Early grasping skill predicts later growth in bimanual skill in infants

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Background and Aim

- Traditional milestone approaches to infant motor development primarily focused on establishing averaged developmental norms and ignored individual variability between and within infants.
- Dynamic Systems Theory (DST) emphasizes that any component of an infant’s structure–function relation is embodied and self-organized in which each new emergent state is influenced by previous states. Thus, the emergence of a new motor skill should be viewed as nested events that are embedded within each other and within the context of the individual infant’s past experiences.
- The aim of this study was to examine whether early manual skill cascades into later more complex manual skill such as role-differentiated bimanual manipulation (RDBM), which is defined by one hand supporting an object for the other hand to explore the object’s components.

Methods

- N = 90 infants with typical development.
- Longitudinal study design with 7 timepoints.
- Group III Touwen’s (1976) Neurological assessment was used to measure grasp proficiency at 6 months of age.
  - Grasping skill was rated on a scale from 0 to 5:
    - 0 = no goal-directed motility of hands.
    - 5 = ability to hold two objects in one hand.
- Growth in RDBM was measured from 9 to 14 months with a battery of 17 objects.

Analysis: The Noldus Observer software was used to score RDBM performance offline (RDBM performance score = total rate of right hand RDBMs / total # trials per timepoint). Latent growth modeling using Mplus was used to examine whether intra-individual growth in RDBM could be predicted based on a prior level of the manual control system (grasping).

Results and Discussion

- At 6 months of age, infants showed significant variability in grasp proficiency, \( \sigma^2 = 1.83, p < .001 \); ~95% of infants received a grasp proficiency rating between 1 and 5 (Fig. 1).
- At 9 months, infants had an average RDBM performance score of 10.3%, \( p < .001 \); however, there was also significant variability in RDBM at 9 months, \( \sigma^2 = .003, p = .005 \), and ~95% of infants scored between 0% and 21.3%. There was a 4% average linear growth in RDBM performance per timepoint from 9 to 14 months of age, \( p < .001 \); however, there was also significant variability in growth patterns, \( \sigma^2 = .001, p < .001 \) (Fig. 2).
- Grasp proficiency at 6 months predicted individual patterns of development in RDBM performance from 9 to 14 months of age, \( \beta = .006, z = 2.518; p = .012 \). Greater grasping proficiency at 6 months was related to steeper slopes in RDBM growth from 9 to 14 months (Fig. 3).

Take-Away Points:

- Early manual experience is predictive of individual change in later manual skill.
- Findings support the DST assumptions of self-organization and time saliency.
- Future work will examine whether RDBM mediates development in other domains.