



# Understanding Motor Planning Deficits in Young Children with Autism Spectrum Disorder

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(ECEP)

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# What is motor planning?

- Motor actions are planned in advance of the intended goal.
  - Gripping a spoon and avoiding an awkward hand position
  - Climbing in and out of a car seat
  - Putting on a jacket



# For Example



- Audience participation
- Break into pairs
- One person copy the action / share how it felt with the other
- Switch
- Full group reflection

# Typical motor learning & planning

- The first time we learn something new it takes conscious thought. With practice, we integrate the sensory and motor information needed for success. The movement becomes automatic.

- Examples of complex actions:

Learning to ski

Step aerobics

Driving a car

Climbing stairs (uneven steps)

Writing

# What's typical?



- Inner drive to move, explore, try new things.
- Master each challenge and feel successful.
- Success gives confidence to try increasingly more difficult motor challenges.

- The more a child practices a motor skill, the better it becomes.
- Motor planning develops by solving *challenges* with the body: climbing into a car seat, going down a slide, walking up stairs.
- Success with motor planning challenges leads to gaining more skills. Climbing a jungle gym progresses to climbing a tree.
- When skills do not develop naturally, a child may avoid movement activities.





# Children with Autism Spectrum Disorder

- Children with ASD have been found to have deficits and delays in:
  - Gross and Fine motor skills
  - Adaptive or daily living skills – eating dressing bathing
  - Balance and coordination
  - Postural control
  - Motor control – force, direction, timing of movement
  - Motor Imitation
  - Motor Planning



# Motor Planning Deficits in Children with ASD

- Has trouble figuring out how to use a spoon
  - Can't get the spoon to the mouth without spilling
  - Holds object so tightly that it is difficult to use
  - Holds object so loosely that it is difficult to use
- Has trouble learning to dress himself
  - Learning how to don a jacket has to be the same each time
- Has trouble climbing in and out of the car seat
  - Difficulty seating self on the seat – turning / overshooting
  - After repeated practice can seat self

# Motor Planning Deficits

Forti et al 2011

- Preschoolers with ASD with typical cognition compared to age matched peers – placement FM task
  - Deficits in velocity changes
  - Deficits in moving directly to target (spatial control)

# Motor Planning deficits

Ecker and Parham 2010

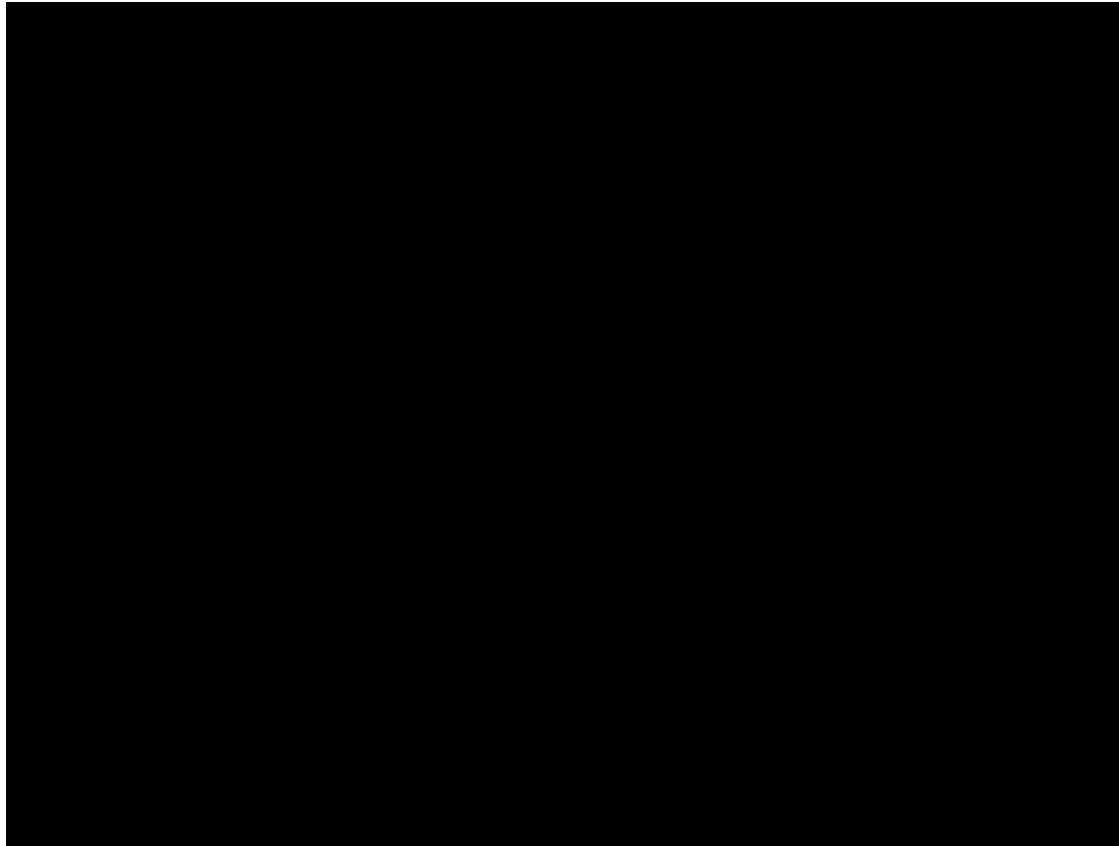
- Shows poor coordination and appears to be clumsy
- Has trouble grading movement – either using too much force or too little force to complete an action
- Tends to play the same activities over and over rather than shift to new activities
- Has trouble coming up with new ideas during play

# Motor Planning Deficits

Ecker and Parham 2010

- Has trouble figuring out how to carry multiple objects at the same time
- Seems confused about how to put away materials/toys in their correct places – and when learned – will do it the same way every time
- Becomes confused about the sequence of actions
- Fails to complete tasks with multiple steps
- Has difficulty imitating demonstrated actions, such as movement to songs or games with motions
- <https://www.youtube.com/watch?v=SH0VIYNIuHw>

# Visual Supports for Children with ASD



<https://www.youtube.com/watch?v=SH0VIYNIuHw>

# Impact Continued...

## What do you see in the Classroom?

- Needs extra/excessive practice to gain skills
- Inconsistency
- See skills spontaneously but not on command
- Has to *think* about how to move
- Too much or too little force
- Too fast or too slow
- Have to look to see how they're moving
- Clumsy, awkward
- Trips or falls when walking or running – long after peers have become more stable

# What do you see in the Classroom?

- Frequently bump into objects and people accidentally
- Have difficulty learning to go up and down stairs, and may be frightened
- Difficulty printing or writing
- Poor articulation
- Difficulty eating and forming speech sounds



# How does it feel?

Imagine if...

- You could see obstacles in your way, but you could not make your body move to avoid them.
- You felt like you were sitting on a block of ice, could no longer sense where you were sitting, and fell off of your chair repeatedly.
- You tried to drink a cup of water from a paper cup, only you couldn't tell how hard to squeeze it to hold onto it. You squeezed it too hard and the water spilled all over you. The next time you didn't squeeze it hard enough and it fell right through your hands and onto the floor.

# What do you see in the Classroom?

- Crave the familiar and stick to routines
- Low self esteem
- Shut down or avoidance
- Verbal strategies to avoid or distract

# Motor Planning Deficits

Gowen & Hamilton, 2012

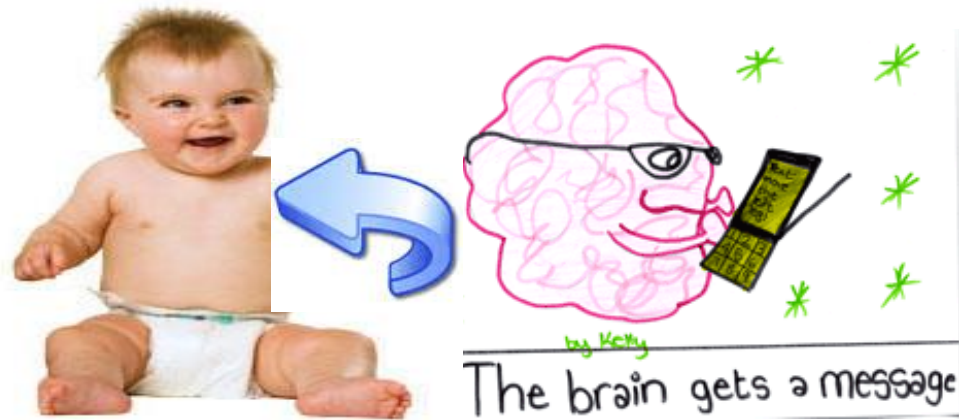
- Motor skills do not become automatic. The shift from needing to pay attention to what you are doing to the task being fairly automatic requiring minimal attention *takes longer or does not happen*
- Poor integration of information for efficient motor planning
- Increased variability in basic sensory inputs and motor outputs

## Trouble can show up at any or all stages of praxis:

- Coming up with an idea of what to do (repetitive play, restricted play)
- Planning and organizing what the body needs to do
- How to sequence and execute movements
- Remembering results of past experiences
- Motor planning problems: active, conscious, frustrating

# Motor Planning and Learning

- Ever hear a parent say: My child has selective hearing? Or he does things when he wants to? She is just being stubborn-I have seen her do it before?
- Children diagnosed with ASD may seem to ignore directions given to them, but they are most likely not doing the requested activity because it is **QUITE DIFFICULT** for them. They have trouble getting the message from their brains to their bodies to perform the requested activity.



# Motor Planning and Learning

- Having the cognitive skills vs. being able to demonstrate it
- For example, doing a math problem in class
- Getting out your pen and paper
- Finding the problem on the board
- Attending to the teacher's voice
- Locating where to write your answer on the paper
- Remembering all the numbers
- Working through the problem to get the answer

# How to support Learning

- To teach motor planning the child may need 1:1 attention
- Teaching a child with these difficulties may require a lot of patience
- Teaching social skills may include motor awareness.
- Consider how gymnastics, karate, or swimming can give a child practice learning new motor activities, but can also improve his ability to organize, complete academic activities, and even socialize with other children.



# Learning Through Play

Think about the skills you need to play cars with a peer....

- Orchestrate your body to sit down
- Ability to establish eye contact
- Ability to understand the social exchange
- Imitate gross motor movements
- Appropriately manipulate toys

# School based Play and Recess activities

- For school aged children social communication can often be practiced during school yard activities. These activities usually require proficient motor skills to be successful (Berkley, Zittel, et al., 2001)
- Motor skill deficits are common in school ages children with ASD and may effect opportunities to practice social communication.

# Being SOCIAL THROUGH PLAY

- So if a child cannot keep up the other kids due to motor planning deficits; moving through the crowds of kids and play equipment at recess... they may experience:
- Difficulties with self-esteem
- Demonstrate behavioral issues
- Increased difficulties with socialization
- Increased isolation and repetitive behaviors

# Motor Planning and social interactions

To gain another attention you need to:

- Establish eye contact
- Follow simple directions
- Spontaneously request

To take turns.....

You need the same skills

# Integrating motor skills and socialization

- So if a favorable environment is provided ASD difficulties such as peer relationships can be improved
- So teaching functional motor skills to children with ASD → optimal environment → practice social skills during physical play → Increased social success
- More research is needed in this area to develop programs that support both

# A child who goes to school then comes home.....

- Possibly is frustrated from school
- Then again it is time to string together steps to get through your evening routine
- How many steps to brush your teeth???
- Go to the bathroom → get out your toothbrush → turn on the water → turn off the water → grab the toothpaste → squeeze it on → brush → spit → clean up (9 steps)
- And the night time routine is just beginning and who is there the whole way.....PARENTS

# Effects on Parent child relationship



<https://www.youtube.com/watch?v=3g5YbibjJ7Q>



# Developmental Perspective

- Small differences in early motor development are one of the essential factors that effect early social development of toddlers with ASD. (Bhat, et al. 2011)
- Motor skills and social impairment are still interrelated in older children with ASD.



# Increasing understanding and support

## One Mother's Story:

- Mother was an amateur triathlete and business executive and had been impatient with her daughter since birth.
- She believed her daughter could do more or better “if she just put her mind to it.”
- Her perspective and approach to challenges shifted as she began to understand her daughter's abilities
- She began to understand that her daughter's struggles were beyond her daughter's control and her daughter deserved help. The mother's annoyance shifted to supporting daughter's efforts and nurturing her self-esteem.
- (Miller, Sensational Kids, 2006)
- Calling for support in the home

# Impacts of motor planning on oral motor development and communication



<https://www.youtube.com/watch?v=BuZMQiuu7nc>

# Oral Planning in ASD



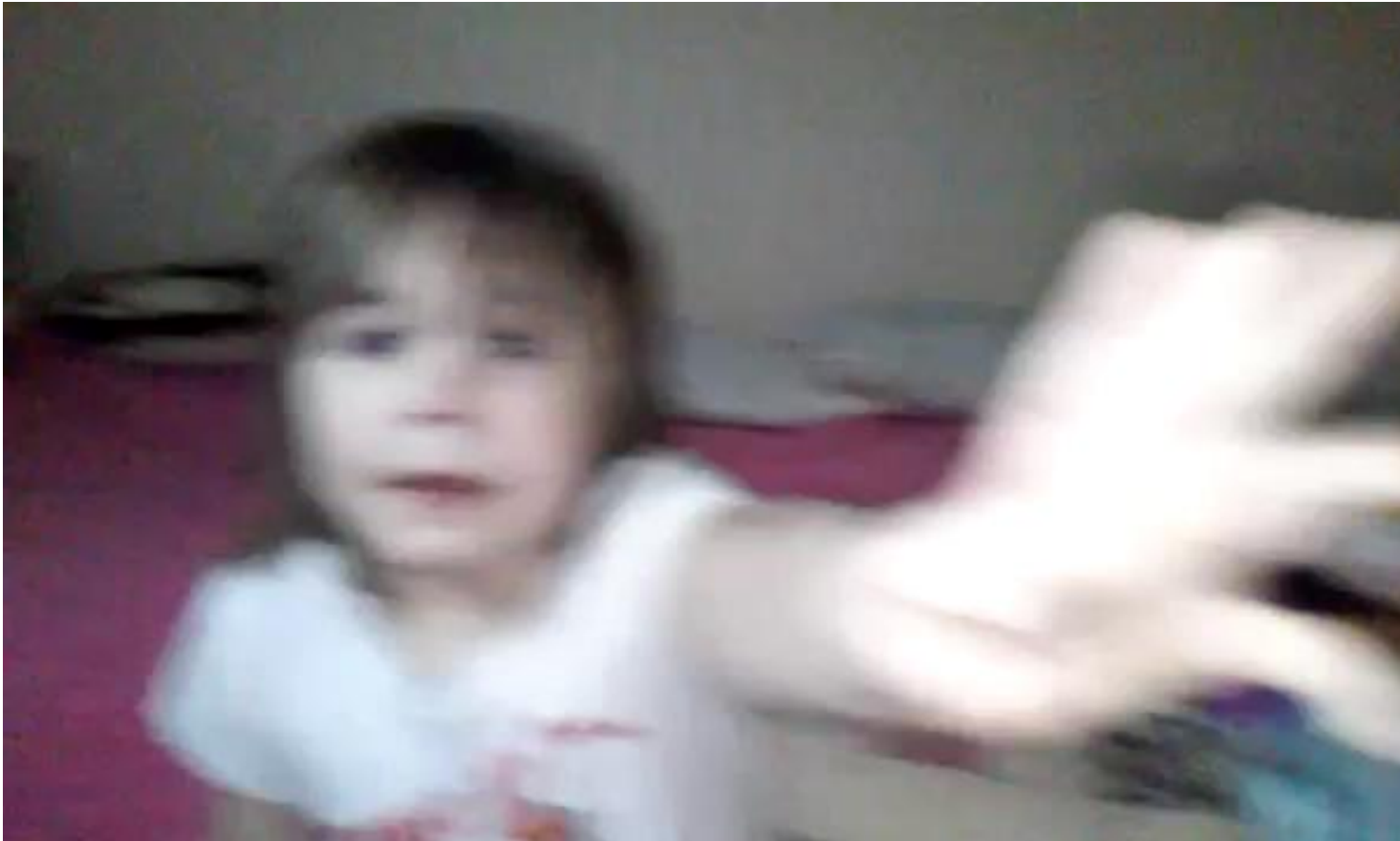
- Poor oral-facial imitation
  - Children with ASD have significantly reduced oral-facial imitation. Rogers et al. (2003) said that “lack of social cooperation did not account for their poor performance” (p. 763).

# Oral Planning in ASD

- Reduced oral movement and complex syllable production
- Increased oral scanning/groping
- Reduced ability to isolate oral movement from other movements
- Try These Three Times Fast:
  - “Toy boat”
  - “People pledging plenty of pennies”
  - “Pad kid poured curd, pulled cod”

# Motor Planning Impact on Language

- Manual forms of communication (e.g., signs, gestures, exchange systems, etc.) may be more difficult



<https://www.youtube.com/watch?v=izNjpkI3dJE>



# Motor Planning Impacts on Language

- Assessment of receptive language (e.g., pointing to pictures, showing what is known) may be impacted

**Preschool  
Language Scales  
(5th Edition)  
Jane, 4 yrs 4 mo**

<https://www.youtube.com/watch?v=oA5bkoY2H7o>



# Motor Planning Building Language

- Verbal imitation deficits in ASD can impact language development



<https://www.youtube.com/watch?v=vQ64R0KKssc>

# Where does Sensory fit in?

- Problems with sensory processing can lead to motor planning difficulties. To move efficiently and effortlessly, a child must be able to register, interpret and organize sensory input from his body.
- Motor planning is dependent upon unconscious body sensations.
- If a child does not receive accurate information from his senses, the result is abnormal motor output with abnormal feedback.

# Understanding Underlying Sensory Components of Motor Planning



# What do we see in children with ASD?

- Children with autism and sensory processing differences have difficulty registering and/or processing sensory information that is crucial for motor planning.
- They do not learn new motor skills in the same way as typically developing children. They often need support and additional practice when learning a new skill.
- A variety of mechanisms have been proposed to account for the motor functioning differences observed in individuals with ASD, including impaired sensory input and impaired multisensory integration.



## Body Senses

# Sensory Foundation



# Activities to Work on Improving Motor Planning Skills

Emerging evidence for use of individualized approaches emphasizing motor control and repetition to treat gross motor deficits in children with ASD.

Bhat, et. al, (2011), Johnston (2009)



# Activity Ideas



<https://www.youtube.com/watch?v=JSbD9vwVJoQ>



# General treatment strategies

- Hand-over-hand assistance (or hand-under-hand)
- Physically help with the first step and then coach through with the rest of the steps (brief physical assistance, verbal cues, demonstration, refer to model). Fade any physical cues.
- Break down multi-step tasks
- Use pictures or video to help sequence through a multi-step task
- Slow down
- Use simple language
- Wait time

# General treatment strategies

- Use visual cues – shapes taped to floor, lines to walk
- Talk with your therapists about using weighted items
- Keep classroom arrangement consistent
- Supportive seating for fine motor
- Let other children go first and model
- Practice in context – practice in empty classroom, playground
- Generalize to new playground with same equipment

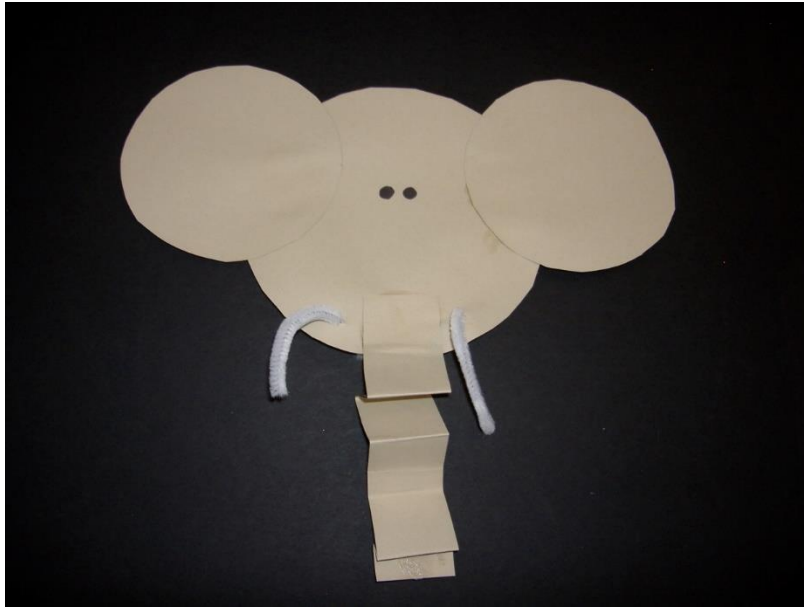
# General treatment strategies

- Give one direction at a time (complete step) then give next direction
- Give specific feedback (beyond, “Good job!”)
- Repetition and extra opportunities to practice
- Teach what seems to be the same skill across contexts (e.g. pull up pants and pull up socks)
- Depending on language skills, talk through the steps and have child tell you what’s next
- Short tasks to ensure success
- Check off list (pictures)
- Motivation and meaning!

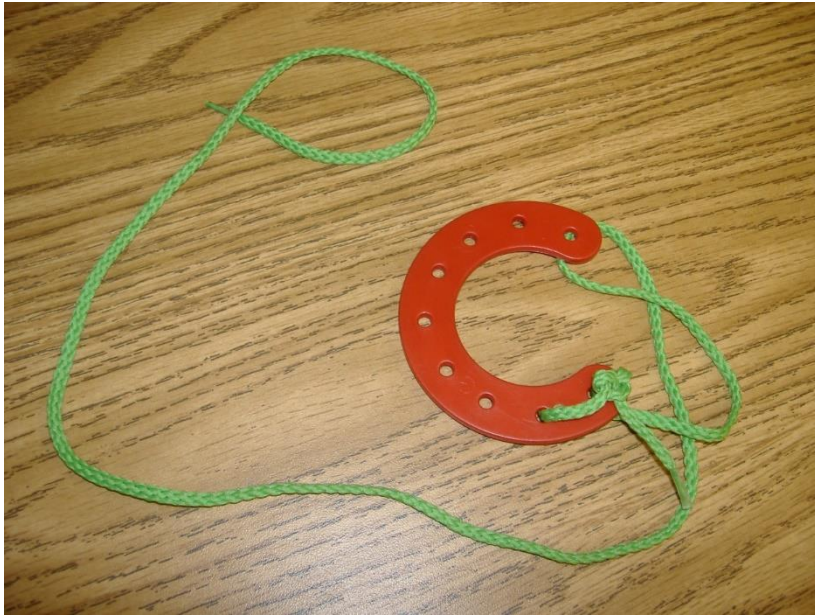
# Accommodations

- Cut out table and chair
- Support feet
- Chairs with arms or sides
- Allow frequent position changes – stand, kneel, lie on tummy





Back and forth folding, shape placement,  
threading pipe cleaner through holes.  
Craft assembly challenges a child's ability to  
develop strategies for organizing as they relate  
parts to the whole.







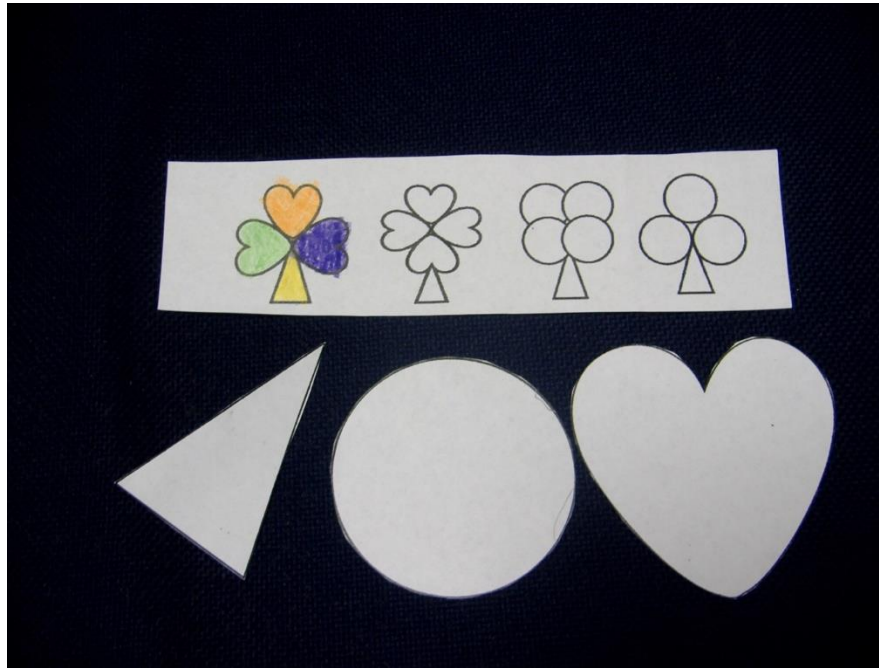
Sort by size, shape, color or make a pattern.



Match clothespins to  
color or shape.  
Orient pegs.



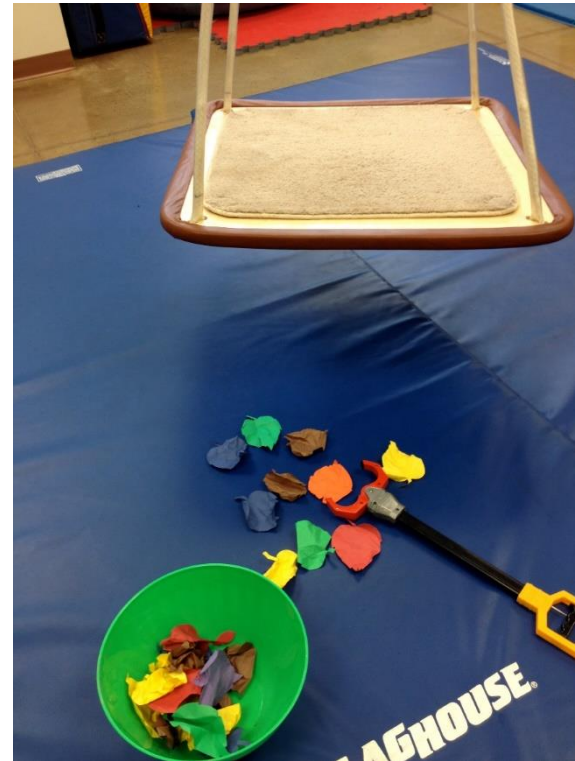




Choose shapes, make a plan.  
Arrange shapes & compare to model.











## How to I maintain order?

- Try it out first!
- Consistent routine
- Beginning, middle, end rituals
- Spot markers
- Timer, flip lights or use music cues
- Have a related activity for those who finish early





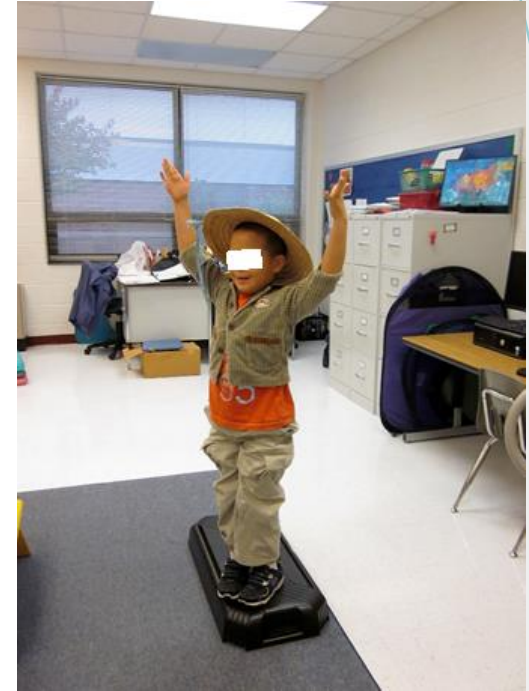
Built it together to improve planning.  
Try barefoot, inside, outside.





# Scarecrow Dress-up Group





# Yoga for Kids

<http://www.namastekid.com/learn/kids-yoga-poses/>

<http://www.kidsyogastories.com/kids-yoga-poses/>

<http://www.joyfulbirthbaby.com/yoga-poster-for-kids/>



# Put out the Fire!

*Put Out The Fire!*  
*Sidewalk Chalk Fun and Games*  
*www.YourTherapySource.com*

- <https://www.youtube.com/watch?v=3GpwsamlyuQ>

# Motor Activities with Tape



<https://www.youtube.com/watch?v=eVaeaZEgDhc>

# Musical Magnet Maze

## **Musical Magnetic Mazes**

**YourTherapySource.com**

- <https://www.youtube.com/watch?v=BwfzVXyrr7w>



# Rhythmic Timing – who is struggling?

Rhythmic Timing Activities

YourTherapySource.com

- <https://www.youtube.com/watch?v=qTz90L0pWJ8#>

# Motor Planning with Pool Noodles



<https://www.youtube.com/watch?v=-7xpV-RIQtQ>



# Questions / Reflections

- Contact information
- ECEP
- <http://www.cdd.unm.edu/ecep>
  
- CDD information network
  - <http://www.cdd.unm.edu/infonet>

# Bibliography

- Baranek, G. T. (2002). Efficacy of sensory and motor interventions for children with autism. *Journal of autism and developmental disorders*, 32(5), 397-422.
- Bhat AN, Landa RJ , Galloway JC. (2011). Current perspectives on motor functioning in infants, children, and adults with autism spectrum disorders. *Physical Therapy*, 91 (7), 1116-1129.
- Biel, Lindsey & Peske, Nancy. (2009). *Raising a Sensory Smart Child*. New York, NY: Penguin.
- Bissell, J., Fisher, J., Owens, C. and Polcyn, P. (1993) *Sensory Motor Handbook*. Torrance, CA: Sensory Integration International.

# Bibliography

- Eker, C. & Parham, D. (2010). *Sensory Processing Measure-Preschool*. Western Psychological Services.
- Fournier, K. A., Hass, C. J., Naik, S. K., Lodha, N., & Cauraugh, J. H. (2010). Motor coordination in autism spectrum disorders: a synthesis and meta-analysis. *Journal of autism and developmental disorders, 40*(10), 1227-1240.
- Forti, Sara, Valli, Angela, Perego, Paolo, Nobile, Maria, Crippa, Alessandrea, & Molteni, Massimo. (2011). Motor planning and control in autism. A kinematic analysis of preschool children. *Research in Autism Spectrum Disorders, 5*(2), 834-842.
- Gernsbacher, M. A., Sauer, E. A., Geye, H. M., Schweigert, E. K., & Hill Goldsmith, H. (2008). Infant and toddler oral-and manual-motor skills predict later speech fluency in autism. *Journal of Child Psychology and Psychiatry, 49*(1), 43-50.

# Bibliography

- Gowen, E., Hamilton, A. (2013). Motor Abilities in Autism: A Review Using a Computational Context. *Journal of Developmental Disorders*, 43, 323-344.
- Hirata, S., Okuzumi, H., Kitajima, Y., Hosobuschi, T., Nakai, A., Kokubun, M. (2014). Relationship between motor skill and social impairment in children with autism spectrum disorders. *International Journal of Developmental Disabilities*, 60 (4), 251-256.
- Infant and Toddler Curriculum. (1999). *Eden Family of Services: Infant and Toddler*. West Windsor, NJ: Eden Institute, Inc.
- Johnston, Michael V., (2009). Plasticity in the Developing Brain: Implications for Rehabilitation. *Developmental Disabilities*. 15(2), 94-101.

# Bibliography

- MacDonald, M., Lord, C., Ulrich, D. (2013). The Relationship of Motor Skills and Social Communicative Skills in School-Aged Children with Autism Spectrum Disorder. *Applied Physical Activity Quarterly*, 30, 271-282.
- Miller, L.J. (2006). *Sensational Kids: Hope and Help for Children with Sensory Processing Disorder (SPD)*. London, England: Penguin Books.
- Pennisi, P., Tonacci, A., Tartarisco, G., Billeci, L., Gangemi, S. & Pioggia, G. (2016). Autism and Social Robotics: A Systematic Review. *Autism Research*, 9, 165-183.
- Stock Kranowicz, Carol. (1998) *The Out-of-Sync Child*. New York, NY: Skylight Press.

# Bibliography

- Stock Kranowicz, Carol. (2003) *The Out-of-Sync Child has Fun*. New Yourk, NY: Perigree.
- Kranowicz, Carol & Newman, Joye. (2010) *Growing an In-Sync Child*. New York, NY: Perigree.
- Williams, J. H.G (2008). Self-Other Relations in Social Development and Autism: Multiple Roles for Mirror Neurons and Other Brain Bases. *Autism Research*, 1(2), 73-90.
- Williams, Mary Sue and Shellenberger, Sherry. (1996) *How Does Your Engine Run? A Leader's Guide to the Alert Program for Self-Regulation*. Albuquerque, NM: Therapy Works, Inc.
- Rogers, S. J., Hepburn, S. L., Stackhouse, T., & Wehner, E. (2003). Imitation performance in toddlers with autism and those with other developmental disorders. *Journal of child psychology and psychiatry*, 44(5), 763-781.

# Websites

- <http://www.autism-programs.com/articles-on-autism/dyspraxia-movement-difficulties-in-children.htm>
- <http://handsonaswegrow.com/gross-motor-activities-preschoolers/>
- <http://idoinautismland.com/>
- <http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=7402644&fileId=S0140525X00081504>
- <http://www.joyfulbirthbaby.com/yoga-poster-for-kids/>
- <http://www.kidsyogastories.com/kids-yoga-poses/>
- <http://www.namastekid.com/learn/kids-yoga-poses/>
- <http://theinspiredtreehouse.com>
- <http://www.sensory-processing-disorder.com>
- <http://www.SPDFoundation.net>
- <http://yourtherapysource.com>