Innovation in Language Learning International Conference

New Methods to Learn and Generalize Novel Words in Children

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Abstract

Generally, picture books targeted at young children rely on single picture presentations. A picture illustrates an object or an action or a property. Then, a word is associated with this picture. This associative mode of teaching novel words considers word learning as a mechanism in which the word underlying a concept and the concept are connected via simple associations. This is far from current research tells us: children produce numerous extension errors (e.g., under- or over-generalizations). There is now ample evidence that the opportunity to compare several exemplars to the same target category name (e.g., several apples rather than one apple) gives better results in terms of word extension (e.g., Thibaut & Witt, 2015). Comparisons promote extensions that are based on deep semantic commonalities rather than on superficial features. The central idea is that comparisons are invitations to align objects on many properties, starting on easily accessible ones and, later, with deeper conceptually based regularities. In this paper, we will review the evidence regarding the role of comparisons in novel word learning. We will also review several conceptions of comparison effects such as progressive alignment or concreteness fading. We will illustrate situations these different comparison modes and suggest how picture books devoted to word learning might be implemented in e-learning.

Keywords: *Children, Word learning, meaning, stimulus comparison, word generalization.*

1. Word Learning and word generalization

Scholars have stressed young children's ability to learn novel words with very few presentations (fast mapping, Carey & Bartlett, 1978) and in situations in which the available evidence is unstructured or ambiguous (designation, pointing situations, Grassman & Tomasello, 2010). Numerous theories explain how children learn the reference of novel nouns (Bloom, 2002). Biases have been described that are supposed to constrain novel word learning, such as the shape bias (Kucker et al., 2019). Many studies of word learning rely on generalization tasks in which participants are given a stimulus together with a novel name and are asked to generalize the name to new stimuli. Understanding which stimuli children generalize the novel nouns to gives us a closer picture of what children's word meanings are. The generalization of novel names is a wonderful magnifying glass of how children see and understand the world. Generalization studies show us how children progressively learn to name novel instances of a category according to adults' standards. Correct generalization means that one should avoid under generalizing (not include all the entities included by adults) or overgeneralizing the novel name (going beyond referents included by adults). In most learning situations, the child is presented with a limited number of exemplars, most often one (or objects are introduced one by one on successive situations). Later, Then, one tests generalization with novel different stimuli. One difficulty is that generalization of novel names often suppose that children will be able to ignore easily accessible dimensions in favor of less obvious properties (e.g., texture a less salient dimension compared to shape, or taxonomically related items, e.g., a banana for an apple, and ignore items perceptually similar but taxonomically dissimilar, such as a red ball).

Here, we focus on comparison of stimuli which has been shown to be a powerful learning condition supporting conceptually-based generalization of novel names. The available evidence that the opportunity to compare several exemplars of a novel category that have associated with a common name promotes deep, conceptually-based generalization. These comparison situations would stand in sharp contrast to generalizations that would be grounded on salient perceptual properties such as their shape. According to this hypothesis, comparisons would help children to find deep commonalities between stimuli that are usually unnoticed when the objects are studied in isolation (Augier & Thibaut, 2013; Gentner & Namy, 1999; Namy & Clepper, 2010; Namy & Gentner, 2002; Son, Smith, & Goldstone, 2011; Thibaut & Witt, 2015).

How would comparisons contribute to language concepts learning? Gentner & Namy (1999) used a novel name extension procedure in which children were presented with either a single object (e.g. a bicycle - single condition) or two objects from a familiar category (e.g. a bicycle and a tricycle - comparison condition). The learning objects were associated with a non-word (e.g. "this is a buxi" in the single condition or “this is a buxi and this is also a buxi” in the comparison condition). In the transfer phase, children were asked to extend this novel name to one of two transfer objects, one which was a perceptually similar match (e.g. eyeglasses) or a taxonomic match (e.g. a skateboard), which was perceptually different. Children chose the perceptual target significantly in the majority of cases in the single learning object condition. In contrast, in the comparison condition the taxonomic match was chosen beyond chance. Gentner and colleagues argued that comparison conditions promote what they call alignment that would initially build on perceptual similarities. These first similarities would ground further comparisons that would progressively lead to more “essential”, deep conceptually relevant similarities (see also Thibaut, 1991; 1995; Thibaut & Witt, 2015).

2. Comparison and semantic distance

For the vast majority of studies, “comparison” refers to comparison of stimuli belonging to the same category (e.g., both stimuli are “daxes”). However, contrasting stimuli might uncover previously unnoticed unifying dimensions. Later contributions also showed that contrast categories provided comparison situations which were much less powerful than within category conditions (i.e., “these are two buxis”), or that comparisons and name were more powerful than comparisons alone. However, when children construct a conceptual system and learn the name of categories, they are confronted to items that belong to the same category but the distance of which differs. For example, the items that receive the name “Golden apple” are semantically very close (and also perceptually). There is less diversity in such a category compared to two different apples (e.g. a gala apple and golden apple) which is, in turn, less diverse than an apple and a banana (i.e., two fruits) or even an apple and a piece of meat (two foods). Indeed, these categories which differ in their breadth are exactly what the children have to master when they learn language. They can be described as subordinate categories (golden apples), basic level categories (apples) or superordinate categories (fruits or foods). When children have to learn the name of these categories, breadth of extension is part of the difficulty, since subordinate categories are very homogeneous, basic categories are both reasonably homogeneous and distinctive, where superordinate are conceptually very heterogeneous.

Thibaut and Witt (2015), Stansbury, Witt, & Thibaut (2019) focused on conceptual distance between training items (apple and apple, compared to apple and banana, for example) and between training items and test items. Thibaut and Witt (2017) used a comparison design (two stimuli) and tested generalization of novel names for familiar objects with 4- and 6-year-old children. Semantic distance between training items (e.g., two bracelets versus a bracelet and a watch), and semantic distance between the learning items and the transfer items (e.g., a pendent versus a bow tie, la shorter and a longer distance respectively) (See Figure 1). Thus, they tested whether a smaller semantic distance at learning would give a more efficient generalization than a longer generalization distance, or, in contrast, to a larger number of generalization errors. There were main effects of induction distance, and generalization distance and interaction with age, with children aged 6 years benefiting from longer distance during training to perform longer distance generalization. In contrast, the 4 year-old children failed to give distant generalization even in the case of far comparison during the learning phase. Conceptual distance during learning may affect differentially subsequent generalization performance across age groups (see Figure 2). However, as expected, the no comparison condition gave the worse generalization results (Figure 2) and elicited a majority of perceptually based generalizations. In both ages, quite expectedly, near transfer was better than far transfer even in the no-comparison conditions. In any case, distant generalizations, that is generalizations involving stimuli from the same superordinate categories, were more difficult for both groups of children. This confirms former evidence showing that superordinate categories are more difficult than other categories, most likely because conceptual commonalities are more difficult to find than at the basic level.

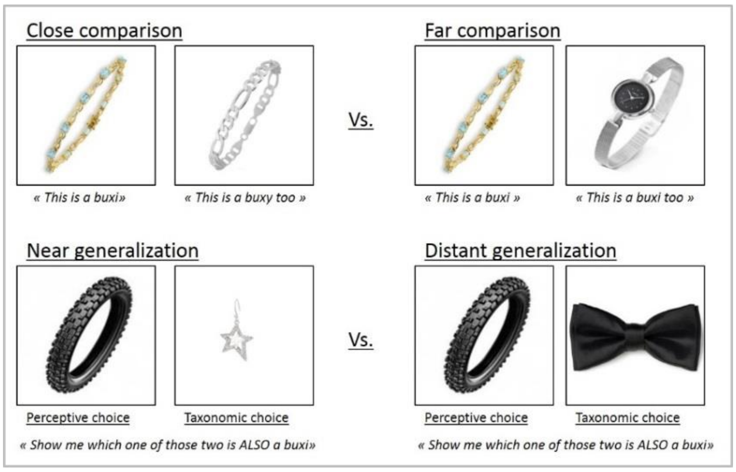

Figure 1. A stimulus set and instructions. Age (4 and 5) Comparison (no comparison, close comparison, far comparison stimuli) and Distance with transfer items (near or distant).

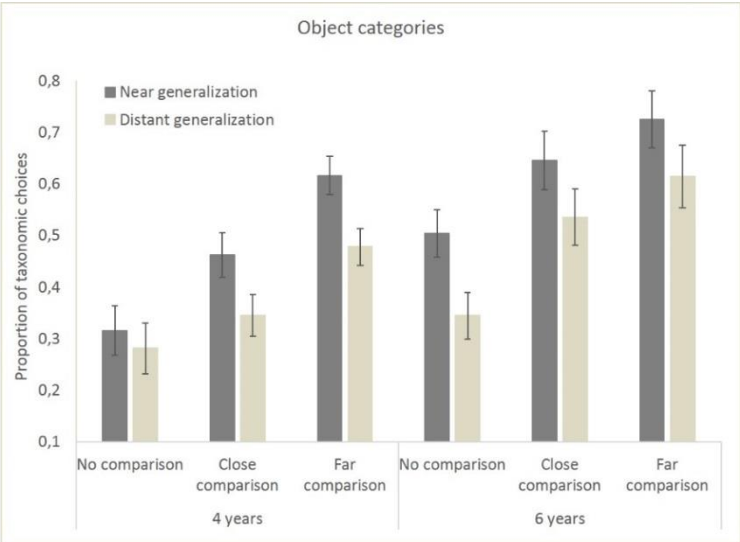

Figure 2. Mean percentage of taxonomic choices as a function of Age, Comparison (no, close, far) and Generalization (Near, Distant).

3. The role of executive functions

Augier and Thibaut (2013), Thibaut and Witt (2015) linked comparisons activities with executive functions. By executive functions, we refer to control processes, such as inhibition, which have been associated with the prefrontal cortex (see Zelazo et al., 2014). There are three fundamental executive functions (inhibition, cognitive flexibility, and updating in working memory, see Miyake et al. 2000). Augier and Thibaut (2013) proposed that because of their less developed executive functions, young children might be less able to integrate stimuli into consistent conceptual representations, because they would integrate all the available information less efficiently (see also French et al. 2017 or Bugaiska & Thibaut, 2015, for similar demonstrations in other tasks or other age groups). Stansbury et al. (2019) studied children's comparison time course with eye tracking data. The idea was to divide each trial in three time slices (beginning, middle, end) as a function of conceptual distance (see above). They were particularly interested by children transitions (switches) between the learning items and the correct answer but also between the learning items and the perceptual and a thematic match (e.g., a tree when the training items were apples). Interestingly, younger children compared the learning items (L1L2, see Figure 3) than older children, which suggest a less accurate analysis of the training stimuli. They also focused more on distractors than older children, even when they gave the correct answer. This can be interpreted in terms of inhibition of distractors or as difficulties of inhibition.

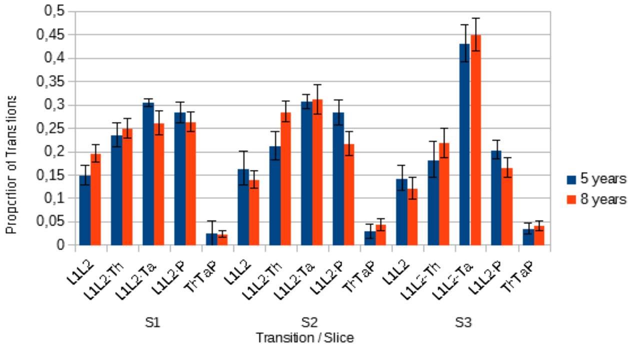

Figure 3: Proportion of transitions as a function of the Slice (S1, S2 or S3) and the Transition type (L1L2, L1L2-Th, L1L12-Ta, L1L2-P, ThTaP) for correct trials.
Note: L1L2 are transitions between Learning1 and Learning2; L1L2-Th, between L1 or L2 and Thematic; L1L2-Ta, between L1 or L2 and Taxonomic; L1L2-P, between L1 or L2 and Perceptual; ThTaP, between Th, Ta and P) (Error bars are SEM)

4. Conclusion

This positive role of comparisons has been documented for a wide variety of stimuli and situations in both adults and children. In the case of children, this has been shown for object names, names for parts, action verbs, adjectives, or perceptual categories (e.g., Thibaut, 1991, see Augier & Thibaut, for references). Most studies show that the most usual types of presentations (single presentation, such as the ones used in picture books) are not the most efficient to convey optimal information regarding word extension. This has deep consequences for book designs, which should take these recent studies into account.

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