Behavioral sleep state coding around motor milestone acquisition

Melissa N. Horger[1], Rebecca D'Aloia[2] & Sarah E. Berger[1,2]

[1]The Graduate Center, CUNY, [2]The College of Staten Island

Introduction

- Sleep is essential for physical and cognitive functioning. It prepares us for next-day functioning and consolidates information learned during the day (Diekelmann, 2014).
- During sleep, individuals cycle through two primary states: rapid eye movement (REM) and non-REM.
- In addition to differing physiological characteristics, sleep states have a differential and bi-directional relationship with learning (Fogel et al., 2015).

Objective

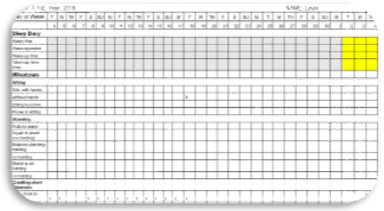
To examine infant sleep states the night before and after a naturalistic learning event: the acquisition of crawling.

Participants

Participant	Sex	Age at crawl
S#1	M	249 days
S#2	M	254 days
S#3	F	244 days

Methods

- Infants were enrolled in a larger study examining the relationship between infant sleep quality and motor milestone acquisition
- All were given a Nanit camera to keep in their home.
- Parents completed a motor milestone diary to precisely track skill onset.



Acknowledgements: This work was supported by National Science Foundation grant BCS-1551703 and Professional Staff Congress (PSC–CUNY) [Award No. 68597-00 46] to S.E.B

Video Coding

- Full nights of video around motor milestone acquisition were coded
- Videos watched at 8-16x the normal playback speed and coded in Datavyu

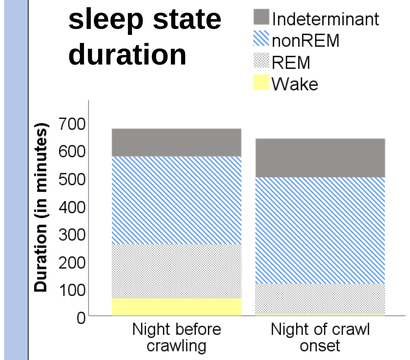
Behavioral markers of sleep states

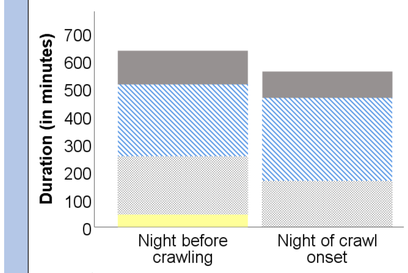
	REM	Non-REM	Wake
	Eyes closed. Lids may flutter and eye movements visible	Eyes closed	Eyes open
	Twitching, small movements, squirming, and stretching. Brief periods of inactivity (< 2 min)	Generally still but sudden movements (startles) may occur	Bouts of movement
	Lasts for a minimum of 5 minutes	Lasts for a minimum of 10 minutes	Lasts for a minimum of 5 minutes

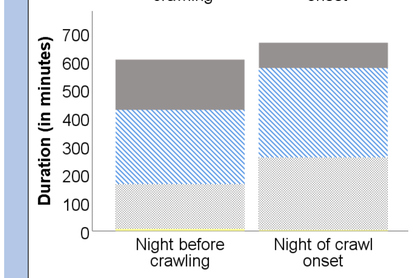
Sleep was marked as indeterminant (IND) if characteristics of both states were displayed or timing criteria was not met.

Results

Stacked bar charts of sleep state duration







Tables of minutes per state and total sleep

S#1

	REM	Non-REM	Total sleep
Before	210.5	258.9	591.1
After	167.2	298.4	560.6

S#2

	REM	Non-REM	Total sleep
Before	195.4	316.4	612.2
After	111.6	383.2	634.2

S#3

	REM	Non-REM	Total sleep
Before	158.9	261.8*	598.3*
After	255.9	316.6	622

*S#4 was missing the first hour of video. As such, estimates for non-REM and total sleep are slightly off.

Conclusion

- All participants had more time awake and two showed more time in REM the night **before** the motor milestone was achieved. All had longer durations of non-REM the night **after** the motor milestone was achieved.
- This supports the idea that the acquisition of a new motor skill alters infants' sleep. It may be reasoned that REM is particularly influential for readiness to acquire a skill while non-REM consolidates it.
- Future work will include more participants and examine the nights before and after other skills such as walking.