

PUTTING THINGS IN PLACES

DEVELOPMENTAL CONSEQUENCES
OF LINGUISTIC TYPOLOGY

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Our presentation today represents joint work by a team from the MPI. We explore how different languages describe events of putting things in places, and how children begin to talk about such events in their very early multi-word utterances. Our original plan was to explore how children learn to talk about motion towards a goal more generally, and so to include expressions of spontaneous as well as caused motion, but our data quickly became overwhelming so we decided to home in on “putting” events. Although it is restricted relative to the broader domain of motion towards a goal, the domain of “putting” events is still large enough to allow us to identify some important factors that influence the course of acquisition.

auch - rein - sack 'also - into.there - bag'



Children and their caregivers talk frequently about events of “putting”. Here are a few examples of the kinds of utterances we are interested in. In this scene, a young German-speaking child, age 1;11, is talking about putting a toy into a bag.

iske andar aa jaaegaa 'this will go inside'



In this scene, a Hindi-speaking child, age 1;10, talks about putting a small cloth doll into a plastic cup.

Child: *in* 'this.one'

Grandma: *latza tey ine* 'stack.insert.it there.'



And in this scene we see a Tzeltal-speaking grandmother instructing her grandchild, age 2;0, to put one nesting cup into another.

Why study how children learn to talk about placement crosslinguistically?

Role of:

- language typology: satellite- vs. verb-framed languages (Talmy), and beyond
- inflectional morphology
- semantic categorization and semantic specificity
- discourse patterns in adult input

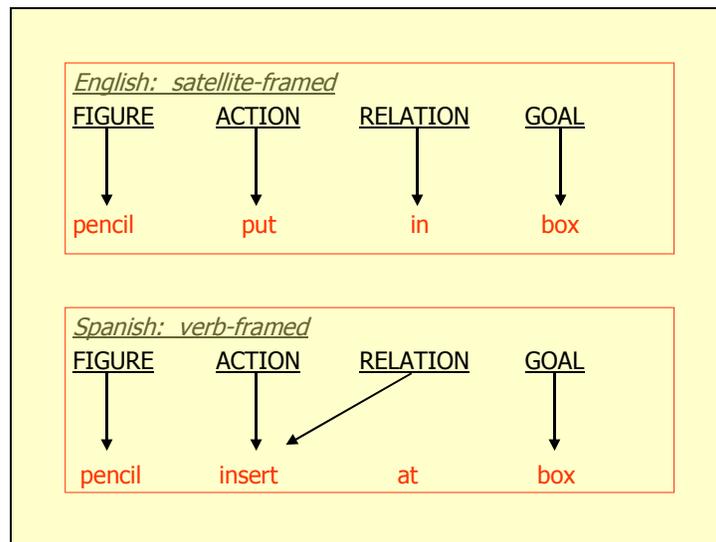
The most important feature of our study is that it is crosslinguistic. One motivation for working crosslinguistically was to investigate the role of language typology in children's expression of motion events. In his well-known typology of how languages encode motion events, Talmy (1991) distinguishes between "satellite-framed" languages and "verb-framed" languages on the basis of where in the clause information about path is characteristically encoded. We do find that this typological distinction plays an important role in the course of language acquisition, but, as we will discuss, other features that crosscut this typology play a role as well. These include properties of the target language's inflectional morphology, its semantic categories - in particular how semantically specific vs. general its categories are - and the typical discourse patterns found in the adult input.

<u>satellite-framed</u>	<u>verb-framed</u>
English	Spanish
German	Hindi
Russian	Turkish
Finnish	Tzeltal (Mayan)

We will be looking at eight languages, four verb-framed and four satellite-framed languages. Verb-framed languages characteristically encode the *path* of motion (e.g., the path 'into', 'out of', 'upward', or 'downward') in the verb, whereas satellite-framed languages encode it in a "satellite" to the verb (e.g. particles, prefixes, directional adverbs).

Information about the manner or cause of motion is also treated differently in the two types of languages. In verb-framed languages, it is typically encoded in an (optional) constituent outside the verb, such as an adverbial. In satellite-framed languages, it is most typically encoded in the verb itself.

The treatment of manner/cause information deserves extensive analysis, but for the purposes of this talk, we focus principally on the encoding of the path of motion.



To illustrate the differences among our eight languages, we distinguish the following four components of a placement event (this is an adaptation of Talmy's scheme to our purposes):

- Figure: The object that is caused to move
- Action: The placement action (caused motion toward a Goal)
- Goal: The location toward which the Figure is moved
- Relation: The resulting spatial relationship between the Figure and the Goal. (A subtype of Talmy's "path" category.)

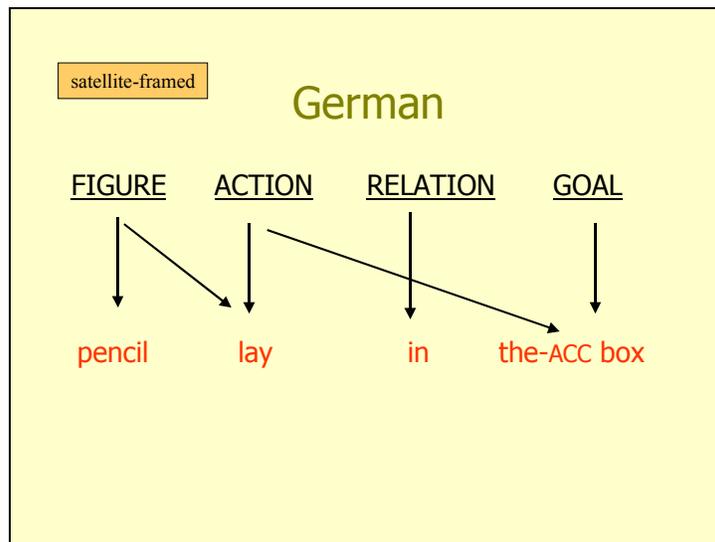
How our different languages map each of these components onto the words of a placement expression can be diagrammed. (In this and subsequent slides, we abstract away from information about word order and the specific lexical items, and focus only on the differences we are interested in; for convenience of presentation, we use English glosses to give all examples from other languages).

Let us start with how English, a satellite-framed language, and Spanish, a verb-framed language, express an event of *putting a pencil into a box*. In English, the placement action is expressed in the verb while the resulting relation between the pencil and the box is encoded in a particle ('put the pencil *in*') or - as shown here - a preposition (cf. Talmy 1985). The verb could also express the manner of the caused motion, as in 'roll the pencil into the box'. In Spanish, BOTH the placement action AND the resulting relation are expressed by the verb, which can be roughly translated as 'insert'. (The preposition preceding the Goal expression, translated here as 'at', gives some general spatial information, but - unlike in English - not the specific containment relationship obtaining between the Figure and the Goal.)

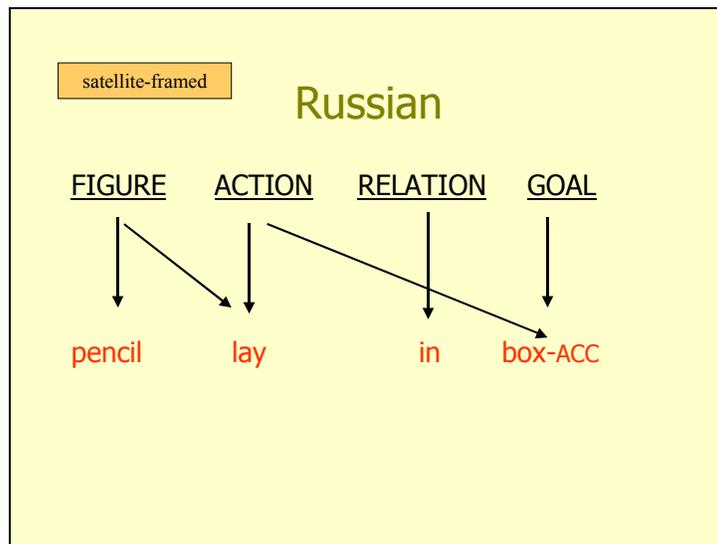
satellite-framed languages

- English
- German
- Russian
- Finnish

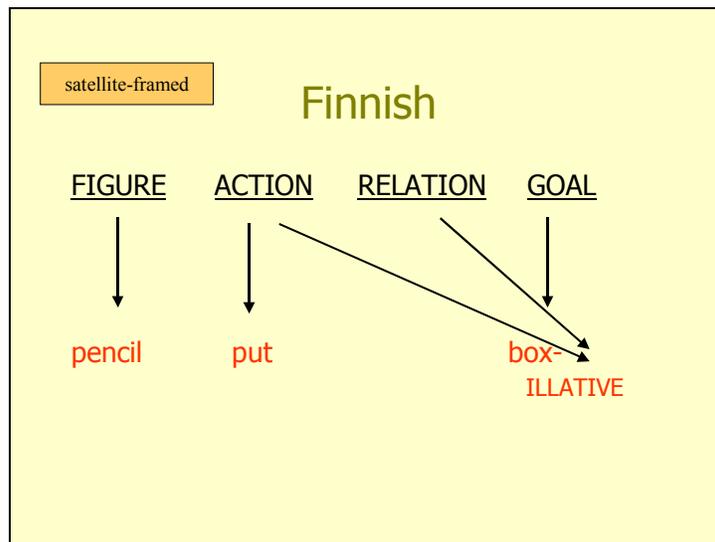
The dichotomy between verb-framed and satellite-framed is useful, but, as we will see, it is not the whole story: there is considerable variation within each of these language types that has an impact on acquisition. Let us look first at the languages which, together with English, represent the satellite-framed type.



In German, as in English, the placement event is encoded in the verb and the relation in a particle or - as in this example - a preposition. But the verb obligatorily expresses more information than simply "placement": the speaker must choose between verbs such as *legen* 'lay' and *stellen* 'set' on the basis of the shape and final orientation of the Figure. Further, a subcomponent of the Action, which we may call the "Vector" (motion towards a Goal) is encoded not only in the verb, but also in the accusative case ending on the determiner of the Goal nominal. (Accusative contrasts with dative case, which is used for encoding a static locative relation.) Although German and English are both satellite-framed, then, they present rather different structures for the child to learn.



Russian patterns similarly to German except that the accusative case-marking appears directly on the Goal nominal.

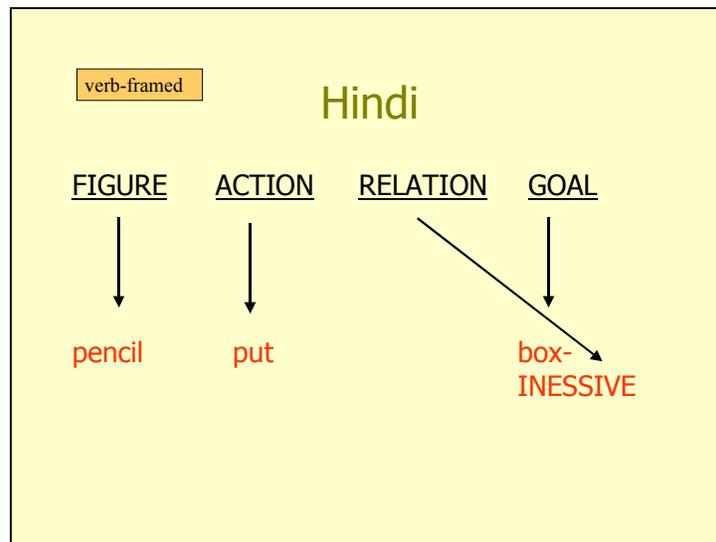


Although Finnish is also a satellite-framed language, it shows a different patterning: information about the Relation (containment) is combined with information about an aspect of the Action (Vector: motion towards), and both are expressed simultaneously in the illative case ending on the Goal nominal (translatable as 'into').

verb-framed languages

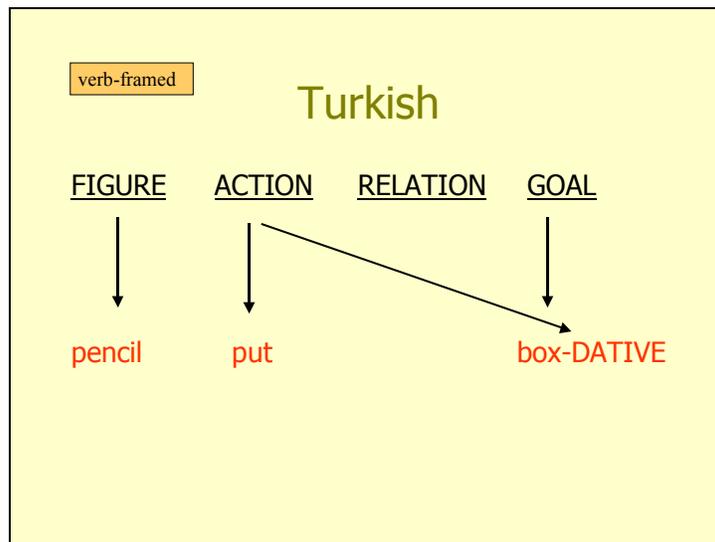
- Spanish
- Hindi
- Turkish
- Tzeltal

Now let us have a look at our verb-framed languages. We have already seen how putting a pencil in a box is expressed in Spanish. What about Hindi, Turkish, and Tzeltal?

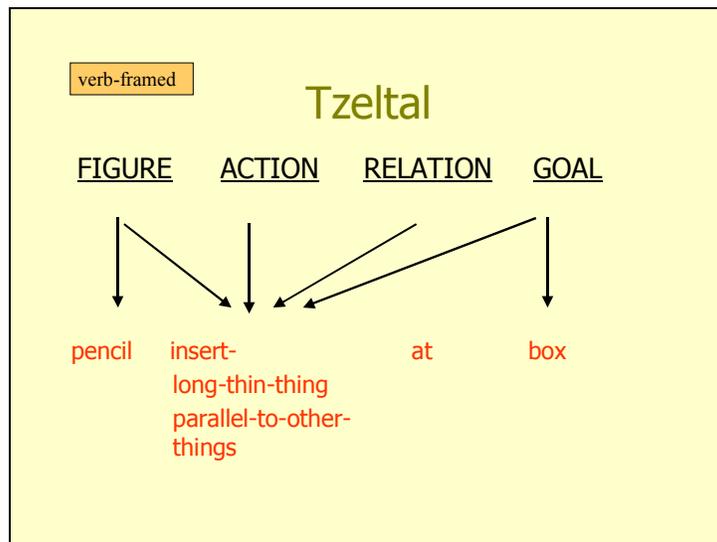


Recall that in Spanish, the Relation and the Action are conflated and both expressed in the verb. In the most usual Hindi encoding of an event of putting a pencil in a box, however, the Relation is expressed in the inessive case ending on the Goal nominal. This case ending - unlike its Finnish counterpart - does not include information about Vector: the same case is used regardless of whether the scene described is a dynamic one (putting 'into') or a static one (being 'in').

Given that Relational information is expressed here in a case ending rather than in the verb, it may seem surprising that we have classified this language as "verb-framed". But Hindi *is* in fact verb-framed: like Spanish, it has a full set of path verbs comparable to 'enter', 'exit', 'ascend', 'descend', 'insert', 'extract', and so on; and - again like Spanish but unlike satellite-framed languages - it does not allow the verb slot to be filled with a manner verb, as in 'roll the pencil into the box'. Unlike Spanish, however, it does not REQUIRE the use of a verb that expresses the Relation. (In the case of spontaneous motion, deictic verbs such as 'come' and 'go' can be used instead of path verbs such as 'enter' and 'exit' in conjunction with locative case-marked nominals).



Turkish is also a verb-framed language that has a full set of path verbs and does not allow the verb to express information about the manner of motion. But in describing an action of putting a pencil in a box, the speaker does not even have to express the Relation at all! The dative case ending on the Goal nominal expresses the “Vector” subcomponent of the Action (motion towards a Goal), but the fact that the pencil ends up in the box is typically left to inference: listeners know what spatial relation is likely to result when a pencil is moved to a box.

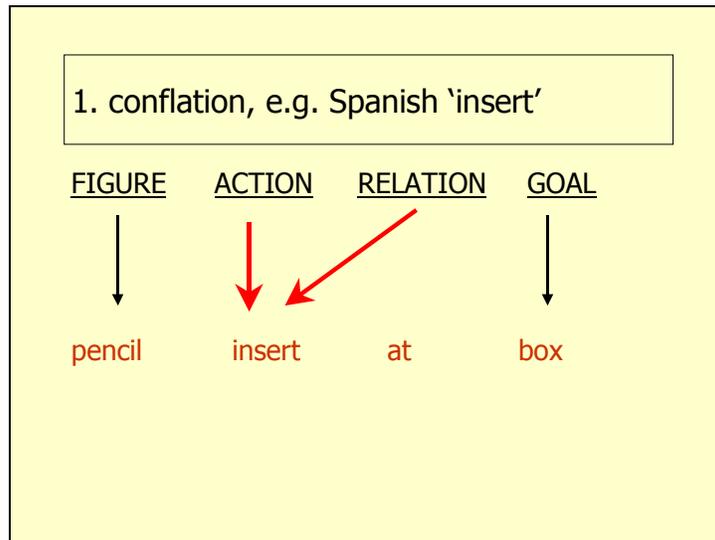


Tzeltal conforms to the canonical pattern of verb-framing in combining information about both the Action and the Relation together in the verb. But it differs from our other verb-framed languages in packing additional information into the verb: here, the verb tells us not only that a Figure object is put into a Goal object, but also that the Figure is a long thin thing, and that the Goal contains other elongated objects to which the Figure ends up parallel.

complex form-meaning mappings: three factors

1. conflation: two or more meaning components expressed simultaneously by one form

Let us summarize the range of different patterns we have shown for expressing placement events by singling out three phenomena for special attention. First, notice that two or more meaning components can be expressed simultaneously by one form. This combination of information is termed “conflation” by Talmy.

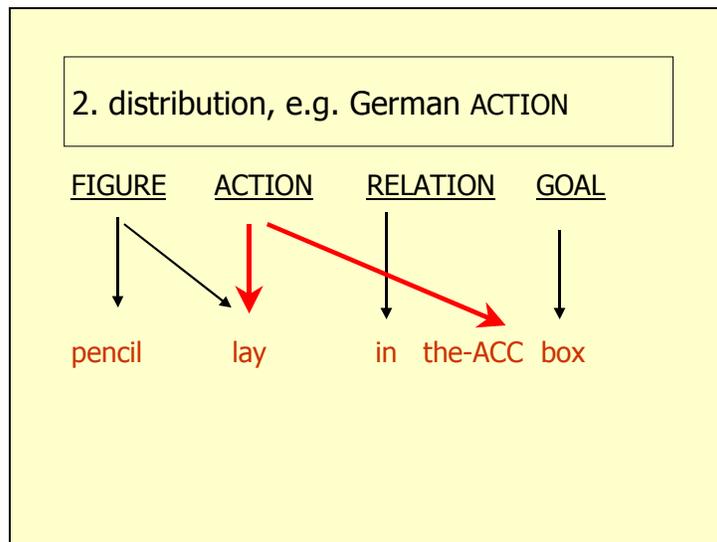


A classic example of conflation is provided by the verb *meter* 'insert' in Spanish, which expresses both an action (of caused motion) and a relation (of containment).

complex form-meaning mapping: three factors

2. distribution: aspects of a meaning component expressed by more than one form

A second phenomenon warranting special attention - in a sense the converse of conflation - is that a meaning component can be distributed across more than one morpheme. This potential source of crosslinguistic variation has tended to escape attention in Talmy's typology, but has been discussed by Sinha & Kuteva (1995) under the rubric "distributed semantics".

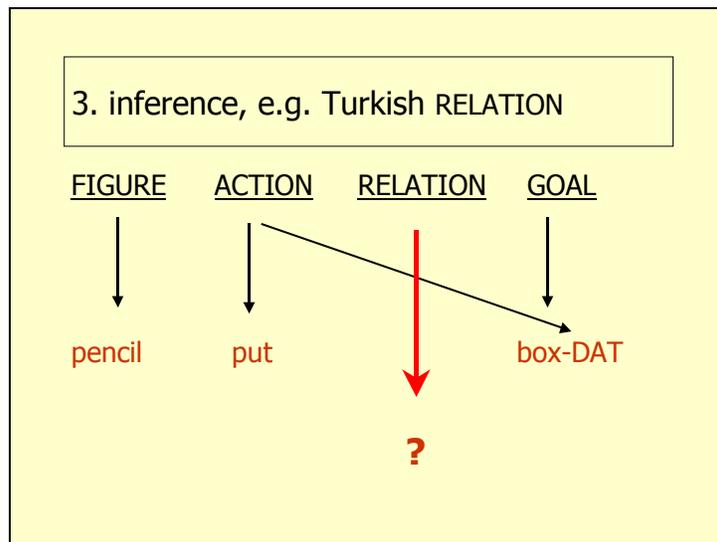


An example of distributed semantics is found in our German example, where information about the Action (caused motion to a Goal) is expressed in two places, both in the verb and in the accusative case ending on the determiner of the Goal nominal.

complex form-meaning mapping: three factors

3. inference from the situation and
from world knowledge

Finally, a particular meaning component may not be explicitly encoded at all, but rather left to be inferred on the basis of discourse context and world knowledge.



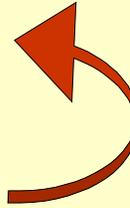
An example of this can be seen in our Turkish example, where the relation of containment is inferred from knowledge of the canonical relationship between pencils and boxes. If the first part of the sentence is held constant and the word 'table' is substituted for 'box', the listener will infer that the pencil ended up ON the table.

multiple options and preferred patterns

- choices within a language

- Hindi

- pencil put box-INESSIVE
 - pencil insert box-INESSIVE
 - pencil insert box's inside



- role of input frequency

In addition to calling attention to crosslinguistic differences in *conflation*, *distribution*, and *inferencing*, we would like to emphasize that even when languages offer the same set of options for encoding a placement event, they may differ in the *choices speakers typically make* from among these options.

Recall, for instance, that Hindi has more than one option for expressing an event of putting a pencil in a box: speakers can use a Spanish-style verb like 'insert' that conflates the Action and the containment Relation, but they can also select a verb like 'put' and express the Relation either with the inessive case-ending, as in our example, or with a spatial nominal ('inside'). In actual fact, the child rarely hears the 'insert' verb in the input: the pattern most frequent in parental speech involves combining the 'put' verb with the inessive case ending.

What does the child have to learn?

- what to attend to in placement events: LANGUAGE-SPECIFIC SEMANTICS
- how to express semantic content: LANGUAGE-SPECIFIC MORPHO-SYNTAX
- what must be expressed and what can be left to inference: LANGUAGE- AND CULTURE-SPECIFIC PRAGMATICS

To summarize our introduction, let us review some of the important things children must learn in order to express placement events in their language.

First they have to figure out what aspects of the situation to attend to - e.g., do they routinely have to worry about the orientation of the Figure, as in German, its inherent shape properties, as in Tzeltal, or neither, as in English? This kind of information is essential for handling the language-specific semantic categories of the input language.

Second, they must learn how to express this semantic content, i.e., where to distribute information of various kinds in the sentence. This involves learning the mappings between the meanings to be encoded and the morphosyntax of the input language.

Finally, they must learn what *must* be expressed in their language and what can be left to inference (language- and culture-specific pragmatics).

outline

- introduction
- early development in
 - four satellite-framed languages
 - four verb-framed languages
 - interpreting the patterns
- beyond typology
 - specificity of semantic categories
 - child-directed speech
 - intra-typological variation
- conclusions

To preview the rest of the talk, we begin with an investigation of the main patterns we find in the description of placement scenarios in children acquiring our four satellite-framed and four verb-framed languages.

We then focus on a specific set of issues: crosslinguistic variation in semantic categorization in child language, a study of child-directed speech in English and German, and a discussion of intra-typological variation with specific reference to “variation sets” in the input.

We conclude with an overview of our findings and their implications.

- early development

data sources:

spontaneous family interaction

- video- or audio-tapes
(some from CHILDES)
- diary studies

All the analyses we will present in the following are based on either diaries which parents have kept of their children's linguistic development or on video or audio recordings of spontaneous family interactions. Some of the data come from the CHILDES data base.

our own data, and with additional
data and help from:

- English: Roger Brown, Eve Clark, Michelle Chouinard, Jacqueline Sachs
- German: Heike Behrens, Harald Clahsen, Max Miller
- Hindi: Rukmini Bhaya-Nair, Pritha Chandra, Ayesha Kidwai, Rajesh Kumar, Bhumika Sharma, Rachna Sinha
- Russian: Sabine Stoll
- Spanish: José María Albalá, María Benedet, María Carrasco, Celis Cruz, José Linaza, Victoria Marrero, Rosa Graciela Montes, Rosanna Mucetti, Susana López Ornat, Elisabet Serrat Sellabona, Catherine Snow
- Turkish: Ayhan Aksu-Koç, Aylin Küntay
- Tzeltal: Antun Osil, Petul Osil, Xun Osil, Alux Ch'ijk, Nik Ch'ijk, AlvinaCh'ijk, Petul Ch'ijk, Xpet Kojtom, and Xmik Choj

Other data were gathered and analyzed by ourselves or by a large number of colleagues we would like to thank for their assistance.

focus of analysis

- placement utterances that express causing an inanimate object to move to a place (*put, place, attach ...*)
- excluded:
 - self-motion+placement (*bring, etc.*)
 - putting clothing on
 - giving to animate recipient
 - answers to where-questions
 - imitations and self-repetitions

In our analysis of early development, we have focused on placement utterances that express causing an inanimate object to move to a place (e.g. *put, place, attach*).

We did not include in our analysis utterances describing self-motion plus placement (expressed by verbs like *bring*), putting clothing on, or giving something to an animate recipient. Moreover, we excluded answers to where-questions as well as imitations and self-repetitions.

coding

Placement utterances coded in:

- child speech at t1
(starting from first two-word utterances encoding object placement)
- child speech at t2
(about six months to a year later)
- input from caregivers and older children

We coded placement utterances at two time points: The first time point, t1, captured the first two-word utterances which encoded object placement. These data were compared to data recorded about six months to a year later, at t2.

In addition, we analyzed the input the children received from caregivers and older children.

where do the children begin?

- At t1, when children are putting just two morphemes together, which ones do they select to talk about placement?
- Does this differ for satellite-framed and verb-framed languages?
- What are children's favored patterns in each of our eight languages?

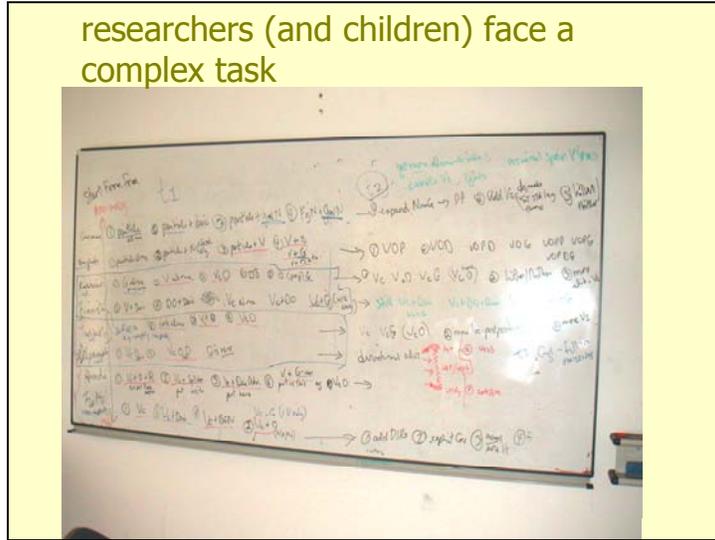
children at t1

focus on the most prominent patterns
in each language:

- four satellite-framed languages
- four verb-framed languages

In our analysis of children's placement utterances at t1, we have tried to establish the most prominent patterns for our four satellite-framed and four verb-framed languages.

researchers (and children) face a complex task



Describing these patterns revealed the complexities of the cross-linguistic variation children and researchers are faced with, and the complexities involved in producing a comprehensible overview of the basic patterns and the generalizations emerging from them.

so we abstracted away ...

- schematized examples of favored patterns from eight languages at t1
- English glosses only
- semantic elements in the verb phrase only
- relevant morphology only
- normalized word order

In order to simplify the presentation of the most prominent patterns in each of the eight languages at t1, we have abstracted away from language-particular details which were not relevant for our analysis. For each example we have given an English gloss that captures the relevant morphology (e.g. locative case markers), but omits morphological markers which do not serve to encode Figure, Action, Relation, or Goal (e.g. person, number, or tense marking). Moreover, we have focused on the semantic elements in the verb phrase, omitting the AGENT of the placement action, negation elements, etc. For the sake of comparability, we have also normalized the word order according to English patterns.

types of elements we find

words	semantic elements
in	relation
inwards	relation& <u>vector</u>
put	action
enter-CAUS	action&relation
lay	action&figure
box	goal
here	<u>deixis</u>
hither	<u>deixis&vector</u>

Analyzing the most prominent patterns for the description of placement scenarios, we found the following types of elements:

Particles in which the Relation or Path is encoded either by itself (e.g. 'in') or in combination with the Vector or direction of the motion (e.g. 'inwards'), verbs expressing the action (e.g. 'put'), a conflation of the Action with the Relation (e.g. 'enter-CAUS'), or a conflation of the Action and the Figure (e.g. 'lay'), nouns referring to the Goal of the motion (e.g. 'box'), and deictic elements like 'here' or 'hither', which contain deictic information only or a combination of information about deixis and about the Vector or direction of the motion.

- early development
 - four satellite-framed languages

Recall that in satellite-framed languages, the path of motion is lexicalized not in the verb itself, but in a “satellite” (e.g. in a verb particle such as ‘in’ in Germanic languages, or a corresponding path prefix or suffix in other types of languages). In this section, we review children's preferred patterns for expressing placement events in our four verb-framed languages: English, German, Russian, and Finnish.

English t1

- in
relation
- bead in
figure relation
- in mouth
relation goal
- pour in
action relation
- put sink
action goal

In four of the five dominant patterns found in the English child language data, the Relation was encoded by a particle like 'in'. Thus, the English-speaking children produce utterances like 'bead in', 'in mouth' or just 'in'. In contrast, only two of the five most frequent patterns for placement utterances involve a verb. Such verbs typically encode information about the Action but not additional information, e.g. about the Relation or Goal.

German t1

- inwards
relation&vector
- there inwards
deixis relation&vector
- that inwards
figure relation&vector
- girl chair
figure goal

None of the most frequent patterns of placement utterances we found in the German child data contains a verb. Rather, children acquiring German show an overwhelming preference for utterances with particles like 'inwards', in which the Relation and the Vector are conflated. These particles occur either by themselves or in combinations with deictic elements ('there inwards') or noun phrases encoding the Figure ('that inwards'). In addition, noun-noun combinations encoding the Figure and the Ground can be observed.

Russian t1

- put
action
- put on table-ACCUSATIVE
action relation goal-vector
- everything bag-ACCUSATIVE
figure goal-vector
- set bear
action&figure figure

Russian children produce more verbs in placement utterances than English and German children, and they do not use path prefixes to express Relations or Vectors. Rather, they make use of local cases which encode Vector information. However, just as in the English and German child data, placement utterances without verbs can be found. In these utterances an element encoding the Figure is combined with a case-marked element encoding the Goal; e.g. 'everything bag-ACCUSATIVE'.

Finnish t1

- put there-ILLATIVE
action deixis-relation&vector
- there-ILLATIVE cow
deixis-relation&vector figure

In the Finnish data, just as in the Russian data, locative case markers appear from early on. In contrast to the Russian case-markers, however, Finnish case-markers conflate Relation and Vector. Moreover, only one of the two dominant patterns of placement utterances contains a verb.

summary: satellite-framed languages

- Children learning these four languages put emphasis on **spatial relation** or **vector**
- In three of the four languages the children express vectors (*inwards*, ILLATIVE case).
- English-speaking children express spatial relations (*in*, *on*) but not vectors (*into*, *onto*).

- Children learning satellite-framed languages focus especially on the spatial relation or on the vector, and secondarily on the goal.
- They typically omit the verb.

- early development

- four verb-framed languages

Recall that in verb-framed languages, Action and Relation are typically conflated in the verb. In this section, we review children's preferred patterns in our four verb-framed languages: Turkish, Spanish, Hindi, and Tzeltal.

Turkish at t1

- throw this.place-DATIVE
action goal-vector
- put this.one
action figure
- put
action

Children acquiring Turkish show an overwhelming preference for Actions encoded in verbs. All of their favored patterns involve verbs encoding placement actions such as 'throw' or 'put'. So they say things like 'throw to this place' or 'put this one', or even just 'put'.

Spanish at t1

- put it
 action figure
- insert it
 action&relation figure
- put-it here
 action-figure deixis

Spanish children also express an Action in all their favored patterns, using general verbs of placement such as 'put' in sentences such as 'put it' or 'put it here'. They also frequently use verbs such as 'insert', in utterances such as 'insert it' which, following the canonical pattern of verb-framed languages, conflates action with the spatial relation of containment.

Hindi at t1

- attach this-INESSIVE
action goal-relation
- do this down
action figure relation
- put here-LOCATIVE
action deixis-relation

As in Spanish and Turkish, placement events in early child Hindi are also encoded in verbs in all of the favored patterns. Whereas verbs such as 'insert' which conflate Action and Relation are also used in Spanish, in Hindi (as in Turkish), placement events typically tend to be encoded in general verbs of placement such as 'put', 'do', or 'attach' as in 'attach in this', 'put here' or 'do this down'.

Tzeltal at t1

- put
action
- insert
action&relation
- set [of bowl-shaped object]
action&relation&figure
- cover [with-cloth]-for.her head
action&figure goal

Tzeltal children also use verbs in all their favored patterns, e.g. 'put', 'insert'. What is remarkable is the early use of very specific verbs which conflate the action with properties of the Figure. So they use very specific verbs which mean things like 'set [bowl-shaped object]' or 'cover [with cloth]'.

summary: verb-framed languages

- All of the favored patterns involve action (encoded by the verb)
- Tzeltal and Spanish children use mostly verbs with canonical verb-framed conflation patterns (action&relation, e.g. 'insert')
- Hindi and Turkish children use mostly general verbs of placement (action, e.g. 'put', 'attach')

- early development

- interpreting the patterns

We have now looked at the predominant patterns of description of placement scenarios in our corpora. Let us go on to interpret these patterns in light of Talmy's binary classification of languages.

Talmy's typology is relevant

- It matters whether your language is verb- or satellite-framed.
- Children learning verb-framed languages go for the action expressed in the verb.
- Children learning satellite-framed languages go for the spatial relation and/or the vector, expressed outside the verb.

As discussed in the introductory section of this talk, one aspect of Talmy's distinction between verb-framed and satellite-framed languages has to do with the locus of encoding path information. Path information is lexicalized in the verb in verb-framed languages, versus in "satellites" in satellite-framed languages.

In encoding placement events, children tune in to the typological characteristics of their language at an early stage of their development. Children acquiring Hindi, Tzeltal, Spanish, and Turkish typically use verbs, focusing on the action of putting. Children acquiring Finnish, English, German, and Russian tend to use satellites, paying relatively more attention to the Vector and Relational elements of the placement scenario.

but....

the typology does not capture the variation:

- *within* satellite-framed languages
- *within* verb-framed languages

However, at a finer-grained level of analysis, a more differentiated picture emerges. Both satellite-framed languages and verb-framed languages differ from each other in the degree to which they exhibit the properties typical of their language type.

variation within satellite-framed languages

Children acquiring Russian and Finnish pay more attention to the **action** than children acquiring English and German.

In other words, children acquiring Russian and Finnish are more likely to use *verbs*.

Within the set of satellite-framed languages, children acquiring Russian and Finnish pay more attention to the action (encoded in the verb) than children acquiring English and German.

variation within verb-framed languages

- Children acquiring Turkish and Hindi express the goal explicitly more often than children acquiring Spanish.
- In early Tzeltal verbs, more information is conflated than in early Hindi verbs. For instance, aspects of figure and goal are encoded in the verb.

Children acquiring verb-framed languages do not pattern identically either. Children acquiring Turkish and Hindi explicitly encode the Goal (expressed in case-markers or spatial nominals) more often than do children acquiring Spanish. Unlike children acquiring Hindi, Tzeltal-acquiring children produce verbs which conflate Figure and Goal information (a pattern reminiscent of Atsugewi, a language which conflates information about properties of the Figure along with motion in the verb root, Talmy 1985).

SO....

- the languages scale:
 - GERMAN and ENGLISH at one end,
with relatively little emphasis on action
encoded in verbs
 - RUSSIAN, FINNISH, TURKISH, and SPANISH
fall in between the extremes
 - TZELTAL and HINDI at the other end,
with overwhelming attention to action

So rather than conforming to a binary split - verb-framed versus satellite-framed - the preferred patterns of use in early child language distribute along a scale.

At one end, we have German and English, where verbs are rare.

At the other end, we have Tzeltal and Hindi, where all of the children's preferred patterns include verbs.

Russian, Finnish, Turkish, and Spanish occupy an intermediate position between these extremes.

factors contributing to variation in early favored patterns

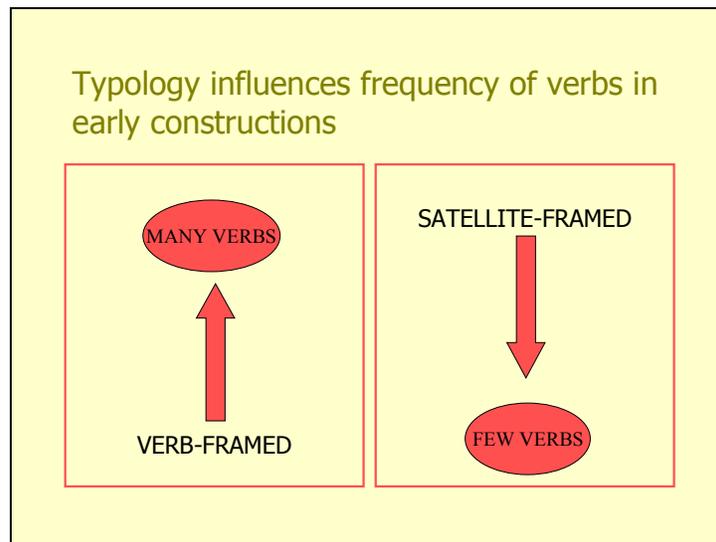
- typology
- perceptual salience of grammatical morphemes encoding relations
- semantics of bound morphemes and verbs

A number of factors potentially contribute to the variation we find.

One is language typology.

A second is the perceptual salience of the grammatical morphemes which encode spatial relations (particles, verbal affixes, case-markers, and adpositions).

A third is the semantics of these forms, and of the verbs. For instance, many Tzeltal verbs conflate the properties of Figure/Goal along with the Action, whereas placement verbs in Hindi typically do not.



We can schematize some of these observations in the following way.

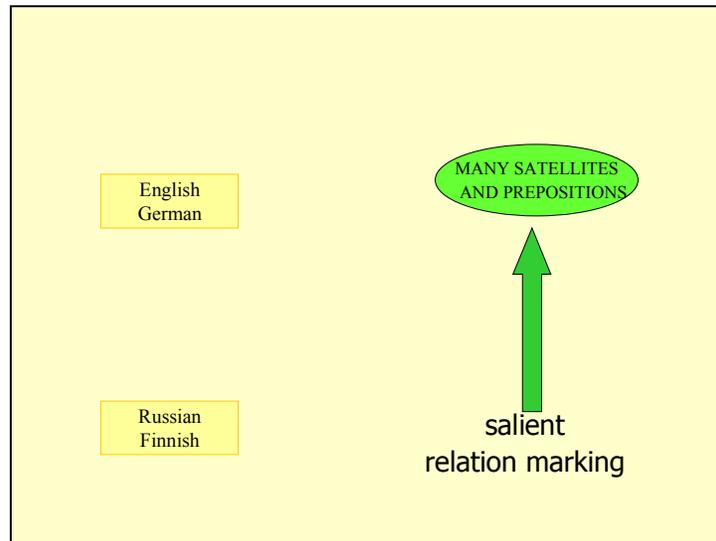
The typology of the language plays a role in the frequency of verb use in children's preferred ways of talking about placement scenarios. There are many verbs in the speech of children learning verb-framed languages, and far fewer in the speech of children learning satellite-framed languages.

Perceptual salience influences frequency of relation markers in early constructions in satellite-framed languages

- transparent marking of RELATION
 - English satellite: *put* ***in***
 - English preposition: ***in*** the box
- non-transparent marking of RELATION
 - Russian satellite: ***v****ložit'* ***in***'lay'
 - Russian preposition: ***v*** *korobku* ***in*** box'

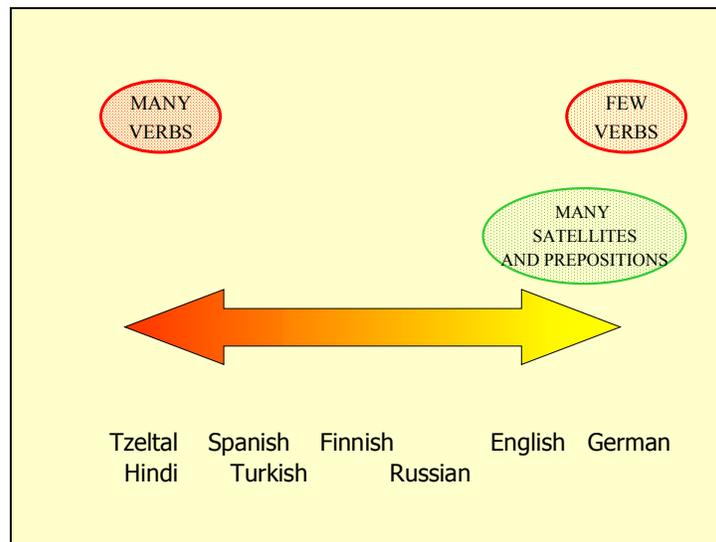
Within a language type, perceptual salience also plays a role: children learning satellite-framed languages are more likely to encode spatial Relations/Vectors when talking about placement scenarios if their language marks the spatial relation in a **transparent** way. For instance, the spatial relation of containment, encoded in English 'in' (as in the particle in *put in* or the preposition in *in the box*) is syllabic, separable from the verb, and often stressed.

In contrast, the relation is relatively **non-transparent** in the Russian prefix **v-**, as in ***vložit'*** 'inlay', as well as the preposition in ***v korobku*** 'in box'. In both cases, the relational marker is syllabic, unstressed, and glued to the following content word.



We can represent the role of perceptual salience in satellite-framed languages as follows. The more salient the grammatical marking of the spatial relation, the more likely children are to encode these relations, using satellites and prepositions.

Hence the early favored patterns in the English and German data sets include a spatial relation or Vector more often than the patterns found in the Russian and Finnish data sets.



The two dimensions of language typology and perceptual salience of relational marking both contribute to the scalar distribution of children’s favored patterns at the two-word stage.

At one end of the scale, we see the use of many verbs in the Hindi/Tzeltal data sets; this contrasts with few verbs in the English/German data sets. This distinction correlates with the typology of the languages as verb-framed or satellite-framed.

Perceptual salience of relational marking also plays a role. Although Russian and Finnish are satellite-framed, children learning them produce fewer satellites and prepositions, and more verbs, than learners of English and German. We think this has to do with the non-transparency of relational marking in these languages.

Further research is required to determine the extent to which these factors play a role and how they interact. In the next section, we investigate in more detail the third factor contributing to variation in children’s early patterns, that is, the semantics of verbs and grammatical (closed-class) forms.

- beyond typology - part 1

- specificity of semantic categorization

One important thing that jumps out of our data is differences in the **semantic specificity** with which languages cut up the semantic space. First, we will home in on types of semantic variation in what the word or morpheme encodes and its implications for acquisition.

- Languages differ in:
 - how finely they divide the domain of placement
 - what semantic distinctions they require or encourage speakers to make in talking about placement situations
- The semantic specificity of verbs and bound morphemes (case, adpositions) varies independently of satellite- and verb-framing.
- Children must become sensitive to these distinctions.

types of semantic variation

- degrees of specificity of the spatial relation, e.g., Spanish **en** vs. English **in, on**, ...
- spatial properties of the figure and/or goal (its shape, substance, orientation) e.g., **lay** vs. **stand** vs. **set, put** vs. **pour** vs. **scatter**

In our data we find two types of semantic variation in what the word or morpheme covers:

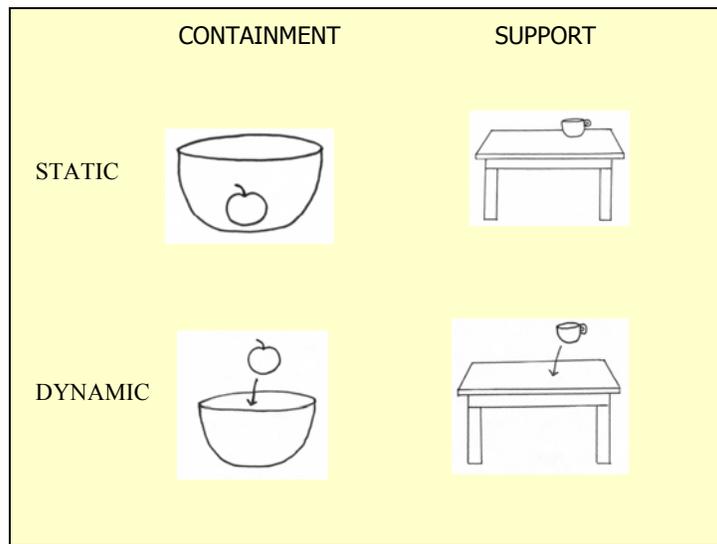
- specificity of the spatial relation (path, trajectory)
- whether or not spatial properties of the Figure and/or Goal or the end configuration of Figure and Goal are incorporated in the verb. To the extent that they are, languages display different action categories in placement verbs.

Let's look at two kinds of examples.

Example 1:

Obligatory marking of goal phrase

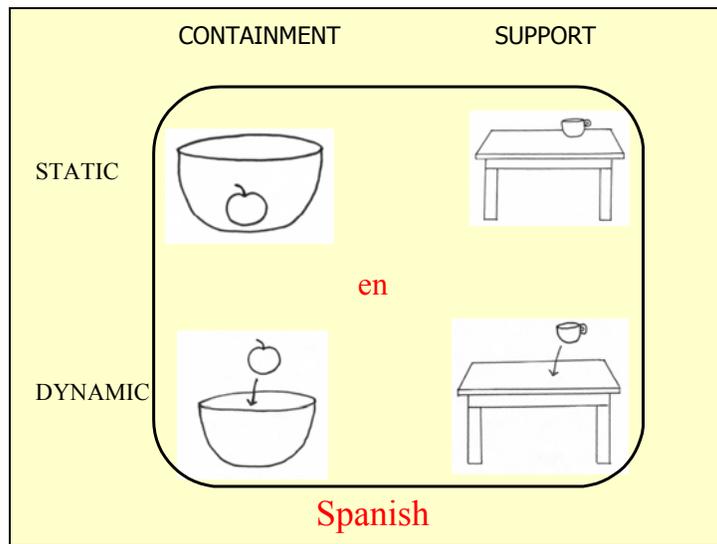
In four of our languages, prepositions or case-endings obligatorily mark a Goal nominal. How do the semantic categories of these markers differ across languages?



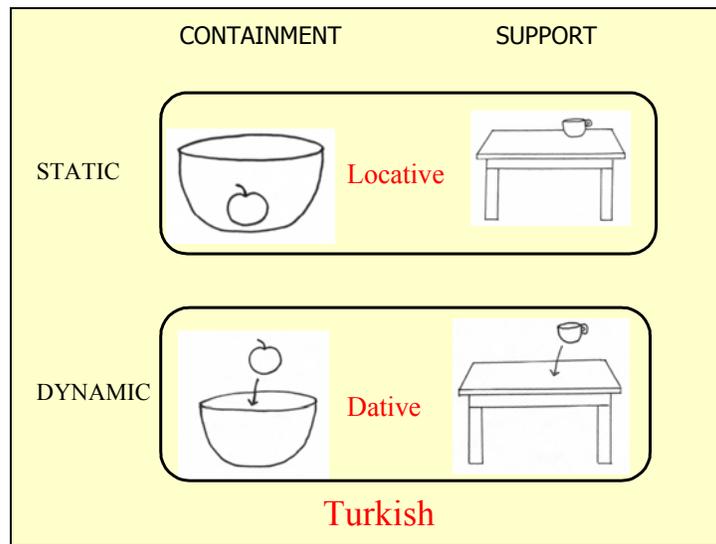
These pictures represent four typical kinds of scenes in our data: two static [apple IN bowl, cup ON table], and two dynamic [apple INTO bowl, cup ONTO table]

These scenes are grouped in different ways by the obligatory markers of our languages.

Children have to form these categories.

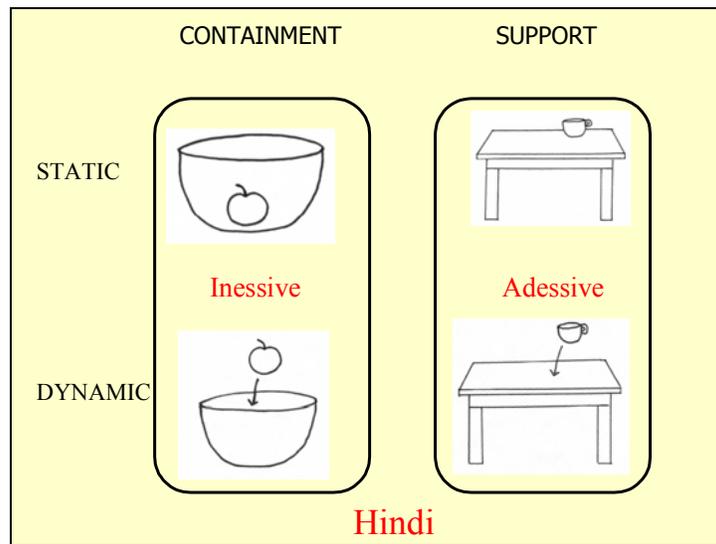


Spanish uses the preposition *en* 'in', 'on' for a Goal phrase for all four scenes. Children must then form a category for *en* that is indifferent to containment vs. support and to the static vs. dynamic distinction.

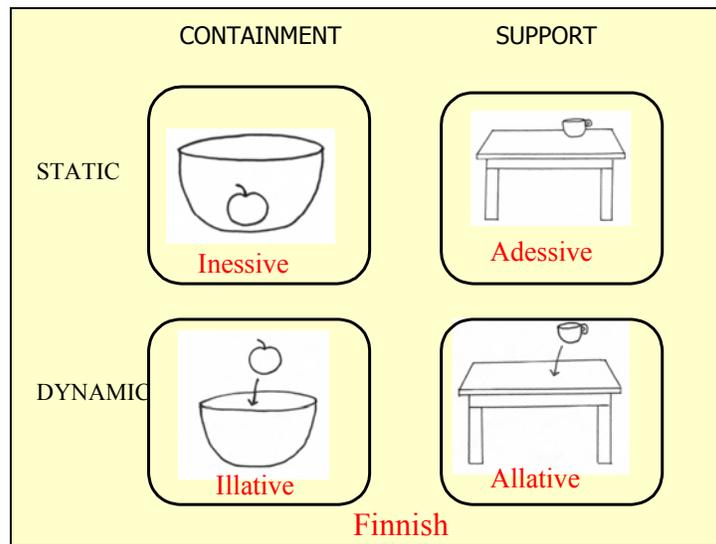


Turkish obligatorily marks the Goal with case-markers which distinguish the two static scenes (locative case) from the two dynamic scenes (dative case).

Children learning Turkish have to ignore the containment/support distinction for the purpose of this case-marking. Of course, in Turkish you *can* distinguish, e.g. apple INTO bowl from cup ONTO table if you want to (with additional specifiers), but this distinction is normally left to inference.



Case-markers in Hindi are indifferent to whether the placement event is static or dynamic, but they are sensitive to whether it involves containment or support. The inessive case is used for both containment scenes, while the adessive case applies to both support scenes.



Finally, Finnish requires speakers to make a four-way distinction: static containment (inessive case), static support (adessive), dynamic containment (insertion) (illative), and dynamic support, placement onto a surface (allative).

So children learning Finnish have to attend to both the distinction between static and dynamic *and* the distinction between containment and support.

What are the consequences of these differences in categorization for children learning to mark Goals in these four languages?

acquisition of goal marking

What's early?

- generalized preposition in Spanish
- CONTAINMENT/SUPPORT distinction in Hindi
- STATIC/DYNAMIC distinction in Turkish

What's harder?

- Finnish four-way distinction: use of any of the forms requires selection of value on *both* dimensions simultaneously

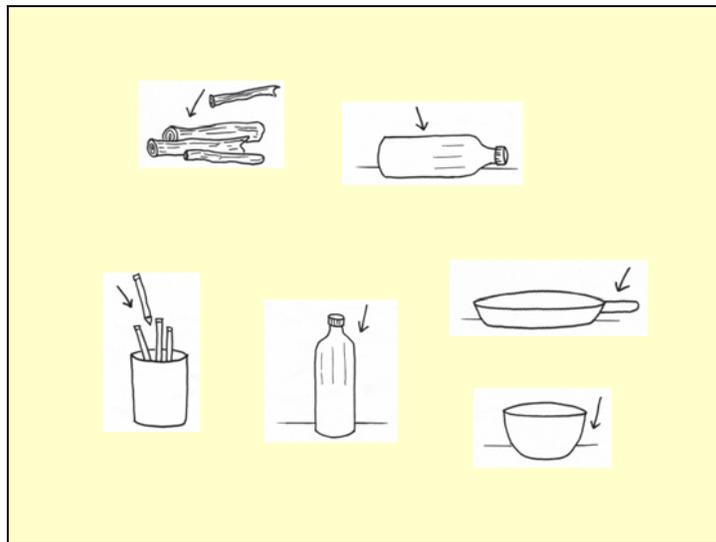
One potential consequence is in what is earlier learned: we might expect making one categorial distinction to be easier than making two; thus Finnish children would be predicted to have the hardest task.

This is indeed what we find: at t1, the Spanish children are using *en* and the Hindi and Turkish children are making the contrast between the two relevant cases for their languages. (Similarly, English children at this age make the appropriate distinctions between containment and support) But the Finnish children have trouble with their four-way case distinction: they consistently differentiate static versus dynamic scenes, but make many errors with containment versus support.

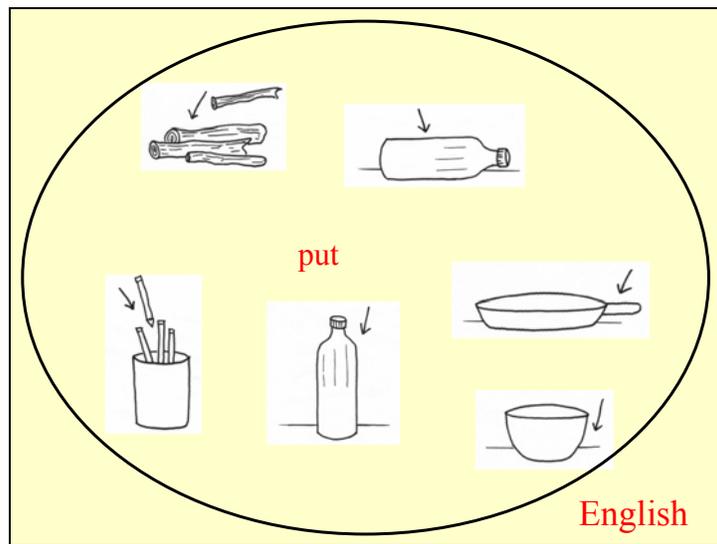
Does this mean that linguistic systems requiring more semantic distinctions are inevitably harder to learn? Let us explore this by looking at another example, this time involving verbs.

Example 2: verb categories

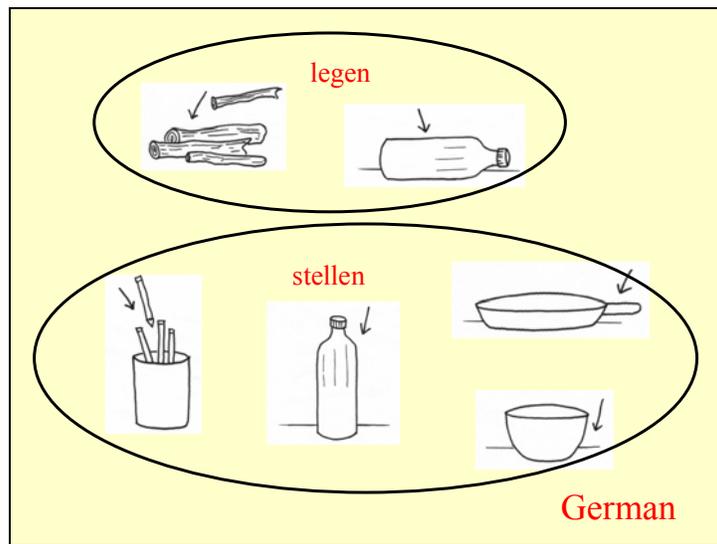
Verbs differ in the **level of granularity** with which they divide up events. "Light" verbs like 'put' cover a wide range of events; "heavy" verbs like 'attach by inserting tightly between two pinching surfaces' cover a relatively small range of situations.



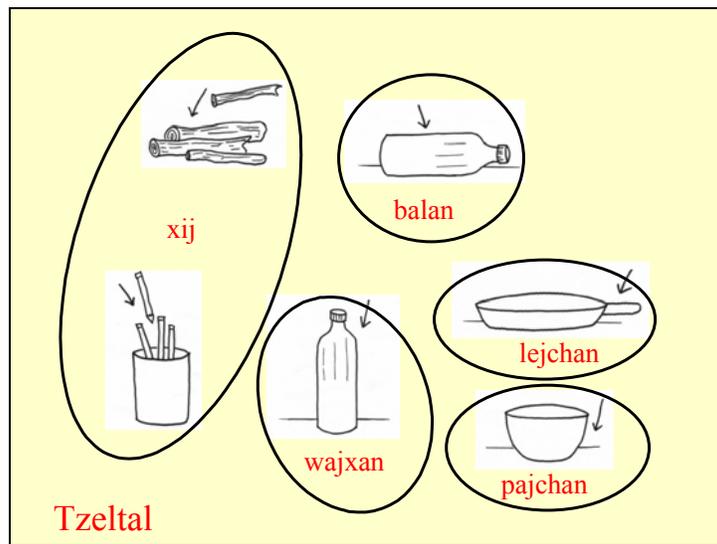
Here are some of the placement events that appear in our data: putting a stick of firewood on the fire, setting a bottle down on its side, putting a pencil into a cup of pencils, setting down a bottle, a frying pan or a bowl on a table.



In English, the verb *put* is typically used to describe all six of these events. Of course, we could make finer distinctions, but we generally don't bother to, and in our data the children don't either.



In German, in contrast, speakers (and our children) typically make distinctions based on the shape and orientation of the Figure being placed. For example, they use the verb **legen** 'lay' for events in which the Figure is placed with the long axis horizontal, while they use **stellen** 'set' for events in which the Figure is placed vertically, or sitting canonically on its base.



Tzeltal makes even finer distinctions, requiring five different placement verbs for these scenes, depending on precise characteristics of the orientation and spatial configuration of Figure and Ground objects resulting from the placement action.

What are the implications for acquisition of these differences in semantic specificity?

acquisition of placement verbs

English, German:

- early use of light verbs:
put, do, make
- later use of more specific verbs:
set, lay, stick...

Both the English and German children use predominantly “light” verbs in our data at t1, which again seems to suggest that more distinctions are harder to acquire.

If so, we should expect the Tzeltal children to have a hard time with their very specific placement verbs.

Tzeltal: Range of placement verbs at t1
and t2:

t1	t2
give/put	stick-on
ch'ik-insert	drop
lut-insert	tie-on
make-enter	put-on-clothes
put-away	spoon-out
set-down-upright	set-down-on-top-of-something [of bowl-shaped-thing]

But the Tzeltal children use a range of verbs at t1, including not only a general 'give/put' verb (semantically more general than English *put*) but also several semantically specific verbs, including **ch'ik** ('insert something between supports'), **lut** 'insert tightly between forked objects', and **pajchan** ('set down something bowl-shaped upright'). They seem to use these verbs correctly, and do not overextend them to inappropriate placement scenes.

In the Tzeltal input, at t1:

32 placement verbs! e.g:

stand-up-vertically

set-down-stacked

set-down-on-its-side

raise-high-up

mix-in-with [particulate things]

pile [multiple things]

insert-long-thin-thing-into-tight-fit-at-one-end

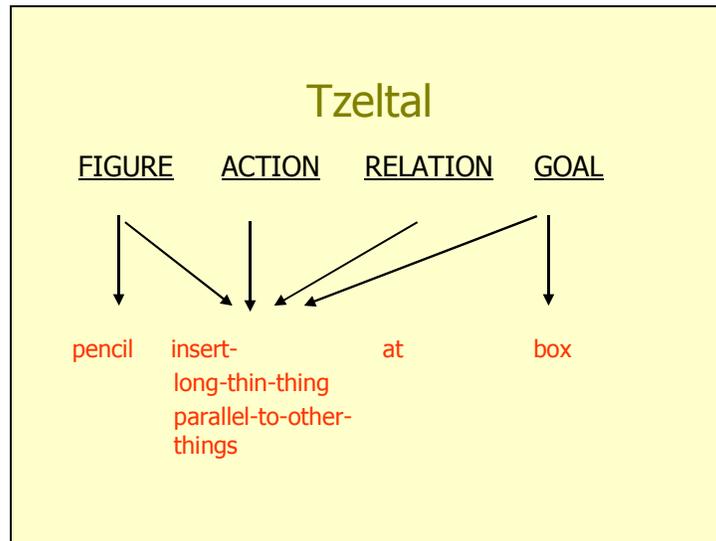
put-standing-at-an-angle

Looking at the Tzeltal input, we find 32 distinct placement verbs. The children use only a small proportion of these. So although children begin very early to create the relevant fine-grained categories, it takes them a while to finish the job.

summary: semantic specificity

- Crosslinguistic variation in semantic categorization creates a complex learning problem.
- More distinctions are not necessarily harder.
- Learning semantic categories interacts with other aspects of language, e.g.:
 - How much information you can compress into a word affects what else you need to say...

To sum up: the kinds of crosslinguistic variation we have been examining create a complex learning problem. Categories with more distinctions are not necessarily harder; it depends on what the distinctions and contrasts are - what situations are being classed together. Finnish children do have a hard time with two cross-cutting distinctions which simultaneously determine which case to use. But Tzeltal children do not appear to find semantically specific verbs particularly difficult.



This leads us to a final point: there may be an interaction between the ease of learning semantic categories and where the language puts its information. As we saw in the first section, Tzeltal children are encouraged by the structure of their language to attend to verbs at an early age. German children are not as oriented to verbs (at least for placement events), and, correspondingly, it takes them longer to make the needed semantic distinctions, e.g. between *legen* 'lay' and *stellen* 'set'.

Since in Tzeltal a lot of placement information is compressed into the verb, it is often unnecessary to separately mention the Relation or the Goal. Hence the favored pattern for the Tzeltal child at t1 is a verb alone, or a verb plus a deictic. What you can say with a verb alone in Tzeltal can also be said using a verb in conjunction with a noun in Hindi, but having this information packaged in one verb lets you take it for granted in the context, so you can omit explicit reference to Relation/Goal.

- beyond typology - part 2

- child-directed speech

Variations on a theme

How caregivers try to get a point
across to a 2-year-old

Regardless of the typology of the exposure language, the child has to make use of patterns of speech in discovering the structures of the language. When a caregiver rephrases a child-directed utterance, language-specific patterns of expression can be subtly revealed. Such repetitions and rephrasings are typical of speech addressed to very young children who do not often readily respond to questions and commands.

mother to child, age 2;3

MOT: Nomi, don't put your bread on the floor, honey, put it *back on the table*, Nomi. Put it *up on the table*.

back on → up on

Consider a mother who is instructing a 2-year-old (Sachs data, CHILDES; Sachs 1983). Note the substitution of *back on* by *up on*. This gives the child the information that a verb particle ("satellite"), *on*, can be combined with a temporal adverb, *back*, and a directional adverb, *up*. Of course, such information can also be derived from comparing stored utterances, but the immediacy of the mother's rephrasing, with no change in the situation, may draw the child's attention to the linguistic contrast.

MOT: I think I'll put her over in your toy basket until you're finished with breakfast, OK? I'll put her right over here and you can go get her after you're finished.

over in your toy basket → right over here

This example, also from the Sachs corpus, presents a more complex substitution pattern: the directional adverb *over* is strengthened by the emphatic particle *right*, and a specified location, *in your toy basket*, is replaced by a deictic adverb, *here*.

Variation Sets
(Slobin & Küntay, 1995)

“We will refer to a series of adult utterances on a theme as a variation set.”

“Underlying a variation set there is a constant communicative intention.”

Slobin and Küntay have used the term *variation set* to designate a series of utterances produced with a constant communicative intent, but with changing form.

Variation sets are characterized by three types of phenomena:

- lexical substitution and rephrasing
- addition and deletion of specific reference
- reordering

Variation sets provide clues about the typological characteristics of the exposure language

- What are the patterns of word-order variability?
- What elements can be omitted (ellipsis)?
- What types of elements alternate with one another?

Variation sets provide information about the meanings of lexical items

- What verbs can occur with the same array of arguments?
- What are alternative expressions of noun arguments and relations?
- How are events segmented into linguistic units?

child-directed speech to two Turkish children (Slobin & Küntay)

Gül: 1;8 – 2;3

3,167 maternal utterances

220 variation sets:

- include 21% (667) of total CDS from mother
- average length: 3 utterances (range: 2-25, but above 6 are outliers)

Mine: 1;6 – 1;11

1,072 maternal utterances

128 variation sets:

- include 35% (377) of total CDS from mother
- average length: 3 utterances (range: 2-10, but above 6 are outliers)

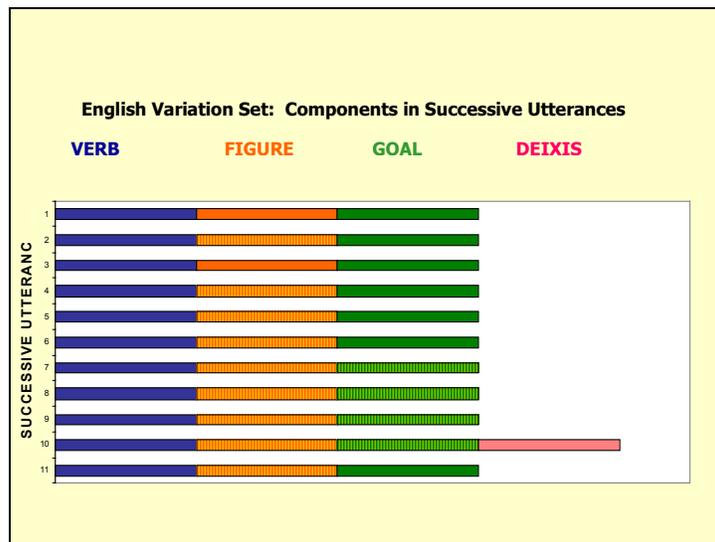
In a study of the speech of two Turkish mothers to children at the beginning of grammatical acquisition, Slobin and Küntay found that a considerable proportion of child-directed utterances during this period occur in variation sets. Our examination of naturalistic data for the current presentation has drawn our attention to variation sets in several of the languages considered here: English, Russian, Hindi, and Turkish. Each of these languages presents the child with particular learning problems. The variation sets in the input serve to highlight critical features of the morphology and syntax of the language.

English variation set (to child age 2;1)

VERB FIGURE GOAL

1	let's	put	J's bottles	in the refrigerator	
2	want to	put	them	in the refrigerator	with me
3	let's	put	J's bottles	in the refrigerator	
4	we'll	put	it	in the refrigerator	
5	let's	put	it	in the refrigerator	
6	we'll	put	it	in the refrigerator	
7	you can	put	it	in	
8	I'll let you	put	it	in	yourself
9	you	put	it	right in	
10	you	put	it	in there	
11		put	it	right in the refrigerator	

This English example is typical of variation sets in a language with fixed word order. The mother is trying to get the child to put her doll's bottles in the refrigerator. Note that all of the utterances adhere to the same word-order scheme: pragmatic introducer - verb - object - locative goal. The verb is always present. The object is quickly reduced to a pronoun, but it never disappears. The Goal shows the most variation: *in the refrigerator*, *in*, *right in*, *in there*, and finally the most elaborated form, *right in the refrigerator*. (This is typical of variation sets addressed to very young children who do not readily show signs of comprehension or compliance: moderate elaboration, followed by reduction, followed by more elaboration.)



This figure, and the following figures of this type, shows the elements that are present in successive utterances (solid bars), the elements that are substituted or reduced (striped bars), and the elements that are absent (no bars). The figures track four major components of placement events: verb, Figure, Goal, and deixis. Input patterns of this sort in English show the child that English is a fixed word-order language, with neither verb nor object ellipsis, and with various types of locative expressions and the optional expression of deixis (*in there*).

Russian variation set (to child age 2;0)

Gather the toys.

Put (them) into the basket.

The blocks.

Put into the basket the toys.

Throw (them) over there.

Into the basket (you) must put.

Put.

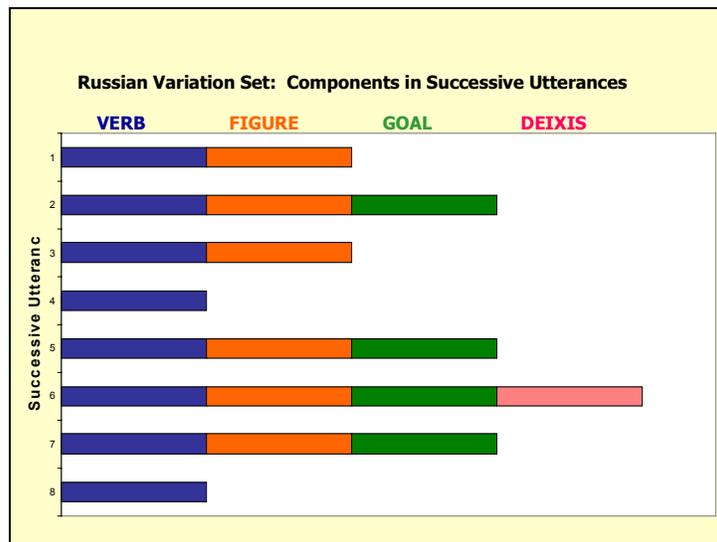
Russian presents rather different morphosyntactic information in variation sets. (For ease of presentation, examples from Russian, Hindi, and Turkish are presented only in English glosses. Parenthetical items do not occur in the original utterances.)

Russian variation set (to child age 2;0)

VERB **FIGURE** **GOAL** **DEIXIS**

1	<u>gather</u>	<u>toys-ACC</u>		
2	<u>put</u>		<u>in basket-ACC</u>	
3		<u>blocks-ACC</u>		
4	<u>put</u>		<u>in basket-ACC</u>	<u>toys-ACC</u>
5	<u>throw</u>			<u>thither</u>
6			<u>in basket-ACC</u>	<u>must put</u>
7	<u>put</u>			

Variation sets of this sort demonstrate a range of patterns of ellipsis, e.g., no Goal in utterance 1, no Figure in 2, no verb or Goal in 3, etc. Deixis is optional, appearing only in 5 ('thither'). And there is considerable word-order variability. Again, repeated exposure to variation sets of this sort throws critical factors of Russian morphosyntax into relief.



These patterns are evident in this figure, where only the verb is a constant.
 (The figures abstract away from word-order to present only presence or absence of each element.)

Hindi variation set (mother and brother,
age 3;3, to child age 1;7)

MOT: Attach all this in this.

Come on, attach (it).

It won't attach in that.

Put (it) here.

BRO: Will (it) attach in that?

MOT: No, this attaches here, yes.

BRO: (It) doesn't attach there.

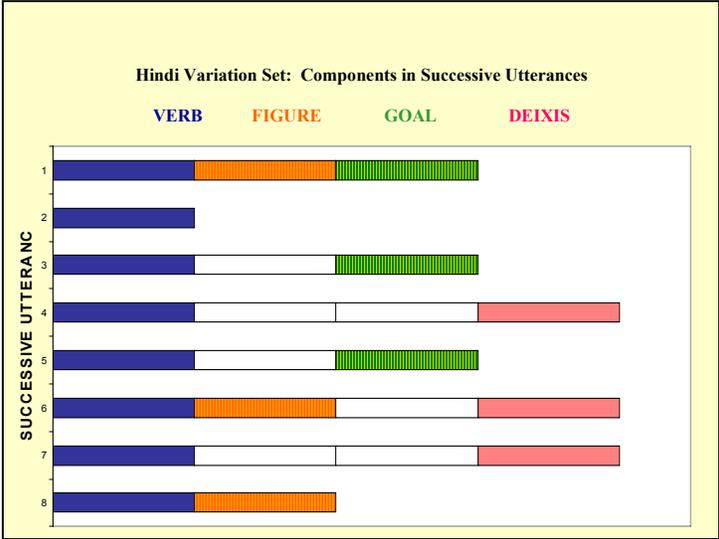
MOT: Good. Attach this. Attach this.

The Hindi example is interesting in that mother and brother collaborate in constructing a variation set for the child.

Hindi variation set (to child age 1;7)

	<u>DEIXIS</u>	<u>FIGURE</u>	<u>VERB</u>	<u>GOAL</u>
1	<u>this-ACC</u>	<u>all-ACC</u>	<u>attach-CAUS</u>	<u>give-IMP</u> <u>this-INESS</u>
2			<u>attach-CAUS</u>	<u>give-IMP</u>
3		<u>that-INESS</u> <u>that</u>	<u>not attach-FUT</u>	
4	<u>here</u>		<u>put-IMP</u>	
5		<u>that-INESS</u>	<u>attach-FUT</u>	
6		<u>this-NOM</u> <u>here</u>	<u>attach-FUT</u>	
7	<u>there</u>		<u>not attach-HAB</u>	
8		<u>this-NOM</u>	<u>attach-CAUS-IMP</u>	

Again, the verb is always present, and all other elements come and go. Note, too, that case-marking is not a reliable cue to semantics: the Figure is expressed with accusative, inessive, and nominative case, depending on the syntactic frame.



Turkish variation set (to child age 2;0)

How (do we) put (it)?

Put (it) here.

Put (it) to its nest.

Inside of its nest like this.

Turkish variation set (to child age 2;0)

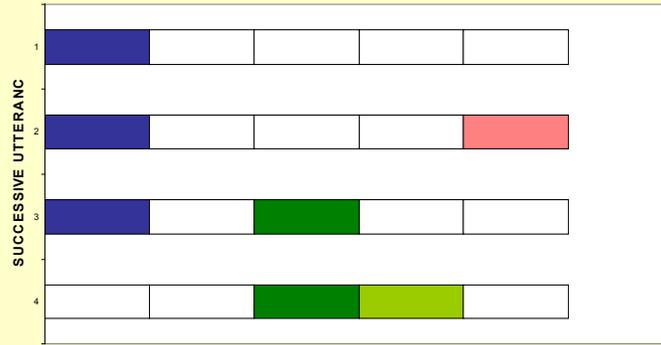
VERB **FIGURE** **GOAL** **DEIXIS**

1	<u>how</u>	<u>put?</u>		
2	<u>put</u>			<u>hither</u>
3		<u>its.nest-DAT</u>	<u>put</u>	
4		<u>its.nest's inside-LOC</u>		<u>like.this</u>

Turkish exhibits the greatest amount of ellipsis, as is evident in the many empty bars in the following figure. Even the verb is not constant; and the figure is never lexicalized at all. Here the child is shown the Turkish preference for ellipsis of all but the least redundant elements.

Turkish Variation Set: Components in Successive Utterances

VERB **FIGURE** **GOAL** **LOCATIVE** **DEIXIS**



Syntactic bootstrapping (Lila Gleitman, 1990)

"Children's sophisticated perceptual and conceptual capacities yield a good many possibilities for interpreting any scene, but the syntax acts as a kind of mental zoom lens for fixing on just the interpretation, among these possible ones, that the speaker is expressing. ... This examination of structure as a basis for deducing the meaning is the procedure we have called *syntactic bootstrapping*."

Variation sets amplify the sort of *syntactic bootstrapping* proposed by Lila Gleitman.

**Consequences of syntactic
bootstrapping for acquisition
(Naigles & Hoff-Ginsberg, 1998)**

“The prediction of the syntactic bootstrapping hypothesis is that the more frames in which a child hears a verb, the easier that verb will be to learn because each additional syntactic frame has the potential to provide additional semantic information. ... If a mother uses a verb in a diversity of constructions, the child is most likely to learn that verb quickly and use it appropriately.”

The proposals of Gleitman and Naigles & Hoff-Ginsberg focus on verbs, and the child’s task of keeping track of the frames in which particular verbs occur. A variation set “magnifies” the effects of syntactic bootstrapping, because a set of sentence frames is present in a single context of relatively brief duration. That is, the memory burden required by syntactic bootstrapping is greatly reduced. Note, finally, that in our examples the variation sets highlight the meanings and patterns of expression not only of verbs, but of all linguistic elements.

- beyond typology - part 3

- intra-typological variation in explicit mention of goal



Attending to goals in English and German

Finally, we go beyond typology in examining two closely related languages of the same type, English and German.

locative goals in English CDS

- **EXPLICIT:** Put the flowers in this bucket.
- **PRONOUN:** Here's a pretty cup.
Let Mommy put coffee in it.
- **PROLOCATIVE:** Where did we put the
box? Do you wanna put them
back in here?

We present a small case study of the expression of locative Goals in child directed speech - again dealing with verbs of placement. In English the Goal can be explicitly stated, using a prepositional phrase with a full noun; or it can be indicated in a prepositional phrase with a pronoun or a deictic element (*here*, *there*), which we refer to as a prolocative.

locative goals in German CDS

- **EXPLICIT:** *Steck's mal in deine Tasche 'rein.*
C'mon, put it in your pocket into.there.
- **PRONOUN:** *Leg mal die Teller drauf.*
C'mon, put the plates there.on.
- **PROLOCATIVE:** *Die stellen wir hier hin.*
That one we put here thither.

The same three options are available in German, but with two important differences: the use of directional verb particles and word-order variation. When the Goal is explicit, it is accompanied by a particle such as **'rein** (a colloquial neutralized form for **herein** 'hither.inwards'). Such forms are verb particles in German and their placement is determined syntactically (cf. *Willst du es in deine Tasche reinstecken?* 'want you it in your pocket in-put' [=Do you want to put it in your pocket?]). Note that the particle follows the prepositional phrase in the imperative form given in the example. In the pronoun version a similar locative particle occurs at the end, **drauf** 'there.on'. In the prolocative version, yet another word order appears. Consider the consequences of the English and German word-order patterns for online programming of utterances.

English: word order and choice points

Put the book in...



...the box

...it

...here



An English-speaking parent can begin by saying "Put the book in" and can stop there if it seems that the child has understood. If not, the parent can continue with the options of explicit, pronominal, or deictic reference. That is, English word order gives the speaker flexibility in deciding how to finish an utterance in mid-stream - and thus how explicit to make the statement.

German: word order and choice points

Leg das Buch...

Lay the book...



...in die Kiste 'rein

...in the box into.there

...'rein

...into.there

...hin

...thither



German is rather different. If the parent begins with **leg das Buch** 'lay the book' she must decide next whether to mention the Goal explicitly or not. If she thinks the child understands, and continues with **'rein** 'into.there' or **hin** 'thither', it is too late to add the explicit Goal. The whole utterance has to be reformulated.

prediction

These differences between English and German matter:

If the child is not attending to the goal of the motion event, the caregiver might want to provide more information.

English, in contrast to German, allows a caregiver to incrementally increase the **specificity of goal information** without reformulating the utterance.

What might be the consequences of these subtle differences for the explicit mention of Goals in child-directed speech in the two languages? The syntactic patterns of English make it easy to add specific Goal information without having to reformulate an ongoing utterance.

Therefore, we expect that:

English-speaking parents will mention explicit goals *more frequently* than German-speaking parents.

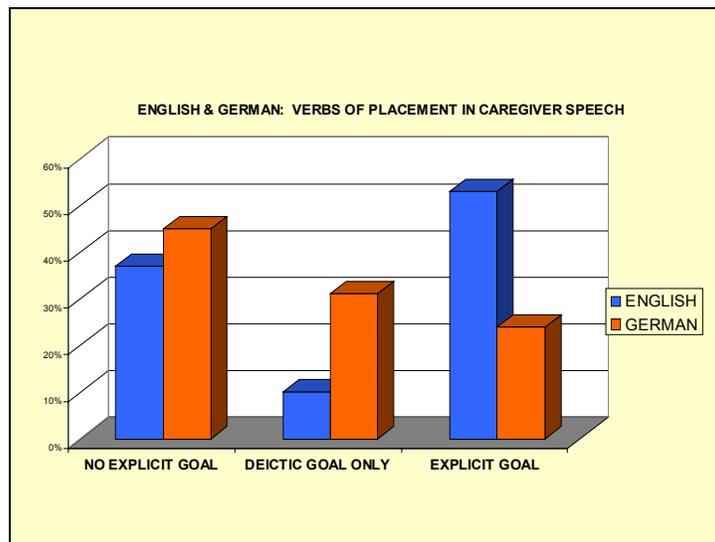
a case study (Behrens, Bowerman, & Slobin)

- two girls and their parents
 - English: Naomi (Sachs data)
 - German: Simone (Miller data)
- six months, beginning with the child's first expression of a motion event that includes specification of goal
- coding all motion event expressions of child and parents

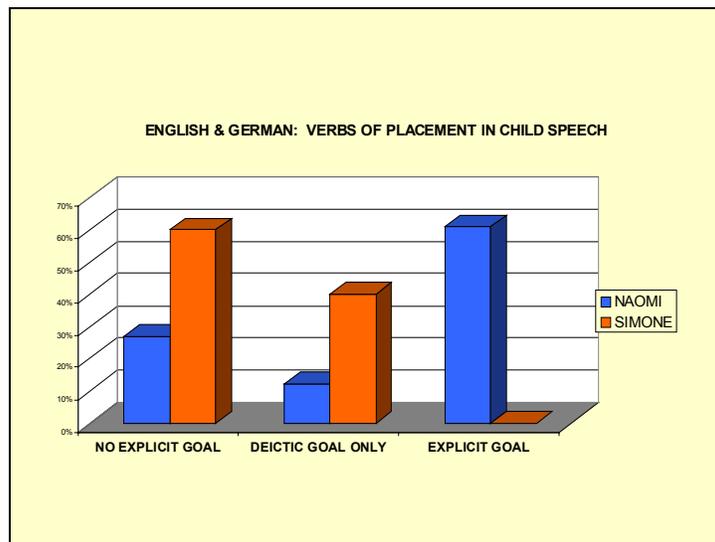
This question is examined in a small case study of two girls and their parents, designed by Heike Behrens, Melissa Bowerman, and Dan Slobin at the Max Planck Institute for Psycholinguistics. The work is ongoing, including more verbs, more children, and more languages; here we present an interim summary. We began a search of transcriptions at the point when the child first spontaneously spoke of a motion event with inclusion of a specific Goal. The search continued for the next six months of recordings, coding all motion event expressions of the child and her caregivers. What follows are the patterns for verbs of object placement.

substudy: object placement events

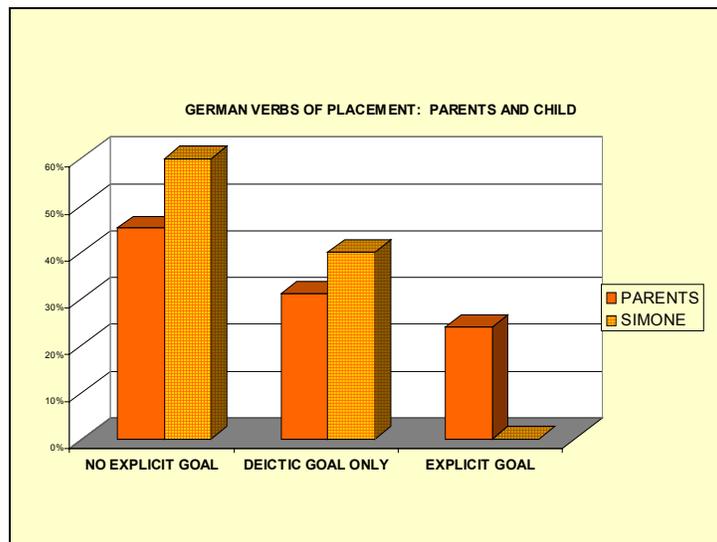
- reference to moving a physically present object to another location
- comparable naturalistic situations: eating, play with toys
- verbs of placement:
 - English: *hang, pour, put, stick, throw*
 - German: *hängen* 'hang', *legen* 'lay', *machen* 'make', *schmeißen* 'hurl', *stellen* 'place', *tun* 'do', *werfen* 'throw'



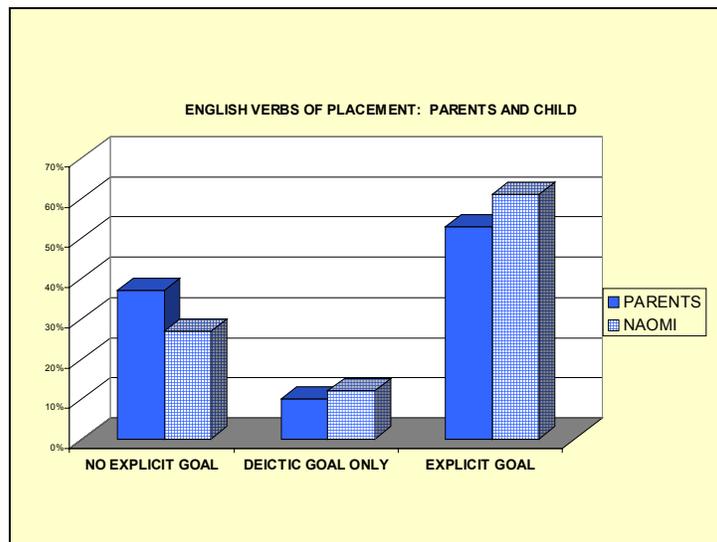
In this and the following figures, English is blue and German orange. Note especially that the English caregivers made explicit mention of the Goal about twice as often as the Germans. (In addition, German pays far more attention to deixis, given its systematic use of the directional particles *hin* 'hither' and *her* 'thither') The predicted English attention to explicit Goals is supported.



The children match the prediction even more strongly than their parents: Simone *never* made explicit mention of a Goal in the types of placement scenarios examined, and she paid far more attention to deixis than Naomi.



Finally, comparing each girl with her parents, it is evident that each child matches the exposure language more than the corresponding child in the other language. Here are the statistics for Simone and her parents.



Here are the statistics for Naomi and her parents. In fact, Naomi slightly overproduces explicit Goals in comparison with her parents.

Implications: attending to goals in English and German

- Two languages within a typological and a genetic grouping can differ in preferred patterns of event encoding.
- With regard to English and German: explicit reference to the physically present end-locations of object movement can be influenced by **morphosyntactic factors that affect ease of online production**

When we take a finegrained look at particular event structures and their expression, there is more at play than overall typology. In this intratypological comparison between English and German, it appears that strategies of online production are influenced by ease of processing, based on available morphosyntactic structures. Where the English-speaking parent can decide, online, whether to provide explicit Goal information, the German-speaking parent must make this decision before beginning an utterance. Apparently this difference is sufficient to lead to the differing degrees of attention to explicit Goals shown in our data.

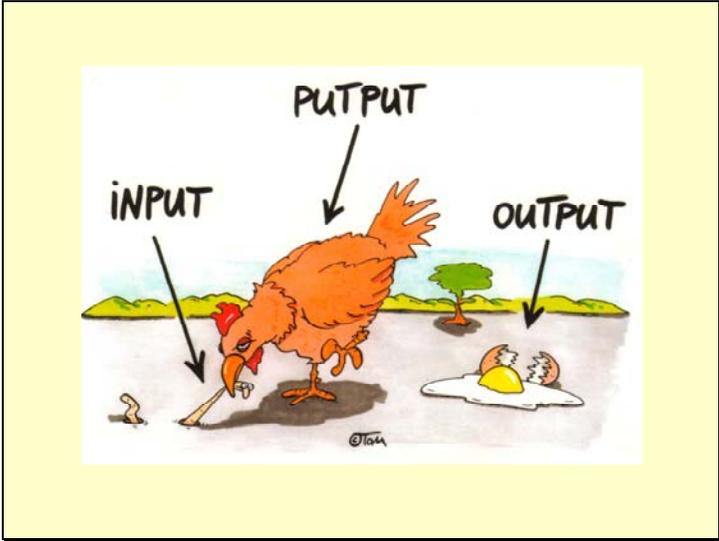
- overall conclusions

- Children's early talk about placement events reflects the typology of the target language:
 - satellite-framed languages: emphasis on goals and vectors/relations.
 - verb-framed languages: emphasis on actions.
- But crosscutting factors are also important:
 - perceptual salience of relational markers.
 - patterns of ellipsis and discourse framing.

- Children look language-specific in their semantic distinctions.
- Input influences acquisition in several ways:
 - it displays grammatical and semantic properties of the language;
 - from among those properties, it displays patterns preferred for specific discourse purposes.

the bottom line

Any reasonable model of acquisition must consider a multiplicity of interacting factors. Each factor has its own regularities. So what we end up with is not infinite variation, but rather constrained variability.



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