The 6th China International Forum on Cognitive Linguistics

Language, Culture and Mind:

10 lectures on development, evolution and cognitive linguistics

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Lecture 6

Concept, context and extended embodiment:

Spatial language and cognitive development

Whorf on Spatial Language and Concepts

- The concept of space will vary somewhat with language as an intellectual tool....which is linguistically conditioned (Benjamin Lee Whorf, 1939) (cited in Penny Lee, 1996)

Outline

- Spatial understanding in infancy
  - The legacy of Piaget
  - Do infants have concepts of space?
  - Is space a distinct domain?
- The development of early spatial concepts and language in a crosscultural and crosslinguistic perspective

Spatial understanding in infancy: The legacy of Piaget

- From sensori-motor understanding to conceptual representation: the late emergence of concepts
- The integration of domains in global stages of development
- The universality of the epigenetic process and its products
- The priority of cognition over language

Do infants have concepts of space? Piaget's claims

- The development of the object concept implies a sensori-motor representation of spatial location (the "A not B" infant search or object permanence task).
- Representational understanding does not emerge until mastery of the object concept is complete (about 18 mo.)
- There is a universal developmental sequence from topological to projective spatial representation and this is reflected in early language.

Do infants have concepts of space? Recent research

- Views spatial cognition as part of event structure cognition
- Experimental paradigms:
  - Habituation/dishabituation
  - Violation of expectation
  - Preferential looking
- All these paradigms employ length of gaze as the experimental variable (non-motoric response).

Do infants have concepts of space? Motion

- Infants begin to display expectations about motion events in the physical world from 12 weeks of age or less.
- They track the path of a moving object when its path of motion is invisible
- They are not surprised when the object reappears from behind the occluder
- They are surprised when it reappears at the ”wrong” place.
  (Baillargeon, 1998)

Do infants have concepts of space? Occlusion and Containment

- Infants of 3.5 mo. understand that when one object occludes another, whether the occluded object completely or partially disappears depends upon the relative heights of the objects (Baillargeon and De Vos, 1991).
- Infants distinguish between occlusion and containment from 4.5 mo., they can reason about height in occlusion but not (until 7.5 mo.) in containment events (Hespos and Baillargeon, 2001)

Do infants have concepts of space? Support and Containment

- Infants of 4.5 mo. can distinguish between possible and impossible support events, and are surprised at impossible ones.
- By 6.5 mo. they understand that balance plays a role in support against gravity (Needham and Baillargeon, 1993).
- 9 mo. infants understand that upright containers are more likely to take their contents with them, when displaced, than inverted containers, when tested using the infant search paradigm (Freeman, Lloyd and Sinha, 1980)

So do infants have spatial concepts?

- Most of the experiments referred to above involve an understanding that goes beyond perception, implying a level of *spatial representation.* This is consistent with findings in other domains such as object categorization (Mandler, 2000)
- However, this understanding is context-specific, not yet generalized, and linked to other aspects of causal event cognition.
- Spatial understanding can also mislead infants and give rise to errors in predicting the nature of events and organizing actions.

Is space a distinct cognitive domain for infants?

- Spatial notions are integrated (sometimes inappropriately) with other aspects of event cognition.
- Spatial notions do not emerge simultaneously. There is some evidence that motion and gravity have priority. These are salient in the infants perceptual world.
- The evidence is consistent with the existence of innate predispositions for forming spatial representations, but much less so with the hypothesis of a unified spatial cognition ”module”

Cognition and spatial language acquisition

- We have seen that pre-linguistic infants have already constructed cognitive representations (proto-concepts) of spatial relations such as occlusion, support and containment.
- This gives rise to the cognition hypothesis:
  "We are able to understand and productively to use particular linguistic structures only when our cognitive abilities enable us to do so" (Cromer, 1974) (weak version)
- The process and content of early spatial semantic development is determined by universal pre- and non-linguistic perceptual and cognitive processes and structures (strong version)

Cognition and cross-linguistic variation

- However, languages vary very widely in the particular ways in which they semantically organize space.
- This is dramatically so when we compare English prepositions with, for example, Japanese postpositions, or with body-part locative languages.
- What consequences does this have for language acquisition patterns?

Two hypotheses on cognition and early spatial language acquisition

- The cognition hypothesis predicts that children map spatial relational words to universal pre-existing spatial concepts. Since languages vary so much in their semantics, this should give rise to many and predictable errors.
- The language-specific acquisition hypothesis predicts that children should pay attention to usage in the language they are acquiring, changing their pre-linguistic cognition in the direction of the semantics, and making fewer errors.

The Jensen de López Danish-Zapotec spatial language acquisition study

- Kristine Jensen de López (directed by Chris Sinha) compared spatial language and cognitive development in Danish and Zapotec acquiring children.
- We found significant differences in performance between the two groups, motivated by the semantics of the two languages, in both linguistic and non linguistic tasks.

Two cultural contexts, two languages

Danish language & culture

- Germanic language spoken in North-West Europe
- “Western”, industrialized society with many canonically unifunctional artifacts
- High degree of division of labour with predominance of non-manual labour
- Prepositions are the principal linguistic means for expressing spatial relations

Zapotec language & culture

- Otomanguean language spoken in Southern Mexico
- “Non-Western”, agrarian society with relatively few, multifunctional artifacts
- The human body is both the principal instrument of labour and a culturally salient semantic source domain
- Body Part locatives are the principal linguistic means for expressing spatial relations

The Zapotec BPL's

- Regularly, productively and obligatorily used to express location
- Lexically identical to the Body Part Noun
- Preposed to the Landmark NP
- At an advanced stage on a grammaticalization path to being prepositions (morphological reduction and constructional change)

Zapotec Body Part Locatives

San Marcos Tlapazola (Valley Zapotec)

(Jensen de López, 1998; for comparison see MacLaury, 1989)

Quia = head
Lo = face
Ruu = mouth
Láani = stomach
Dets = back
Llaan = bottom
Nii = foot

Body Part locative usage is based on the metaphorical projection of the human body schema in canonical orientation onto physical objects, modulated by pragmatic-functional considerations.

Examples of Zapotec BPL constructions

- Bidy quia yuu

chicken head house

chicken on roof of house

- Bidy dets yuu

chicken back house

chicken behind the house

- Bidy láani yuu

chicken stomach house

chicken inside the house

- Bidy lo yuu

chicken face house

chicken in front of the house

- Bidy ruu yuu

chicken mouth house

chicken in the window/doorway of the house

- Bidy lo mes

chicken face table

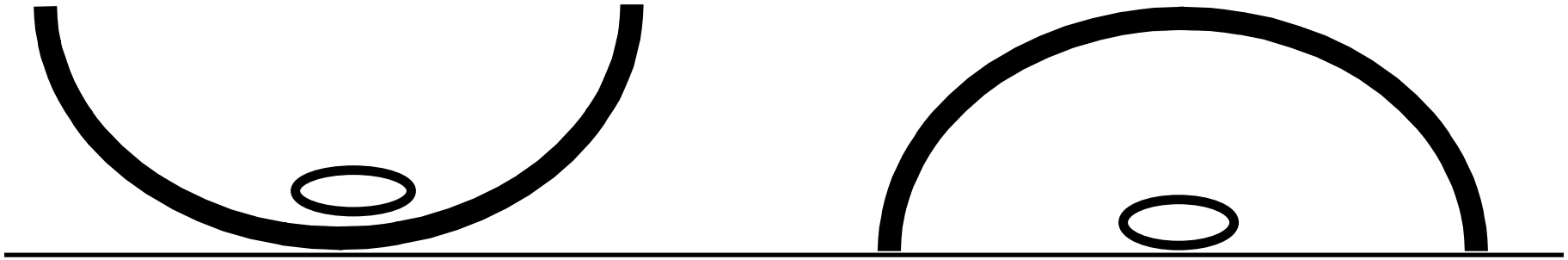
chicken on the table/ in front of the table (associated space)

English and Zapotec Containment Schemas

English

IN

UNDER



Zapotec

STOMACH

STOMACH

The experiments

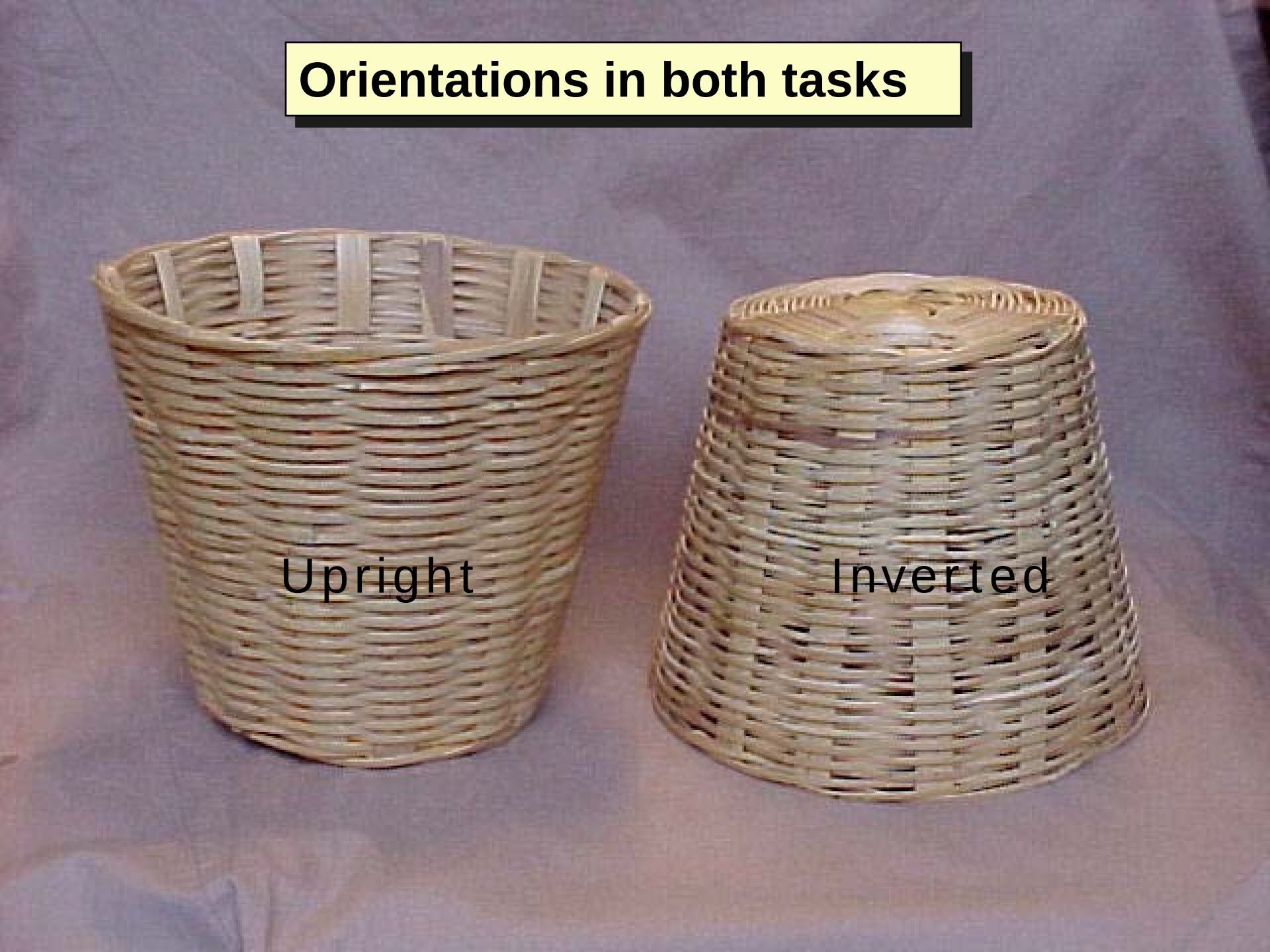
- Action Imitation:

  Imitate an action resulting in a spatial configuration (corn grain *In, On, Under* an upright or inverted basket).

- Language Comprehension:

  Carry out an instruction to bring about a spatial configuration (corn grain *In, On, Under* an upright or inverted basket).

Orientations in both tasks




Inside the basket


On top of
the basket


Under the basket

Analysis

- The spatial configuration produced by each child for each trial was etically coded (Actual end-state was coded independently of the semantics of either language)
- Response type frequencies were counted and compared across conditions x languages

Table 1
Subjects by age and language group

Age groups	Age range	Danish	Zapotec	Total
Group I	17-24 months	10 male 9 female N = 19	5 male 1 female N = 6	15 male 10 female N = 25
Group II	25-35 months	19 male 2 female N = 35	5 male 11 female N = 16	23 male 28 female N = 51
Group III	36-46 months	9 male 8 female N = 17	7 male 4 female N =11	16 male 12 female N = 28
Totals		71	33	**104**

Table 2. Responses to the Language Comprehension task by Language Group

Language	Inside	On top of basket	Under INV Basket	Under upright basket	Beside INV basket	Beside Upright basket	Other response	No response	Total
DK	184 (44%)	118 (28%)	55 (13%)	16 (4%)	2 (0%)	7 (2%)	6 (1%)	38 (8%)	426
ZAP	45 (34%)	47 (36%)	27 (20%)	0 (0%)	0 (0%)	3 (2%)	2 (2%)	8 (6%)	132

Table 3. Responses to the Action Imitation task by Language Group

Language	Inside	On top of basket	Under INV Basket	Under upright basket	Beside INV basket	Beside Upright basket	Other response	No response	Total
DK	166 (39%)	131 (31%)	100 (23%)	1 (0%)	3 (1%)	0 (0%)	4 (1%)	21 (5%)	426 (100%)
ZAP	60 (30%)	58 (30%)	56 (28%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	24 (12%)	198 (100%)

Table 4. The four main response types to the action imitation task and the language comprehension task by language group

Task	*In* responses	*On* responses	*Under* responses	*Other* responses	Total
Action Imitation*a* Danish Zapotec	 39 % 30 %	 31 % 30 %	 23 % 28 %	 7 % 12 %	 100 % 100 %
Language Comprehension*b* Danish Zapotec	 44 % 34 %	 28 % 36 %	 13 % 20 %	 15 % 10 %	 100 % 100 %

Between group differences in response patterns for each of the subtasks:

a) 2-sided Test Pearson Chi-Square, p = .034.

b) *2-sided Test Pearson Chi-Square, p = .013.*

Figure 1: All Response Types in Language Comprehension Task

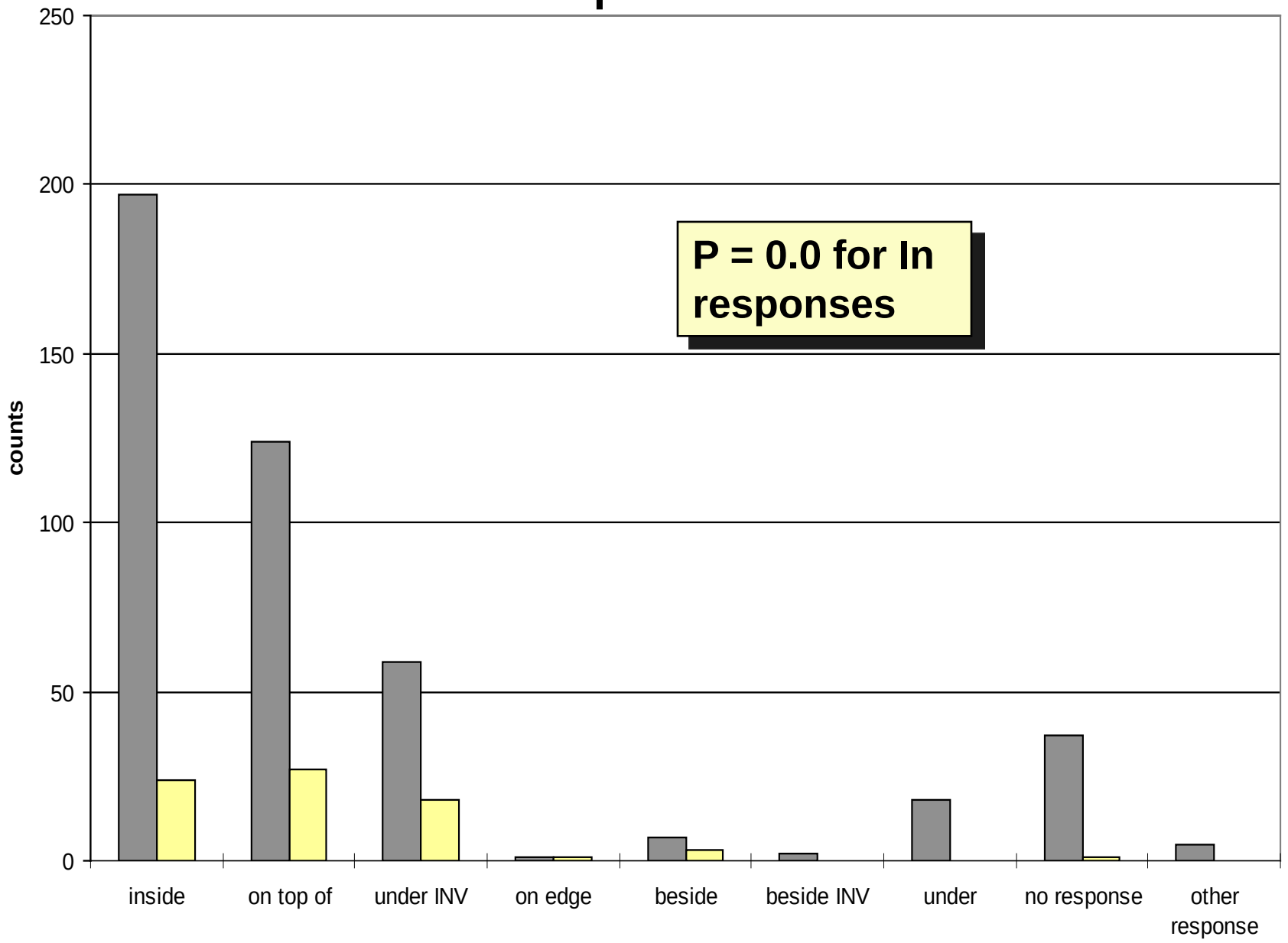
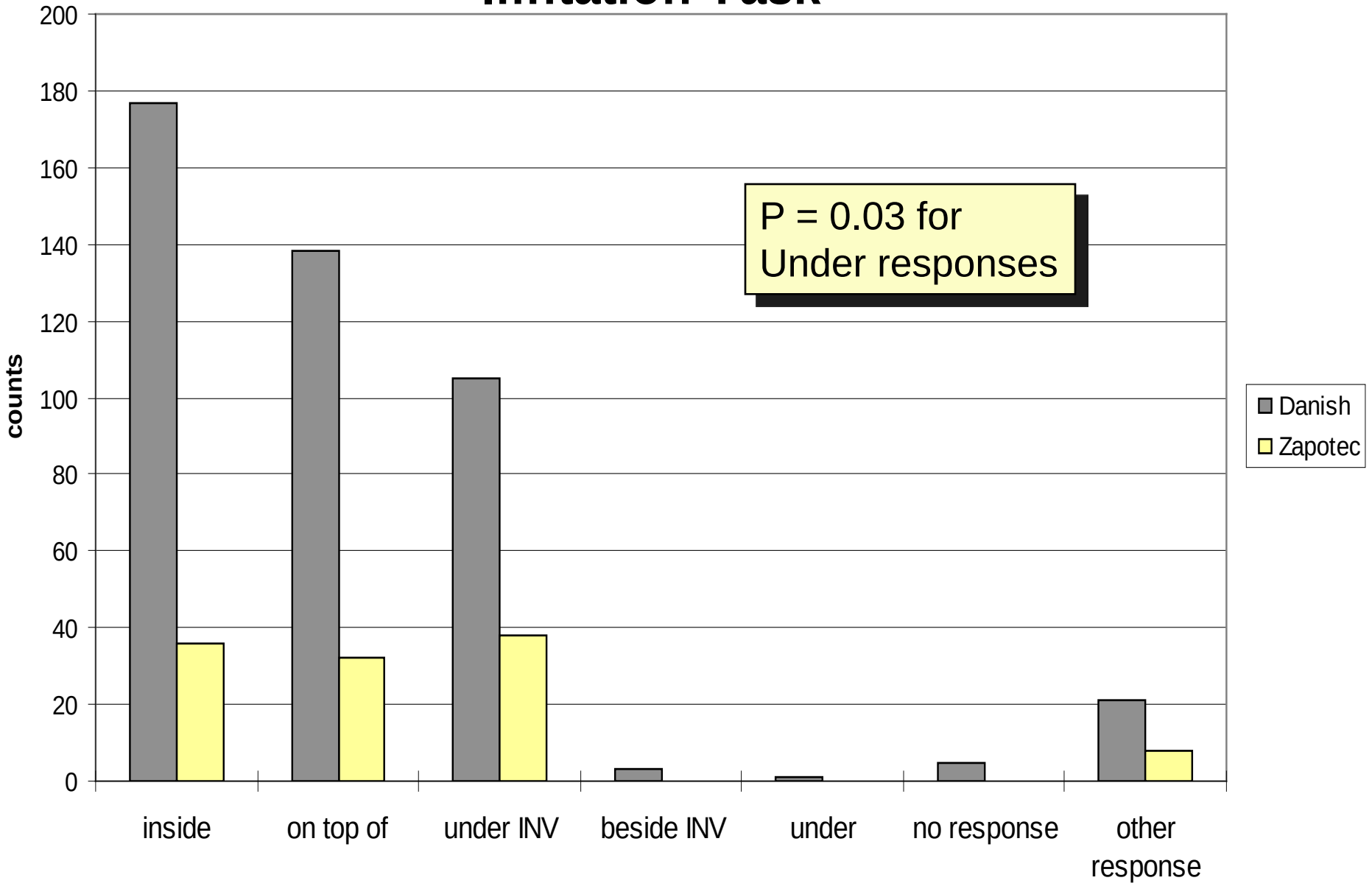


Figure 2: All Response Types in Action Imitation Task



Discussion

- The two language groups differed significantly in their response patterns on both tasks
- These differences were parallel across tasks. The patterns for each group on the linguistic and non-linguistic tasks resmbled each other and differed from the patterns of the other group

Discussion (continued)

- The Danish children showed a In>On>Under frequency pattern (*in* preference or canonicality effect)
- The Zapotec children showed no such pattern or effect
- These differences were not simply due to relative frequencies of correct vs. incorrect responses. Both groups made erroneous placements. There was no overall performance superriority for either group

Why Is This?

- The differences between the groups on the language comprehension task can be accounted for by the language specific acquisition hypothesis. This is also consistent with Jensen de López's longitudinal production data
- This does not however account for the differences on the action imitation task

Containment As Cultural Practice

- To explain the difference in performance on the nonlinguistic task, we could appeal to a Whorfian effect, but is this plausible at such a young age?
- An alternative explanation examines cultural practices using baskets as containers and covers

The Zapotec culture makes use of a smaller variety of artifacts than the Danish culture, and tends to employ them flexibly and multi-functionally. In the village where the Zapotec study was conducted, baskets are commonly used, in “inverted” orientation, as “covers” for *tortillas* and other food items, and are stacked for storage in inverted orientation. They are also frequently used in inverted orientation in children’s games, for example in catching chickens. Inverted baskets are sometimes placed over brooding chickens in order to keep them on their eggs, so that the eggs will hatch. If [Zapotec] containment schema involves *constraint* by the landmark of the location of the trajector, it would seem that in this culture, at least, the schema is not canonically associated with an orientation of the container with its cavity upwards.

Sinha & Jensen de López 1999

Conclusion

- Objects and spatial relations are not just physical but also socio-cultural objects and relations
- Biologically based spatial cognition is embedded in interwoven, culturally specific non-linguistic and linguistic practices
- It is through their participation in such practices that children gain mastery of culturally and linguistically appropriate spatial cognition

Beyond Linguistic Relativity

- The right question is not ”does language determine thought?”, but ”How does language both express and entrench cultural variations in universally constrained patterns of thinking?”
- “Language both expresses and constitutes world view but could only fully determine it in a culture that lacked other means of expression and communication.” (Palmer 1996).

Thank you