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What's so special about verbal imitation? Investigating the effect of modality on automaticity in children

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ABSTRACT

Young children experience difficulty across a wide variety of situations that require them to suppress automatic responses. Verbal imitation, in contrast, is easy for children to suppress. This is all the more surprising because data from adult studies appear to be at odds with this observation. In two experiments, we investigated whether this surprising developmental finding with verbal imitation reflects a more general phenomenon—relating either to verbal responses or to auditory stimuli—or whether verbal imitation itself represents a unique case. In Experiment 1 ($N = 24$), it was found that verbal responses were not inherently easier for 3-year-olds to inhibit than manual responses. Experiment 2 ($N = 24$) showed that auditory stimuli did not evoke less automatic activation than visual stimuli. Taken together, these data suggest that verbal imitation is unique, or at least unusual, in being particularly easy for children to resist. It is suggested that the automaticity of verbal imitation may develop slowly and that the relation between word complexity and automaticity is likely to be a fruitful topic of further investigation.

Introduction

At 3 years of age, children experience difficulty with laboratory tasks that require them to suppress an automatic response. They struggle to suppress manual imitation (Diamond & Taylor, 1996) as well

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as other familiar behaviors, including pointing (Simpson & Riggs, 2009) and using a variety of artifacts (Simpson, Carroll, & Riggs, 2014). Success on these tasks requires children to use inhibitory control to suppress the automatic, but inappropriate, responses that the tasks create. Children's difficulty on these tasks relative to adults is profound and is held to reflect a weakness in executive function and, more specifically, in inhibitory control. Recent research indicates that there may nevertheless be an exception to this general finding; for children, avoiding verbal imitation is trivially easy (Simpson, Cooper, Gillmeister, & Riggs, 2013).

What is particularly striking is the marked difference between two ostensibly similar activities: verbal imitation and manual imitation. Why should avoiding verbal imitation be so easy, whereas avoiding manual imitation is so hard? Intriguingly, this appears to be a uniquely developmental phenomenon. In adults, both verbal imitation (e.g., Fadiga, Craighero, Buccino, & Rizzolatti, 2002; Fowler, Brown, Sabadini, & Weihing, 2003; Möttönen, Dutton, & Watkins, 2013) and manual imitation (e.g., Lakin & Chartrand, 2003; Press, Bird, Walsh, & Heyes, 2008) seem to arise automatically. That is, for adults, it seems that the activation of a perceptual representation of a speech sound or manual gesture inevitably leads to some activation of the motor representation needed for its production. However, the verbal–manual difference apparent in developmental research suggests that this is not the case with children. This article seeks to investigate why, in children, verbal imitation is different from manual imitation.

This question is an important one because it informs us about the development of imitation in children and because of what it can tell us about the nature of automaticity more generally. This question also has other theoretical implications. Some theories of speech perception are consistent with the suggestion that verbal imitation is automatic (e.g., the motor theory of speech perception; see Galantucci, Fowler, & Turvey, 2006, for a review). These theories propose that speech perception relies on the same cognitive processes used for speech production such that perceiving a word will automatically activate a motor representation of that word. If production processes are needed for efficient speech perception, it is reasonable to assume that these processes must be active when such perception occurs. That being the case, those production processes would need to be inhibited before other speech could be outputted. However, the observation that young children—typically with poor inhibitory control—can easily avoid verbal imitation in laboratory tasks (Simpson et al., 2013) calls this assumption into question.

Both verbal imitation and manual inhibition appear to arise automatically in adults. It is known that adults sometimes copy other people's manual actions without intending to do so (e.g., Lakin & Chartrand, 2003), a phenomenon entirely consistent with action imitation being automatic. Furthermore, many studies suggest that the actions of others can interfere with an observer's behavior by making him or her slower to act even when the observer actively tries to ignore others' actions (e.g., Press et al., 2008). Similarly, with regard to verbal imitation, there is evidence that perceiving simple speech sounds, such as "pa" and "ta," automatically activates the motor code needed to produce those sounds. Fewer studies have investigated behavioral interference (Fowler et al., 2003), but there is a large and growing neurophysiological literature suggesting that the motor cortex is activated when perceiving speech and that this activation aids perception (e.g., Fadiga et al., 2002; Möttönen et al., 2013).

Ideomotor theory points to a potential single mechanism to make both manual and verbal imitation automatic. Ideomotor theory proposes that we learn to associate manual actions with their consequences—for example, associating lifting a cup to your mouth with the consequence of quenching your thirst (Hommel, Musseler, Aschersleben, & Prinz, 2001). The consequence of this outcome–action contingency is the creation of a common code for action observation and action production, making manual imitation automatic. Thus, it is not that two separate representations (of outcome and action) become linked such that when one is accessed the other is also automatically accessed; rather, it is that outcome and action are encoded, at least in part, within the same representation. In other words, activating an outcome representation *is* activating an action representation. A similar mechanism can be proposed for verbal imitation; a common code links the perceived sound of a word (i.e., an outcome) to the motor program needed to produce that word. Finally, the discovery of the mirror neuron system (e.g., Iacoboni et al., 1999; Kohler et al., 2002) has provided a neurological substrate for these