

## **UC Merced**

### **Proceedings of the Annual Meeting of the Cognitive Science Society**

#### **Title**

Remarks on the Psychological Reality of the Subset Principle: Its Relation to Universal Grammar as a Model of the Initial State

#### **Permalink**

<https://escholarship.org/uc/item/68p1q7g2>

#### **Journal**

Proceedings of the Annual Meeting of the Cognitive Science Society, 8(0)

#### **Author**

Lust, Barbara

#### **Publication Date**

1986

Peer reviewed

REMARKS ON THE PSYCHOLOGICAL REALITY OF THE  
SUBSET PRINCIPLE: ITS RELATION TO  
UNIVERSAL GRAMMAR AS A MODEL OF THE INITIAL STATE<sup>1</sup>

Barbara Lust  
Department of Human Development and Family Studies  
Cornell University

Recent theory of language learnability has argued that the "Subset Principle", as defined in 1, significantly constrains the language learner's induction from primary language data (PLD) to the knowledge of language. This "Subset Principle" was argued formally to maximize learnability probabilities, in fact to be "necessary and sufficient for identifiability from positive evidence" given an inductive and deterministic mechanical model of language learnability (Angluin, 1980). Recently, there has been additional argumentation that the Subset Principle (SP) empirically characterizes acquisition of natural language (Berwick, 1982, 1985). In fact, it has been argued that "a single characterizing condition, the Subset Principle, subsumes all acquisition ordering constraints that have been proposed in the linguistic literature... This result is not surprising, since the Subset Principle is a necessary condition for acquisition from positive-only evidence" (Berwick, 1982, 240, cf. 1985, 275).

- (1) Condition 1. An indexed family of nonempty languages satisfies Condition 1 if and only if there exists an effective procedure which on any input  $i \geq 1$  enumerates a set of strings  $T_i$ , such that
- i)  $T_i$  is finite
  - ii)  $T_i \subseteq L_i$ , and
  - iii) for all  $j \geq 1$ , if  $T_i \subseteq L_j$  then  $L_j$  is not a proper subset of  $L_i$
- Angluin, 1980,121

Angluin (120) states that "informally, this condition requires that for every language  $L$  of the family there exists a 'telltale' finite subset  $T$  of  $L$ , such that no language of the family that also contains  $T$  is a proper subset of  $L$ . Moreover, it must be possible to enumerate effectively some such telltale finite set from any index for  $L$ . The point of the telltale subset is that once the strings of that subset have appeared among the sample strings, we need not fear "overgeneralization" in guessing  $L$ . This is because the true answer, even if it is not  $L$ , cannot be a proper subset of  $L$ . In this case, we will eventually see a conflict between the data and  $L$ , which will force us to change our guess." Intuitively, given a hierarchy of language classes, where  $L_i \subset L_j \subset L_n$ , and a procedure for 'guessing' possible language classes on the basis of input data, such 'guesses' will be constrained by condition 1 to choose the smallest possible language class which includes the input data. The Subset Principle (SP) thus guarantees that an initial hypothesis (H) in 'guessing a language' on the basis of limited data will not be "too large," thus requiring correction by negative evidence.

If the Subset Principle (SP) can be validated psychologically as well as formally, this will provide a major advance in the study of acquisition of natural language for several reasons. (i) It is known that the set of hypotheses available to the language learner must be limited in order to

## LJST

account for the acquisition of language in finite time. The SP would provide restrictions on both the number and the nature of possible hypotheses at any one time. (ii) Since the SP ensures inductive inference from positive-only evidence, it proposes a solution to the well known problem of learnability in finite time based on induction from input which does not include negative evidence (e.g., Gold, 1967). Gold shows that mechanical learnability in finite time of any class of languages over an alphabet which contains every finite L together with at least one infinite L is impossible in this case. The empirical facts of first language acquisition document little or no significant negative evidence in the acquisition process (e.g., Brown & Hanlon, 1970). (3) Since the SP principle formalizes a constraint on induction, it would provide a significant complement to UG which is primarily deductive. In fact, some constraint on induction is a necessary complement to UG, if UG is to be "psychologically real", i.e., if UG is to be consistent with the actual mapping from PLD to a specific language grammar in first language acquisition. This mapping occurs in real time, and thus necessarily involves successive hypothesis formation on the basis of successive input. (iv) Finally, the SP would provide a mechanistic, therefore theory-independent, definition of 'markedness.' No other theory-independent definition of 'markedness' exists. (According to the SP, the initial hypothesis (H) determined by the SP is 'unmarked'; that alternative H requiring experience for its confirmation is 'marked.') 'Markedness' would therefore mechanistically be defined in terms of amount of experience required for learnability.

In this paper we first (1) show that many of the predictions for English first language acquisition made by certain interpretations of the SP are disconfirmed by empirical data from studies of first language acquisition. We concentrate in particular on predictions made for acquisition of anaphora, given the centrality of anaphora to UG and to language knowledge (e.g., Chomsky, 1981, 1982).<sup>2</sup> (2) We then suggest that these ostensible failures to confirm the psychological reality of the SP arise at least in part from an ambiguity in the interpretation of this principle. We also suggest that where it appears that certain acquisition data confirm an extensional interpretation of the SP, an intensional interpretation in terms of UG is also possible. (3) We also suggest that recent attempts to apply the SP to cross-linguistic predictions for acquisition of anaphora, although not yet fully tested experimentally, can be problematic with regard to the linguistic analyses of anaphora in these languages and with regard to the consequent learnability problem they pose the child. Whether or not these problems exist also depends on how the SP is interpreted.

Specifically, in many cases the SP is interpreted in terms of language (L) (*viz.*, in terms of the size or 'broadness' of language domains consistent with a certain H, e.g., number of sentences or sentence types which the H allows). Thus if the learner has a choice between  $H_i$  and  $H_j$ , and  $H_i$  leads to more types of sentences than  $H_j$ , and the set of sentence types allowed by  $H_j$  is included in the set of sentence types allowed by  $H_i$ , then  $H_j$  will be predicted to be the learner's initial 'unmarked' H, according to this interpretation of the SP. On the other hand, some predictions based on the SP are framed in terms of restrictiveness of the grammar (G) involved in each H, rather than in terms of the size of language domains which are the

## IJST

extensional results of this grammar. In this case, if the learner has a choice between  $H_i$  and  $H_j$ , and  $H_i$  is a more 'restrictive' version of a grammar or a grammatical component (e.g., rule or principle), then  $H_i$  is said to be predicted to be the learner's initial  $H$ . This prediction is independent of size of the language domain (sets of sentence types) which follow from each  $H$ . It requires only that the  $G$  of  $H_i$  be included in the  $G$  of  $H_j$ .

We will argue that the principled Grammar/Language ( $G/L$ ) distinction is critical to the formulation of the SP; and that these two formulations of the SP are not necessarily equivalent as they have been assumed to be. We will argue that the empirical predictions made by application of the SP to language acquisition are confirmed to a greater degree if the SP is interpreted in terms of  $G$ , not  $L$ . We will suggest that where data appear to support interpretation of the SP in terms of  $L$ , an alternative explanation in terms of a grammatical constraint on  $H$  is available. (4) We suggest that this restriction on interpretation of the SP in terms of grammar is in accord with its formal nature (Angluin, 1980); and with formal relations between 'language' and 'grammar'. (5) Finally, we suggest that this interpretation of the SP in terms of  $G$ , not  $L$  accords more closely with the theory of UG as a model of the initial state (e.g., Chomsky, 1981, Lasnik, 1981). In this model of UG, it is grammars which are proposed to be mentally represented, not languages. It is "constraints on the form of grammars which are of "central importance since they narrow the class of  $H$  that the child must consider" so that "...even where the cardinality of the class is not reduced (i.e., when the class remains infinite), the density of grammars compatible with fixed data will in general be lowered, thus facilitating acquisition" (Lasnik, 1981, 10).

In conclusion, although it has been claimed that the SP is "necessary and sufficient" to explaining learnability in a theory of UG, the facts reviewed here suggest that a specific linguistic theory of UG is necessary to the definition of the SP and to each instantiation of it. This conclusion raises the issue of how the SP relates to the PMF (Principle of Minimal Falsifiability) proposed by Williams 1981. This PMF defines 'most restrictive' and 'most unmarked'  $H$  as that which involves principles of Grammar "which require the least amount of evidence to acquire," but does not involve inclusion relations between alternative hypotheses and thus does not necessitate the SP.

### THE GRAMMAR-LANGUAGE DISTINCTION

We assume here the formal distinction between 'language' and 'grammar': "Grammars ( $G$ ) are formal systems". (Levelt, 1974, 1). "The LANGUAGE  $L(G)$  generated by  $G$  is the set of sentences generated by  $G$ " (1974, 5). Chomsky's theory of UG explicitly refers to this distinction:

I have argued that the grammar represented in the mind is a "real object," indeed that a person's language should be defined in terms of this grammar, and that the vague everyday notion of language, if one wants to try to reconstruct it for some purpose, should be explained in terms of the real systems represented in the minds of individuals and similarities among these (Chomsky, 1980, 120)

## LUST

We refer to statements that refer to languages, e.g. to sets of sentences or sentence types (e.g., by the size of these sets), as extensional in nature. We refer to statements that refer to grammars, or components of grammars, (e.g. to rules or principles or constraints), as intensional.

In general, the formal distinction between G and L is clear. It is well known from studies of the "Chomsky Hierarchy of Grammars" for example, (e.g., Levelt 1974), that a particular set of sentences (a language in the formal sense) may not map unambiguously onto a particular type of grammar. For example, a particular set of sentences which may be generated by a highly restricted type 3 'regular grammar' may also be generated by less restricted higher types of grammars (e.g., type 2 context free (CF) or type 0 unrestricted rewrite systems). Inclusion relations between such individual languages do not necessarily correspond to significant contrasts between grammars on this hierarchy. For example, language 1 may include the sentence types 'bbbbbb' and 'ababab', while language 2 includes only the sentence types 'ababab'. Both languages however are generable by highly restrictive regular grammars. The L-inclusion relation need not correspond to a significant G-inclusion relation, and therefore has no significance in itself. It could be argued in this case that some grammatical distinction other than that described by the Chomsky hierarchy does characterize the difference between these languages, and does establish a hierarchy between them, but such a grammatical theory would have to be developed to make the L-inclusion relation significant.

Language types on the Chomsky hierarchy (i.e., regular, context free, and context sensitive languages) do "show the same relations of strict inclusion as the grammar types" (Levelt, 1974,11); but only in so much as each language type refers to a 'class of languages'. Thus there are context free (CF) languages within the class of possible CF languages which are not regular, etc. Here 'class of languages' must be defined in terms of 'type of grammar'.

It follows thus that interpretations of the SP in terms of H's which bear an inclusion relation to each other need not be equivalent when formulated extensionally in terms of language domain, and when interpreted intensionally in terms of restrictiveness of Grammar.

Although the SP (as stated in 1 above) involves a "telltale set of sentences," the principle itself involves using these sentences to constrain inductive 'guesses' of possible 'classes of language;' where specification of 'class of L' requires determination by a Grammar. Thus the Hypotheses tested involve G, not L within the initial formulation of the SP.

Consequences of this G/L contrast for interpretation of the SP can be seen simply by the following example. The set of sentences with bare verbs (V) may be viewed as included in the set of sentences with verbs including verb phrases (VP) as well as bare verbs. (We will assume for the purpose of this argument that verbs can occur either transitively or intransitively, as in the English 'he ate' or 'he ate a meal'). On an extensional interpretation of the SP we could reason that the the SP would predict that the child's initial H was that sentences have bare verbs. Sentences with

bare V's therefore were more 'unmarked' than those with VP's. On an intensional interpretation of the SP, however, a more restrictive H grammatically (given certain theoretical assumptions) might reason that sentences with VP's represent a more restrictive H, because sentences with bare V's may involve deletions or empty categories. They would thus involve an expanded (less restricted) set of grammatical rules relative to full VP's. (Consider for example, the bare V's in "Who do you like e?" or in "Tom bought e and Sam ate the nougats".) Thus interpretations of the SP intensionally or extensionally may lead to distinct predictions relevant to the same data set.

Below we consider several proposals made in terms of either extensional or intensional interpretations of the SP, and evaluate available data from studies of first language acquisition which are relevant to these predictions. These data lead us to conclude that while extensional interpretations of the SP do not fare well, intensional interpretations are more often consistent with the initial acquisition data available. This conclusion has consequences for the nature of the SP and its integration with UG.

PREDICTIONS MADE BY THE SP FOR ACQUISITION OF ENGLISH WHEN FRAMED  
EXTENSIONALLY IN TERMS OF LANGUAGE.

**Acquisition of Anaphora Types.** In the current theory of Universal Grammar (UG) (e.g., Chomsky 1981, 1982), one module of UG, termed "Binding Theory" (BT) is specifically concerned with relations between nominal antecedents and their proforms, e.g. pronouns like 'he'/'him' or reflexives like 'himself' in English. A typology of such nominal categories distinguishes 'anaphors' as those elements like 'reflexives' which require an antecedent in the sentence, and have no independent reference, from those non-reflexive 'pronouns' which may be used deictically and do not require a grammatical antecedent. It is now known that 'anaphors' (e.g. English reflexives such as 'himself' in the examples 2, 4 and 6) and 'pronouns' (e.g. the lexical pronoun 'him' in examples 3, 5 and 7) must be differentiated in a theory of UG. The fact that 'anaphors' and 'pronouns' occur in different domains, as examples 2-7 show, suggests that they obey different principles. Principles of the 'Binding Theory' module of UG have been formulated accordingly to apply either to anaphors or to pronouns. By Principle A of BT, for example, "anaphors must be bound in their GC". By Principle B of BT, "pronouns must be free in their GC". ("GC" here refers to "Governing Category," one specification of a local domain).<sup>3</sup>

- (2) John<sub>i</sub> admires himself<sub>i</sub>.
- (3) John<sub>i</sub> admires him\*<sub>i,j</sub>.
- (4) John<sub>i</sub> wants Tom<sub>j</sub> to admire himself\*<sub>i,j</sub>.
- (5) John<sub>i</sub> wants Tom<sub>j</sub> to admire him<sub>i,\*j</sub>.
- (6) John<sub>i</sub> wants Tom<sub>j</sub> to make Sam<sub>k</sub> adore himself\*<sub>i,\*j,k</sub>.
- (7) John<sub>i</sub> wants Tom<sub>j</sub> to make Sam<sub>k</sub> adore him<sub>i,j,\*k</sub>.

With regard to acquisition of anaphora types, , Berwick (1982, 300) considers that the initial H regarding anaphors and pronouns in acquisition of English may be constrained by the SP according to the following reasoning: "One can see . . . that the set of surface structures (now interpreted in an extended sense to include co-indexing), where pronominals can appear is larger than the set of surface structures in which some anaphors appear. One could therefore invoke the SP and establish an order in which H about the properties of an unknown NP element will be made." The initial H will be

## IUST

that they are anaphors, not pronouns. Berwick notes that this interpretation of the SP "is not forced...since in fact pronominals and pure anaphors are in nearly complementary distribution"(1982,301) and therefore the domains at issue are not in an inclusion relation as application of the SP requires, according to 1. (cf. Manzini and Wexler, in preparation, on this issue). This formulation, however, is based on an extensional interpretation of the SP, since it refers to size of language domain allowed by each H being compared, (where 'set of surface structures' defines sentence types). It does not refer to Grammar, since the grammatical principles involved for 'anaphors' and 'pronouns' (Principles A and B) are complementary. These do not involve an inclusion relation between them, and neither of them is 'more restrictive' than the other.

The prediction, based on an extensional interpretation of the SP, that the initial H of children acquiring language would be that nominal pro-forms are anaphors, not pronouns, has been disconfirmed empirically, and theoretically on the basis of empirical first language acquisition studies (Wexler and Chien, 1985, Manzini and Wexler, in preparation, Padilla-Rivera, 1985; see Iust 1986 for review). Whether or not a child initially interprets an anaphor more like a pronoun or a pronoun more like an anaphor appears to be dependent on the context in which it appears.

**Optional and Obligatory Anaphora.** Another prediction of the SP interpreted extensionally was that the initial H of children would be that anaphora would be 'obligatory,' not 'optional.' This prediction can be interpreted in terms of the observation that "optional" language domains are extensionally larger than "obligatory" ones, and the sentence types resulting from the obligatory rule are included in the set of sentence types resulting from the optional rule. The grammatical principles of 'optionality' or 'obligatoriness' are not in themselves in an inclusion relation, but complementary. Therefore, the SP may not apply intensionally with regard to this domain of language knowledge.

This extensional prediction too has been disconfirmed empirically in certain situations. For example, Iust, Solan, Flynn, Cross and Scheutz, 1986 have found that young children assign an optional anaphora interpretation to sentences like 8a. They often convert the null sites in 8a (which are obligatorily subject-controlled in English adult grammar) to pronouns with verb tensing (in imitation) as in 8b; and they determine the interpretation of both 8a and b with sensitivity to pragmatic context, i.e., as though they were optional like the pronoun, in comprehension.

8a) John<sub>i</sub> saw Tom<sub>j</sub> when O<sub>i,\*j</sub> running down the street

b) John<sub>i</sub> saw Tom<sub>j</sub> when he<sub>i,j,k</sub> was running down the street

Roeper 1986 reports another set of data which also appears to disconfirm this prediction. Roeper reports (from a preliminary experimental study) that children's initial H when interpreting the null subject in a sentence like 9a is similar to that in 9b. That is, children interpret the null subject in 9a as though it were a free lexical pronoun (with optional coreference thus), not as though it were a bound variable as it is in adult grammar. (For example, children attribute coreference between the person who "thinks" and the person who "wears a hat" in 9a.)

## LUST

- 9a) Who does he think e wears a hat?
- b) Who thinks he wears a hat?

### PREDICTIONS MADE BY THE SP FOR ACQUISITION WHEN FRAMED INTENSIONALLY IN TERMS OF GRAMMAR.

Berwick 1982 also proposes that the SP may be interpreted to predict that children's initial H regarding empty categories is that they must be 'governed'. This hypothesis is defined independently of size of language domain. In fact, size of language domain resulting from this hypothesis is irrelevant, since it is either false or indeterminable that there are more sentences or sentence types with ungoverned than with governed empty categories. This H is 'intensional' in that it explicitly reflects a property of grammar, viz., the ECP (Empty Category Principle, which states that 'an empty category must be governed' in Universal Grammar (cf. Chomsky, 1981.)

This prediction, which involves an intensional interpretation of the SP, is consistent with certain empirical acquisition data. In Lust, Solan, Flynn, Cross and Schuetz, (1986), cited above in 8a for example, the child's main error was to tense the verb, thus governing the empty category subject, and allowing it to receive case. Thus it can and does appear as a lexical pronoun with case as in 8b. It is not clear how the SP actually applies to this H intensionally, however, since the grammar which includes the ECP is not included in a grammar which does not.

In cases, where data appear to support an extensional interpretation of the SP, an alternative (intensional) interpretation is possible. For example, in putative confirmation of the prediction of the SP as interpreted by Jakubowicz, and described above, it was reported that children make more errors on sentences like 10b and 11b than on 10a and 11a (cf. Deutsch and Koster, 1982, Wexler and Chien, 1985, Padilla-Rivera, 1985, Jakubowicz, 1984, and Lust, 1986 for relevant data here). Children reportedly often take the closest NP subject as antecedent for the pronoun in 11b, for example.

- 10a) John<sub>i</sub> washed himself<sub>i</sub>
- b) John<sub>i</sub> washed him<sub>\*i,j</sub>
- 11a) John<sub>i</sub> said that Peter<sub>j</sub> washed himself<sub>\*i,j</sub>
- b) John<sub>i</sub> said that Peter<sub>j</sub> washed him<sub>i,\*j</sub>

An alternative explanation of these acquisition data (which are themselves now being tested for replication) might be the following. Children's initial H determined by UG regarding a nominal pro-form is that such proforms are bound if they are c-commanded. The child's initial H is that the minimal (possibly cyclic) constituent is assumed to be the relevant binding domain.

Cross-linguistic work on acquisition of anaphora in Chinese and English by Lust, Mangione and Chien (1984, and in preparation) is consistent with this alternative intensional hypothesis. Here children acquiring Chinese appear to use plus/or minus c-command to determine whether an empty category is bound or free. Padilla-Rivera's (1985) experimental test of acquisition of Spanish anaphora (which varies constituent domains of anaphors and pronouns) is also consistent with such an intensional representation of the knowledge underlying the acquisition facts. Here children acquiring Spanish

## LUST

were found to assume that the minimal domain (e.g. prepositional phrase) in which a proform appears, is a binding domain for both anaphors and pronouns.

### CROSS-LINGUISTIC APPLICATION OF THE SP

The above remarks concern interpretations of the SP with regard to choice between H which involve language possibilities within a single L. It is possible to interpret the SP in terms of cross-language variation. In this case, the H's involved would involve grammars for one language vs another. A-priori, this interpretation of the SP is more closely isomorphic to the structure of condition 1. However, in cross-linguistic application, interpretation of the SP can also be either extensional or intensional. Again, extensional predictions are problematic.

The concept 'parameter'(P) in UG specifies significant dimensions of possible cross-language variation, and the values these variations may take. Only a few of these P's involve a possible inclusion relation across their values, however, and thus allow application of the SP.

The Pro Drop Parameter (e.g., Chomsky, 1981, Hyams, 1983). Languages may take one of the binary values on this parameter or another. If they are [+ pro-drop] they will allow null subjects in tensed sentences optionally; if they are [- pro drop] like English, they will not. There is no grammatical basis for distinguishing one value of this parameter as included in another, or as intrinsically more marked than another. (See Lasnik 1983 for discussion of this point.) Each value of the parameter has a distinct set of grammatical consequences. Interpreted extensionally, however, in terms of the sizes of domains of language, or sentence types that each value of the parameter allows, then the [+ pro drop] is clearly more inclusive than the [- pro drop] hypothesis. Available acquisition data, however, do not support the prediction that children's initial H cross-linguistically is that the language they are acquiring is [- pro drop]. See Hyams 1983 and Mazuka et al to appear for alternative treatments of the acquisition facts.

**Locality of binding domains for anaphors.** Another aspect of language variation which has been predicted to be accessible to the SP involves 'locality' of anaphor binding. Japanese, unlike English, but like many Dravidian and other languages (e.g., Malayalam, Tamil, Telugu, Kannada, for example) allows 'long distance binding' of reflexives (cf. N. Akatsuka McCawley 1972, and K.S. Yadurajan 1986 for example). Compare English 4 and Japanese 12 below for example. It has been proposed that Japanese and English anaphora may be described in terms of a subset relation, wherein English is a subset of Japanese. Jakubowicz, 1984, 162, following Berwick's extensional proposal, interprets the SP as predicting that languages with long distance control of anaphors are "marked" by the SP relative to those languages without long distance binding, because those without it 'contain only one type of output string (sentences where anaphors are locally bound)', whereas those with long distance control 'contain two types of output sentences'. This prediction is based on an extensional interpretation of the SP.

- (12) [[Zibun<sub>i</sub> ga nusunda] to Sarah<sub>j</sub> ni iwareta] to John<sub>i</sub> ga omotta]  
self nom stole that dat was said that nom thought  
(John thought that Sarah said that he/self stole  $\emptyset$ )

## IJST

On the grounds of this observation, it has been suggested that the SP predicts (if interpreted extensionally) that children's initial H (in Japanese as well as English) is that anaphors are locally bound. Although this H has not yet been extensively tested experimentally, there are several problems with this extensional instantiation of the H. Intensional and extensional interpretations again make different predictions for application of the SP.

(i) On the basis of recent cross-linguistic analyses, it appears that 'local' anaphors and 'long distance' anaphors may be grammatically distinct. In some languages, e.g. Malayalam, different forms distinguish these, but in other languages (e.g. Chinese or Japanese) different grammatical facts distinguish these syntactically and semantically. (See Giorgi 1984, Harbert to appear, Bowers in preparation, Tang in preparation, and Yadurajan 1986 for independent proposals of this type across several different languages which allow long distance 'anaphors'. If these grammatical analyses are correct then grammatically the local anaphor is not in an inclusion relation with the 'long distance' anaphor, since these are qualitatively distinct. Thus only an extensional, but not an intensional, interpretation of the SP would predict that 'anaphors' are locally bound in children's initial H.

(ii) Wexler and Manzini (to appear) and Manzini and Wexler (in prep) observe that the SP makes different predictions for pronouns than it does for anaphors. On an extensional interpretation, Icelandic is less restrictive than English with regard to anaphors because it allows long distance binding. However, it is more restrictive with regard to pronouns. Harbert argues for example, that English and Icelandic share sentence types with pronouns like 13, but Icelandic does not allow sentence types with pronouns with a coreferential reading like the English 14 does.

13) They<sub>i</sub> help them<sub>j</sub>

14) They<sub>i</sub> expect me to help them<sub>i,j</sub>

On an extensional interpretation of the SP, then, children's H would be predicted to be more like Icelandic than English, because there are fewer such sentence types with pronouns in Icelandic than in English. Harbert (in prep) argues, however, that grammatically the facts in 13 and 14 result from the fact that English has a more restrictive grammar than Icelandic (i.e., there are more restrictions on what constitutes a binding domain). Harbert supports the suggestion that it is the Icelandic grammar which is more marked on the basis of its low frequency across languages and on the basis of language change data. If this analysis is correct, however, then again, an intensional and an extensional interpretation of the SP will make distinct, in fact, opposite predictions for acquisition.,

iii) Wexler and Manzini (to appear) and M&W (in prep) have argued that the parameter of locality must be multivalued, ranging from English and other languages with 'very' local binding to Icelandic and other languages with less restrictive binding, to Japanese and other languages with least restrictive binding. The scale here is in terms of extensional size of domain of anaphora. W&M make the interesting and highly significant argument, however, that intensionally, i.e., grammatically, the substantive universals which characterize Binding Domains across languages are themselves in an

## LUST

inclusion relation which correlates with the extensional size of domain of anaphors across languages.

However, any interpretation of a non-binary dimension of language variation in this way e.g., ' $L_i \subset L_j \subset L_n$ ' will always formally require a violation of the SP. That is, whenever a child's H is in accord with  $L_i$  when  $L_n$  must be acquired, there will be an 'intervening language'  $L_j$ , thus offending condition 1 (SP). The only way that a subset offense can be avoided is if the child is constrained to hypothesize that  $L_j$  (and every intermediary language successively on the inclusion hierarchy) is the correct language, before it hypothesizes that  $L_n$  is.

Certain languages (e.g., Chinese, Huang, pc, Tang, 1985 and in preparation) allow binding of the reflexive *dzji* (a) in minimal local domains as in 15; (b) in long distance domains as in 16; and (c) critically, in either maximal or minimal, but not intermediary domains in cases like 17. (Examples are from Tang, 1985). A phenomenon similar to 17 reportedly occurs in several other languages as well (e.g., Icelandic, Harbert, pc.; cf. also Giorgi, 1984). If the SP is interpreted extensionally, and the child is forced to formulate successive H up the hierarchy of locality, then a child acquiring Chinese will never acquire both 15 and 16 without making an error on 17. (If the inclusion hierarchy is formulated grammatically, then the grammar for a language which allows the intermediate clause antecedent in 17 must not be included in the grammar which allows the farthest antecedent in 16, in order for there not to be a required SP offense in this interpretation.)

15) Lisz<sub>i</sub> dwei dzji<sub>i</sub> mei syinsyin  
no confidence

(Lisz has no confidence in himself) (=Tang #1)

16) Jangsan<sub>i</sub> jrdau [Lisz<sub>j</sub> tauyan dzji<sub>i</sub>, j]  
know dislike

(Jangsan<sub>i</sub> knew that Lisz<sub>j</sub> disliked himself<sub>i</sub>, j)

17) Jangsan<sub>i</sub> renwei [Lisz<sub>j</sub> jrdau [Wangwu<sub>k</sub> dwei dzji<sub>i</sub>, \*j, k]  
think know

mei syinsyin]

no confidence (=Tang #83)

(Jangsan<sub>i</sub> thought that Lisz<sub>j</sub> knew that Wangwu<sub>k</sub> had no confidence in himself<sub>i</sub>, \*j, k)

Note that if the grammatical parameter for distinction of binding domains across languages would be a binary one (as in Harbert, to appear, for example or as in a conflation of the W & M hierarchy), then the above issue need not arise.

## CONCLUSIONS

These arguments do not motivate the conclusion that the SP is invalid. They do motivate the conclusion that in order for the Subset Principle to apply it is necessary not only that two languages (or two domains of language data) are in an inclusion relation, but also that the grammars (or some aspects of those grammars) which generate the language are in an inclusion relation. These arguments also motivate the conclusion that the interpretation of the SP must be restricted to close integration with theory of UG, if it is to be efficacious in a psychologically real model of the Initial

## LUST

State. The current work of Wexler et al. (to appear) and Manzini and Wexler (in preparation) and Berwick, 1985 do represent advances in this regard. Wexler et al. and Manzini and Wexler, for example, pursue the linguistic/grammatical nature of what constitutes variation in Binding Domains across languages, i.e., of what the proper linguistic formulation of the Parameter or Parameters of language variation in this area are. The results above suggest that this contribution to UG is critical to specifying the dimensions of language variation which children may consult in formulating hypotheses, and the values these H may take. Empirically valid and successful application of the SP to children's test of these H in first language acquisition depends on the success of this linguistic theory of UG.

### FOOTNOTES

- 1 I thank Jim Gair, and Wayne Harbert, John Bowers, Reiko Mazuka, Shin Oshima, and Kazuyo Otani for discussion of issues raised in this paper. I thank Reiko Mazuka, Shin Oshima, Kazuyo Otani and Wendy Snyder for Japanese data, and Jim Huang for Chinese data. I am thankful to Reiko Mazuka for critical assistance in paper preparation, with the assistance of Nancy Goss.
- 2 We will use the term "anaphora" in a general sense to refer to the relation between nominal antecedents and proforms (whether phonetically realized or null) as in examples 8a and b. This relation of anaphora determines the interpretation of the proform (e.g., either the pronoun 'he' or the null subject in examples 8) by reference to the antecedent. The relation of anaphora is often represented by co-indexing (as in the subscripts in 8), signifying possible coreference. (See various papers collected in LUST 1986 for study of this issue.)
- 3 In general, the reflexive 'himself' in sentence 2 reflects the fact that it is 'bound' in that it is 'c-commanded' by its antecedent, and obligatorily coreferential with it. ('C-command' is a concept defined over the geometry of tree structure; it involves dominance.) The pronoun 'him' in sentence 3 reflects the fact that it is 'free' in that it is not 'c-commanded' by its antecedent, may not refer to the main clause subject which c-commands it, and may refer to an antecedent outside the clause.

### REFERENCES

- Angluin, D. (1980). Inductive inference of formal languages from positive data. Information and Control, 48, 117-135.
- Berwick, R. (1982). Locality principles and the acquisition of syntactic knowledge. (Vols. 1-2). Unpublished doctoral dissertation, MIT.
- Berwick, R. (1985). The acquisition of syntactic knowledge. Cambridge: MIT.
- Bowers, S. (In preparation). Non-anaphoric reflexives. Cornell University.
- Brown, R., & Hanlon, C. (1970). Derivational complexity and order of acquisition in child speech. In J. R. Hayes (Ed.), Cognition and the development of language (pp. 11-53). New York: John Wiley & Sons.
- Chomsky, N. (1980). Rules and representations. NY: Columbia University Press.
- Chomsky, N. (1981). Lectures on government and binding. Dordrecht: Foris.
- Deutsch, W., & Koster, J. (1982). Children's interpretation of sentence internal anaphora. PRCLD, 21, 39-45.

LUST

- Giorgi, A. (1984). Toward a theory of long distance anaphors: A GB approach. The Linguistic Review, 3.
- Gold, E. M. (1967). Language identification from given data. Information and Control, 10, 447-474.
- Harbert, W. (in press). Binding, Subject and accessibility. In R. Friedin (Ed.), Proceedings of the Princeton Workshop on Comparative Grammars.
- Hyams, N. M. (1983). The acquisition of parameterized grammars. Unpublished doctoral dissertation, The City University of New York, New York.
- Jakubowicz, C. (1984). On markedness and binding principles. Proceedings of the North Eastern Linguistic Society, 14, 154-182.
- Lasnik, H. (1981). Learnability, restrictiveness, and the evaluation metric. In C. L. Baker & J. J. McCarthy (Eds.), The logical problem of language acquisition (pp. 1-21). Cambridge: MIT Press.
- Lasnik, H. (1983). On certain substitutes for negative data. Unpublished manuscript, University of Connecticut, Storrs.
- Levelt, W. J. M. (1974) Formal grammars in linguistics and psycholinguistics. (Vol. 1). The Hague: Mouton.
- Lust, B. (1986). Introduction. In B. Lust (Ed.), Studies in the acquisition of anaphora: Vol. 1. Defining the constraints. Dordrecht: Reidel.
- Lust, B., Mangione, L., & Chien, Y-C. (1984). Determination of empty categories in first language acquisition of Mandarin Chinese. Cornell University Working Papers in Linguistics, 6, 151-165.
- Lust, B., Solan, L., Flynn, S., Cross, C., & Schuetz, E. (1986). A comparison of null and pronoun anaphora in first language acquisition. In B. Lust (Ed.), Studies in the acquisition of anaphora: Vol. 1. Defining the constraints (pp. 245-277). Dordrecht: Reidel.
- Mazuka, R., Lust, B., Wakayama, T., & Snyder, W. (in press). Distinguishing effects of parameters in early syntax acquisition: A cross-linguistic study of Japanese and English. FRCLD.
- Manzini, R., & Wexler, K. (in preparation). Parameters and learnability in binding theory. Unpublished manuscript, U. of California, Irvine.
- McCawley, N. A. (1972). A study of Japanese reflexivization. Unpublished doctoral dissertation, University of Illinois, Chicago.
- Oshima, S. (1985). Anaphora: A GB approach. Unpublished manuscript.
- Padilla Rivera, J. (1985). On the definition of binding domains in the first language acquisition of anaphora in Spanish: The modular role of binding principles and lexical factors. Unpublished doctoral dissertation, Cornell University, Ithaca, NY.
- Roeper, T. (1986). How children acquire bound variables. In B. Lust (Ed.), Studies in the acquisition of anaphora: Vol. 1. Defining the constraints (pp. 191-200). Dordrecht: Reidel.
- Tang, C. C. J. (1985). A study of reflexives in Chinese. Unpublished master's thesis, Graduate Institute of English National Taiwan Normal University.
- Wexler, K., & Chien, Y-C. (1985). The development of lexical anaphors and pronouns. Papers and Reports on Child Language Development, 24, 138-149.
- Wexler, K., & Manzini, R. (in press). Parameters and learnability in binding theory. In Roeper & Williams (Eds.), Parameters & linguistic theory.
- Williams, E. S. (1981). Language acquisition, markedness, and phrase structure. In S. Tavakolian (Ed.), Language acquisition and linguistic theory. (8-34). Cambridge, MIT Press.
- Yadurajan, K. S. (1986). Reflexives in Dravidian. Paper presented at SALA, Urbana, IL. Unpublished manuscript, CIEFL, Hyderabad, India.