

Longitudinal Development of LoOming: How optical variables may become information

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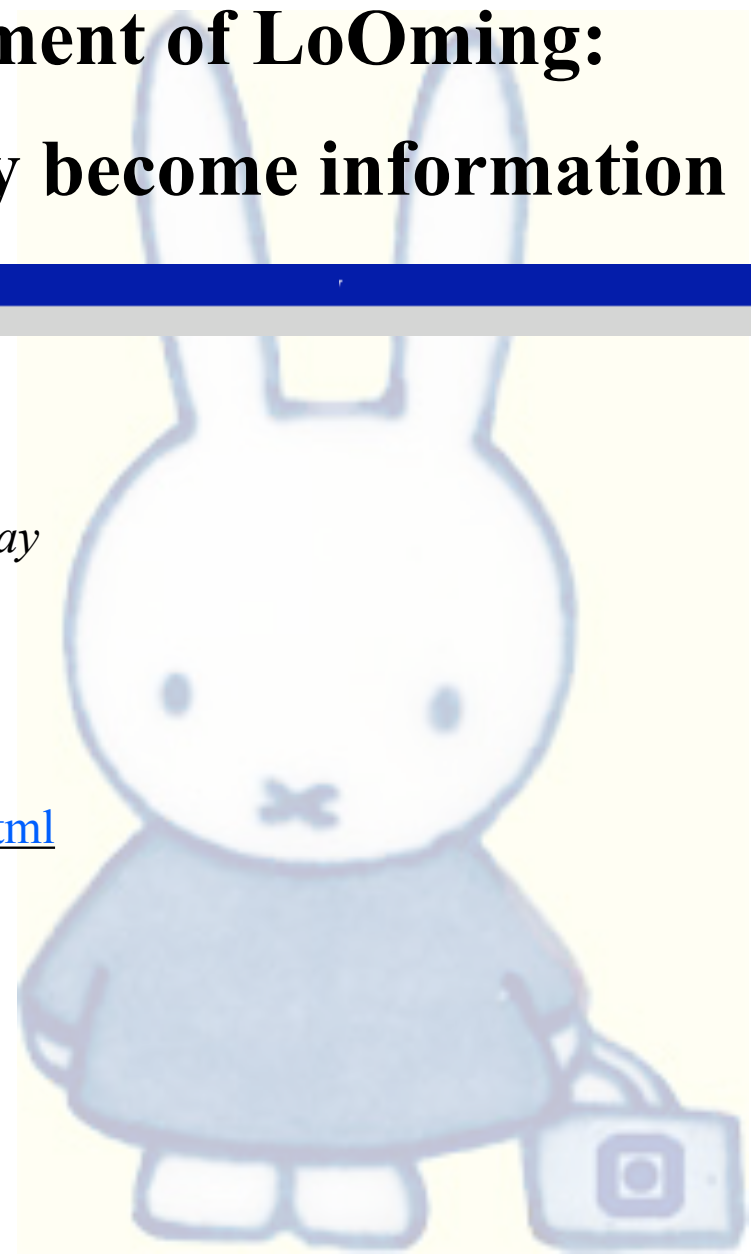
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- Research ass. Asif Muhammad
- Research ass. Jan Frederik Léger
- Research ass. Pablo Gómez Margareto



KEYNOTE PRESENTATION I

The State of Ecological Psychology

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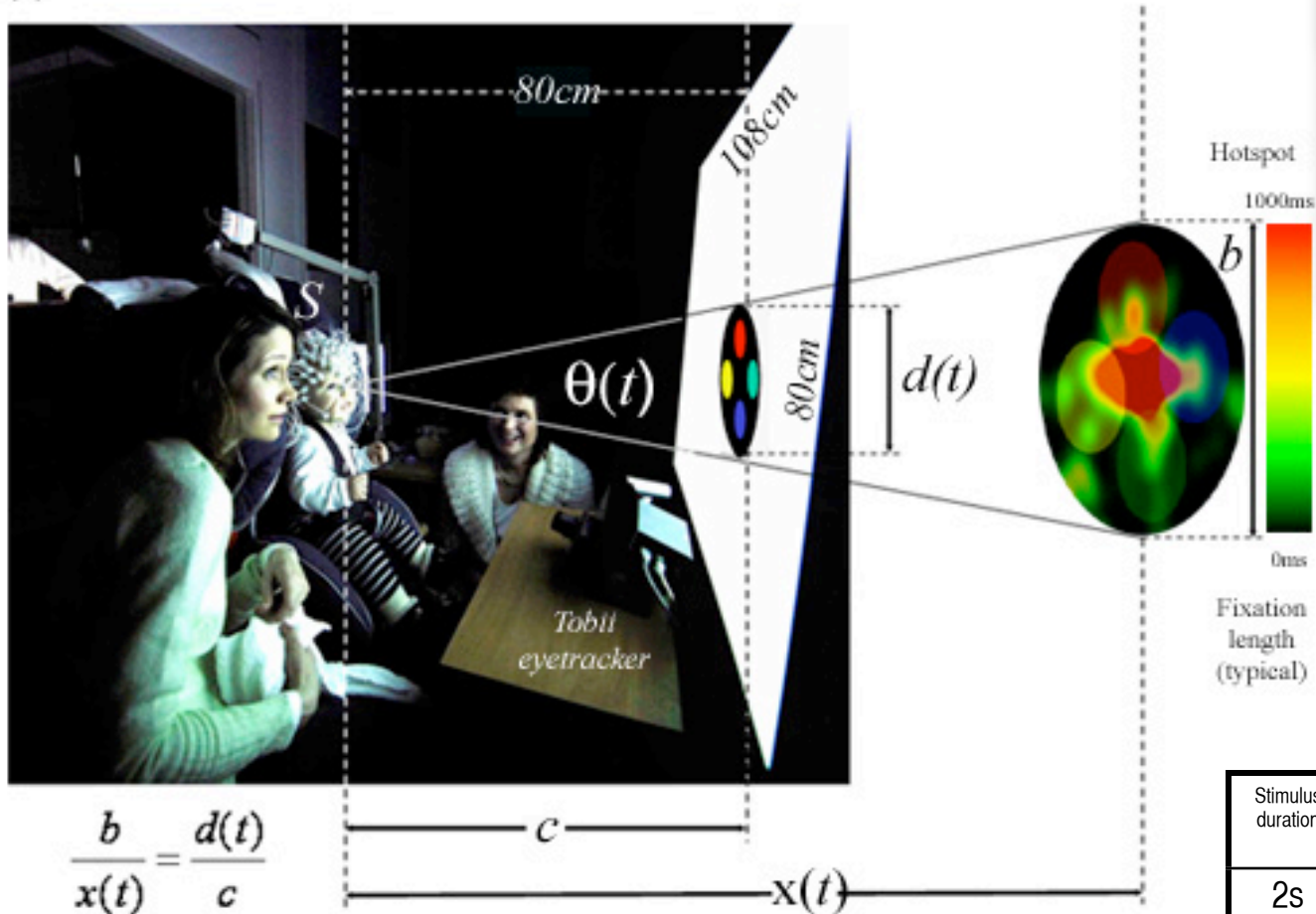
In this article we discuss the state of ecological psychology, broadly defined as the branch of science dealing with the coordination of activity with respect to perceptual information. Three theoretical approaches to this theme are distinguished: direct perception, kinetic theory, and pattern dynamics. After a brief summary of these approaches, we critically review their merits and limitations with regard to four problem areas, namely, the identification of the essential variables of perception and action, the empirical testing of models and hypotheses concerning these variables, the theoretical and methodological response to the variability of perception and action, and the theoretical and methodological response to lasting changes in perception and action during learning and development. A plea is made for the identification of multiple alternative variables for a specific problem, the rigorous construction and empirical testing of models in which these alternatives are considered, and the development of new theoretical constructs and model constructs to deal with the variability of perception and action as well as the changes that accompany learning and development.

The Looming Setup

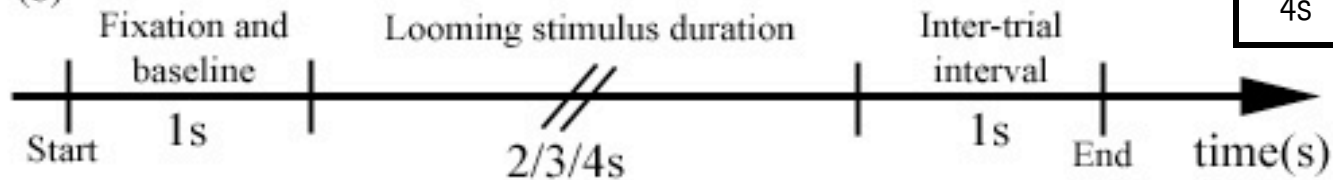
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(a)

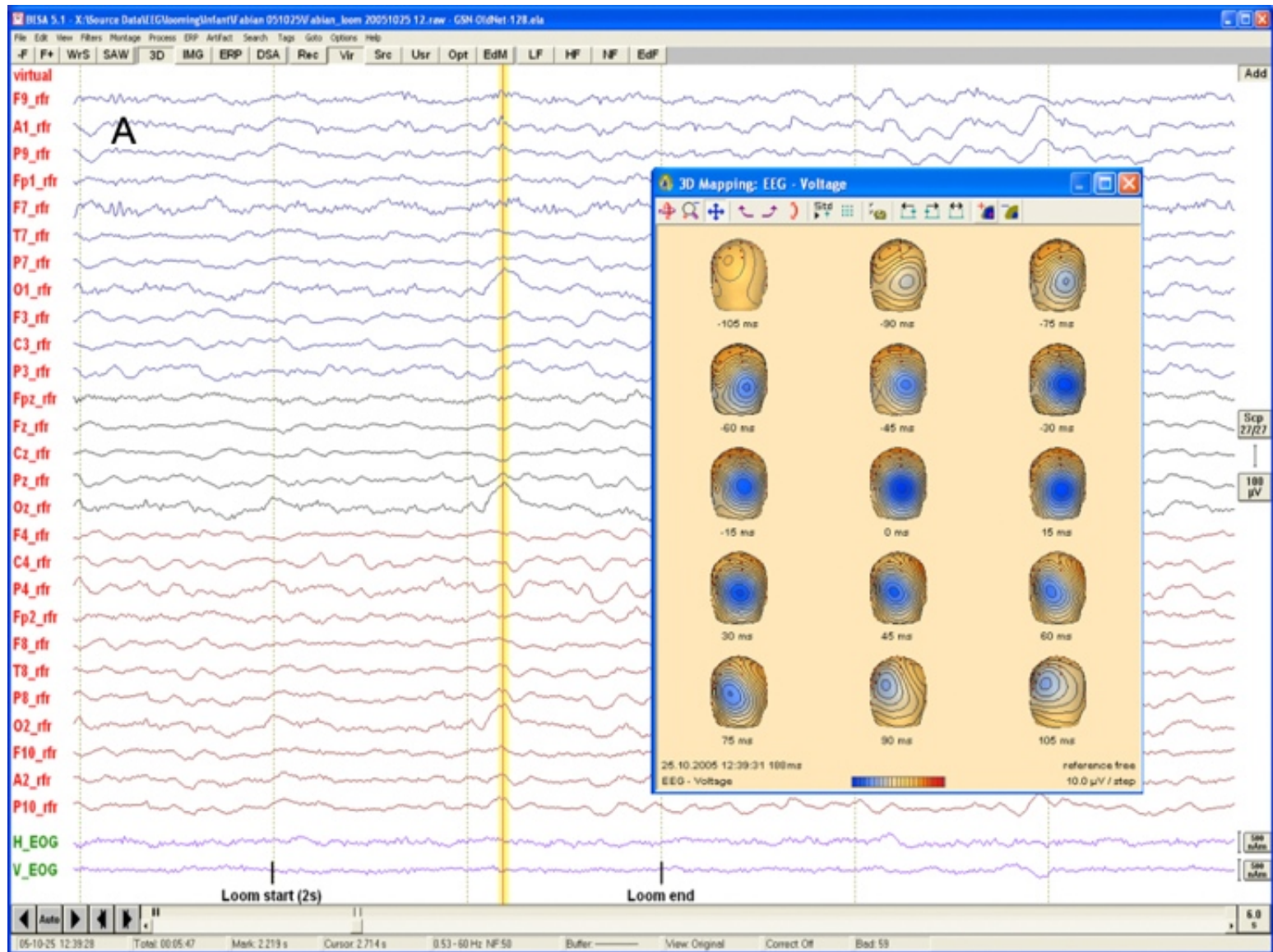


(b)

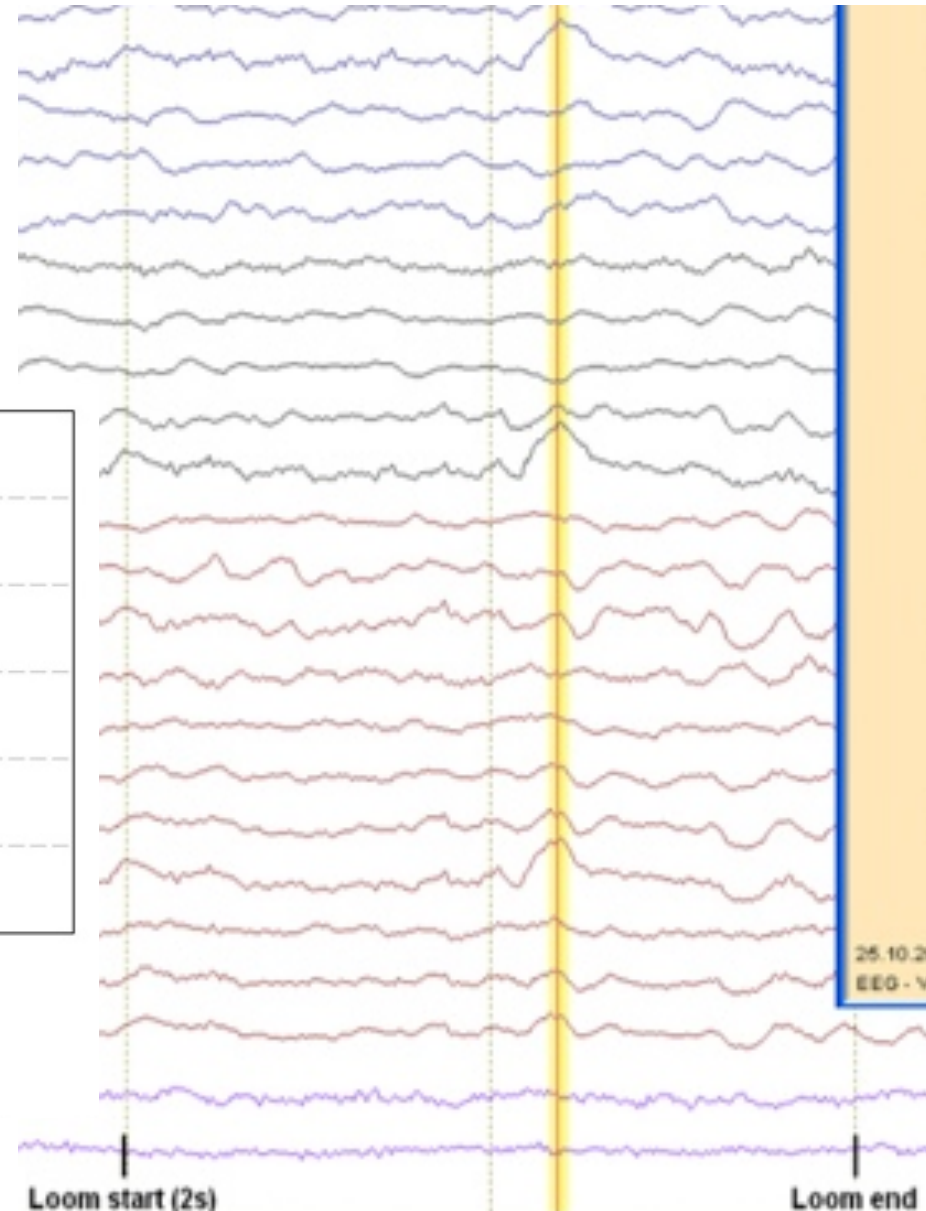
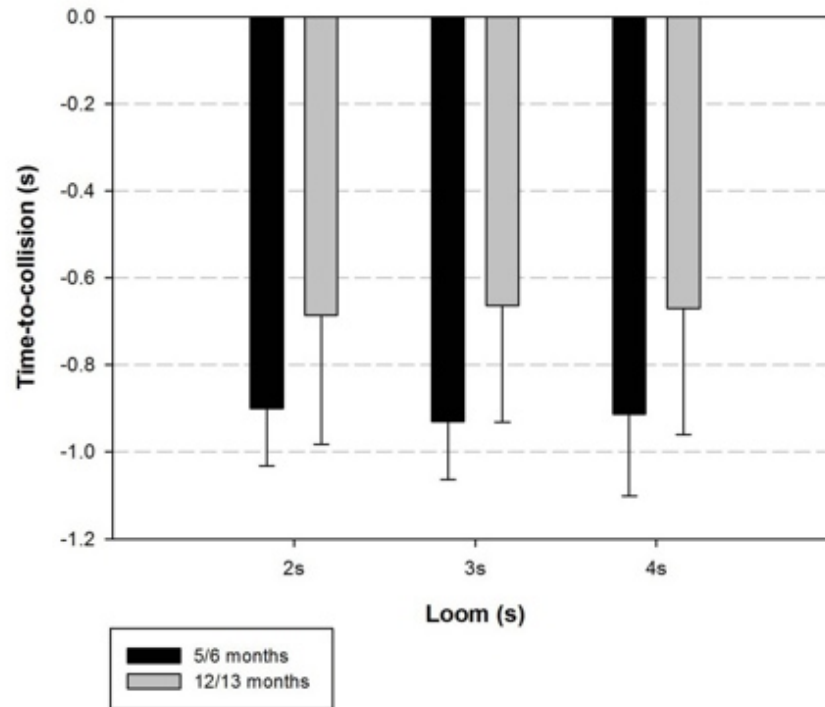


Stimulus duration	Diameter acceleration	ttc with subject S
2s	1.72 m/s ²	2.019s
3s	0.76 m/s ²	3.028s
4s	0.43 m/s ²	4.038s

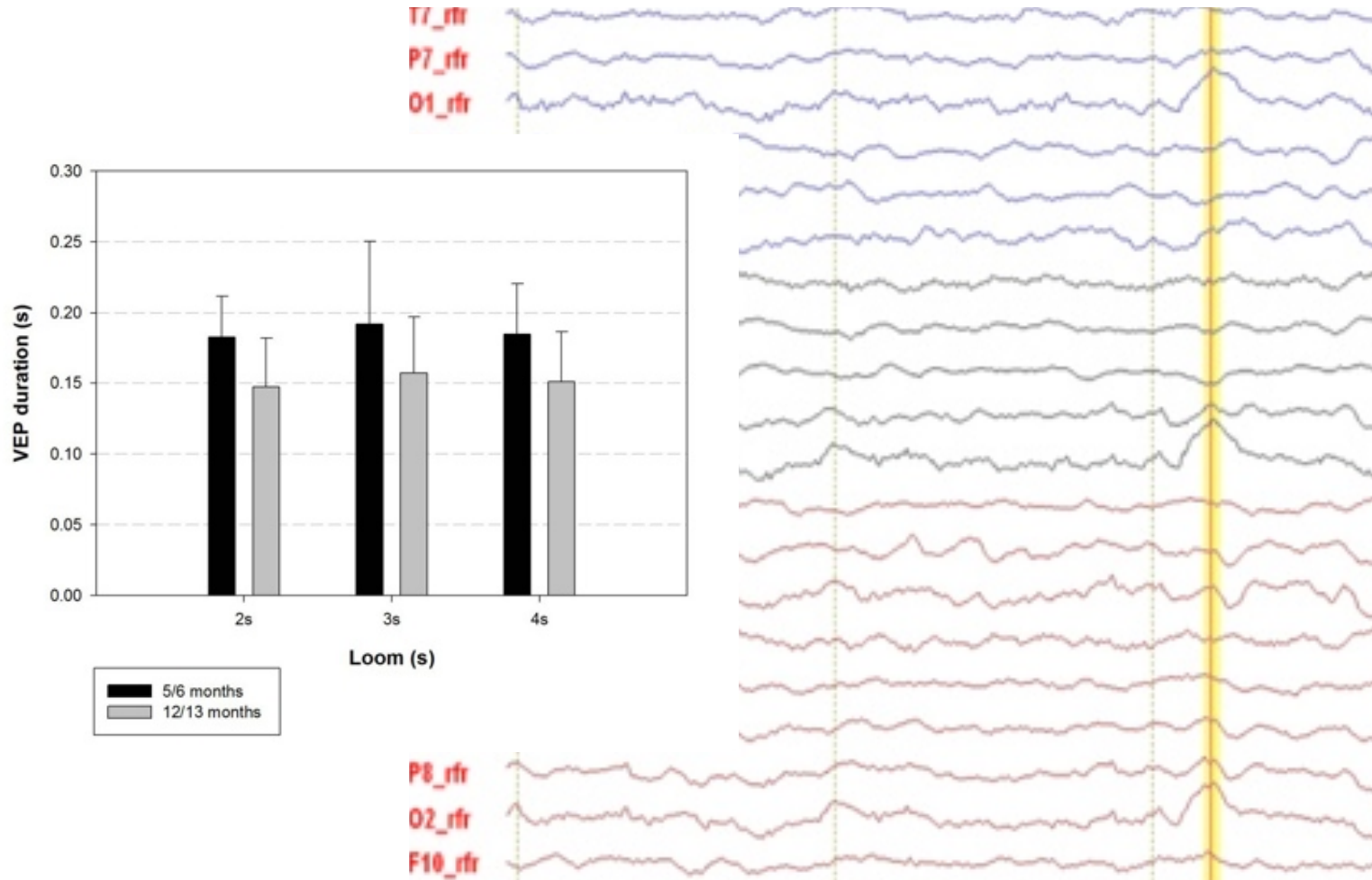
Typical Loom VEP in Areas O1, Oz, and O2



Occurrence of Averaged Peak VEP Activity



Averaged VEP Duration, $VEP_{end} - VEP_{start}$



At 5 months, peak VEP activity occurred earlier in the looming sequence and VEP duration lasted longer than at 12 months.

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- Due to immature cortical pathways brain regions (V1) may initially respond to a wide variety of visual stimuli only partially becoming activated using the first available pathway often leading to a slow or incorrect response.
- With age (i.e. due to synaptic maturation, pruning, myelination etc.) cortical pathways get more specifically tuned to certain stimuli so that they only become engaged by a subset of these stimuli leading to quicker and more accurate responses.



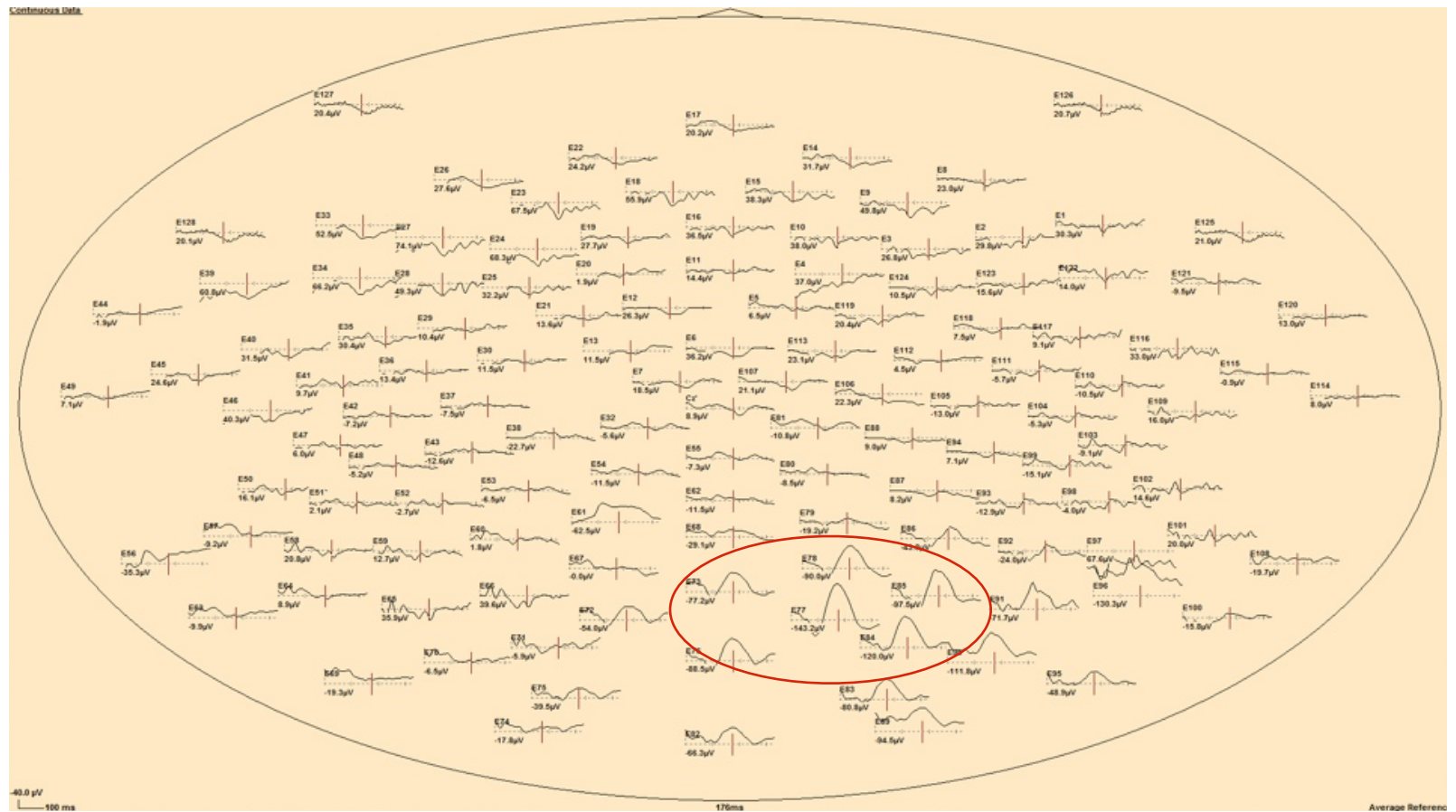
5 months



12 months

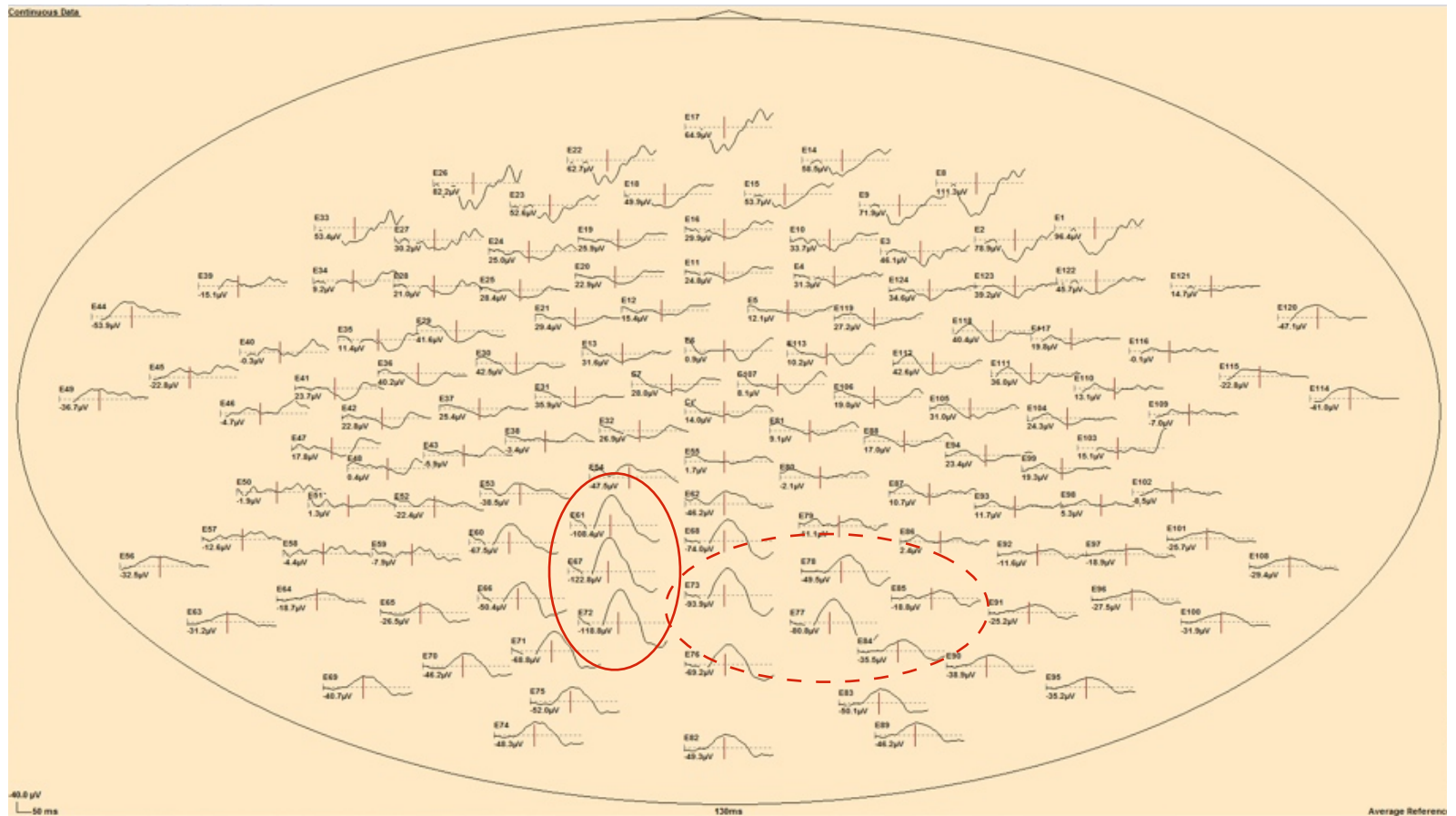
Localized Peak VEP Activity at 5 Months (top view)

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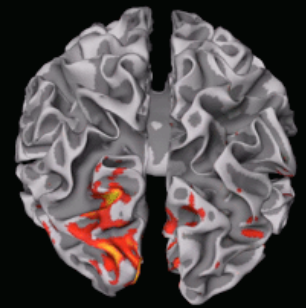


Localized Peak VEP Activity at 12 Months (top view)

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Peak VEP activity shifted from the right occipital areas at 5 months to the left occipital/parietal areas higher up the dorsal stream at 12 months



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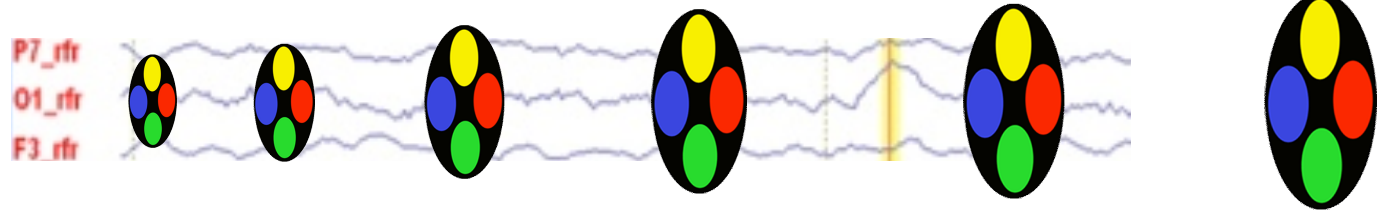


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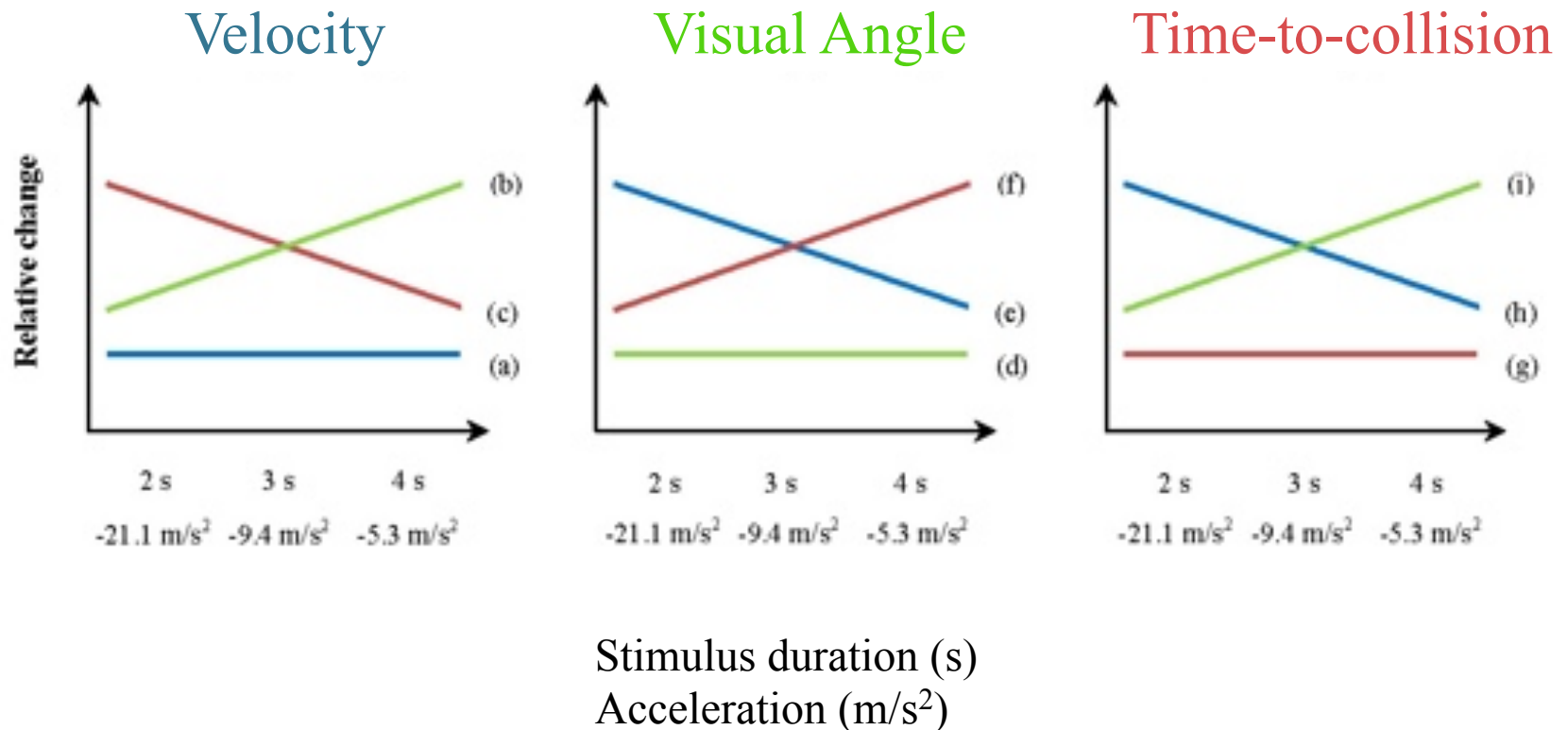
- Adult data shows that the processing of motion stimuli is propagated along the dorsal stream towards the V5/MT+ area of the brain (Rokers et. al., 2009).
- The decrease in activity in the occipital area and increase in the parietal area with age may imply that activation in the occipital area propagates forward and starts to influence more advanced areas in parietal and temporal leads.
- So, why is this shift occurring?



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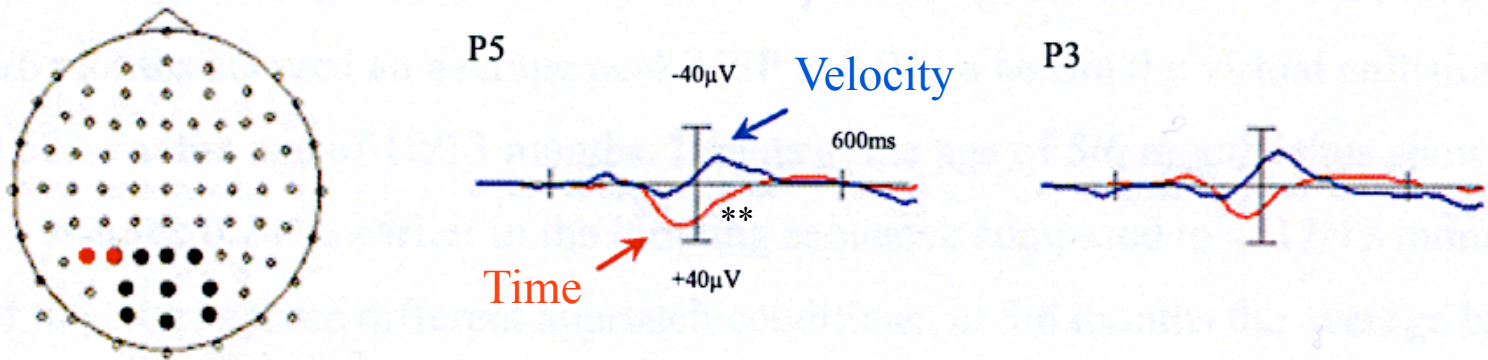
Loom Variables Considered to 'Time' Peak VEP





ID	5 months			12 months		
	Time	Velocity	V. angle	Time	Velocity	V. angle
OJ	0.13	0.18	0.24	0.08	0.28	0.23
TM	0.21	0.17	0.34	0.06	0.17	0.23
FS	0.24	0.17	0.46	0.01	0.13	0.22
IO	0.17	0.22	0.31	0.24	0.25	0.27
LP	0.24	0.21	0.27	0.14	0.26	0.28
RI	0.06	0.11	0.21	0.08	0.15	0.18
VL	0.19	0.16	0.32	0.04	0.25	0.24
LT	0.05	0.11	0.21	0.11	0.19	0.24
UL	0.12	0.16	0.20	0.25	0.13	0.42
RM	0.07	0.12	0.23	0.23	0.17	0.24

VEP_{peak} Morphology Differences between Velocity and Time infants (Grand Average data)



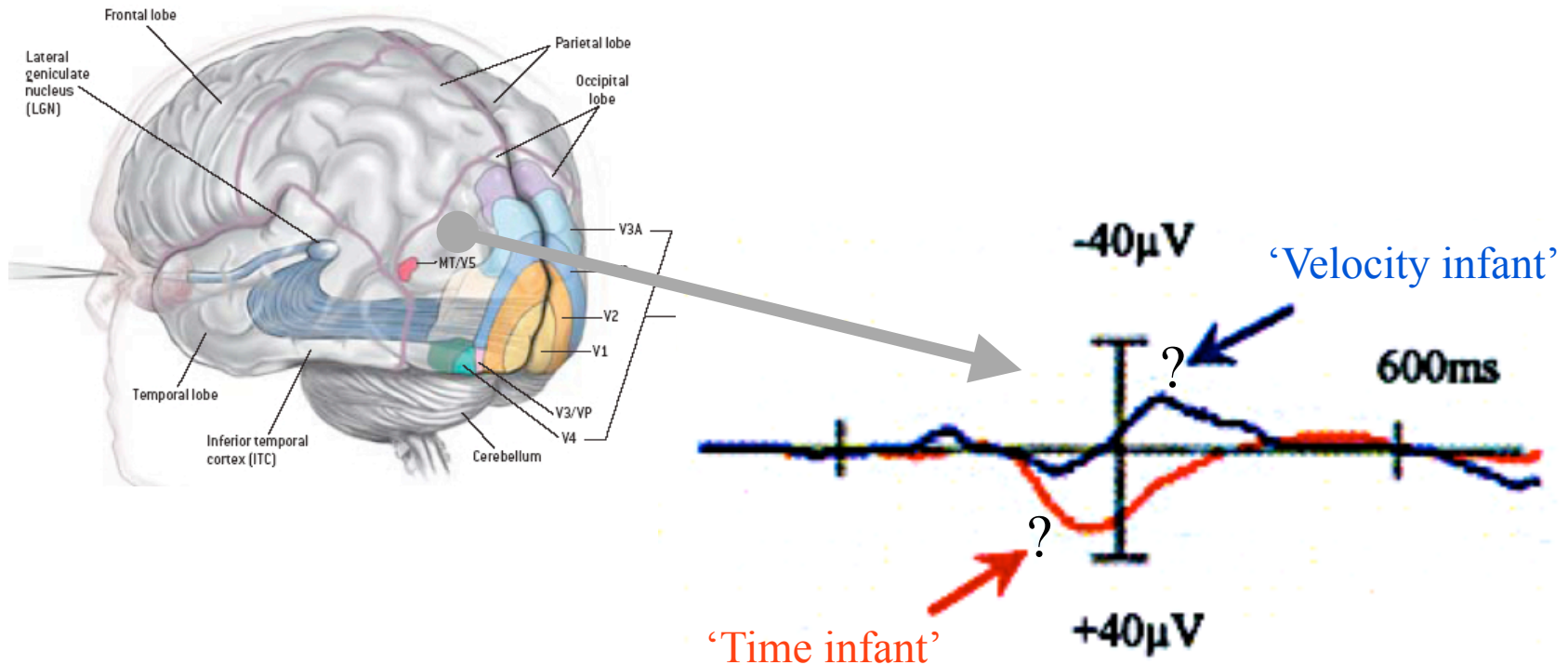
- Biophysical/Anatomical (Proverbio, 2007)
- Developmental (Barnet, 1980)
- Informational?

Michaels & Beek's (EWEP3) proposal as to how the pick-up of higher-order perceptual variables may come about: *Smart Perceptual Device* (Runeson, 1977)?

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“Lower level, merely correlated variables (*such as velocity*) might be exploited initially and perhaps guide the search for or come to be selected as integral parts of a higher order informational complex (*such as time*)”

Thanks to all our participants and their parents.

