Grammar and lexicon are mediated by distinct neural systems in adult brain. Evidence for the claim**
 1. Neural imaging studies of grammatical and lexical processing in normal adults.
 2. Dissociations between grammar and lexicon in patients with focal brain injury.



n Evaluation of the evidences:

1. Demonstration of a specific pattern of neural mediation at birth.
2. Any difference in experience or behaviour must be accompanied by difference in neural activity.
3. Localization and domain specificity are not the same thing.

Evidence in favour of an association between grammar and lexicon

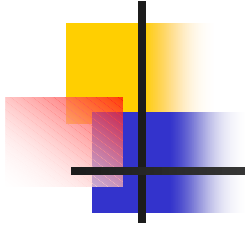


- n All aphasic patients have lexical deficits**
- n Agrammatic patients still know their grammar**
- n Expressive agrammatism is not specific to any syndrome**
- n Patients display similar grammatical and lexical symptoms**
- n Receptive agrammatism is not specific to any syndrome and can be observed in normals under stress**

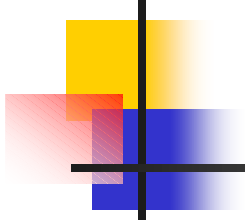


Conclusion

- n The emergence and elaboration of grammar are highly dependent on vocabulary size from the first words to gaining grammar.**
- n Grammar and vocabulary do not dissociate during the early stages of development in late talkers, early talkers and children with focal brain injury.**



- n Grammatical development does not outstrip lexical growth at any point in development, even in William's population.**
- n Grammatical development can fall behind vocabulary in some subgroups, e.g. Down's Syndrome, SLI**



- n The idea that grammar and lexicon are mediated by distinct neural systems in brain is not fully developed with evidences available in favour as well as against it.**



Drawbacks!!!

- n Bates and Goodman try to show a relation between the lexical growth and the grammatical growth but at no point they give evidence for a unified lexicalist approach to grammar.**
- n The association and the dependence of the grammatical system on the lexical system does not point to the development of function words in grammar through the lexical system.**



Thank You
