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Temperament, distraction, and learning in toddlerhood

Wallace E. Dixon Jr.*, Brenda J. Salley, Andrea D. Clements

Department of Psychology, East Tennessee State University, 100 CR Drive, P.O. Box 70649, Johnson City, TN 37614, United States

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Abstract

The word- and nonword-learning abilities of toddlers were tested under various conditions of environmental distraction, and evaluated with respect to children's temperamental attentional focus. Thirty-nine children and their mothers visited the lab at child age 21-months, where children were exposed to fast-mapping word-learning trials and nonlinguistic sequential learning trials. It was found that both word- and nonword-learning were adversely affected by the presentation of environmental distractions. But it was also found that the effect of the distractions sometimes depended on children's level of attentional focus. Specifically, children high in attentional focus were less affected by environmental distractions than children low in attentional focus when attempting to learn from a model, whereas children low in attentional focus demonstrated little learning from the model. Translationally, these results may be of use to child health-care providers investigating possible sources of cognitive and language delay.

Keywords: Temperament; Attention; Language

The fields of temperament and cognitive development have followed long and productive paths, even though they seem to have done so in relative isolation from one another. Temperament researchers have made strides in identifying the nature of early temperament and its potential biological underpinnings, and they have identified a host of social–emotional sequelae of early individual differences in temperament (e.g., Guerin et al., 2003; Molfese & Molfese, 2000). Cognitive development researchers have also made significant strides toward understanding basic mechanisms underlying attention (e.g., Colombo, 2004; Richards, 2004; Rose, Feldman, & Jankowski, 2004; Ruff & Rothbart, 1996) and memory (e.g., Bauer, 2004; Hayne, 2004), among other cognitive domains. Unfortunately, few researchers have undertaken empirical efforts to document interrelations between temperament and basic cognition (e.g., Wolfe & Bell, 2004); although Fagen and co-workers have amply demonstrated that aspects of temperamental fussiness (i.e., affective distress) negatively impact children's performance on cognitive tasks (Fagen, Ohr, Fleckenstein, & Ribner, 1985; Fagen, Ohr, Singer, & Fleckenstein, 1987; Fleckenstein & Fagen, 1994). Much would be gained were researchers able to link individual differences in cognitive function to individual differences in any of a number of domains of temperament, because such an effort would likely inform a better understanding of *intra*domain individual differences.

To the extent that temperament–cognitive relationships have been examined, a major focus seems to have been on temperament–language relationships (specifically vocabulary, e.g., Dixon & Shore, 1997; Dixon & Smith, 2000; Kubicek, Emde, & Schmitz, 2001; Morales et al., 2000). The general finding in this literature is that infants and toddlers who enjoy receptive and productive vocabulary advantages over others are those who are temperamentally more positive

* Corresponding author. Tel.: +1 4234396656; fax: +1 4234395695.
E-mail address: dixonw@etsu.edu (W.E. Dixon Jr.).

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in mood, more adaptable, more soothable, and longer in attention span than others. Although it is not clear why these specific dimensions of temperament are correlated with vocabulary size, it stands to reason that individual differences in attention allocation may at least partially account for the overlap. Attention allocation is often presumed to reflect an overarching *executive control system* which theoretically has implications for both vocabulary and temperament development (cf. Rothbart & Bates, 1998). Specifically, children high in executive control would be better able to both focus attention in the service of learning environmental contingencies, such as happens in making word-referent associations, and in allocating attention in the service of regulating distress or negative emotion more generally, such as happens in various affective subsystems.

Smith and co-workers have underscored the necessity of taking basic attentional principles into account when explaining vocabulary acquisition (Jones & Smith, 2002; Jones, Smith, & Landau, 1991; Kersten & Smith, 2002; Samuelson & Smith, 1998; Smith, 1999; Smith, Jones, & Landau, 1992; Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002). They argued that in most cases "dumb attentional mechanisms" are sufficient to enable the acquisition of vocabulary because they allow children to detect word-referent correspondences. Consequently, Smith and co-workers have argued that assumptions regarding underlying cognitive or social constraints for word learning (cf. Hollich et al., 2000) are unnecessary, at least early on. But even "smart" constraint theorists (e.g., Carpenter, Nagell, & Tomasello, 1998; Golinkoff, Hirsh-Pasek, & Hollich, 1999) require that children allocate attention to people, sounds, and objects in the environment in order to learn words. So regardless of the theoretical perspective, it stands to reason that infants and toddlers who are better able to allocate their attention would be better able to both detect and respond to parental attention-directing efforts during bouts of word learning, as well as to detect and acquire the word-referent mappings their parents expose them to. For these reasons, children with temperamentally long attention spans, would be advantaged in terms of vocabulary.

From a control systems perspective, children high in attention allocation would also score high on dimensions of temperament reflecting positive mood, adaptability, and soothability (Kochanska, Murray, & Harlan, 2000; Rothbart & Bates, 1998), because they would be better able to manage transitions to new environments (adaptability) and to soothe themselves in times of distress (soothability) than children low in executive control. Executive control would also be linked to the regulation of mood to the extent that emotional expression in high executive control children is more easily subordinated to cognitive function than in low executive control children (Chang & Burns, 2005; Derryberry & Rothbart, 1988). Longitudinally, children high in aspects of executive control generally enjoy greater anger control (Kochanska et al., 2000), coupled with heightened internalization of parental standards and conscience development (Kochanska & Knaack, 2003; Kochanska, Murray, & Coy, 1997; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996) than children low in executive control. Miceli, Whitman, Borkowski, Braungart-Rieker, and Mitchell (1998) summarized this sentiment in their claim that "Infants who are better organized in terms of the way they react to stimulation and who can modulate their arousal appropriately are likely to have better control of their state changes and their attention. In contrast, poorly organized infants may be forced to use their attentional capacities for regulatory purposes" (p. 121).

By virtue of its ability to regulate emotion in the service of attention allocation, executive control also enables word learning—in at least two ways. First, it regulates the distribution of attention toward the word-learning event, as compared with other events taking place in the environment. Second, it regulates the distribution of attention among elements within the word-learning event, including the target word, the target referent, and any social or intentional cues provided by the social partner. In uncertain or distracting environments in which attentional priorities may be distributed more widely, word learning would be compromised. Word learning would suffer either because attention was not allocated to the word-learning event, or because elements within the word-learning event, though minimally attended to, were not sufficiently processed. This perspective can be understood within the context of Allport's (1989) attention allocation model.

In his model, Allport (1989) argues that the "primary *purpose* of an attentional system must be to ensure the *coherence* of behavior under . . . often conflicting constraints" (p. 652). He argues further that "coherent, goal-directed behavior requires processes of selective *priority assignment* and *coordination* at many different levels (motivational, cognitive, motor, sensory)" [and that] "together this set of selective and coordinative processes can be said to make up the effective *attentional engagement* (or attentional *set*) of an organism at any moment" (p. 652, emphases in original). Thus, although it is the goal of an organism to maintain attentional engagement with some object or event of interest, such as is found during word learning, humans and other species have evolved systems that allow attention to be "diverted or overridden by changing external – or internal – events" (p. 652).