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Cognition 87 (2003) 209–213
COGNITION
www.elsevier.com/locate/cognit

Discussion

Whose DAM account? Attentional learning explains Booth and Waxman

Linda B. Smith[a,b,*], Susan S. Jones[a], Hanako Yoshida[a], Eliana Colunga[b]

[a]*Department of Psychology, Indiana University, Bloomington, IN, USA*
[b]*Program in Cognitive Science, Indiana University, Bloomington, IN, USA*

Received 29 October 2002; accepted 30 October 2002

Abstract

Booth and Waxman (*Cognition 84* (2002) B11) have recently shown that linguistic cues to animacy affect children's novel name extensions. They argue that this demonstration contradicts two central tenets of our attentional learning account of object naming, which Booth and Waxman characterize as the "dumb attentional mechanism" or "DAM" account. In the present article, we show that the first of these tenets has never been a feature of the attentional learning account, and that the second tenet, which *is* central to our account, is not addressed by Booth and Waxman's findings. We suggest that the debate about the nature of children's language and cognition would profit from an increased awareness of the different levels of analysis at which different researchers are working.

Keywords: DAM account; Attentional learning; Booth and Waxman

Booth and Waxman (2002) recently reported a study in which they presented children with novel, named objects that featured in short descriptive vignettes. Although the objects were clearly artifactual, the stories included many descriptors and verbs specific to animate kinds. In this linguistic context, rich in animacy cues, the children generalized the names as if the novel artifacts were animate things – that is, by similarities in shape and texture rather than by shape alone.

Booth and Waxman (2002) designed this study to test what they call the "dumb attentional mechanism" or "DAM" account of novel word learning. They concluded that their results strike at the heart of this account, by providing evidence against its two central

* Corresponding author. Department of Psychology, 1101 E. 10th Street, Indiana University, Bloomington, IN 47405, USA. Fax: +1-812-855-4691.
E-mail address: smith4@indiana.edu (L.B. Smith).

0010-0277/03/$ - see front matter
doi:10.1016/S0010-0277(02)00236-6

tenets – the first, that perceptual information alone contributes to the process of early word learning, and the second, that attention to category-relevant properties is automatically activated in early word learning. As the authors of the account labeled "DAM", we disagree both with Booth and Waxman's characterization of our ideas, and with their conclusions concerning the implications of their findings for those ideas. In what follows, we disown the first of these tenets, defend the second and suggest a new direction for the debate.

In a previous paper (Smith, Jones, & Landau, 1996; the only paper in which we used the phrase "dumb attentional mechanism"), we asked why children systematically attend to category-relevant properties in naming tasks but not in non-naming tasks. We considered two possibilities. The first, suggested by Gelman and Medin (1993, p. 164), is that "… the change in weighting [of different properties, from the naming to the non-naming task] is the result of a slower, more conscious and deliberate weighting and ignoring of different aspects of the situation". The second possibility is that children's attention to category-relevant properties is controlled by automatic, non-deliberative forces – for example, by the intrinsic salience of particular perceptual properties and by well-learned associations.

To test these alternative accounts, we pitted perceptual salience against more deliberative processes in both naming and non-naming tasks. We showed that even when children were well able to make inferences in a non-naming task, naming took them to the most potent perceptual cues. These results were evidence that the mechanism underlying children's performance in the naming task is more automatic than deliberative. Moreover, by our interpretation, that mechanism is "dumb" in the sense described by Fodor (1987): the mechanism operates on *only some* of the information rather than taking account of all of the information available.

The literature provides examples of two kinds of automatic influences on attention. One kind (e.g. Kruschke, 1992; Lewicki, Hill, & Sasak, 1989; MacIntosh, 1965; Younger, 1990), exemplified by the salience of perceptual properties, seems to arise largely as a function of the structure of the nervous system. The second kind, however, is clearly a consequence of learning. For example, the Stroop effect (e.g. MacLeod, 1992) arises because participants cannot attend to the color of the ink but instead – even against instruction – attend to the shapes of the word forms in their over-learned associations to color names.

In a similar way, we have suggested that naming automatically takes children's attention to specific perceptible object properties because of well-learned associations. And in a series of studies (e.g. Colunga & Smith, 2002; Jones & Smith, 2002; Jones, Smith, & Landau, 1991; Landau, Smith, & Jones, 1988, 1992, 1998; Sandhofer, Smith, & Luo, 2000; Smith et al., 1996; Yoshida & Smith, 2001) we have examined how correlations between linguistic cues and category structure, and between perceptual cues and category structure, may underlie children's kind-specific novel name generalizations. The account we offer – which we characterize as an attentional learning account – suggests that the way that the presence of eyes pushes attention to shape and texture, the way that count noun syntax pushes attention to shape, and the way that adjective syntax pushes attention to properties such as texture and color are all explained by the very same set of processes (Smith, Colunga, & Yoshida, 2002).

Because we have always claimed that linguistic information organizes children's atten-

tion in the novel name generalization task, Booth and Waxman were not addressing a tenet of our account when they set out to show that children's smart novel noun generalizations are not products of perception alone. Moreover, the influence of linguistic cues on children's novel noun generalizations is not a novel finding. We and many others have shown that children's novel name generalizations are modulated by the linguistic context within which the name is presented (Landau et al., 1992; Markman, 1989; McPherson, 1991; Soja, Carey, & Spelke, 1991, 1992).

Like these previous findings, the results reported by Booth and Waxman (2002) are entirely consistent with the attentional learning account. In fact, the same results were predicted and obtained by Yoshida et al. (Yoshida & Smith, in press; Yoshida, Smith, Swanson, & Drake, 2001) who show – just like Booth and Waxman – that children can treat the very same object sometimes as an animate and sometimes as an inanimate, depending on the linguistic cues presented when the object is named.

It should be said that Booth and Waxman do not construe their vignettes primarily as linguistic cues, but as stories, and these stories are thought to influence children's name extensions by providing relevant category information at a conceptual level. Whether we agree or disagree with this idea depends on what one takes to be "conceptual". An associationist account much like our account of children's novel name generalizations is currently a viable (albeit not universally accepted) implementation of conceptual knowledge (Colunga & Smith, 2002; Rogers & McClelland, in press; Samuelson & Smith, 2000; Smith, 2000). If conceptual knowledge, for which there is no agreed-upon mechanistic explanation, turns out to consist of learned associations, then the apparent differences between our attentional learning account and Booth and Waxman's alternative will be a difference in levels of analysis, and may in future disappear.

In the meantime, our point is that the first tenet of Booth and Waxman's characterization of DAM – that the basis for children's novel noun generalizations is solely perceptual – was never part of the attentional learning account. Thus, an empirical challenge to that tenet does not discriminate between the attentional learning account and Booth and Waxman's alternative.

The second central tenet of DAM, according to Booth and Waxman, is that the mechanism that takes children to different perceptual properties when generalizing novel nouns is automatic. This tenet *is* central to our account. But Booth and Waxman's empirical experiments do not address this question at all. Their finding that vignettes shift children's novel noun generalizations says nothing about the kind of underlying processes that cause that shift to happen.

We suggest that the automatic learning of relations between cues (both linguistic and perceptual) and attention is a mechanism that is always running in the background, behind conscious thought. The result is attention dynamically coupled to those cues currently in the input that have historically mattered to the task at hand. Thus, we are able without conscious thought to attend appropriately, whether the task is interpretation of a novel count noun, a novel adjective, or a novel mass noun.

Clearly, not every instance of attention is a consequence of well-learned associations and automatic pulls. Sometimes, the processes *are* slower and more accessible to conscious control. Our claim is that children's attention in the novel noun generalization task may well be an instance of automatic control. We see this kind of solution as an

elegant one because it means that going to the right properties to complete a particular task will be certain, robust, efficient, and linked to the specific history of the learner and the language they are learning. Moreover, we see this solution as compelling because it makes use of well-documented, psychologically and neurally real, formally specifiable mechanisms.

In conclusion: the experimental results of Booth and Waxman (2002) do not strike at the heart of the attentional learning account of children's novel noun generalizations. They provide evidence on a claim never made, and they don't address the claims that were. Rejoinders of the present "we did not say that" form may be more than defensive: they may reflect fundamental confusions in the field. In the contemporary study of cognition, there are sets of ideas that tend to co-occur, and these sets are treated as natural enemies. "Perceptual", "similarity-based", "associational", "attention-driven", and "automatic" often co-occur in individual theories of cognition. Similarly "conceptual", "knowledge-based", "inferential", "theory driven", and "deliberative" often occur together. These sets are treated as alignable and mutually exclusive: an account is perceptual *or* conceptual, similarity-based *or* knowledge-based, and so on. But the contrasting components of these two kinds of accounts are not alternative values of the same dimensions. The relations between these sets of ideas are much more complex than that. So, for example, knowledge-based theories are taken as the alternative to similarity-based theories. But *all* associationist theories are similarity-based *and* knowledge-based: indeed, they are specific claims about the nature of knowledge. An associationist account like the attentional learning account is one possible implementation of conceptual knowledge. We imagine that this is not the implementation that Booth and Waxman have in mind. But if the discussion is to be fruitful, we would argue, the implementation that they do favor needs to be spelled out. The relation between theories and results should not be in the eye of the beholder, such that the same results can be seen as both predicted by and ruling-out the very same theory. The core ideas of the attentional learning account – learned associations between linguistic and perceptual cues and category structure – have been formally shown to predict the effect of language on children's categorization and the sometimes greater influence of linguistic over perceptual cues (Colunga & Smith, 2002). We suggest that the discussion that will most likely produce advances in our understanding of children's language and cognition will take place at this level – the level of detailed and formal mechanistic accounts.

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