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Early motor development is part of the resource mix for language acquisition

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Abstract

There is intense scientific interest in the relationship between cognitive and language development in infancy and beyond. With this interest in mind, early motor milestones such as grasping and exploring objects have typically been viewed as a proxy for cognitive development. Iverson argues that a deeper appreciation of the unique contribution of motor development to language development enriches theories of typical and atypical language development.

In the first 18 months of life, children's accomplishments in language and motor development are striking and synchronous. Language and motor abilities emerge through biological and environmental prompts and facilitators, without explicit instruction. Early language (Fenson et al., 1994) and motor milestones (Darrach, Senthilselvan, & Magill-Evans, 2009) are broadly universal, although growth trajectories vary widely in both domains (Reilly et al., 2009). Asynchronies in motor and language abilities are observed in developmental disorders such as cerebral palsy and Specific Language Impairment (SLI).

In the Cartesian and Piagetian traditions, the relationship between mind and body has long been the subject of intense philosophical debate and empirical scrutiny. Iverson (2009) encourages us to consider emergent motor abilities and early sensorimotor experience as part of the resource mix for language acquisition and cognitive development. Her view is that early motor experiences and accomplishments transform the infant's world and are a developmental means for language and cognitive development. She expresses the view that 'the development of language should be viewed in the context of the body in which the developing language system is embedded' (Iverson, 2009: 4).

Recently, Zubrick, Taylor, Lawrence, Mitrou, Christensen and Dalby (in press) proposed a conceptual framework for understanding the acquisition, accumulation, transformation and loss of human capability from early childhood onwards. Within this framework, developmental mechanisms are described as prompts, facilitators and constraints. Developmental prompts are necessary for the acquisition of a particular ability and include biology, expectations and opportunities. Facilitators are helpful for the development of ability but are not essential - they provide leverage for developmental prompts. Constraints impede or diminish the influence of developmental prompts and facilitators. Constraints vary in magnitude and effect, resulting in low ability levels within the normal range through to ability levels in the clinical range.

Zubrick and colleagues applied this model to the development of social skills, however it has application in and across all domains of development. The application of this model to

the study of child development allows for DEVELOPMENTAL ENDS such as walking to be viewed as developmental means for other abilities such as talking. According to this model, motor development would be viewed as a facilitator of language development. Iverson expresses a similar view.

In this model, prompts for language development include biology, expectations and opportunities. Normal brain maturation, normal neurodevelopment, social interaction, shared activity and adult input are all necessary for normal language development. Children depend on social interaction and shared activity with adults to learn how to use language and to map words and sentences to agents, actions, objects, attributes, locations, and intentions (Carpenter, Nagell, & Tomasello, 1998).

The study designs required to study children's early development directly and in great detail necessarily limit observation, measurement and interpretation to the most proximal influences on children's development, that is children themselves and their caregivers. These informative studies have yielded valuable information about the onset, timing and convergence of emergent language and motor abilities. These studies cannot answer questions about the complex interplay between proximal (i.e., child, maternal, family) and distal (i.e., school, community, society) influences on children's development, as in the Bronfenbrenner tradition (Bronfenbrenner, 1979).

To understand the interactions between proximal and distal influences on child development, multiple study designs and sources of data are needed. Prospective population based longitudinal studies with large numbers of children play an important role in helping disentangle multiple factors that influence children's development (Taylor & Zubrick, 2009). This is accomplished using multivariate methods, such as multivariate logistic regression that is adjusted for the effects of other predictors in the models.

Recently, Bavin and colleagues (2008) examined the prediction of vocabulary development at 12 and 24 months from performance on the CDI gesture subscales (Fenson et al., 1993) at 8 and 12 months. The close relationship between gesture and expressive vocabulary development in the first two years of life has been well documented in small studies. Bavin and colleagues confirmed this relationship in their large epidemiological sample of Australian children. Their results provided general support for the relationship between gesture and expressive vocabulary development. Their data showed that the CDI gesture subscales administered at 8 months contributed 14.3% of the variance in vocabulary production at 12 months, with low prediction of individual components of the gesture subscales. The same pattern held at 24 months, with 14.5% of the variance in vocabulary production explained by performance on the CDI gesture subscales at 12 months.

Iverson points us to the small literature that reports sub-clinical levels of motor impairment in children with SLI (Bishop, 2002). Late language emergence at 24 months is one of the hallmarks of SLI. In studies of small numbers of otherwise healthy children with and without late onset of language, lower levels of motor development have been reported for late talkers relative to controls (Zubrick, Taylor, Rice and Slegers, 2007) extended this finding. Recently, Zubrick et al. used multivariate methods to investigate a comprehensive range of candidate child, maternal and family influences on late language emergence in an epidemiological sample of 1766 children at 24 months. From a vast set of candidate child, maternal and family predictors of late language emergence, the significant predictors in order of magnitude were: developmental lag in personal-social skills, developmental lag in gross motor skills, male gender, developmental lag in adaptive motor skills, developmental lag in fine motor skills, positive family history of late language emergence, the presence of one or more sibling, suboptimal fetal growth and lower child age. The results of this study

suggested a strong role for neurobiological mechanisms in the late onset of language. It is not known whether this multidimensional developmental lag is part of the phenotype or the etiology of late language emergence.

Recent gene discoveries in language, speech and reading impairment (Rice, Smith, & Gayan, 2009; SLI Consortium, 2004; Smith, Pennington, Boada, & Shriberg, 2005; The SLI Consortium, 2002; Vernes, Newbury, & Abrahmas, 2008) have inexorably led the field to re-engage with maturational theories of language development (cf. Muller, 2005) and re-consider the role of genetically regulated biological timing mechanisms in language acquisition and language impairment.

Finally, an understanding of human development, beyond the epoch of childhood, can inform our thinking about early development. The kind of physical exploration that Iverson describes is prompted by children's cognitive capability and facilitated by adult expectations, opportunities and input. The means-end relationships between cognition, language and motor development change across childhood and indeed over the life course. In the first two years of life, cognitive and motor abilities can be viewed as a developmental means for language acquisition. Once children have a language system, language is a means for cognitive development. Late in the lifecourse, normal aging and disease processes (e.g., dementia, stroke) can constrain cognition, language and motor function to different degrees. In a sense, these abilities that were so well synchronized early in life become dissociated.

There are formidable scientific and clinical boundaries around different domains of development in childhood. Iverson has successfully penetrated the boundaries around the study of motor and language development in infancy. In doing so, she has provided us with an enriched account of developing language in a developing body.

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