

## **The Comprehension Hypothesis Extended**

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**In this paper I review the evidence for the Comprehension Hypothesis in oral language and literacy, and discuss the possibility that the Comprehension Hypothesis provides a plausible explanation for non-human language acquisition. The clearest data comes from several areas of research in animal language but we will also briefly consider what some of the possibilities are for other non-human species.**

### **The Comprehension Hypothesis**

**The Comprehension Hypothesis states that we acquire language and develop literacy when we understand messages, that is, when we understand what we hear and what we read, when we receive “comprehensible input” (Krashen, 2003). Language acquisition is a subconscious process; while it is happening we are not aware that it is happening, and the competence developed this way is stored in the brain subconsciously.**

**Studies have shown that several affective variables are related to success in language acquisition – anxiety (low anxiety is correlated with more success in language acquisition), self-esteem (more self-esteem is related to success in language acquisition), and motivation, with “integrative motivation,” (a desire to belong to a certain group) related to long-term success in language acquisition (until membership is achieved), and “instrumental motivation” (to accomplish a task) related to shorter term success (until the task is done).**

**To relate affective variables to the Comprehension Hypothesis, it has been hypothesized that for input to enter the “language acquisition device” the acquirer must be “open” to the input: the “affective filter” must be low, or down. This view considers affective barriers to be outside the “language acquisition device,” a hypothesis that predicts that affective factors will not influence the nature of acquisition or the order of acquisition of the parts of language (Krashen, 1982, 2003).**

**Smith (1988) hypothesizes that for language acquisition to take place, the acquirer must consider himself or herself to be a potential “member of the club” of those who speak the language. It is easy to translate this idea into the affective filter framework: When integrative motivation (Gardner and Lambert, 1972) is high and anxiety is low, the affective filter is lowered, and those late-acquired aspects of language that mark club membership are acquired.**

**Club membership explains why we do not always acquire all varieties of language we are exposed to, why, for example, older children prefer the language of peers over the language of their parents.**

**The Comprehension Hypothesis has had several inventors and has been known by several different names. I have referred to it as the Input Hypothesis in previous publications. Well before my work began, Frank Smith and Kenneth Goodman have hypothesized that “we learn to read by reading,” by understanding what is on the page (e.g Smith, 2004; Goodman and Goodman, 1979). James Asher (Asher, 2000) and Harris Winitz (Winitz, 1981) among**

others, also hypothesized that comprehension is the mechanism underlying language acquisition in publications that predate mine.

### Output Hypotheses

The chief rivals of the Comprehension Hypothesis are two kinds of “output plus feedback” hypotheses. The Skill-Building Hypothesis maintains that we acquire language when we consciously learn rules of grammar and vocabulary, and we learn to read by first consciously learning the rules of phonics. Output helps us by making our knowledge more “automatic” through practice and by providing a domain for error correction, which helps us arrive at a better version of our rule. This approach is also known as “direct teaching” or formal instruction.

The Comprehensible Output Hypothesis maintains that language acquisition occurs when we say something and our conversational partner does not understand, forcing us to notice a gap in our competence. We then try again until we arrive at the correct version of the rule.

The evidence reviewed here and elsewhere (references to follow) strongly supports the Comprehension Hypothesis for both literacy and language development, and the evidence for both is similar.

### Direct Confrontations

We first examine direct confrontations, studies in which comprehension-based methods are compared with methods based on rival hypotheses.

### Experimental Studies

For second language acquisition at beginning stages, comprehensible-input based methods such as Total Physical Response and Natural Approach have been shown to be more effective than skill-building based methods (for reviews, see Krashen, 1982, 1994, 2003). For beginning literacy development in the first language, students in classes in which more real reading is done outperform those in classes in which less reading is done (Krashen, 2002a).

The results at the intermediate level are similar. In second language development, comprehensible subject matter teaching in the second language, known as “sheltered” subject matter teaching, has been shown to be as or more effective as traditional intermediate instruction for literate, intermediate level foreign language students (research reviewed in Krashen, 1991).

In both first and second language development, students who participate in classes that include in-school self-selected reading programs (known as sustained silent reading) typically outperform comparison students, especially when the duration of treatment is longer than an academic year (reviews include Krashen, 2003, 2004, 2005).

### Correlational Studies

Crucial correlational studies are those that compare the Comprehension Hypothesis with competing hypotheses, using multivariate methods.

Using multiple regression, Gradman and Hanania (1991) reported that “extracurricular reading” was a strong and significant predictor of performance on the TOEFL examination for international students taking the test abroad. Extremely problematic for output hypotheses was the result that the amount of “extracurricular writing” and “extracurricular speaking” reported were negatively related to TOEFL performance.

S.Y. Lee (2005) examined predictors of writing performance of university students studying English as a foreign language in Taiwan. The results of a structural equation model analysis revealed that the amount of free reading students reported doing was a significant predictor of writing performance, but the amount of free writing done was not. Also, students with a stronger belief in the efficacy of reading and writing instruction did not do better on the writing test.

### The Effect of Applications of Rival Hypotheses

Increasing comprehensible input clearly results in more language acquisition and more literacy development; we consistently see positive correlations between the amount of reading done and progress in reading, as well as the amount of aural comprehensible input received and language development (Krashen, 1982, 1988a, 2003). But adding more direct instruction or output either does not result in more development or results in only very modest improvement. When improvement occurs, it occurs just where the Monitor hypothesis predicts it will.

### Direct Instruction: Grammar

Studies done over the last century have failed to find a significant effect for the teaching of grammar on the reading and writing of native speakers of English (for reviews, see Krashen, 1984; Hillocks, 1986).

In the field of second language acquisition, a parade of studies done in the last decade has attempted to demonstrate that grammar instruction is beneficial. Truscott (1998) and Krashen (2003) have reviewed many of these studies and conclude that they only demonstrate that grammar study has a very limited effect: The subjects used in these studies are students who are familiar with grammar study and who generally accept the claim that grammar study is useful. Yet, after a considerable amount of study, gains are typically very modest, are demonstrated only on tests in which there is a clear focus on form, and typically fade with time.

These results are consistent with the Monitor Hypothesis: Consciously learned grammar is only available as a Monitor or an editor, and the constraints on Monitor use are severe: The

user has to know the rule (see the complexity argument below), have time to apply the rule, and be thinking about correctness (Krashen, 1982, 2003).

#### **Direct Instruction: Vocabulary**

A few studies of direct instruction of vocabulary seem to have produced what appear to be remarkable results (Nation, 2001, p. 298). But the “advantage” of these methods is only apparent. As argued in Krashen (1989), vocabulary teaching methods that appear to be very efficient do not provide a deep knowledge of words, with their full semantic and syntactic properties, generally providing only synonyms or short definitions.

#### **Direct Instruction: Spelling**

There is good evidence that direct instruction in spelling has limited effects (Krashen, 1989). Here are some samples of this research. Over one hundred years ago, Rice (1897) reported no relationship between the amount of time devoted to spelling and spelling achievement, when measured on tests involving words in sentences and compositions.

Cook (1912) tested high school and college students who had just completed a semester of intensive study of spelling rules. There was no difference in spelling accuracy among those who said they knew the rules and used them, those who said they knew the rules and did not use them, and those who said they did not know the rules. As we will see later, Cook also reported that few students really knew the rules.

More recent confirmation comes from Wilde (1990), who estimated that each spelling word learned through direct instruction takes about 20 minutes of instructional time. Given the huge number of words we learn to spell, this result strongly suggests that instruction cannot do the job.

#### **Correction**

As noted above, the skill-building hypothesis claims that language acquisition and literacy development depends on output plus error correction; when we are corrected, we change our idea of what our conscious generalization is, and come to a better version of the rule. Correction thus is thought to impact consciously learned knowledge.

The research on correction parallels the research on grammar. The results of a number of studies (Truscott, 1996; Krashen, 1994; 2002b) indicate that correction, whether in class or in the “informal” environment, has no impact, that is, students who were corrected showed no gains, or were similar to comparisons who were not corrected or were corrected less. When error correction has been shown to have an effect, the impact is modest, and the effect occurs just where language acquisition theory predicts it should have an effect, that is, when the conditions for the use of conscious learning are met, when the acquirer knows the rule, has time to apply the rule, and is focused on form. In all studies in which error correction had an effect, the measure used emphasized form, and the subjects had done a great deal of conscious learning.

#### **Direct Instruction: Phonics**

The claim has been made that methods including more phonics instruction (“intensive systematic phonics”) are more effective than those that include less (NICHD, 2000). Garan

(2002), however, has demonstrated that students in classes in which more phonics is taught are superior only on tests in which students are asked to pronounce lists of words in isolation. They do not do significantly better on tests of reading comprehension given after grade one.

### Output

As noted earlier, output fails as a predictor of second language competence when compared to reading; more speaking or writing does not result in more language or literacy development, but more reading does (Gradman and Hanania, 1991, for speaking and writing; SY Lee, 2005, for writing; for other studies, see Krashen, 1994).

In addition, adding writing to reading-based methods has not been shown to have a consistently positive effect on language development (Mason, 2004, K. Smith, in press).

One of the few studies to even examine whether increasing the amount of comprehensible output increases language proficiency is Nobuyoshi and Ellis (1993). Of the three subjects, only two showed improvement after interacting with a teacher who requested clarification each time they did not produce the past tense correctly. In both cases, the number of instances produced was very small and in one case the gain was modest. Also, all three subjects had studied the past tense rule, and had been clearly focused on it in the session. The improvement may have simply been the result of their being reminded to use a consciously learned rule that they had all certainly studied in school.

Izumi, Bigelow, Fujiwara, and Fearnow, (1999) and Izumi and Bigelow (2000) induced comprehensible output in several ways. In one condition, for example, they asked adult second language acquirers to write essays requiring the use of a target structure, then provided written input containing this structure, focusing subjects on the structure by asking them to underline forms in the input they felt were necessary to help them rewrite their essay. Subjects were asked to “reformulate” or reconstruct the text they had read containing the target form. Subjects improved either not at all or very little in this condition and in similar tasks in both studies.<sup>1</sup>

Mason (2004) is relevant both to this section as well as the previous one. Students of English as a foreign language in Japan who participated in an in-class free reading program volunteered for one of three supplementary activities: writing short summaries of what they read in their first language (Japanese), writing short summaries in English, or writing summaries in English and having their errors corrected. There were no differences in gains in reading and vocabulary among the groups. The extra output (writing) in English and getting corrected did not result in more English language acquisition.

### The Complexity Argument

The complexity argument presents a serious problem for any rival hypothesis that insists on the necessity of consciously learning rules of language or writing.

As has been documented elsewhere, there are too many vocabulary items to be learned one at a time; estimates of adult vocabulary size in the first language range from about 40,000 to over 150,000 words (Smith, 1988; Krashen, 2004). Also, word meanings are often subtle and complex, e.g. the difference between “vagrant” and “homeless” (Finegan, 1999), and word

knowledge often requires knowledge of grammatical properties (e.g. whether a verb is transitive or intransitive).

A number of papers have confirmed the enormous complexity of many rules of phonics (see Smith, 2004). In Krashen (2002c) I argue that attempts to provide simpler versions of complex phonics rule result only in more complex versions.

Spelling rules are also varied and complex (Smith, 1994). Cook (1912) demonstrated that even “simple” rules that teachers think are obvious and teachable (e.g. the famous “i before e” rule) are often not. In his study, high school and university students took a spelling test on words that exemplified spelling rules the students had studied the previous semester. When asked to state the rules, many could not recall them at all. Those who did often recalled a version that was much simpler than the one they had just studied.

Similar arguments have been made for grammar (Krashen, 1982), and writing style (Krashen, 1982; Smith, 1994);

### The Scarcity Argument

“I thought the answer (to how we learn to write) must be that we learn to write by writing until I reflected on how little anyone writes in school, even the eager students, and how little feedback is provided ... no one writes enough to learn more than a small part of what writers need to know” (Smith, 1988, p. 19).

In Krashen (1994) I reviewed the research on the frequency of oral output, writing, and correction. The results in all cases confirm Smith’s conclusion, and eliminate any strong view of the role of output and correction as a cause of language acquisition.

The data on the frequency of comprehensible output is similar (Krashen, 1998b, 2003). Acquirers don’t talk all that much, compared to how much they hear, and when they do talk, they do not often make the kind of adjustments the Comprehensible Output hypothesis claims are useful in acquiring new forms.

In some studies, language acquirers produced as little as one instance of comprehensible output per hour of interaction (Pica, 1988, Lyster and Ranta, 1997).

Shehadeh (2002) claims that his subjects (Shehadeh, 2001) and Iwashita (2001)’s subjects did much better, producing two instances of comprehensible output per minute of interaction. According to my reading of Iwashita’s paper, it was one instance per minute. More relevant, however, is the fact that in both studies, the situation was set up to explicitly induce comprehensible output, interactions in which partners had to work together to accomplish a task. Iwashita also notes that subjects made more syntactic than lexical modifications, but does not provide data. Comprehensible output is of limited value if it is only produced in contrived situations.

### Acquisition without Instruction/Output

Studies showing acquisition without instruction and acquisition without output also present serious problems for strong versions of skill-building and any output-based hypothesis.

The professional literature in reading contains many cases of children who learned to read on their own, with no, or very little, instruction on sound-spelling correspondences (e.g. Goodman and Goodman, 1982).

Very high levels of development of second language competence even for adults without formal instruction has been reported several times in the professional literature (Ioup, Boustagui, El Tigi, and Moselle, 1994; Krashen, 2000).

High levels of vocabulary development without instruction appears to be the norm. Very few of those with large vocabularies report that they worked through vocabulary-building books (Smith and Supanich, 1984) In addition, “read and test” studies confirm that readers can improve their vocabulary (and spelling) from reading alone. In these studies, readers read passages containing unfamiliar words, and are given a (surprise) test afterwards. Researchers concluded that when an unfamiliar word was seen in print, “a small but reliable increase of word knowledge” typically occurred (Nagy and Herman 1987, p. 26).

Case histories of great writers confirm that reading alone is enough to develop a very high level of competence in writing. Richard Wright, for example, tells us that in an attempt to become a writer, he “bought English grammars and found them dull. I felt I was getting a better sense of the language from novels than from grammars” (Wright, 1966. p. 275).

Spelling development without instruction has been confirmed for school children as well as second language acquirers:

Cornman (1902) showed that dropping formal spelling instruction had no effect on spelling accuracy for school children, whether measured in isolation or in compositions. (See Krashen and White, 1991, for a confirmation of Cornman’s results using modern statistics.) Hammill, Larsen and McNutt (1977) reported that children who had spelling instruction spelled better than uninstructed students in grades 3 and 4, but the differences disappeared by grades 4 and 5. This suggests that spelling instruction, when it works, only succeeds in helping children learn to spell words that they would have learned to spell on their own anyway.

Haggan (1991) showed that fourth year Arabic-speaking English majors at the University of Kuwait made fewer spelling errors in their writing than first-year students, even though little emphasis was put on explicit teaching of spelling in the curriculum.

Spelling competence can also grow without output, or writing: Similar to results reported for vocabulary acquisition, a number of studies have confirmed that each time readers read a passage containing words they cannot spell, they make some progress in acquiring the correct spelling (e.g. Nisbet, 1941). Readers also show deterioration in their spelling ability when they read misspelled versions of words they know (Jacoby and Hollingshead, 1990).

#### Preparing for TOEFL by Reading

Mason (in press) provides an example of acquisition without the presence of rival approaches that has enormous practical implications. Five adult second language acquirers in Japan who had studied English as a foreign language in classes that included free voluntary reading of graded readers agreed to engage in a recreational reading program to prepare for the TOEFL. Each of the five chose somewhat different reading material,

according to their own interests, with favorite authors including Sidney Sheldon, Paulo Coelho, Judy Blume, and Bertice Berry. In addition, several continued to read graded readers.

Subjects read for between one to four months, and took alternate forms of the TOEFL test before and after doing the reading. The average gain was 3.5 points per week on the overall test, and improvement was seen on all three components, listening (2.2 points), grammar (3.6 points), and reading (4.6 points). This gain is about the same as one sees with a full time TOEFL preparation class given in the United States and is consistent with Gradman and Hanania's results, presented earlier, showing that reading is an excellent predictor of TOEFL performance.

In addition to the evidence presented just above, in-school free reading studies confirm the acquisition of reading ability, vocabulary, spelling and grammar without instruction.

### Combination Hypotheses

Two weak forms of the Comprehension Hypothesis have been discussed, or assumed.

**Weak version 1: Comprehension is necessary but not sufficient. Without formal teaching and/or comprehensible output, the acquirer will not reach the highest levels of competence.**

I think the evidence is consistent with this version, but only in the sense that supplements can add competence of a different kind, consciously learned knowledge of language. As argued above and in previous publications, there are limits on how much language can be consciously learned and limits on its application. Nevertheless, consciously learned language can have value. Consciously learned rules of grammar can be used to edit output when the conditions for Monitor use are met, which occurs during the editing stage of the composing process. Conscious knowledge of a few basic rules of phonics can, at times, help make texts more comprehensible for beginning readers. Occasional explanation of an unknown vocabulary word or grammatical rule can occasionally serve to make input more comprehensible, whether or not it contributes to the acquisition of the item.

**Weak version 2: Acquisition is slow. Conscious learning and/or output can speed up the acquisition process.**

There is no evidence for this view. Direct comparisons of acquisition-based methods and methods based on rivals consistently show acquisition-based methods to be better, that is, faster. Of course, it is possible that some optimal mix of acquisition and learning will prove to be best, but so far this has not been the case. Adding output and correction, in fact, has been shown to make progress less efficient, not more (Mason, 2004).

### Animal Language

Research in animal language has examined the acquisition of communication systems that animals develop in interaction with others of their own species (but not always their own subspecies), as well as cases of animals acquiring human language (sign).



## Vervet Monkeys

During the first two to three years of their lives, young vervet monkeys acquire alarm calls that alert others to the presence of a predator. The calls are predator-specific. Hearing a specific alarm call from one monkey results in the others taking appropriate action, e.g. climbing a tree in one case, hiding in a bush in another.

The appropriate calls are gradually acquired. Very young monkeys (up to two to three years old) make “mistakes,” not distinguishing between predators and non-predators, and confusing types of predators.

When young monkeys get the call right, the call is often repeated by an adult, and this “reinforcement” is more likely to result in a correct alarm call by the young monkey the next time. This has been interpreted as evidence for a feedback model of acquisition (Cato and Hauser, 1992; Hauser, 1996). Also in support of an output plus feedback hypothesis is the finding that young monkeys have been seen to be punished for inaccurate alarms. Hauser (1987, reported in Cato and Hauser, 1992) observed five cases in which a young monkey gave an inappropriate alarm call and was punished (bit or slapped) by the mother. In three out of four cases, the young monkey’s next attempt to give the same alarm call was correct, suggesting (but not demonstrating) that correction worked. Cheney and Seyfarth (1990), however, “found no indication that mothers pay particular attention to infants who have behaved inappropriately” (p.135).

There is also evidence for the Comprehension Hypothesis. Cheney and Seyfarth (1990) report that young monkeys look at adults before responding to alarm calls, and that looking at adults increased the likelihood of a correct reaction to the alarm call, suggesting that the adults’ behavior is the context that makes the alarm calls comprehensible. In addition, comprehension appears to precede production of alarm calls: Cheney and Seyfarth report that six to seven month old monkeys consistently respond appropriately to alarm class, but the ability to produce an adult-like alarm call takes another 18 months to develop (p. 137).

## Birdsong

A major breakthrough in research on the acquisition of birdsong was Marler’s discovery that the white-crowned sparrow will only acquire the song typical of its species if the song is presented during a critical period, 10-50 days after birth. Marler demonstrated that birds that were raised in isolation and presented with tape-recordings of their species’ song acquired “abnormal” versions of the song if they heard it before they were 10 days old or after they were 50 days old (Marler, 1970).

The birds acquired the songs from input alone: There was no interaction with other birds (songs were presented on tape), no communicative use of the song, no feedback on success, no comprehensible output.

Subsequent research has increased the parallel between acquisition of birdsong and human language by demonstrating the importance of social context, what we have called a low affective filter and the impact of “club membership” (Smith, 1988). Baptista and Patrinovich (1984) reported that white-crowned sparrows can acquire songs beyond the 50 day limit (up to 100 days) if they hear the song from a live bird, not a tape recording. In fact, if the first song has been solidly acquired, a second song can be acquired up to 200 days

later, even if both are not the regular song of the bird's species (Petrinovich and Baptista (1987).

What is particularly interesting and supportive of the club membership concept is the finding that birds prefer the live song of a different species to the recorded song of their own species. For birds, apparently, a close friend is better than a distant relative.

Not all species can fully succeed in song acquisition from tape-recorded input alone. Starlings can acquire some features of song from tape, but do much better with a "live tutor." Chaiken, Bohnert and Marler (1993) reported that both "tape-tutored" and "live-tutored" starlings "developed songs displaying the basic features of species-specific song formation" (p. 1079), but the tape-tutored starlings' songs had "syntactic and phonological abnormalities" (1079). Nevertheless, the tape-tutored starlings did much better than starlings raised in isolation, and "were able to abstract general rules of song organization from the training tapes ..." (p. 1079).

The interesting question for the Comprehension Hypothesis is which aspects of the live input are essential for full acquisition of birdsong. The advantage could be context and/or affective factors (club membership). And of course, some version of the comprehensible output or output plus correction hypothesis may be at work, with the live bird providing feedback on appropriateness (comprehensible output) or form (output plus correction). From the description in Chaiken et. al. (1993) it appears that starlings who were live-tutored were very focused on the input: "The young birds appeared attentive to their tutors' singing. They perched near the tutor, oriented towards him, and ceased other activities" (p. 1089; West, King and Goldstein (2004) also note that starlings, like other species, have a "listening posture," a position in which they are quiet and cock their head to and fro while listening. When a starling hears a new sound, they "stop vocalizing to digest the vocal bite" (p. 384).

Is output/singing necessary to acquire song?

Songbirds typically go through several stages in acquiring song (Marler, 2004; p. 19), a subsong stage ("reminiscent of infant babbling"), a "plastic song" stage in which the bird sings a variety of songs heard previously (60 days duration), and a crystallization stage in which the bird chooses among the plastic songs. Anesthetizing parts of the vocal control mechanism during the subsong and plastic song stages does not result in any deficit in subsequent song production in the zebra finch (Pytte and Suthers, 2000), supporting the hypothesis that actual production is not necessary for the development of song. Disruption of the speech mechanism in later stages, however, did impair song development.

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Analogous studies with humans, the result of injury, have shown that language acquisition can proceed normally without babbling (Lenneberg, 1962) and that aural comprehension and written competence can develop without the ability to speak (Fourcin, 1975).

**Chimpanzees Acquiring Human Language (Sign)**

Fouts' descriptions of the acquisition of sign by one chimp, Washoe, contain a great deal of evidence for the Comprehension Hypothesis (Fouts, 1997).

Attempts to teach Washoe sign using direct instruction and conditioning failed, but “Washoe was picking up signs left and right by seeing us use them” (p. 78); by the time she was 5, she had acquired 132 signs and a rudimentary syntax similar to that developed in early human language acquisition (pp. 101-103). Fouts’ conclusions are consistent with the Comprehension Hypothesis:

“Nobody was teaching, much less conditioning, Washoe. She was learning. There is a very big difference. Despite the misguided attempts in the first year to treat Washoe like a Skinnerian rat, she was forcing us to accept a truism of chimpanzee and human biology: The child, not the parent, drives the learning process. If you try to impose a rigid discipline while teaching a child or a chimp you are working against the boundless curiosity and need for relaxed play that make learning possible in the first place. As the Gardners finally conceded: ‘Young chimpanzees and young children have a limited tolerance for school.’ Washoe was learning language not because of our attempts to school her but despite them” (p. 83).

Loulis, Washoe’s adopted son, was the first non-human to acquire human language from another nonhuman. Loulis began acquiring sign right away, “by watching his mother” (Fouts, p. 244), eventually acquiring 24 signs in 18 months. In a striking example of the effect of club membership, Loulis only acquired the signs he saw used by other chimps, not those used by humans.

There is, however, also evidence that direct teaching works in helping chimps acquire sign. In several instances, Washoe attempted to teach Loulis signs directly, using “molding,” taking Loulis’ hand and shaping it into the appropriate sign. In one instance, “with Loulis watching, Washoe signed FOOD over and over when one of the volunteers brought her a bowl of oatmeal. Then Washoe molded Loulis’s hand into the sign for FOOD and touched it to his mouth several times ... This maternal hands-on guidance seemed to work because Loulis promptly learned the FOOD sign” (Fouts, p. 244).

## Aliens

It is possible that alien language will be completely different from human languages. McKenna (1991) has suggested that aliens are already here and are already communicating with (some of) us: the aliens are psilocybin mushrooms and communication happens when we eat them.

Science-fiction writers often assume that at least some aliens will use ordinary human-type language, or languages that are easily translated into human language by translating devices.

The universal translator of Star-Trek has little trouble doing this, acquiring and translating at the same time. Its occasional problems and hesitations reveal that it operates on the principle of comprehensible input: the translator does not try to produce and then adjust its system when the communication fails (comprehensible output) nor does it get corrected. Rather, it listens and understands, and gradually acquires the system (see e.g. Star Trek Deep Space Nine, Episode 30: Sanctuary).<sup>3</sup>

A great deal of communication with aliens has been reported in accounts of UFO alien abductions. In the vast majority of cases, communication from alien to human is telepathic

(e.g. Fuller, 1966, Jacobs, 1998). It is not clear whether the aliens understand spoken language; Jacobs argues that human-alien communication is also telepathic (<http://www.ufoabduction.com/telepathy5.htm>). Clearly, research in this area has only begun.

It can be argued that making a reasonable case for the Comprehension Hypothesis in these domains does not add support for the hypothesis. According to the rules of science developed by Karl Popper, we only progress when we falsify a hypothesis. Finding additional evidence for a hypothesis or showing that the hypothesis applies to cases beyond those for which it was originally designed, does not add to its believability. Nevertheless, it is impressive when this happens.

## Notes

1. Note: McDonough (2005) reported a positive relationship between progress on the acquisition of question formation and the amount of modified input produced ( $r = .67$ ) for Thai students of English as a foreign language. During the three treatment sessions, each lasting ten minutes, all subjects who received clarification requests produced a total of only 32 instances of modified output related to questions. As 30 students were in this group, this averages to about one instance of modified output per subject. This sheds some doubt on the relationship between amount of modified output produced and acquisition and confirms that comprehensible output is scarce (see text).
2. The changes were, however, not species atypical, but were “within the range of variation present in songs of ... adult zebra finches” (p. 184).
3. In general, Star Trek gets a mixed report card on language acquisition theory. In the first episode of the series Star Trek Enterprise, Ensign Sato was observed using a version of the audio-lingual method in teaching an alien language at Star Fleet academy (Star Trek Enterprise, Episode 1: Broken Bow). But in a subsequent episode, Sato presented a perfect portrayal of a Monitor over-user (Krashen, 1981), hesitant to speak without a firm conscious knowledge of the grammatical system of an alien language. Captain Archer persuaded her that the survival of the Enterprise was more important than the subtleties of the future tense.

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