Review PhD thesis Zuzanna Laudańska

Title thesis: The development of motor and vocal coordination in infancy: dynamic systems approach
Reviewer: Dr Lisette de Jonge-Hoekstra, University of Groningen

Overall evaluation

Very interesting thesis, which —enabled by an impressive and very rich data set— adds important pieces to our understanding of the development of motor and vocal coordination in infancy. The pictures at the start of each chapter are wonderful and paint a nice picture of the data collection.

It's also impressive that the author has written most of the thesis is one month (as is written in the acknowledgements), but this pace is also visible in the occurrence of some minor issues within the thesis (which I pointed out in the comments underneath each chapter, below). When allowed and possible, I would invite the author to adjust these minor issues.

However, it's not difficult to look beyond these minor issues and see a high quality dissertation, which could only be written by an author who is an expert in her field, who knows about important theories and perspectives, and who is able to carry out research according to this knowledge and perspectives. **I therefore conclude that the thesis of Ms Zuzanna Laudańska entitled "The development of motor and vocal coordination in infancy: dynamic systems approach" fulfils the requirements set in the Art. 187 of the Act of 20 July 2018 – Law on Higher Education and Science (Journal of Laws of 2023, item 742).**

On the next pages you can find my evaluation of the different chapters, and some comments.

Dr Lisette de Jonge-Hoekstra
Signed on June 9, 2024 in Uitwellingerga, the Netherlands

Chapter 1

After starting with an engaging example, this chapter provides a clear and concise overview of the theories of complex systems, synergies and affordances. Then the chapter proceeds to seeing infants as complex systems, followed by explaining coordination and it's relevance for infancy. Nonlinear and recurrence-based methods are explained rather superficially, which may confuse a reader not familiar in the field. Nice reflection on that the environment is typically unspecified! Also convincing description of children's early vocal behavior and how this is structured by their interactions with their caregivers. The overview of research questions and hypotheses at the end of Chapter 1 helps the reader to understand how the five different empirical studies relate to the overall thesis goal of investigating "how the increasing multimodal (motor-vocal) specialization to the demands of the task-driven context unfolds with infants' age". The General methodological approach is very impressive and clearly written. As a reader, sometimes I would have liked it if the methodology would have been emphasized again in the empirical papers themselves.

Chapter 2

This chapter describes one of the different corner pieces of such a complex, embedded and longitudinal approach to the development of motor-vocal coupling and specialization. Using MdRQA, which is a very novel technique, the author shows specialization in hand movements' complexity and stability for the different tasks at 12 months of age. The Introduction is quite brief, and as a reader (especially when I pretend that I do not know a lot about complex systems etc.) I wonder what is meant with "complex" and "patterns", and what "Entropy" actually tells me. When reading the Discussion, I wonder what the explanations of the author are for why there are no significant differences in ENT and ML between book reading and rattle shaking, and between book reading and playing, which seem to be very different interpersonal tasks. Maybe a more qualitative description of children's actual behavior across tasks and across time would have been helpful for interpreting the findings. The findings described in this chapter significantly increase our understanding of the development of children's early motor-vocal coupling.

Comments:
- Table 2.2 -> values of ENT and ML for T1 manipulative toys seem to be reversed.
- When was movement data not valid? This explanation is missing.
- How were the parameters for MdRQA estimated? This is described too implicitly, I think.

Chapter 3

This chapter uses another state-of-the-art method to investigate the coupling between arms at different frequences during the rhythmic rattle shaking task. While obviously a very cool study with very cool analyses, I think the Introduction could have been more clear on the importance of the study. Furthermore, I would have been very interested in knowing how different rhythms are nested on different timescales —which seems relevant for the overall goal of the PhD thesis. Cross-wavelet analyses allows for this, but the Results do not report on this (but the Discussion does, see "Issues" below). To my knowledge, this study is one of the first to investigate the important and intriguing topic of the development of infants' multimodal coordination during such a rhythmic task.

Comments:

- A focus on the power within different frequency bands is described in the Discussion, but unfortunately misses from the Results. I think it should be in the Results as well.
- There is a lot of "Method" in the "Introduction", while I wonder whether this is necessary.
- What was done with differences in coding between coders (also for the other Chapters in which behavior was coded)?

Chapter 4

This chapter is about the development of coupling and synchronization between vocalizations, hand movements and feet movements during the rattle shaking task. It was found that the co-activation of vocalizations and hands and feet was similar at T1, higher for feet than for hands at T2 (interesting finding also), and higher for hands than for feet at T3 and T4 (a more "adult" pattern). The findings with regard to synchronization (before, during, after) are a bit more difficult to interpret from the text. This chapter significantly contributes to our understanding of the development and specialization of motor organization in children during a rhythmic task. In the Discussion I wonder how the account by Iverson & Thelen and the account by Pouw & Fuchs are related, and how you think this is relevant for your sample. Could one say that the account by Pouw & Fuchs is a more defined way to characterize the coupling. Is the coupling only bio-mechanical, and therefore direct and Newtonian, or (also) complex?

Comments:

- What is a vocalization occurring on **one egress**? I think this needs to be explained.
- I don't completely understand the calculation of the three windows. Therefore I think these results are also difficult to interpret, and I think the author could have taken the reader more

by the hand and explaining what how we should interpret the Tables, rather than merely referring to them.

Chapter 5

In this chapter the frequence of vocalizations, as well as the ratio of "advanced" vocalizations were investigated across the three tasks throughout the first year of life. At 12 months of age children vocalize less during manipulative play than during book reading and rattle shaking. There is no difference between tasks in the ratio of advanced vocalizations (although at 6 months there does seem to be a large difference in the ratio's variance around the mean between the tasks). With regard to the high frequency of vocalizations during rattle shaking, could an alternative explanation be that the rhythmic hand movements during the task elicit (recruit) rhythmic vocalizations? This study adds to our understanding of how different tasks afford children's vocalizations throughout early childhood.

Comment:

- The coding seems the same as in Chapter 4, but Cohen's K is higher in Chapter 5 than in Chapter 4. What am I missing?

Chapter 6

Very impressive and important chapter. I would have loved to learn much more about the multimodal coordination between parents and their child within this dataset, but I also understand that a thesis needs to stop at some point, such as after 5 empirical chapters. The author found that parents provide more vocal input during book-sharing than during the other two tasks. Furthermore, at T1 and T2 the tasks do not elicit significant differences in turn taking, but at T3 book-sharing elicits more turn-taking than manipulative play and rattle-shaking, and at T4 both book-sharing and rattle-shaking elicit more turn-taking than manipulative play. The specialization for rattle-shaking thus seems to be delayed compared to book-sharing. Lastly, it was found that the response-latency of parents was stable, while the response-latency of infants was different for book-sharing, compared to the other two tasks. This chapter shows how parent-child vocal interactions change across tasks throughout the first year of the child's life. I would be very interested in the content of parents' (and children's) vocalizations.

Comment:

- I think merely referring to Chapter 5 for the statistical analyses is too meager. The variables are very different, and there are two people now, instead of one.

General discussion

Interesting Discussion which clearly highlights the added value of this PhD thesis to the field. In the Introduction the author clearly emphasizes that the environment is often not specified. I would be very interested to go beyond establishing the differences in infant motor and vocal behavior between the different tasks, and discuss how the specific properties of the tasks elicit particular behaviors (i.e. in line with affordances).