

# Which 'Motionese' Parameters Change With Children's Age?

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## Motivation and Abstract

While it is already known that parents modify their demonstrations towards children (Brand et al., 2002; Brand et al., 2007) and that young infants aged 6 to 8 months prefer 'motionese' (Brand & Shallcross, 2007), little is known about whether the modified behavior can also be found in interaction with older children. Here, we therefore seek to investigate the effects of children's age on motionese, defined as modified action demonstration (Brand et al., 2002; Rohlfing et al., 2006).

In our study, parents demonstrated a function of an object (stacking cups) towards their infant and towards another adult. We analyzed parental behavior in three different age groups: parents of prelexical (8 – 11), early lexical (12 – 24) and advanced lexical (25 – 30 months olds) children.

In our analysis, we use objective measurements of hand trajectories providing data about their shape and time structure.

Results suggest that actions chosen to attract attention by providing more range can primarily be found in interaction with younger infants, whose attention needs more guidance. Interactions with older children seem to benefit either from the increase of children's attention abilities or that parents use other means (such as language) to attract their attention. In contrast, parameters that appear to be more in charge of structuring the action by organizing it in motion pauses seem to persist over the age and verbal capabilities.

## Annotation and Data Analysis

**Action Segmentation:** The action of the stacking-cups and additionally, the sub-actions (a1–a3) of grasping one cup until releasing it into the end position (Fig. 1), were marked in the video. We defined:

- 1) the action as the whole process of transporting all objects to their goal positions;
- 2) a subaction as the process of transporting one object to its goal position;
- 3) movements as phases where the velocity of the hand is above a certain threshold; all other phases are defined as pauses.

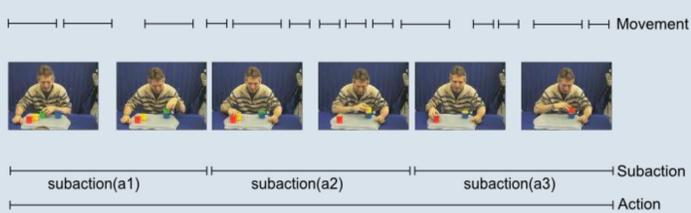


Fig. 1: sub-actions in the task



Fig. 2. In the left picture, the red and pink circles depict the regions which are tracked by the hand tracker system. The points in the middle of the circles are the resulting points for the 2D hand trajectory. The three pictures on the right show the difference between looking to the object (left), looking to the interaction partner (middle) and looking somewhere else (right).

**Action Range:** covered motion path divided by the distance between subaction on- and offset.

**Action Pace:** calculated for each movement by dividing its duration (in ms) by the duration of its preceding pause (in ms).

**Total length of motion pauses:** as the percentage of time of the action without movement.

**Total length of eye-gaze bouts:** to interaction partner as the percentage of time of the action.

## Method and Procedure

### Setting

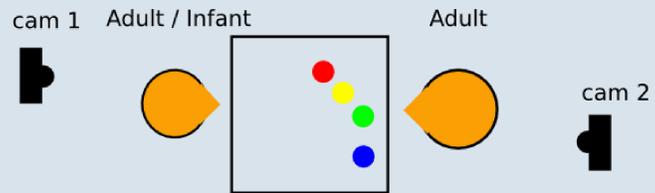


Fig. 3. Setting. There are two cameras which are recording the scene. The interaction partners are seated across from each other and the object is laid on the table in front of the adult tutor.

### Subjects

- Group 1 (8–11 months old children): 8 participants (5 female, 3 male)
- Group 2 (12–23 months old children): 11 participants (5 female, 6 male)
- Group 3 (24–30 months old children): 10 participants (6 female, 4 male)

### Procedure

29 parents demonstrated the function of the stacking cups first to their children and then to another adult. The parents were asked to demonstrate how to stack cups into each other.

## Results and Discussion

### Results

A repeated measures ANOVA with interaction condition (AC/AA) as within-subjects and infants' age as between-subjects factor revealed a significant main effect for the interaction condition for all measures ( $p < 0.001$ ), except range. Subsequently, paired t-tests were conducted for the three age groups separately. For the **range** measure, we found significant differences between the conditions only in group 1 for subaction 3 ( $t(7)=2.55^*$ ) and marginal significance for subaction 2 ( $t(7)=2.15^+$ ). This suggests that the modified range of hand movements is present only in demonstrations towards pre-lexical infants. We think the reason is younger infants' need of gestures to attract their attention. The **pace** measure shows significance for groups 1 ( $t(7)=-4.95^{**}$ ) and 3 ( $t(9)=-2.82^*$ ), which suggests that pace in interactions with infants of all three age groups remains higher than in the AA condition. For **motion pauses**, we found significant differences for age groups 2 ( $t(10)=2.79^*$ ) and 3 ( $t(9)=4.55^{***}$ ) and a trend for group 1 ( $t(7)=3.2^+$ ). Pauses structuring the shown action seem to be used over all age groups. For the **eye gaze** measure, a decrease in significance could be found over the children's age: In the AC condition, the interaction partner was gazed at significantly longer in groups 1 ( $t(7)=3.96^{**}$ ), 2 ( $t(10)=3.16^{**}$ ) and 3 ( $t(9)=2.34^*$ ) and objects were gazed at significantly less in groups 1 ( $t(7)=3.98^{**}$ ) and 2 ( $t(10)=-3.62^{**}$ ) suggesting that the young infants' attention is more often checked on.

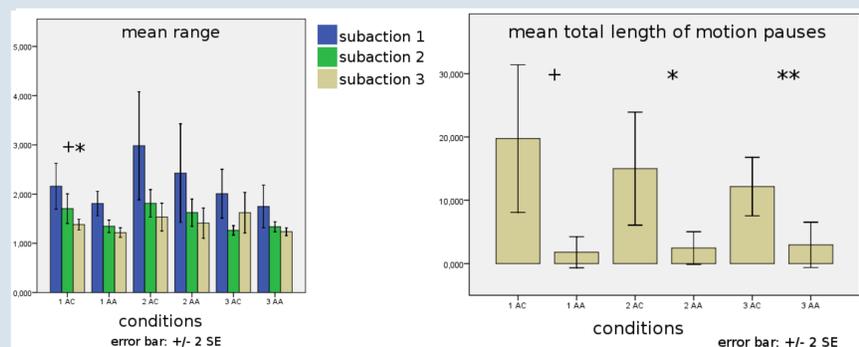


Fig. 4. The results of measures range and total length of motion pauses showing mean values for each condition: +  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$

### Discussion

Actions chosen to attract attention can primarily be found in interaction with younger infants, whose attention needs more guidance. Interactions with older children seem to differ due to either the increase of children's attention abilities or that parents use other means to attract their attention. In contrast, parameters that appear to be more in charge of structuring the action seem to persist over the children's age and their verbal capabilities.

## Acknowledgment

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### References

- R.J. Brand, D.A. Baldwin, and L.A. Ashburn, "Evidence for 'motionese': modifications in mothers' infant-directed action", *Developmental Science*, 2002
- R.J. Brand, W.L. Shallcross, M.G. Sabatos, and K.P. Massie, "Fine-grained analysis of motionese: eye gaze, object exchanges, and action units in infant-versus adult-directed action", *Infancy*, 2007
- R.J. Brand, W.L. Shallcross, "Infants prefer motionese to adult-directed action", *Developmental Science*, 2008
- K.J. Rohlfing, J. Fritsch, B. Wrede, T. Jungmann, "How can multimodal cues from child-directed interaction reduce learning complexity in robots?", *Advanced Robotics*, 2006