

Building up the lexicon: How Japanese children learn meanings to novel nouns and verbs

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Problem of Induction in lexical disambiguation



- Quine (1960, 1969):
 - It is virtually impossible to determine the meaning of a word based on the observation of one exemplar of the extension.

Paradox of word learning in young children



- In spite of the logical problem of induction, young children learn word meanings very efficiently, often successfully inferring the meaning of a novel word only from a single referent.

Goal of the talk



- Discuss how young children constrain possible meanings of words (nouns and verbs) from a single exemplar of the referent to build up the lexicon very rapidly and efficiently.

What children need to do to build up the lexicon



- Segment fluent speech to each unit of meaning (i.e., word)
- Infer the meaning of a given word
 - Decompose the event to appropriate part.
 - Identify which part of the event the word corresponds to
 - Infer to what other instances the word can be generalized

Clues for constraining word meanings: referent identification(1)

- The speaker's eye gaze, gesture, facial expressions.



Clues for constraining word meanings: referent identification(2)

- The learner's pragmatic knowledge about the lexicon.
 - If there is a unfamiliar object and a familiar object whose label is known, a novel label should refer to the unfamiliar object.



Clues for constraining word meanings: generalization (1)



- Different grammatical classes map onto different semantic classes.

Linkage between syntactic form class and semantics in English



- Verbs→Actions, Motions, Relations
- Adjectives→Properties
- Count nouns→Object categories
- Mass nouns→Substances, Materials
- Proper nouns→Unique individuals

Lack of form class cues in Japanese within nominals



- Japanese does not mark the distinctions between
 - common nouns and proper nouns
 - count nouns and mass nouns
 - no number marking

“Kore wa X desu”



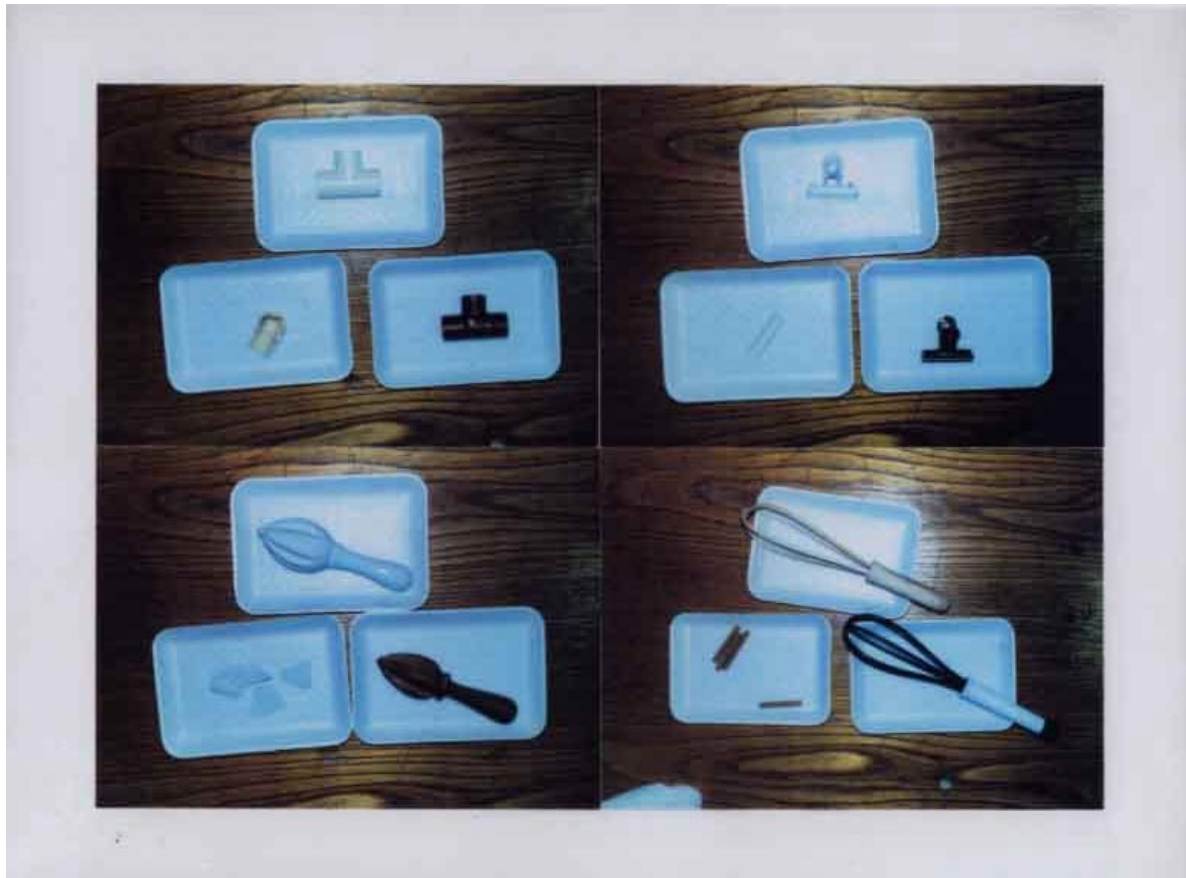
- This is a X (single object)
- These are Xs (multiple objects)
- This is some X (material)
- This is X (proper name)
- This is X (property)

Object names and Substance names (Imai & Gentner, 1997)



- Even though Japanese does not distinguish count nouns and mass nouns, Japanese children know that different extension principles are applied for object names and substance names

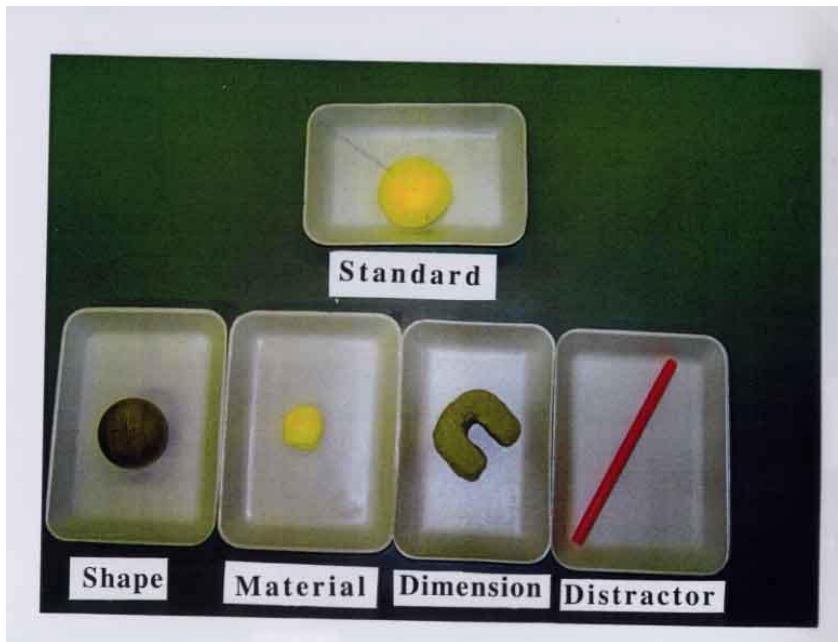
Object names extended by shape



Substance names extended by material



Nouns refer to *either* substance kinds or object kinds



- 3-year-olds know that a noun cannot refer to a disjunctive category (e.g., things of this shape OR things made out of this material)

When the noun refers to an object...



- The noun can be
 - A name of that particular object (proper noun)
 - A name of a category the object belongs to
- Japanese does not syntactically distinguish proper nouns and common nouns. (cf. English “a neke” vs. “Neke”)

Names for unfamiliar objects: artifacts



standard



subordinate



basic



superordinate



unrelated

- Extend the label to the subordinate and basic-level items → Basic level interpretation

Names for unfamiliar objects: animals



standard



subordinate



basic



superordinate



unrelated

- Extend the label to the subordinate and basic-level items → Basic level interpretation

How do Japanese children interpret novel nouns for novel objects? (Imai & Haryu, 2001)



- Even though Japanese does not mark the common/proper distinction, Japanese children assume that a novel name for a novel object is a category name.
- Map the word to a basic-level category

**But when a familiar object is
named with a new noun...**

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Names for familiar objects: animals (Imai & Haryu, 2001)



standard



subordinate



basic



superordinate



unrelated

- Restricted the name to the named object only
→ Proper name interpretation

Names for familiar objects: artifacts (Imai & Haryu, 2001)



standard



subordinate



basic



superordinate

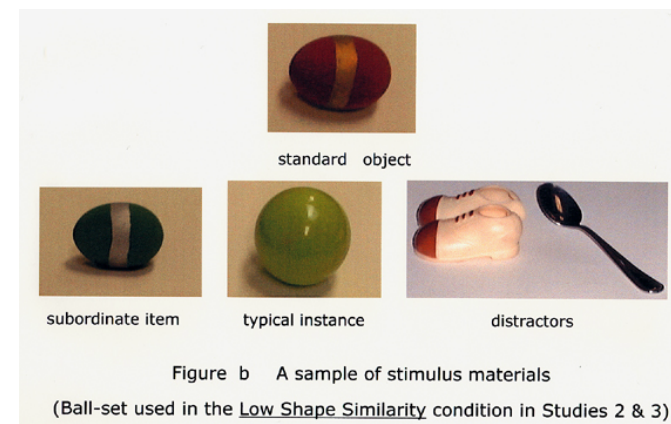
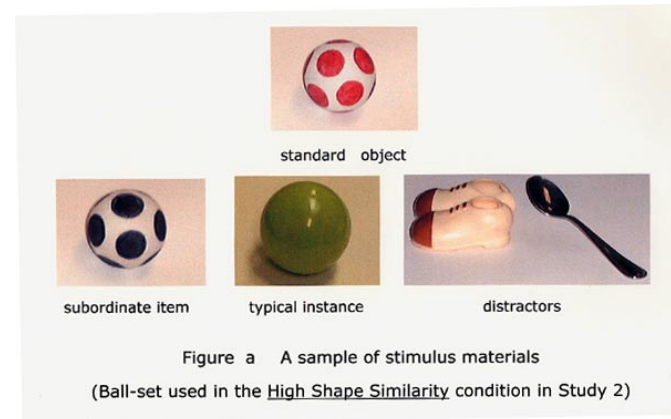


unrelated

- Extended the label to the subordinate item only
→ Subordinate category name interpretation

More about a new label for a familiar artifact... (Haryu & Imai, in press)

- Children do not blindly map the new label to a subordinate category.
- They sometimes exclude the named object from the familiar category to establish a new category.



Summary so far



- Children are able to learn nouns very efficiently by constraining their meanings flexibly recruiting and coordinating clues in the environment and internal knowledge they possess about the noun lexicon.

What about verbs?



■ Question

- Can Japanese children infer the meaning of verbs as easily as the meanings of nouns?

How are verbs different from nouns?



- Referents of nouns are perceptually stable, while referents of verbs are ephemeral.
- Verbs refer to relations between arguments (objects).

Noun vs. Verb controversy

■ Nouns-earlier-than-Verbs View.

Nouns are learned earlier and faster than verbs because concepts denoted by nouns tend to be cognitively more coherent and tangible.
(Gentner, 1982)

■ Input-dependent View

Early noun learning advantage is not universal. If verbs are salient and dominant in the input language, verbs are learned earlier than nouns.
(Gopnik & Choi, 1990; Tardif, 1996)

Property of Japanese



- Japanese have properties that are said to foster verb learning, like Korean and Mandarin
 - pro-drop (also object-drop like Mandarin)
 - SOV
 - relatively simple and transparent verb morphology → No number-gender marking

Specific questions



- Can Japanese children decompose an action event and successfully map a noun and a verb to the appropriate part of the event?
- Do Japanese children generalize
 - Nouns to objects independent of actions?
 - Verbs to actions independent of objects?

What did we do? (Imai, Haryu, & Okada, 2002)



- Japanese children were shown a video scene in which a person was doing a novel action with a novel object.
- A novel word (either a noun or a verb) was introduced while seeing the video.
- Two test scenes were shown, and the child selected which scene the word can be generalized to.

Stimuli



- 6 sets of video scenes
- Each sets consists of a Standard scene and two test scenes.
- Two test scenes:
 - Action-Same-Object-different (Object-Change)
 - Object-Same-Action-Different (Action-Change)

Example of a Standard scene



Two test stimuli



Experiment set-up



Method



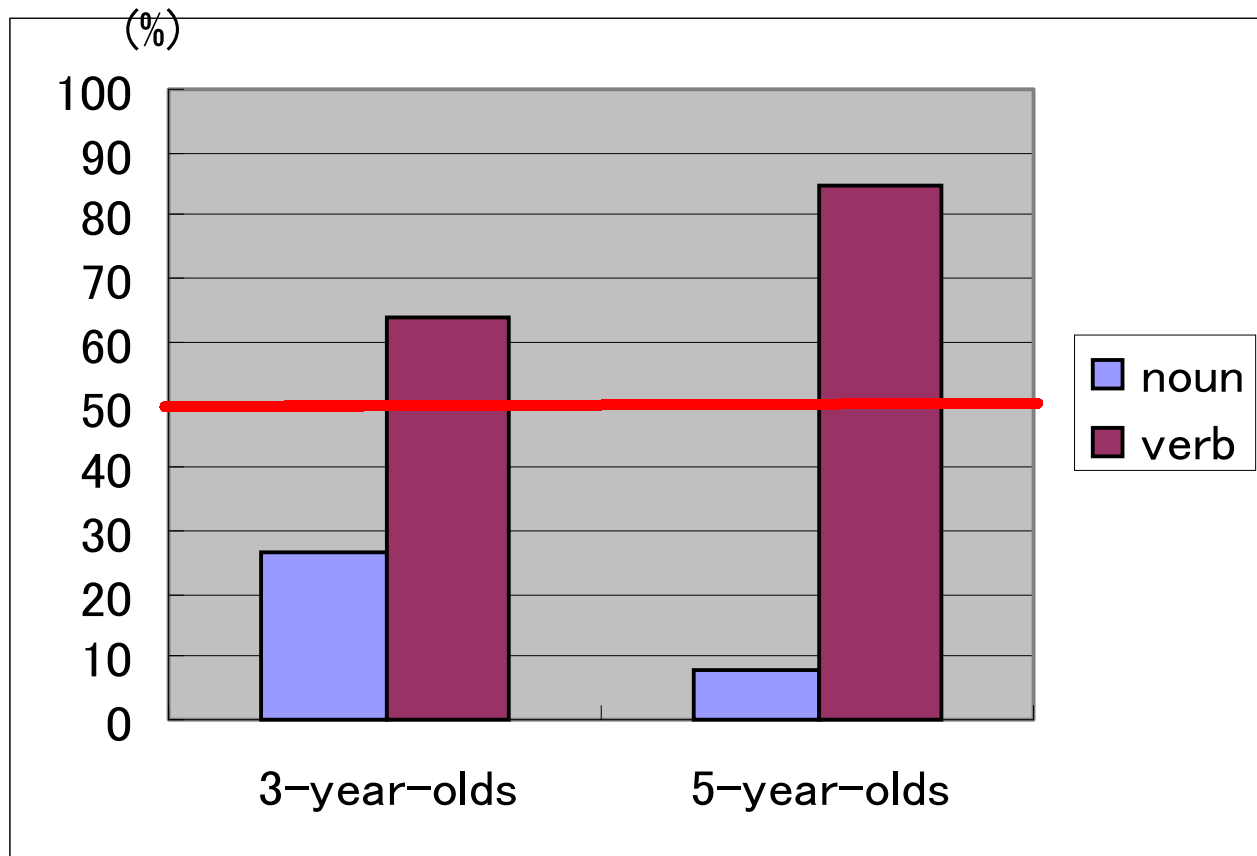
■ Participants

- 29 3-year-olds (15 boys and 14 girls)
- 27 4-5 year-olds (13 boys and 14 girls)

■ Design

2 (Age) X 2 (Condition: Verbs vs. Nouns)

Proportion of Object-Change choice in each condition/age group



Results



- Significant difference between the noun condition and the verb condition in both age groups.
- Noun condition:
 - Above-chance Object-Same response in both age groups.
- Verb condition:
 - 3-year-olds: chance-level response
 - 5-year-olds: above-chance Action-Same response.

Three possibilities for 3-year-olds' chance level response in the verb condition



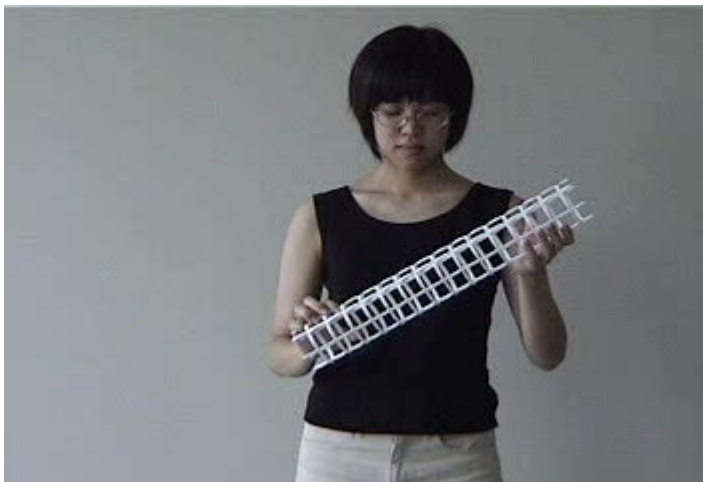
- Do not yet understand verbs refer to actions.
- Understand that verbs are mapped to actions, but the object (that appeared in the action) is incorporated in the verb meaning.
→UNDER-GENERALIZATION
- Assume that a verb refers to an action AND the object related to the action.
→OVER-GENERALIZATION

Study 2

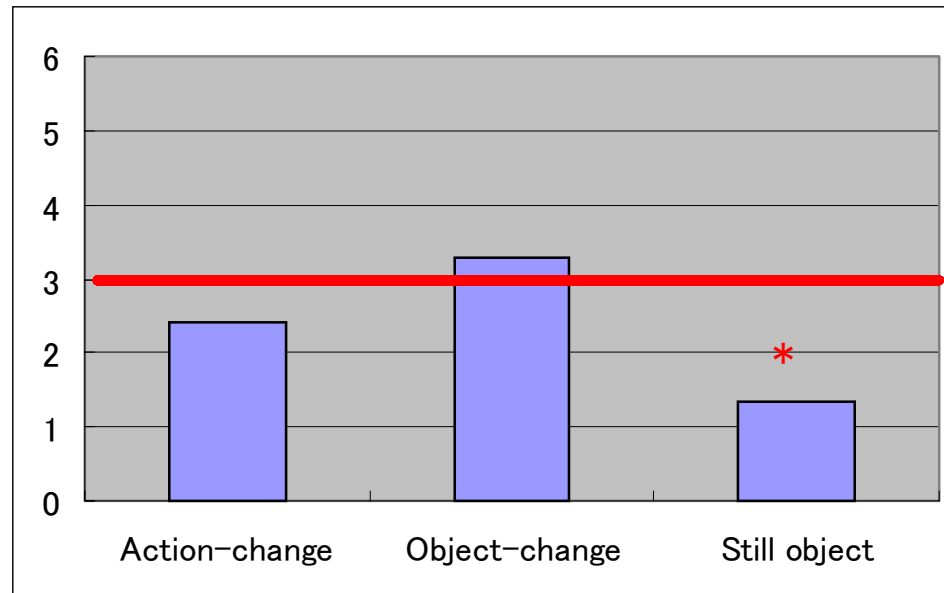


- 3-year-olds' verb generalization was examined using a YES-NO paradigm
- Included the STILL-OBJECT test in addition to the Action-Same-Object-Different test and the Object-Same-Action-Different test.
- 6 standards X 3 tests = 18 trials per child

Yes-No paradigm



Results of Yes-No study



- No effect for the contrast between AC vs. OC
- Significant effect for the $(AC+OC)/2$ vs. Still O

Proportion of Yes-response



- Still → below chance
- AC, OC → at chance
- No effect for the contrast between AC vs. OC
- Significant effect for the $(AC+OC)/2$ vs. Still 0

What if the actor changed?



- 3-year-olds can extend a verb to the same action with a different actor, as long as the object remains the same

Summary of verb-noun fast-mapping experiments

- 3-year-olds immediately map a noun to a novel object. They also know that a noun refers to an object independent of actions the object is used in.
- Children before 4 do understand that verbs refer to actions but do not understand that verbs (action names) are generalized on the basis of the sameness of the action per se, and the object is a variable.

Why is fast-mapping of a verb difficult?

- Learning verb meanings requires
 - decomposition and *alignment* of the event
 - pay attention to only to the relation, ignoring the sameness in the arguments
 - generalize the meaning only on the basis of *similarity* of the relation

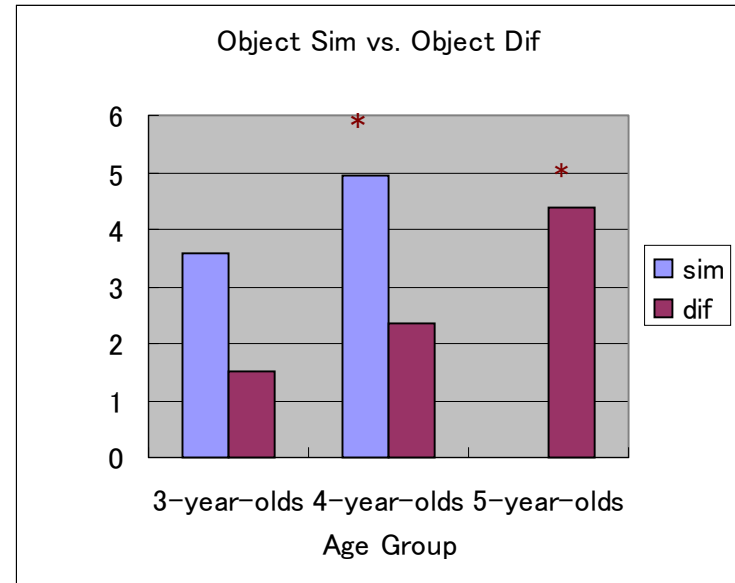
To foster alignment...

- make the object similar



Role of object similarity in verb learning

- Children can generalize verbs based on the identity of the action better **when the object is similar** to the original exemplar.



How young children learn verb meanings



- They know that verbs refer to actions but not objects, but...
- They start out very conservative, extending a verb only when the new event is similar not only in the action (i.e. relation) but also in the arguments.

Further problems in verb learning



- Finding 'similarity' that matters for verb meaning generalization (i.e., 'intension' of a given verb) is not straightforward.
- Within the domain of verbs, there are a number of subclasses. Children need to learn the relation between syntax (the argument structure) and verb meanings separately for each class (cf. Levin, 1993).

Key references



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