# Uncommon Sense: Interactive Sensory toys that encourage Social Interaction among children with Autism

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## ABSTRACT

This paper explores the Design and Impact of the Uncommon Sense toys on children on the Autistic Spectrum. The Uncommon Sense toys are a set of Interactive Sensory toys designed to encourage Social and Collaborative play. It focuses on the development of the toys through a research study that is being conducted to evaluate their impact on children with Autism. The study examines how children with Autism learn to play, what motivates them and what developmental paths open up through play with these toys. We have observed that the Tangible Sensory feedback of the toys has facilitated the development of various play skills like Joint Attention, Imitation and Turn taking.

## Keywords

Interactive, Sensory, Toys, Autism, Design, Social Play, Impact Assessment

## **1. INTRODUCTION**

Autism is a developmental disorder that is characterised by impairments in Social Interaction. Communication and Restricted and Repetitive behaviour. Sensory Abnormalities are also common in autistics i.e. they are hyper or hypo sensitive to various stimuli. Autism is highly variable is and is therefore termed as a spectrum disorder. People with Autism, range from having severe impairments to high functioning individuals with mild deficits [1].

Play is a medium through which children explore and understand the world. It is often observed that children with Autism play in a repetitive way with a few toys; this restricts exploration. Autism affects the development of important skills needed for play, such as the ability to imitate simple actions, explore the environment, share objects and attention with others, respond to others, and take turns [2, 3]. Therefore although some children with Autism are inclined to play, they lack the skills and social understanding to involved in play.

Children with Autism experience the world differently and therefore play differently. They often enjoy sensory play like

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spinning wheels and turning switches on and off. The Causeeffect nature of such play gives them a sense of control [4]. The Uncommon Sense toys are shared objects that encourage children to interact with each other while engaging in sensory play. The toy's Multi-sensory feedback and Cause-effect behaviour motivates and reinforces Social Interaction.

# 2. BACKGROUND & RELATED WORK

Sensory Integration is the process by which the brain organizes sensory inputs and produces an appropriate bodily response [5]. Children with Autism are drawn to and benefit greatly from Sensory Integration activities. This approach rather than focusing on a particular skill, teaches the child how to filter and process information, which makes many tasks easier.

The MEDIATE environment explores the addition of interactivity to Sensory Integration equipment [6]. It was designed as a space for creative expression and exploration via three sensory channels: visual, aural and tactile. The Cause-effect behaviour empowers the child with a sense of control over their environment. Rolling Pins are sensory objects that can communicate with each other and output visual, auditory and tactile feedback. They were designed to build relationships between therapists and children with autism through sensory-motor interactions. Rolling Pins demonstrate that the reward associated with sensory activities can be used to encourage social interaction [7]. LINXX is a language learning tool that demonstrates how interactive sensory toys that use full body tangible interaction facilitate imitation and turn taking [8].

We explore how toys can be designed for collaboration by combining cause-effect interaction and sensory feedback. The Uncommon sense toys are shared objects that must be used collaboratively to trigger multi-sensory feedback.

# 3. UNCOMMON SENSE TOYS

Uncommon Sense is a set of Interactive Sensory toys designed to encourage Social Interaction among children with Autism. The toys have audio, visual and tactile feedback, which can be triggered by a child's actions, movement and voice. The toys Cause-effect behaviour engage children in collaborative play.

Each toy has two kinds of Cause-effect behaviour-

1. Individual: A person can trigger sensory feedback through his or her own actions.

2. Collaborative: Players must coordinate their actions to trigger sensory feedback.

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The set consists of three multi-sensory toys- Touch, Expression and Orientation. Simple activities with the toys that facilitate collaborative, social play have been developed. The activities incorporate movement, rhythm, expression and rhymes to encourage imitation and cooperation. Children may also play independently and enjoy the sensory experience of the toys.

No recognizable shape was given to these toys to avoid any prior meaning that may be associated with it by autistic and non-autistic users. Being *Shared Objects* the size and the form of the toys designed is such that it can be handled by more than one person. The toys have a *Sensory Aesthetic* i.e. the fabrics used in the toys vary in texture to add to the tactility of the toy. The toys are designed for *Full body interaction*- Sensors are embedded in the toys so that they are able to measure movement, actions and sound. The toys output *Tangible Sensory feedback*- light, sound and vibration based on the input received by the sensors.

Play is more intuitive than language. In the case of Autism, if a simple coordinated action results in an enjoyable experience (sensory feedback), it may work better than words in establishing trust (comfort/ familiarity) between two persons. Through play the children begin to associate collaboration and interaction with fun.

## 3.1 Toy Behaviour



Figure 1. An Art based therapist using the Orientation toy in a group play session.

#### 3.1.1 Orientation

The toy has four coloured flaps- Red, Yellow, Blue Green. When the flap is closed or the area near the flap is rubbed, the lights corresponding to the colour of the flap blink. When the toy is tilted the lights flow in the direction of the tilt. For instance if the toy is tilted holding the red side up the lights will move from red to yellow.



# Figure 2. Vibration is triggered when a Child and Researcher touch hands while playing with the Touch toy.

#### 3.1.2 Touch

The toy is made of Lycra and has an elastic feel. The toy is worn on the hands of two players. When the players walk towards each other the toy lights up and blinks quickly. When they walk away from each other the number of lights decrease and glow dimly. Electronic feedback is triggered only when the player touches the fellow players hands. One hand triggers vibration while the other hand triggers a melody. The feedback is not triggered if the players touch their own hands. The pieces worn on the hands are attached to the main body by a press clip. They may be detached if more movement is required during play or if the light distracts the child.



Figure 3. The Expression toy lights up when tapped.

#### 3.1.3 Expression

The front and the back of the toy have different functions.

Front: The toy lights up when a player makes a sound by clapping, tapping, shouting or blowing. Different coloured lights and patterns are triggered with each clap; the lights change from red to blue to yellow to green. On the fifth clap all the lights come on and it randomly chooses one of the four colours.

Back: The toy has two handles. A melody plays when the position of the handles match. Positioning the handles can trigger three such melodies. If the handles move randomly no feedback is triggered.

Children with Autism typically visit a number of therapists-Occupational, sensory, speech, behaviour that work independently to develop different skills. The toys physical form and tangible feedback let children use their full body in play. Play with toys is an integrated approach that allows for the development of multiple skills simultaneously. Below are some of the skills that may be developed through the use these toys:

Social Interaction: Joint attention, coordination, and cooperation.

Motor Skills: Fine, Gross motor movements and Oral motor imitation, imitation of an action with an object and of a sequence of actions.

Communication: Expression of choice and preference

Sensory: Visual, Auditory and Tactile perceptual skills; Visual Discrimination, Spatial organization, Visual Motor planning, balance and vestibular function.

Cognitive: Concepts like counting, colour, rhythm, patterns, speed and efficiency.

# 3.2 Method

There are numerous questions that arise while designing for Autism. What is the nature of play of children with Autism and what are the opportunities for intervention? How do we cater to the varied needs of children across the spectrum? How do we create opportunities for children to play with others?

We conducted several play sessions to collate a set of play characteristics of the autistic child. This was done by 1) observing children in *Free Play.* 2) Observing how they use different materials like paper cut outs, coloured cellophane, household items like lentils, natural materials like leaves and flowers through *Art and Collage* activities. 3) Creating simple *Interaction and Materials* activities through which children interacted with others and explored the properties of materials like magnets, elastic, ball and cloth, textures, walkie-talkies, confetti. 4) Creating an *Experience Prototype* to understand how children process sensory information [9].

The factors that emerged from the play sessions were collated under the following categories: Environment, Sensory, Social, Interaction and Play. The factors guided the design of the three toys.

# 4. STUDY

A study is currently being conducted to observe how children use the toys over time. The impact of the toys will be evaluated on the following parameters: Exploration and Solitary play, Attention, Joint Attention, Comprehension, Imitation, Sensory Response, Cooperation and appropriate use, Interest, Turn Taking, Sharing, Initiative and choice, Spontaneous play, Emotional Response, Language and Communication. The study aims to collect qualitative data on skill development as well as the child's motivation and engagement during play.

## 4.1 Setup

The study is being conducted at a school for children with Autism in Bangalore, India. There are 14 children aged 5-11 diagnosed with Autism who are involved in the study. The toys will be used in 20 minute sessions, twice a week, over 10 weeks. The first 15 sessions will be one on one: researcher and child. The last 5 sessions are peer sessions wherein two children will interact with the toys together with the researcher present.

In a typical session the toy is placed near the child and he/she is left to explore the toy for a few minutes. The Researcher then introduces the functions of the toys to the child. The researcher will then try to engage the child in collaborative play activities with the toy. The first toy is then put away and the child is given the second toy. In the last few minutes all three toys are placed before the child and they are asked to choose the one with which they would like to play.

## 4.2 Analysis

A Checklist that allows for qualitative description of abovementioned parameters has been created. One person, assigned to data collection is present and fills in the checklist for all the sessions. Data will also be collected via Video Analysis of the sessions. The Child's teacher will fill the Autism Treatment Evaluation Checklist at intervals of 4 weeks as well as pre and post the intervention [10].

# 5. OBSERVATIONS

Below are instances of what has occurred in the study.



Figure 4. A child sharing the music emitted by the Touch toy with the researcher.

#### Ankit (name changed), 8 years old

Initially, he would be reluctant to leave class and come to the play session. He would try to leave the room. For the first few sessions he avoided interacting with the researcher and the toys. He would sit on the chair make a repetitive sound and look away. He would keep playing with the fan switch in the room.

By the 10th session (halfway through the study) he was excited to come to the session and would get up as soon as the researcher went to his class and would smile throughout the session. He would play with the toys on his own. He liked standing and watching the Orientation toy spin. He understood that if he closed all the flaps the researcher would spin the toy so he could watch (reciprocation). He interacted with the researcher throughout the session and engaged less in repetitive behaviours.

#### Uditi (name changed), 11 years old

Initially she was very distracted by the camera used to document the sessions and kept grabbing it. She would pinch and get upset often. She picked up the imitation activities quickly and used 3-5 words during the session.

By the 10th session she was anticipating the activities and saying the associated words, using more than 20 words in a session. She would direct play and communicate what she wanted for eg. music or vibration. She would imitate many different action sequences with each toy. She shared the music and vibration with the researcher by holding it the researcher's ear and smiling.

#### Peer Session: Tanvi and Srinivas (names changed)

In the first peer session Srinivas seemed more uncomfortable than Tanvi. He kept pulling the toy away from her and giving it to the researcher. He would look only at the researcher while playing with Tanvi. Tanvi cooperated and shared the toy when prompted by the researcher. Srinivas did not share. Tanvi said "push" to Srinivas and he pushed the toy to her. Although a lot of physical prompting was required they cooperated and used the toy appropriately. Tanvi said the words associated with each activity and initiated play. In their last peer session they played together for the entire session with minimal physical prompting. Tanvi shared spontaneously and Srinivas shared after being prompted. Joint attention was established when they both held and swayed the toy. They looked at each other while pushing the toy to each other. They smiled and looked happy when the touched hands to trigger music and vibration.

Analysis of data so far indicates:

Children are directing play, they are communicating how and with what they want to play.

They are engaging in spontaneous play.

They communicate when they want to play with the other person.

They are anticipating play activities.

Their attention and engagement with the fellow player has increased.

They are taking turns and sharing.

They are expressing emotions and are motivated to play.

There is increased imitation of actions, words and sequences.

They are engaging in parallel and collaborative play with their peers.

#### 6. CONCLUSION

Children with Autism engage in collaborative play when they find the play experience is motivating. The Tangible Sensory feedback of the Uncommon Sense Toys draws children's attention and helps maintain focus. This aids imitation and cooperation. The child feels their fellow players presence through the shared object, which makes it easier to establish joint attention. Children associate the toys with collaborative play; they wait for or ask their fellow player to join in. Once children are aware of the toys play possibilities, they communicate how and with what they want to play.

Toys that involve sharing attention and emotions play an important role in developing social understanding in children with Autism. The Uncommon Sense toys facilitate and reinforce this collaborative behaviour. The simple Cause-effect behaviour makes the toys adaptable to different situations. Therapists, Teachers, Parents and siblings can build activities around the toys as per their needs. Over time one can add to the complexity and vary activity sequences through which children learn flexibility. The toys may be used in existing social play settings like Inclusive Play groups and Sibling-led intervention. The Research and Development of these toys is an effort towards understanding how one can design for the varied needs of children with autism. And to understand the role Interaction Design can play in child development by creating enjoyable collaborative play experiences.

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