

In at least two ways, however, the preschool child's control of attention is still deficient:

1. *Salient versus relevant dimensions.* Preschool children are likely to pay attention to stimuli that stand out, or are *salient*, even when those stimuli are not relevant to solving a problem or performing a task. For example, if a flashy, attractive clown presents the directions for solving a problem, preschool children are likely to pay more attention to the clown than to the directions. After age 6 or 7, children attend more efficiently to the dimensions of the task that are relevant, such as the directions for solving a problem. This change reflects a shift to cognitive control of attention, so that children act less impulsively and reflect more.
2. *Planfulness.* When experimenters ask children to judge whether two complex pictures are the same, preschool children tend to use a haphazard comparison strategy, not examining all the details before making a judgment. By comparison, elementary-school-age children are more likely to systematically compare the details across the pictures, one detail at a time (Vurpillot, 1968).

In central European countries such as Hungary, kindergarten children participate in exercises designed to improve their attention (Posner & Rothbart, 2007). For example, in one eye-contact exercise, the teacher sits in the center of a circle of children and each child is required to catch the teacher's eye before being permitted to leave the group. In other exercises created to improve attention, teachers have children participate in stop-go activities during which they have to listen for a specific signal, such as a drumbeat or an exact number of rhythmic beats, before stopping the activity.

Computer exercises have been developed to improve children's attention (Rothbart & Posner, 2015; Stevens & Bavelier, 2012). For example, one study revealed that five days of computer exercises that involved learning how to use a joystick, relying on working memory, and resolving conflict improved the attention of 4- to 6-year-old children (Rueda, Posner, & Rothbart, 2005). Although not commercially available, further information about computer exercises for improving children's attention can be downloaded from www.teach-the-brain.org/learn/attention/index.

The ability of preschool children to control and sustain their attention is related to school readiness (Rothbart & Posner, 2015). For example, a study of more than 1,000 children revealed that their ability to sustain their attention at 54 months of age was linked to their school readiness (which included achievement and language skills) (NICHD Early Child Care Research Network, 2005). In another study, the ability to focus attention better at age 5 was linked to a higher level of school achievement at age 9 (Razza, Martin, & Brooks-Gunn, 2012). Also, a recent study found that preschoolers' sustained attention was linked to a greater likelihood of completing college by 25 years of age (McClelland & others, 2013).

Memory

Memory—the retention of information over time—is a central process in children's cognitive development. Most of an infant's memories are fragile and, for the most part, short-lived—except for the memory of perceptual-motor actions, which can be substantial (Bauer, 2018). Thus, to understand the infant's capacity to remember, we need to distinguish *implicit memory* from *explicit memory*. Explicit memory itself, however, comes in many forms (Radvansky & Ashcraft, 2018). One distinction is between relatively permanent or *long-term memory* and short-term memory.

Short-Term Memory In **short-term memory**, individuals retain information for up to 30 seconds if there is no rehearsal of the information. Using *rehearsal* (repeating information after it has been presented), we can keep information in short-term memory for a much longer period. One method of assessing short-term memory is the memory-span task. You hear a short list of



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short-term memory The memory component in which individuals retain information for up to 30 seconds, assuming there is no rehearsal of the information.