# Little Red Riding Hood and the Chomskyan Wolf: A debate on Poverty of the Stimulus Arguments

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**Abstract**

The present article discusses the empirical validity of the so-called **poverty of the stimulus argument** within nativist accounts of first language acquisition. Arguments against nativism in early linguistic development are given, which draw from the premises that: a) the linguistic stimulus that infants are exposed to is not as impoverished as linguists had initially stated, and b) infants' learning capacities have been grossly underestimated, since they do possess abilities that allow them to extract the relevant features they need from the input and, thus, acquire grammatical knowledge.

Once upon a time, there was a sweet little girl. Whoever laid eyes upon her could not help but love her. But it was her grandmother who loved her most. She could never give the child enough. One day she gave the girl a present: a red hooded cape, made of velvet. And since it was so becoming and the girl insisted on always wearing it, she was called Little Red Riding Hood.

Unfortunately, due to a blood clot in the brain, Little Red's grandmother had part of her body paralyzed. Consequently, she had to sit or lie in bed all day long. She also lost language. She could understand quite a lot of what she heard but she hardly spoke. However, the doctor said that, with time and with the right treatment, she might show a slight recovery from aphasia one day.

One day, Little Red's mother prepared mashed potatoes. She said to her daughter:

'Come, Little Red! Take this tupperware of mashed potatoes and this bottle of wine and take them to your grandmother. She's feeling sick and weak, and this

will strengthen her. Be sure to tell her about your progress at school, she will be happy to hear that and, besides, hearing samples of language input will help her recover from aphasia. Get an early start, before it gets hot, and when you're out in the woods, be nice and good and don't stray from the path'.

'I'll do just as you say', Little Red promised her mother.

The grandmother lived out in the forest, half an hour from the village. As soon as Little Red entered the forest, she encountered the wolf. However, Little Red did not know what a wicked and Chomskyan sort of an animal he was and was therefore not afraid of him.

'Good morning, Little Red', he said.

'Thank you kindly, wolf!' 'Where are you going so early, Little Red?' 'To Grandmother's'. 'Little Red, I wonder which things John said that Mary thinks who the men expected to see that somebody must have put ___ under your apron, with *wh*-movement of "which things" to Spec, CP'.

'I beg your pardon?'

'Under your apron... what is it that you are carrying?'

'Oh! Mashed potatoes and wine. My grandmother's sick and weak, and yesterday we made this so it will help her get well'.

'Where does your grandmother live, Little Red?'

'Another quarter of an hour's walk from here through the forest. Her house is under the three big oak trees. You can tell which one it is bythe hazel bushes', said Little Red.

The wolf thought to himself, 'This tender young thing is a juicy morsel. She'll taste even better than the old woman. I've got to be real crafty if I want to catch them both!'

Then he made a *wolf*-movement and walked next to Little Red, leaving a *wolf*-trace behind him. He told her, 'Little Red, just look at the beautiful flowers and plants that are growing all around you! Why don't you look around? You march along as if you were going straight to school, and yet it's so delightful out here in the woods, watching *colorless green ideas sleep furiously!*'

Little Red, who was full of botanic sensitivity, looked around and saw how the rays of the sun were dancing through the trees back and forth and how the woods were full of beautiful flowers. So, she thought to herself, 'If I bring Grandmother a bunch of fresh flowers, she'll certainly love that. It's still early, and I'll arrive on time'. So she ran off the path and plunged deeper and deeper into the woods to look for flowers.

While Little Red spent her time walking around, taking redundant maximal paths and looking for flowers, the wolf took the Minimalist Path (MP), with no

flowers or any other redundancies, which took him right to the grandmother's house long before Little Red could ever have arrived.

Once there, the wolf lifted the latch, and the grandmother's door sprang open. Then he went straight to the grandmother's bed without saying a word. He caught her and locked her in the deep structure of a big wardrobe, planning to spell her out later on, once Little Red had already arrived, so that he could eat them both together.

Meanwhile, Little Red had been running around and looking for flowers, and only when she had gathered as many as she could carry did she remember her grandmother and continue on the way to her house again. She found the door open, and she entered. Next, she went to the bed and drew back the curtains. There lay her grandmother, with her sleeping cap pulled down over her face, giving her a strange appearance.

'Dear Grandma, how are you today?', asked Little Red.

To that question, the wolf uttered a long and fluent answer about his health, full of IP and CP projections and with all the corresponding functional categories in it. Although he was faking the grandmother's voice, he didn't really sound aphasic at all. Little Red stared in wonder.

'Wow!', said Little Red, at last, 'that was actually quite well said! But Granny, how did you manage to acquire such a complex linguistic system in such a short period of time?'

'It is not only me, my dear, everyone can! Language acquisition is a snap, as many scientists would claim!', answered the wolf.

'But how is it, that you actually relearned language so quickly? Did any magician help you?

'My sweet and innocent child!', exclaimed the wolf, 'don't you know that languages are never learned or relearned? Language is unlearnable, language is innate, my dear! We come to this world with linguistic knowledge in our brain already. It's our language organ, it's part of our genetic endowment, we just have to let it grow (Anderson & Lightfoot 2000). It's no magician: it's Universal Grammar!'

'Haven't you heard about the poverty of the stimulus argument, my dear? There must be innate linguistic knowledge, indeed, because complex linguistic forms develop extremely rapidly, as you very well noted, and the input available to any language learner is both incomplete and sparsely represented, compared to one's linguistic abilities'.

'Oh! But, I came precisely to talk to you, so that you could have some linguistic input from which to extract some of the properties needed for language development!'

'Oh, my dear! Don't you see? Linguistic knowledge is perfect, and it is impossible to extract perfect knowledge from the imperfect data that constitutes language input. Input really cannot be the main source of language development. "A striking property of language acquisition is that children attain knowledge that, quite literally, infinitely surpasses their actual experience" (Anderson & Lightfoot 2000, 699).'

'I see', Little Red replied. 'Does that mean, therefore, that we do not learn the basic syntactic properties of natural languages from the input we hear?'

'Exactly!', said the wolf. 'Even if children could have learned that the adult grammar has U (given the right data), it does not follow - and it may not be at all plausible - that they acquired a grammar with U by learning. The requisite data may be unavailable to children (or anyone but trained linguists); available data might not be utilizable (by children); or the data might not be sufficiently ubiquitous to account for the knowledge of property U by all normal children, especially with respect to aspects of grammar where very young children exhibit adult linguistic competence" (Crain & Pietroski 2001, 151). So, quite clearly, this proves that we know things that we could not have learned from inductive observation of the input or from any available teaching'.

'But Granny, can you tell me what are these things that we know so well and that we could have never learned from the input? Can you give me any specific example?', asked Little Red.

'Well', the wolf replied, 'just take the example of auxiliary sequences in English (Kimball 1973). How can English-speaking children learn that sentences like (1) are in fact grammatical?'

(1) It may have been raining.

'I don't know', said Little Red. 'How can they?'

'They can't! That is precisely the point, my dear. Children know that sentences with a finite auxiliary plus two nonfinite auxiliaries plus a nonauxiliary verb in sequence are grammatical, and they know what the right order is, out of all the logically possible orders, without being presented with crucial evidence. Quite clearly, the ambient language is not sufficient to learn this grammatical feature from experience alone.'

'But Grandma', protested Little Red, 'sentences like the one you used in (1) are actually very common in a normal English-speaking environment. Pullum and Scholz (2002) found quite a lot of examples like yours! They checked! In fact, I myself found a bunch of them in a Fairy Tale Corpus[1] that I put together for school! Look!'

| | | |
|---|---|---|
| dealt out its blows as before, and | MIGHT | have been dealing them to this |
| he plunged boldly in. How long he | might | have been walking there he never |
| away-who can tell how long they | might | have been living there?-when the |
| Back: it was so wet, it certainly | must | have been raining. "Yes, that it |
| and declared that her daughter | must | have been meddling with it, for it |
| which convinced him that he | must | have been dreaming before. However, |
| events of the night, thinking he | must | have been dreaming; but for all |
| quiet enough. He thought that he | must | have been dreaming, and fell asleep |
| ess drew a long breath- "Then I | must | have been eating MOUSE! ...NO |
| going to shed tin-tears; but that | would | not have been fitting for a |
| took back to the place where they | should | have been feeding, for here he |

Table 1: Examples of occurrences of auxiliary verb sequences from an AntConc window.

'Oh, well!', exclaimed the wolf. 'But we are mainly interested in finding plausible evidence in the input which is available to all children, since all children eventually acquire language. Those fairy tales of yours may be available to some children, not all!'

'That is quite true', admitted Little Red, 'but still, you cannot claim that evidence for these structures is completely absent from the input or from anybody's linguistic experience!'

'Right. In any case, the problem with the stimulus is not only that it is too impoverished in that what people know extends beyond the samples they are exposed to. The input is also too rich, in a way, since it affords incorrect inductive generalizations that children never make. Consider an example of a hypothesis like "move the first auxiliary verb to form *yes/no*-questions". It would yield the right results for cases like the following (Crain & Pietroski 2001, 163)':

(2) a. Bill can play the sax.
b. Can Bill play the sax?

(3) a. The sky is blue.
b. Is the sky blue?

'It looks like evidence available from the input would support this hypothesis. However, is this hypothesis correct? Bear in mind, my dear girl, that in some cases, fronting the first auxiliary verb is impossible':

(4) a. The man who is beating a donkey is mean.
b. Is the man who is beating a donkey mean?
c. *Is the man who beating a donkey is mean?

'And do you know why this is so, my dear child? Because there's the so-called Head Movement Constraint! The attentive girl that you are, you must have seen that heads of phrases can only move locally. Movement of the auxiliary verb in the

(1) Is he who is only half a man to get the best?
(2) Was the sleep he had last night not enough for him?
(3) Shall a creature that I bought for an eighth trouble me from morning till night?
(4) Did not the young man who brought the dagger call him whom your majesty believes to be your son Labakan, and say he was a crazy tailor?
(5) Could the voice which had bewitched Alonzo have come from one of these?
(6) Have the two rascals who are my prisoners dared to play me such a trick as this?

Table 2: Examples of occurrences of main auxiliary fronting taken from Fairy Tale Corpus (see footnote 1)

relative clause would violate this constraint because such movement would cross the heads of two other phrasal projections (Crain & Pietroski 2001). Now the point is, my dear child, whether all children who form *yes/no*-questions in an adult fashion have been exposed to enough evidence of the relevant sort'.

'Grandma, there are indeed plenty of examples of questions like yours in (4b), from which children can infer that it is the main auxiliary verb that is to be fronted, and not the first auxiliary verb that occurs in a word sequence. In fact, I've got many of those as well from my Fairy Tale Corpus! Look!'

At this point, the wolf started to get angry. He shouted, 'Stop it! Will you stop talking about your silly Fairy Tale Corpus? I told you before, it is not relevant here. You cannot prove that *all* children have been exposed to the necessary evidence with that corpus thing! Besides, provided *some* children had access to some evidence that would allow them make some generalizations about *some* grammatical properties of their language, what does this prove? What about the exceptions to the grammatical rules?'

'No, no, my dear child, we still need innate linguistic knowledge to explain children's ultimate steady state. We might have evidence for some generalizations, all right, but we do not have enough evidence for where these generalizations break down! "As children, we come to know the generalizations and their exceptions, and we come to this knowledge quickly and uniformly. Yet our linguistic experience is not rich enough to determine the limits to the generalizations´´ (Anderson & Lightfoot 1999, 701)'.

'I'll give you another example, my dear child, because I can see you're rather lost by now. Consider the following examples, not taken from a silly childish Fairy Tale Corpus, but from the wise academic work of some sound scientists (Crain & Pietroski 2001, 156-157)':

(5) The Ninja Turtle$_{i}$ danced while he$_{i/j}$ ate pizza.

(6) While he$_{i}$ ate pizza, the Ninja Turtle$_{i/j}$ danced.

'You see, my dear child, that in (5) and (6), the pronoun *he* may or may not be

dependent on the referential expression the *Ninja Turtle*. In (7), however, referential dependence is impossible. (7) is unambiguous, it only has the (a)-reading':

(7) He danced while the Ninja Turtle ate pizza.

a. $He_i$ danced while the Ninja $Turtle_j$ ate pizza.
b. *$He_i$ danced while the Ninja $Turtle_i$ ate pizza.

'Sweet Little Red', continued the wolf, 'the relevant constraint here is Principle C of the Binding Theory. It prohibits backwards anaphora in (7). That is, the constraint does not allow coindexing a pronoun and a referring expression when the pronoun c-commands the expression. If child grammars lacked Principle C, then (7) would be ambiguous, since the (7b)-reading should be available for children. However, it is not (Crain & Pietroski 2001)'.

'But Granny', replied Little Red, 'wouldn't it be possible that young children could actually figure out that a referentially dependent term must be c-commanded by its antecedent?'

'I'm afraid this is not possible', continued the wolf. 'This would require figuring out a good deal of syntax! Humans must have a priori knowledge of the relevant principle of the Binding Theory, making it both unnecessary and impossible for children to consider grammars that do not respect these constraints. Children never consider hypotheses at odds with the principles of Universal Grammar! "This suggests an acquisition scenario according to which children are guided by innate knowledge" (Crain & Pietroski 2001, 159)'.

'Ooohhh!! I'm impressed!', said Little Red. 'But Grandma, there might actually be a better solution, don't you think? I've heard about this situation before, that in which a subset of input has two possible formal descriptions, and the infant learner has to choose one of them... the induction problem, they call it!'

'Exactly!', said the wolf, 'and what does the infant learner do, in that situation? He chooses the formal description which is constrained by the principles of Universal Grammar! Isn't that great?'

'My dear Granny, with all due respect, but I don't think you need any UG constraint to explain that. Actually, there's this nice paper I read (Gerken, in press) where they perform an experiment with artificial language to test the induction problem, using the very same data that Marcus and his colleagues (Marcus et al., 1999) used in their own study. They presented nine-month-old children with stimuli that exhibited an AAB pattern, but they also ended in syllable *-di*. Thus, both descriptions (i.e. follows AAB pattern" and ends in *-di*) would allow learners to generalize beyond the particular syllable to which they were exposed to a new set of syllable strings'.

'Well, Grandma, the results in this experiment showed that infants made only the generalization involving the position of the syllable *-di*. It appears as though learners would compare the subset of the input they have received to the range of input generated by the two different formal descriptions. Then, learners would make one of the two generalizations tested, the one that is most statistically consistent with the particular subset of the data they received!'

'Oh, well', said the wolf, 'I'm sure this friend of yours... what was her name, again? Gerken? Well, I'm sure she's a very nice and well-intentioned girl, but she clearly has no idea of what language acquisition is about! Statistically consistent, she said? For Chomsky's sake! How can one talk about statistics when dealing with a scientific discipline like Linguistics! I'm afraid you'll have to accept that the fact that essential aspects of grammar are innate is the only viable explanation for how languages can be acquired so quickly yet under such impoverished conditions'.

'But Grandma', protested Little Red, 'this statistics thingy is in fact really cool! They say that speech contains "a host of statistical regularities that are sufficient to support the kind of robust learning observed in neural networks. This knowledge has emerged from the analysis of huge computerized corpora of written and spoken language, revealing regularities that are not visible to the naked eye. Chomsky's belief in the impoverished nature of linguistic input holds only if we look "locally" at relatively short segments of speech. Such imperfections wash out with a large enough sample"! (Bates & Elman 1996, 1849)'.

'My dear, sweet child', said the wolf, 'forget about statistics! The fact that languages exhibit properties for which there is no evidence in the input is an unquestionable truth! There cannot be any overt evidence for the kinds of abstract underlying structures characteristic of grammatical theory. How is a child supposed to know what a Noun or a Verb is? And you definitely need grammatical categories to form phrases, and phrases to project into larger phrases and sentences!'

'Yes Granny, we *do* need grammatical categories, what we don't need is *innate* grammatical categories, because distributional information might play a very important role in categorizing words! Mintz et al. (2002) carried out an experiment to test whether grammatical categories could be learned through a distributional analysis of the input. In fact, grammatical categories could be well defined by similarities in word patterning! Consider the example in (8)':

(8) The dog is barking at the moon.

'Both dog and moon are preceded by the. And they are also preceded by the same words across many sentences. This similarity would lead them to be classified together (Mintz et al. 2002)'.

'My dear child', replied the wolf, 'do not trust such distributional analyses because they do not always give you the right results! Consider the following examples':

(9) a. John ate fish
b. John ate bread
c. John can fish
d. *John can bread.

'See the problem, dear girl?', continued the wolf. 'A distributional learner would incorrectly categorize fish and bread together and, hearing (9c), she would incorrectly assume that (9d) is also possible!'

'Yes Granny, I do see the problem!', answered Little Red. 'In fact, it is also captured by Mintz and his colleagues (Mintz et al. 2002, 396). However, according to them, if *fish* were the only word in the corpus to share any distribution with *bread*, then yes, you were right, maybe *bread* would be assigned the same categorization as *fish*, and it would be incorrectly classified as both a Noun and a Verb, and sentences like (9d) would be permissible. But Mintz et al. (2002) suggest that in any sizable corpus of actual speech directed at young children, *bread* will share many more distributional characteristics with words used as nouns only. This would statistically override any marginal effects produced by sequences like (9a-c). It really looks like the frequencies of sequences that could lead to wrong generalizations in this case are low enough, compared to those that lead to correct ones, as to have little or no effect on categorization outcomes!'

'Well, my dear', said the wolf, 'there is still another problem which neither you nor your friends might have captured! Important distributional regularities are often not local, but occur over a variable distance!'

(10) The big fluffy brown and not so thin dog is barking at the moon.

'How is the learner supposed to know which co-occurrences are important and which should be ignored, dear child? Distributional analyses that consider all the possible relations among words in a corpus of sentences would be impossible, my dear!'

'Well, Grandma', continued Little Red, 'Mintz el al. (2002) have also captured this problem, and their results show that it is actually possible! They analyzed first the distributional context of a word based only on the immediately preceding and following words. Then, they extended the same procedure to analyze larger distributional window sizes (two words to the right and left of a target word, and eight words to the right and left of a target word). All of the input for their analyses

consisted of utterances taken from the CHILDES database directed at children less than 2.5 years old'.

'Well, Granny, you'll be surprised to hear that their analysis yielded successful categorization using various window sizes. I agree categorization was not 100% correct in all cases, but the idea is that an analysis based on distributional similarity has a very strong tendency to cluster nouns with other nouns and verbs with other verbs. The accidental exclusion of linguistically informative co-occurrences and the accidental inclusion of irrelevant co-occurrences resulting from defining contexts by immediate adjacency did not significantly distort the results (Mintz et al. 2002)'.

'So, you see, Grandma, the input is not quite as impoverished and degenerate! "iven a learner who is predisposed to calculate distributions over words, the input contains information from which the grammatical categories of at least nouns and verbs could be constructed" (Mintz et al. 2002, 419)'.

'My dear Little Red...', said the wolf, 'then, you are assuming that there are indeed learners who are predisposed to calculate distributions over words! And what if there aren't any? Let me warn you, my dear child, that young learners are poor learners! The presence of a rich input does not guarantee that children can make appropriate use of it! "One must distinguish between the mere availability of data and the utility of that data for children. It is not enough that there are facts that would help children learn language. Children must be able to recognize and make use of these facts" (Crain & Pietroski 2001, 149). I'm sorry to tell you, my dear, but the evidence seems overwhelming that fundamental aspects of our language are not acquired by learning, but are determined as part of our biological endowment instead'.

'Oh, Grandma!', cried Little Red, 'young children are not as bad learners as people initially claimed! Children are capable of extracting more from their experience than one might think. Take the Saffran et al. (1996) paper, for example! They claim that "infants possess powerful mechanisms suited to learning the types of structures exemplified in linguistic systems"! (Saffran et al. 1996, 1927)'.

'I know you said before that you didn't like statistics Granny, but Saffran and her colleagues conducted an experiment in which they proved that eight-month-old infants could extract information about word boundaries on the basis of the sequential statistics of concatenated speech! In their experiment, children were not provided with any acoustic information about word boundaries. The only cues to word boundaries were the transitional probabilities between syllable pairs, which were higher within words than between words. And guess what! Eight-month-old infants were able to extract information about sequential statistics from only two minutes of listening experience! Ain't that cool?!'

'The Saffran et al. (1996) paper!', exclaimed the wolf, 'I knew you would mention it sooner or later! You might not have realized about this yet, my dear, but what these experiments do not show is that a learner with no innate predispositions could extract from the stream of speech alone the principle of assigning word boundaries! The learner must be built from the beginning to use this procedure to discover linguistic units. Otherwise, language acquisition would be impossible! This is were the real poverty of the stimulus lies: language data do not come packaged with instructions for their own analysis. Learners must approach the data with prior innate constraints (Clark et al. 1997)'.

"'Nobody denies that the child must extract information from the environment; it is no revelation that there is learning in that technical sense". But the point is, my dear child, "that there is more to language acquisition than this. Children react to evidence in accordance with some specific principles" (Anderson & Lightfoot 2000, 710). Thus, linguistic structure cannot be learned through unguided analyses of input sentences, no matter how complex these analyses may be. Such analyses must, in a way, be guided and oriented by innate predispositions of the learner'.

'But Grandma!', exclaimed Little Red, 'those innate predispositions of the learner that you are mentioning now are rather different from innate knowledge of linguistic principles! You've been claiming over and over that humans possess a small set of *innately* specified parameters that make language acquisition possible. But one thing is to say that there is something innate about language acquisition and another rather different thing is to claim that *grammatical knowledge* itself is innate!'

'Dear Grandma, there must be, indeed, something innate about language acquisition. But what is innate about language cannot be determined unless we explore the role of experience to its limits! The statistical learning approach does not deny that children are born with capacities that make language learning possible. It just questions whether these capacities include knowledge of linguistic universals per se. Innate capacities may simply consist of particular sensitivities toward particular types of information inherent in the environment, rather than a priori knowledge of grammar itself (Seidenberg 1997)'.

'But what does this finding tell you about a learner's steady state, anyway?', asked the wolf, 'Saffran et al. (1996) suggest that if children can learn words by recording frequent sound sequences, they might learn grammar the same way. But learning words is one thing, and learning grammar is another thing! The sequence of sounds making up a word cannot be captured by rules. However, the sequence of words making up a sentence can be captured by rules. Thus, learning words and learning grammar are two very different computational problems (Pinker 1997)'.

While Little Red and the wolf were having this discussion, the forest ranger

happened to be around. Being the forest superhero that he was, it occurred to him that the grandmother would he happy to have someone to talk to, so he decided to pay her a visit. He took the Minimalist Path, not because he was a Chomskyan, but because he lacked botanic sensitivity and did not care for flowers at all.

He went in and found Little Red and the wolf, who was still wearing the grandmother's clothes, arguing. He shouted, 'shut up and leave this girl alone! How dare you? How can you question such important new findings about statistical learning in infants? Nobody questions the statistical properties of language nowadays! Even Chomsky once said, "given the grammar of a language, one can study the use of the language statistically in various ways, and the development of probabilistic models for the use of language (as distinct from the syntactic structure of language) can be quite rewarding"! (Chomsky 1965 quoted in Seidenberg 1997, note 24)'.

'And how dare you say that identifying word boundaries and learning grammar are two completely different computational problems?! "Distinguishing words from other words in the stream of speech is a basic syntactic ability: if one cannot segment sound strings into word strings, then there can be no syntax. This is not the only skill involved in synctactic processing, but it is one of the most basic, to be sure" (Hilferty 2003, 192)'.

The wolf was so shocked at the appearance of the ranger and his impressive words, that he fainted. Then, Little Red and the forest superhero tied his legs, so that he couldn't run away, and released the grandmother from the deep structure of the wardrobe, where she had been trapped all this time.

Little Red promised not to stray from the path by herself ever again and to carry on further research on statistical learning by infants and the notion of bootstrapping and the mechanisms that young children use to extract specific types of information from the linguistic input in order to determine the particular regularities which constitute the grammar of their language.

As to the wolf, traditional stories would say that he died or was killed in some way. However, this is the 21st century and present-day animal rights activists would never accept that wolves sometimes should be killed (not even Chomskyan wolves). Besides, the forest guy, who was supposed to be the one to kill him, was too busy having his grandmother's mashed potatoes, because they reminded so much of his own mother's. Thus, the wolf was taken to a laboratory where he was forced to volunteer to do some neuroimaging experiments.

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