Verbs, Particles, and Spatial Semantics: Learning to talk about Spatial Actions in Typologically Different Languages

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Putting a toy in a pot, a child says *in*; taking it out again, she says *out*; laying it on the floor, she says *down*. Spatial morphemes are produced in similar situations by eighteen-month-olds around the world. But where do the meanings toddlers associate with them come from?

Until recently, answers to this question pointed uniformly to infants' nonlinguistic cognitive development of notions such as containment, contact, support, gravity, and, later, projective relations (e.g., Johnston & Slobin 1979). But recent research suggests that although nonlinguistic spatial knowledge is important, it does not account for all the structure in children's early semantic categories of space: the semantic structure of the input language also plays a role. For example, Choi and Bowerman (1991) found that by the time children learning English and Korean begin to use spatial morphemes productively, between 17 and 20 months, they already extend them to different, and language-appropriate, categories of spatial relations.

In this paper we build on this earlier research, exploring the developmental interaction of nonlinguistic and linguistic principles of spatial structuring by comparing children acquiring English, Dutch, Korean, and Tzotzil Mayan. In particular, we ask (1) whether children show universal biases toward certain ways of grouping and distinguishing among spatial relations, regardless of the input language, (2) whether there is extensive evidence for early language-specific spatial categorization, and (3) what the effect is of exposure to languages that differ typologically in WHERE they characteristically express information about trajectory.

1. Overview of the four languages.

Before addressing these questions, let us look at how our four languages encode spatial information. Following Talmy (1985, 1991), we focus on the encoding of "motion events", terming the moving object the *Figure*, the referent object the *Ground*, and the trajectory of the Figure with respect to the Ground the *Path*.

a. ENGLISH and DUTCH are both "satellite-framed" languages in Talmy's typology: in both transitive and intransitive clauses, they characteristically express Path in a "satellite" to the verb root. In English the satellites are verb

particles (which often merge with prepositions; cf. Talmy 1985:105); in Dutch, they are separable or inseparable locative prefixes. Both languages typically express the manner or cause of motion, along with the fact of motion, in the main verb. Examples in English (the satellite is shown in capital letters): *The mouse$_{Figure}$ ran/ jumped IN (to a box$_{Ground}$)/ ON (to a mat)/ OUT (of a box)/ OFF (of a mat).*

b. KOREAN is a "verb-framed" language: it expresses Path with verb roots (shown here in citation form), e.g. (intrans.) *tule* 'enter', *na* 'exit', *olla* 'ascend', *naylye* 'descend', *cina* 'pass', and (trans.) *nehta* 'put in, put loosely around', *kkenayta* 'take out, take from loosely around', and *ollita* 'cause. ascend.' The Ground, if mentioned, takes a locative case ending. Manner or cause is optionally expressed with a non-finite co-verb that precedes the Path verb. (All nonfinal verbs take a connective vowel.) Order is SVO. In intransitive clauses, the Path verb is typically followed by a deictic verb (usually *ota* 'come' or *kata* 'go') that takes tense and modal endings, as suggested by: mouse-SUBJ box-LOC (=at/to) (run-CONN) *ENTER*-CONN go-PAST-DECLARATIVE 'A mouse went (running) into a box.' In transitive clauses, no final deictic verb is needed; e.g., John-SUBJ box-LOC ball-OBJ (throw-CONN) *INSERT*-PAST-DECL 'John put (threw) a ball into a box.' (See Choi & Bowerman 1991 for a detailed analysis.)

Many of Korean's transitive Path verbs combine information about Path with information about the geometry or nature of the Figure and Ground, e.g., *kkita* 'fit in/ on/ together, enmesh (often with some force)', *ppayta* 'unfit, take out/ off/ apart, dis-enmesh (often with some force)', *pwuchita* 'stick on, juxtapose surfaces', *tteyta* 'unstick, separate surfaces'; notable among these is a set of clothing verbs, including *ssuta* 'put clothing on head', *ipta* 'put clothing on trunk', and *sinta* 'put clothing on feet.'

c. TZOTZIL, a Mayan language spoken in the highlands of Chiapas, Mexico, is difficult to classify according to Talmy's typology: depending on the sentence, it encodes Path variously in verbs, particles, and auxiliaries (cf. Haviland, 1993, 1994, in press).

Like Korean, Tzotzil has a comprehensive set of Path verbs. Some are inherently motion roots, e.g. (intr.) *och* 'enter', *lok'* 'exit', *muy* 'ascend', *yal* 'descend'; (trans.) *otes* 'cause.enter', *lok'es* 'cause.exit/ go off', *muyes* ('cause.ascend,' *yales* 'cause.descend', and *tik'* 'put in, insert'. Others are derived from positional roots; e.g., *nap'* 'stick on.' As in Korean, many transitive verbs of both kinds conflate Path with information about the geometry or nature of the Figure and Ground, e.g., *xoj* 'put linear object through ring-or tube-shaped object; put ring or tube over linear object' (henceforth simply

'ring and pole'), *tz'ap* 'pierce, stick pointed end in', *lap* 'put on clothing.'

Unlike Korean, however, and like English and Dutch, Tzotzil has a set of Path particles that can be added to verbs to express directional meanings. These particles are derived from intransitive Path verbs, e.g., *ochel* 'in' (< *och* 'enter'), *lok'el* 'out/ off/ into removal' (< *lok'* 'exit'), *muyel* 'up' (< *muy* 'ascend'), and *yalel* 'down' (< *yal* 'descend'). They combine freely with verbs expressing manner or cause, in the pattern characteristic of satellite-framed languages (e.g., *xanav OCHEL* 'walk IN', *p'it lOK'EL* 'jump OUT/ OFF', *ten YALEL* 'throw DOWN'), and they can also optionally be used with verbs that already express similar Path information (e.g., *tik' (OCHEL)* 'insert (IN)', *botz' (LOK'EL)* 'pull.out/off (OUT/OFF).'

3. The encoding of Path in spontaneous speech, age 1;2 - 3;0.

Our data come from both spontaneous speech samples and an elicited production study. Let us start with spontaneous speech.

We have analyzed spontaneous speech data from children learning English, Korean, and Tzotzil.[1] In all three languages, children began to produce Path morphemes during the one-word period, and they talked about very similar events. But there are often differences in the contours of the semantic categories defined by their patterns of word extension.

a. The first words used by the ENGLISH-speaking children to express Path were predominantly particles expressing topological spatial notions to do with containment (*in, out*), surface contact and attachment, including donning and doffing clothing (*on, off*), and vertical motion (*up, down*) (see Choi & Bowerman 1991); the early preference for particles is widely attested in learners of Germanic languages. These morphemes were used for both spontaneous and caused motions, as is appropriate (e.g., *in* for both getting into the bathtub and putting an object into a box), and they were used for a broad range of events involving different types of animate and inanimate entities. From the one-word stage on, the children also produced a few verbs expressing topological actions on objects or parts of objects : e.g., *open, close,* and *break.*

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b. For children learning KOREAN, Path morphemes were, not surprisingly, verbs (there are no Path particles or prepositions). Unlike the English speakers, Korean children distinguished strictly between spontaneous and caused motion along a Path, using only intransitive verbs for the former and transitive verbs for the latter. Early on, they favored transitive verbs (e.g., *nehta* 'put in, put loosely around', *kkenayta* 'take out, take from loosely around', *tatta* 'close', *yelta* 'open'), particularly those that express Path conflated with other information about the geometry and nature of the Figure and Ground, e.g., three clothing verbs, *ipta* (trunk), *ssuta* (head), and *sinta* (feet), and -- especially frequent -- *kkita* 'fit' and *ppayta* 'unfit.' With these last two verbs, Korean children crosscut the sharp distinction made by English learners between "containment" (*in, out*) and "contact/ support" (*on, off*) (Choi & Bowerman, 1991). Intransitive verbs that express relatively "pure" Path meanings, like *tule* 'enter' and *olla* 'ascend', were slower to emerge.

c. TZOTZIL's frequent use of both verbs and particles to express Path allows us to test a widely accepted hypothesis about why children learning Germanic languages initially favor particles: that particles are perceptually more salient than the verbs they combine with, being stressed and often sentence-final (Slobin 1973). Tzotzil Path particles are also perceptually more salient than the verbs that precede them: they receive the main stress of the verb-particle combination on their second syllable, and they also often occur sentence-finally.[2] If it is true that learners of Germanic languages go for particles because of their perceptual salience, we would expect Tzotzil children to favor Path particles like *lok'el* 'out/ off' over Path verbs like *botz'* 'pull out/ off.'

Surprisingly, the children unequivocally went for VERBS in the early months of Path encoding, successfully segmenting out the CVC root and producing it in isolation. (In this they differed from children learning the related language K'iche', who often isolate syllables consisting of the final consonant

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[2] Since word order is VO(PP)S, the particle comes sentence-finally if there are no other major constituents. This is relatively frequent, since both direct objects and lexical subjects can be omitted if they can be understood from context, e.g.:

(1) (a) I-   O- P'IT   OCHEL   (TA the box) (the mouse)
        CP   3A-jump   in   PREP
        'It (the mouse) jumped IN (to the box).'
    (b) TIK'- O (OCHEL) !
        insert-IMP in
        'Put (it) in!'

(CP: completive aspect, 3A: 3rd sing. absolutive, PREP: all-purpose "relator" (=at, in, on, to, from, because, etc.), IMP: imperative.)

of the verb root plus a suffix; cf. Pye 1983). So children's selection of verb vs. particle is apparently influenced not only by perceptual factors but possibly also by (a) learners' detection of where the language encodes Path most systematically, and (b) a preference -- which competes with and may win out over perceptual salience -- for semantically "richer" over "leaner" Path markers: like the Korean children, the Tzotzil children initially showed a strong bias toward transitive Path verbs, especially those that conflate information about Path with information about the geometries or natures of the Figure and Ground objects, and were relatively slow to learn "pure" Path verbs with meanings like 'enter' and 'ascend'.

Among Tzotzil children's early transitive verbs were *xoj* 'ring and pole', *tz'ap* 'pierce, put pointed end in', *botz'* 'pull out/ off (typically with some force)', *nap'* 'stick on', *tik'* 'put in, insert', *lok'* 'take out/ off, remove', *mak* 'close', and *jam* 'open'. The early acquisition of *xoj* is particularly interesting, because its 'ring and pole' meaning -- like that of Korean *kkita* 'fit' and *ppayta* 'unfit' -- is rather exotic from the standpoint of English. Tzotzil toddlers use it most frequently for putting on clothing (inserting limbs through sleeves and pantlegs, and head through openings in shawls), but they also extend it to novel 'ring and pole' situations, e.g., inserting a chick into a shirt pocket and hooking a coiled rope over a peg.

4. Elicited production study.

To enable us to compare speakers of different languages more systematically, we asked ENGLISH, DUTCH, and KOREAN speakers of different ages to describe a standardized set of 79 spatial manipulations involving "joining" and "separating" objects, e.g., putting things in, on, together; taking them out, off, apart; donning and doffing clothing; buttoning, unbuttoning; opening, closing). For each language there were 40 subjects: 10 in each of 4 age groups (2;0-2;5, 2;6-2;11; 3;0-3;5, and adults). Comparable but less complete data were obtained for TZOTZIL in more informal way, using many of the same stimulus materials, from 7 children age 1;7-2;7, 6 children age 2;8 to 4;0, and 7 adults.

For reasons of space we can show only a portion of the data; it will be discussed in the next section. Figures 1-6 show the dominant classification of the "joining" actions (putting in, on, together, etc.) by the adult and youngest group of child speakers of ENGLISH (Figs. 1, 2), KOREAN (Figs. 3, 4), and TZOTZIL (Figs. 5, 6).[3] The adult speakers of our four languages

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[3] There is a single layout for the actions, based (with modifications) on a multidimensional scaling analysis of similarity matrices derived from the responses. Venn diagrams superimposed on the layout show the dominant pattern for a particular group of subjects. Numbers show the number of subjects (out of 10) who produced the indicated response (except in Tzotzil, where

classified the events similarly in some ways (e.g., everyone treated the 'closing' events as a set), but strikingly differently in others. In general, the children classified similarly to adult speakers of their language, although they knew fewer Path words and overextended certain of the words that they did know. Adult and child Dutch speakers classified similarly to the English speakers, except that they broke down the big English 'on' category into two subcategories: *op* (put suitcase on table, doll on towel, bandaid on hand, hat on head, etc.) and *aan* (hook train cars, join Pop-beads, clothing on trunk and feet, etc.); see Bowerman in press b on the semantics of these two categories.

5. Discussion. Let us now see what the data from sections 3 and 4 mean for the questions outlined in the introduction to this paper.

1. Nonlinguistic biases for spatial organization? Children clearly approach language with some ideas of their own about how to organize space:

- The bias noted earlier by Johnston & Slobin (1979) and Slobin (1973) for TOPOLOGICAL SPATIAL RELATIONS was also obvious in our data: words for "separating" and "joining" in various ways figured prominently in the early vocabularies from all the four languages.

- Children tend to underdifferentiate spatial events relative to the adult target, especially in talking about acts of "separation"; in all our languages, "separation" was discriminated less finely and accurately than "joining".

- Children often focus on the "local geometry" between two objects, when adults take a more "global" perspective. For example, TZOTZIL children often say *xoj* 'ring and pole' for describing donning clothing, while adults more often say *lap* 'put on clothing' (cf. Figs. 5, 6). Similarly, KOREAN children often say *ppayta* 'unfit' for taking off clothing, while adults say *pesta* 'remove clothing.' Children learning ENGLISH often say *on* and *off* for joining and separating symmetrical arrangements of Pop-beads and Lego pieces; adults, in contrast, use *together* and *apart*, thereby overriding the geometry of the point of attachment in favor of attention to the symmetry in shape and motion of the moving objects. A similar pattern was found in DUTCH.

2. Evidence for early language-specific spatial categorization? Our subjects all showed a special interest in topological spatial relations, but the way they

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there are fewer subjects). Actions that fall outside of all Venn diagrams in a figure were either (1) responded to very inconsistently, (2) (for English and Korean learners) received few relevant verbal responses, or (3) (for Tzotzil learners) not offered. Dotted and solid lines are sometimes alternated simply to make visual inspection easier.

classified these relations was strongly influenced by the input language. For example, the distinction between *in* and *on* in children learning ENGLISH (Fig. 2) is crosscut by the category of *kkita* 'fit' in children learning KOREAN (Fig. 4), and both of these sets of categorical distinctions are crosscut again by the category *xoj* 'ring and pole' in children learning TZOTZIL (Fig. 6).

3. Effect of exposure to typologically different languages? The preference of learners of ENGLISH for particles has been attributed to the fact that they are stressed and often utterance final. But TZOTZIL children hear both Path particles and Path verbs in the input, and they clearly opt for the verbs. As discussed, perceptual salience seems to compete with additional determinants of acquisition, such as attraction to "semantically rich" ways of encoding Path.

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Figure 1. Categorization of JOINING
actions by ENGLISH-speaking ADULTS.

Figure 2. Categorization of JOINING actions
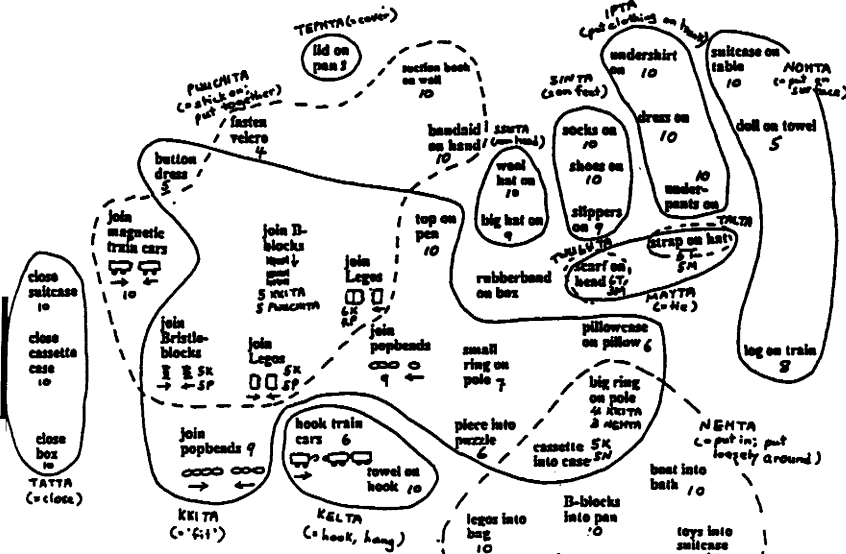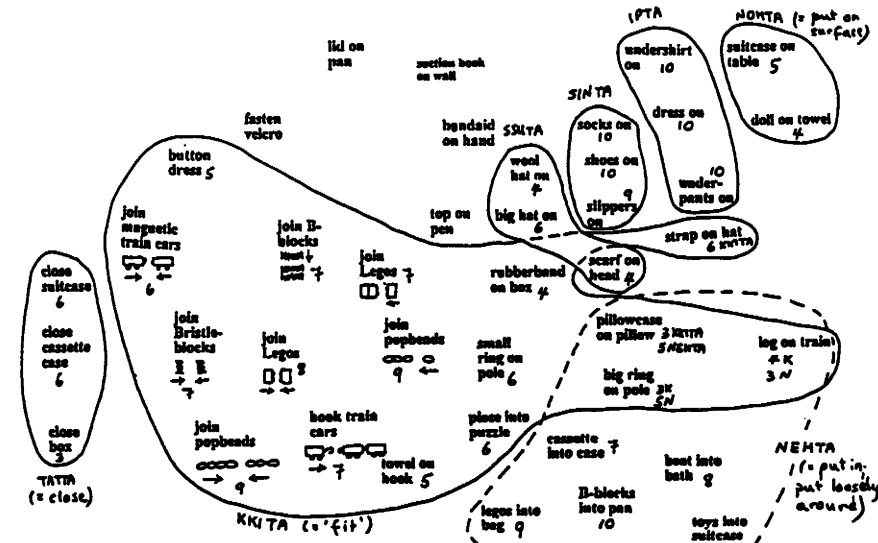by ENGLISH-speaking CHILDREN age 2;0-2;5.

Figure 3. Categorization of JOINING actions by KOREAN-speaking ADULTS.

Figure 4. Categorization of JOINING actions by KOREAN-speaking CHILDREN age 2;0-2;5.
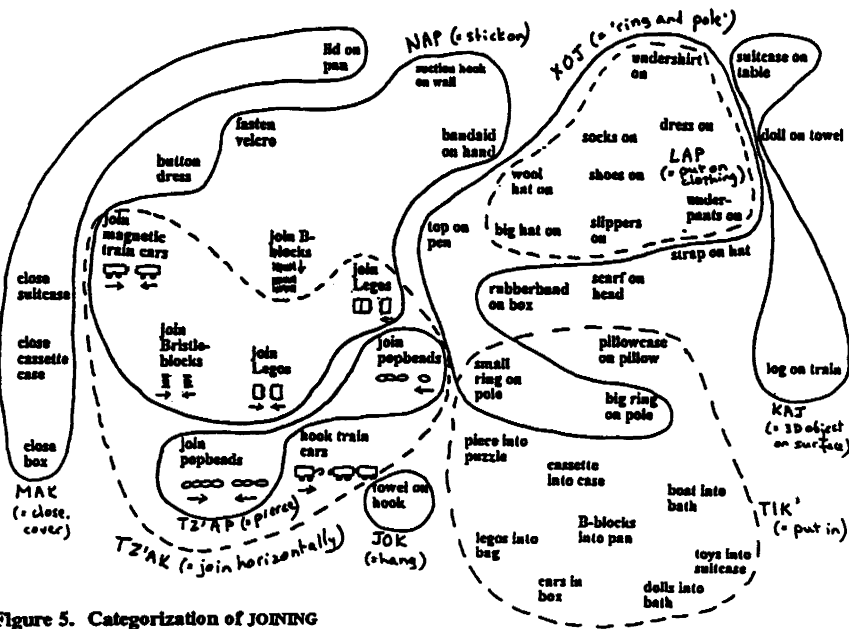
NAP (= 'stick on')

XOJ (= 'ring and pole')

lid on pan

suction hook on wall

undershirt on

suitcase on table

fasten velcro

bandaid on hand

socks on

dress on

doll on towel

button dress

wool hat on

shoes on

LAP (= 'put on clothing')

join magnetic train cars

join B-blocks

top on pen

big hat on

slippers on

under-pants on

strap on hat

close suitcase

join Legos

rubberband on box

scarf on head

close cassette case

join Bristle-blocks

join Legos

join popbeads

small ring on pole

pillowcase on pillow

log on train

big ring on pole

KAJ (= 3D object on surface)

close box

join popbeads

hook train cars

piece into puzzle

cassette into case

boat into bath

TIK' (= put in)

towel on hook

MAK (= close, cover)

TZ'AP (= pierce)

JOK (= hang)

legos into bag

B-blocks into pan

toys into suitcase

TZ'AK (= join horizontally)

cars in box

dolls into bath

Figure 5. Categorization of JOINING actions by TZOTZIL-speaking ADULTS.

NAP' (= stick on)

XOJ (= 'ring and pole')

lid on pan

suction hook on wall

undershirt on

suitcase on table

fasten velcro

bandaid on hand

socks on

dress on

doll on towel

button dress

wool hat on

shoes on

under-pants on

join magnetic train cars

join B-blocks

top on pen

big hat on

slippers on

strap on hat

close suitcase

join Legos

rubberband on box

scarf on head

close cassette case

join Bristle-blocks

join Legos

join popbeads

small ring on pole

pillowcase on pillow

log on train

big ring on pole

close box

join popbeads

hook train cars

piece into puzzle

cassette into case

boat into bath

TIK' (= put in)

towel on hook

MAK (= close, cover)

legos into bag

B-blocks into pan
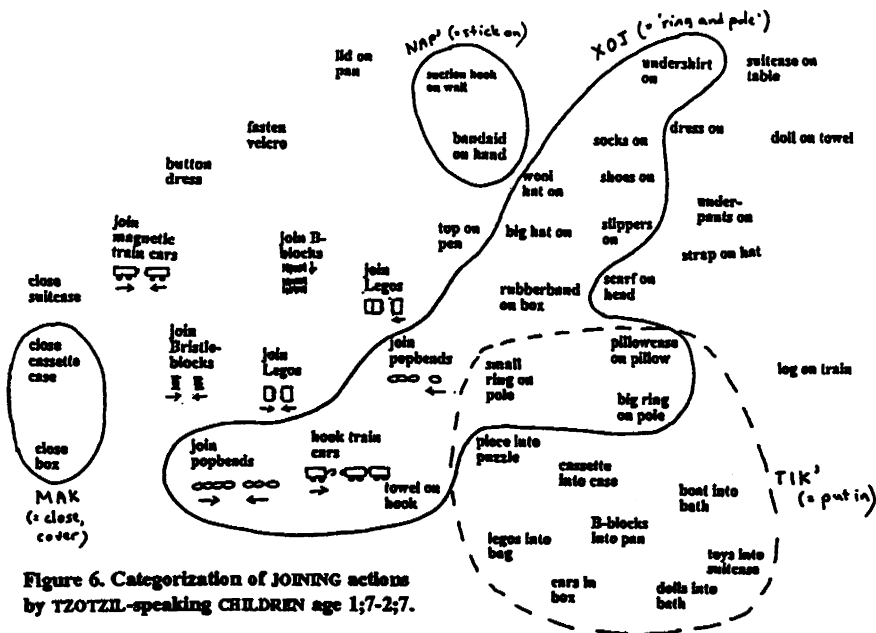
toys into suitcase

cars in box

dolls into bath

Figure 6. Categorization of JOINING actions by TZOTZIL-speaking CHILDREN age 1;7-2;7.