

The Contrast Theory of negative input*

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ABSTRACT

Beliefs about whether or not children receive corrective input for grammatical errors depend crucially on how one defines the concept of correction. Arguably, previous conceptualizations do not provide a viable basis for empirical research (Gold, 1967; Brown & Hanlon, 1970; Hirsh-Pasek, Treiman & Schneiderman, 1984). Within the Contrast Theory of negative input, an alternative definition of negative evidence is offered, based on the idea that the unique discourse structure created in the juxtaposition of child error and adult correct form can reveal to the child the contrast, or conflict, between the two forms, and hence provide a basis for rejecting the erroneous form. A within-subjects experimental design was implemented for 36 children (mean age 5;0), in order to compare the immediate effects of negative evidence with those of positive input, on the acquisition of six novel irregular past tense forms. Children reproduced the correct irregular model more often, and persisted with fewer errors, following negative evidence rather than positive input.

INTRODUCTION

A pervasive assumption in theories of child language acquisition is that parents do not correct the grammatical errors of their children. That is, the child is said to receive ‘no negative evidence’ (e.g. Pinker, 1989; Hyams, 1992; Jackendoff, 1993). Of course, this belief is naturally conditioned by how one defines the notion of correction in the first place. In fact, when one

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analyses extant ideas on what it means to be corrected, it emerges that current conceptualizations are either limited in scope (Brown & Hanlon, 1970) or conceptually flawed (Gold, 1967; Hirsh-Pasek, Treiman & Schneiderman, 1984). Moreover, it is apparent that, hitherto, little attention has been paid to the issue of how potential forms of negative input might fulfil a corrective function in practice (e.g. Bohannon & Stanowicz, 1988). *NEGATIVE INPUT* will be used here as a generic term to denote any kind of adult response, contingent on child grammatical errors, which embodies information conducive to the realignment of an overgeneralized grammar. Within the Contrast Theory of negative input two distinct forms of corrective information are identified, termed *NEGATIVE EVIDENCE* and *NEGATIVE FEEDBACK*, respectively. The focus in the current article is on negative evidence and its influence on the child's immediate speech output (cf. Farrar, 1992; Morgan, Bonamo & Travis, 1995). However, in contrast with previous work, an experimental methodology is adopted in order to compensate to some extent the inherent disadvantages of naturalistic data.

The specific aim of the present study is to compare the immediate effects of negative versus positive input on the acquisition of six irregular past tense verb forms. As defined here, negative evidence and positive input are identical in terms of the linguistic information conveyed to the child. They differ only in terms of the discourse context in which each occurs, since only negative evidence creates an immediate contrast between (erroneous) child and (correct) adult forms. It is predicted within the Contrast Theory that this unique discourse structure can fulfil a corrective function for the child. This prediction was supported by the finding that children are far more willing to reproduce the correct irregular model in their own speech output following negative, rather than positive, input.

Current definitions of negative input

Hitherto, three main contenders have been given serious consideration as possible sources of corrective information for the child:

- (1) a. an informant presentation (Gold, 1967)
- b. overt markers of disapproval (Brown & Hanlon, 1970)
- c. differential response rates (Hirsh-Pasek, Treiman & Schneiderman, 1984)

Of the three, the notion of differential responding has attracted by far the most attention, empirically (e.g. Hirsh-Pasek *et al.*, 1984; Demetras, Post & Snow, 1986; Penner, 1987; Bohannon & Stanowicz, 1988; Morgan & Travis, 1989; Farrow, Baillie, McLaren & Moore, 1993; Morgan *et al.*, 1995). For this reason, the discussion below will deal with this candidate in somewhat greater depth than the first two alternatives.

The concept of an informant presentation figures in Gold's (1967) mathematical model of language learnability. In this model, the task of the child is conceived as the selection of the target language from a hypothesis space comprising the full range of languages which could potentially be acquired. At least for the formal languages on the Chomsky Hierarchy (Chomsky, 1962, 1963; Chomsky & Miller, 1963), Gold demonstrated that the quality of the input is crucial if the child is ever to fix on the correct language. One form of input, known as an *INFORMANT PRESENTATION*, allows the learner to distinguish between sentences from the target language versus non-sentences from all other potentially learnable languages. That is, non-sentences are explicitly identified for the learner.

Following Gold (1967: 450, 453), there has been a strong tendency to confuse the notion of a labelled non-sentence, or *NEGATIVE INSTANCE*, with the labelling of child errors by a parent, in the act of correction (e.g. Pinker, 1989). A recent example of this confusion is provided by Atkinson (1992: 12), who suggests that under informant presentation 'the learner is exposed to both *POSITIVE AND NEGATIVE INSTANCES* from the target language together with an indication of which category they belong to' (original emphases). The problem with this interpretation, though, is that labelled non-sentences (negative instances) do not, in fact, belong to the target language at all. They are, instead, sentences drawn from all the other languages in the hypothesis space. Hence, a negative instance is defined as a non-sentence, only in the sense that it is not a sentence of the target language.

A sharp contrast can be drawn between this conceptualization of a 'negative instance' and the situation in which a child's grammatical error is corrected by the parent. When the child makes a grammatical mistake, it is normally clear that the error arises from a partial understanding or misapplication of the rules of the target grammar. Therefore, the issue of negative input is language-internal, and pertains only to those situations in which the child produces sentences which transgress the grammatical rules or principles of the language being learned. Notably, strings of pure, asyntactic nonsense are extremely rare in child language, for the simple reason that, unlike child speech, they do not derive from an identifiable system of grammar. In practice, the errors produced by children tend to be clearly recognizable, in the sense that they appear to stem from linguistic rules and processes predicated on those adhered to by adults. Thus, negative input is relevant to defining the strict bounds of grammaticality within a particular language. Its function is not to identify sentences in languages that are essentially irrelevant to the learning situation as implied by Gold's informant presentation.

The second potential source of corrective input, and perhaps the most widely cited, was examined by Brown & Hanlon (1970). They discovered that parents do not overtly disapprove of grammatical errors by means of

interjections such as *That's wrong* or *Don't say that*. Instead, such comments are closely associated with the SEMANTIC status of the child's utterances. The findings of Brown & Hanlon (1970) thus serve to rule out one possible source of negative input for the child. However, the modesty of this conclusion must be set against the much more ambitious claims commonly made on the basis of Brown & Hanlon's study. For their findings have been widely and persistently (mis)interpreted in support of the notion that 'there is probably NO information available to the child as to the grammaticality of his or her utterances' (Pinker, 1988: 105; my emphasis). In fact, though, Brown & Hanlon (1970) were keen only to refute the idea that parents subscribe to a behaviourist-inspired notion of correction, based on negative reinforcement. It was not their intention to confirm or disconfirm the existence of any other possible forms of correction.

The third potential source of corrective information for the child was identified by Hirsh-Pasek *et al.* (1984). Beginning with this study, a consistent finding has been that certain adult response categories, including expansions and clarification requests, follow ungrammatical child utterances more often than they follow grammatical child utterances (e.g. Hirsh-Pasek *et al.*, 1984; Demetras *et al.*, 1986; Penner, 1987; Bohannon & Stanowicz, 1988; Morgan & Travis, 1989; Furrow *et al.*, 1993; Morgan *et al.*, 1995). There is, then, a differential response rate, which, it was reasoned, might provide a signal for the child concerning the grammatical status of her utterances. However, it has become apparent that this notion of correction is seriously flawed in a number of ways.

The fundamental problem is that differential response rates are predicated on the occurrence and distribution of specific response CATEGORIES in the input. The child must be capable of recognising, say, an expansion *qua* expansion, in order to establish a basis for apprehending a differential response rate. On this view, therefore, the particular linguistic content of individual adult responses is, strictly speaking, immaterial (Saxton, 1993). However, it is not at all clear that young children would be able to identify input categories of this kind. To illustrate, Penner (1987: 383) scored an EXPANSION when 'the parent repeated part or all of the utterance and made additions and other grammatical or semantic changes to words and morphemes in the utterance'. The problem is that the child is somehow expected to generalize across a potentially limitless range of lexical and syntactic variation in order to extract the category of expansion (Marcus, 1993; Morgan *et al.*, 1995). Even if the child possessed this kind of processing capacity, it is extremely difficult to envisage what might motivate the child to seek out input categories of this kind in the first place. Thus, the all-embracing, amorphous nature of standard category definitions greatly diminishes confidence that they could ever be identified as psychologically real constructs by the child.

A further problem is the unlikelihood that the child could ever exploit the information from differential responding in practice. Drawing on probability theory and existing evidence, Marcus (1993) demonstrates that, if the child wishes to assess the grammaticality of a particular utterance, she would have to repeat that utterance a great many times in order to amass sufficient data from adult responses. The practical absurdity of this scenario stems from the fact that the adult response categories are not exclusively associated with child errors. They merely follow errors more often than correct utterances. How, then, is the child to know, unequivocally, that a particular recast, say, signals an error? The problem is that corrective information is held to derive from the overall PATTERN of recasts in relation to the grammaticality of child speech. Bowerman (1988: 96) first intimated that such response patterns provide indeterminate, or 'noisy' input (cf. Marcus, 1993), with the observation that 'if a child's first impulse on hearing such responses is to question the adequacy of his grammar, he would be continually trying to revise perfectly acceptable rules'. However, it is extremely doubtful that the 'noise' referred to by Bowerman and Marcus is detectable by the child in the first place. Arguably, the perceived 'noise' is no more than an artifact of the researcher's analytical framework.

The need to identify appropriate response categories does not represent the only burden on the child's processing capacities. Having extracted particular response types from the input, the child's next task is to somehow compute, or otherwise become aware of, whatever significant differential response rates there may be in the input. Again, it is stretching credulity to suggest that the young child's processing capacities could cope with the sequence of relatively sophisticated mathematical operations required for this calculation. At the very least, the child would require the ability to assign, with accuracy, each and every instance of a relevant adult response category to one of two accumulators, corresponding to GRAMMATICAL and UNGRAMMATICAL child utterances (cf. Wynn, 1992). Note that this procedure would have to be conducted individually for each grammatical structure giving rise to child errors. The contents of each accumulator must be stored in memory, so that the products of each can be compared with one another. Of course, the limits of the sample size selected by the child are not specified in any way, a fact which could greatly influence the outcome of any calculations. Moreover, when the child finally comes to compare the outputs of each accumulator, she is left to her own devices in assessing how great the differential between the two accumulators should be, before accepting it as a viable indicator of grammaticality.

Perhaps a more fundamental problem with the notion of 'category-as-correction' is that adult response categories cannot target individual grammatical structures. Instead, they are applicable to child sentences *in toto*, with the only relevant distinction being whether or not the sentence as a whole is

grammatical or ungrammatical. However, the stark message that an entire sentence is ungrammatical is not especially helpful. For the child would have no notion about which particular aspect of the sentence was in need of attention (Pinker, 1989: 12). However, it is precisely this kind of information which is required by the child, if the notion of differential responding is to have any value. The best a differential response rate could offer, though, would be to alert the child to the existence of a set of sentences containing an unspecified range of ungrammatical aspects, somewhere in amongst perfectly grammatical features. Clearly, therefore, negative input cannot apply to entire sentences. Instead, it must be interpretable by the child as being applicable only to those aspects of a sentence which render it ungrammatical. In contrast, adult categories like expansion, in and of themselves, can never reveal to the child the precise locus of error within a sentence.

Overall, a number of arguments have been presented which compel one to reject differential response rates in the investigation of negative input. The main objections can be summarized very briefly as follows:

- (2) *Against differential response rates as a source of negative input.*
 - a. Unwarranted emphasis on adult response CATEGORY rather than response CONTENT (Saxton, 1993).
 - b. Adult response categories probably too difficult for the child to identify (Marcus, 1993; Morgan *et al.*, 1995).
 - c. Adult response categories provide only an indeterminate source of information, since they are contingent on both correct and incorrect child utterances (Bowerman, 1988).
 - d. The child would have to repeat an utterance a great many times, in order to utilise the corrective information available in differential response rates (Marcus, 1993).
 - e. Computation of a differential response rate probably beyond the child's processing capacities.
 - f. Adult response categories such as recasts can never reveal the precise locus of ungrammaticality within a particular child sentence (Pinker, 1989).

To summarize so far, the study of negative input has been dominated hitherto by three possible sources of corrective information: an informant presentation; overt markers of disapproval; and differential response rates. A brief survey of these three candidates has revealed that two of them (an informant presentation and differential response rates) are conceptually flawed. In the final analysis, one is left only with Brown & Hanlon's (1970) concept of disapproval, which was ruled out on empirical, rather than conceptual, grounds. As mentioned above, though, the elimination of a single plausible candidate by no means exhausts all possibilities. Nevertheless, the 'no negative evidence' assumption has been allowed to proliferate, largely

unhindered, so that now it is often presented in the guise of a foundational empirical finding within developmental psycholinguistics (see, for example, Cole & Cole, 1993; Berk, 1994; Carroll, 1994).

The Contrast Theory of negative input

In falling prey to the siren influence of differential response rates, there is a danger that one will lose sight of the reasons why expansions, recasts and the like were advanced as likely sources of corrective information in the first place. One can avoid this outcome if one wrests attention back onto analyses in which corrective potential is assessed in terms of two fundamental factors: (1) the linguistic content of individual adult responses, and (2) the proximity of potentially corrective responses to child errors. When one takes these two factors into account, it becomes apparent that there are sufficient grounds for exploring further the corrective potential embodied in specific kinds of adult-child interaction. This potential is highlighted in the Contrast Theory of negative input, in which two distinct kinds of corrective input are identified, termed NEGATIVE EVIDENCE and NEGATIVE FEEDBACK. The current article focuses on the effects of negative evidence in particular (see Saxton, 1993, 1995 for a discussion of the occurrence and functioning of negative feedback).

(3) *Negative evidence*

Negative evidence occurs directly contingent on a child error, (syntactic or morphosyntactic), and is characterized by an immediate contrast between the child error and a correct alternative to the error, as supplied by the child's interlocutor, e.g.

(a) Child: He SHOOTED the fish.

Adult: He SHOT the fish!

(b) Child: I'm the Scarecrow and I can BEAT UP you.

Adult: I can BEAT you UP!

(c) Child: Do you know how Big Foot was BORNED?

Adult: No, how was he BORN?

Unless otherwise stated, the adult-child exchanges reported throughout are taken from a diary study in which the child was aged 4;1-4;9 (Saxton, 1995). There is ample evidence that negative evidence, as defined here, is supplied to the child. Thus, in all of the studies on differential response rates, it is apparent that many of the (specifically error-contingent) adult responses examined would qualify (Hirsh-Pasek *et al.*, 1984; Demetras *et al.*, 1986; Penner, 1987; Bohannon & Stanowicz, 1988; Furrow *et al.*, 1993). It should be stressed, however, that the category of negative evidence, as defined here, is conceptually far removed from the three candidate forms of correction

discussed above. In this regard, it is important to emphasize that, according to the Contrast Theory, corrective information is not held to derive from adult response categories *per se*. Thus, there is no expectation that the child be able to identify categories like recast or expansion. Instead, the child need only be capable of recognizing a relevant point of contrast between child and adult speech. It will be apparent that negative evidence, when conceived in this way, cannot easily be interpreted as indeterminate, or ‘noisy,’ from the child’s point of view. This assertion is based on three assumptions: first, negative evidence is so defined that it can only ever occur contingent on grammatical errors (cf. the concept of PARTIAL FEEDBACK in Marcus, 1993); second, on occasions when its corrective function is not fulfilled, it is highly unlikely that the child could be confused or misled in any way that might destabilize her grammar; third, it is assumed that other kinds of reformulation the adult might produce will not be misinterpreted by the child as being relevant to the correction of grammatical errors, nor otherwise introduce indeterminacy into the input of the kind described above. Theoretical and empirical evidence in support of the Contrast Theory is supplied in the Results and Discussion sections below.

Effects of negative input

Beyond the question of existence one must consider whether or not negative input exerts any influence on the child in the retreat from errors (Pinker, 1989). After all, there is a handful of well-worn anecdotes in the literature which document the child’s recalcitrance in the face of parental efforts at correction (Berko, 1958; Zwicky, 1970; Braine, 1971; Cazden, 1972). Beyond these anecdotal accounts, however, evidence is beginning to emerge that the child’s immediate responses to negative input are often consistent with their purported corrective function. Thus, the exchanges in (4) below exemplify the fact that children sometimes make an immediate shift from ungrammatical to grammatical forms for a given structure, following the intervention of negative evidence.

(4) *Immediate effects of negative evidence*

- a. Child: I got a little bit of pooh on me, but I don’t know how MANY.
Adult: Well, how MUCH have you got?
Child: I told you. Not MUCH.
- b. Child: It’s even GOODER than anything. [repeated four times]
Adult: Yes, it is BETTER.
Child: BETTER, yeah.
- c. Child: That policeman FALLED all the way down to the tiger.
Adult: He FELL down.
Child: Yes, he did.
He FELL down ’cos he likes that tiger.

Farrar (1992) found that children imitate the correct adult model around 12 % of the time when it is presented in the form of a so-called CORRECTIVE RECAST. Similarly, Morgan *et al.* (1995) report that Roger Brown's (1973) subjects, Adam and Eve, switch from erroneous to correct forms on 23 % and 29 % of occasions, respectively, following so-called TARGET RECASTS of article errors. Significantly, the class of responses encompassed by these two categories would seem to overlap largely with that covered by the definition of negative evidence offered in (3) above. Thus, naturalistic data reveal that children do sometimes shift from erroneous to correct versions of particular structures following the intervention of negative evidence (see also Saxton, 1995).

Even more impressive, naturalistic data have revealed that children are more willing to adopt correct adult forms when they are modelled as negative rather than as positive input (Farrar, 1992). Comparisons of this kind are useful for establishing whether or not the input categories defined by the researcher are distinguished in practice by the child. For the purposes of this study, positive input is defined as any input utterance which models grammatical structures, excluding all instances of negative evidence. Thus, negative evidence supplies the correct adult model directly following a child error, while positive input supplies the correct form in all other discourse contexts. Since positive input, so construed, cannot be contingent on child errors, a direct comparison with negative evidence (which only ever follows errors) can be achieved.

On standard nativist definitions, the discourse context in which grammatical information is supplied is immaterial (e.g. White, 1989; Goodluck, 1991; Marcus, 1993). From a nativist perspective, the only input resource available to the child is the LINGUISTIC information. In consequence, a nativist prediction would be that negative evidence and positive input, as defined here, will be identical from the child's point of view. Fortunately, one is afforded the opportunity to test the two competing explanations empirically. Negative evidence, as defined in (3) above, should provide a powerful source of information concerning the bounds of grammaticality. Hence, the Contrast Theory supplies the general prediction that negative evidence will be more effective than positive input, in terms of encouraging the child to shift towards usage of correct adult forms. From a nativist perspective, on the other hand, there should be no difference in the immediate effects of either form of input.

In order to test the predictions outlined above, an experimental design was implemented. Hitherto, the study of negative input has relied almost exclusively on analyses of naturalistic corpora of adult-child conversations. While data of this kind are important on their own account, it is nevertheless impossible to isolate unequivocally the effects of one kind of adult input from all others. Thus, if a child switches from erroneous to correct forms following

negative evidence, one can never be certain that information adduced from the input on a previous occasion is not, at least in part, responsible for the child's current response. In contrast, an experimental design affords the possibility of strict control over the sources of information available to the child regarding particular linguistic structures.

METHOD

An experimental approach was made possible through the adaptation of a standard technique in psycholinguistic research, namely, the teaching of nonsense words to child subjects (Berko, 1958). In the present study, children are taught six novel verb forms which are designated as irregular by the experimenter. Subjects then encounter the correct irregular past tense form for a given verb in one of two conditions: either as positive input or as negative evidence. The aim was to monitor the influence of each form of input on the child's own subsequent production of past tense forms.

Subjects

Subjects comprised 36 children, eighteen boys and eighteen girls, ranging in age from 4;9 to 5;6 (mean age 5;0). Subjects were assigned at random to one of six groups for the purposes of training on the novel verbs.

Materials

Verb forms. Previous work (Saxton, 1993) has revealed that, provided novel verb forms are devised with care, the child's propensity to produce past tense forms is determined neither by the distinction between novel versus real (e.g. *smite*; *fling* versus *bloog*; *pren*) nor by the distinction between regular versus irregular (e.g. *jab*/*jabbed*; *seb*/*sebbed* versus *fling*/*flung*; *pren*/*pron*). In consequence, it was decided to concentrate solely on novel verb forms in the present study, since one can exercise far greater control over the input information supplied to the child than is the case with genuine verbs.

Novel verb forms were created which rhymed precisely with real verb forms, both in their base and past tense irregular forms, as shown in Table 1 below. Verb meanings were selected or devised so as to denote a manner of action, in accord with the finding that 'preschoolers appear to have a preference for a novel verb to encode manner of action rather than change of state' (Naigles, 1991: 75). In order to facilitate the training process, all of the actions were also designed so that the children could easily enact them for themselves, rather than passively watch a demonstration or look at pictures in which the actions occur.

Each novel verb was assigned to one of two groups on the basis of the way in which the past tense was formed. Thus, the past tense for Group I verbs

TABLE 1. *Meanings and past tense alternations of six novel verb forms*

Verb type	Novel verb alternations	Novel verb meanings	Real verb counterparts
<i>Group I verbs</i> (vowel change only)	pro/prew	Twisting motion applied with a cross-ended stick.	throw/threw
	neak/noke	Repeated clapping motion in which target is trapped between the palms.	speak/spoke
	jing/jang	Striking a target with a beanbag flipped from a spoon.	sing/sang
<i>Group II verbs</i> (vowel change plus ED suffix)	streep/strept	Ejection of a ping-pong ball from a cone-shaped launcher towards target.	creep/crept
	sty/stought	Prodding action performed with a plastic stick which concertinas on contact to produce a honking noise.	buy/bought
	pell/pold	Striking action achieved by swinging a beanbag on the end of a string towards target.	sell/sold

was formed by a vowel change only: *pro/prew*; *neak/noke*; *jing/jang*. Group II verbs, on the other hand, required a vowel change plus the addition of the regular past tense suffix (denoted ED for convenience): *streep/strept*; *sty/stought*; *pell/pold*. The reason for devising two subgroups in this way was to provide a more subtle indicator of effectiveness. Thus, children might be sensitive to the lack of ED suffix on Group I past tense forms, and correspondingly produce more non-ED forms like *pro* or *prew*, than ED forms like *proed*. Conversely, for Group II verbs, it is predicted that children will produce more ED forms like *streeped* or *strept*, than non-ED forms like *streep*. Thus, although children may not reproduce the correct irregular form precisely in their own speech, they may nevertheless demonstrate sensitivity to the presence or absence of an ED suffix. Specifically, it was predicted that, in the Negative Evidence condition in particular, the child should produce fewer ED forms for Group I, as opposed to Group II, verbs.

Inducing past tense forms. In order to induce past tense forms from children, the six verb actions featured in a puppet narrative which was produced on video. The narrative followed a cyclical plot structure, in which a dragon is constantly thwarted in his attempts to sleep. In the first instance, the dragon is seen falling asleep. Two characters are then shown complaining about the dragon's snoring, before plotting to wake him up by means of one of the six verb actions. One of the characters approaches the sleeping dragon, performs the verb action and then disappears, leaving the dragon to wake up,

roaring loudly. In this way, a past tense context for the verb is created, since one can pause the video at this point and ask the child *What happened?* An appropriate response to this question clearly demands the production of a past tense form. When the video is resumed, the dragon is shown falling asleep once more. The character who performed the verb action is then shown meeting up with a new character, who complains about the former's lack of success and boasts about a better method for waking the dragon. In discussing the new method, the verb is used twice, one in the base form and once in the *-ing* form. At this juncture, the cycle begins all over again and the new character attempts to wake the sleeping dragon. The novel verbs occur in the following order in the video: *pro-jing-neak-streep-pell-sty*.

Procedure

A within-subjects design was adopted in which each child was exposed to positive input for three of the verbs and negative input for the remaining three verbs. In this way, it was possible to compare the levels of responsiveness of individual subjects to each form of input. Subjects were assigned to one of six groups, each containing six children. To avoid the association of a given verb with a particular input condition, the verbs were rotated through the six groups of six children. Each of the six test verbs occurred in the Positive Input and Negative Evidence conditions on an equal number of occasions.

Training phase. The training phase was implemented over three consecutive days in three separate sessions. In the first two sessions, each lasting roughly 15 to 20 minutes, subjects were exposed to the novel verbs in their groups of six. As before, subjects only ever heard the test verbs in the base and *-ing* forms, and were not encouraged to PRODUCE past tense forms. In the two group sessions, use was made of the glove puppets which appear in the video, along with the appropriate props. Thus, children were variously encouraged to perform the verb actions themselves and also act them out with one of the puppets as the protagonist. At some point in the proceedings, children were paired off with one another, making it easier for the experimenter to check that each child could both comprehend and produce all of the verb forms. The final training session took place on the third day, immediately prior to the testing phase, and comprised a simple picture description task. In this way, it was possible to gauge whether or not the child was thoroughly familiar with each verb. Both this final training session and the subsequent testing session were conducted on an individual basis. Throughout the training sessions, an effort was made to demonstrate that verb meanings were not associated exclusively with a particular target, but instead were based solely on a manner of action, performed in some cases with an appropriate prop.

Testing phase. In the testing phase, past tense forms were elicited by pausing the video at the point where the dragon wakes up. It is at this point that the two experimental conditions are distinguished from one another. In the Positive Input condition, the experimenter stopped the video and first supplied the child with the correct past tense form, couched within a comment on the preceding action (e.g. *Oh look, he strept his tummy*). If the child failed to respond with some form of the relevant verb, then she would be encouraged further with questions like: *Can you tell the dragon what happened?* or *Is that right? Tell the dragon what happened.* In the Negative Evidence condition, children are initially asked *What happened?*, and only after they have produced a past tense form of their own is the correct irregular form provided. Since the experimenter has designated the verbs as irregular, and since the child has never heard the correct past tense form before, the child inevitably produces an error in the Negative Evidence condition. Typical errors included overregularized forms (e.g. *neaked*; *pelled*; *stied*), in addition to base forms in a past tense context (e.g. *He streep his tummy*). An error having been produced, the experimenter immediately supplied the child with negative evidence concerning the correct irregular form.

Subject responses were initially allocated to one of four categories: Use Correct; Irregular Vowel; Persist-with-Error; and Move-On. In Use Correct (UC) responses, the child utterance correctly exemplifies the correct irregular past tense form as modelled by the experimenter (e.g. *prew*). An Irregular Vowel (IV) response is similar to a UC response, in so far as the child correctly reproduces the vowel of the irregular past tense form, although in other respects the response does not match perfectly with the adult model (e.g. *prewed*). A Persist-with-Error (PE) response was scored when the child repeated or produced an erroneous past tense form, while Move-On (MO) responses were coded for all other child responses (including no further use of the target verbs). The sequence of events in each of the two input conditions is summarized via the exchanges in (5) and (6) below.

- (5) *Negative Evidence Condition*
 Adult: What happened?
 Child: He PELL~~E~~D him on the leg.
 Adult: Yes, he POLD him.
 Child: UC/IV/PE/MO
- (6) *Positive Input Condition*
 Adult: Look what happened!
 He POLD him on the leg.
 Child: UC/IV/PE/MO

RESULTS

It will be recalled that each child is exposed to three verbs in the Positive Input condition and three verbs in the Negative Evidence condition. Table 2 below summarizes the numbers of responses in each category, for each verb, summed across all 36 children.

Perhaps the most striking feature of these results is the zero score for Use Correct (UC) responses following positive input. Taken together with the zero score for Irregular Vowel (IV) responses also, it would seem that the children in this study are signally reluctant to use the correct irregular form when it is presented as positive input. Instead, there is a strong tendency to ignore the correct adult model and produce an erroneous past tense form instead, as signalled by the high level of Persist-with-Error (PE) responses in the positive input condition. In sharp contrast, the same children do reveal a willingness to use the adult model when it occurs in the form of negative input. In fact, 23 of the 36 subjects produced at least one UC response, while a total of 29 children produced a minimum of either one UC or one IV response in the Negative Evidence condition. Overall, UC responses accounted for about 30% of the total, with IV responses accounting for a further 13%. The large discrepancy between the two conditions was confirmed by means of the McNemar formula, which allows one to determine the extent to which individual subjects produce the correct model in one condition rather than another. When subject responses were re-categorized as either Use Correct (UC) or Not-Use-Correct (\sim UC), it emerged that subjects who produce UC responses following negative evidence were unlikely to produce the same kind of response following positive input ($\chi^2 = 21.043$, $df = 1$; $p < 0.0005$). (IV responses were categorized as \sim UC.)

The final indicator of input effects was the level of ED responses produced for Group I versus Group II verbs. It will be recalled that Group I verbs form the past tense via a vowel change only (*pro/prew*, *neak/noke*, *jing/jang*), while Group II verbs require both a vowel change and the addition of the ED suffix (*streep/strept*, *sty/stought*, *pell/pold*). In consequence, relatively low levels of ED responses were predicted for Group I verbs in the Negative Evidence condition in particular. Thirty of the original thirty-six subjects were exposed to Group I and Group II verbs in both Positive Input and Negative Evidence conditions. Subject responses were re-categorized according to the presence or absence of an ED suffix, and appropriate contrasts were computed corresponding to the main effects of input type (positive versus negative), verb type (Group I versus Group II) and the interaction between the two (input \times verb type). Summing responses across both input conditions, it emerged that there were fewer ED responses for Group I as opposed to Group II verbs (Wilcoxon $Z = 2.629$, $p < 0.004$). However, a

TABLE 2. *Child responses in Positive Input and Negative Evidence conditions*

Verb	Positive input				Negative evidence			
	UC	IV	PE	MO	UC	IV	PE	MO
Group I								
pro	0	0	17	1	6	1	5	6
neak	0	0	16	2	6	4	5	3
jing	0	0	14	4	2	3	8	5
Group II								
streep	0	0	16	2	4	3	5	6
sty	0	0	12	6	7	0	7	4
pell	0	0	17	1	7	3	3	5
Total	0	0	92	16	32	14	33	29
(%)	(0.0)	(0.0)	(85.2)	(14.8)	(29.6)	(13.0)	(30.6)	(26.8)

KEY: UC, Use Correct; IV, Irregular Vowel; PE, Persist-with-Error; MO, Move-On.

similar comparison between levels of ED responses in the Positive Input versus Negative Evidence conditions did not reveal a significant difference (Wilcoxon $Z = 0.417$, $p < 0.792$); nor was there any significant interaction between input type and verb type (Wilcoxon $Z = 1.308$, $p < 0.191$). Overall, therefore, it would seem that children are sensitive to the difference between Group I and Group II verbs. However, children seem just as likely to suppress ED responses for Group I verbs in the Positive Input condition as in the Negative Evidence condition.

DISCUSSION

The experiment described above reveals that children are far more willing to reproduce a correct irregular past tense form when it is presented in the form of negative, rather than positive, input. In this respect, these findings provide a replication of Farrar (1992), whose study was based on naturalistic data. The only discernible influence of positive input on subjects was in the depressed levels of ED responses recorded for Group I verbs. In the Positive Input condition, this effectively means that subjects were especially likely to produce an uninflected base form for Group I verbs (e.g. *He pro his head*). In fact, negative input was equally effective in depressing levels of ED responses for Group I verbs, although in this case, of course, non-ED responses comprised both base forms and the correct past tense form modelled by the experimenter (e.g. both *pro* and *prew*).

A limitation of the current study is that it reports only on the immediate effects of negative input. It remains to determine, therefore, how short-term gains might feed into the long-term process of recovery from over-generalization. Morgan *et al.* (1995) provide an initial examination of the long-term impact of corrective input, but their findings are controversial in

interpretation. Amongst other problems, the data on Adam, Eve and Sarah (Brown, 1973) are inherently ill-suited to the econometric time series analyses they attempt (see Saxton & Kulcsar, 1995; Saxton, forthcoming, for more detailed discussion). Clearly, research on long-term effects is in its infancy, but it should be clear that the methodology outlined here could readily be adapted in pursuit of an experimental approach to this issue.

A distinct advantage of the current experimental design is that it allows the effects of positive input and negative evidence to be isolated for the first time. Naturalistic data, on the other hand, can never eliminate the possibility that prior experience (in any combination of positive and negative input) may have influenced the child's behaviour. Apparently, the experimental method adopted here throws into sharp relief the differences between the two forms of input. Certainly, the contrast between the effects of positive and negative input are more pronounced in the experimental setting described here than has been reported in studies based on naturalistic data (cf. Farrar, 1992; Saxton, 1995). It is worth asking, therefore, what factors might contribute to the heavy bias in favour of negative evidence. Perhaps the single most important factor in the experimental design is that, prior to the testing phase, the child has no experience of the correct irregular past tense form at all. Moreover, the experimenter models the correct form only once. In the case of negative evidence, this paucity of experience does not seem to disadvantage the child. It is possible, though, that this factor is especially potent in depressing the child's performance in the Positive Input condition. Certainly, positive input occurs far more frequently than cases of negative evidence in naturalistic data. In the course of normal adult-child discourse, therefore, a given irregular past tense form will be modelled as positive input on several occasions. Thus, the sheer quantity of exposure to a given linguistic form may well be especially important in the case of positive input, when it comes to encouraging the child to reproduce the adult model in her own immediate speech output.

It may also be noteworthy that positive input occurs in a wide range of discourse contexts, not simply the one investigated in this study. Conceivably, the child may respond selectively to different kinds of positive input. If this proved to be the case, though, one would have to abandon the nativist assumption that positive evidence constitutes no more than 'evidence that a particular form exists in a language' (Goodluck, 1991: 142). In the present study, it was shown that the child's responses are critically affected by the discourse context within which linguistic information is presented. Hence, support is accrued for the idea that there is, in fact, more to the input than examples of grammatical sentences (see also the papers in Galloway & Richards, 1994).

An examination of the discourse contexts of each form of input reveals how negative evidence is uniquely suited to supplying the child with genuinely

corrective information. Thus, in the Positive Input condition, the adult models the correct past tense form, which the child is then at liberty to imitate or otherwise ignore. There is no element of correction in the proceedings, if only because the child has not committed an error. Thus, even if the child imitates the adult, there is no sense in which one could impute a corrective function to the adult utterance. In the Negative Evidence condition, by contrast, a Use Correct response requires the child to reject her own (erroneous) version of the past tense and adopt instead the alternative (correct) version offered by the adult. Of course, this kind of behaviour is precisely what one would expect if the adult response was exerting a corrective influence on the child. The process by which negative evidence might fulfil a corrective function is set out in the so-called Direct Contrast hypothesis in (7) below.

(7) *The Direct Contrast hypothesis*

When the child produces an utterance containing an erroneous form, which is responded to immediately with an utterance containing the correct adult alternative to the erroneous form (i.e. when negative evidence is supplied), then the child may perceive the adult form as being in CONTRAST with the equivalent child form. Cognizance of a relevant contrast can then form the basis for perceiving the adult form as a correct alternative to the child form.

The corrective potential of negative evidence is seen to arise from the immediate juxtaposition of child and adult forms. For it is predicted that a direct contrast, or conflict, is created between the two forms, which can presage awareness in the child that the form she has produced is erroneous. The Direct Contrast hypothesis predicts that negative evidence is especially well adapted for highlighting not only the existence of such contrasts, but moreover, for revealing which of two linguistic forms should be retained and which rejected.

The following exchange will help illustrate the discussion of how the child might become aware of the contrast between correct and erroneous forms.

- (8) Child: Well, I feeled it.
 Adult: *I* felt it.
 Child: *I* felt it.

The most striking aspect of the exchange in (8) is that the adult has selected a different form to the child for expressing the past tense of *feel*. But why should the adult do this? After all, the context of utterance is shared jointly by both child and adult, in as much as they are both referring to the same event, at the same time. In consequence, one might predict that the child will be surprised at the adult's selection of *felt* rather than *feeled*. The reason is

that the child's choice of *feeled* is immediately flouted by the adult. As a result, the child's faith in the interchangeability of the two forms may be shaken. It is predicted, then, that the child will be sensitive to the way in which the adult shuns the child's own selection, both directly and conspicuously, in favour of an alternative form. In this way, the child will perceive her own selection to be ill-favoured, a perception which is in natural accord with the ungrammatical status of the child form in the adult grammar.

On this account, it is apparent that the child requires some prior knowledge in order to be able to exploit the corrective potential of negative evidence as defined here. Critically, though, the child does not need to be equipped *a priori* with a knowledge of the adult grammar in order to identify a particular form as an error (cf. the discussion of recasts in Marcus, 1993). Instead, the knowledge required by the child is that two forms, such as *bought* and *buyed*, fulfil identical grammatical functions. It is noteworthy in this respect that child errors, including overregularizations, tend to occur as part of an overgeneralized system, since child speech often exemplifies both grammatical and ungrammatical versions of a given structure (e.g. Marcus, Pinker, Ullman, Hollander, Rosen & Xu, 1992). On the assumption that the child will be able to apprehend that the two forms are functionally equivalent, the Direct Contrast hypothesis predicts that negative evidence can then highlight for the child that, in fact, the adult has a preference for one of the two forms over the other. On this view, negative evidence provides the ideal means for revealing the contrast between two forms which previously fulfilled the same function for the child.

On a related matter, if the child is to benefit from negative evidence she must be able to focus on just those points of contrast which are relevant to the realignment of an overgeneralized grammar. It is equally clear, though, that child and adult utterances can diverge from one another in many different ways. Arguably, however, the child can be alerted to the presence of a corrective contrast only in cases where two linguistic forms fulfil the same grammatical function for the child. Without this natural link between two forms, there would be no basis for going on to observe a contrast in usage between them. By this token, it is highly unlikely that the child would misinterpret just any two structures, one each selected from consecutive child and adult utterances, as fulfilling identical grammatical roles. If the child did proceed in this way, her nascent grammar would very quickly be devastated by the rejection of structures mistakenly identified as being in conflict with adult forms. Since child grammars do not appear to suffer from this kind of disintegration, one can reasonably assume that children are not in fact distracted by the many spurious points of contrast between child and adult utterances. At the same time, the findings of the present study contribute to a growing body of evidence that children can and do identify RELEVANT points of contrast, despite what other differences may exist

between child and adult utterances, and adopt the form favoured by the adult in place of their own version (Farrar, 1992; Morgan *et al.*, 1995).

It is noteworthy that the kind of immediate contrast illustrated in (8) can arise only in cases of negative evidence. No such contrast exists in cases of positive input, as the (constructed) exchange in (9) illustrates.

- (9) Child/Adult: [any utterance excluding a child error with the past tense of *feel*]
 Adult: I felt it.

The 'free-floating' occurrence of *felt* in the input to the child doubtless serves the purpose of underscoring its acceptability in the adult grammar. However, it cannot point to the conflict which exists between *felt* and *feeled*. As a result, the adult model in this case cannot be interpreted as a source of corrective information for the child. In contrast, Morgan *et al.* (1995: 194) suggest that positive input COULD fulfil a corrective function, if the child undertakes to make 'covert comparisons between parental utterances and how the children themselves would have said the same sentences'. But what would prompt the child to make such a comparison in the first place? Simply hearing a positive exemplar cannot provide the trigger, since an over-generalized system, by definition, permits both erroneous and correct forms to coexist quite happily. Thus, on this account, there must be some prior motivating force which suddenly allows the positive instance to be re-interpreted by the child as the trigger for change. By itself, though, there is nothing in a positive exemplar to suggest that it could INSTIGATE the retreat process.

Evidently, the Direct Contrast hypothesis relies on the assumption that the child can make relevant comparisons between aspects of her own speech and those produced by the adult. In this respect, the hypothesis echoes Nelson's (1987) rare event cognitive comparison theory. In other ways, though, it is clear that both the phenomena being explained and the mechanisms of change being proposed are quite different. Thus, in Nelson's theory, learning is assumed to proceed on the basis of comparisons made by the child between acquired and to-be-acquired aspects of linguistic structure. For example, the child might acquire a new sentence structure (e.g. *The alligators will swim*) via cognitive comparisons with established structures (e.g. *The alligators swim*). The Direct Contrast hypothesis, on the other hand, deals with a situation in which the child already possesses, say, both *feeled* and *felt* in her productive repertoire, or can readily apprehend their functional equivalence.

With regard to the mechanisms of change, the Direct Contrast hypothesis suggests that the immediate juxtaposition of child and adult forms can provide the impetus for the child to compare the two forms. By contrast, the rare event theory is more vague about what might bring particular mismatches between new and current structures to the child's attention,

suggesting only that ‘what the child has already learned about the language may effectively prepare the child to look for certain kinds of new information and new structures’ (Nelson, 1987: 291). There is a difference, though, between being in a position to exploit new input information, and actually seeking out that information. One is thus still left with the problem of explaining what causes the child to make critical comparisons in the first place. In this respect, the potential benefits of so-called ‘growth recasts’ have been intensively explored by Nelson and his colleagues as a particularly effective context for presenting the child with challenging new language forms (e.g. Nelson, Denninger, Bonvillian, Kaplan & Baker, 1984). As mentioned above, specifically error-contingent recasts often embody instances of negative evidence, as defined within the Contrast Theory. One must ask, therefore, whether adult responses of this kind could simultaneously perform the functions of alerting the child to new structures, as well as revealing the unacceptability of certain ‘old’ structures. In principle, there should be no conflict of interest, since negative evidence can only function in cases where the child can easily perceive a functional equivalence between two forms. In the case of two entirely independent grammatical structures, as dealt with by the rare event theory, each structure would be used to encode quite different meanings and would presumably be deployed in entirely distinct situations. Hence, the child would be unlikely to assume that they fulfilled the same grammatical function, in the way that *feeled* and *felt* can both function as past tense forms for the verb *feel*.

To return to Nelson’s example, any comparison made between the structures in *The alligators swim* and *The alligators will swim* would be made on the basis of the different meanings they encode and the different contexts in which each is uttered. According to Nelson, this comparison can be made ‘off-line’, although ‘growth recasts’ are assumed to be especially efficacious for presenting challenging new structures to the child. An immediate problem is that the child utterance *The alligators swim* could be regarded as either grammatical or ungrammatical from an adult perspective. Thus, if the child is referring to an habitual event, then the sentence is acceptable, but if a future event is being referred to then the utterance is incorrect owing to the missing auxiliary *will*. Generally, one can assume that the context of utterance will reveal the child’s intentions to the adult. If an habitual event were under discussion, it is highly unlikely (although again, subject to empirical verification) that the adult would respond with *The alligators will swim*. Hence, it is unlikely that a recast would provide the child with the opportunity to observe the kind of mismatch between the independent grammatical structures discussed by Nelson. On the other hand, if both child and adult are discussing a future event, then it is highly feasible that the child utterance *The alligators swim* would be responded to with something like *The alligators will swim*. In this event, a specifically corrective influence would be

imputed to the adult utterance by the Direct Contrast hypothesis. If, as seems likely, both child and adult are talking about a future event, then the functional equivalence of child and adult structures should be easily apprehended by the child. Given this parity of grammatical functions, the way is left open for the child to observe that, when referring to future events, the adult prefers a sentence pattern in which the auxiliary is included.

It is beyond doubt that negative evidence, as defined here, is supplied to many children, since responses of this kind have been reported in every empirical study on negative input (see Introduction section). However, many questions concerning the occurrence and functioning of negative input remain to be addressed. For example, it remains to determine whether all children receive negative input, and also whether it is available for all kinds of grammatical error. With regard to the effects of negative input, both short-term and long-term, naturalistic data are still rather scarce, and subject to controversy in interpretation (cf. Morgan *et al.*, 1995; Saxton & Kulcsar, 1995). Beyond issues of existence, generality and effectiveness, one is also faced with the daunting empirical task of establishing whether or not negative input constitutes a necessary component of language acquisition (cf. Pinker, 1989). In this respect, one must be mindful that even if one could demonstrate that negative input was necessary, one could not thereby reject the concept of innate knowledge of grammar (*contra* Bohannon, MacWhinney & Snow, 1990: 222). The simple reason is that the child's genetic endowment at birth is entirely unaffected by the state of the linguistic environment. One must also take into account the fact that negative input has no relevance for WHAT linguistic items are acquired by the child. Thus, corrective input cannot impinge on the way linguistic structures are initially acquired, in the creation of an overgeneralized system. Instead, negative input comes into play, if at all, only after an overgeneralization has manifested itself in the child's speech. Thus, while Universal Grammar may or may not contribute to the initial learning of linguistic structures, negative input may or may not contribute to the subsequent process of 'unlearning', that is, the shedding of ungrammatical forms.

Our current level of knowledge concerning the way in which the child retreats from overgeneralization does not allow one to rule out either negative input or alternative mechanisms as possible influences on the child. Nor are these two classes of explanation mutually exclusive. Thus, the discovery that negative input plays a role in the recovery from errors would not allow one to conclude that innate factors and positive input have no role to play in the retreat from overgeneralization. In fact, it would not be surprising to discover that all three factors (innate attributes, positive input and negative input) contribute in some way. In consequence, it would make more sense to discuss this issue in terms of THE RETREAT PROBLEM faced by the child, rather than the 'no negative evidence' problem. In addressing the retreat problem, the

Contrast Theory supplies a plausible explanation for how the child could come to identify the occurrence of an ungrammatical form and, ultimately, expunge it from the developing grammar. Moreover, in testing the specific predictions generated by the Contrast Theory, it is apparent that the experimental methodology described above provides a valuable supplement to analyses based on naturalistic data.

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