

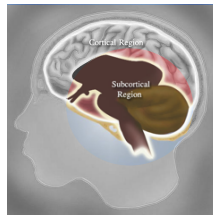
Neurobehavioral Development in Infants at High-Risk for ASD

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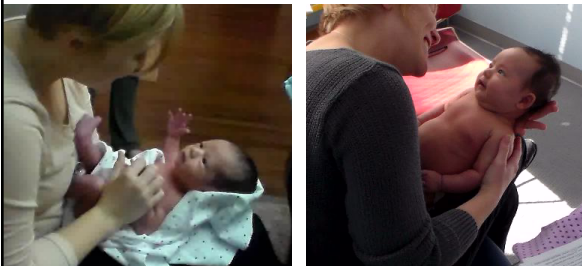
The Neonate Experience

- Reflexive & Stimulus-bound
- Complex & Organized
- Opportunistic & Non-volitional
 - Subcortically-mediated
- Experience-expectant
- Adaptive



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Reflexive Action Systems as Learning Opportunities



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Dynamic Transition

Key Transition


A Critical Transition

Psychological Birth

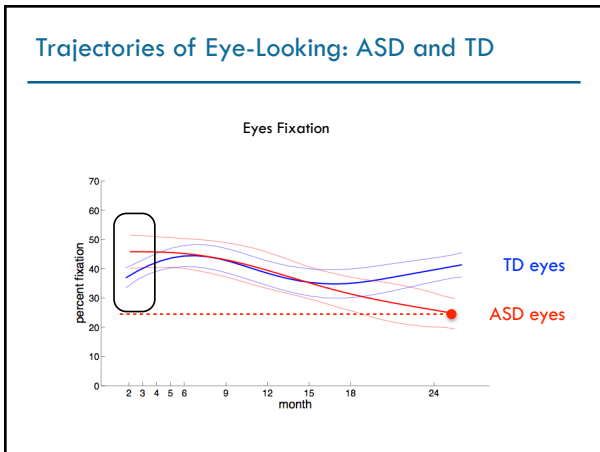
2-Month Revolution

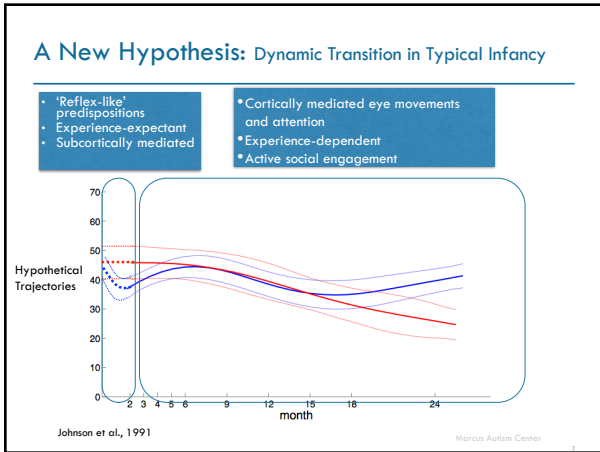
Critical Transitions

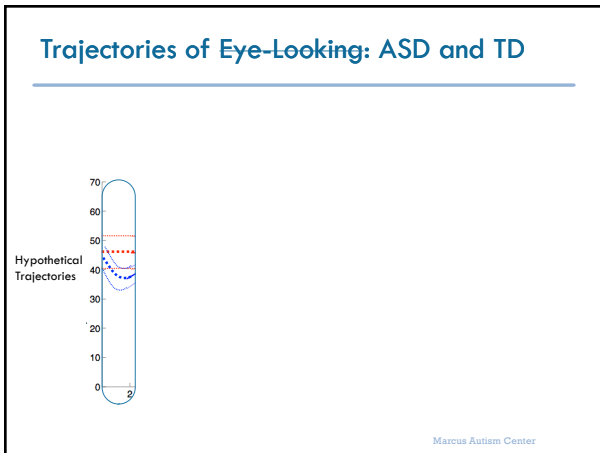
- Intentionality
 - Cortically-mediated
 - Inhibition of reflexive reactions
- Experience-dependent
- Increased alertness
- Social Smile
- Very little direct evidence
 - Later maturation of primary visual cortex
 - Cortical specialization for face processing at 2-3 months

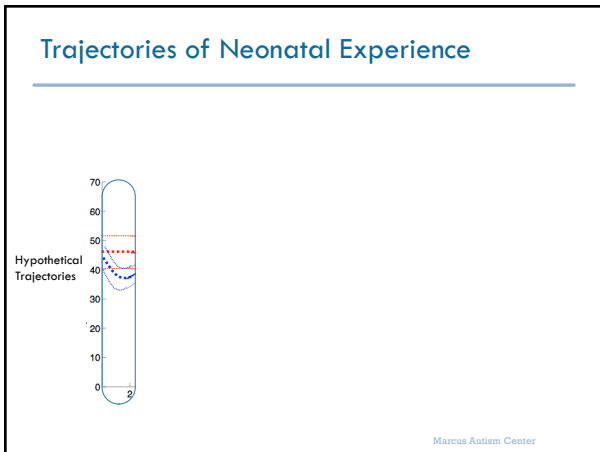


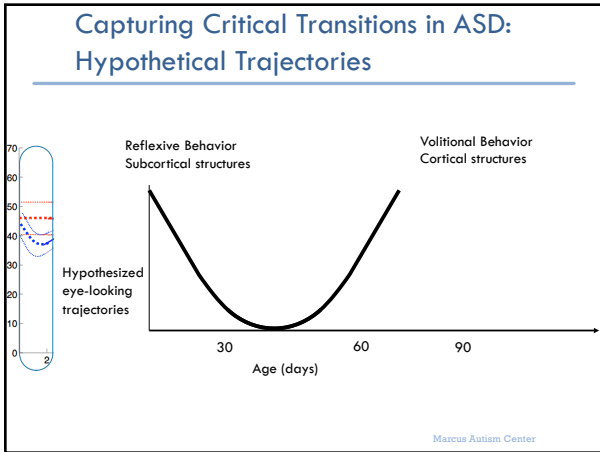
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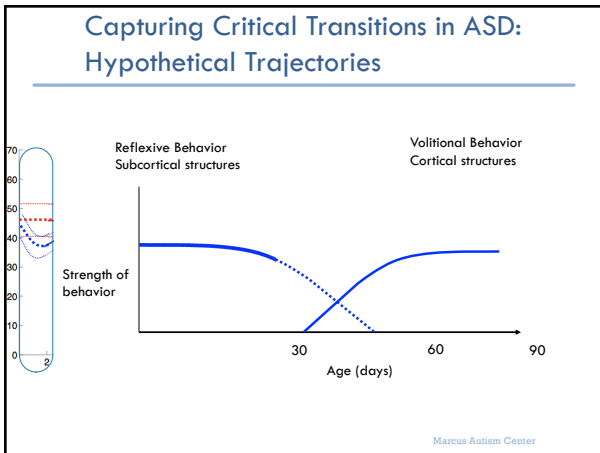


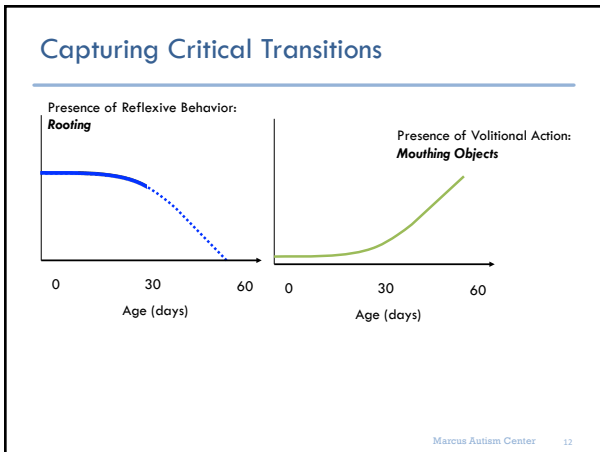


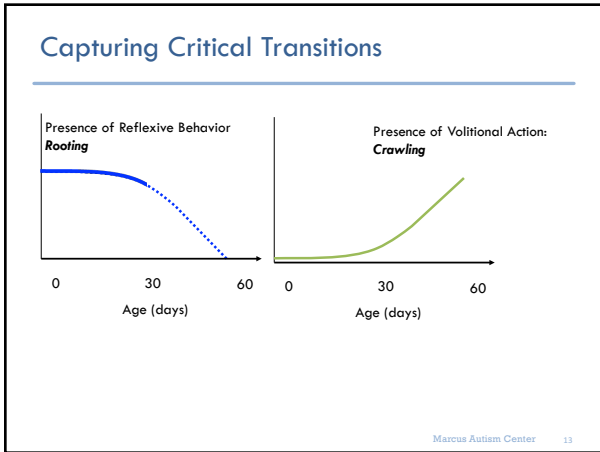


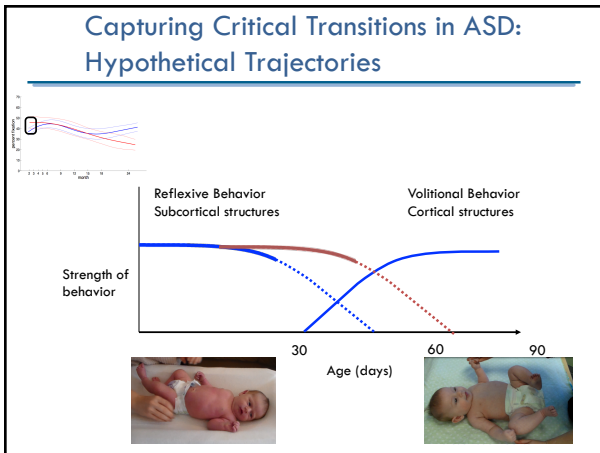












Neurobehavioral Development

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NIMH Autism Center
of Excellence

Children's
Healthcare of Atlanta

The Developmental Task of a Newborn

Organize autonomic/physiologic system

1. Stabilize breathing
2. Reduce number of tremors and startles
3. Maintain temperature control

Regulate motor behavior


1. Making smooth movements
2. Reducing jerky movements
3. Developing muscle tone

Regulate "state"

1. Self-soothe (e.g., hand to mouth behavior)
2. Amenable to soothing

Regulate social interaction

1. Maintain alert periods
2. Attend to visual and auditory stimuli
3. Engage a caregiver



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Neurobehavior

- Neurological integrity and behavioral responses that co-construct an infant's experience from the first days of life.
- Allows us to see how baby's discrete behaviors are integrated into coherent patterns of behavior

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Domains of Neurobehavior

Autonomic/Physiological Regulation	Color changes, tremors, startles

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Domains of Neurobehavior

Autonomic/Physiological Regulation	Color changes, tremors, startles
Motor Organization	Quality of movement and tone; activity level

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Domains of Neurobehavior

Autonomic/Physiological Regulation	Color changes, tremors, startles
Motor Organization	Quality of movement and tone; activity level
State Organization and Regulation	Arousal and state lability; ability to regulate state in the face of stimulation

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Domains of Neurobehavior

Autonomic/Physiological Regulation	Color changes, tremors, startles
Motor Organization	Quality of movement and tone; activity level
State Organization and Regulation	Arousal and state lability; ability to regulate state in the face of stimulation
Attention and Social Interaction	Attend to visual and auditory stimuli; overall quality of alertness

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Clinical Applicability

	Strengths	Areas in need of support
Autonomic System	<ul style="list-style-type: none"> Breathing is smooth 	<ul style="list-style-type: none"> Substantial color change with slow recovery Many startles and tremors
Motor System	<ul style="list-style-type: none"> Good tone throughout exam 	<ul style="list-style-type: none"> Jerky movements
State System	<ul style="list-style-type: none"> Can be consoled easily by the examiner Uses hand-to-mouth behavior 	<ul style="list-style-type: none"> Easily upset Moves rapidly from sleep state to distress state
Social Interactive System	<ul style="list-style-type: none"> Looks away when interaction is too intense 	<ul style="list-style-type: none"> Constant gaze aversion Difficult to maintain stable alert state

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Measuring Neurobehavioral Development

- NICU Network Neurobehavioral Scale (NNNS; Lester & Tronick, 2004)
 - Neurologic integrity
 - Behavioral functioning
- 115 Items
- Primitive Reflexes
- Muscle Tone
- Social and Nonsocial Orientation
- Self-Regulation
- Stress Signs

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Primitive Reflexes

<ul style="list-style-type: none"> Plantar Grasp Babinski Leg Recoil Stepping 	<ul style="list-style-type: none"> Palmar Grasp Arm Recoil Rooting Sucking 	<ul style="list-style-type: none"> Tonic Deviation ATNR Moro
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Lower Extremity



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Upper Extremity



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Upper Extremity



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Moro Reflex



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Asymmetric Tonic Neck Reflex (ATNR)



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Tonic Deviation

- Vestibular reaction prior to onset of voluntary control of eye movements



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Stepping



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Research Using NBAS/NNNS

- Cocaine Exposure (Lester et al., 2002)
 - Lower arousal
 - Poorer quality of movement
 - Poorer self-regulation
 - Higher excitability
 - More hypertonia
 - More nonoptimal reflexes
- Nicotine/tobacco exposure (Mansi et al., 2007)
 - Poorer scores on several items, especially irritability (does-dependent)
- Alcohol

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Research Using NBAS/NNNS

- Very Low Birthweight preterm infants (Wolf et al., 2002)
 - At term-age
 - More signs of stress
 - Poorer self-regulation
 - At 6-months
 - More stress
 - Less approach
 - Poorer self-regulation

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Environmental Health Perspectives
Vol. 71, pp. 185-189, 1987

**The Neonatal Behavioral Assessment Scale
as a Biomarker of the Effects of
Environmental Agents on the Newborn**
by Edward Z. Tronick*

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Measuring Volitional Behavior

- Bayley Scales of Infant Development, 3rd Edition (Bayley, 2006)
 - Cognitive
 - Receptive Communication
 - Expressive Communication
 - Fine Motor
 - Gross Motor

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Volitional Behavior


- Retaining object
- Keeping hands open
- Reaching and Grasping
- Rotate wrist
- Shifting Attention

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Volitional Behavior

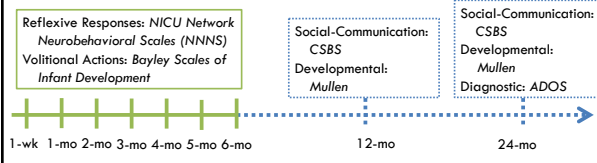
- Social Smile
- Recognize Caregiver
- Social Vocalization
- Reacts to disappearance of a face
- Responds to name
- Plays a social game



The Current Study

76 participants recruited in early infancy

- 40 infants with a sibling with ASD
- 36 infants with no family history of ASD



Reflexive Responses: NICU Network Neurobehavioral Scales (NNS)
Volitional Actions: Bayley Scales of Infant Development

Social-Communication: CSBS
Developmental: Mullen

Social-Communication: CSBS
Developmental: Mullen
Diagnostic: ADOS

1-wk 1-mo 2-mo 3-mo 4-mo 5-mo 6-mo 12-mo 24-mo

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