

POVERTY OF STIMULUS ARGUMENTS AND BEHAVIOURISM

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ABSTRACT: A substantial proportion of philosophers are operating under the assumption that Chomsky's conception of language acquisition has refuted Quine's behavioristic conception (Gibson 1982). In this paper I will evaluate Quine's theory of language acquisition in light of Chomsky's poverty of stimulus argument, and his claims that children are not corrected when using incorrect grammatical constructions, which are typically used to show that Quine's behavioristic project is impossible. I will demonstrate that current empirical research does not support either, Chomsky's poverty of stimulus argument, or his claims about children not being corrected when using language incorrectly. It will be shown that Quine's behavioristic research program is still a live option and one that is currently better supported by empirical data than Chomsky's conception of language is.

Key Words: poverty of stimulus argument, auxiliary inversion, negative evidence, reinforcement, primary linguistic data

CHOMSKY AND QUINE ON LANGUAGE LEARNING

When it comes to the details of how children learn their first language there is a substantive difference between Chomsky and Quine. The primary

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difference between them centers on the role that they think reinforcement and punishment plays in a child learning his first language. The Quinean picture of a child learning his first language involves the child using his innate babbling instinct as he mouths various different words. Parents and others reinforce and punish these emissions until they shape the child's pattern of verbal behavior into the external shape of that child's social environment. As Quine put it in *Word and Object* (1960):

People growing up in the same language are like different bushes trimmed and trained to take the shape of identical elephants. The anatomical details of twigs and branches will fulfill the elephantine form differently from bush to bush, but the overall outward results are alike (1960, p. 8)

Linguistic nativist Chomsky disagrees with this Quinean picture. He thinks that the outward shape of language results not from the child's faltering attempts at speech being corrected by his peers, but from the child using his innate universal grammar to structure the data of experience, which the child contingently encounters.

The issue between Chomsky and Quine on this point is a purely empirical one. In the last twenty years much detailed evidence has emerged which can be used to decide between the two theorists. The central idea around which nativism was built has been poverty of stimulus arguments (PSA; Chomsky 1975, Pinker 1994, Boeckx 2006). Chomsky (1975) has argued that children display knowledge of language, and that this knowledge is not provided by the environment, and therefore it must be innate. Typically Chomsky uses the subject-auxiliary inversion rule to illustrate how PSA work (Chomsky, 1971; 1972; 1975; 1986; 1988). In their paper "Empirical Assessment of Stimulus Poverty Arguments", Geoffrey Pullum and Barbara Scholz (2002a) call the subject-auxiliary inversion rule the paradigm case, which nativists use to illustrate poverty of stimulus arguments. They cite eight different occasions that Chomsky uses the example (1965, p. 55-56; 1968, pp. 51-52; 1971, pp. 29-33; 1972, pp. 30-33; 1975, pp. 153-154; 1986, pp. 7-8; 1988, pp. 41-47). They also cite other Chomskian thinkers, including linguists such as Lightfoot, (1991, pp. 2-4); Uriagereka, (1998, pp. 9-10); Carstairs-McCarthy, (1999, pp. 4-5); Smith, (1999, pp. 53-54); Lasnik, (2000, pp. 6-9) as well as psychologists such as Crain, (1991, p. 602); Marcus, (1993, p. 80); Pinker, (1994, pp. 40-42; 233-234) who here endorsed the claim. They argue that this supposed instance

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of a PSA is being passed around and repeated over and over again. In this paper, I examine whether the PSA argument (as applied to syntactic knowledge) actually works. I will discuss how, if sound, the PSA affects Quine's view of language learning. It will be shown how Quine's theories on language acquisition will be affected if the PSA turns out to be false.

Pullum and Scholz (2002a) show that poverty of stimulus arguments are used in a variety of not always consistent ways in the literature. Having surveyed some of the literature on the PSA, they isolate what they believe to be the strongest version of the argument. The argument they construct is as follows:

- (A) Human infants learn their first languages either by data-driven learning or by innately-primed learning.
- (B) If human infants acquire their first languages via data-driven learning, then they can never learn anything for which they lack crucial evidence.
- (C) But infants do in fact learn things for which they lack crucial evidence
- (D) Thus human infants do not learn their first languages by means of data-driven learning.
- (E) Conclusion: Humans learn their first languages by means of innately primed learning.

This gloss on the PSA is one that Chomsky would accept as an appropriate schematization of the PSA, though Chomsky believes that there is more evidence to support a belief in innate domain-specific knowledge than the PSA. Pullum and Scholz (2002a) claim that the key to evaluating the soundness of the PSA is premise (C), which is the empirical premise of the argument. So to evaluate the argument, they study the linguistic environment of children. Their aim is to check if there really is no evidence provided by the environment that the child can use to formulate a hypothesis of a particular rule. For example, will a child be presented with datum such as 'Is the man who is at the shop happy?', which can help them learn the subject-auxiliary inversion? Pullum and Scholz's (2002a) research program involves searching *The Wall Street Journal* corpus to discover if constructions which Chomsky claims a person could go much or all of their life without encountering are in fact, more frequent than he would lead us to believe. However, prior to discussing what the evidence tells us about the frequency of the sentences, I first want to discuss what Quine would make of the PSA as discussed by Pullum and Scholz (2002a).

The first premise of Pullum and Scholz (2002a) version of the PSA is that a child learns language either by data-driven learning or by innately-primed learning. Quine maintained throughout his entire philosophical career that our linguistic abilities are not distinct from our overall theory of the world. In fact, he has consistently maintained that learning a language is learning a theory of the world, and, furthermore that learning a scientific language is learning a more explicit regimented form of ordinary language. According to the picture presented in *Word and Object*, a child begins by babbling various different sounds and has these sounds reinforced in various different ways. Through the

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process of conditioning and reinforcement, the child eventually learns when it is appropriate to use which sounds. According to Quine, at this stage the child has not learned any concepts. Quine argues that through processes such as analogical reasoning, abstraction etc., children eventually learn to structure some of these sounds into syntactic units. It is only after we have mastered this syntax and can then speak of certain objects as being the same as or different than other objects, that we can be said to have grasped the concept of an object, and learned to speak about objects in the world. The important point is that for Quine, the processes which a child uses to learn a language are the same as the processes he uses to learn about the world. So Quine would not accept that language is learned by innately-primed learning (in the sense of innate domain-specific knowledge). The question of whether a child learns his first language by data-driven learning is a more complicated question on the Quinean picture.

On some versions of data-driven learning, the child is presented as a passive observer of verbal behavior. From when they are born (strictly speaking, when in utero as well), children are bombarded with verbal behavior. So, on one data-driven learning picture, children (unconsciously) observe the various different patterns of verbal behavior; circumstances of occurrence, order of occurrence, tone used etc. and unconsciously construct a model of the language they are presented with.

Quine does not deny that the child uses such statistical methods to organize the data of experience; so in this sense he agrees with the statement that a child learns by data-driven learning. However, for Quine, the word 'data' has a much wider meaning than mere models constructed based on observed linguistic regularities. For Quine, an important part of the data are the types of reinforcement and punishment that is given for the child's linguistic behavior. The child emits utterances and receives various different types of reinforcement, either negative or positive depending on the appropriateness of the utterance. So on the Quinean picture, as the child is learning his first language, he might be reinforced for putting forth a question such as 'Will Mama feed me?'. Now suppose the child had been constructing questions by moving the first auxiliary of various statements to the front of the sentence, and suppose further that the child had been positively reinforced for this behavior. Given this state of affairs, the child will continue to emit questioning behavior like this until he receives punishment. Now suppose that the Quinean child wants to ask a more complicated question; suppose he wants to discover whether the sentence 'The man who is tall is sad' is true. The child will

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continue along the pattern of previous questions and will turn the statement into a question and ask ‘Is the man who tall is sad?’¹ On the Quinean picture, this questioning behavior will be punished. The child will continue to try different constructions based on past experience and reinforcement until eventually their language output is molded into the shape of the child’s community. So for Quine, the data the child learns from are not merely observation of the statistical patterns of the language he is exposed to, but also includes the ways various constructions are reinforced and punished. The important point is that in order for Quine to accept premise (A) of Pullum and Scholz’s (2002a) reconstruction of the PSA, he would have to understand data in a wider manner than that obtained by mere passive observation.

Quine would accept premise (B) as long as data-driven learning is considered in this expanded sense (reinforcement, punishment, plus statistical regularities in the environment). Premise (C) is the crucial empirical premise: but infants do in fact learn things for which they lack crucial evidence. The most cited case where nativists argue that children display knowledge that they could not have learned from their environment is the subject-auxiliary inversion (Pullum and Scholz 2002a p.39). Quine emphasizes induction, analogy, reinforcement and punishment as the primary tools in language learning. He has never endorsed the claim that children have knowledge of the rules of language for which they have not received data from their linguistic environment. For Quine, any sentence a child utters is either learned inductively from the child’s Primary Linguistic Data (PLD) or is constructed through an analogy with previously heard utterances in the PLD. Through induction, analogical reasoning, reinforcement and punishment, the child will eventually arrive at the language of his peers. So Quine would deny the truth of the crucial empirical premise (C). Furthermore, premise (C) is a crucial test of Quine’s theory of language acquisition: if it could be demonstrated that a child has knowledge of a rule of language which was not learned by experience, analogy or reinforcement, then this would demonstrate that Quine’s theory of language acquisition is seriously incomplete.

By reviewing *The Wall Street Journal* 1987-1989 corpus through the 1993 Linguistic Data Consortium, Pullum and Scholz (2002a) have provided evidence that the constructions that Chomsky claims a child will never be exposed to in their lifetime do, in fact, occur. They used *The Wall Street Journal* because it is easy to obtain and free. People have justly complained that *The Wall Street Journal* is obviously not a representative of the type of data a child will be exposed to. To this they have replied that since Chomsky claimed that the type of sentences which a child needs to be exposed to in order to learn structure dependence rules are so rare that a child can go much or all of his life without encountering them, then *The Wall Street Journal* is therefore evidence that Chomsky is wrong on this point. Geoffrey Sampson, in his book *The ‘Language Instinct’ Debate*, has provided evidence that the type of constructions which Chomsky claims are vanishingly rare occur in children’s books. Furthermore, he has searched the British National Corpus (including a

¹ indicates that the sentence is ungrammatical.

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search of child-parent interaction) and found hundreds of examples of the relevant constructions.²

Pullum and Scholz (2002a) think that since they have shown that premise (C) is not in fact true, then the overall argument, while valid, is not sound and therefore the argument for linguistic nativism does not go through (p. 45). Let us assume that Pullum and Scholz (2002a) are correct and that Chomsky's argument is not sound: what then are the implications of this for Quine?

As we have seen, Quine thinks that children learn language through data-driven learning, in a broad sense. One of the primary objections to the Quinean picture of language learning is that punishment does not play the role in language learning that Quine thinks it does. A wide variety of experimental evidence has been put forward by psychologists who claim that this evidence shows that children are not corrected when they speak ungrammatical sentences (see for example, Marcus 1993, pp. 53-85; Gropen et al., 1989, pp. 203-57; Crain & Nakayama 1987, pp. 113-25). At a superficial level, this seems to show that Quine's picture of language acquisition is incorrect. The empirical evidence seems to indicate that the picture of a child mouthing constructions such as 'Is the man who tall is sad?*', and receiving punishment is, in fact, incorrect. Therefore, one could conclude that even if Pullum is correct that the child is exposed to some examples that help the child learn the structure-dependent rule, this view will not help the Quinean conception of language learning.

However, it does not automatically follow that because explicit punishment is not involved in language learning that a more subtle kind of punishment is not used. Whether or not punishment is explicitly used in learning complex grammatical utterances, it is unquestionable that children do receive positive reinforcement for speaking. When a child begins to speak first, every utterance is encouraged and rewarded with affection. In *Word and Object*, Quine notes that any reinforcement that the child receives will be concomitant with a variety of different stimulations. As he writes:

² I will deal with the frequency of the constructions later in the paper and whether there are enough constructions for a child to learn the rules. For now I want to focus in a schematic way on what these findings mean to a Quinean picture of language learning.

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The original utterance of 'Mama' will have occurred in the midst of sundry stimulations, certainly; the mother's face will not have been all. There was simultaneously, we may imagine, a sudden breeze. Also there was the sound of 'Mama' itself, heard by the child from its own lips. (1960, p. 81)

So, for Quine, the effect of the reinforcement will be that the child will repeat the word in the presence of Mama's face, in the presence of a mild breeze, and upon hearing the sound mama. However, the child's behavior of saying 'Mama' in the presence of a sudden breeze, will not receive positive reinforcement so he will eventually stop emitting this behavior. The child's behavior of saying 'Mama' in the presence of mama, and his behavior of saying 'Mama' upon hearing someone near him speak it, will be positively reinforced. One helpful consequence of this type of reinforcement, according to Quine, is that the child who repeats 'Mama' when someone says 'Mama' will have this behavior reinforced, and from the parent's points of view, the child appears to be engaging in mimicry. If the child can recognize that not only is his behavior of using sounds in certain appropriate contexts reinforced, but also his mimicking the behavior of his peers receives reinforcement, then he will have had a very useful tool reinforced. The child will have realized that it pays to listen to his peers and to try to imitate their behavior. To this end the type of statistical abilities postulated by people such as Lappin and Clark (2011) will be obviously useful in helping the child learn his first language. Furthermore, if what is being reinforced is mimicking behavior, then the fact that certain sentences which Chomsky claims do not occur in the data do, in fact, occur, will obviously be of vital importance for Quine's theory. Obviously, Quine's mimicking theory will only work if the child experiences the constructions which he displays knowledge of. All of this is schematic. While it does not show that Quine's theory of language acquisition is correct, it shows that recent research that purports to show that Chomsky's PSA arguments in syntax do not work can also play a role in supporting Quine's theory of language acquisition.

RECENT CRITICISMS OF THE POVERTY OF STIMULUS ARGUMENT

Pullum and Scholz (2002a) did the first detailed study of how often sentences relevant to the structure-dependent PSA appear in the data a child is exposed to. As I discussed above, they began by making the logic of the PSA explicit by structuring it as a logical argument. They isolated the third premise that claims that datum relevant to learning the structure-dependent nature of language do not occur enough in the child's PLD for him to learn the relevant construction. They set out to test this claim by checking a corpus of linguistic text; they used *The Wall Street Journal* as their corpus because it was free and easily available.

In order to test how often a construction is encountered by a child learning a language, it is first necessary to test how much linguistic data a child is exposed to. Pullum and Scholz (2002a) relied on the work of the psychologists Hart and Risely (1995), who in their *Meaningful Differences in the Everyday Experiences of Young Children*, detailed the amount of linguistic data a child is exposed to. Hart and Risely (1995) documented the vocabulary development of

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forty-two children aged 1-3. The authors noted the production and use of language of the children as well as the language they were exposed to. They also noted that the amount of linguistic data a child is exposed to depend greatly on the socio-economic class that they belong to. According to their study, a child from a professional household will have been exposed to about 30 million word tokens. A child from a working-class family will have been exposed to 20 million word tokens, and a child from a family on welfare will have been exposed to 10 million word tokens.

Pullum and Scholz (2002a) also report findings from Hart and Risely's 1995 book, indicating that 30% of the speech directed at children is in the form of interrogatives. The authors also estimate that the mean length of utterances directed to children is four words long. Pullum and Scholz (2002a) then argue that if we take the statistic of a child whose family are on welfare, being exposed to 10 million word tokens, divided into sentences four words long, we arrive at the conclusion that the child is exposed to 2.5 million sentences every three years. Furthermore since 30% of those sentences are interrogatives, we can argue that the child is exposed to seven hundred and fifty thousand questions every three years, i.e. a quarter of a million questions per year. In their research of *The Wall Street Journal* they discovered that the questions relevant to learning the structure-dependent rule occur in 1% of interrogatives in the corpus. From this they conclude that a child will typically be exposed to seven thousand five hundred relevant examples in three years. This means that the child will be exposed to two thousand five hundred examples per year; therefore on average the child will be exposed to seven relevant questions a day. They conclude their paper by asking if seven relevant questions a day is enough to learn such a rule. Furthermore, they correctly claim that if nativists think that it is not, they need to explicitly set out a learning theory that shows why it is not.

The obvious objection to the above argument is that Pullum and Scholz (2002a) get their data from *The Wall Street Journal*, and such data is hardly representative of the linguistic experience of the child. Pullum and Scholz (2002a) cite some research which shows uniformity across linguistic texts as evidence that *The Wall Street Journal* may, in fact, be representative of the child's linguistic experience. However, the fact that the Hart and Risely (1995) research claims that child-directed sentences are typically four words long shows this to be incorrect. The average length of sentences in *The Wall Street Journal* will obviously be much longer than four words. Geoffrey Sampson's

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(2002) research taken from the British National Corpus (BNC; not available in America at the time Pullum (1996) was writing) uses samples of speech between child and parent as well as the ordinary speech of adults, so it avoids some of the difficulties of Pullum (1996), and Pullum and Scholz's (2002a; 2002b) research.

In his (2002) paper "Exploring the Richness of the Stimulus", Sampson largely agrees with Pullum and Scholz's (2002a) research; however, he claims that while his research is complementary to theirs it is not subject to the same objections. He sampled the normal conversational speech which people typically have with each other and which a child is routinely exposed to. To this end he used the BNC. He used the demographically sampled speech section of the BNC that he claimed contains 4.2 million words. This section of the BNC was constructed by giving recording equipment to individuals selected to be representative of the national population with respect to age, social class, and region (2002, p. 3). By exploring this corpus, Sampson aimed to avoid the criticisms directed at Pullum and Scholz (2002a) that claimed that their corpus did not accurately represent the data a child is exposed to when learning a construction.

Sampson (2002) begins his discussion by making a terminological point. Whereas Pullum (1996) uses the term 'auxiliary verb' as something that can be the main and sole verb of a clause, Sampson (2002) calls a verb "auxiliary" only if it is followed by another verb. For this reason, while Pullum (1996) would call the following sentences auxiliary inversions, Sampson (2002) would call them "verb-fronting questions".

Here we will discuss what Pullum and Scholz (2002a) refer to as "auxiliary-initial clauses". Poverty of stimulus theorists claim that children typically will not hear examples of questions formed by fronting verbs which in the corresponding declarative statements are preceded by complex constituents. Sampson (2002) aimed to test what people actually say when speaking to each other. He did this to help him understand whether the poverty of stimulus theorists were correct. However, when trying to analyze the data he found an unexpected complication. There are two different types of verb-fronting sentences, both of which Pullum and Scholz (2002a) include in their WSJ search. These different types of constructions occur in radically different magnitudes in spoken speech.

The first type of verb fronting is of the following form:

(1) Will those who are coming raise their hands?

(1a) Those who are coming will raise their hands

Sampson (2002) reminds us that in the above constructions, the complex constituent is the subject of the fronted verb. So he calls sentences 1 and 1a verb-fronting sentences that involve complex preverbal subjects.

The second type of verb fronting has the following form:

(2) If you do not need this, can I have it?

(2a) If you do not need this, I can have it.

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Sampson (2002) reminds us that in (2), the main clause is preceded by an adverbial clause. He calls sentences like (2) and (2a) “verb-fronting sentences” involving initial adverbial clauses. He first begins to consider questions of the form of (2), which he calls initial adverbial clauses.

He searched for adverbial initial clauses in the BNC-demographic (which contains 4.2 million words). He claimed that his search was not exhaustive because such an exhaustive search would be extremely difficult with this grammatical pattern and the BNC corpus. He did not offer any reasons why this particular grammatical pattern would make an exhaustive search so difficult. However, he did claim that such a detailed search was not necessary since Chomsky (1975) had claimed that ‘a person might go through much or all of his life without being exposed to a relevant construction’, and that therefore finding any examples of the constructions would refute Chomsky (1975).

In attempting to find such examples, Sampson (2002) targeted cases where the adverbial clause begins with *if*. He found twenty-two clear cases of initial adverbial clauses. He furthermore claimed that *Wh*-questions could also be considered relevant. *Wh*-questions also involve moving an auxiliary of the main clause, rather than one in the preceding adverbial clause. And he claimed that that if this class is relevant, then he had a further twenty-three cases. However, he realized that counting *Wh*- questions would be controversial, so he only counted the twenty-two constructions that he found for initial adverbial clauses.

Sampson (2002) uses Hart and Risely’s (1995) estimates of how many words a person is exposed to every three years. He takes the figure they provide that a working class person is exposed to twenty million words every three years. This choice itself is controversial; there is no reason to focus on the stimuli that a working class child is exposed to rather than the stimuli that a professional child is exposed to, or the stimuli that a child from a family on welfare is exposed to. If we accept that children from linguistically deprived backgrounds develop normal linguistic abilities, then the figure of ten million should be used because children develop such abilities despite only being exposed to this amount of linguistic data. Furthermore, if the relevant constructions do not occur in the data, and children display competence of the rules, then this shows that the rule must be innate. However, Sampson (2002) would probably reply to this that the argument relies on the untested assertion that people from linguistically deprived environments have languages as richly structured as those of ordinary members of the linguistic community. Sampson

(1997; 2002) has long argued against the dogma of convergence, the view that all speakers from all societies speak languages that are equally complex. He holds that if we are to establish that children from linguistically deprived environments have language as complex as their better educated colleagues, then we will need evidence to support this claim. And he holds further that nativists have so far not provided us with any evidence of this kind.

So to avoid begging the question against either nativists or anti-nativists, it is best to start, as Sampson (2002) does, with Hart and Risely's (1995) figure of twenty million words every three years. So let us work out the numbers. Sampson (2002) found twenty-two constructions out of a corpus consisting of 4.2 million words. Using Hart and Risely's (1995) data, we can estimate that the average length of each construction for a child up to three is four words long. So we can estimate that Sampson's (2002) 4.2 million words amounts to about 1.1 million sentences in the corpus. Hart and Risely (1995) estimate that a working class child will be exposed to five million sentences (of four words long) in the first three years of their lives. So if Sampson (2002) finds the relevant data twenty-two times out of 1.1 million sentences, then we can expect that he will find at least one hundred and ten examples in five million sentences. This would work out at about thirty seven relevant examples per year. So a child could expect to encounter a relevant construction at least once every ten days.³

The question which Pullum and Scholz (2002a) raise in their paper can be fruitfully asked of Sampson's (2002) results: is one example every ten days enough for the child to learn the construction? The nativist who is claiming that innate domain-specific knowledge is the only explanation for our competence in the relevant construction owes us an answer as to why we cannot learn it from one example every ten days. Typically nativists have not met this challenge; they have merely pointed to the supposed poverty of stimulus as evidence that the construction must be innate. However, likewise, if anti-nativists claim that the relevant construction can be learned using some kind of data-driven learning, then they owe us a model of how this is done. Assessing whether such constructions can be learned by experience will require mathematical models of how learning from such few constructions is possible. Other possible tests may involve developing computer programs which can learn from this amount of data. Such programs have been developed already. So, for example, Clark and Eyraud (2007), Perfors, Tenebaum and Reiger. (2006), as well as Reali and Christiansen (2005) have all developed programs which can learn from less data than discovered by Pullum and Scholz (2002a) and Sampson (2002). Ultimately what we have learned from this data is that

³ Like Pullum and Scholz (2002), Sampson (2002) interprets his corpus data using Hart and Risely's figures. One difficulty with this is that Hart and Risely estimate that the sentences a child encounters are 4 words long. The few examples Sampson published from his corpus research contain sentences that are 10 words long. So doubt could be cast on whether his corpus is representative of the child's PLD. Obviously much further research is needed to clarify this matter; however, like Pullum and Scholz (2002), Sampson is to be applauded for beginning this research into the PLD instead of ignoring it like Chomsky.

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Chomsky's confident assertions that children cannot learn certain constructions from the data they experience have not been justified with enough evidence.

The other type of verb fronting which Sampson (2002) discusses is the type of construction where the complex constituent is the subject of the fronted verb. An example of this type of construction is:

- (1) Those who are coming will raise their hand.
- (2) Will those who are coming raise their hand?

Here Sampson (2002) found some surprising results. Sampson (2002) discovered that on this point Chomsky (1975) was correct. In the 4.2 million word BNC, Sampson found no constructions of the relevant kind. However, he did not view this as providing support for Poverty of Stimulus theorists. He claimed, on the contrary, that the reason that the construction did not occur in the BNC is because the construction is not an idiom of ordinary English speech. It is rather an idiom of written English.

Sampson's (2002) search of the speech-directed portion of the corpus showed that the relevant construction never occurred in 4.2 million word tokens. He did not do an exhaustive search of the written-language section of the BNC; instead he merely provided examples from random searches of the corpus. Here are some of the examples he found:

- (14a) Did the fact that he is accompanied by a doctor on the campaign trail help to lose him last week's TV showdown with Clinton? CAT.00742 (*Punch*, 1992)
- (15b) Did Mr. Mortimer, 69, who has an Equity card, enjoy himself? CBC.08606 (*Today*, 1992)
- (16c) 'Is the lady who plays Alice a child or a teenager?' asked my six-year-old' B0300647. (*Alton Herald*, 1992)
- (17d) Is a clause which is known to be unenforceable in certain circumstances an unreasonable one? J6T.00908 (R. Christou, *Drafting Commercial Agreements*, 1993)
- (18e) Will whoever is ripping the pages out of the stony new route book please grow up. CG2.1379 (*Climber and Hill Walker*, 1991)

(2002, p. 18)

Sampson (2002) thinks that these examples show that children do not typically form questions using auxiliary fronting when speaking. He argues that constructing questions using auxiliary fronting is restricted to written questions. However, he does not provide any evidence as to how often such constructions occur in written work. His primary point is that, in order for an PSA theorist to use a lack of examples in speech of yes/no questions formed by fronting a main-clause verb as evidence for innate knowledge, they have to rule out the possibility that children learn the rule from written language. The fact that people will judge certain constructions as grammatical, despite not encountering them in spoken language, is not that important if the person has encountered them in written language. Here, in short, Sampson (2002) is shifting the burden of proof onto the PSA theorist to show that the child cannot learn such rules from written language. And in absence of such a proof, he is assuming that the PSA does not hold.

What Sampson (2002), Pullman (1996) and Pullum and Scholz (2002a) have shown is that the most cited case of PSA as put forth by Chomsky (Pullum and Scholz, 2002a, p.39) does not offer clear evidence at all. Obviously much more research is needed on the topic. The important point to note is that this PSA has been shown to be incorrect in claiming that children learn a particular rule in the absence of experience. Hence, this particular PSA does not establish that Quine's (1960) conception of language learning is incorrect. The question of the viability of Quine's story of how the child learns his first language remains open. Nor of course can this PSA be used to support Chomsky's claim that we need to postulate innate domain-specific knowledge to explain language acquisition.

THE ROLE OF CORRECTION IN LANGUAGE IN LANGUAGE LEARNING

In order to achieve a complete picture of what contemporary evidence tells us about the debate between Chomsky's and Quine's picture of language learning, we will now need to evaluate what the state of play is in regard to the issue of negative evidence. Most linguists believe that the issue of negative evidence is crucial to understanding language acquisition. The issue of negative evidence centers on the fact that children do not typically encounter ungrammatical sentences that are marked as such. A child will not, for example, hear a sentence such as 'Is the child who beside the man is happy?' along with a tag to indicate that the sentence is deviant. So the question arises as to how children know that these sentences are ungrammatical. The children are not presented with these sentences and told they are ungrammatical. Nor (so the theory goes) do they produce these ungrammatical sentences only to be systematically corrected by their peers. Hence, it is argued that the only way to explain how a subject tested by a linguist can clearly tag certain sentences as grammatical, and certain as ungrammatical, is to postulate innate domain-specific linguistic knowledge.

A key premise in the above argument is that children are not systematically corrected for their grammatical mistakes by their peers. This

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claim goes back to the experimental research of Brown and Hanlon (1970) who supposedly show that parents do not correct children for uttering ungrammatical sentences. Furthermore Ochs and Schieffelin (1984), claim that in some cultures corrections plays no role, because the child's parents do not interact with the child till they are competent speakers. And the research of Crain and Nakayama (1987) whose experiments supposedly shows that children do not even try certain grammatical constructions, so even if correction did play a role in language learning (which they argue it doesn't) it would not be enough because children do not even try out the false constructions in the first place.

Since Crain and Nakayama (1987) supposedly rules out trial and error learning so dramatically I will discuss their experiment first. They elicited yes/no questions from children between the ages of 2-3 and 5-11 in response to prompts such as "Ask Jabba if the boy who is watching Mickey Mouse is happy". They found that (with different frequencies at different ages) children sometimes produced correct forms such as (15a) and they sometimes produced various incorrect forms, one example being (15b). However, they never produced the kind of incorrect form predicted by the 'structure-independent hypothesis' such as (15c). They offered this as support for the theory of innate linguistic knowledge.⁴ Below are the two examples which children sometimes produced, and the structure-independent hypothesis which children never reproduced:

(15a) Is the boy that is watching Mickey Mouse happy?

(15b) Is the boy who's watching Mickey Mouse is happy?

(15c) Is the boy who watching Mickey Mouse is happy? (2002, p. 20)

Examples like (15c) are the type of production which one would predict based on the structure-independent hypothesis. However utterances like these do not ever occur. In particular they claim that this shows that children are innately predisposed to prefer structure-dependent rules to organize the data of experience (Sampson 2002, p. 20). So here the issue is that children do not try

⁴ In this section I am following Sampson's (2002, p. 20) reconstruction of Crain and Nakayama (1987).

out constructions like (15c) and have them criticized by their peers. They automatically construct questions like (15a) and (15b) which are structure-dependent rules. That is, independent of poverty of stimulus considerations, Crain and Nakayama (1987) claim to have shown that children do not construct structure-independent rules, and so do not receive any negative evidence that sentences (15c) are ungrammatical. If we add to Crain and Nakayama's (1987) claim the fact that children do not hear sentences like (15c) spoken yet know that they are ungrammatical, we have an argument for innate knowledge based on a lack of negative evidence.

The argument of Crain and Nakayama (1987) is of vital importance to this paper. It offers support to Chomsky's claim that children are born with an innate language faculty. It also contradicts Quine's picture of a child learning the rules of syntax through positive and negative reinforcement, and punishment. Obviously, if children do not utter constructions such as (15c), then Quine's claim that such constructions are shown to be incorrect through punishment must be false.⁵

The supposed lack of negative evidence in the instance of auxiliary inversion may not be as damning to Quine's picture of language learning as it appears. The data which Pullum and Scholz (2002a) gathered from *The Wall Street Journal* indicates that in the case of subject-auxiliary inversion, children encounter about seven relevant constructions every day. Using statistical reasoning, the child exposed to this type of experience from passive observation alone would within a few days of birth have evidence that the structure-dependent hypothesis was superior to the structure-independent one. A child who was unconsciously analyzing the data of experience would then not even try the structure-independent rule of (15c) though he may try structure-dependent rules such as (15a) and (15b).

However this argument fails when one takes account of Sampson's (2002) work. His data shows that examples of verb-fronted sentences (excluding cases where the subordinate clause precedes the main subject which we discussed above) in actual speech is zero. So the child cannot learn the rule inductively. If Crain and Nakayama (1987) are correct that children never try out the barred interpretation, then this indicates that they are correct that the rule is innate.

So it could be argued that Crain and Nakayama's (1987) result combined with Sampson's show that Quine's conception of language acquisition is incorrect. A critic could argue that Sampson and Crain and Nakayama's research shows that Quine is incorrect because they show that induction, reinforcement and punishment do not play any role in learning that this particular rule. However, given that Crain and Nakayama's experiment only relates to the subject-auxiliary inversion, it could be argued that it is obviously not equipped to rule out stimulus/response learning entirely either. However, there is a more fundamental reply that could be raised to this experiment. The

⁵ Quine does not anywhere discuss auxiliary inversion; however, his constant emphasis on the fact that language is a social art in which people's utterances are beaten into shape through reinforcement from their peers; shows that he thinks that all our linguistic rules are structured through positive and negative reinforcement from our peers.

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reply is Geoffrey Sampson's and uses data from how people actually speak which is used to cast doubt on Crain and Nakayama's (1987) experiment.

Sampson has raised objections to this experiment based on his discoveries that children do not typically form questions using auxiliary inversion. He correctly notes that based on his corpus research children would not be expected to reply in the manner they do in the experiment. Crain and Nakayama (1987) use the fact that children never try out 15c to support their claim that children do not use the structure-independent hypothesis. However, Sampson points out that in ordinary speech, as revealed by his corpus analysis, people do not use auxiliary inversion to form questions. According to his analysis, children should form the question in the following manners:

(16a) Is he happy, the boy who's watching Mickey Mouse?

(16b) The boy who's watching Mickey Mouse is happy, isn't he?

Sampson correctly notes that, since we know from the corpus analysis that children do not typically form questions like 15a and 15b in speech, it is odd that children would answer in this way in the experiment. He points out that Crain and Nakayama (1987) only give figures for children's 'correct' question formation, so it is impossible to tell whether children tried out 16a, and 16b. He further speculates that the fact that children use an idiom of speech not ever found in ordinary discourse may indicate that the children were primed for the experiment. Sampson's discussion does not refute Crain and Nakayama's experiment; however, it does demonstrate that the experiment is far from conclusive. So Crain and Nakayama's experiment does not refute Quine's trial and error position of language acquisition. The Crain and Nakayama (1987) experiment would need to be replicated and done in different cultures to be viewed as anything more than a suggestive idea. The other experiment which is typically offered as evidence that children do not learn their language through trial and error is Brown and Hanlon's (1970) paper.

Brown and Hanlon's (1970) paper purports to show that children do not learn by explicit instruction. However, their paper has negligible impact on Quine's position, because behaviorism is not committed to reinforcement being explicit. In fact contemporary research in psycholinguistics supports the view that much language instruction is implicit rather than explicit.

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In their 2003 paper “Adult Reformulations of Child Errors as Negative Evidence”, Chouinard and Clark (2003) constructed an experiment which was designed to test whether adults were implicitly instructing their children about the rules of their language. The test aimed to discover if adults were using side sequences and embedded constructions as ways to correct the children’s utterances. On pages 9 and 10 of their paper they gave the following examples of side sequences and embedded corrections.

An example of a *side sequence*: (indented sequence is the correction):

(1) Roger: now-, um do you and your husband have a j-car.

Nina: have a car?

Roger: yeah.

Nina: no-

(Startvik and Quirk 1980: 8.2a, p. 335)

An example of embedded corrections:

(2) Customer in a hardware store looking for a piece of piping:

Customer: Mm, the *wales* are wider apart than that.

Salesman: Okay, let me see if I can find one with wider *threads*.

(looks through stock) how’s this?

Customer: Nope, the *threads* are even wider than that.

They claimed that adults made use of side sequences and embedded corrections to correct children’s errors and to keep track of what the children meant to say. The adult reformulations indicate to children (a) that they have made an error, (b) what the error was, and (c) the form needed to correct the error.

In their experiment they set out to test the following four claims:

(1) Negative evidence is available in adult reformulations.

(2) Negative evidence is available to children learning different languages, and for different types of errors.

(3) More reformulations are available to younger children.

(4) Children detect and make use of the corrections in reformulations (2003, 12).

The experimenters got their data from five corpora in the CHILDES Archive. Three of the children were acquiring English (Abe from the Kuczaj

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corpus, Sarah from the Brown corpus, and Naomi from the Sachs corpus) and two were acquiring French (Philippe from the Leveille and Suppes corpus, and Gregoire from the Champaud corpus) (Ibid., 13). In order to analyze child errors, the experimenters included all spontaneous child utterances in the transcript, with the exception of utterances with unintelligible speech and child utterances preceded or followed by unintelligible speech on the part of adults. The experimenters first tested whether the children's strings were adequate. If the string contained an error, they categorized what sort of an error it was, i.e., morphological, syntactic etc. They then checked whether the next adult utterance was a reformulation. The utterance was a reformulation if it repeated in corrected form the portion of the child's utterance, which had contained an error. They further coded the correction by noting whether it was side sequence or an embedded correction. They finally checked whether children took up the repeated change that had been made, rejected it or tacitly accepted it.⁶

For the analysis of conventional child utterances, they took a random sample of 200 utterances for every age slice for each child. They identified all the error-free child utterances in the sample and tabulated how many of the constructions were replayed by the adult in the next turn. If the adult just repeated what the child said, they called it a replay (Ibid., 14). They got two different researchers to code each transcript and they agreed on their codes 90% of the time. Where the two researchers disagreed, they resolved their disagreement by discussion.

Once they had coded the transcripts, they coded each of the lines for detailed analysis. For each of the children, they enumerated the total coded lines and the total number of erroneous utterances. They then divided the data into age slices to track developmental trends.

They devised a table to represent the four different age slices of the three children in the English corpora, and they divided the adult replies into conventional and erroneous. They found that adults repeated erroneous utterances far more than they repeated conventional utterances. On average, they repeat erroneous utterances more than twice as often as they repeat conventional utterances. More interestingly, the percentage of corrections of erroneous utterances is extremely high. In the age slice 2.0-2.5, (of the three English-speaking children) the following pattern was observed: Abe had 67%

⁶ The study used only adults who were the children's parents.

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erroneous utterances reformulated, Sarah had 65%, Naomi had 48%. In the French corpora, Philippe had 67% reformulations, and Gregoire had 60%. So in the age range 2.0-2.5, most of the children had at least 60% of their utterances reformulated, and Naomi, who had the lowest number of reformulations still received almost 50% corrections of her reformulations. Out of the other age-slices, the lowest number of reformulations for incorrect utterances was for the ages of 3.6 to 3.11. Here there was not enough data to complete the French reformulations; however, the reformulations for the English speakers were as follows. Abe received 28% reformulations for incorrect utterances, Sarah 41%, and Naomi 20%. So it is certain that children do receive reformulations of incorrect utterances. Even in the worst case that of Naomi between the ages of 3.6-3.11, 20% of her incorrect utterances were corrected. Of the corrections given side sequences made up the majority of corrections the children heard as opposed to embedded corrections. Chouinard and Clark (2003) (*Ibid.*, 21) claimed that of the five children Abe, Sarah, Naomi, Philippe and Gregoire, the amount of side sequence corrections respectively was 57%, 70%, 70%, 73%, and 62%. In other words the reformulations in the majority of cases were designed to check what the child had meant.

The study found that negative evidence was available for each of the children whether they were French or English. Furthermore, negative evidence was used at comparable rate whether the error was phonological, morphological, lexical or syntactic. And again, reformulations occurred at a much higher rate than repeating of conventional utterances. Furthermore in general adults tend to decrease their reformulations as children get older and make fewer mistakes. However, there was one exception to this trend: as Naomi got older, her errors were reformulated more. So this question needs to be looked into further.

Obviously, just because adults use reformulations it does not follow that such reformulations are understood and used by the children. Evidence that children understand and use such reformulations can only be discovered by noting how the children respond to them. Chouinard and Clark (2003) discuss four possible ways that children could respond to an adult reformulation: (1) they can take up the reformulation explicitly by repeating it and, in doing so, correcting at least part of their original utterance; (2) they may overtly reject the adult's reformulation, thereby signaling that the parent has misinterpreted what the child intended, and when the parent tries a different reformulation the child may accept it; (3) after hearing a conversation, they may acknowledge it at the start of the next turn in the conversation; (4) they can simply continue with the conversation without overtly acknowledging the change or taking it up. Such continuations could be counted as tacit acceptances of adult reformulations. Overall, the responses where children acknowledged a reformulation or repeated new information, alongside those where they either took up or else rejected the formulation were as follows: Abe 56%-72%, Sarah 25%-38%, Naomi 39%-100%, Philippe 39%-75%, Gregorie 25%. By any standard, this shows that children do attend to reformulations a sizable percentage of the time.

Four of the children used in the experiment had a parent who was college-educated; however, as Chouinard and Clark (2003) acknowledge, it is unclear

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whether this experiment will generalize across socio economic backgrounds.⁷ Furthermore, only two cultures were used in the experiment, so it is unclear whether the experiment can generalize across cultures. However the experiment shows that for the children in the study implicit parents and these corrections use correction change the verbal behavior of the child by dramatically decreasing the child's mistakes. Therefore the corrections can be viewed as punishers that decrease the amount of grammatical mistakes a child makes. Furthermore the paper shows that Brown and Hanlon's 1970 paper that parent's do not use explicit correction, even if correct, has no effect of Quine's behavioristic position because implicit corrections are sufficient to serve as punishers and decrease the probability of grammatical (and other kinds) of mistakes occurring.

Chouinard and Clark (2003) further discuss the oft-cited evidence from Ochs and Schieffelin (1984), who claim that in some cultures negative evidence is not presented to children, because the child's parents do not interact with the child till they are competent speakers. Their paper is of central importance because it is usually offered as key evidence in favor of the nativist's argument for innate domain-specific linguistic knowledge. Usually nativists will point to Brown and Hanlon's (1970) paper, as well as Crain and Nakayama's (1987) paper, to demonstrate that children do not receive explicit negative evidence. However, typically anti-nativists point out that, while there is evidence that children do not receive explicit instruction, they do in fact receive implicit instruction. To this nativists reply that, while this may be so in our culture, it is certainly not so in all cultures. To demonstrate this point, they cite Ochs and Schieffelin's (1984) paper. It is claimed that since all of the members of the various different human cultures learn a language, and only some receive negative evidence, then negative evidence is not a key factor in learning language. This objection is clearly relevant to the work of Chouinard and Clark (2003) as they only considered two cultures in their experiment. However, Chouinard and Clark (2003) consider this objection (*Ibid.*, 39) and offer a criticism of it. Ochs and Schieffelin (1984) had claimed that in Kaluli and Samoan cultures parents do not converse with children who are not yet competent users of language. They claim that, contrary to what is typically

⁷ See Pinker 1994 for discussion of rural families from South Carolina who do not speak to their children.

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believed, Ochs and Schieffelin's 2004 paper is in fact largely consistent with their own findings. It is true that in the Kaluli and Samoan cultures adults do not converse with children who are not yet competent speakers of the language. However two points need to be made about this. Firstly, the fact that adults do not engage in conversation with children of this age may not be as important as sometimes considered if older children in the community converse with the younger children of the community.⁸ Secondly, even if parents do not converse with children who are not yet competent users of language, it does not follow that they do not correct their language use. Chouinard and Clark (2003) cite a section of Ochs and Schieffelin (1984) that indicates that children of the Kaluli do indeed receive negative feedback:

Kaluli mothers pay attention to the form of their children's utterances. Kaluli correct the phonological, morphological, or lexical form of an utterance or its pragmatic or semantic meaning. (1984, 293)

Chouinard and Clark (2003) claim that in the Kaluli culture feedback takes the form of adults telling the children what to say on different occasions. For example, the adult would prefix a child's statement with the instruction 'elema' (meaning 'say like that'). If the child makes a statement that is grammatically incorrect when talking to another person, the adult will face that person and say 'elema' followed by the grammatically correct utterance. So clearly in this culture explicit instruction is used to teach the child how to speak. However, contrary to what is typically reported, Ochs and Schieffelin (1984) do not provide evidence against anti-nativist theories of language acquisition.

If Brown and Hanlon (1970), Ochs and Schieffelin (1984), and Crain and Nakayama (1987) held up to critical scrutiny, this would have been a disaster for Quine's picture of language learning with its emphasis on trial and error, reinforcement, and punishment. However as we have just seen none of the experiments stand up to critical scrutiny and contemporary evidence actually shows that implicit correction does actually play a big role in the child learning their language. Here again we can see that the evidence does not favor the Chomskian innateness hypothesis but rather it favors Quine's behavioristic model.

CONCLUSION

The evidence I have discussed above shows that contemporary evidence is still largely consistent with the picture of language acquisition sketched by Quine in the 1960's. The arguments by Chomsky and those influenced by his paradigm have not shown that Quine's view of language acquisition is incorrect. The evidence indicates that the primary poverty of stimulus argument used by Chomsky does is not empirically supported and therefore

⁸ Whether the older children of such a community do, in fact, engage with the younger children in a manner in which they can use to learn the rules of their language is an empirical question. The point is that Ochs and Schieffelin's (1984) paper does not rule out this possibility.

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does not rule out behaviorist models of language learning. Experimental evidence which purports to show that that reinforcement and induction do not play a role in language learning have also been shown to be empirically inadequate. Therefore Chomsky or his supporters have not refuted, contrary to what is often asserted, behavioral explanations of language acquisition.

In this paper, I have evaluated whether Chomsky's PSA has refuted Quine's conception of language acquisition. By reviewing the best arguments which have been put forth by Chomsky in defense of the PSA, I concluded that the PSA has not refuted Quine's conception of language acquisition. However, the evidence that I have reviewed does not indicate which conception of language is the correct one. There is much research which needs to be done before we can decide whether the nativist or the empiricist conception of language acquisition is the correct one.

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