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Reflections

Taking the task seriously: Reflections on measures of color acquisition

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Abstract

The experiments described in the lead articles by Kowalski and Zimiles and by O'Hanlon and Roberson examine factors that lead to color term acquisition. These experiments touch on the debate regarding the relative contributions of language and concepts in word learning. In this reflection, we examine how conclusions concerning the debate depend deeply on the particular task presented to children, and we propose an alternative approach to studying color term acquisition.

Keywords: Color; Adjectives; Acquisition; Words (phonetic units); Learning; Cognitive development; Concepts; Language

There is now an extensive literature on how children acquire color terms—words such as *red, green*, and *yellow* (Backsheider & Shatz, 1993; Bartlett, 1978; Cruse, 1977; Darwin, 1877; Istomina, 1963; Landau & Gleitman, 1985; Sandhofer & Smith, 1999; Soja, 1994). This base of literature has shown repeatedly that, in comparison with other types of words, the course of acquisition for color is protracted and errorful (see, e.g., Andrick & Tager-Flusberg, 1986; Bornstein, 1985; Rice, 1980). In contrast to the rapid learning of nouns (Carey, 1978), the extended time scale for learning color terms offers an opportunity to examine the word learning process in detail as it unfolds. The lead articles in this issue of the *Journal of Experimental Child Psychology* take advantage of this slow course of acquisition to examine the factors that lead children to ultimately learn color words.

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Kowalski and Zimiles (2006) ask whether color learning is led by conceptual or linguistic factors, and O'Hanlon and Roberson (2006) examine how different types of training draw differentially on linguistic, attentional, and conceptual factors to facilitate color term acquisition. These studies touch on the greater question of the role of language versus cognition in word learning.

Kowalski and Zimiles's (2006) article confronts the issue of color language versus color concepts. The authors maintain that color acquisition derives from two sources: conceptual knowledge and lexical knowledge. They seek to determine whether, in the course of color acquisition, conceptual knowledge precedes lexical knowledge or lexical knowledge precedes conceptual knowledge. To do so, Kowalski and Zimiles compare children's performance on a color memory/abstraction task with children's performance on a color comprehension task. Their results indicate that children who know more color words are more likely to succeed in the memory/abstraction task than are children who know fewer color words. Kowalski and Zimiles conclude from this that a concept of color emerges around the same time as do children's first color words. They write, "Although the results of the current study indicate that initially lexical knowledge of color is linked closely to the development of conceptual representation, once a basal level of lexical knowledge is achieved, the ability to use color conceptually appears to develop somewhat independently of color nomenclature." Thus, Kowalski and Zimiles treat children's performance on the two tasks in their study as indicative of two separate (but interacting) domains of knowledge: lexical and conceptual. The question of interest for Kowalski and Zimiles is what is the temporal relation between the acquisition of color lexical knowledge and that of color conceptual knowledge.

Several authors have reported highly divergent chronologies of the relation between color language and concepts. Soja (1994), for example, argued that children begin with color concepts and can make inferences based on color but only later infer that a color word maps onto this conceptual representation. Kowalski and Zimiles, in contrast, argue that children initially do not have abstract conceptual representations of color but that children quickly acquire color concepts after they learn some color words. So, which account is correct? Do color words precede color concepts (although closely linked in time), or do color concepts precede color words?

As Kowalski and Zimiles point out correctly, the answer depends on the task being presented to the children. In Soja's (1994) task, children had nothing competing with color as a possible solution and may have had some similarity support that could aid them in selecting the correct color. In Kowalski and Zimiles's task, children also have nothing competing with color as a possible solution, although the task presents children with additional memory demands. According to Kowalski and Zimiles, their task is a more appropriate test of conceptual representation because, they argue, the only way in which children can solve their task is if they have a conceptual representation of color. Other researchers have even stricter criteria for what qualifies as color abstraction. Sandhofer and Smith (1999), for example, presented children with a color abstraction task in which shape competes with color as a possible solution and found that most children master this task several months after learning color names. In all of these tasks, the amounts of support versus competition from other features vary along with the findings of the relative timing of the onset of color concepts in relation to color words. Tasks with support for a color match lead to earlier conceptual representations, and tasks with competition for a color match lead to later conceptual representations.

The argument can be reduced to the question of which task is the most appropriate test of conceptual representation. Do children have a conceptual representation of color if they can solve the task with similarity support? Or, do children have a conceptual representation only when they can remember colors over some time delay? Or, do children have a conceptual representation when they distinguish color from competing properties? Each of the tasks presents a different view about the nature of color representation and creates a continuum of early to late color representation linked to a continuum of easy to hard "conceptual" tasks. The inherent danger in concluding that children possess a conceptual representation at a specific point in time is that, depending on which task is presented to children, the timing of conceptual attainment of color shifts dramatically. With each researcher claiming that his or her task is the most appropriate, and with each task supporting a different view of conceptual representation, the question of which account is correct becomes unanswerable. Each laboratory task comes with its own sets of requirements and idiosyncrasies, and as several studies have indicated, children's performances on these tasks vary accordingly. Presenting children with different types of conceptual color tasks does provide valuable information about how children acquire color, but the value of doing so resides within the variability of children's performance on the different types of tasks and what this variability tells us about the factors that contribute to learning color terms.

In contrast to Kowalski and Zimiles (2006), O'Hanlon and Roberson (2006) provide a more unified account of the contributions of conceptual and linguistic factors in learning color words. O'Hanlon and Roberson suggest that one reason why children experience difficulty in learning color terms is that children are biased to attend to other (noncolor) properties of objects (e.g., shape). To comprehend color words correctly, children must shift attention away from these competing object properties and focus attention toward the dimension of color. In the studies presented in their lead article, O'Hanlon and Roberson seek to discover the relative roles of linguistic and attentional factors in helping children attend to the property of color and ultimately map color terms onto color properties. In so doing, the authors present children with different types of feedback and ask what types of feedback best lead children to comprehend novel colors correctly. They find that one type of feedback, *corrective feedback*, leads to higher performance on tasks that ask children to map unfamiliar color words to unfamiliar colors and that a task that makes color more perceptually salient also leads to more success in mapping color words to novel colors. They conclude that both linguistic and attentional factors influence color word mapping; however, "linguistic input contributes over and above children's readiness to attend to color."

Like Kowalski and Zimiles, the task selections made by O'Hanlon and Roberson are integral to their ultimate conclusions about the relative contributions of language and attention in mapping colors to color words. O'Hanlon and Roberson use the size of children's color lexicons as a proxy measure for children's readiness to attend to color. That is, readiness to attend to color is suggested by the presence or absence of five color terms in children's lexicons. The authors find that providing children with corrective feedback helps both children who have demonstrated a readiness to attend to color, as indicated by knowing five or more color terms, and children who have not demonstrated a readiness to attend to color, as indicated by knowing fewer than five color terms. It is this finding that leads the authors to conclude that linguistic factors play a greater role than attentional factors in aiding children to map novel color terms.

Once again, the question arises as to how much of the conclusion about the relative primacy of linguistic over attentional factors arises solely from the measure of attention to color selected by O'Hanlon and Roberson. For example, if the authors had selected knowing six color words as the indicator of readiness to attend to color, they may have arrived at different conclusions regarding the relative roles of linguistic and attentional factors. Furthermore, it is difficult to separate the two factors of language and attention in the tasks chosen by the authors; children who know five color words also have learned a good deal of linguistic information about color. Moreover, the authors suggest that the reason why their linguistic measure of corrective feedback may be so effective in helping children to map novel colors is that the "linguistic and nonlinguistic information converge, so that a child's attentional resources can be focused on the intended object." Linguistic feedback makes use of the child's existing color term vocabulary, but in so doing it highlights the relevant feature of the object, the abstract property of color. That is, corrective feedback is an effective linguistic tool precisely because it promotes attention to color. Consequently, at the same time the authors seek to pit linguistic and attentional factors against each other, they argue that the two factors work by converging on each other.

Thus, although both lead articles address factors that contribute to color acquisition, they do so from fundamentally different approaches. Kowalski and Zimiles investigate how language and color concepts are learned and represented, focusing on the relative timing of conceptual and language representations of color. O'Hanlon and Roberson focus on language and attention issues in a learning situation. And although both articles conclude supremacy of one factor over another, O'Hanlon and Roberson are more inclusive in their descriptions of the relative contributions of linguistic and attentional factors.

Is there value in concluding that one factor may play a greater role than another factor during the process of language acquisition? We would suggest that although experiments can readily identify some factors that do or do not contribute to color acquisition (e.g., if investigating whether learning how to ride a tricycle leads to greater color acquisition, we suspect the answer is no), other factors are less readily definable and questions about the relative contributions of these factors break down into semantic arguments about the meanings of "concept" and "attention."

We suggest that rather than pitting different tasks against each other and arguing about which task is the most appropriate measure of language or conceptual representation or attention, research stands to gain from studying the variability in performance across different tasks—treating the variation between children's performances on different tasks seriously and treating the variation between different children's performances on the same task seriously. This type of analysis could lead to an understanding of why children may experience difficulty in learning color words in comparison with learning other types of words in the real world. That is, what is it about the task demands inherent in learning color words that leads to slow and errorful learning outside of the laboratory?

This account departs from the view that portrays children's conceptual understanding as a binary proposition—one in which children either possess a conceptual understanding or do not possess a conceptual understanding—and instead places greater emphasis on the fluidity of acquisition and the specific task demands. By this account, the key questions involve how factors such as memory, similarity, and attention work together to construct a sophisticated understanding of color. Approaching the question from this angle ultimately will move us forward in answering questions about how words and concepts are acquired and constructed.

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