Body know-how acquisition during the first months of life

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Introduction

Body know-how: ability of an organism to control its body effectively in its interaction with the environment. We used this term to differentiate this implicit form of knowledge from higher level notions such as body image, body consciousness, etc.

The best known method to investigate this notion is the mobile paradigm developed by Rovee-Collier – see Rovee & Rovee (1969). It consists in attaching one limb of the baby to a mobile above its head. This allows the baby to show its ability to move in order to generate a stimulation. **But, does the baby understand that a specific limb is generating the stimulation?**

Research question

How do infants acquire their body know-how during their first months of life?

Hypothesis

Suggested by Rovee-Collier & Morrongiello (1978), Heathcock et al. (2004, 2005) and Watanabe & Taga (2006, 2009).

- First, **undifferentiated body know-how**: young infants will move their whole body to generate the stimulation.
- Then, **differentiation between upper and lower body**: older infants will narrow down their ability to a general body region (e.g. upper body, lower body).
- And then, **differentiation between right and left limb**: older infants will narrow down their ability to a specific limb (e.g. right arm, left arm).

➢ Compatible with the notion of **adaptive curiosity** used by roboticists – see Baranes & Oudeyer (2013): hypothesis that infants preferentially explore what they are able to understand at each step of development.

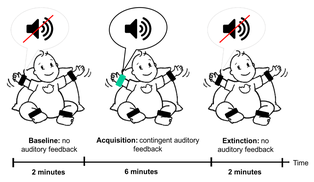
Our study

Modified mobile paradigm: bracelets generating perceptual feedback (music) contingent on infants' movements.

Subjects: infants of 2, 4 and 6 months of age. 73 infants were tested and the data of 10 infants per group were analyzed.

Experimental design:

During exposure to the contingency:
- one arm is "**connected**": movements of this arm generate music in the room
- the other arm is "**unconnected**".



➢ We compared the activity of each limb during the baseline and during the last 2 minutes of the acquisition phase (after 4 minutes of exposure to the contingency).

Data analysis

➢ We measured percent of activity of each limb:

$$\frac{\text{time during which the limb is active}}{\text{total time of the period}} \times 100$$

➢ We used a **learning criterion** to keep in our analysis only the data of infants who showed learning of the contingency (n = 8 per group):

% of activity of the connected arm in acquisition 3rd or extinction ≥ 1.5 x % of activity of the connected arm in baseline

➢ We calculated two **indexes of differentiation** by comparing percent of activity in Baseline and in Acquisition 3rd:

- Upper/Lower body differentiation – **if > 1 → differentiation between upper and lower body**:

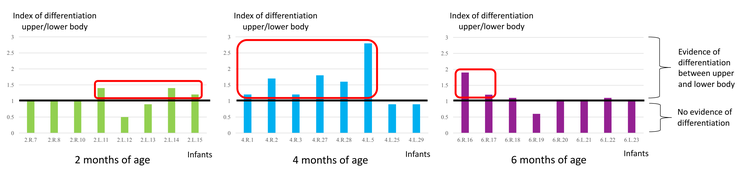
$$\frac{Arms\ vs.\ whole\ body\ activity\ -\ \text{Acquisition 3rd}}{Arms\ vs.\ whole\ body\ activity\ -\ \text{Baseline}}$$

- Right/Left arm differentiation – **if > 1 → differentiation between right and left arm**:

$$\frac{Connected\ arm\ vs.\ both\ arm\ activity\ -\ \text{Acquisition 3rd}}{Connected\ arm\ vs.\ both\ arm\ activity\ -\ \text{Baseline}}$$

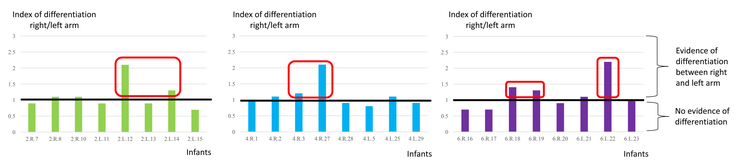
Results

- **Upper/Lower body differentiation:**



Undifferentiated body know-how | **Tendency : differentiation between upper/lower body** | **Undifferentiated body know-how (?!)**

- **Right/Left arm differentiation:**



No differentiation between right and left arm | **No differentiation between right and left arm** | **No differentiation between right and left arm (?!)**

Conclusion

- Undifferentiated body know-how:
➢ **Observed at 2 months of age.** But we need a non-contingent control for arousal.

- Differentiation between upper and lower body:
➢ **Trend observed at 4 months of age.** But we need a control experiment with foot connected.

- Differentiation between right and left arm:
➢ **Not observed at 6 months of age (?!).** We need to understand this lack of result.

Discussion

Why have we found it so hard to demonstrate a sensitivity to contingencies in infants?

➢ **The literature on contingencies is actually not so convincing!**

- Not many non-contingent controls have been done: only 2 studies of Rovee-Collier (1969, 1978).
- Not all infants seem to be sensitive: in Watanabe & Taga (2009): 55% of the non-fussy infants were rejected because they did not learn the contingency.
- No study by Rovee-Collier succeeded in laboratory conditions; only in the baby's home.
- Lack of reproducibility: there has been a failure to replicate Bahrick & Watson (1985).

Literature cited

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Acknowledgements

The authors were financed by ERC Advanced Grant "Feel" Number 323674.

Further information

Raw data and scripts of data analysis are accessible online. For more details please contact:
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