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Interaction of Language Type and Referent Type in the Development of Nonverbal Classification Preferences

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15.1 Introduction

We have argued for the utility of a comparative developmental approach to exploring the relation between language diversity and thought (Lucy and Gaskins 2001). In this chapter, we elaborate the importance of taking a structure-centered approach to such comparative-developmental research (Lucy 1997a). A structure-centered approach begins with an analysis of language structure and then moves to an operational characterization of reality implicit in it, rather than the other way around (Lucy 1992b, 273–275; 1997a). This contrasts with prevailing domain-centered approaches that begin with a characterization of some domain of reality and then consider how language structure responds to it. Ideally, a structure-centered approach entails a comparison of *patterns* (or configurations) of cognitive response across language-internal structural variations (Lucy 1992a, 86–91). Such a comparison of patterns of language-thought association escapes many of the interpretive difficulties inherent in the comparison of absolute levels of performance across vastly different cultures and assessment conditions.

Although our earlier comparative-developmental work did implement a structure-centered approach, it did not fulfill this ideal of providing evidence of cognitive patterning across language-internal structural variation. Here we extend that earlier work so as to compare configurations of linguistic and cognitive behaviors rather than absolute responses. We begin by discussing the general importance and nature of a structure-centered approach. We then present a case study relating specific language-based predictions to parallel cognitive-experimental work with adults and children. We conclude by comparing the results of this approach with some related contemporary work.

15.2 A Structure-Centered Approach

15.2.1 A Whorfian Approach: From Language to Reality

Contemporary research into the influence of language type on thought takes the work of Benjamin Lee Whorf (1956) as its point of departure—whether or not the actual substance and significance of that work are well understood by those who invoke it. This is not the place to revisit Whorf's arguments in detail (for that see Lucy 1985, 1992b, in press), but one key aspect, namely, his views about the mutual relation of language and reality, deserves mention since it lies at the heart of his comparative approach and motivates the one developed here.

Whorf's approach to the relation of language and reality emphasizes the equal value of diverse languages as referential devices. This view, part of the heritage of Boasian anthropology, contrasts with previous hierarchical views wherein some languages were regarded as intrinsically superior at representing reality and hence as vehicles for thought (Lucy, in press). The grounds used to establish the nature of reality under the hierarchical views have been quite various—religious, aesthetic, practical, scientific. But the recurrent theme in such views is that reality is given and knowable independently of language such that different languages can then be judged as capable of representing it more or less adequately.[1] But once we entertain the alternative view that diverse languages represent reality equally well, then the hierarchical views and the various assumptions they depend upon (about the specific nature of reality as well as its givenness and knowability) are necessarily called into question.

Although the egalitarian view of languages officially prevails in contemporary scholarly discussion, the hierarchical view lives on unofficially. It appears in the folk belief that one's own language conveys reality better or with more precision than do other languages. And it emerges in language research in the persistent (if unwitting) tendency to privilege the investigator's own language categories and their construal of reality both in theoretical works and in crosslinguistic description and comparison. Any linguistic investigator examining how diverse languages construe reality must, therefore, constantly be on guard to represent reality and undertake comparison in a way that is neutral or fair to all the systems being compared. To do this effectively, the researcher needs a set of formal procedures for developing such descriptions since good intentions rarely suffice when deep, pervasive biases are at issue.

One common approach to developing a neutral basis of comparison attempts to characterize some domain of reality independently of any language, usually through the use of some purportedly neutral technical or scientific metalanguage. However, such *domain-centered* approaches (Lucy 1997a), built as they are from our own language and culture, still risk rendering reality in terms of our own categories and finding that other languages fail to measure up in complexity and accuracy.[2] This has been, for example, the fate of research on the differential encoding of color in language. Color term "systems" are developed for various languages by grouping together various lexical forms in each language referring to the domain of color (in this case, a set of standardized color samples developed for art and commerce). These systems are taken as functionally equivalent to our own even though they may lack any structural unity within the other languages and have dramatically different semantic implications. These "systems" are then ordered into an evolutionary hierarchy largely according to how closely they match our own system, which conveniently serves as the unspoken telos for the whole project (Lucy 1997b).

An alternative, *structure-centered* approach to comparison, as first envisioned by Whorf (1956; Lucy 1997a), begins with an analysis and comparative typology of language structures and their semantics, developing thereby a rendering of reality as it appears through the "window of language" (Lucy 1992b, 275). In this approach, the collective tendencies of many languages are pooled to form a comparative grid within which each individual contrast can be made. Here there is no pretense, at least for now, of a final rendering of reality—rather, only of a provisional rendering adequate to the task of fair comparison of languages. Operationally, such an approach to comparison through language centers on careful analysis of actual systems of language category meanings within a typological framework. It characterizes the implications of these meanings for the interpretation of reality and for nonlinguistic behavior with respect to it. Ultimately, it aims to understand how diverse linguistic renderings of the world arise and what effects they have on thought about reality. But it does not, indeed cannot, presuppose a language-independent access to reality at the outset.

15.2.2 Previous Research: From Language to Cognition

The present study continues a line of research assessing the correspondence of linguistic structures with patterns of cognitive behavior. The original research (Lucy 1992a) explored the ways structural differences between American English and Yucatec Maya (an indigenous language of Mexico) related to the cognition of adult speakers of those languages. Specifically, the research focused on the patterned relationship between grammatical number marking and responses on memory and classification tasks involving pictures and objects.

The linguistic portion of the research compared the languages in terms of a formal, crosslinguistic typological characterization supplemented by frequency-of-use data. This linguistic analysis revealed three noun phrase types relevant to the English-Yucatec comparison. Each type can in turn be characterized by a semantic feature bundle drawn from a larger set manifest crosslinguistically in number-marking systems (Lucy 1992a, 56–61, 79–82). Associated with each semantic feature bundle is a set of actual referents, some of which will be relevant to the experimental work to follow. These referents were characterized notionally as Animals, Implements, and Substances,[3] where these are to be understood as rough labels of certain extensional sets and not intentional criteria for assignment to the language categories.[4]

The cognitive portion of the research demonstrated that where the two languages agreed in their treatment of a given referent type (Animals and Substances), the nonverbal cognitive responses were similar; and where the two languages diverged in their treatment of a given referent type (Implements), the nonverbal cognitive responses also differed. This result appeared most clearly in a series of tasks using picture stimuli that represented the various referent types and assessed attentiveness to their number.[5] Insofar as both groups perform alike in certain respects, we have assessment-internal evidence that the two groups see the task in the same way, increasing our confidence that the observed differences are real differences. Further, even when there is no specific match in absolute response pattern (perhaps due to differential cultural familiarity with the assessment procedure), the comparison of *patterns* of response across the referent types remains valid. Indeed, the pattern of results is the real phenomenon, not the absolute preference score on any individual item. And it is this pattern (i.e., the relative ordering of responses with respect to different referent types) that any alternative explanation will have to account for.

A second task series focused more narrowly on just object referents, the point of major contrast between the two languages, and used actual physical items for stimuli. These tasks revealed a relative classification bias toward shape on the part of English speakers and toward material on the part of Yucatec speakers, in line with the expectations based on the language analysis. This work has since been replicated with a wider and more carefully controlled array of stimuli and extended to trace out the developmental emergence of the contrast in young children (Lucy and Gaskins 2001). But this research with actual physical stimuli lacked an internal comparison among types of stimuli—primarily because the presupposed unit (and hence the cognitive predictions) seemed to vary across noun phrase types in a way difficult to address experimentally (see discussion Lucy 1992a, 88–90).

The new research reported below extends the cognitive assessment procedure using actual stimulus objects by exploring responses to referents closer to the material type of referent, where the two languages, and hence cognitive responses, should be in rough agreement. The primary aim is to assess whether the nonverbal cognitive responses of speakers agree where the languages agree (i.e., for materials), just as they differ where the languages differ (i.e., for objects). In this way, the work reported here brings to the tasks using physical objects the overall design logic adopted in the previous work using the picture tasks, with its attendant benefits in terms of predicting both similarities and differences between languages and patterns of response within languages. The new work should also forestall the tendency in some quarters to misconstrue the shape or material bias as general over all referent types. A secondary aim of the current work is to explore how children respond to these referent types. This will help resolve a number of questions left open by the previous developmental work regarding the extent of children's early classification preferences for shape. Here again, it is the pattern of response across ages that is central rather than the particular absolute rates.

15.3 Empirical Study

15.3.1 Language Contrast: Number-Marking Semantics

As background for the cognitive assessment, we first need to describe the language contrast. Yucatec Maya and American English differ in their nominal number-marking patterns.

First, the two languages contrast in the way they signal plural for nouns. English exhibits a *split* pattern whereby speakers obligatorily signal plural for nouns semantically marked as referring to discrete [+discrete] objects (e.g., *car*, *chair*) but not for those referring to amorphous [−discrete] materials (e.g., *sugar*, *mud*).[6] Yucatec exhibits a *continuous* pattern whereby speakers are never obliged to signal plural for any referent, although they may opt to do so if they wish.

Second, the two languages contrast in the way they enumerate nouns. English is again split such that for [+discrete] nouns, numerals directly modify their associated nouns (e.g., *one candle*, *two candles*) whereas for [−discrete] nouns, an appropriate unit (or *unitizer*) must be specified, which then takes the number marking (e.g., *one clump of dirt*, *two cubes of sugar*). Yucatec is again continuous such that all numerals must be supplemented by a special form, usually referred to as a *numeral classifier*, which typically provides crucial information about the shape or material properties of the referent of the noun (e.g., *'un-**tz'íit** kib*' 'one **long thin** candle', *ká'a-**tz'íit** kib*' 'two **long thin** candle'). Numeral classifiers of this type are a well-known grammatical phenomenon with wide area distribution, though probably best known from the languages of Asia, such as Chinese, Japanese, and Thai.

Since many classifiers have to do with the shape or form of a referent, one common interpretation of them is that they represent a special emphasis on these concepts in a language's semantics in contrast to languages such as English. This claim would be more plausible if the classifiers were optional, occurred in many morphosyntactic contexts, and appeared only in a few languages. But in fact they are obligatory, they are confined to a single morphosyntactic context, and they are fairly common among the world's languages—all of which suggests that they do not represent merely an emphasis but rather an indispensable solution to a formal referential difficulty characteristic of languages of a certain morphosyntactic type.

So why have numeral classifiers? What problem do they solve? The need for them reflects the fact that *all nouns in Yucatec are semantically unspecified as to quantificational unit*—almost as if they referred to unformed substances. So, for example, the semantic sense of the Yucatec word *kib'* in the example cited above is better translated into English as 'wax' (i.e., 'one **long thin** wax')—even though, when occurring alone without a numeral modifier in conditions other than enumeration, the word *kib'* can routinely refer to objects with the form and function that we would call candles (as well as to other wax things). Once one understands the quantificational neutrality of the noun, it becomes clearer why one must specify a unit (i.e., use a form such as a classifier) when counting, since expressions such as *one wax* apparently do not make quantificational sense in this language, much as they do not in English. By contrast, many nouns in English include the notion of quantificational "unit" (or "form") as part of their basic meaning—so when we count these nouns, we can simply use the numeral directly without any classifier (e.g., *one candle*). In essence, then, whereas English requires such a unitizing construction only for some nouns, Yucatec requires one for all of its nouns.

The patterns of plural marking and numeral modification just described are closely related to each other and form part of a unified number-marking pattern evidenced across many languages. In particular, languages with rich, obligatory plural marking such as Hopi tend not to have obligatory unitizing constructions such as numeral classifiers, and those with a rich, obligatory use of numeral classifiers such as Chinese tend not to have plural marking. Languages at these extremes are essentially continuous in their number-marking pattern over the entire spectrum of noun phrase types. However, many languages have both types

Table 15.1
Obligatory number-marking patterns: contrast for stable and malleable referent types for continuous (e.g., Yucatec) and split (e.g., English) type languages

	Referent type	
Language type	Stable	Malleable
Continuous (Yucatec)	unitizer	unitizer
Split (English)	plural	unitizer

of marking; that is, both pluralization and unitization are present. In such languages, the lexicon tends to be internally split such that noun phrases requiring plural marking with multiple referents tend not to require unitizers for counting, and those requiring unitizers for counting tend not to require plurals when used with multiple referents. More specifically, there is an ordering relationship such that, across languages, it is more common for some referents to have plural marking and others to have unitizer marking. (Again, see Lucy 1992a, 61–71, for fuller discussion.)

Yucatec exhibits the continuous pattern requiring unitizers in the form of numeral classifiers for all nouns and not requiring plurals for any of them. English exhibits the split pattern; it requires plurals but not unitizers for nouns referring to ordinary discrete objects, and it requires unitizers but not plurals for nouns referring to amorphous entities. This contrasting pattern is displayed graphically in table 15.1. However, it should be emphasized that the label *unitizer* employed here to indicate the crosslanguage functional similarity should not be overinterpreted in terms of structural-semantic meaning. Even where these languages look similar, there are important differences in syntactic structure and hence in semantic value for the various form classes. In particular, quantification-neutral Yucatec nouns are not structurally identical to quantification-neutral English nouns (so-called mass nouns) since the Yucatec nouns do not enter into a systematic contrast relation with quantification-marked nouns (so-called count nouns).[7] Likewise, their actual cognitive construal remains an empirical question.

15.3.2 Cognitive Hypotheses and Predictions

To assess whether traces of these contrasting verbal patterns appear in speakers' cognitive activities more generally, we need first to draw out the implications of these grammatical patterns for the general interpretation of experience. We have seen that English encodes quantificational unit (or some equivalent) in a large number of its lexical nouns whereas Yucatec does not. It is difficult to form a single generalization about the meaning value of such patterns because the kind of unit presupposed apparently varies across the spectrum of lexical noun types both within and across languages. What might be a good default presupposition may well differ dramatically for an animate referent, an object, a material, and so on. But if we focus first on the denotational meaning of nouns referring to objects—that is, discrete concrete referents with *stable* form—then certain regularities exist from which cognitive implications can be drawn.[8]

The quantificational unit presupposed by English nouns referring to discrete objects of this type is frequently the shape of the object. Hence, use of these English lexical items routinely draws attention to the shape of a referent as the basis for incorporating it under some lexical label and assigning it a number value. Yucatec nouns of this type, lacking such a specification of quantificational unit, do not draw attention to shape and, in fact, fairly routinely draw attention to the material composition of a referent as the basis for incorporating it under some lexical label. If these linguistic patterns translate into a general cognitive sensitivity to these properties of referents of the discrete type, then *Yucatec speakers should attend relatively more to the material composition of objects (and less to their shape), whereas English speakers should attend relatively less to the material composition of discrete objects (and more to their shape).*

We can develop a second prediction about material referents. Any concrete material referent must appear at any given moment in time with some spatial configuration, that is, in some shape or arrangement.[9] We will confine our interest here to those materials that retain their contiguity without the assistance of a container, what we will term *malleable* objects.[10] For these referents, a temporary (or accidental) shape is available at the moment of reference, but it could be otherwise for it is highly contingent on the current state of affairs.

Since *both* Yucatec and English nouns referring to such material referents *lack* a presupposed quantificational unit, their semantics should ignore the temporary shape and, in fact, should routinely draw attention to the material composition of a referent as the basis for incorporating it under a lexical label. If these linguistic patterns translate into a general cognitive sensitivity to these properties of referents of the material type, then *both Yucatec and English speakers should attend relatively more to the material composition of such malleable objects (and less to their shape)*.

The two sets of predictions can be brought together into a unified prediction for these two types of objects. English and Yucatec should disagree on their treatment of discrete stable objects in line with the differences in their grammatical treatment of them, but the two languages should agree on their treatment of malleable objects in line with the similarity in their grammatical treatment of them. Alternatively, looking within each language, we can predict that English will show a cognitive split vis-à-vis the two types of objects whereas Yucatec will show cognitive continuity across them. These predictions are displayed in table 15.2. Notice that the predictions are relative rather than absolute; that is, they contrast patterns, not absolute values.

15.3.3 Cognitive Contrast: Shape versus Material Preference

These language-based cognitive predictions were tested with speakers from both languages by developing several experimental assessments.

Table 15.2
Predicted relative attentiveness to material versus shape: contrast for stable and malleable referent types for speakers of continuous (e.g., Yucatec) or split (e.g., English) type languages

	Referent type	
Language type	Stable	Malleable
Continuous (Yucatec)	material	material
Split (English)	shape	material

15.3.3.1 Adult Differences The initial step was to compare the performance of adults in both groups. One would expect the maximal contrast among adult speakers, and the adult contrast also provides the baseline for developmental comparisons that follow.

Stable Objects The first prediction tested was that for stable objects. (These results are described more fully in Lucy and Gaskins 2001.) Adult speakers were shown triads of naturally occurring objects familiar to both groups. Each triad consisted of an original *pivot* object and two *alternate* objects, one of the same shape as the pivot and one of the same material as the pivot. So, for example, speakers were shown a plastic comb with a handle as a pivot and asked whether it was more like a wooden comb with a handle or more like a plastic comb without a handle. The expectation was that English speakers would match the pivot to the other comb with a handle whereas the Yucatec speakers would match it to the other comb made of plastic. Informants were shown a large number of such triads, which, across the stimulus set, controlled for size, color, function, wholeness, and familiarity. Examples appear in figure 15.1.

The predicted classification preference was strongly confirmed, with 12 English speakers choosing the material alternate only 23% of the time and 12 Yucatec speakers favoring it 61% of the time. Clearly, the two groups classify these objects differently and in line with the expectations based on the underlying lexical structures of the two languages. Notice that both patterns of classification are reasonable and neither can be described as inherently superior to the other.

Manipulations of color, size, and wholeness did not affect the basic shape or material preference. Unfamiliar objects—that is, objects made of an unknown material or in an uninterpretable shape—tended to produce consternation and to lower the Yucatec preference for material choices. The case with function, in the sense of the typical use of an object, was more complicated. The results just reported obtain when function is neutralized by having all three objects share a function or differ in function. But when function coincided with either shape or material, this tended to alter the responses for both groups (see Lucy and Gaskins 2001).[11]

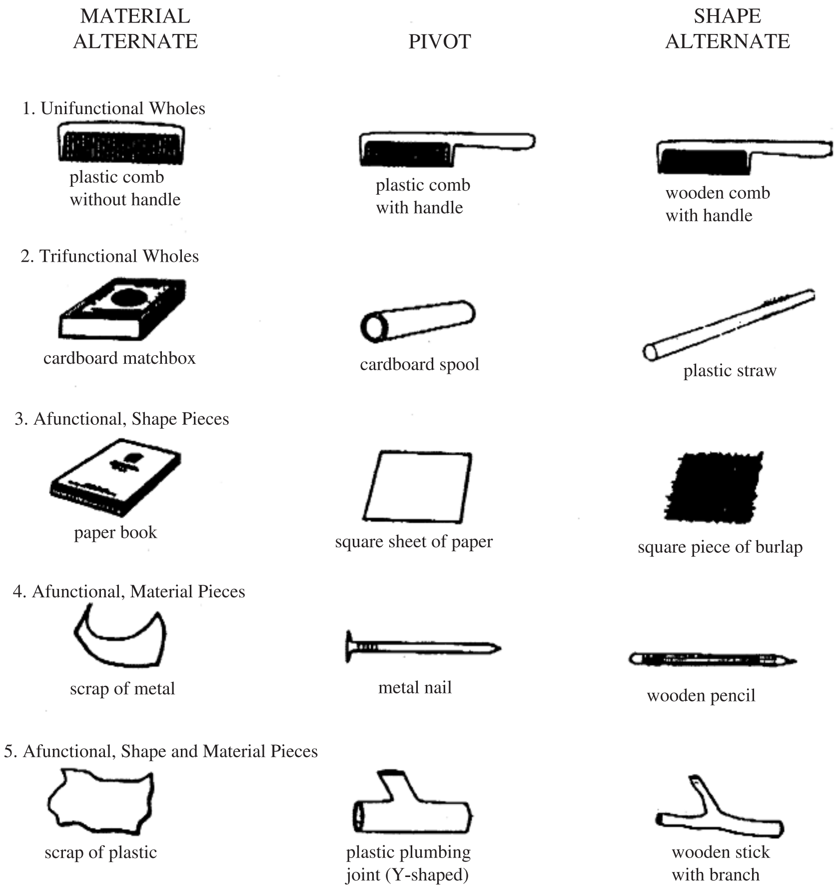

Figure 15.1
Examples of triad stimuli for stable objects. (Excerpted from figure 9.1 in Lucy and Gaskins 2001, 266.)

Malleable Objects The prediction for material referents in the form of malleable objects was also tested with adult speakers from both languages, again using a triads classification task. Informants were shown six triads such that each pivot and its alternates were composed of different sorts of materials such as foams, creams, gels, pastes, powders, particles, or granules, each formed temporarily into distinctive shapes (see figure 15.2). Although both the materials and shapes were selected to be familiar to both sets of informants, the individual *combinations* of

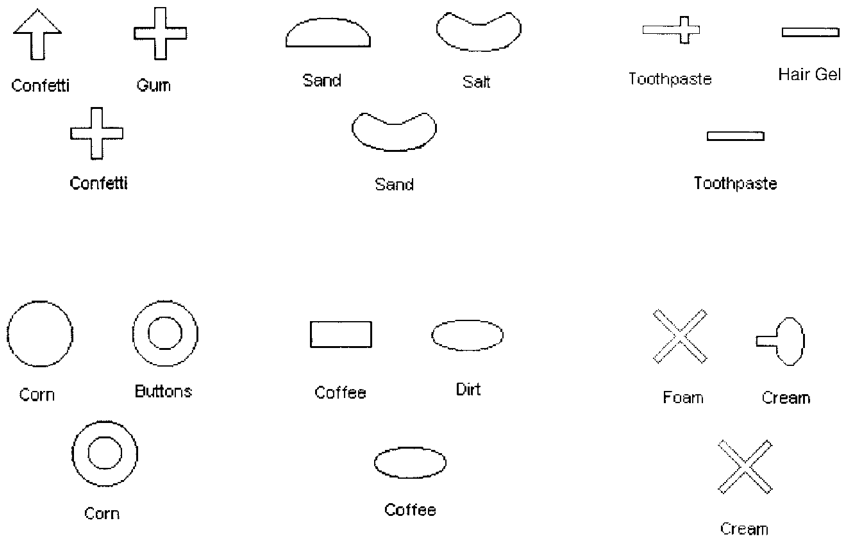

Figure 15.2
Examples of triad stimuli for malleable objects

shape and material were relatively novel for everyone. Size and color were controlled in these triads. Function was also controlled in the sense that each malleable object taken as a whole had no clear function.[12]

It is perhaps worth mentioning that the transitory properties of these objects made the assessment itself difficult, especially in the Mexican field conditions. For example, arranging beads, toothpaste, and the like into fixed shapes was intrinsically difficult in both settings; and working with shaving cream and instant coffee in the Yucatec setting—that is, in a house open to tropical humidity and occasional breezes—was especially difficult. Just at this practical level it was obvious that these were "objects" in a different sense than those used in the first study.

The results show both groups making a substantial number of material choices as expected, with Yucatec speakers favoring material choices 53% of the time and English speakers favoring them 34% of the time. However, clearly English speakers still favor shape overall. Although the direction of contrast is similar to that found for stable objects, the group difference was not statistically reliable with these materials.

Summary Essentially, the results are in line with the predictions. Where the two languages agree in their treatment of malleable objects, there is no difference in their degree of preference for material classification. Where the two languages disagree in their treatment of stable objects, there are divergent preferences for material or shape classification as a function of the language difference. The full import of these results will only become clear in the light of the developmental data reported next.

15.3.3.2 Developmental Patterns As part of an effort to unpack the mechanisms and linkages at work, we next explored the developmental emergence of these preferences. Assessments using the same triad materials described above were made of 12 English-speaking and 12 Yucatec-speaking children at ages 7 and 9.

Stable Objects With stable object stimuli, English-speaking and Yucatec-speaking 7-year-olds showed an identical early bias toward shape—choosing material alternates only 12% of the time. By age 9, the English-speaking children continued to favor shape, choosing material alternates only 18% of the time. But by this age, the Yucatec-speaking children were choosing material alternates 42% of the time, a result contrasting significantly with the English-speaking children and much like that of adult Yucatec speakers. Thus, the same kind of language-group difference found among adult speakers is also found in children by age 9—and the result is statistically reliable. Again, the manipulations of color, size, and wholeness did not affect the results. Further, shifts in the alignment of function did not produce the big deflections characteristic of the adult groups. The adult and developmental data are jointly displayed in figure 15.3. (For full discussion see Lucy and Gaskins 2001.)

Malleable Objects With malleable object stimuli, both English-speaking and Yucatec-speaking 7-year-olds showed a substantial number of material choices. English-speaking children choose the material alternate 42% of the time and Yucatec-speaking children choose the material alternate 46% of the time. This contrasts strongly with the 7-year-old pattern of choosing material for stable objects only 12% of the time and resembles the preference pattern shown by older Yucatec speakers with

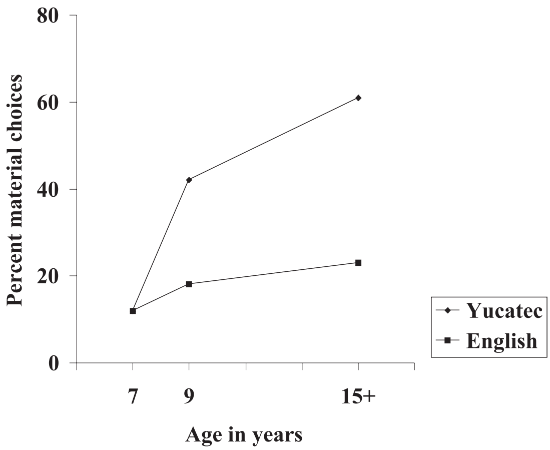

Figure 15.3
Developmental pattern for English and Yucatec classification preferences with stable objects: material versus shape. (Excerpted from figure 9.3 in Lucy and Gaskins 2001, 274.)

stable objects. At age 9, there is essentially no change: English-speaking children choose material alternates 43% of the time and Yucatec-speaking children choose them 50% of the time. Thus, the similarity of response found among adult speakers for objects of this type also appears in children. And again, the manipulations of color, size, and wholeness did not affect the results. The adult and developmental data are jointly displayed in figure 15.4. Viewed in contrast to the developmental data, the adult results appear more strongly differentiated in a manner reminiscent of the stable object results—which perhaps suggests some general transfer of effect from the latter category.

Summary On the basis of these results, consolidated in figure 15.5, we can draw three conclusions about the development of language-related classification preferences for these types of referents.

First, all things being equal, 7-year-olds show marked sensitivity to referent type independently of language group membership.[13] They show a relative preference for material as a basis of classification with malleable objects and a relative preference for shape as a basis of classification with stable objects. Both bases of classification respond to stimulus

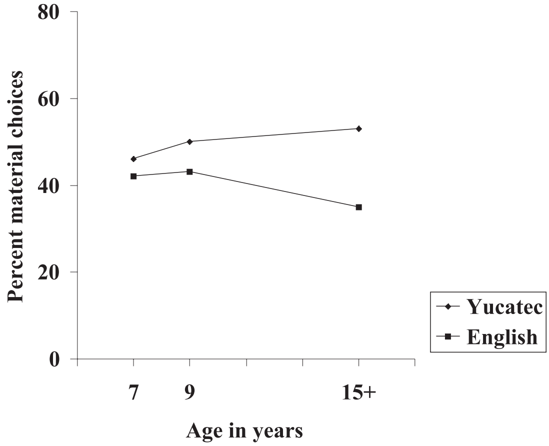

Figure 15.4
Developmental pattern for English and Yucatec classification preferences with malleable objects: material versus shape

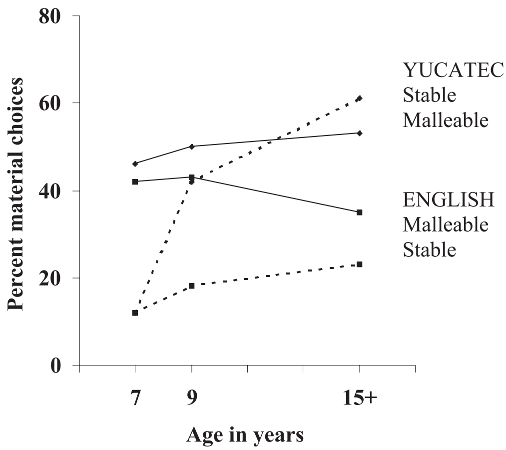

Figure 15.5
Developmental pattern for English and Yucatec classification preferences with both stable and malleable objects: material versus shape

properties and are fully available to and used by both groups. Apparently, referent type but not language type is the dominant factor in these nonverbal cognitive tasks at this age.

Second, 9-year-olds show differential sensitivity to referent type as a function of language group membership. Their preferences differ where the languages differ and correspond where the languages correspond. Essentially, 9-year-old English-speaking children continue to differentiate the two types of referents, a pattern that accords well with the split pattern in English. By contrast, 9-year-old Yucatec-speaking children begin to give up their relative shape preference with stable objects in favor of more material-based classifications, a pattern that accords well with the unified or continuous treatment of these referents by the adult language. Apparently, both referent type and language type affect cognition by age 9.

Third, in the context of the developmental data, we can see that there is some trend in the adult responses toward consolidation into a dominant pattern for each group. The Yucatec responses converge toward material choices and the English responses toward using shape. The split-marking pattern in English obviously makes the erasure of the distinction difficult in that language; that is, this trend remains subordinate to the main effect of cognition aligning with the specific linguistic treatment of a referent type. We can summarize by saying that *the two groups begin by grouping distinct referent types in the same way and end by regrouping same referent types in quite distinct ways as a function of language type*.

15.4 Discussion

The results reported here confirm the patterns found in earlier work. Overall, number-marking patterns in the two languages correspond to patterns of adult cognitive preference. Where the languages agree, so does the cognition, and where the languages disagree, so does the cognition. This holds true not only for plural-marking patterns in relation to attentiveness to number using picture stimuli (Lucy 1992a, in preparation) but now also for number-marking patterns in relation to preference for shape or material using object stimuli. The results show that the cognitive responses to particular referent types depend on the treatment of those referent types in each language. Neither language type nor referent type alone is sufficient to predict the results.

Several factors converge to suggest that language is the organizing force in these correspondences. First, the language patterns allow prediction of adult cognitive patterns, but not vice versa. The grammatical patterns allow us to predict both global cognitive differences (e.g., relative overall attentiveness to number or material across a range of stimuli) and local patterns of response as a function of grammatical distinctions among referent types. Knowing what stimuli are in play, what task is in use, or what sorts of cognitive responses are "natural" to humans will not allow equivalently precise prediction of adult language use. The remaining alternative would be to claim that these highly specific response patterns are somehow shaped by other aspects of culture and then the language patterns fall into place. However, the developmental results with stable objects undermine this view: 7-year-olds show the language contrast before they show the cognitive one. And it is not at all clear what cultural factor(s) would explain just this pattern of results across referent types.

The argument for the primacy of language (rather than culture) can be further bolstered by evidence from other languages associated with markedly different cultures. Fortunately, similar assessments of shape and material preference have now been made with Japanese speakers (Imai 2000; Imai and Mazuka, this volume). The Japanese language is similar to Yucatec in that it rarely marks plural and obligatorily uses classifiers in count constructions. In a comparison with English, therefore, we would expect adult Japanese speakers to perform more like Yucatec speakers in showing a relative preference for material over shape overall and in showing the strongest contrast for stable objects. The Japanese-English results are presented in table 15.3 along with the comparable Yucatec-English results from the present project.

Although the stimuli, tasks, and goals of the Japanese study were quite different,[14] the relevant results were very similar. First, across all referent types, the Japanese speakers favored material choices more than did the English speakers.[15] Second, for simple object referents (the set most equivalent to our stable objects), where we would expect a marked contrast between the two groups, Japanese speakers strongly favored mate-

Table 15.3
Percentage of adult English, Japanese, and Yucatec classification choices showing preferences for material as a basis for object classification. (Adapted from table 9.3 in Lucy and Gaskins 2001, 269, and figure 3 in Imai 2000, 155.)

	Object type	
Language	Stable	Malleable
Imai		
Japanese	73	83
English	28	50
(Difference)	(45)	(33)
Lucy and Gaskins		
Yucatec	61	53
English	23	35
(Difference)	(38)	(17)

rial and English speakers strongly favored shape. Third, for substance referents (the set most equivalent to our malleable objects), where we would expect more similarity, the Japanese speakers continue to favor material at about the same level, but English speakers now show a significant number of material choices, leading to a somewhat narrower gap between the two groups. Crucial here are the patterns: Japanese speakers show a relative preference for material when compared with English speakers performing the same task, and the group difference is relatively larger for stable objects, where the languages contrast maximally, than for malleable objects, where they contrast minimally. In the context of substantial cultural, task, and procedural differences, these results conform remarkably well to the predictions based on the grammatical analysis and lend further credibility to the argument that language is the decisive factor.[16]

The Japanese research also explored children's responses on these tasks, although with 4-year-olds rather than 7- and 9-year-olds. The Japanese 4-year-old results are presented in table 15.4 along with the comparable results for 7-year-olds from the present project. Here, given the findings reported above, we would expect to find differential responses to the referent types for these age groups, but we would not expect to find overall differences between the two language groups. The

Table 15.4
Percentage of children's English, Japanese, and Yucatec classification choices showing preferences for material as a basis for object classifiction. (Adapted from table 9.3 in Lucy and Gaskins 2001, 269, and figure 3 in Imai 2000, 155.)

	Object type	
Language	Stable	Malleable
Imai		
Japanese (4-year-olds)	70	92
English (4-year-olds)	55	74
(Difference)	(15)	(18)
Lucy and Gaskins		
Yucatec (7-year-olds)	12	46
English (7-year-olds)	12	42
(Difference)	(0)	(4)

first expectation is borne out in that both groups prefer material choices more for malleable objects than for stable ones. But the second expectation, that the two groups will look roughly similar, is not borne out: the Japanese speakers show a stronger overall preference for material than do the English speakers.[17] In itself this might suggest some global language-specific effect. However, the overwhelming preponderance of material choices in all the Japanese subgroups contrasts so strongly with the results of the Yucatec-English study that it suggests there is some fundamental difference in the assessment task or materials.

One way to interpret these differences, and reconcile the two sets of results, is to regard the children's data in each case as the baseline or default for speakers working with the specific task and materials used. From this vantage, in the Japanese-English study, speakers find the stable object stimuli used in the task somewhat material biased. Adult Japanese speakers apparently find this material bias congenial because they also tend to show it in their responses. Adult English speakers, however, find their language out of sync with this material bias and opt for more shape-based choices, more or less evenly across referent types. Applying the same sort of reasoning to the Yucatec-English comparison, speakers find the stable object stimuli used in the study somewhat shape biased. Adult English speakers seem to find this congenial overall and show the

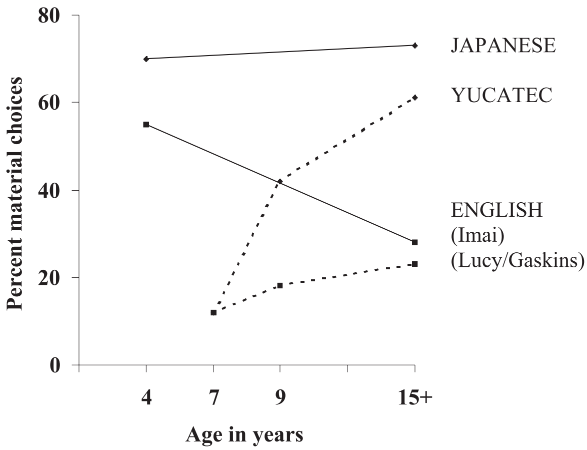

Figure 15.6
Developmental pattern for English, Yucatec, and Japanese classification preferences with stable objects: material versus shape

same basic response pattern. Adult Yucatec speakers, however, find the shape bias out of sync with their language and opt for more material-based choices. The malleable objects are more or less neutral in childhood (consistent, actually, with their lexical semantic marking) for both studies, and the two groups show modest deflections in the direction of their overall preference. In short, even though the two experiments appear to have quite different baseline response biases as indicated by the choices of the children, the adults shift from these baselines in a way consistent with an interpretation in terms of a language influence. For the crucial stable object referent group, figure 15.6 displays graphically the deflections in classification preference that occur from childhood baseline toward an adult pattern in line with the structure of each language.[18]

Although, when interpreted in this way, the Japanese-English comparative findings support the main conclusions of the Yucatec-English research, they emerge from a distinct research tradition with different goals and assumptions. That tradition embraces the notions that certain nonlinguistic experiences are ontologically privileged and that linguistic forms referring to them should be learned earlier. So, for example, nouns are thought to be easier to learn than verbs (Gentner 1982) and object names easier than substance names (Gentner and Boroditsky 2001, 221).

The conceptual and empirical viability of these claims remains controversial but need not concern us here.

What requires emphasis is that the present research project neither makes nor requires equivalent claims about ontological privilege. Rather, the referent types defined here have been developed through linguistic comparison within a typological framework. Insofar as they have a notional interpretation as linguistic forms,[19] they do not directly reflect nonlinguistic reality or the perception of it; rather, they reflect speech-centric categories deriving from the self-reflexive capacity of language (see Lucy 1992a, 70–71, for an explanation, which follows Silverstein 1981 in this regard).[20] Although many such categories may well turn out to correspond in interesting ways to pre- or nonlinguistic category biases, it is not necessary or even desirable to assume this at the outset. Inversely, there is nothing in this research that precludes the presence of pre- or nonlinguistic universals of categorization. In short, the research reported here focuses on the impact of language on thinking, and the analysis neither depends on nor aims to establish claims regarding universal nonlinguistic ontology.

From this vantage, the division of nouns in English into two classes (i.e., lexically unitized or not) is a linguistic fact that we can use to delimit two types of referents. We can then look at how these referent types are treated in Yucatec. But there is no expectation that these referent types have, as types, a language-independent ontological status, or that Yucatec speakers will mark them, or, if they don't mark them, that they in fact "actually" have the distinction and then have somehow to learn to "overlook" or "suppress" them in their language. Rather, the claim is the following: if the distinction in referent types turns out to be relevant or irrelevant for their language, then their cognition should reflect this in some detectable way.

By contrast, research on linguistic relativity arising out of an acquisition paradigm tends to take a different approach. This research, based largely on English, seeks to establish that an object/substance (or individuated/nonindividuated) distinction is ontologically given to all children prior to learning language on the view that this will then help explain how the child learns the count/mass distinction (e.g., Soja, Carey, and Spelke 1991). Evaluating this proposal has proven difficult, however, because English-speaking children are constantly exposed to the count/mass distinction in their language even if they don't produce or comprehend it, raising the possibility that the distinction arises from this language exposure (this position attributed to Quine 1960, 1969). Cross-linguistic comparison with Japanese, which lacks a count/mass distinction, was undertaken precisely to eliminate these confounding effects of early exposure (Imai and Gentner 1997). But notice that the original language acquisition arguments no longer make much sense from this comparative perspective. An ontologically "given" distinction between objects and substances (or preindividuated and nonindividuated entities) cannot help a child acquiring the Japanese lexicon because the language doesn't mark the contrast lexically. So the presence of the distinction certainly cannot aid acquisition—if anything, it would interfere with it. Despite this, the comparative acquisition research continues to focus on evaluating the ontological givenness of this English distinction even among Japanese speakers.[21] This perhaps accounts for the tendency to frame research on linguistic relativity in terms of an opposition with universal ontology even though these two notions need not necessarily be in opposition.[22] It also illustrates the common tendency in comparative research to privilege certain language categories in characterizing how domains of reality are encoded. The apparently neutral characterization of reality already contains within it the categories of one of the languages.

In sum, the approach advocated and exemplified in the current study remains resolutely Whorfian by focusing on contrasts in linguistic structure and minimizing a priori commitments about the nature of reality. Analysis begins with close description of linguistic structure, follows this with systematic linguistic comparison, frames the contrast typologically, and then characterizes differences in referential tendency. It is the latter differences that provide the basic hypotheses for the psychological research rather than any a priori assumptions about what in reality must be encoded, about universals of human cognition, or about how infant perceptual patterns implicate adult ontological commitments. In short, rather than beginning with a somehow-already-known reality and asking how different languages manage to cope with it, the approach advocated here takes the characterization of reality itself as problematic and therefore begins with language structures and induces the implicit construals of reality emergent in them. Careful analysis of these patterns should lead in time to a vision of reality as it emerges through the "window of language," that is, reality as it gets utilized in human discursive activity. This in turn would provide the foundation for asking deeper questions about the extent to which our *conception* of reality can be independent of our language.

Notes

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1. Whorf occasionally espoused similar views about the relative "fit" between individual languages and reality before fully embracing the egalitarian view (Lucy 1992b, 32–36).

2. Nearly all research that sees language acquisition as a "mapping" of a single known reality runs afoul of this bias.

3. Implements were of two types, tools and containers. In later work, we use the term *Material* instead of *Substance* when speaking of experimental stimuli (versus semantic value).

4. So, for example, referents marked semantically as [+animate] need not be animate or living from a biological point of view, and vice versa. What is crucial, rather, is the degree to which the referent approaches the maximally presupposed referents in speech. See Silverstein 1981 and discussion in Lucy 1992a, 68–71.

5. In the picture study, the three referent types were operationalized as Animals, Implements, and Substances, respectively. The original study used only adult male subjects. The finding has now been replicated with a sample including adult women (Lucy, in preparation).

6. Lucy (1992a, 56–83) explains the features used here as well as the frequent, yet optional marking of plural in Yucatec for the [+animate] subset of [+discrete] entities.

7. See discussion below regarding "mass" and "count" nouns.

8. When we call an object "stable," we mean only that the current shape would hold steady under many actions (moving it, setting another object on it, etc.). We do not mean that it would remain stable under all imaginable actions or conditions or even that the current shape is canonical in some way. A metal spoon, a wooden stick, or a sheet of paper would all be stable by this criterion even though each can be cut or bent and might be encountered in a variety of specific shapes. Whether an object is regarded as stable (or malleable) ultimately depends on the predicate at issue in the discourse; we have chosen exemplars where the presuppositions run strongly in one direction such that the discrete form of the referent can generally be presupposed for predication. See note 10.

9. The impossibility of presenting the referent of a noun referring to material without *some* shape was one of the reasons this referent type was not assessed in Lucy 1992a. Here the problem of representing the semantics of these nouns operationally in the cognitive tasks is "solved" by using objects whose shapes, although distinctive enough to allow a shape designation, neither are durable nor have any intrinsic connection with the materials. See also notes 8 and 10. The deeper point is that the meaning of any lexeme (or lexical class) is never adequately represented by one of its referents. In experimental work, we are always using approximations.

10. When we call an object "malleable," we mean to highlight the highly contingent nature of its shape such that practically any action or change of conditions will alter its configuration unless some outside force conserves it. Thus, the discrete form of the referent cannot generally be presupposed for predication. We did not use liquids or vapors in this study primarily because their use generally would require introducing a second, containing object into the tasks to give them shape. See note 8.

11. When function aligned against a group's preferred classification preference, it led to choices against the usual pattern. Specifically, the Yucatec preference for material dropped from 61% on the function-neutral triads to 39% when function was aligned with shape, and the English preference for material rose from 23% for the function-neutral triads to 72% when function was aligned with material, both statistically reliable shifts. It appears that when function matches are available, they can affect the results and need to be carefully controlled when assessing a relative shape versus material classification preference (see Lucy and Gaskins 2001).

12. In the terminology of Lucy and Gaskins 2001, these stimuli were comparable to the "afunctional pieces."

13. It is perhaps worth emphasizing that just as the English-speaking children have substantial command of the plural by age 7, so too do the Yucatec-speaking children have substantial command of the numeral classifier system by this age. Seven-year-old Yucatec-speaking children reliably use classifiers when counting, draw appropriate semantic distinctions among them in comprehension tasks, and will judge a number construction lacking them as faulty. However, they fall far

short of having command of the full range of classifiers in comprehension and their range in production is narrower still. In short, they have the basic structural implications straight but do not yet have the full lexical range of an adult. Hence, to the extent that these cognitive results derive from these basic structural characteristics of the language rather than mastery of specific lexical items, there is no reason they could not appear at age 7. That they do not do so suggests that some rather specific reorganizations in the relation between language and thought take place between ages 7 and 9.

14. Regarding the stimuli, in addition to simple objects and substances (our stable and malleable objects), the Japanese-English comparative work also used complex objects—that is, "factory-made artifacts having complex shapes and specific functions" (Imai and Gentner 1997, 179; cf. Imai 2000, 146). The results for these complex object stimuli cannot be directly compared with our results because there was no formal counterbalancing of the coincidence of function with shape and material alternatives in the Japanese-English comparison. However, the extremely high number of shape choices for these object types relative to other object types in both groups is quite consistent with our findings that the coincidence of function with shape sharply increases the number of shape choices (Lucy and Gaskins 2001, 269; also see note 11 above). The instructions in the Japanese-English work asked whether the shape or material alternative was "the same" as the pivot rather than which was "more like" it. In our experience, use of the term *the same* in certain constructions can prompt more material choices, which may account for the greater absolute number of material choices found in Imai's tasks. Finally, regarding the differences in goals, these relativity studies are rooted in a paradigm concerned with what shapes a child's acquisition. As will be pointed out later in the discussion, this leads to a consistent preoccupation with universal prelinguistic ontology (seeing this as the opposite of relativity) even when the comparative cases chosen have effectively rendered this concern irrelevant (since the ontological distinction can be of little help in acquiring a language that does not honor it). As indicated in the introduction, the present approach resists making such prior, language-independent commitments about ontology or reality.

15. The Japanese-English study elicited more material responses in every cell. This difference is discussed below.

16. These responses were also shown to be in very tight alignment with characteristic word extension patterns elicited experimentally in the two languages. See note 21.

17. It is not clear whether this difference is statistically reliable.

18. Mazuka and Friedman (2000) report adult Japanese speakers showing a preference for shape over material using a similar assessment. The results are difficult to evaluate because they did not control for function (see note 11). Their explanation for the preference in terms of "cultural" or "educational" factors, always tenuous since no substantive evidence was ever given for them, now seems even less tenable in light of the new Japanese and Yucatec developmental data.

19. The notional characterizations referred to here have to do with semantic and pragmatic meaning. They should not be confused with the notional approximations used to pick stimuli for the cognitive research.

20. The hierarchy of noun phrase types developed by Lucy (1992a, 56–83) should not, therefore, be termed an "animacy" hierarchy (cf. Gentner and Boroditsky 2001, 229) since this suggests a completely nonlinguistic basis for the categories and elides the essentially discursive (or pragmatic) basis for the ordering. This hierarchy based on an empirical comparison of language structures also produces orderings distinct from those postulated employing other criteria (e.g., Gentner and Boroditsky 2001, 215, 230).

21. Since the acquisition of the Japanese language cannot in itself show the effects of the ontological distinction in ordinary use, the usual measure of effect is experimentally induced word extension. When these extensions align with the grammar, they are taken to show the influence of language on thinking; when they don't align, they are taken to show the influence of thinking on language. Conceptually, then, these word extension patterns hover somewhere between language and thought: a measure of both yet not quite a measure of either. On the one hand, the Japanese-English comparative data show contrasting extension patterns among words that are treated alike grammatically—even in adulthood. So the extensions cannot be used as an exact measure of having acquired the grammar. On the other hand, such extensions really cannot be construed as a nonlinguistic measure either since they involve judgments about verbal meaning. In this respect, they are silent on the question of linguistic relativity proper, that is, on the question of the influence of language on thinking more generally. Indeed, this limitation prompted Imai (2000) to supplement these word extension tasks with nonlinguistic (or "no-word") classification tasks precisely to allow her to examine the relation of language to nonverbal classification preferences as had been done in the Yucatec-English research.

22. Insofar as there exist some universal aspects of ontology, they may be irrelevant to language (hence not marked), relevant but optionally encoded, or universally exploited. And even if universally exploited, they need not be lexically encoded but rather signaled grammatically or discursively. So no necessary relation can be assumed. It seems more sensible then to work forward from what languages *do* encode than to presume what they *must* encode.

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