

# Food for Thought: Preparing the Brain to Eat New Foods through “Messy” Play

L. Bernabeo, T. Loftus

**Abstract**—Many children often experience phases of picky eating, food aversions and/or avoidance. For families with children who have special needs, these experiences are often exacerbated, which can lead to feelings that negatively impact a caregiver's relationship with their child. Within the scope of speech language pathology practice, knowledge of both emotional and feeding development is key. This paper will explore the significance of “messy play” within typical feeding development, and the challenges that may arise if a child does not have the opportunity to engage in this type of exploratory play. This paper will consider several contributing factors that can result in a “picky eater.” Further, research has shown that individuals with special needs, including autism, possess a neurological makeup that differs from that of a typical individual. Because autism is a disorder of relating and communicating due to differences in the limbic system, an individual with special needs may respond to a typical feeding experience as if it is a traumatic event. As a result, broadening one's dietary repertoire may seem to be an insurmountable challenge. This paper suggests that introducing new foods through exploratory play can help broaden and strengthen diets, as well as improve the feeding experience, of individuals with autism. The DIRFloortime® methodology stresses the importance of following a child's lead. Within this developmental model, there is a special focus on a person's individual differences, including the unique way they process the world around them, as well as the significance of therapy occurring within the context of a strong and motivating relationship. Using this child-centered approach, we can support our children in expanding their diets, while simultaneously building upon their cognitive and creative development through playful and respectful interactions that include exposure to foods that differ in color, texture, and smell. Further, this paper explores the importance of exploration, self-feeding and messy play on brain development, both in the context of typically developing individuals and those with disordered development.

**Keywords**—Autism, development, exploration, feeding, play.

## I. INTRODUCTION

MANY typically developing children often experience phases of picky eating or avoidance. Introducing new foods can become a battle at home, as parents feel pressured to provide their children with a healthy and balanced meal. As a result, mealtime can often become a negative and avoided event. For families with children who have special needs, these experiences are often exacerbated, which can lead to feelings of guilt, anger, and disappointment, and can negatively impact a caregiver's relationship with their child. Within the scope of practice in the area of speech language

pathology, knowledge of both emotional and feeding development is key.

For the first six months of life within typical development, babies get all their nutrition from milk or infant formula, which is full of easily digested nutrients. However, between six months and a year of age, children's diets begin to expand in order to provide them with additional nutrients required for growth and development. During this time, children benefit from time and space to acclimate to the textures and tastes of foods in order for their bodies to adjust.

Oral motor skills for the purpose of feeding develop progressively and are not initially driven solely by hunger. Research across the feeding spectrum [1] shows that there can be as many as 28 steps in the pre-feeding process. While children are developing these oral motor skills, they are simultaneously acquiring gross motor skills that are closely correlated and also play an essential role in feeding development. Since children are acquiring many skills at the same time, their movements may not always appear organized. Between birth and four months, the typical infant develops head control as they learn to use a suckle to drink liquids. The suckle eventually leads to the suck, at which time an infant's ability to grasp is also developing. It is also around this time in typical development that we see babies begin to develop the necessary core strength to be able to sit independently, which is the foundation for spoon feeding. This is where we observe children bringing their hands to midline and engaging in hand-to-mouth play, with both edible and non-edible items. This is significant for children because it allows them to explore new textures with their hands before bringing them to their mouths. Around seven months, babies are beginning to crawl. This allows for them to be able to pull themselves up. As babies become more mobile, they move about their environments, exploring various textures such as wood floors, carpets, grass, and blankets. This is often one of a child's first experiences with different types of textures, which is incredibly important for development. It is around this time that mashed solids and soft chewable foods are introduced, which are manipulated in the mouth with the tongue and jaw moving up and down together with limited disassociation (i.e. munching). As children begin to cruise, they are simultaneously developing a vertical chew with more control as they explore soft meltable foods. Between the ages of 12 to 36 months, as children become proficient walkers, they are developing the ability to utilize a mature, rotary chew in which the jaw is moving semi-circularly as they explore a full range of textures [1]. Not all children acquire skills at the same pace, nor do they learn to eat in the same way. Many children with special needs do not

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have these experiences all together due to constrictions within neurological and biological development.

Data collection of these milestones does not always take into account qualitative measures such as pleasure, joy, discomfort, or frustration. It is difficult to look at the development of feeding skills without also considering social-emotional growth. Since the founding of Rebecca School in 2006, its staff has sought to expose its students to more meaningful opportunities in the world around them, while considering each individual's thoughts, ideas, and passions. The school utilizes the DIRFloortime® model, developed by Dr. Stanley Greenspan, [2] to meet each student where they are functioning developmentally while considering their individual differences. By building meaningful and trusting relationships with students, we support their ideas and communication through play-based interactions and project-based learning. The DIRFloortime® model focuses on building healthy foundations for social, emotional, and intellectual capacities that foster children's critical thinking, rather than encouraging rote tasks. The model is used to support the understanding of positive development in all children. In addition, it is commonly utilized as a framework for children with various neuro-developmental delays, including Autism Spectrum Disorders (ASD).

Autism is a disorder involving difficulties in relating, communicating and thinking. Not every child with this diagnosis displays the same deficits. Just as each typical person's biology is unique, so is an individual with ASD. Differences in sensory modulation, language skills, motor skills and social-emotional skills, as well as how they are integrated, are often the most common variables. The biological side of autism is not expressed in a global autistic pattern, but through the individual ways children react to and comprehend the various sights, sounds, touches and movement patterns in their environment, along with the ways they plan their actions. Working with the underlying processing differences can influence much of the child's behavior and help him or her interact across a broader range of contexts and situations, rather than developing isolated cognitive skills or behavior [2], [3].

Because children expand their interests through communication with others, an individual with ASD may possess a narrow range of interests, due to challenges within social interactions. ASD should be viewed as a dynamic disorder; traits such as emotions and feelings are changeable with the right treatment plan. The DIRFloortime® model is not a single therapy or intervention program; it is a solid understanding of each child's uniqueness, after which a thoughtful and comprehensive treatment plan can be designed. Using relationships, therapists tailor an interaction or activity to the child's nervous system, building spontaneity and harnessing interests. Therapists are demonstrating that interactions geared to a child's unique neurological profile can help the child relate, think and communicate [2], [3].

The methodology examines the Development, Individual-differences and Relationships of a child as a whole.

Development, including the milestones mentioned earlier, describes the developmental continuum of skills that an individual progresses through as each skill builds on what came before. Individual differences refer to the unique ways each person processes, responds to, and comprehends the world around them. And Relationship is harnessing the affectively charged, emotionally meaningful ways that people relate to others. When utilized in practice, it is referred to as Floortime®, which is the intervention used to promote an individual's development through a respectful, joyful, and engaging process. Within this model, the focus is on following the child's lead and joining what interests them, as well as providing them with what they need to progress developmentally. Speech-language pathologists working within this child-lead model utilize this framework within their practice, including when introducing new foods and textures to our students [2], [3].

Greenspan writes "mastering new challenges is not always easy for children with ASD (or for any children). In particular, mastering bodily functions such as eating new foods, using the toilet and dressing themselves can be especially difficult for children with ASD and other developmental challenges because often they do not feel fully in control of their bodies. They may have motor planning problems or overreact to tastes and sensations, and they may fear activities relating to their bodies because of the lack of control they feel" [3]. The goal for all new situations, including trying new foods, is to see the child take charge, think and problem solve with greater independence. When the child is able to take charge, it is no longer a power struggle. A trusted adult can empathize with the child's positive feelings about having the foods they want, as well as how hard it is to try something new. Maybe it is scary or surprising; whatever the experiences is, the therapist is providing empathetic affect and language. Then, the adult and child can begin to problem solve together, breaking down the challenge into smaller steps, making it less daunting to accomplish the task of eating a new or less familiar food [3].

There are a plethora of reasons children are "picky eaters" and many etiologies are strongly connected to the brain. Research has shown "there is a strong connection between gut health and the brain" [4]. There appears to be an increased prevalence of gut issues in individuals with autism and other developmental delays, which often leads to a limited diet. It is important that we explore the possibility that what is happening in our children's guts may be connected to their picky eating habits and desire to try new foods. The gut-brain connection refers to the physical and chemical connections between the gut and brain where neurotransmitters and other chemicals produced in the gut also affect the brain. By altering the types of bacteria in the gut, it may be possible to improve brain health. In addition, various underlying conditions such as reflux, constipation, respiratory issues, and low muscle tone can cause feeding challenges that have a negative impact on a child's overall feeding experience. Often, these issues can be resolved early in a child's development but in many cases, these feeding and swallowing difficulties continue to perpetuate. This leads to a dietary repertoire that is limited to

foods that a child's oral cavity can acclimate, tolerate, manipulate, chew, and swallow.

Within typical development, children utilize their senses to explore new mediums through messy play, which has a tremendous effect on their cognitive and creative development. The word "messy" often has a negative connotation, leaving its value to be underutilized. Children are utilizing their creativity when they use material in new ways, combining previously unconnected materials (i.e., lemons and cornstarch) and making discoveries that are new to them (i.e., lemon slime). Messy play often promotes a shift of focus from making or producing something to allowing a child to simply explore and be present. It promotes curiosity in our students by harnessing their desire to explore. By giving our students the opportunity to participate in messy play, we give them the opportunity to explore materials fully. Duffy writes, "There is a strong link between the process involved in messy play and Piaget's concept of cognitive disequilibrium. Cognitive disequilibrium is when thinking has to change to incorporate new information. Children's interpretation of the world is challenged when they take on new information and find that they now have two contradictory view of the same event" [5]. Additionally, allowing children to explore mediums in this way can be done through less structured activities, while also providing children with respectful and safe boundaries. If the adults are well prepared and actively supporting the children, it can be an enjoyable experience for everyone involved. Messy play also brings benefits to a child's speech and language development. Engaging in this type of play requires minimal verbal language and children of all abilities can join in without pressure. Children learn to share space and communicate, through both verbal and nonverbal means, such as utilizing eye gaze, gestures, and increased body proximity. Moreover, there is no "right" or "wrong" way to participate, which can help build a child's confidence and self-esteem in peer relationships.

Children show readiness to eat solids at different stages; however, most babies begin in the same way--by exploring foods via messy play. According to Delaware and McNamee, "to be a competent eater, your child must be allowed to get messy. Sensory play and getting messy teaches the nervous system about the feel, texture and temperature of foods." They go on to say that "by allowing a child to listen to their body, you let her physiological cues - not outside influences - determine what and how much to eat" [6], [7].

Research shows that children with special needs, including autism, have a different neurological makeup than typically developing children. Some differences include increased brain volume, a difference in "mirror neurons," a tendency to overreact to objects, hyperemotionality, hyperorality (a tendency to investigate all objects with their mouth, including those that are inedible), agnosia (the inability to recognize faces), and notable differences in the limbic system, especially in the amygdala, which is the area of the brain associated with social processing or visceral responses [8]. Many children with special needs experience changes in regulation around food, which may be exhibited in a "fight or flight" response.

As a result, "normal" events may be perceived as traumatic due to neurologic vulnerabilities [9], [10]. The amygdala is popularly associated with this response in perceived dangerous situations, as well as emotional behavior and food intake [11]. It also is associated with other characteristics of autism, such as one's ability to identify faces and situations, as well as evaluating emotions. Misfires can occur and are often associated with sensory processing disorders.

Another way all individuals differ is in their sense of taste, otherwise known as the gustatory system. This system relates to the smell, texture, look and feel of foods and is inherently multi-sensory [12]. Similar to how the brain processes sounds, it processes information along the gustatory pathway via the insular cortex which is not context-dependent. For example, if you once gagged on a food after eating it, you are not like to eat that food later. This is called conditioned taste aversion [12], [13], and it is a survival mechanism that trains the body to avoid substances that cause harm. According to Kaye, "this shows there is not just a wire from the tongue to the brain [telling us what a taste is]. It is modulated all over the place based on expectations and experiences. If it was simply what goes on the tongue, then expectations [of taste] wouldn't matter" [10]. Moreover, the insular cortex is connected to the limbic system, which includes the amygdala. When gustatory messages arrive here, we experience pleasant or unpleasant feeling and memories, thus we eat foods that bring us pleasure and avoid certain foods. As individuals differ, so do these responses. Moreover, to our brains, taste is a fusion of smell, touch, texture and odor in a single sensation and causes a physical and chemical interaction in the mouth [14]. Preferences for certain tastes can either be innate or learned. The learned preferences depend on the consequences of eating foods, and whether one finds it to be pleasurable or unpleasurable. The natural response is to reject what we find unpleasurable. This can occur immediately by vomiting or later once the body begins to digest the food. Therefore, one single bad experience with a food can cause an extreme aversion [13].

## II. PROFESSIONAL EXPERIENCE

As DIRFloortime® trained speech-language pathologists, a large focus of therapy is encouraging clients and students to explore new foods using all five senses, thus giving their brains opportunities to process information before bringing it to their mouths. *What will it taste like? Will it need to be chewed?* Through exploration and play, a safe and fun environment to learn is created. In order to develop a well-rounded diet, children must experience food from a multi-sensory point of view. At Rebecca School, children are encouraged to be a part of the food preparation process. This provides therapists with an opportunity to notice patterns "picky eaters" may follow, including food aversions. Children that avoid foods of certain colors or textures help provide crucial information on how to prepare an appropriate plan of care.

Rather than focusing on getting children to consume foods,

the work is centered around sensory play and exploration as a means of creating new pleasurable experiences around food. By creating positive experiences with food, the hope is to create new neural pathways that promote positive interactions with new textures. This is done through the presentation of edible items in a playful, non-threatening manner. It is incredibly important that when engaging in sensory exploration, one is using edible items, as it is the natural progression of development which dictates that babies put objects/items in their mouths in order to gain more information about that object/item. As students explore new textures, they are able to take the next developmental step of bringing those objects, the foods presented, to their mouths rather than being discouraged when the items are inedible.

When students are allowed to engage in sensory play with foods, such as painting with applesauce or exploring mashed peas, they are more likely to tolerate, smell, lick, or taste the foods after just a few sessions. Children who were once avoidant of unfamiliar and less preferred foods are now sharing space and interacting with foods that vary in smell, color, taste, and temperature. In conjunction with the playful and respectful methodology of the Floortime® practice, the focus is on providing the student or client with joyful and positive experiences that allow the brain to make new neurological connections. These emotionally meaningful experiences rewire the brain to create new positive connections, thus preparing the brain to anticipate eating new foods as low pressure response situations. Tortora, clinical director of the Rebecca School states, “What’s the difference between “ready set go” and “ready set Oooooh”? Answer: The way our brain processes the environment. Our lower brain and brainstem house our survival skills: fight, flight, freeze. When our bodies cannot anticipate and predict that our world is safe through the sensory systems our brains tell us to react instead GO. This may be dangerous, scary, not safe, GO get out of here, fight back, or freeze. However, when the body is able to process sensory information then we can think, “Oooh I wonder what that is, I’m going to explore” [15].

Typically, messy play takes place as a semi-structured activity where the members of a group all have a shared responsibility. The adults provide respectful and safe boundaries while supporting their feeding and language development. Again, engaging in this type of play requires minimal verbal language. Children can be “wooded” into joining via affect, sounds, intonation, gestures, and increased body proximity [16]. Foods are typically first presented in whole form, such as a whole pumpkin. Through the use of high affect and a sense of anticipation, the goal is to create a shared social experience that students want to be a part of. By providing students the opportunity to touch the pumpkin, describe how it looks and feels, and share their guesses of what it may look like on the inside, higher level thinking is being promoted. Following the initial exploration, the pumpkin may be carved or cut it into chunks and pureed; during which each student will have the opportunity to use the blender to create a sticky puree. Many students tend to spend their time on the periphery of the space during these activities,

which may be due to a combination of their individual sensory systems and food aversions. However, sharing space during these times can be beneficial, as they are simply being exposed to the sights and smells of less familiar foods. It is imperative to recognize each individual student works at their own developmental pace, and the time and space should be allowed to further explore foods when they are ready to do so [17].

Once the student is ready to approach the food, they are gently encouraged to get “messy” through adult and peer modeling, as well as through affective means. Some children display a readiness to explore by touching with their whole hands with minimal support, while others benefit from verbal encouragement and the option to touch the food wearing a rubber glove or through a plastic bag. When a student increases his or her comfort level to the point where they are able to lick or taste a food, they are provided with celebratory affect, as well as intrinsically rewarded through feeling positively about themselves and what they have accomplished.

Prior to sessions, during the planning stage, therapists and caregivers can select foods that possess a similar element to a food that is already in a child’s repertoire. For example, if a child eats bread, chicken nuggets and French fries, beginning with something similar in texture such as sweet potatoes, or similar in color such as hummus, helps to slowly increase a child’s comfort level around new foods. Changing more than one element might be jarring for a child with picky eating habits. Caregivers are encouraged to utilize leftover foods from dinner, as these might be familiar and it saves on wasting foods. Of note, foods used are of minimal amounts and are shared by students. In addition, waste can be prevented by saving the foods over several sessions or days. By freezing pureed foods, the child will get the added benefit of the change in temperature as well as change the solid to liquid state during play.

One pillar of the DIRFloortime® approach is that each child is given the opportunity to grow and learn at their own pace. Often times, this is best seen in a group setting. Children are all working towards similar goals; however, they may not be on a similar pathway to meeting them. For example, some students may be working towards sharing space with new foods, with others are ready to touch new textures and bring it to their mouths. Even students who are not eating orally can participate and gain something from the experiences. Often times, children at these varying developmental levels serve as motivators for their peers throughout this enjoyable, cohesive group experience.

An integral piece of the program at Rebecca School is the emphasis on an interdisciplinary model. Students are supported by a team of professionals with various areas of expertise. In addition to speech and language therapists, the team includes special education teachers, occupational therapists, physical therapists, counselors, social workers, music therapists and the parents or caregiver. Advantages of this model include the collaborative input of the entire team. The speech and language therapists can model skills for others who have the opportunity to interact with the child, thus

allowing for carry over into different contexts, environments and relationships. Furthermore, each individual on the teams is given the opportunity to voice their ideas, comments and concerns within their specific field of knowledge while all are working towards a common goal.

### III. CONCLUSION

In conclusion, the opportunity to engage in “messy play” plays an important role within feeding development. Children benefit from exploring various textures in a playful, non-threatening manner as a means of increasing their familiarity with new foods and thus expanding upon their dietary repertoire. There are many underlying reasons that an individual may be characterized as a “picky eater”; including a history of reflux, constipation, respiratory challenges, and low muscle tone. There is often an increased prevalence of these issues in individuals with special needs, including autism. In addition, due to the differences in their neurological makeup, individuals with a diagnosis of autism and other neurodevelopmental delays may exhibit a “fight-or-flight” response before, during or after mealtime, which may result in their perceiving a typical feeding experience as a traumatic event. When provided with ample opportunities to explore various foods through multi-sensory modalities, children are able to create more pleasurable and positive experiences around food. To reiterate, within the playful and respectful methodology of the DIRFloortime® practice, the focus is on providing the student or client with joyful and positive experiences that allow the brain to make new neurological connections. These emotionally meaningful experiences rewire the brain to create new positive connections thus preparing the brain to anticipate eating new foods as low pressure response situations.

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### REFERENCES

- [1] Reva, J. (2018). *Key Elements of Picky Eaters: Feeding Assessment*.
- [2] Greenspan, S. I., & Lewis, N. B. (2000). *Building healthy minds: The six experiences that create intelligence and emotional growth in babies and young children*. Cambridge, MA: Perseus Pub.
- [3] Greenspan, S. I., & Wieder, S. (2009). *Engaging autism: Using the floortime approach to help children relate, communicate, and think*. Cambridge, MA: Da Capo Press
- [4] Allen, N. (2016). *Gut Instinct: Making the Connection between the Intestines & the Brain*.
- [5] Duffy, B. (2007). *All about...Messy Play*. Retrieved May 1, 2019, from [http://www.keap.org.uk/documents/eyfs\\_messyplay\\_bduffy.pdf](http://www.keap.org.uk/documents/eyfs_messyplay_bduffy.pdf)
- [6] Delaware, J. McNamee, M. and (2019). *Infant Feeding: The Baby-led Way*.
- [7] Delaware, & McNamee. (n.d.). *Get the expert feeding help you need for your family on your own time*. Retrieved February, 2019, from <http://www.feedinglittles.com/babies.html>.
- [8] S. Baron-Cohen, H.A. Ring, E.T. Bullmore, S. Wheelwright, C. Ashwin and S.C.R. Williams (2000). *The amygdala theory of autism*.

- Retrieved May 2019 from <https://www.uv.es/~olucha/aprendizaje/amygautis.pdf>.
- [9] Andrés Porges, S. W. (2011). *The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, and self-regulation*. New York: W.W. Norton.
- [10] Rosenberg, S. (2016). *Accessing the healing power of the vagus nerve: Self-help exercises for anxiety, depression, trauma, and autism*. Berkeley, CA: North Atlantic Books
- [11] Zhang, Q., Li, H. & Guo, F. Front. Biol. (2011) *Amygdala, an important regulator for food intake*. Front. Biol. 6: 82. <https://doi.org/10.1007/s11515-011-0950-z>
- [12] Edwards, Scott. P (2008). *Delicious! Disgusting! So Say Our Brains*. Retrieved May 2019 from <http://www.dana.org/Publications/Brainwork/Details.aspx?id=43717>
- [13] Molero-Chamizo et al. Effects of lesions in different nuclei of the amygdala on conditioned taste aversion, *Experimental Brain Research* (2017). DOI: 10.1007/s00221-017-5078-1
- [14] Admin. “How Does Food Texture Affect Taste? DuPont USA.” DuPont, 4 Aug. 2016, [www.dupont.com/corporate-functions/media-center/featured-stories/august-2016/food-texture-taste.html](http://www.dupont.com/corporate-functions/media-center/featured-stories/august-2016/food-texture-taste.html).
- [15] Personal interview (2019, May 5).
- [16] Rapley, G., & Murkett, T. (2011). *Baby-led weaning: The essential guide to introducing solid foods and helping your baby to grow up a happy and confident eater*. New York: Experiment.
- [17] Beckerleg, T. (2009). *Fun with messy play: Ideas and activities for children with special needs*. London: Jessica Kingsley.

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