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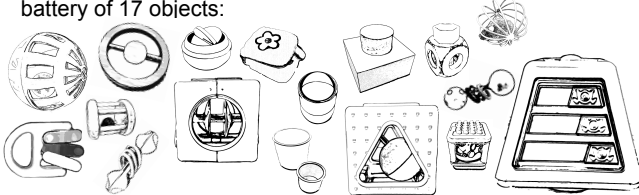
Analysis: The Noldus Observer software was used to score RDBM performance offline (RDBM performance score = total rate of right hand RDBMs / total # trials per timepoint). Latent growth modeling using Mplus was used to examine whether intra-individual growth in RDBM could be predicted based on a prior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

Results and Discussion

- At 6 months of age, infants showed significant variability in grasp proficiency, σ^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, σ^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, σ^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, β = .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**).
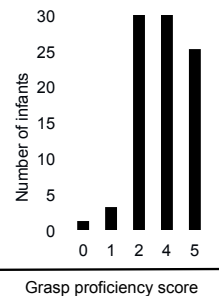

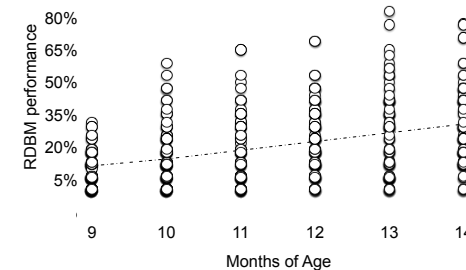**Fig. 1.** Significant variability in grasp proficiency at 6 months of age, p < .001.

Fig. 2. Significant variability in RDBM performance at 9 months, and in patterns of RDBM growth from 9 to 14 months of age, ps < .05.

Fig. 3. Early grasp proficiency predicted individual patterns of development in RDBM performance, p = .012. Greater grasp proficiency at 6 months indicated higher rates of RDBM growth. Each line represents the development of an individual infant.
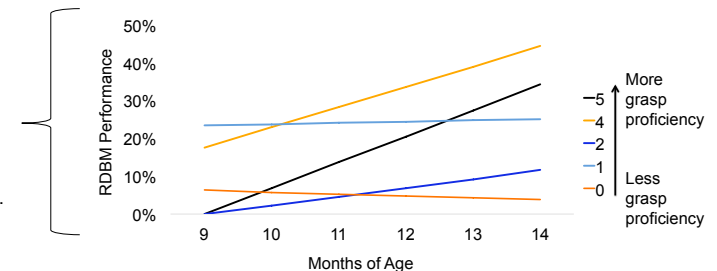
Take-Away Points:
- ✓ Early manual experience is predictive of individual change in later manual skill.
- ✓ Findings support the DST assumptions of self-organization and time saliency.
- ✓ Future work will examine whether RDBM mediates development in other domains.