A system to structure daily life
based on personal preferences

for people with Autism Spectrum Disorder

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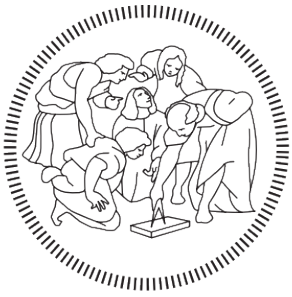

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THANKS...

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ABSTRACT

The people with autism spectrum disorder (ASD) have different characteristics in perceiving sensory stimuli and organizing appropriate responses, as in many other areas. They have limitations in organizational skills. The things that they need to cope with turn into a significant challenge, such as the situations which need to manage the task and time while interpreting sensory information. That's why most of the people with ASD have difficulties in sustaining their daily lives independently. However, it is possible to improve the life expectancy of people with ASD by providing proper services and products that assist them in giving control of their lives by taking into account their sensory preferences. They must have access to personalized services/products so that they can continue their everyday life as an independent, individual adult.

The main purpose of the present study is to design a unique assistance service and product in managing daily tasks by helping them overcome anxiety and stress originated by routine breakdowns and unfamiliar situations, while improving their autonomy during the day. It will be a task management device for daily tasks in order to facilitate in dealing with them with digitilazed physical interaction.

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Figure 1. Tezi Gabunia, Exhibition

INTRODUCTION

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder that affects social interaction and communication and leading to limited and repetitive behavior. People with ASD have different sensory stimuli that include its unique challenges to manage the tasks they need to do to sustain their daily lives such as how to communicate, how to respond, and even how to dress or cook (Öztürk Özgönenel, 2012). The things that they need to cope with turn into a significant challenge, such as the situations which need to manage the task and time while interpreting sensory information. Even if realizing the importance of the independence of people with ASD, the meaning of freedom can change according to the people depending on their level of need. While deciding where to go can be a meaning of independence for one person, for another, it could mean choosing what to wear.

This can not be accomplished in a single move, no matter what degree of independence. They need a mix of functional assistance that can help them achieve to live a more independent lifestyle. That's why they need some unique and personalized assistance tools to live independently.

It is possible to improve the life expectancy of people with ASD by providing proper services and products that assist them in giving control of their lives by taking into account their sensory preferences. The feeling of having control of their lives is very vital for them since they can manage all of the steps that they need to follow during the day. At this point, digital technology plays a significant role. In particular, interactive technologies can play a further part in the development of social and daily living skills, according to researches. Besides, significant studies on Tangible User Interface (TUI) show that they assist in improving the quality of life of people with ASD to ease their lives. It is essential to have an understanding of how people with ASD interpret the world and view people and objects around them. TUI uses physical form and features to help users understand how intangible digital knowledge can be accessed, grasped, and manipulated. Tangible interfaces offer tangible handles by reflecting on people's intuitive awareness and perceptions of how physical objects work in the real world (Copenhagen Institute of Interaction Design, 2008).

Research Purpose

All people have different sensing thresholds for sensory stimuli, and we perceive sensory stimuli as soon as we enter that sensation tresholds. There are a lower threshold and an upper threshold for all people. However, the lower and upper limits fit most of the people, and they can quickly adapt themselves to the new situations, whether this threshold has an upper or lower limit. However, it is not so easy for people with ASD like other people, and such a kind of excessive threshold effects to sustain their daily lives. That's why it is essential to understand the sensory differences and the reason to design personalized products/services for people with ASD since these sensitivities became their characteristics for their whole life, by better defining their needs, desires, and environment. Therefore, they must have access to personalized services/products so that they can continue their everyday life as an independent, individual adult.

The main purpose of the present study was to design a unique assistance service and product in managing daily tasks by helping them overcome anxiety and stress originated by routine breakdowns and unfamiliar situations, improving their autonomy during the day.

Focus Group of Research

In this thesis, people, who are older than 18 years old, with ASD are chosen as focus groups because of the lack of designed tools after their childhood periods (Johnston, 2016) since it is not so easy to manage to continue their daily lives like other people and they need specialized tools even in their adulthood. Education starts very early age to provide a better lifestyle for them. While there are lots of resources for children with autism, there is less support for adults. When these children grew up, they are facing lots of problems in their daily lives that affect their both mental and physical well-being due to the lack of ability to make social connections and manage the daily tasks to sustain their lives (Vaillancourt, 2016). However, even children with ASD take proper education in the early period of their childhood, they are likely to be strictly committed to their routines in their adulthood. They tend to maintain their habits and sensory preferences, and these sensitivities can make their lives difficult because of the difficulties of adaptation to the situations that face during the day (Öztürk Özgönenel, 2012). Another reason is that for this focus group because of the legal rights of the individuals for the research, such as workshops, user interviews that are explained briefly in the methodology section..

Figure 2. Tezi Gabunia, Exhibition

Importance of Designing for Autism Spectrum Disorder

In the early period of their childhood, it has already been studied towards the differences of sensory stimuli, but specific characteristics remain with them whole their life. If this different stimulus is examined and designed for proper solutions, they can have a chance to achieve to gain independent living skills. The incidence of autism is increasing year by year. The prevalence of autism 20 years ago was 1 in 10000, currently 1 in 55. Yet, the reason is not explicitly known. There is some evidence that it has its basis in genetics. There are also some research about environmental factors could be a problem. Together with, today's world conditions expect a high level of performance from individuals both economically and socially.. This might mean that some differences can not be tolerable, anymore (The Tohum Autism Foundation).

Whatever the reason is that, it is an incredibly fast-growing line. It is necessary to work on integration in relation to such a situation with increasing frequency. These people need to be supported in order to participate in the production by being a part of daily life. This provides a contribution to the country's economy, and so as the world economy. Therefore, their inabilities need to be supported by personalized services and products. In such a rapidly increasing disorder, a solution is required.

Research Methodology

The structure of the thesis was designed in two main parts. The first part consists of the three-step study; a literature review, project context and user research. In the user research part, semi-structureded qualitative interviews were conducted with people with ASD as well as educators who work with them and their family members, in total 15 people. Material gathered during the research phase was used to uncover patterns, identify common problems and define a framework to explain how the design of built environments can impact people with autism. Then, second user research was made based on the results of the preliminary study. The workshop was carried out with five people with ASD in order to understand the more important points while designing the product and its service. From an analysis of what had been observed and recorded, key project findings and insights were defined. Then, second part dedicated to the product design and its system. In this part, the features and the interaction of the design are explained. The connections between the research of the first part and the second part are shown.

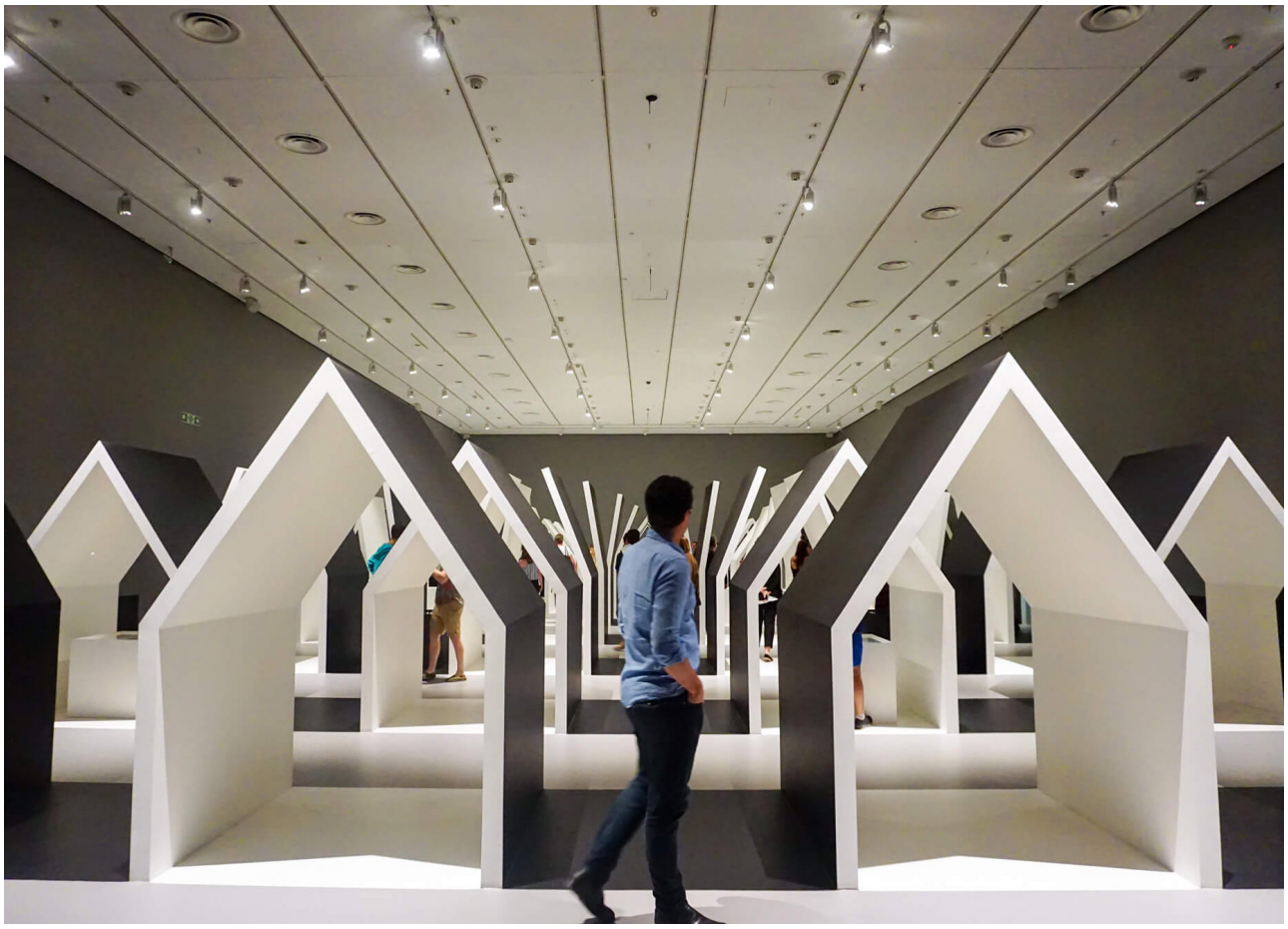


Figure 3. National Gallery of Victoria, Escher X nendo | Between Two Worlds.

BACKGROUND RESEARCH

In this section, the definition of autism, the theories and method are researched that is carried out and proved by years.

To start with, it is very vital to understand the importance of interpreting sensory information and its effects on people with ASD since they see the world differently according to many people because interacting with others and the environment becomes extremely challenging. Together with, there are some methods and theories that are needed to understand in order to address the services/products properly while talking about autism. In particular, Self - Determination Theory and Sensory Integration Theory are researched carefully among the theories because they are the basis of the education of the people who have ASD as approved theories (Mthimunye, Pedro & Roman, ; Chou et al., 2017). And, TEACCH (Treatment and Education of Autistic and Communication Handicapped Children) Method is used while designing the service/product since It fosters organized learning environments which promote visual engagement and communication. Several studies endorse and extend work on the TEACCH approach, as a useful learning and teaching methods and as possible successful components of classroom interventions (Schopler, Mesibov & Hearsey, 1995; Paneri, Ferrante & Caputo, 1997).

Autism Spectrum Disorder /

Autism Spectrum Disorder And Its Diognastic Features

Autism, which Kanner originally called “early childhood autism” in 1943, was recognized as an emotional condition until 1970. In the late seventies, autism was generally accepted to be a “neurodevelopmental disorder” resulting from the physical dysfunction of the brain. For the first time in 1980, DSM III (American Psychiatric Diagnosis and Statistics Handbook - third edition-) was described as “a developmental disorder and a part of a broader spectrum of associated disorders.” Similarly by the World Health Organization, “early childhood autism” first took place in ICD (International Statistical Classification of Diseases and Related Health Problems) as a type of schizophrenia. In DSM V and ICD 10, are the last editions of both systems, autism and its associated conditions are referred to as “Common Developmental Disorder.” These disorders have been called “Autistic Spectrum Disorder (ASD)” in recent years and described briefly individuals that demonstrate social isolation by closing in their inner world (Schopler, Mesibov & Hearsey, 1995).

DSM V (American Psychiatric Association), ICD (International Classification of Diseases), and WHO (World Health Organization) have the most commonly used diagnostic criteria in autism, accepted by autism research experts.

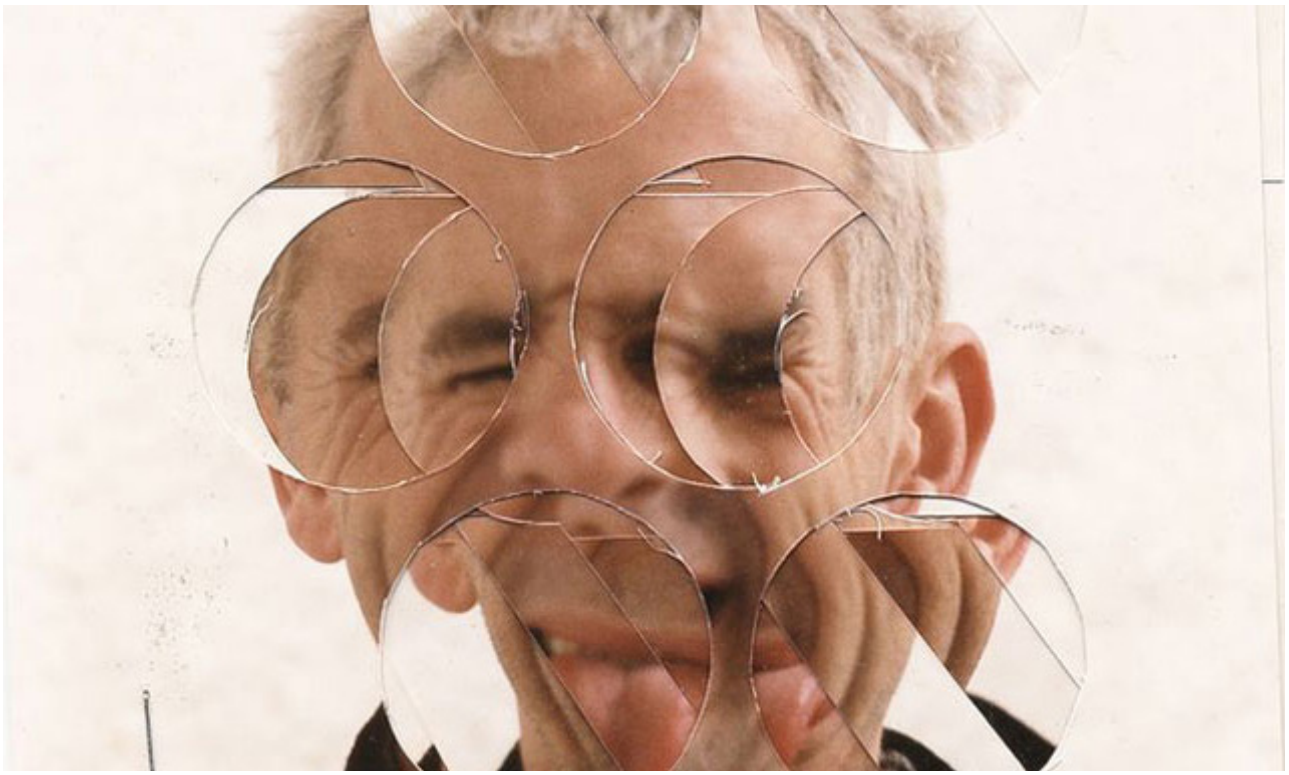


Figure 4. Jean Faucheur , Taste for Rupture

DIAGNOSTIC CRITERIA FOR THE STANDARD AUTISM DIAGNOSIS ARE PROVIDED BELOW ACCORDING TO DSM IV (1994);

1 In order to be diagnosed with autism, at least two features from (1) articles and one features from (2) and (3) articles. A total of six (or more) features should be observed.

Qualitative deterioration in communication that shows the presence of at least one of the following:

- delay in the development of the spoken language or not developed at all (not accompanied by other means of communication, such as hand, arm or face movements),
- inability to start or continue the conversation with others who have sufficient speech ability,
- using repetitive or a special language,
- not playing spontaneous or imitative games based on the level of development.

2 Delays or unusual functionality before the age of 3 in at least one of the following areas

3 If this disorder cannot be explained by Rett Disorder or Childhood Disintegrative Disorder, a diagnosis of autism is put (DSM IV, 1994).

Having limited, stereotyped, and repetitive patterns in behavior, interests, and activities that are shown in the presence of at least one of the following:

- having limited interest patterns in terms of attention level or focus
- showing the type of behavior without any flexibility to the everyday work and compliance strictly
- having repetitive motor mannerisms (eg. finger shifting, clapping or twisting or complex whole body movements)
- constantly dealing with pieces of thing

Qualitative deterioration in social interaction that shows the presence of at least two of the following:

- hand-arm movements to ensure social interaction, body position received facial expression, a significant deterioration in many nonverbal behaviors such as eye contact.
- inability to develop appropriate relationships with peers,
- having fun with other people, their interests or do not intend to share the success (eg. not showing, bringing, or specifying objects of interest),
- not giving social or emotional responses

- Social interaction,
- Language used in social communication,
- Symbolic or imaginative play

According to the World Health Organization's "ICD-10 Classification of Mental and Behavioral Disorders, Clinical Definitions and Diagnostic Guidelines (1992), some of the symptoms of "autistic disorder" or "communication disorder" are:

- It occurs before the age of 3.
- It is a common developmental disorder.
- Dysfunctions are typical in social relationships, communication, and repetitive, limited movements.
- Inability to adjust their behavior according to the social environment.
- The existing language skills are not functional.
- The inconvenience of the tone of voice and highlights.
- Incompatibility of gestures and facial expressions.
- Some behaviors and habits become strict attitudes.
- Resistance to environmental change appears as typical features (Mesibov, Shea & Schopler, 2005).

The variation in the IQ distribution constitutes the most important criterion in the diagnoses that differ from Common Developmental Disorder, Autism and Other Non-Named Common Developmental Disorder. Autistic individuals are a hetero geneous group that differs in terms of behavioral characteristics and intelligence division distribution, and those with "borderline or over-border in mental skills" are called "high-functioning autistic" (High Functioning Autistic - HFO) (Mesibov, Shea & Schopler, 2005).

Characteristic Features Of People With Autism Spectrum Disorder

Autism is considered in a graded range from the heaviest to the lightest. Although all individuals with autism do not have the same features/competencies or deficiencies, autistic features that can occur in different degrees and categories mainly cause disorders in 3 areas (Wing, 2005).

Social Interaction
Verbal and non-verbal communication
Imagination and creativity

Figure 5. Temple Grandin, Thinking In Pictures, Movie Scene

Social Interaction

The characteristics of people with autism in social interaction are defined as irrelevant, cold, distant, passive, uniform, unusual. Individuals with the characteristics of autism do not like to make eye contact; they are not interested in other people, especially with their peers. They regard social interaction as passive. Sometimes it can be felt that they enjoy it. They do not initiate the interaction themselves and have difficulty maintaining the communication that is initiated. Although they occasionally approach other people, this behavior does not occur in suitable environments and times, but repetitive and unfamiliar forms (Atasoy, 2003).

Verbal and non-verbal communication

People with autism in the field of verbal and non-verbal communication either do not communicate at all or communicate only in one-way, simple, and repetitive forms in line with their needs (Korkmaz, 2005).

Individuals with autism do not like talking and do not care about interacting socially. This situation does not change even for individuals with ASD who are able to speak. They usually speak in monologues. They have difficulty using gestures and adjusting tones during communication. They can either talk very lowly or very loudly. The sounds may be uniform, and the highlights may be wrong. They do not quite understand the meaning of hand-arm movements, facial expressions, or tone of voice. Even if functioning at an advanced level can use hand-arm movements, they are strange and meaningless (Öztürk Özgönenel, 2012). They use language to express their wishes and needs rather than to express their feelings and thoughts. They have difficulty understanding other people's feelings and thoughts. They use language very simply. Sometimes they can make long sentences, but the content of the sentences is either very limited or not meaningful. Although there are many words they know, they often have problems in meaningful juxtaposition, that is, organizing the language (Wing, 2005).

They do not understand that language is a tool for transmitting information to other people. They may ask questions to meet their own needs, but they have difficulty talking about feelings and thoughts. They cannot understand the feelings, beliefs and opinions of other people. Although they often understand and use basic emotions such as happiness and sadness, they have problems in understanding more complex emotions such as confusion and disappointment both in themselves and in others (Girli, 2004).

Insufficiency of the individual with autism in the field of imagination and creativity can be listed as follows;

- Using objects for simple stimuli
- Dealing with objects for practical use
- Imitating the symbolic game of others
- Limited, repetitive and isolated symbolic game play
- Stereotypically creating its own world (Atasoy 2003)

Children with autism cannot play proper or symbolic games with objects and toys. Instead of symbolic games such as driving cars, putting them in the garage, repairing, they prefer to keep the toy in their hands and play alone without being creative. Similarly, instead of being home with babies, they can develop an addiction to the baby they love, or they can play it repeatedly, such as shaking, spinning. However, while these children do not show interest in toys, they may show excessive interest in some household items (spoons, etc.). They do the activities they love, for example, one puzzle after another. They play in a non-creative, repetitive way, such as lining or stacking building blocks. They can line up legoes like trains or build towers with cubes, but they cannot improve the game (Mesibov et al., 2005; Wing, 2005).Since they cannot use their imagination, they want to maintain the same routine instead of doing different things. They may like to do certain things in a special order, if this order is somehow disrupted, they can be restless (going to school a different way, etc.) The games can be concrete and repetitive in their own right. They focus their attention on the tiniest details of things around or the trivial things. For instance, they pay attention to an earring in the ear, and they are not concerned with the earring. Instead of playing with the toy train, they are interested in their wheels. They may get the attention of a toy's label or a colored detail on it because they focus on the detail, they have difficulty in grasping the object or the whole surrounding event and cannot perform the appropriate behaviors (Mesibov et al., 2005; Wing, 2005).

In addition to the disorders seen in these three areas, some special skills, stereotypical movements, and problem behaviors, sensory features can also be observed in children with autism (Öztürk Özgönenel, 2012).

Special Skills In Autism

One of the surprising features of individual with autism is that they have special skills in some areas, although they have difficulty in many areas. These unique skills are; it is not seen in every person with autism. Generally, it does not attract the attention of many people; It can emerge in the form of advanced visual abilities related to details such as knowing bus-ferry-train departure times, airport flight schedules, or numbers in mind. Many children with autism are seen singing before speaking.

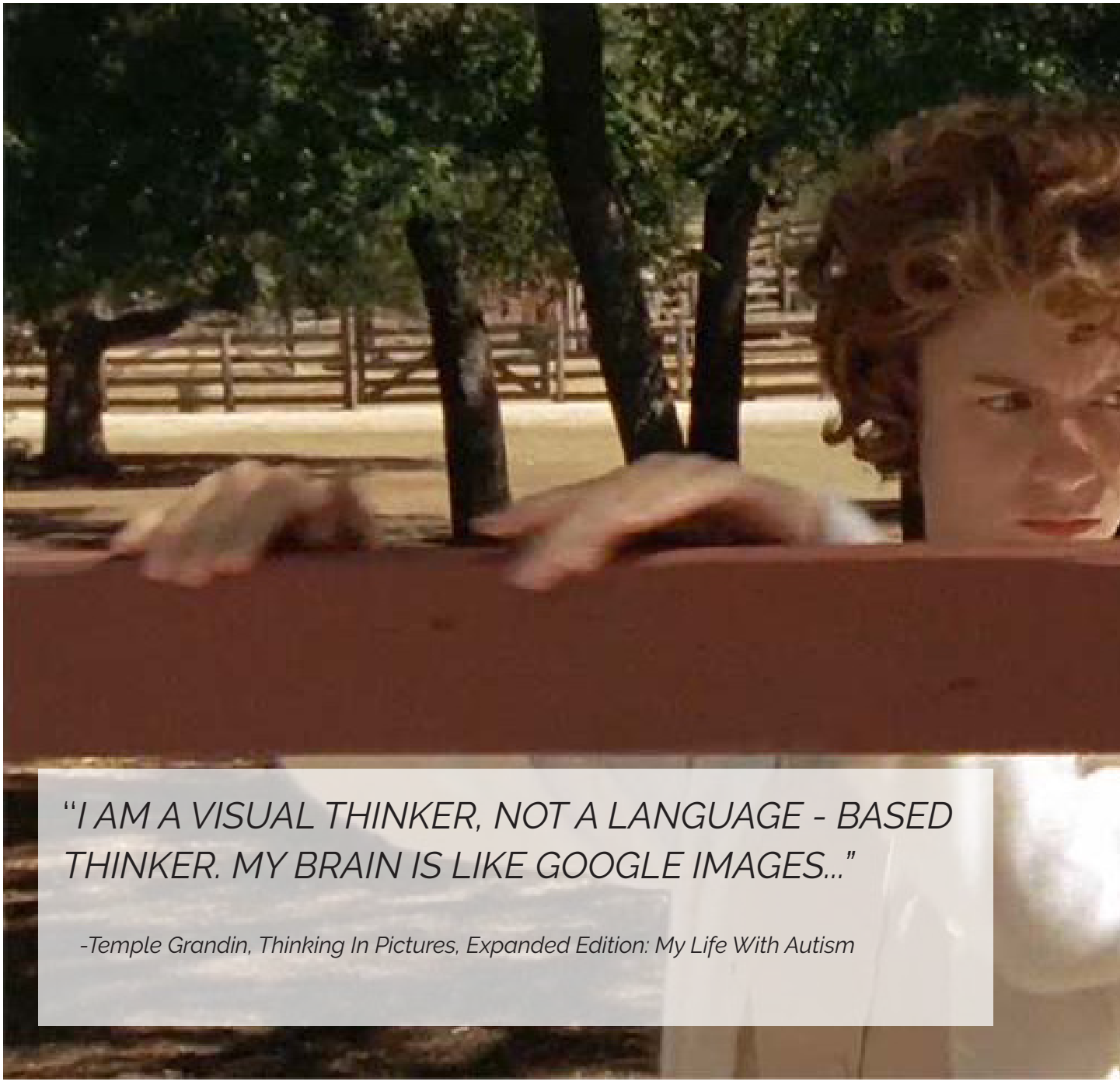


Figure 6. Temple Grandin, Thinking In Pictures, Movie Scene

Some of them can play an instrument very well. In addition to his musical skills, he may have a strong memory, his ability to memorize very long poems, and the ability to repeat a very long conversation they listen to on television (Darıca, Gümüşçü & Pişkin, 1992).

It is accepted that these special skills seen in children with autism are independent of speaking skills and focus on music, mathematics, and memory. It is thought that 10% of children with autism also have such special skills (Mesibov et al., 2005).

Problem Behaviors And Repetitive Movements

Individuals with autism of characteristics may have behaviors that are socially unacceptable and can harm themselves and their environment. Some of those;

Tantrums

Most children start the tantrums at the age of 2.5. Especially in this period, since there is little or no speech, children cannot express their wishes and needs verbally. For this reason, behaviors such as kicking, crying, shouting, and throwing to the ground occur in children with autism, most of which are called tantrums. These behaviors can be short-term or very long-term (Korkmaz, 2005).

Figure 7. Christian Edler's self-portraits

Behavior that harms the environment and themselves

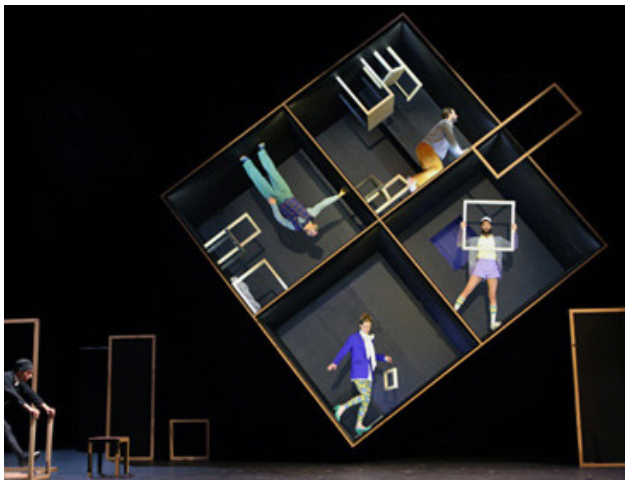


Figure 8. Hans was Heiri - Theatre scene

Individual with autism can also behave like screaming in the street, throwing things, damaging things, hitting someone else, or pulling their hair, because they cannot communicate with the environment too much. In addition to these behaviors, they can also exhibit behaviors that occur when the child is angry, worried, or fails and is often difficult to control, pulling his hair, scratching, knocking his head, etc. (Darıca et al., 1992; Korkmaz, 2005).

Some body movements are seen in people with autism, which becomes apparent after infancy. The origin of these behaviors is not known, but it can occur for no reason, extinguish by itself, or leave its place to another repetitive movement. These behaviors are also called self-stimulation. The reason for self-stimulation is that they do not perceive the world like us. While it may be overly sensitive to certain sensations, sometimes even a small amount of sensation is enough to stimulate it. If a person who is hypersensitive to sensations, s/he will show avoidance behavior that will be restless in the face of these sensations. At the same time, a individual with autism features may be less sensitive to some sensations and seek it because it needs a lot of stimulation (Wing, 2005).

Figure 9. Déjà Vu , Installations

Sensory Stimuli

Our lives are filled with sensory experiences. We are subconsciously aware of what we know or where we are and how we interact with the environment. When we manage to interpret sensory information quickly, it affects our behavior at the subconscious level. An example of this is turning off the alarm clock. When it closes in the morning, we reach and close it, often without looking. Our brain knows how much movement/force it needs to go out and press the button. If we hit the wrong place, our fingers provide the information our brain needs for more activity so that we can turn off the alarm - without looking (Falkirk Council, 2013).

People with ASD may be ***hypersensitive (over-sensitive)*** to some things, or ***hypersensitive (under-sensitive)*** to others. Generally, hypersensitive children with ASD do well to avoid any sensory stimulation. For people with hypersensitivity problems, it is advisable to try and find items that can help you cope and prevent sensory overload. Things such as gloves, ear protection, specific shoes, sunglasses, hoods, caps, etc. can help minimize stimulating environmental effects. Hypersensitivity is essentially an accurate drug of hypersensitivity-hypersensitive people who are very sensitive to certain types of sensory information.

Many hypersensitive people go to "sensory quest," where they seek to locate different sensory inputs. Many children with hypersensitivity benefit by setting a "sensory diet" for themselves. This means a well-balanced list of activities that properly stimulates the senses (Wikia).

Occupational therapists and physical therapists conduct the diagnosis and treatment of the essential sensory integrative processes.

General aims of the therapist are:

- providing the person with sensory input that helps coordinate the central nervous system
- assisting the child in processing a more coordinated response to sensory stimuli.
- assisting the person in suppressing and modulate sensory information

The theory - Sensory Integration Theory will be explained in detail in the next section - is used to describe the brain-behavior relationship and explains why individuals respond to sensory stimuli in any way, and how it influences behavior (Hatch-Rasmussen, 2014).

There are five main senses; ***Touch - tactile, Sound - auditory, Sight - visual, Taste - gustatory, Smell - olfactory***; in addition, there are two other powerful senses; ***vestibular (sense of motion and balance)***-provides details about where the head and body are in space and about the surface of the earth, ***proprioception (joint / muscle sense)-*** provides information about where the parts of the body are and what they do (Hatch-Rasmussen, 2014)

Figure 10. Sony Exhibition at Milan Design Week- Hidden Senses

Sound - auditory

It can be observed that children who are less sensitive to hearing stimuli seem not to hear what people are saying, they love music and some certain sounds, they like toys that make certain sounds, they like to talk in a fun way (Darica et al., 1992; Korkmaz, 2005; Wing, 2005). It is also observed that children who are hypersensitive to auditory stimuli hear very low sounds, they grab their ears when they hear some sounds, cry when they use machines (washing machine, dishwasher, etc.) and run away. These children can experience many adaptation problems especially in crowded classroom environments due to their sensitivity to sound (Wing, 2005).

Sight - visual

Although people with autism do not look at the human face and many objects around them, it can be seen that they can look at some moving, rotating or bright objects for a very long time, some of them are uncomfortable with the light from time to time and even more comfortable in a dark room. It can be observed that people who are less sensitive to visual stimuli turn the lights on, watch repetitive movements (turning book pages, opening and closing doors, watching their fingers, etc.), lining up objects, looking at objects from different angles. People who are hypersensitive to visual stimuli prefer darkness, they often narrow their eyes or avoid the sun (Darica et al., 1992; Korkmaz, 2005; Wing, 2005).

Touch - tactile

People who are less sensitive to touch may not be they seem to like them, wrap themselves in blankets, squeeze them into tight places (behind the seat, etc.), insist on wearing tight clothes, lay flat on the floor, bang on people, clap their hands, hold objects in their hands, put objects in their mouths, grind their teet (Darica et al., 1992; Korkmaz, 2005; Wing, 2005).

It is observed that people who are hypersensitive to touch do not like the things sticking to their hands (playdough, mud, paint, etc.), they like the fabric of some clothes, do not like some of them, do not like wearing hats and gloves, do not like the washing or cutting of the hair, they do not like the food that requires crunching and chewing (Darica et al., 1992; Korkmaz, 2005; Wing, 2005).

Smell - olfactory and Taste - gustatory

It can be observed that people with autism characteristics are less sensitive to some odors and flavors, they discover by licking or smelling objects to eliminate this, and they like too much spicy foods. In case of hypersensitivity, it may be observed to be sensitive to certain odors (perfume smell) to like soft foods. Resisting changes, which is a key feature of autism, also applies to these children's eating habits. It may be impossible to diversify the food they prefer for a long time. Eating foods of the same color, drinking beverages of specific brands, refusing foods of a certain color can be observed, or eating food in a certain order, eating in the same place or eating around (Öztürk, 2012).

Vestibular System

The vestibular system refers to structures inside the inner ear (semi-circular channels) that detect movement and changes in head position. The vestibular system, for example, informs you whether your head is inclined or upright (even with your eyes closed). Those people, in general, seem clumsy. The person can intentionally pursue very intense sensory experiences on the other extreme, such as excessive body whirling, jumping, and/or spinning (Hatch-Rasmussen, 2014).

Proprioceptive System

The proprioceptive system refers to components of muscles, joints and tendons, which give a person a subconscious awareness of his or her body position. As proprioception functions effectively, the location of an individual's body is automatically changed in various situations; for example, the proprioceptive mechanism is responsible for giving the body the required signals to help us to sit properly in a chair and smoothly step off a curb (Hatch-Rasmussen, 2014).

Figure 11. Tightrope walker 1890

Foundational Theories For ASD /

Self – Determination Theory

According to the theory of self-determination, when a person meets the following needs, such as autonomy, competence, and relatedness, the person should be regarded as a psychological well. These three innate psychological needs are necessary to support optimum functioning and to encourage the natural development process and to promote social wellbeing. When these requirements are met, intrinsic motivation grows. The inherent psychological needs produce improved self-motivation and wellbeing (Deci & Ryan, 2000). Self-determination is a combination of skills, knowledge, and beliefs that enable a person to engage in purpose-driven, self-regulated, autonomous behavior (Mthimunye, Pedro & Roman, 2011). Being self-determined means that taking the appropriate steps to attain one's objectives (Chou et al., 2017).

Over the past decade, awareness of how the idea of self-determination applies to people with disabilities has been significantly improved (Brown & Cohen, 1996; Erwin & Brown, 2003; Palmer & Wehmeyer, 2003; Shogren & Turnbull, 2006). Self-determination has been started to use in the field of special needs education and disability services (Wehmeyer, 2001). Communication skills and social interaction challenges make self-determination is a problem for people with autism and other developmental impairments. Self-determination skills, including choice-making, decision-making, problem-solving, goal setting and achievement, preparation, self-management, self-reliance, self-awareness and self-knowledge, allow people with and without disabilities to act as causative notions against valued goals and outcomes (Wehmeyer, 2001).

The term self-determination has a way to answer a lot of the needs of the person with ASD. There are difficulties in saying this and with the help of multiple partners and key role models for the person who can develop a sense of self-determination (Mthimunye, Pedro & Roman, 2011). At this point, some people play a crucial role in developing and generalizing self-determination skills of children and adults with intellectual disabilities, such as their educators, parents etc. (Carter et al, 2013). Together with, Self - Determination Theory which is involved in choice and decision making, is an important educational goal that can help people with Autism Spectrum Disorder (ASD) to interact with the environment or try to go to university, work, or community involvement, for an independent life. All learners' educational programs will be guided towards encouraging and enhancing self-determination. An emphasis on self-determination ultimately leads to the need to understand personal and self-esteemed outcomes for people with ASD (Palmer & Wehmeyer, 2003)

The teachers used the model successfully to promote student interests, encourage choices, and set young children's goals and achievements (Wehmeyer, 2001). The findings indicate that even the youngest children (age 5—6) were capable of setting goals and using the model to achieve them.

So, theory also aims to teach students how to understand, personalize and implement in order to achieve self-selected objectives. There can be phases to achieve this aim by following the some steps.

Phase 1 / ***Set a goal***

The question to solve is "What is my goal? "And students are encouraged to establish their goal by answering questions related to their knowledge and understanding of their learning desires, needs, expectations, interests and values. At the end of Phase 1, students set a target. They'll work. This target is usually similar to or equivalent to the goal set by an instructor for student learning. Still, the student is actively involved in the process of defining the goal and has control of the goal and steps taken toward achieving the goal in later stages.

Phase 2 / ***Take action***

The overall issue is answering the question, "What is my plan? "And the students are charged with evaluating the actions needed to achieve their self-selected objectives. The process of recognizing obstacles that would discourage them from taking action and steps that they can take to overcome those obstacles is directed to the students. The instructor helps the student to create an action plan to achieve the Phase 1 target and to establish a method of self-monitoring to keep track of progress towards the target.

Phase 3 / ***Adjust goal or plan***

The issue in Phase 3 is to answer the question, "What have I learned?" Teachers assist students in assessing the progress they have made towards their goal, and in determining if they have accomplished their aim. When students have achieved their target, they start working again through the phases, beginning with Phase1, to decide the next objective that they want to focus on (Raley, Shogren & McDonald, 2018).

After completing Phase 3, the model is repeated and children experience several opportunities to exercise skills with different goals aligned with self-determined action.

'I AM DIFFERENT, NOT LESS... "

-Temple Grandin, Thinking In Pictures, Expanded Edition: My Life With Autism

People with ASD needs some special and personalized arrangements to achieve the psychological needs of the Self - Determination Theory. At this points, Sensory Integration Theory should be taken into account since it helps increase the self-awareness of a person about the effect of sensory and motor influences on day-to-day behaviors and real-life circumstances . It offers ways to overcome sensory processing issues (American Occupational Therapy Association, 2008). It encourages optimal functioning and the natural growth by promoting social well-being.

Figure 12. Temple Grandin

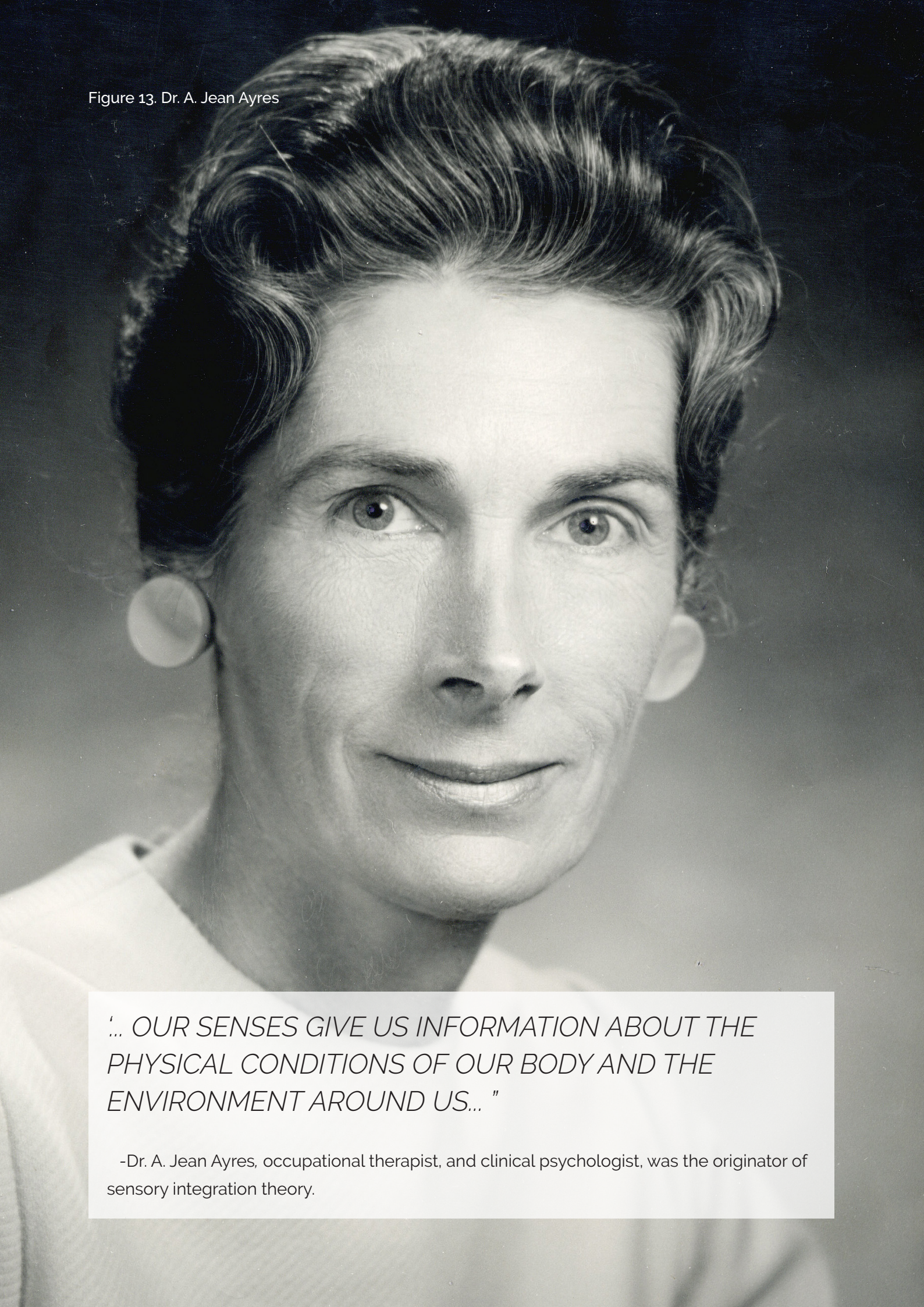


Figure 13. Dr. A. Jean Ayres

'... OUR SENSES GIVE US INFORMATION ABOUT THE PHYSICAL CONDITIONS OF OUR BODY AND THE ENVIRONMENT AROUND US... "

-Dr. A. Jean Ayres, occupational therapist, and clinical psychologist, was the originator of sensory integration theory.

Sensory Integration Theory

Dr. Ayres (2005) defined sensory integration as "The organization of sensations for use. Our senses give us information about the physical conditions of our body and the environment around us... The brain must organize all of our sensations if a person is to move and learn and behave in a productive manner" (p. 5).

While talking about senses and sensory differences of the people who have ASD, "Sensory Integration Theory" should be adequately understood in order to aware of the mechanism that interacts with the environment since this theory can be considered as a mechanism by which people record, modulate and discriminate sensations obtained through the sensory systems in order to generate purposeful, adaptive behaviors in response to the environment (Ayres, 2005).

Dr. A. Jean Ayres, who is a pioneering occupational therapist, and clinical psychologist, was the originator of sensory integration theory. She developed the theory of sensory integration and its application to people with cognitive disabilities by reviewing literature from the fields of neurology, neurophysiology, psychology, motor learning and motor control, education and occupational sciences that supported her ideas on the subject, recognizing the role of hidden neural and behavioral mechanisms. She was the first occupational therapist to systematically examine the practical implementation of her ideas, setting a precedent for scientific study as the basis for clinical decision-making (Roley, 2006). Since the early writings of Ayres, starting in the 1950s, several publications have led to the development of this theory, one of the most cited and applied in occupational therapy theories (Mulligan, 2002).

Her hypothesis was based on the premise that behavior is related to neurological processes and that sensory input at the brain stem level that allows for the development and specialization of the higher neural center. She suggested disorganized neuronal processes would contribute to disorganized behaviors (Roley, 2006). Learning is a brain function that involves effective processing of sensory information to help improve the fundamental skills required for the attention, comprehension and organization of multiple sensory inputs. The brain focuses on filters, and reacts to this sensory input in order to organize emotions, thoughts, experiences, and actions. This process is called sensory integration: the arrangement of stimuli from the outside as well as the stimuli from your body that tell you who you are, where you are, and what's going on around you so that you can make sense of the world (Ayres, 2005).

Ayres extended her ideas to a wide spectrum of conditions and across age groups, indicating that enhanced sensory integration would promote adaptive behaviors and wellbeing. Ayres claimed that the individual's intrinsic desire to learn and develop emerged with the optimal environment, a fun and playful engagement incentive, and "just-right" challenges. She applied her research

in an artful, playful, and child-focused way, underlining the value of adaptive responses and self-direction.

She developed therapeutic approaches which were used in hospitals, families, communities and schools (Roley, 2006). According to available research results, it is estimated that % 40 –80 of children (Baranek et al., 2002) and %3 –11 of adults with developmental disorders (Baranek, Foster, & Berkson, 1997) may have major sensory processing issues. Therefore, sensory processing disorders are estimated to occur in 10% -12% of people in the general population who have no medical disorder defined (American Occupational Therapy Association, 2008). These huge amount of results show that the importance of the integration of our senses in order to continue our daily lives.

A person's reactions to sensation also affect everyday self-care routines; the ability to understand and pay attention to the task; the ability to manage the appropriate fine and gross motor skills; and the ability to prepare, order, and coordinate the time and resources to conduct these tasks within a fast-paced schedule or a busy household (Dunn, 1999). Effective integration of these sensations requires the skills to participate effectively in the variety of occupational roles that we value, such as self-care, interaction with people and objects, and involvement in social contexts (American Occupational Therapy Association, 2008). There are also common problems with self-regulating emotions, concentration, and ability to cope with change and tension that contribute to emotional and social issues (Roley, Blanche & Schaaf, 2001). A sensory integration can be considered like a sensory diet which consisting of a specifically planned realistic diet of appropriate sensory activities that is tailored according to the individual needs of each person. Like a diet, sensory integration theory should be designed to meet the nutritional needs of an adult. This sensory diet is composed of different elements designed to meet the needs of the person for sensory integration (Wilbarger & Wilbarger, 1991). Sensory integrative dysfunction is a condition where sensory feedback is not adequately incorporated or structured into the brain and may cause varying degrees of cognitive, information-processing and behavioral problems (Carter et al., 2000).

So, could a dysfunction in sensory integration be cured? The symptoms can be reduced when occupational or physical therapy is conducted using a sensory integration system. The nervous system can be modified and the sensation-processing capability can be enhanced. Researches has shown that counseling can significantly reduce the involvement of sensory processing dysfunction with day-to-day life activities (Hatch-Rasmussen, 2014). In sensory integration theory, occupational therapy is used for the dysfunction of the brain (Wilbarger & Wilbarger, 1991).

THE AIM OF THERAPY IS TO INFORM TEACHERS, PARENTS, CHILDREN AND ADULTS ABOUT SENSORY INTEGRATION AND TO DEVELOP STRATEGIES TO ADJUST AND COMPENSATE FOR DYSFUNCTIONS. SUCH AS;

- changes in how people communicate with the child
- adaptation to everyday activities
- environmental changes

SOME OF THE INTERVENTIONS OF THE OCCUPATIONAL THERAPY ARE;

- Identify and adjust sensory and environmental difficulties that affect efficiency and participation in daily activities, as well as human abilities and supports.
- Identify and provide integrated sensory and motor techniques to promote full engagement in everyday activities and social interactions using a range of sensory approaches.
- TEACHH model activities - will be explained in detail in the next section - help sensory, cognitive, and behavioral needs

Learning Differences And TEACHH Method /

Thinking And Learning Characteristics Of Children With Autism Spectrum Disorder

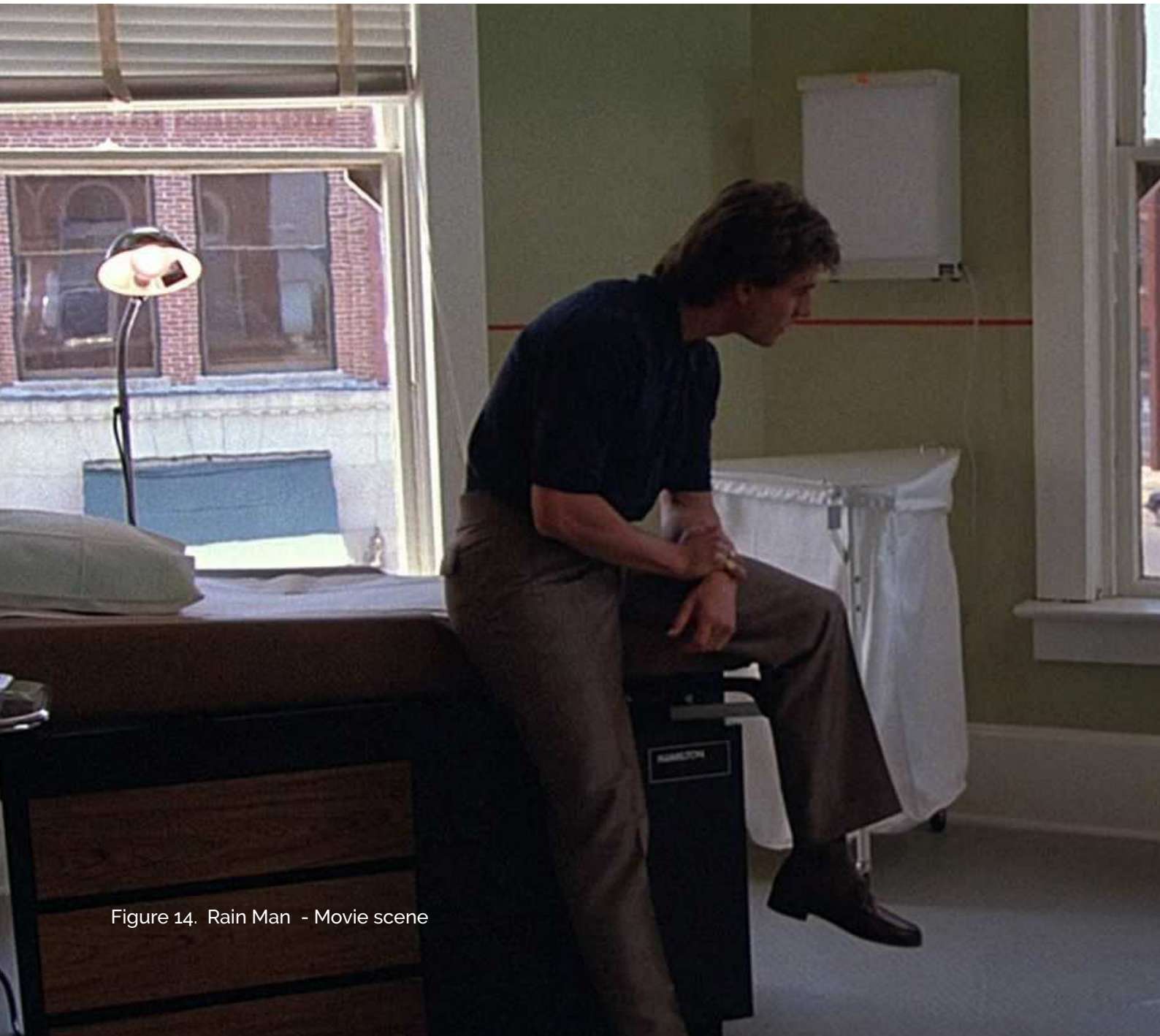


Figure 14. Rain Man - Movie scene

Approximately 10-15% of individuals with autism are at reasonable and supernormal intelligence levels; 25-35% of them are in the limited intelligence and mild mental retardation level; the rest of the intelligence is moderate to heavy group (Schopler, Mesibov & Hearsey, 1995). Children with ASD, with a mild disability of mental capacity to superior mental capacity (about 35-50%), can benefit from inclusive education from the pre-school period with a good preparation process (Girli, 2004). The diagnostic features of autism are useful for distinguishing autism from other disorders. However, it does not give us enough information about how the autistic individual understands the world, how he behaves, and how he learns. The main difficulties and deficiencies of autism are the determinants of how we can gain the knowledge and skills that will adapt to daily life and how we need programs for this. Therefore, it is necessary to know different thinking and learning features and to create programs around difficulties and deficiencies by taking them into consideration. (Mesibov et al., 2005).

Inability to Understand the Whole and Combining the Ideas

Individuals with normal development see everything as part of the whole. They combine piecemeal information from the environment in their minds. Our thinking system takes us to integrity with our knowledge. Frith explains the fact that individuals with ASD stick to the details or get stuck in meaningless things that are not useful to them by combining their knowledge and lack of implementation as a whole. He states that if we did not have the power to unify mentally, then our knowledge would remain fragmented and we could not adapt to the environment, and the difficulties suffered by individuals with autism (Girli, 2004). Understanding the notions one by one for the people with ASD is easier to understand than to combine with relevant information. For example, for an autistic child who has learned that it is right not to break the flowers, it is wrong for someone to bring flowers to someone they love. He finds it difficult to understand that two inconsistent concepts/ thoughts such as "it is wrong to pick a flower" and also "give flowers to the person he loves" can fit together. According to him, the right thing is not to pluck flowers and give flowers (Mesibov et al., 2005).

Inability to Comprehend the "Meaning"

People with ASD can be taught with many skills, and appropriate behaviors can be gained. But they do not have a complete idea of what it means. While their own world is made up of a lot of unrelated experiences and desires, the underlying themes, concepts, causes, and principles are unclear for them. They have difficulty understanding the connections between events, behaviors, skills, and cause-effect relationships. The ones around them, what is expected of them in the social environment; they have difficulty understanding rules, especially social rules (Mesibov et al., 2005).

Inability to Abstract Thinking

They find it difficult to understand the concepts of symbolic or abstract language, especially in understanding that the words have a second or figurative meaning. Idioms understand concrete words or phrases that are figuratively strong, such as proverbs, as they hear them. For example, they can understand the proverb "The lake becomes a drop by drop" for a long time, "the dripping water accumulates and forms a lake." They may not think that their mother's head is very sore, saying "My head is cracking," and they may worry by thinking that her head will be cracked and split (Girli, 2004).

Inability in Generalizing the Information

People with ASD experience difficulties in transferring the skills that they learned in any situation. When they start writing with a blue pencil, they can resist writing with a pen or another color. While counting the steps of the stairs, they may not be able to count the paints on the table. Hand washing at home and in the restaurant, at school or in the neighboring hand washing is not the same event for them, so a child with autism who washes at home may not wash at school (Mesibov et al., 2005).

What they learn from different people in different environments and with different materials, it takes time for them to combine skills, realize that they are the same. For this reason, it may take time for them to repeat the knowledge and skills they have previously acquired at home or in kindergarten in their new school, with new teachers and new friends (Mesibov et al., 2005).

They are very keen on their interests and doing what they love. They can play for hours with a computer or string of their favorite material, but they may not be interested in a new game or skill you are trying to teach. For this reason, motivation and extrinsic motivation approach, such as using food as a favorite toy as a reward, are effective (Mesibov et al., 2005).

Inability in Observing, Imitation and Motivation

The individual with autism have little interest in learning new things that are not of their interest, their intrinsic motivation, watching the environment, paying attention to what is happening and learning through imitation is not enough. For this reason, they cannot learn many skills and games while other children learn by observing. Therefore, it may not work for some children to ask your friend to do/imitate what they do. He sees his friend's behavior, but by looking at him, he may not know how to organize his own behavior. He may not understand what the teacher wants to do or to whom he wants to look (Mesibov et al., 2005).

Inability in Management the Tasks

Bringing together various elements is an arrangement to achieve a previously decided result. There are limitations in organizational skills in individuals with autism. He has difficulties in ordering problems and following them in a row while doing. It is difficult for them to focus on both the expected result and the current issue. For this reason, they can do business in an unreasonable and purposeful order, for instance, they can mix shoes while wearing clothes and wear shoes instead of socks (Mesibov et al., 2005).

Eric Schopler and Robert Reichler developed TEACCH Method in 1964 at the University of North Carolina (Applied Behavior Analysis Programs). TEACCH Method is a structured teaching educational technique that emphasizes visual support and aims at raising and optimizing independent functioning. It regulars need for correction and reprimand by teachers. Autistic children respond more favorably to structured settings than unstructured ones (Mesibov et al., 2005).

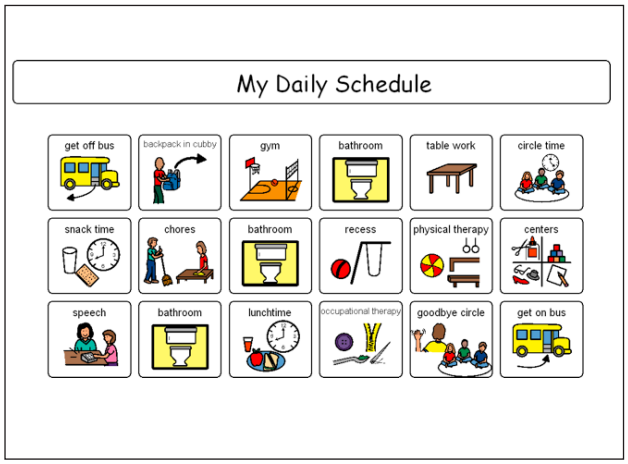


Figure 16. Example of visual schedule

Children with ASD need a specialized program that promotes independence and skills needed for independent living. With special education and structured support, it is possible to increase the skills and problem behaviors of a child with autistic features (Korkmaz, 2005). Program objectives help students' function to control their actions and inspire students through context and natural consequences, over unrelated contingencies and reinforcements individually (Olley, 1999). Despite these learning objectives, autism students often find it difficult to undertake activities independently and/or stay engaged with materials independently (Pelios, MacDuff, & Axelrod, 2003).

Figure 15. Example of visual layout

THERE ARE FIVE MAJOR COMPONENTS OF STRUCTURED TEACHING WHICH ARE (Applied Behavior Analysis Programs).;

Physical structure

Physical structure refers to the immediate surrounding of individuals, organization of the environment. The physical boundaries of everyday tasks should be identified clearly.

Routine

Routine is key since consistency is the most critical functional help for people with ASD

Schedules

It is possible to provide a clear schedule through different media, such as drawings and photographs. It is visual information that defines where/when/what the activity will be

Visual Layout

The visual layout provides visually-based reminders and instructional signs what the learning task is about

Work Systems

The system of work establishes measures of expectations and behavior which promote independence. Ideal job processes must have minimal written guidance to convey goals. Visual information informing a student what to do while in a work or play area

- the tasks
- the amount of work to be completed
- a signal that the work is finished
- instructions for the next activity in their schedule

The recent focus on freedom and inclusive placements and communities' priority highlights the urgent need for research and action in this area. However, the primary learning features of people with ASD, which include struggles in planning, distracting, organizing, and generalizing, allow therapy to be structured around the unique strengths (e.g., visual-spatial organization) and needs (e.g., structure and predictability) of them (Mesibov et al., 2005).

Studies have shown the efficiency of structured teaching methods to support autism and extreme intellectual disability in children during work sessions and transitions and reducing self-injurious behavior (Panerai, Ferrante, & Caputo, 1997). The individual work system was described as a visually structured space where children work under the direct supervision of an adult or perform work previously mastered..

While defining the task engagement is an activity in the absence of adult prompting as an independent functioning, the deficiency in independent functioning may be linked to inspiring lots of features. These features could be related to the care provider's continuous intervention, organizational difficulties, and timing due to reduced capacity to generalize skills to new environments issues with interpretation and understanding audit guidelines (Keel, Mesibov & Woods, 1997).

In one of the research, all the play items to be used have been put in a shelf to the student's left. Upon completing each work/play activity (by prior description), the participant put the finished material in the box on his right. When all tasks were done and put in the finished box, each participant was sent a visual cue to their

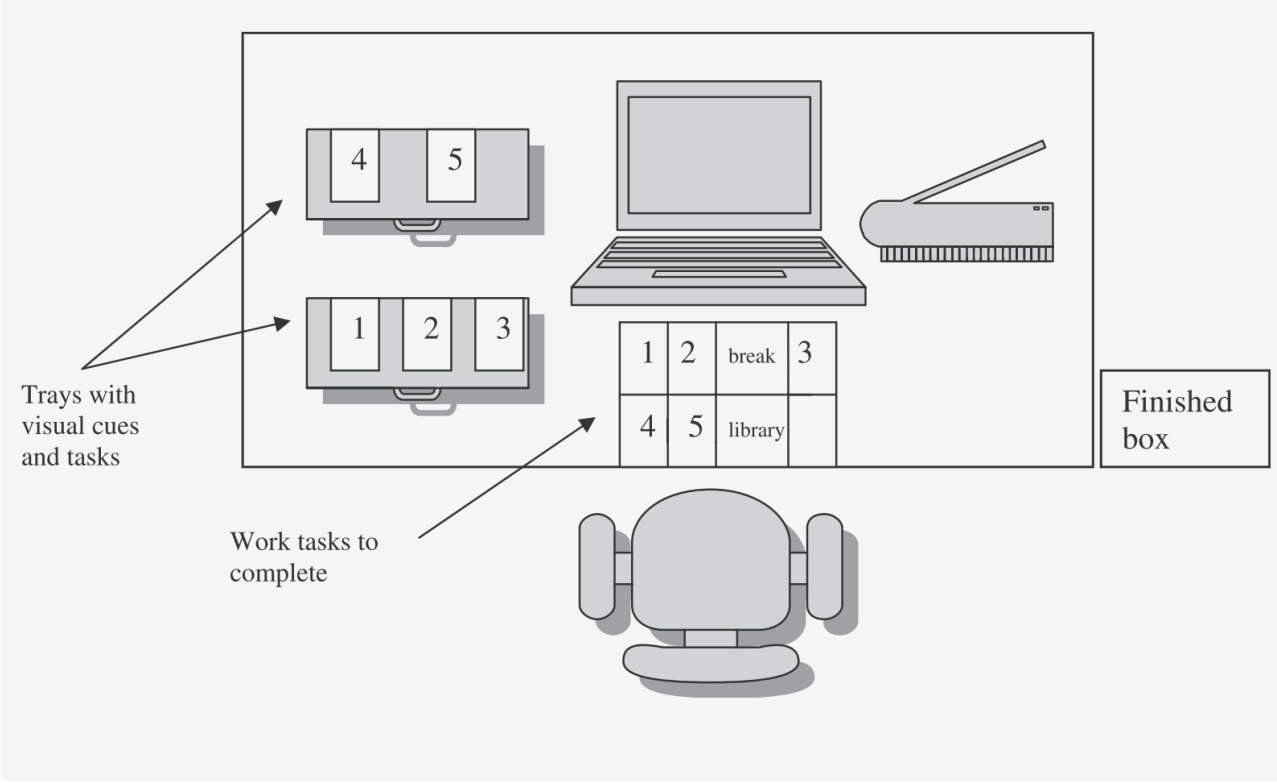


Figure 17. The independent work system1 (Hume & Odom, 2007)

next scheduled activity, which differed regularly depending on the schedule of the students (Hume & Odom, 2007).

In the depiction, squares on the left represent trays with mastered tasks and materials. Visual cues on the desk will be matched to the cues on the trays. Completed tasks will be placed in the finished box, **Fig.17** (Hume & Odom, 2007).

In the depiction, shaded shapes on the left represent mastered play materials. The visual cue representing the next scheduled activity is placed at the end of the sequence of materials. Completed play activities will be placed in the finished box participants, **Fig. 18** (Hume & Odom, 2007).

Using an individual work method was successful in that the functioning of independent work for all three subjects

Figure 18. Example of work system

and sustaining success during the 1-month follow-up. Positive improvements in independent performance occurred when the work system was implemented after the initial baseline; performance declined with the removal of the work system, and participants subsequently improved independent performance when the work system was restored (Hume & Odom, 2007).

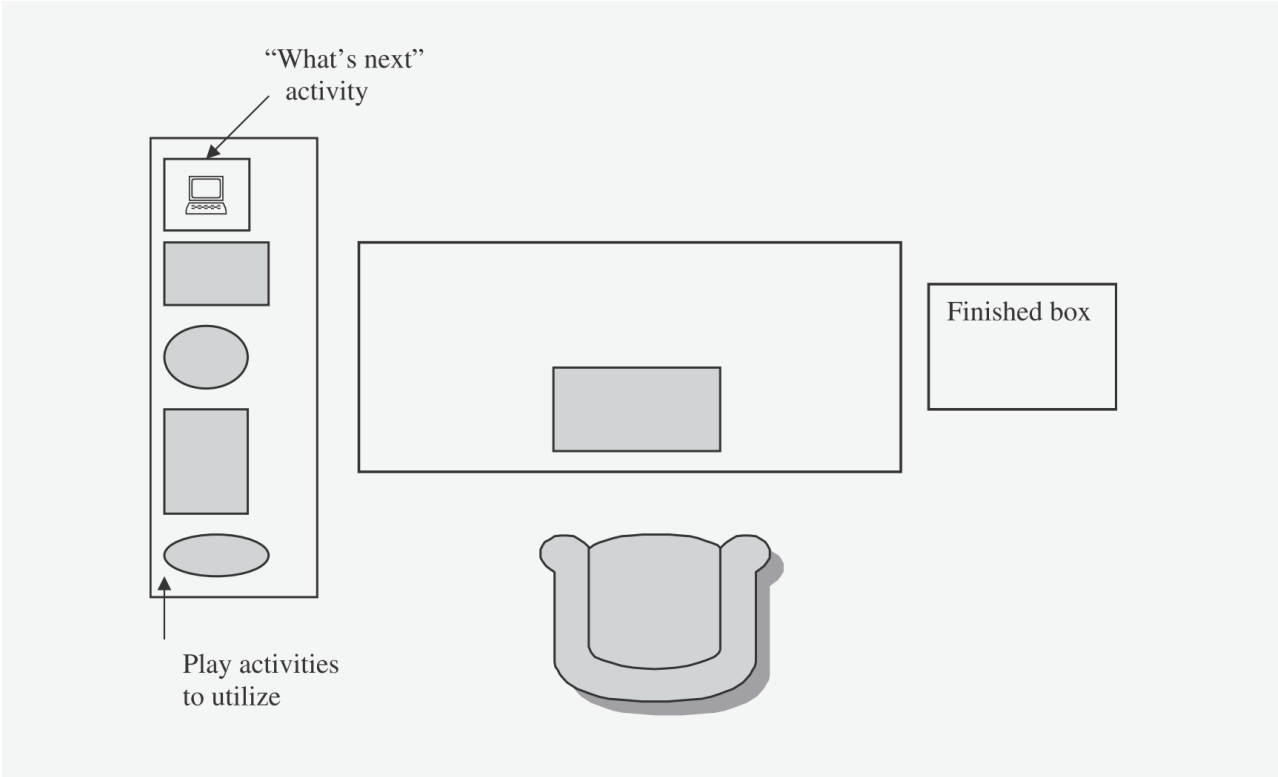


Figure 19. The independent work system2 (Hume & Odom, 2007)

'... THE WORD "AUTISM" STILL CONVEYS A FIXED AND DREADFUL MEANING TO MOST PEOPLE—THEY VISUALIZE A CHILD MUTE, ROCKING, SCREAMING, INACCESSIBLE, CUT OFF FROM HUMAN CONTACT. AND WE ALMOST ALWAYS SPEAK OF AUTISTIC CHILDREN, NEVER OF AUTISTIC ADULTS, AS IF SUCH CHILDREN NEVER GREW UP, OR WERE SOMEHOW MYSTERIOUSLY SPIRITED OFF THE PLANET, OUT OF SOCIETY... "

-Temple Grandin, Thinking In Pictures, Expanded Edition: My Life With Autism

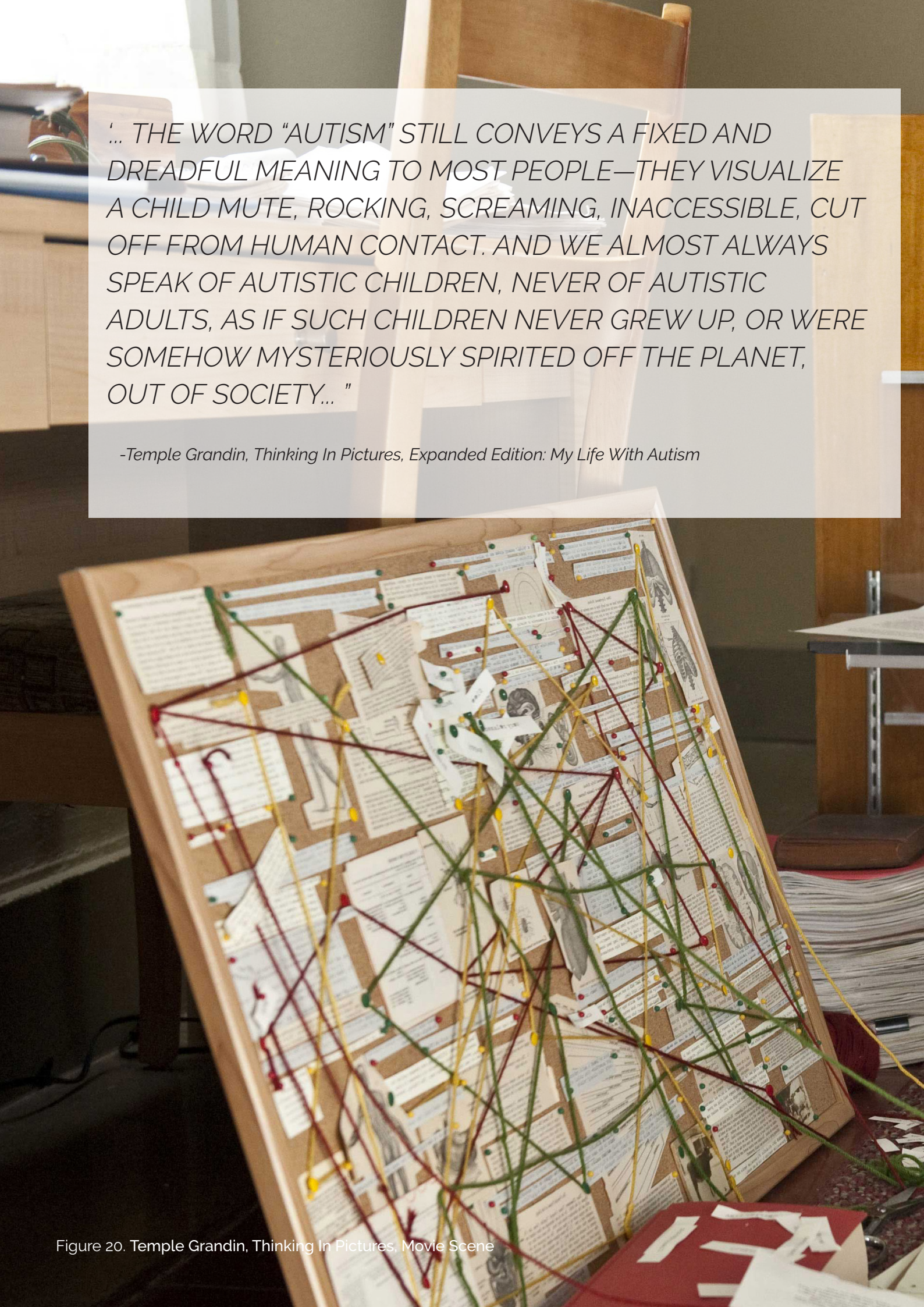


Figure 20. Temple Grandin, Thinking In Pictures, Movie Scene

3

PROJECT CONTEXT

People with ASD may require help to live in their own homes, whether as tenants or owners, alone or with others. To increase the quality of life for them, they need to have the ability to make free decisions in order to be independent (Brand, 2010). When we look at the data that shows the independence of the people with ASD and how they live, whether alone or not, it shows that **%17 of adults with ASD live independently,** following high school and up to eight years after. It is very important to understand the reasons that cause this lower percentage. For instance, developing skills like cooking, getting dressed and cleaning are essential tasks to promote autonomy and self-determination and improving quality of life according to the researches. Together with, **%44 of adults over 25 with an ASD live at home with their parents,** rather than in any of the housing options. **Of those adults living away from their family, only 4% are living fully independently, and 30% are living semi-independently in some form of supported housing**. This can lead to problems as parents age and need care themselves. When the parents die or become too infirm to cope, this often leads to a crisis in the life of the person with an ASD (National Autistic Society). These results show us how vital to support the independence of people with ASD throughout their lives since they need to learn and adapt themselves in daily living situations.

Sensory assistances play an important part in helping people with ASD to improve their living environment, which response specifically to an individual's sensory needs can help to enhance attention, communication, and social interaction. Sensory assistance could be the objects that stimulate principal senses. People with ASD, who often give extreme reactions to sight, sound, smell, taste and touch, prefer to interact with the objects by simplifying the process rather than performing complex tasks. It may allow them to explore their sensory limits in a healthy, enjoyable and comfortable way (Brand & Gaudion, 2012).

In this section, the role of design in assisting with the different situations such as meal planning, shopping, money management, leisure activities, personal care, and, above all, providing encouragement are researched. It is very vital to let each person achieve a greater degree of independence to unlock their potential. The interaction with the services and products affects the people with ASD, so it is essential to realize and understand how they interact with the tools in order to live their lives more independently (Kapetanovic, 2002).

While designing for people with ASD, there are some researches by addressing motion, sensory and cognitive capabilities of them within the context of inclusive design. The notion of "Inclusive Design" refers to the concept of creating digital and visual environments that can be used by all people regardless of age, health conditions, employment, skills, and others, to the greatest extent possible (Kapetanovic, 2002).

Inclusive Design

"INCLUSIVE DESIGN IS A METHODOLOGY, BORN OUT OF DIGITAL ENVIRONMENTS, THAT ENABLES AND DRAWS ON THE FULL RANGE OF HUMAN DIVERSITY..."

- Microsoft Inclusive Design Toolkit

The United Nations (UN) Convention on the Rights of Persons with Disabilities (CRPD) reflects the change from a former medical model to a social model in which disability is understood to result from the interaction between persons with impairments and environmental barriers that hinders their full and effective participation in society on an equal basis with others (Berghs et al. 2016). Lim and Nickpour (2015) extended the definition of Inclusive Design by exploring the psychosocial aspects that could be associated with it. Even, these studies often concentrate on the direct connection between people and products, intending to mainstream the recognition of diverse expression, sensory and cognitive abilities.

Making environments easy to use for every-one means considering signage, lighting, visual contrast, and materials. It also requires people to have sufficient information, often before they leave their house, that makes them feel confident enough to access a building or space (Design Council, 2006).

British Standard 7000, Part 6, states that design should be available and functional by as many people as fairly possible on a global basis, in a wide variety of circumstances, and as far as possible without the need for special adaptation or specialized design (Keates, 2004). According to the other definitions, Inclusive Design aims to "integrate older and disabled people into the mainstream," "as involved, engaged and contributing members of society" through "products and services that thrill the end-user, rather than stigmatizing and alienating" (Clarkson & Coleman, 2015).

Together with, the social model in disability studies points out that disability is not only about how society views people who have limitations, but also about the life experiences of people who have disabilities (Thomas, 2004). An alternative definition of Inclusive Design could be conceivable: assisting people in fulfilling needs, such as social interactions with others, supported by designs that promote this fulfillment in more ways. An additional layer of Inclusive Design may be that of a facilitator in which designs or strategies allow a person to enhance his or her life experience and social resilience, beyond physical adaptation. Another approach could be to focus on the experience of situations and how to meet the needs of an individual (Boess, 2018).

5 PRINCIPLES OF INCLUSIVE DESIGN
(DESIGN COUNCIL ,2006)

1 **Inclusive design places people at the heart of the design process.**

To achieve this, we should ensure as many people as possible are involved in the design. This will help facilitate personal wellbeing, social cohesion, and enjoyment for everyone.

2 **Inclusive design acknowledges diversity and difference.**

Good design can only be accomplished if the environment addresses the needs of as many people as possible. It is also important to consider the obstacles experienced by people with learning disabilities, mental disability, visual impairment, and hearing impairments.

3 **Inclusive design offers a choice where a single design solution cannot accommodate all users.**

The inclusive community doesn't seek to fulfill every need. However, it will break down barriers and discrimination by recognizing the diversity of individuals, and can also find superior solutions that benefit all. When implementing the same high-quality criteria to satisfy all users' access specifications, a system welcomes everyone on an equal playing field.

4 **Inclusive design provides for flexibility in use.**

Meeting the principles of inclusive design requires an understanding of how the building or space will be used and who will use it.

5 **Inclusive design provides buildings and environments that are convenient and enjoyable to use for everyone.**

Designing inclusion for autism should bridge the gap between technical progress and human evolution by giving priority to human factors in product design and service design since one in 70 to 100 children is diagnosed as being on the autism spectrum (Autism Speaks). Some researches had been carried out, and one of them is about integrating certain senses into the physical objects. Van Rijn and Stappers (2008) sketched an evocative image of the way children view the world on the autism spectrum: integrating specific sensory experiences is a challenge to them. As a result, they frequently withdraw or get stressed in social contact, which, in effect, impedes their social relations. One example is the incorporation of auditory impressions: children find it hard on the continuum, which quickly contributes to sensory overload.

VAN RIJN AND STAPPERS (2008) DESCRIBES ELEMENTS TO TAKE INTO ACCOUNT WHILE DESIGNING FOR AUTISM:

- give them a feeling of being in control
- provide a structured situation
- let them create a structure themselves
- make use of their special interests
- facilitate their excellent memory
- reward them with sensory experiences
- facilitate their eye for detail
- let them use their whole body.

Figure 21. The Color Factory

Importance Of Digital Technologies On People With Autism Spectrum Disorder

Digital technology plays a significant supporting role in people with ASD. For them, technology can be a 'compensatory mechanism', a psychological tool that can 'transform…natural abilities into higher mental functions…' (Kozulin and Gindis, 2007). Internet-of-Things foresees a future in which digital and physical entities can be connected to create a whole new class of applications and services, using appropriate information and communication technologies(Miorandi et al., 2012). The Internet of Things (IOT) is kind of a comprise of digitally present physical devices.

If children with autism struggle to understand the world around them, then they must face everyday difficulties in managing their environment (Williams, 2004). Giving children with autism an opportunity for increased modification may bring new directions through an improved sense of control (Rotter, 1989). Computers offer an opportunity for children with autism to experience information and symbols that can facilitate social interactions, help guide behavior, and inspire activities (Jordan and Powell, 1995) since, during machine interaction, the tension and unpredictability caused by social interaction are largely removed (Murray, 1997). They experience a difference between their natural and social development routes, equipment, strategies, and objects to emphasize the usage of social and interaction by providing ways to mediate and enhance development (Kozulin and Gindis, 2007).

Figure 22. Saverio Tutino - The Little Museum of Diary

Figure 23. Resonance - Samsung Interactive Installation

Effects Of Interactive Digital Technologies On People With Autism Spectrum Disorder

Digital technologies have enabled communication growth in recent years among people with Autistic Spectrum Disorder (ASD). Some websites like YouTube.com supports people with ASD to express their ideas and comments since they were unable to communicate until the advent of computers and the internet in their present form (Ullmer & Ishii, 2000). The interaction between people with ASD and digital technologies depends on the well-defined interfaces according to their unique characteristics.

The Interaction Design Association (2004-2010) regards interaction design as defining 'the structure and behavior of interactive products and services' (Wang, Moriarty & Wu, 2015). Interaction
design focuses on designing interfaces that are connecting with well thought out behaviors.

There are five dimensions that are defined by a professor at London's Royal College of Art, Gillian Crampton Smith, and a senior interaction designer, Kevin Silver, in Interaction Design.

The first one is words that include text, such as button labels, which help convey the right amount of information to users.

The second one is visual representations, which means graphical elements such as images, typography, and icons that aid in user interaction.

The third one is physical objects/space that involves the medium through which users interact with the product or service—for instance, a laptop via a mouse or a mobile phone via fingers.

The fourth one is time, which refers to the relation to media that changes with time, such as animations, videos, and sounds.

The last one is behaviors concerned with how the previous four dimensions define the interactions a product affords—for instance, how users can perform actions on a website, or how users can use a coffee machine. Behavior also relates to how the product responds to inputs from the users and provides feedback (Interaction Design Foundation).

Good user experience can make people like the tool, while inappropriate user experience can make people dislike the tool and abandon it despite its other benefits (Pavlov, 2014). The design and implementation of a user interface (UI) for the assisting tool is an essential part of the project. Accessibility makes user interfaces perceptible, operable, and understandable by people with a wide range of skills, including people who have been in different situations. There has been a large amount of work on accessibility, and there are many established requirements and guidelines for designing and creating open applications. You can see the methodology for the preparation of documents for people with learning disabilities that had been done by The Uk Department Of Health And Social Care.

- Each idea needs both words and pictures—both pictures and words are important.
- Pictures and words go next to each other—this helps more people to understand the information.
- Make sure that it is clear which pictures support which bits of text.
- Pictures must be easy to understand.
- Pictures should go on the left.
- Pictures can be drawings, photographs, or other images.
- Make sure that pictures are as big as possible.
- Words must be easy to understand.
- If you use complicated words, say what they mean using easy words
- Words go on the right.
- Words must be written clearly—a font like Arial is good.
- Words must be big—font size of at least 14 points is good.
- Each sentence must be as short as possible— more than 15 words are harder to read.
- Each document must be short—more than 20 pages are too long.

While considering all these aspects of the design process for people with ASD, personalization is a crucial factor for good user experience for people with ASD, as they have very different personal preferences and needs. This states that individuals with ASD will benefit from this because this enables them to ensure explicitly that the system is customized to their particular needs. For instance, Personalized Interactive Urban Maps for Autism (PIUMA), which aims to develop novel digital solutions for helping people with cognitive problems in their everyday movements by making cities accessible to people with cognitive disabilities, going beyond the mere physical accessibility. The project supports personalized not only according to the user's preferences and interests but also taking into account their peculiar problems with sensorial modalities, in order to provide comfortable "safe" environments according to the user's current level of stress and anxiety (Cena, Rapp & Mattutino, 2018).

Together with, **ARKit** which is developed by APPLE, supports the education of the children with ASD by using augmented reality.

Figure 24. ARkit - APPLE

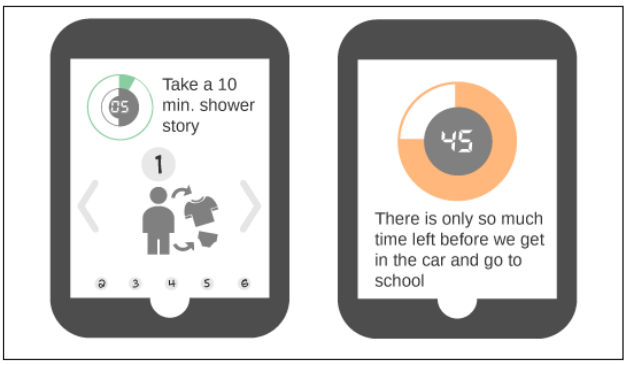


Figure 25. UI digital planner for children with autism

Together with, there has been made a lot of research into ways to link the physical and digital worlds. A variety of interfaces have begun to investigate the relationship between physical representation and digital information, highlighting interactions (Ullmer & Ishii 2000). An extension of object affordance with tangibles by digital effects seemed to help people with autism. Predictable and personal playback of content provided a more high-quality experience (Farr, Yuill & Hinske, 2012).

For instance, The Future Lab Program™ T is an interactive tabletop projector that uses touch to control images projected onto a tabletop or object (Sony).

Figure 26. Sony Interactive Tabletop

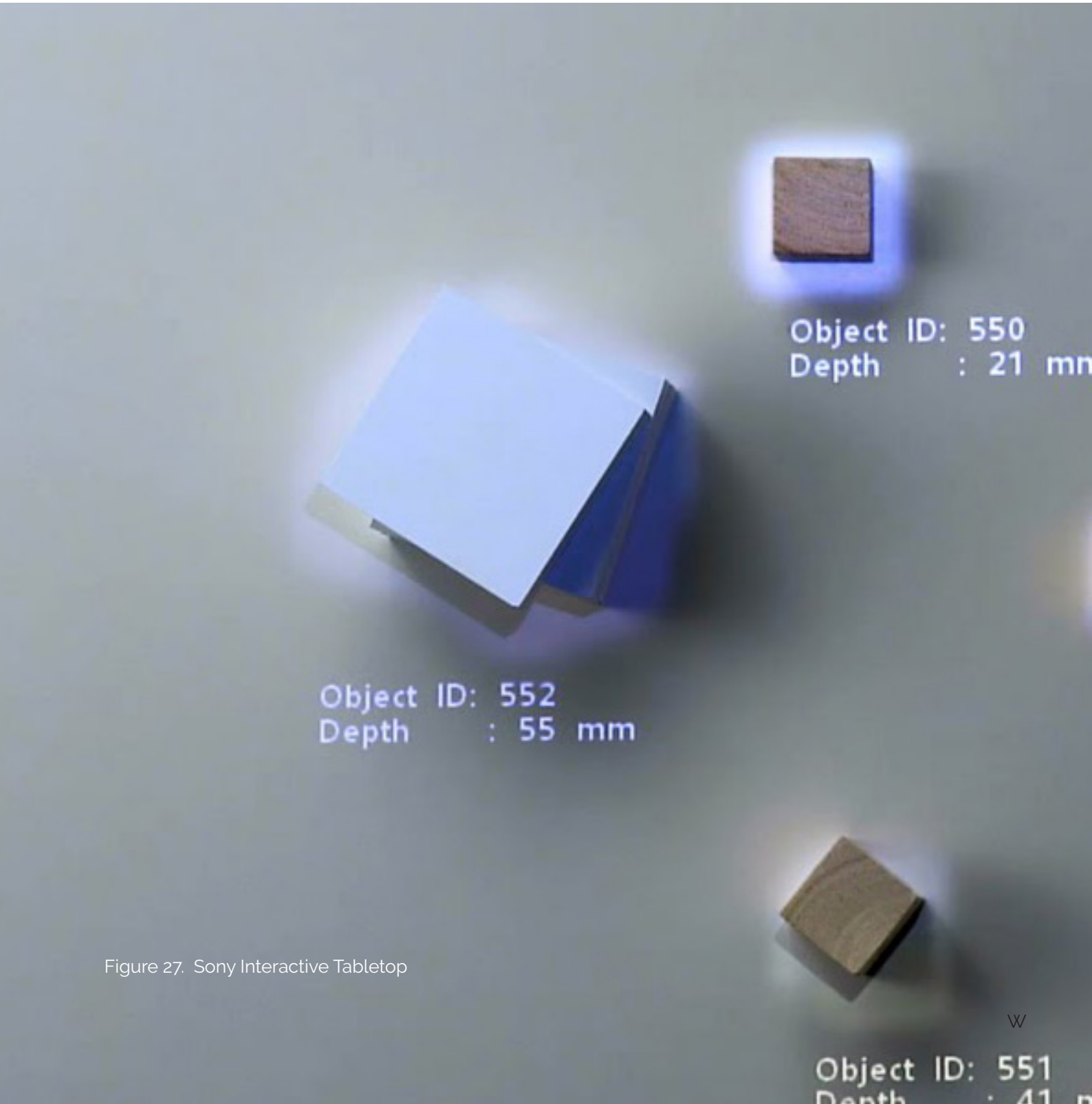
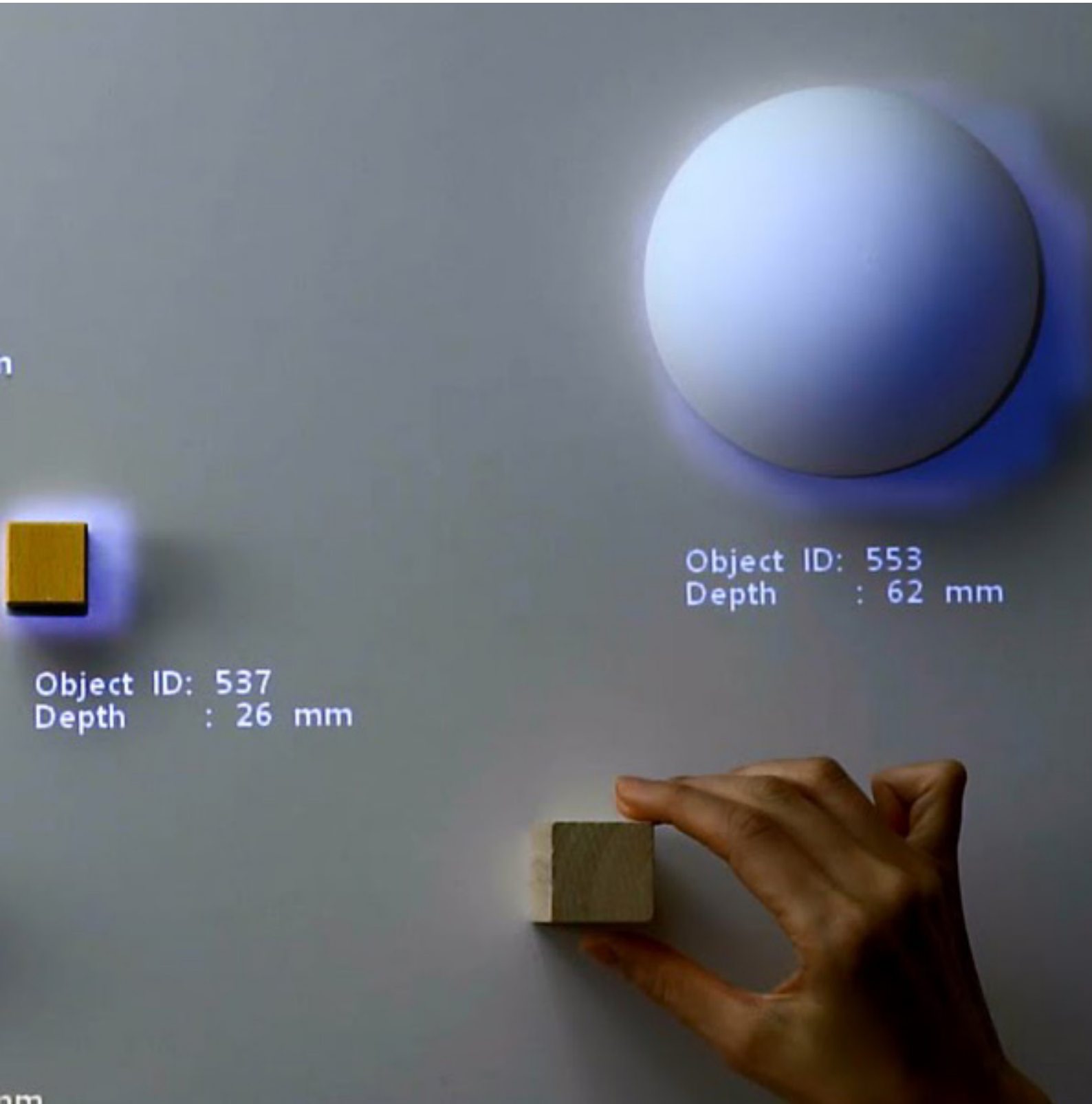


Figure 27. Sony Interactive Tabletop

THE COGNITIVE AND SOCIAL IMPLICATIONS OF THE TUI ARE THAT USERS CAN PROJECT THEIR OWN SYSTEMS OF MEANING ONTO BOTH THE DESKTOP ENVIRONMENT AND THE SOCIAL EXCHANGES OF AROUND TOKENS...

- Tangible User iInterfaces for Peripheral Interaction,
Darren Edge, University of Cambridge



Tangible User Interfaces (TUI) build on the physical skills that we use in our interaction with the real world. Professor Hiroshi Ishii from the MIT Media Lab set up the research program "Tangible Bits" Here Ishii proposed, people, have developed sophisticated skills for sensing and manipulating our physical environments. However, most of these skills are however not used by traditional GUI (Graphical User Interface). Tangible Bits seeks to build upon these skills by giving digital knowledge a physical form, seamlessly combining the dual worlds of bits and atoms (MIT Media Lab).

Even Graphical User Interface (GUI) paradigms can support the remote expression of ideas by people with ASD, and efforts that are also made to support co-located collaboration between them through emerging computer interface paradigms (Farr, Yuill & Raffle, 2009); Tangible User Interfaces has the ability to creatively communicate information that can greatly enhance their ability in order to represent and manage information.

TUI beings together with the digital functions and encompass physical forms in an appropriate and meaningful manner. If we look at the environmental perspective, TUI focuses on tangibility and full-body experiences, incorporating computing into the daily world and intuitively helping use (Wang, Moriarty & Wu, 2015). TUI provides physical, concrete interactions to make engagement with the environment and people easily since people with ASD have difficulties in understanding and perceiving the environment and people because of their unique characteristics.

Figure 28. Tangible Bits - MIT Lab

The effects that physical interactions can have on autistic individual's social and emotional daily lives is a new approach. Literature does define so-called "transitional objects": objects that a person may use to provide psychological support, particularly in difficult or specific circumstances, and that can also reflect relationships with others (Holmes, 2011). Together with, the effects of physical interaction on people with ASD is inevitable.

There are some researches that have been carried about tangible user interfaces and its effects on individuals with ASD. Piper et at (2006) used a Mitsubishi diamond-touch surface to show that table-top interactions designed with the Autistic Spectrum, can allow them to be more mindful of those around and function for more extended periods while minimizing typical behavior for those with ASD.

Tangible tools, which have also been demonstrated to promote collaboration, can help people with ASD to collaborate and interact in new ways (Ullmer & Ishii, 2000). Fundamental evidence from Lego Therapy

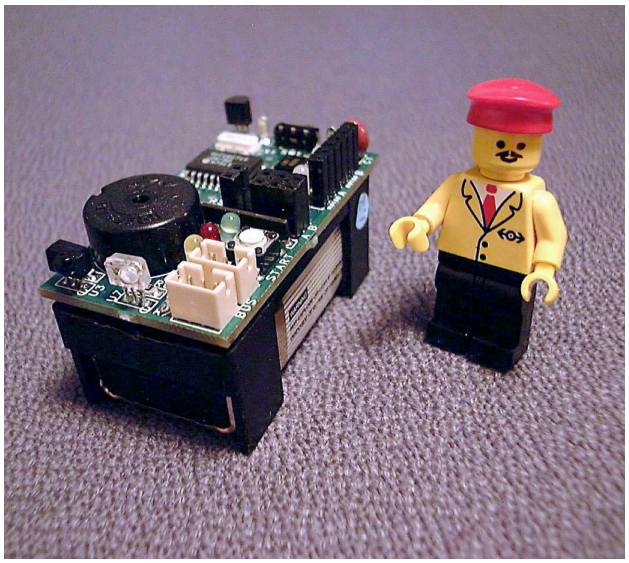


Figure 29. Lego - Tangible Programming Bric

(2004) indicates that contact with physical manipulations can help individuals with ASD to communicate for prolonged periods by helping to redirect the attention of individuals and providing a shared sense for the exchange of objects and ideas.

Tangibles can be especially appropriate for people with ASD since they take advantage of people because they are active learners who are rooted in the body and strengthened by sensory sensitivity (Farr, Yuill & Raffle, 2009).

Figure 30. Topobo

Topobo is another project which demonstrates a constructive assembly system with kinetic memory (Wang, Moriarty & Wu, 2015). It facilitates the external representations if an internal cognitive process via tangibles, which assists autistic children learn to interpret other people's behaviors and attitudes and provide time and space to advance their inner cognition (Scaife & Rogers, 1996). Externalization of expressive representation by tangibility provides a focus for tasks, allows for the documentation of work, and can give users the ability to think and talk about objects that are being used (Horneker & Buur, 2004).

4

It all started one big question;

IDEA RESEARCH

IS IT POSSIBLE TO DEVELOP NOVEL ASSISTANT TOOL FOR HELPING PEOPLE WITH AUTISM TO SUPPORT THEIR DAILY LIVING SKILLS IN ORDER TO PROVIDE A HIGH QUALITY INDEPENDENT LIFE

Is it possible to enhance of their life experience focusing on digitalized physical interaction?

-

Is it possible to improve their daily life skills by getting people with ASD out from their comfort zone by adding new tasks?

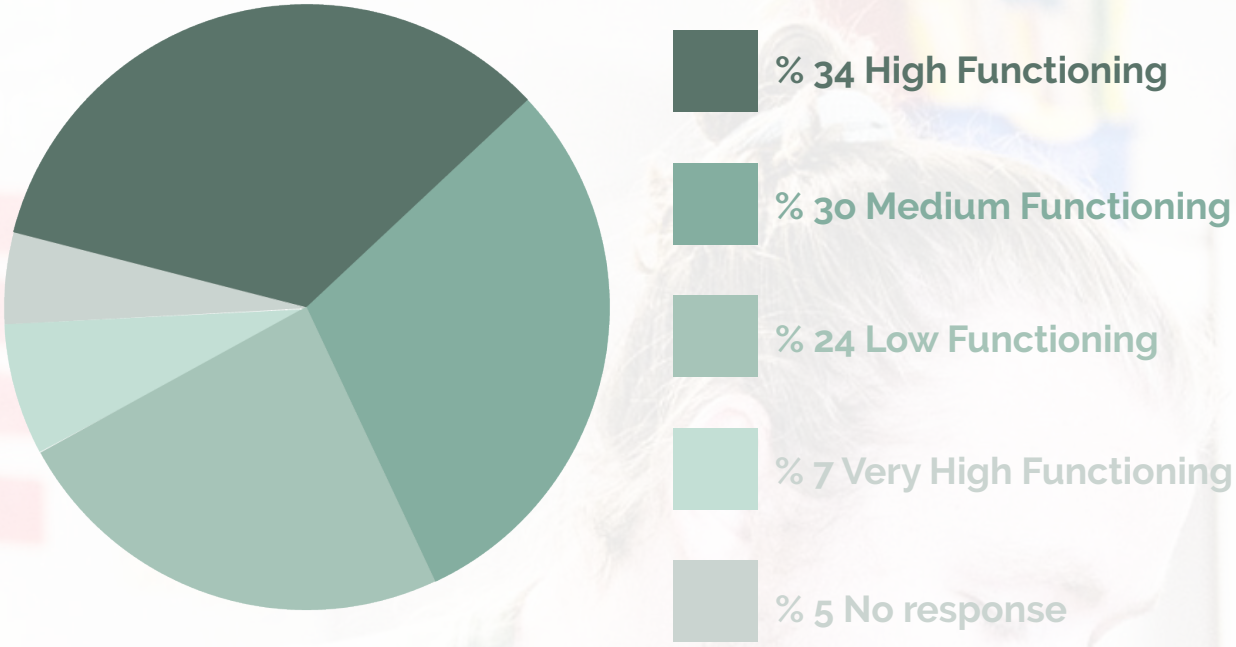


Figure 32. Cognitive Capability (Brand, 2010)

Figure 31. Adult with ASD. Education Center

% 49 In parental home

% 32 In a residential setting

% 8 Independently with regular professional or family support.

% 5 No Response

% 3 Independently

% 3 other

Figure 33. Living Arrangements (Brand, 2010)

User Research

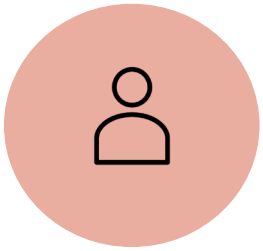
Figure 34. Scale Model of Hobbit House, Nicholas Busch

User research is important to identify the correct problems and then figuring out how to solve them for people. It is about learning what a user is trying to do and understanding what is and isn't working for them. It is all about trying to reach the insights of the user to define the vital points for them.

In today's world, it is a complicated process to analyze the feeling, desires, and the real demands of people. Notably, the needs can be challenging. In order to collect more data to support the thesis and argument, semi-structureded qualitative interviews were conducted with people with ASD as well as educators who work with them and their family members, in total 15 people. Material gathered during the research phase was used to uncover patterns, identify common problems and define a framework to explain how the design of built environments can impact people with autism.

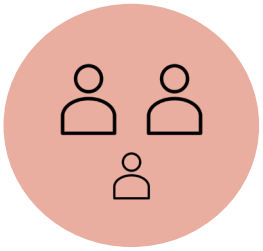
Priliminary Research - Semi - structured interviews

I wanted to understand their real demands and reach the insights in order to define teh vital points. Therefore, I focused on some of the basic tasks such as cooking and shopping in order to anayze the fundamental steps among different situations.



Individual with ASD
(5 participant)

Educator
(5 participant)



Parent
(5 participant)

"I prefer written recipes while cooking rather than watching the videos since it is so difficult to follown."
Participant 1, Anonymous

"I would like to try cooking new foods if there are more structured recipes that I can follow."
Participant 2, Anonymous

"I am following a schedule that my teacher made; it makes my tasks easier during the day."
Participant 3, Anonymous

"We are generally making weekly tasks according to the level of them since we are meeting once a week or twice a week. Then, we are arranging their schedule."
Semra Öztürk, Special Education Teacher

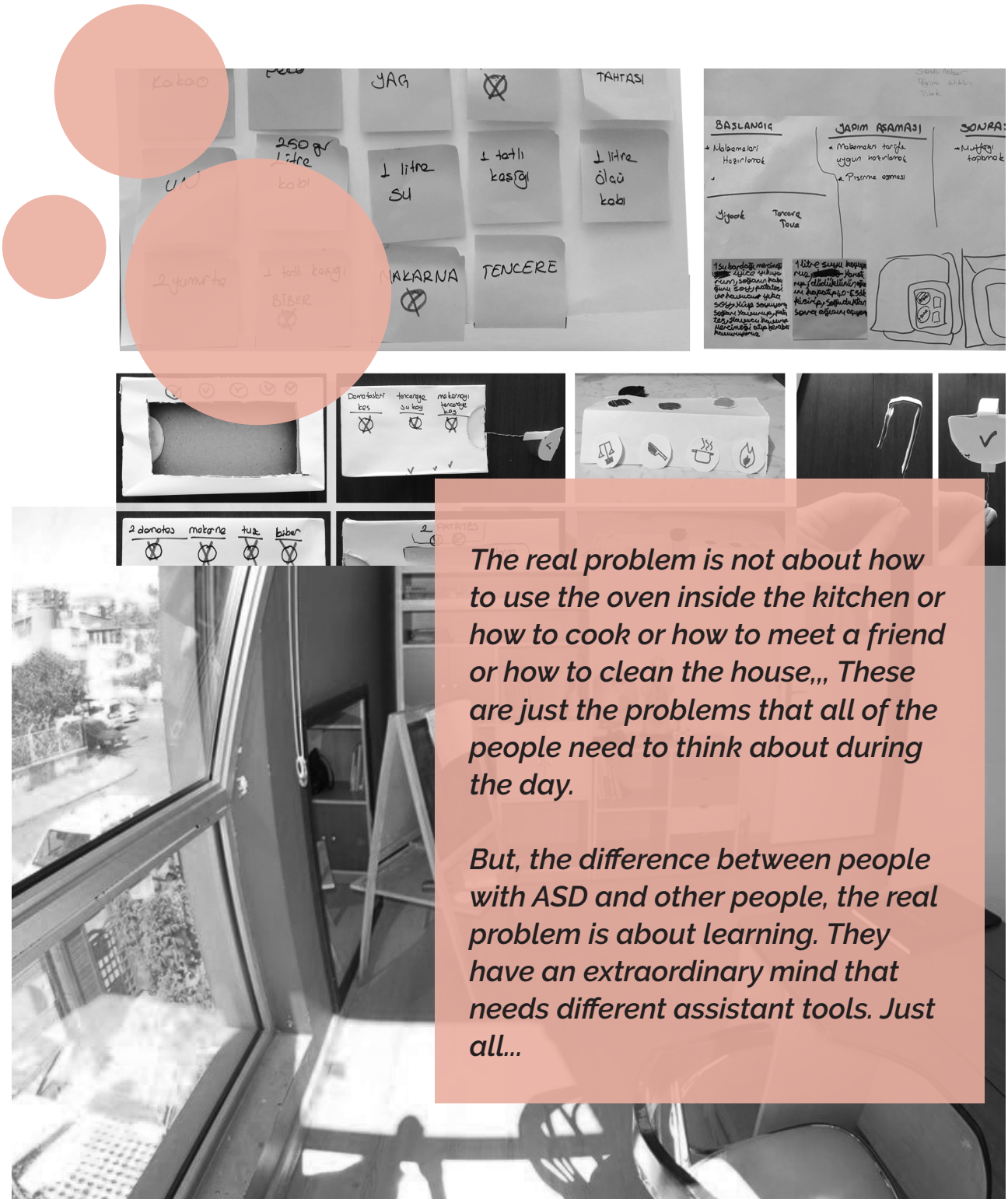
"We need to add new tasks to their routines depend on their level of autism in order to prepare them for real-life since, during the day, usually, you can face with lots of unexpected situations that you have to deal with. When you add a new task to their weekly schedule, even they do not want it, at least, they are going to try it."
Nurhan Gökçe, Special Education Teacher

"From the morning, they wake up till they sleep, they are always following a visual schedule that shows the tasks they need to during the day. It is a list on their wall.."
Participant 1's Parent, Anonymous

"They are geniuses when it comes to the digital application; they can do anything."
Participant 1's Parent, Anonymous

** Since participants with ASD would like to join the interviews if their data are confidential; their name, age, picture.*

Main Research - Workshop

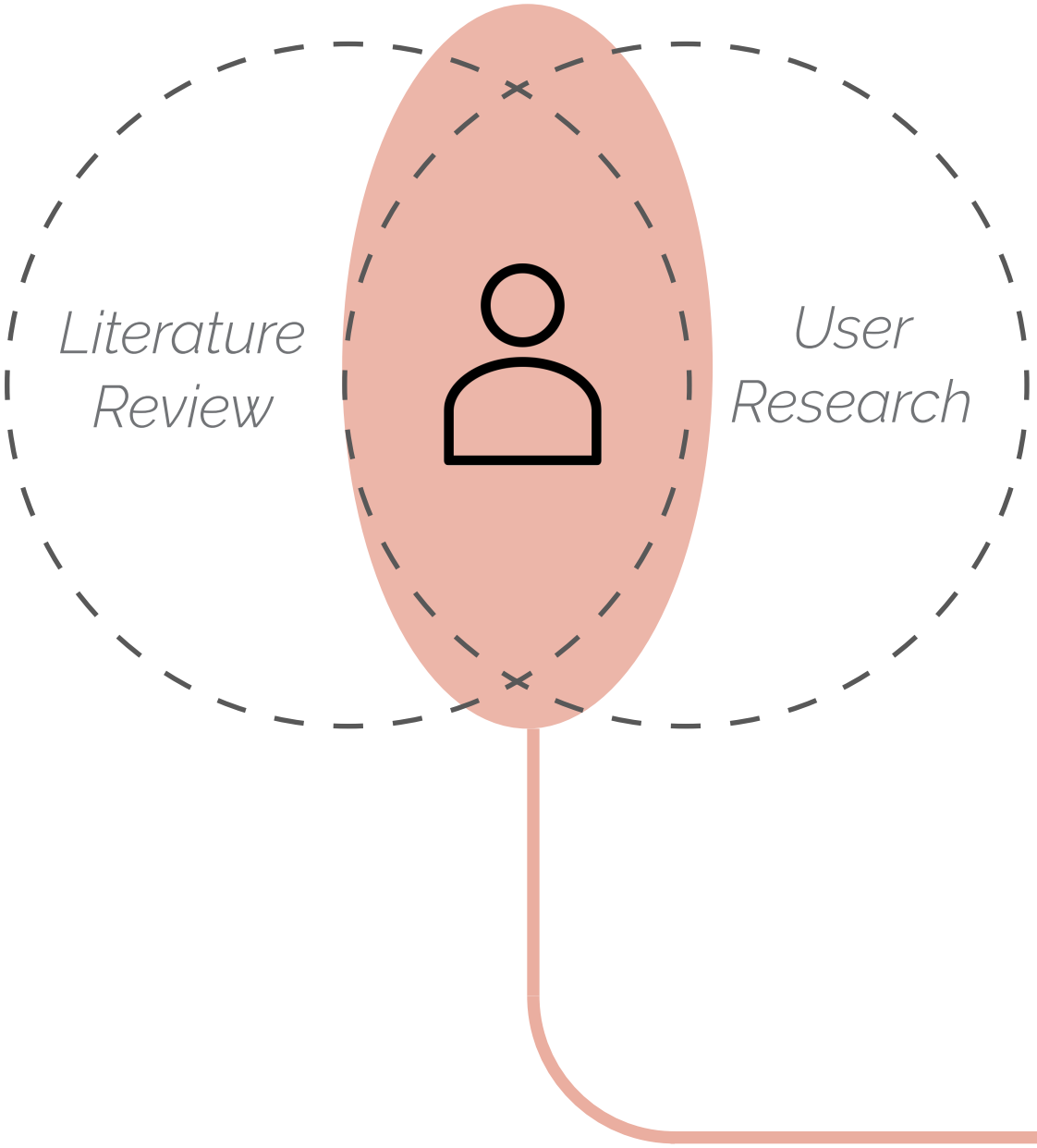


The real problem is not about how to use the oven inside the kitchen or how to cook or how to meet a friend or how to clean the house,,, These are just the problems that all of the people need to think about during the day.

But, the difference between people with ASD and other people, the real problem is about learning. They have an extraordinary mind that needs different assistant tools. Just all...

Figure 34. Special Education Room for Autism

** Since participants with ASD would like to join the workshops if their data are confidential, so there is no picture of them, just some of the outcomes that they have done.*


Literature Review
User Research

NEEDS

Work system

Assistive Technologies

Personalization

" YOU NEED TO STRETCH KIDS WITH AUTISM SLIGHTLY OUTSIDE THEIR COMFORT ZONE, BUT NEVER HAVE SURPRISES. "

-Temple Grandin, living with Autism

According to the research that has been done in Uk and its results that have been shown in Fig. 32, and Fig. 33; even their cognitive capability allows them to sustain their daily lives, just ***%3 of them live independetly*** and ***% 8 of them live independently with regular professional or family support***.
Most of them continue to live with their parents or residential settings (Brand, 2010).

When the parents die or become too infirm to cope, this often leads to a crisis in the life of the person with an ASD (National Autistic Society). These results show us how vital to support the independence of people with ASD throughout their lives since they need to learn and adapt themselves to daily living situations.

WHY

To give them a feeling of being in control and provide a structured situation

-

To define the physical boundaries of everyday tasks clearly

-

To let them use their whole body

-

To let them understand the concept of time and proces information

WHAT

Visual schedule that the user can follow during the day

-

A visual layout about the tasks that user need to the during the day

-

Instructions for the next activity in their schedule

Assists to follow the routine of the autistic individuals to maintenance the adaptation to the daily life

-

Visual support tool to assist them understand what is going to happen and when

-

A visual layout which provides visually-based reminders and instructional signs what the learning task is about

A signal, which is visual and auditory that shows the work is finished and a reminder of the next one

-

Digital Interaction via application

-

Physical Interaction via tangible user interfaces

To understand and pay attention to the task

-

To manage the appropriate fine and gross motor skills

-

To prepare, order, and coordinate the time and resources to conduct with tasks

Touch - Material

-

Sound - Auditory

-

Sight - Visual

User Analysis

Persona

We need to teach them how to be part of society by integrating the technology ...

SEMRA

45, special education teacher

Semra is a special education teacher and loves her work. Her passion comes from the feeling of helping others and makes their lives more liveable. She loves to see their students being a part of society. Together with, she always ready to assist them whenever they need even they become adults.

She knows that autism is not disappearing magically when they grow up. Their education needs to be arranged according to their age and needs based on their personal sensory preferences. That's why she would like to have a system that helps her to control the schedule of her students easily.

MOTIVATIONS

Personalization

Social

Convenience

NEEDS

easy to follow their tasks

add new tasks easily

let them feel free

I would like to do my own schedule easily, I want to follow my own tasks... .

SARA

18, student who has ASD

Sara has just started at university and lives with her parents. She is following her daily schedule during the day since it is very important to know what she is going to do. Every morning, she checks what she should do based on the list that her teacher gave; and makes her own "To do list".

However, she prefers to follow some technological guidelines that assist her while following her daily schedule since, when she goes to university, she wants to deal with her schedule easily. She would love to have personalized products that make her feel confident

MOTIVATIONS

Personalization

Social

Convenience

NEEDS

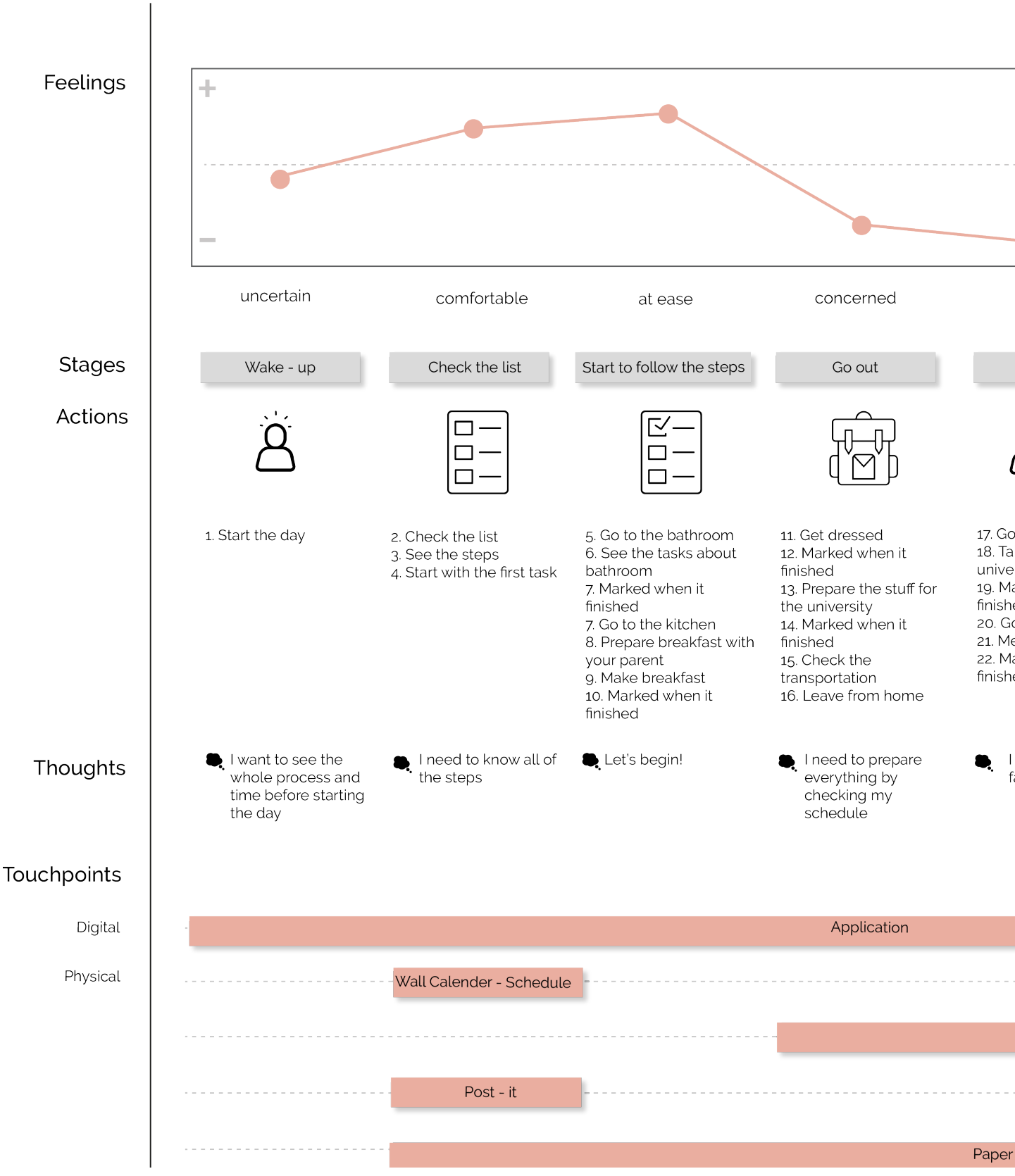
easy to follow tasks

to feel safe

be in control

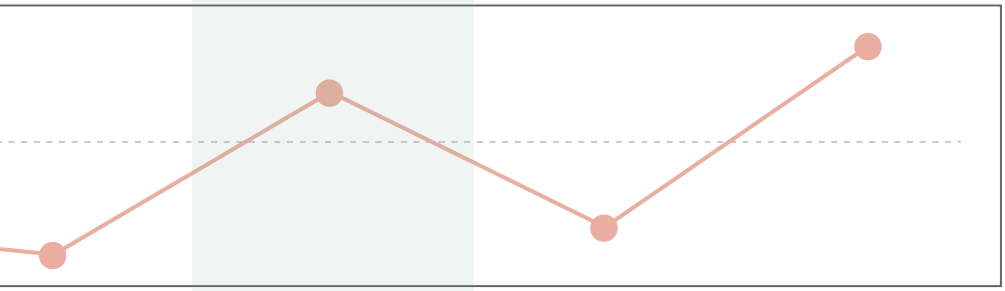
User Journey

SARA / Daily Schedule



** Just the ones related with the task management and making daily schedule touchpoints, are added throughout the journey*

Sara does her weekly schedule with her special education teacher, Semra. This intersection part includes the design concept from the perspective of Semra.



nervous | relax | exhausted | glad

Meeting	Go to education center	Check the list	Go to bed
to the bus stop ke the bus to go to rsity arked when it ed o to the prof. room eet with the prof arked when it ed	23. Go to the special education center 24. Meet with Semra 25. Check your weekly schedule with her 26. Leave from center 27. Marked when it finished 28. Check the other steps	29. See the next task 30. Go shopping 31. Do shopping 32. Marked when it finished 32. Go to the home 33. Help parent while preparing the dinner 34. Eat dinner 35. Marked when it finished	36. See all of the finished tasks 37. See the schedule for the next day 38. Make arrangements to the schedule if necessary 30. Sleep
do not want to ace any surprises!	I want to meet my teacher.	It is so exhausted! Shopping...	I know what I am going to do tomorrow.

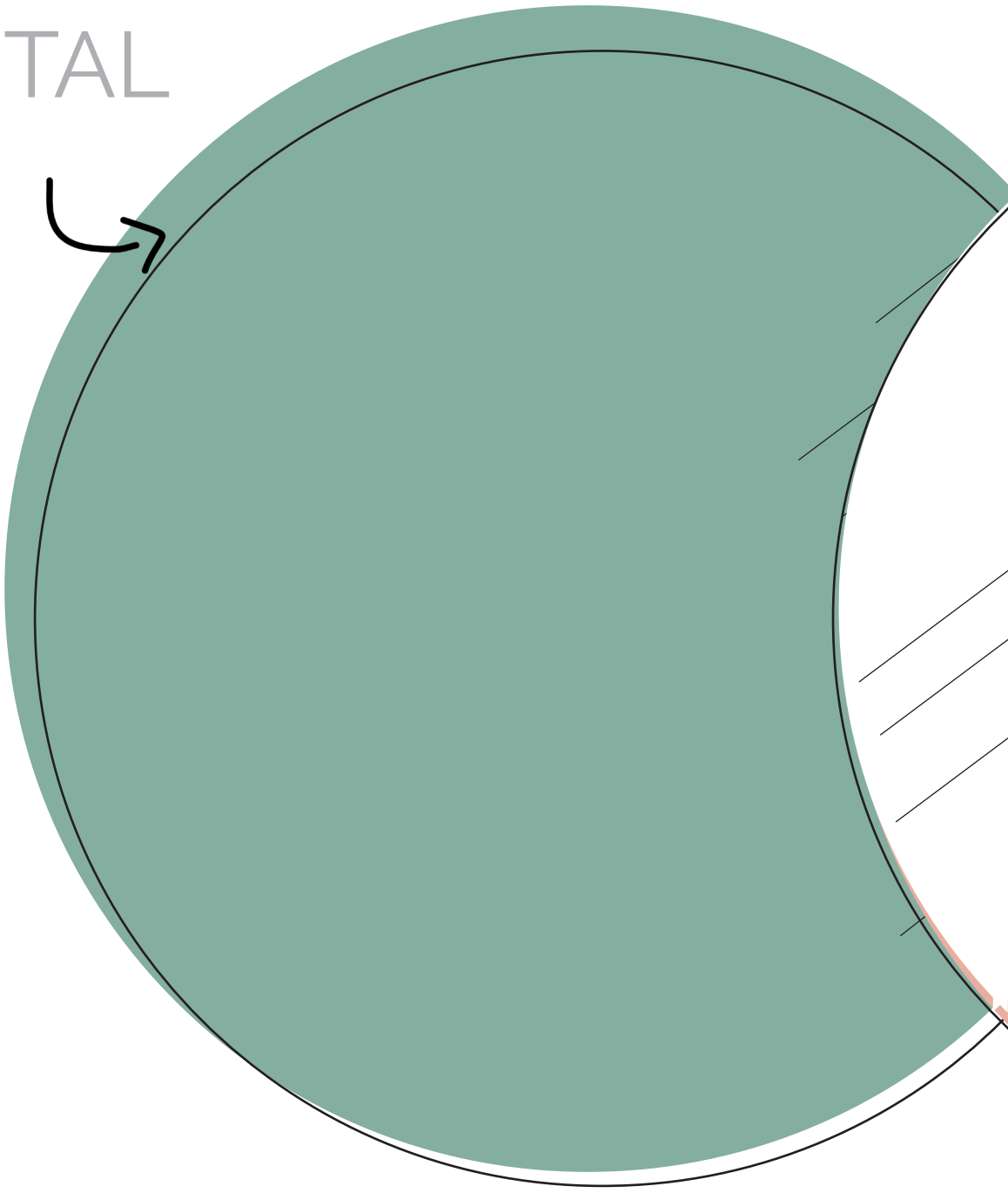
Wall Calender - Schedule

Personalized sensory product

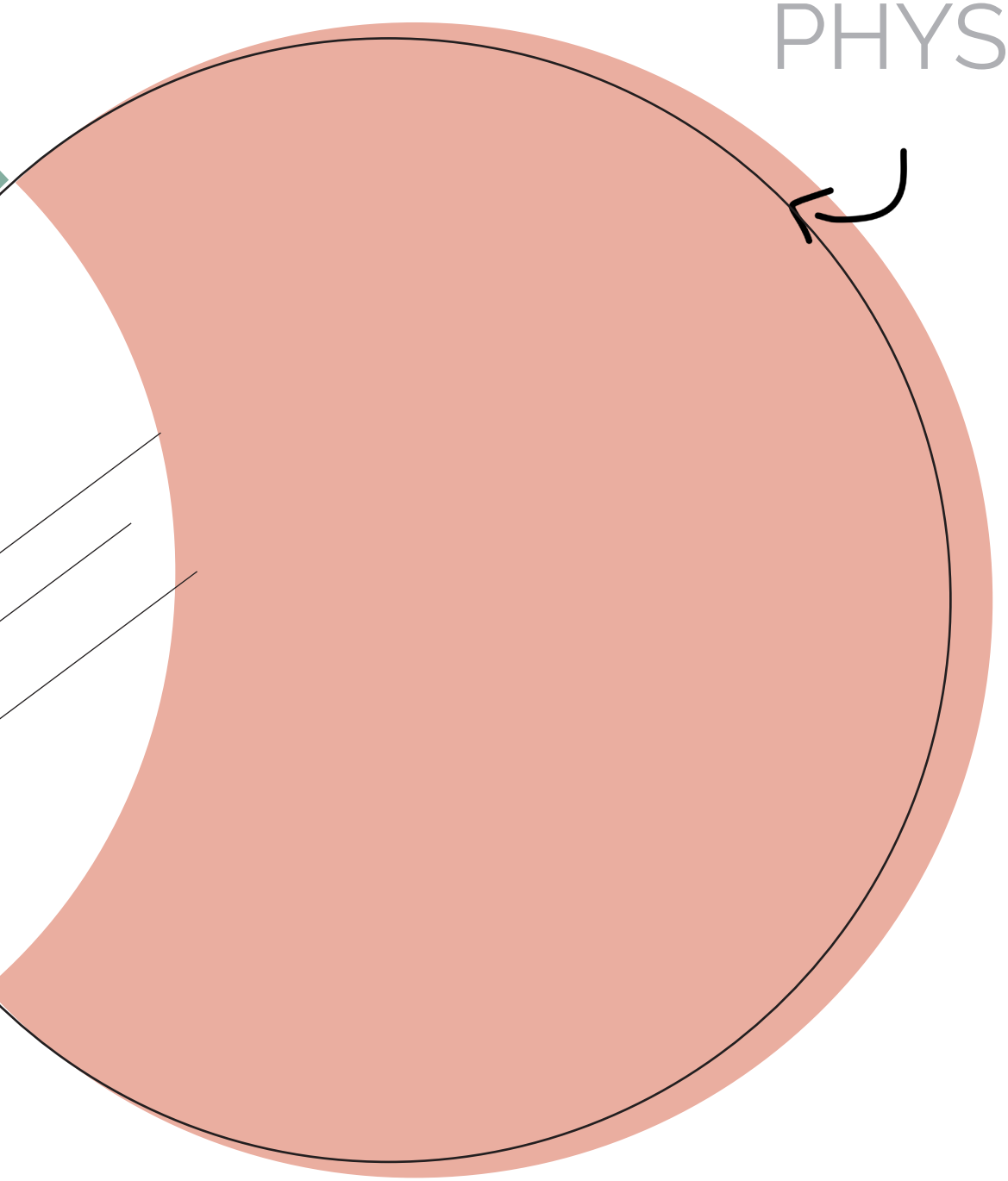
Post - it

and pen

DIGITAL



PHYSICAL



THE IDEA IS TO DESIGN A TASK MANAGEMENT DEVICE FOR DAILY TASKS IN ORDER TO FACILITATE IN DEALING WITH THEM WITH

DIGITILAZED PHYSICAL INTERACTION

Benchmark Analysis /

Existing Products

In order to evaluate and create criteria for the desired product, it is decided to use three different scales; personalization, sensory stimuli and interaction performances of the products.

Before looking at the market, the first digitalized physical interaction, which is an inspiration for the thesis, should be known.

Durrell Bishop created an original answering machine,in 1992 which is considered to be one of the first measurable user interfaces (TUI). Messages are represented by marbles and when a message comes, the machine spits out a marble each time. The order of the marbles indicates the order in which the messages arrived.

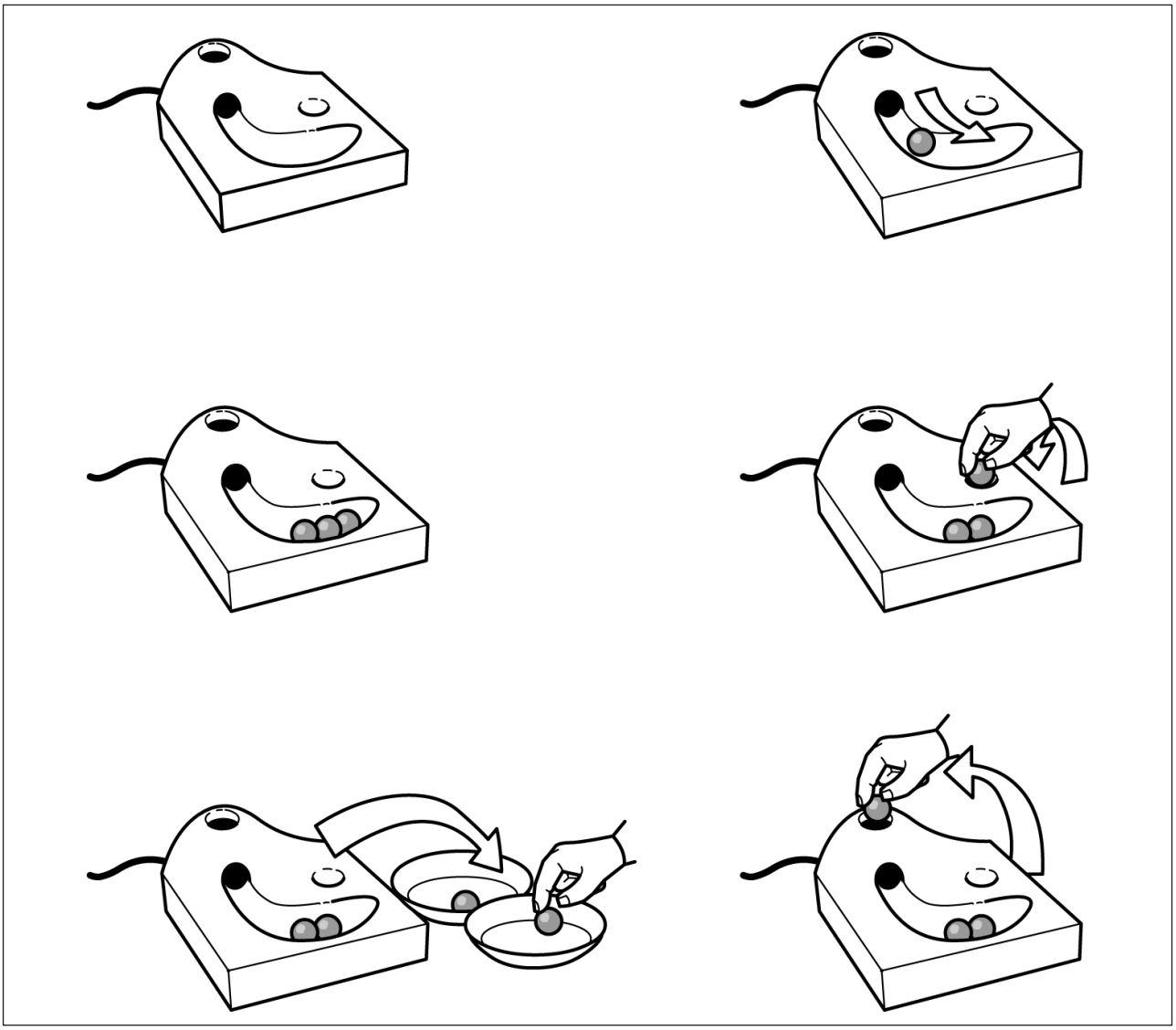
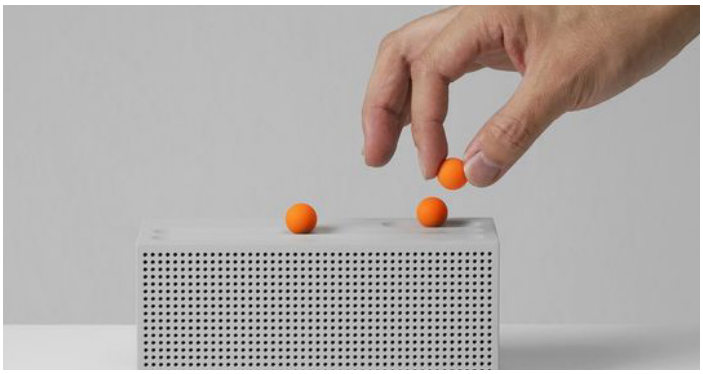


Figure 35. Durrell Bishop's Marble Answering Machine




PET ALLERGY
SMOG
NEW HOUSE

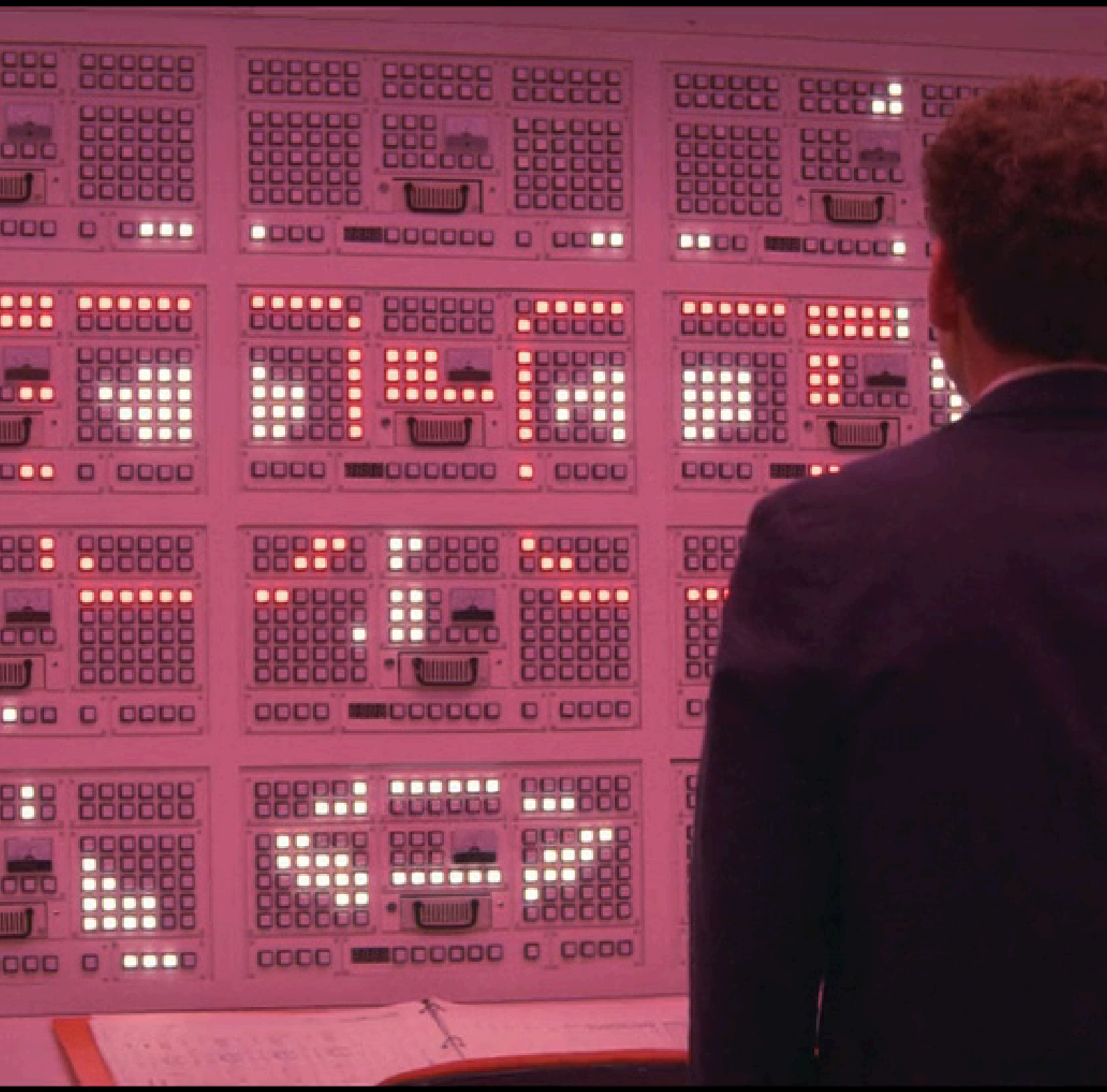


Figure 36. Maniac, TV series

Evaluation Standards

Interaction

People with ASD, who often give extreme reactions to sight, sound, smell, taste and touch, prefer to interact with the objects by simplifying the process rather than performing complex tasks In the literature review, Tangible User Interface show that they assist in improving the quality of life of people with ASD to ease their lives. It uses physical form and features to help users understand how intangible digital knowledge can be accessed, grasped, and manipulated.

Personalization

The interaction between people with ASD and digital technologies depends on the well- defined interfaces according to their unique characteristics. While designing for people with ASD, we need to address their motion, sensory and cognitive capabilities of them. They perceive the world differently due to their sensory issues. Their inabilities need to be supported by personalized services and products. In this project, personalization criteria are defined based on **texture (material), auditory, and visual.**

Figure 37. Synchrony

Synchrony is a music therapy platform that helps parents and children with autism develop intimacy and promote understanding with each other through improvised music play.

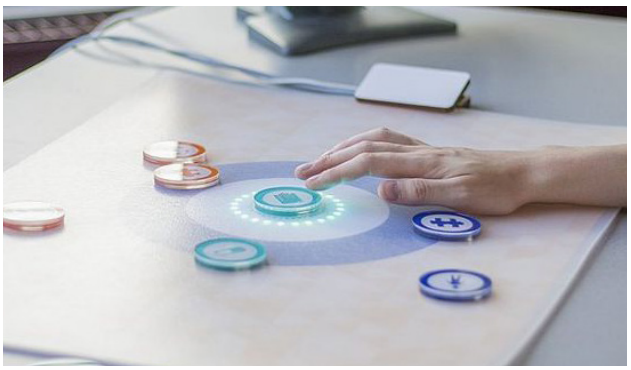


Figure 38. Tangible Blocks

Tangible blocks help build a conversation between children and a doctor. An interactive mat keeps track of what has been said through a visual timeline that is comprehensible for children.

Figure 39. Bitskit

Bitskit tags are used to link physical project assets to corresponding digital files. The tags are magnetic and have a dry-erase surface for writing what project is linked to it.

Figure 40. CogCubed

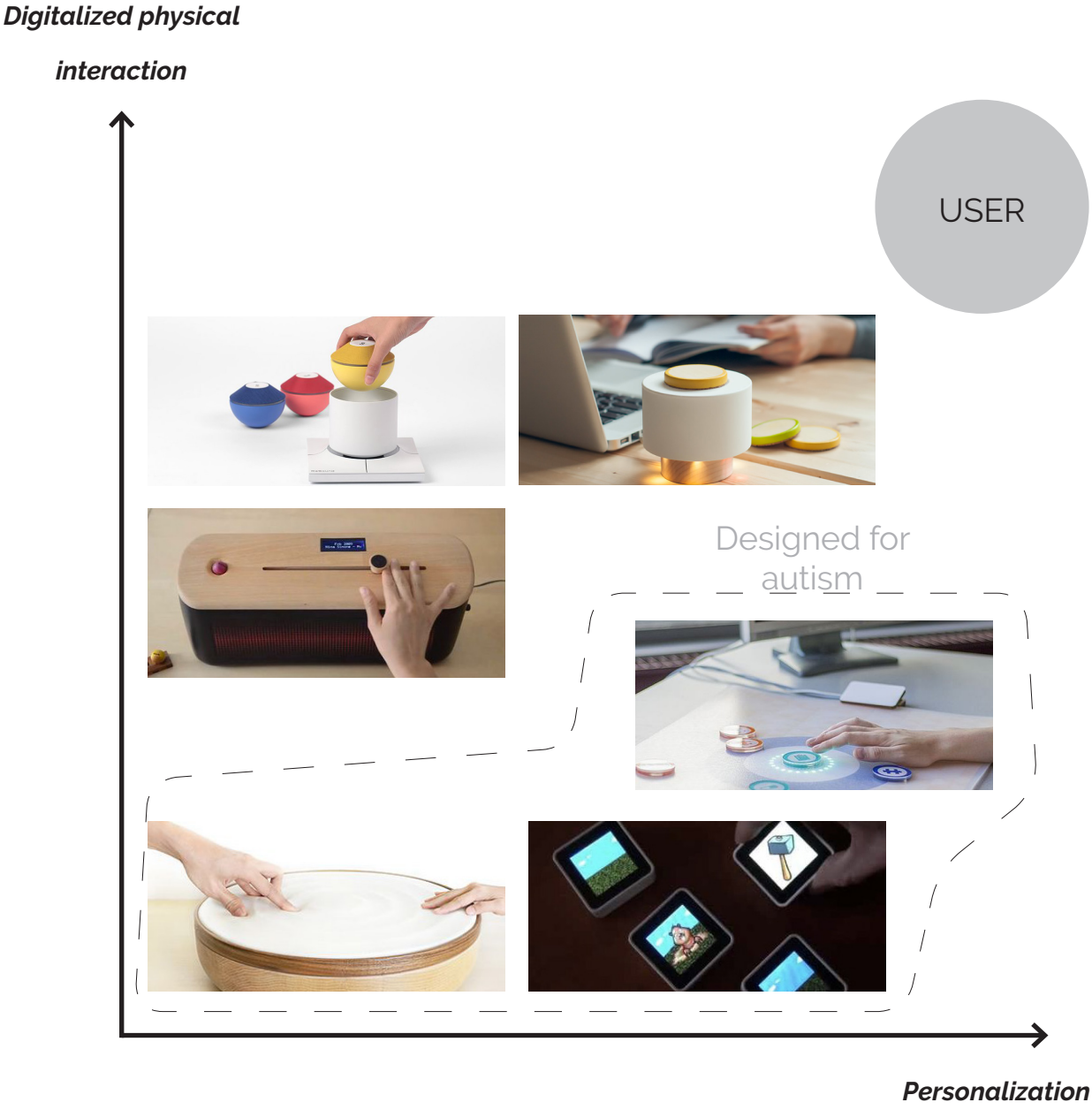
CogCubed is applying the TUI to help diagnose and eventually offer treatment to patients with ADHD and other cognitive issues, especially those related to executive functioning.

Figure 41. Ofek's Resound

'ReSound' is a speaker and recording device for electronic audio production which explores the tangible properties of music.

Figure 42. PAST.FM

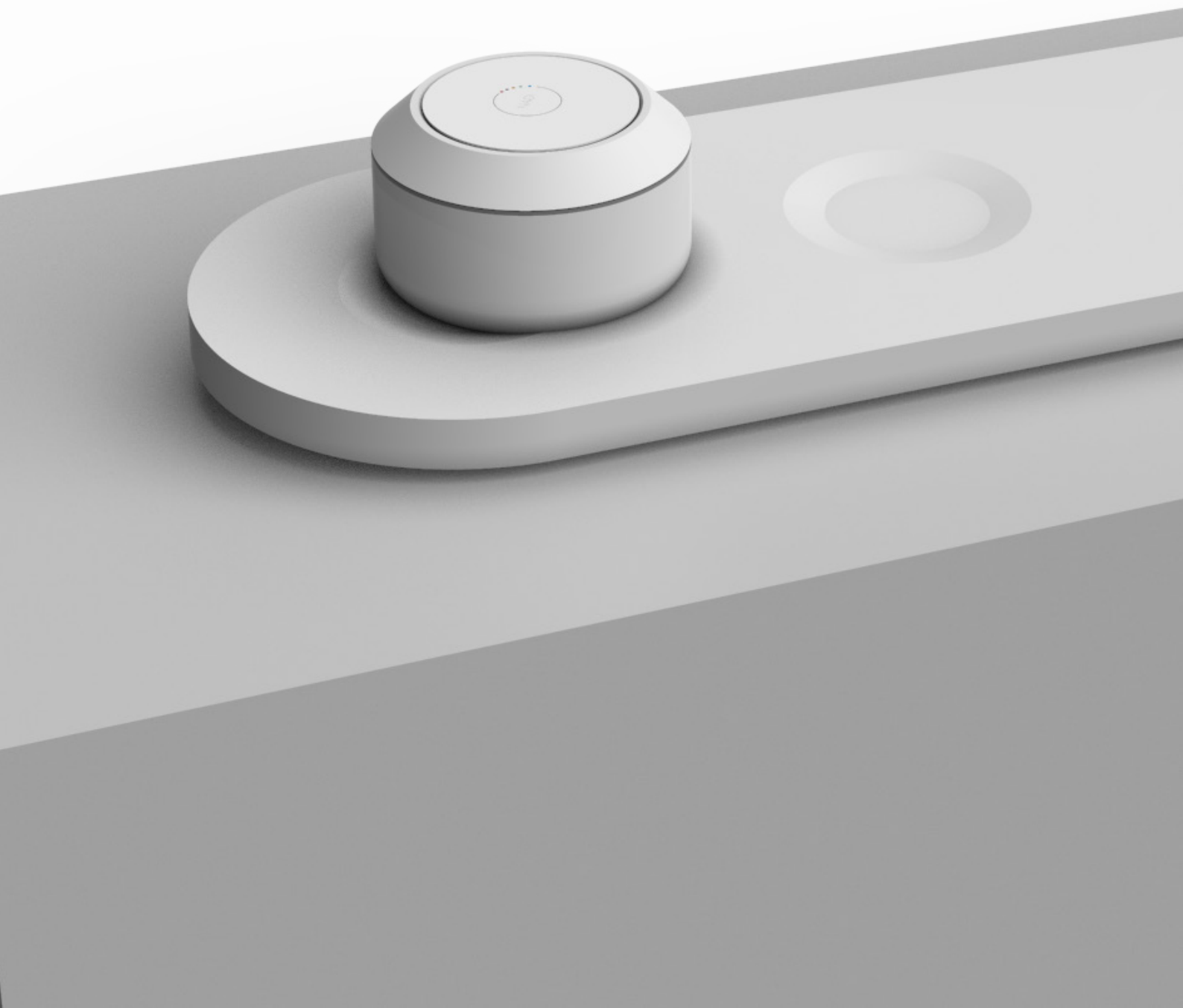
PAST.FM is an audio device that provides users with a tangible timeline of their listening history or other time-based music content

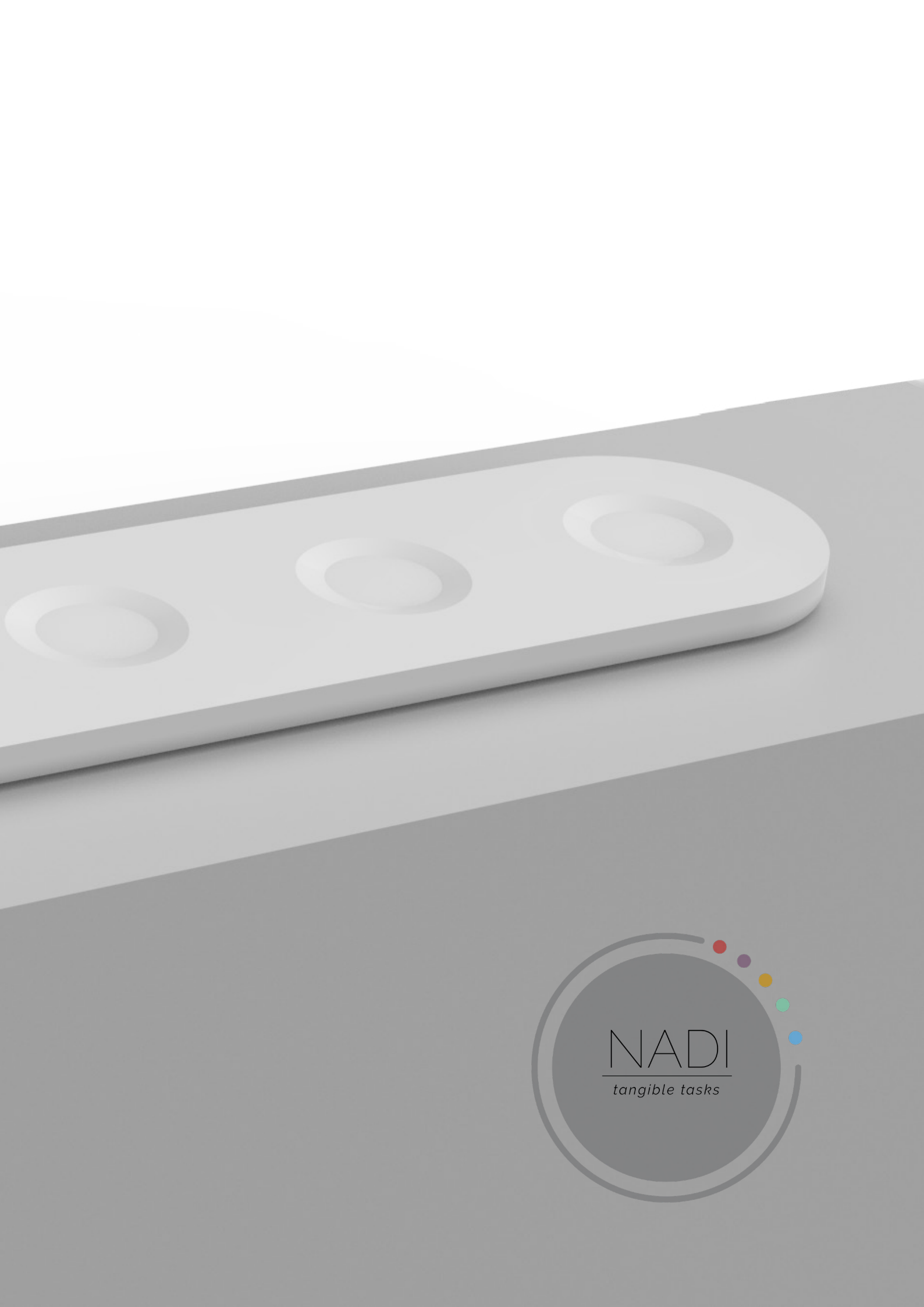

Digitalized physical
interaction
USER
Designed for
autism
Personalization

5

NADI

To prepare, order, and coordinate
the time to conduct with tasks




NADI
tangible tasks

Concept

The main purpose of this thesis is to design a unique assistance service and product in managing daily tasks by helping people with ASD to overcome anxiety and stress originated by routine breakdowns and unfamiliar situations, improving their autonomy during the day.

The individual with ASD's needs can vary from basic requirements to more complex needs. They involve the desire for happiness, security, good relationships, and the opportunity to attain goals and integrate into society without being judged and marked (Wehmeyer, 2001). The individual with ASD has different characteristics in perceiving sensory stimuli and organizing appropriate responses, as in many other areas. Thinking and organizing the experiences help them understand how to best handle under - wheeling situation. Avoiding depressive or unhealthy sensory experiences can help calm a young person with a sensory problem hand participate in daily task (Falkirk Council, 2013).

The vital issue is to assist them understand how to best handle daily tasks.

Improve their autonomy for a more independent life

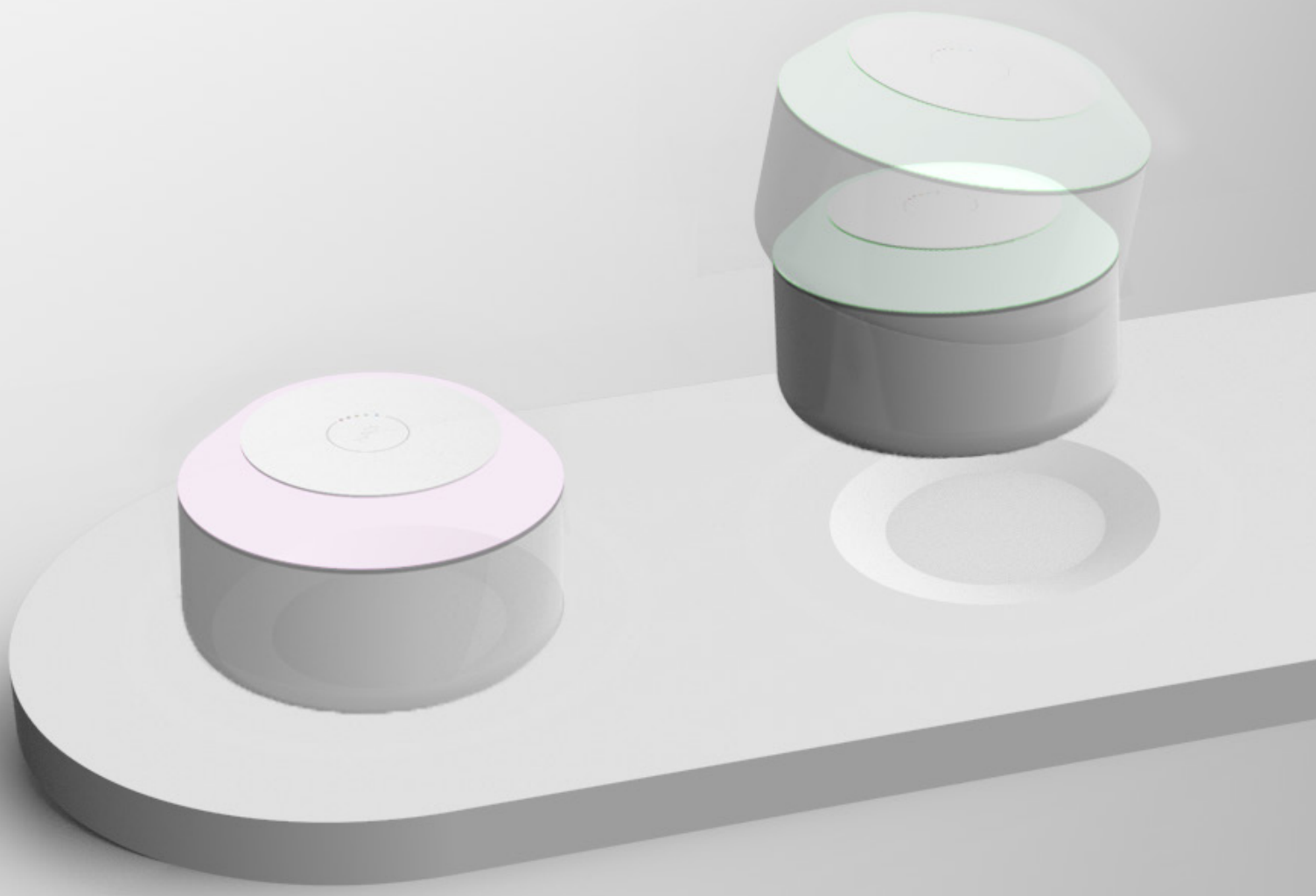
Prepare, order, and coordinate the time to conduct with tasks

Overcome anxiety and stress originated by routine breakdowns and unfamiliar situations

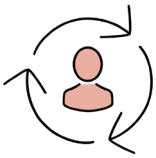
NADI

tangible tasks

drop, rotate, pick up

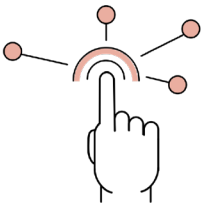


Key Points



Personalization

- **Sensory Preferences**
  - Touch - Material
  - Sight - Visual
  - Sound - Auditory
- **Level of Autism**
  - Task Arrangements



Interaction

- **Digital**
  - Supporting tools for digital communication
- **Physical**
  - Supporting tools to give a link to the digital interface

STEP 1/ *Initial Phase*

NADI will allow making weekly / daily schedules throughout the application. The main tasks and sub-tasks will be defined by the care giver. Besides, it will be possible to arrange the time and music based on sensory preferences which triggers the multi-sensory process in order to assist user to remember the tasks.

STEP 2/ *Arrangement Phase*

NADI includes an interactive tablemat which contains an embedded RFID reader and LED pixel ring. When a token is placed one by one on the mat, LED pixel ring light up in the token's color based on the selected task, thus providing visual feedback.

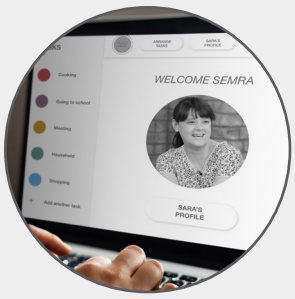
STEP 3/ *Departure Phase*

Tangible taks interface also will be a portable product which is an assistant device that helps the user to cope with the unexpected situations during the day, such as forgetting the sub-steps of the actions and do not know what will be the next one. When the new task comes, it gives signals, which are light and music in order to support the multi-sensory process. Together with, in case of an emergency like breakdowns, the personalized texture around the product help user to feel safe when s/he holds it. There will be an emergency button, too.

STEP 1/ *Initial Phase*

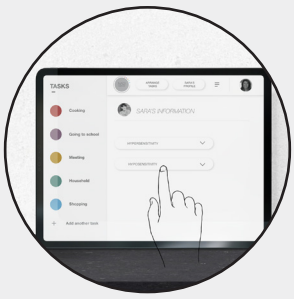
USER/ Sara

EDUCATOR/ Semra



She enters the general information about the user

Sensory preferences of SARA



She arranges sensorial preferences for the each task based on touch, sight and hear.

STEP 2/ *Arrangement Phase*

Sara chooses the first task
among the others by using NADI

After each task is finished, NADI
gives a signal to trigger the
multi - sensory process

She defines the sub - steps of
the main tasks

STEP 3/ *Departure Phase*

She takes the NADI while she is leaving

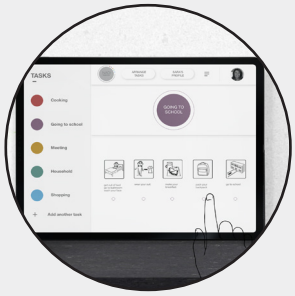
NADI reminds the task with a signal which triggers the multi - sensory process

NADI helps her to relax if she feels anxious during the day thanks to its personalized texture around it

NADI sends a signal in case of emergency

When she meets with her special educator, she communicates with her by putting NADI on interactive base

She sees what SARA has done during the week when she feels anxious,



She continues to arrange the sub-steps based on the data on the system

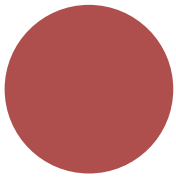
Usage Scenario

Digital Interaction

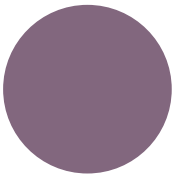
People with ASD need a list since knowing the steps reduce stress during the day and helps to find the right way to manage the daily routines in order to avoid unexpected situations. To understand and know what they will do during the day facilitates the steps which they need to do in order to manage the tasks. It allows plan everything from private work to life and share.

Therefore, in this project, there will be five different main tasks on the user system that can be easily defined throughout the system by the caregiver. These main tasks are represented in five different colors to assist the user by providing visual discrimination. Besides, it will be possible to define the music for each task in order to trigger the multi-sensory process.

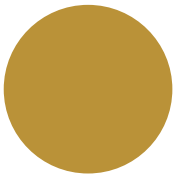
The schedule will be planned by considering all of the sensory choices either by adding new tasks in order to support the independence of the user or foster the user to continue to his / her routine. This choice depends on care giver of the user according to the level of the ASD.



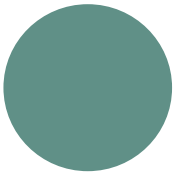
Cooking



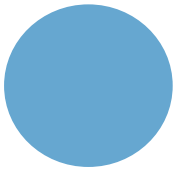
Going to school



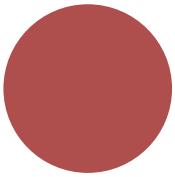
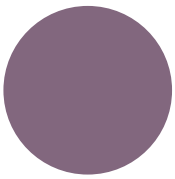
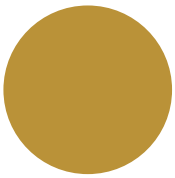
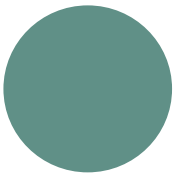
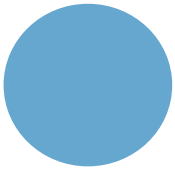
Meeting



Household



Shopping

MAIN TASKS	SUB - STEPS
 Cooking	○ Breakfast ○ Snacks ○ Desserts ○ Drinks ○ Sides ○ Main Dishes
 Going to school	○ Preparation at home ○ Using the transportation
 Meeting	○ Preparation at home ○ Using the transportation ○ NADI help (communication helper)
 Household	○ Clean the bathroom ○ Clean the kitchen ○ Clean the room ○ Make the bed
 Shopping	○ Grocery shopping ○ Clothes shopping ○ Hobby shopping

** System will show all of the steps that the user needs to follow, which are defined by the caregiver based on the selection of the main task and sub - steps.*

It explained in detail the next parts.

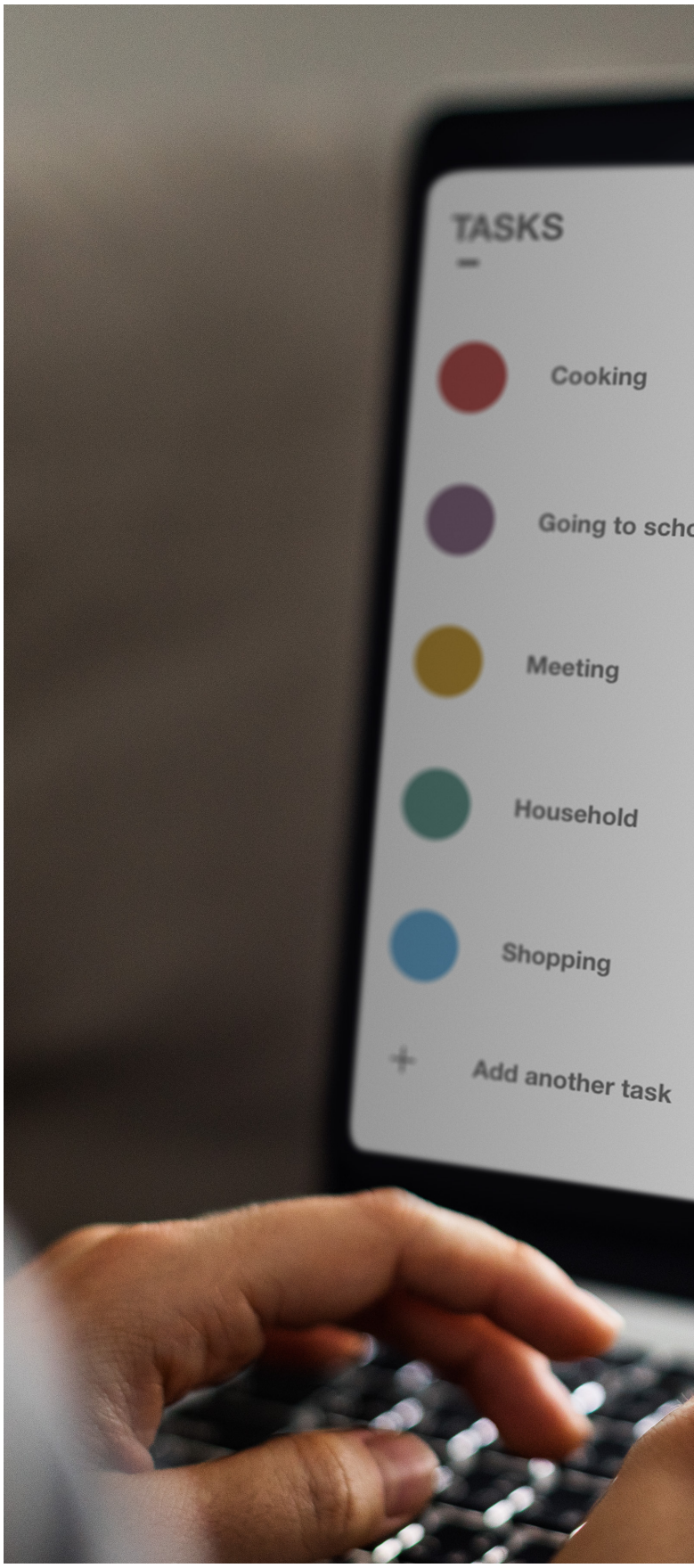
STEP 1

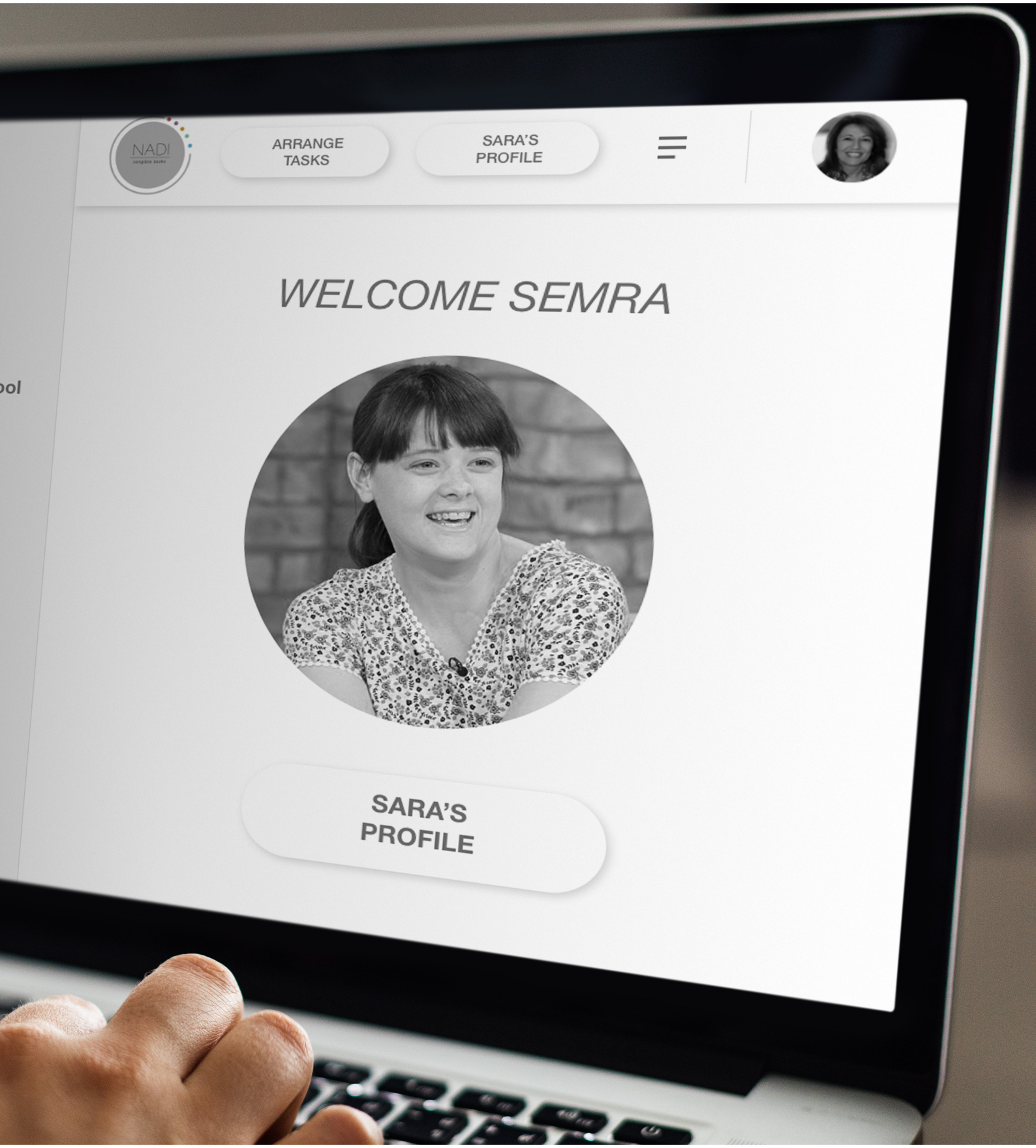
INITIAL PHASE

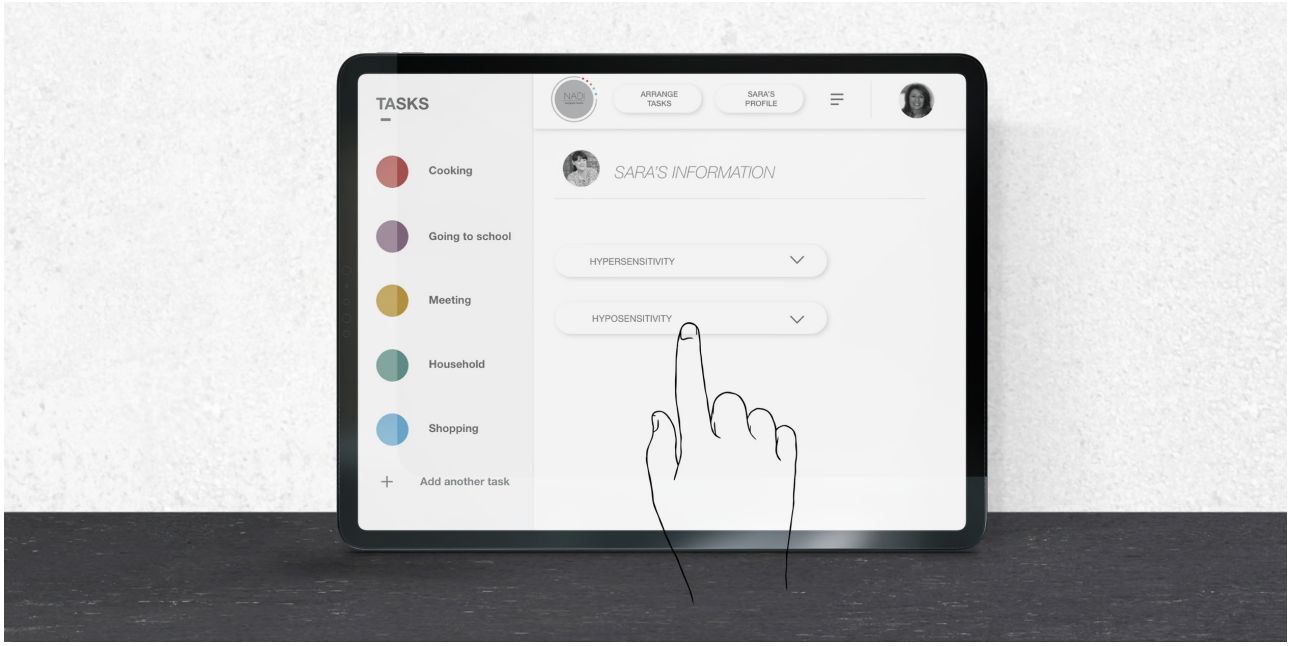
The schedule will be planned by the help of an educator/ family member. Making plans provides better engagement between the activities and the user, even if these tasks involve new routines.

Each task will have the sub-steps in order to define the proper plans for the user. And, each defined task and their sub-steps will be saved throughout the system based on the time. This system will assist to the user in following his / her daily routine without any arrangement during the week.

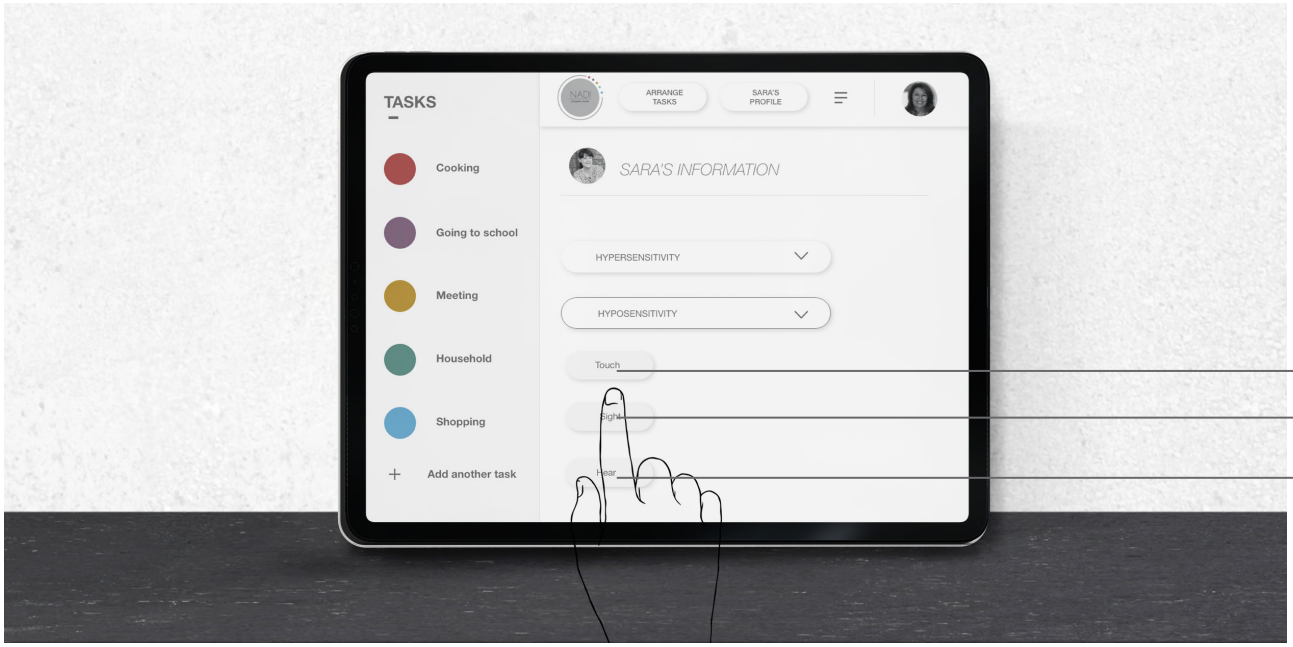
Together with, the essential part is to show all of the steps by providing the visual layout since the visual support tool is the right way of assisting them in understanding what is going to happen and when. It helps to organize and process information efficiently. However, the machine learning system behind the process will continue to organize the steps of the tasks by providing suggestions. These suggestions will help the user to adapt himself/ herself to the new daily routines.




NADI
ARRANGE TASKS
SARA'S PROFILE
WELCOME SEMRA
SARA'S PROFILE



1. The caregiver enters the general information about the user, whether if she has hypersensitivity or hyposensitivity.

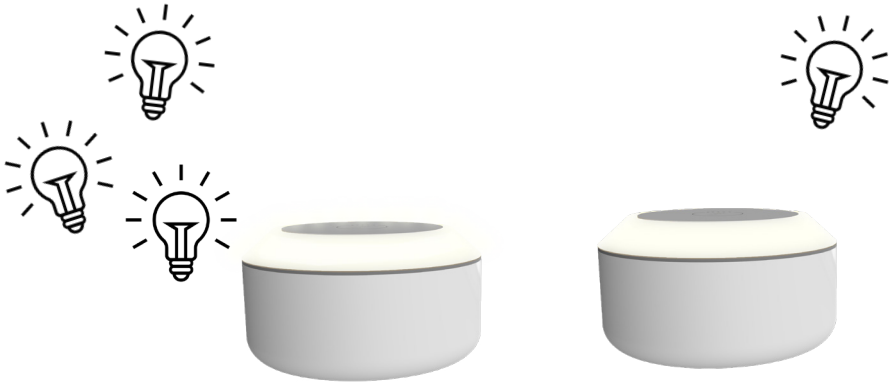


2. The caregiver arranges sensorial preferences for each task based on touch, sight, and hear.

Touch

The material will come with the product based on the choices throughout the system, which stimulates the touch sensory integration.

Sight



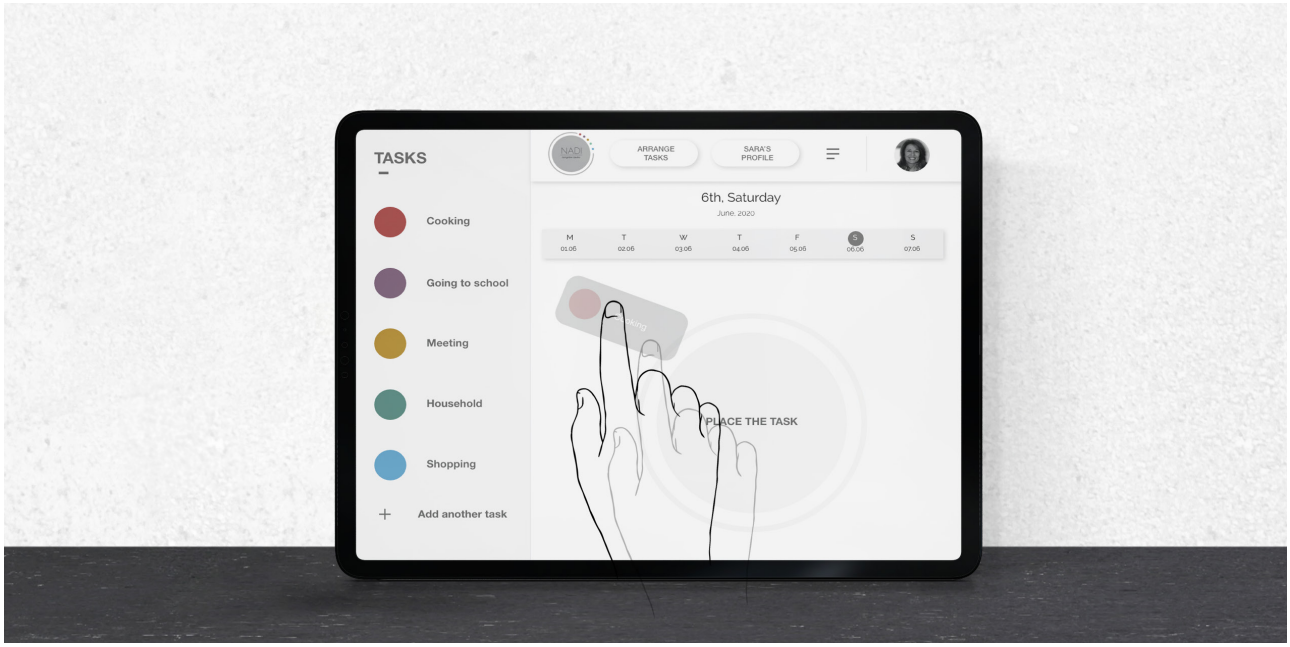
The power of light can be arranged throughout the system based on the sensory preferences of the user.

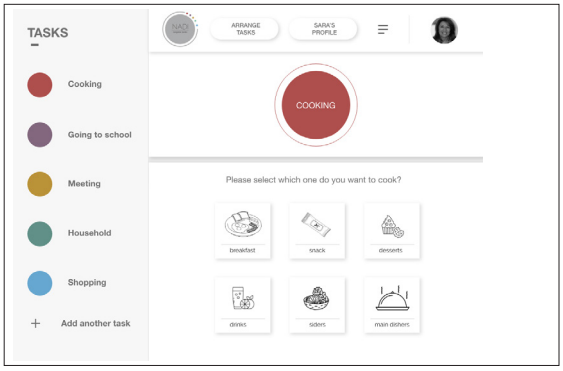
Hear

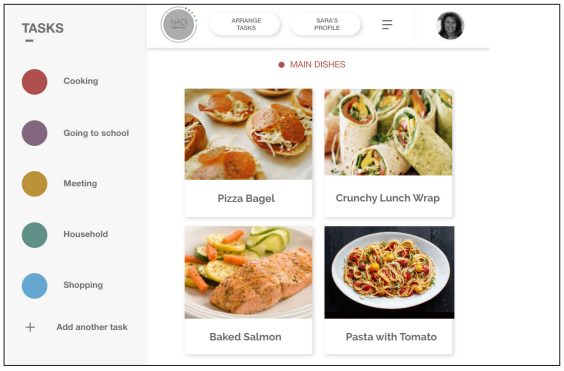
The power of music can be arranged throughout the system based on the sensory preferences of the user.

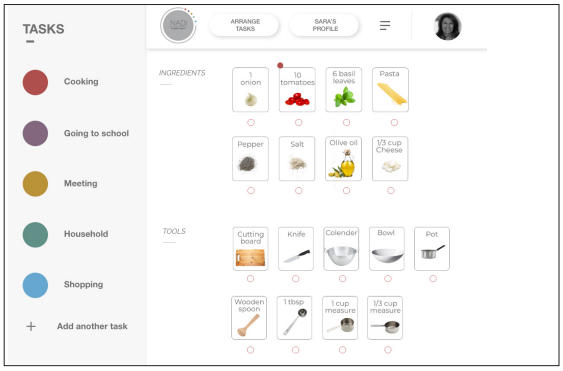
If we look at the eating part, most autism spectrum disorders individuals are selective eaters according to the researches, and this causes lots of health problems (Cornish, 1998). They select the food according to the smell, texture, even color. However, they need to eat properly to stay healthy.

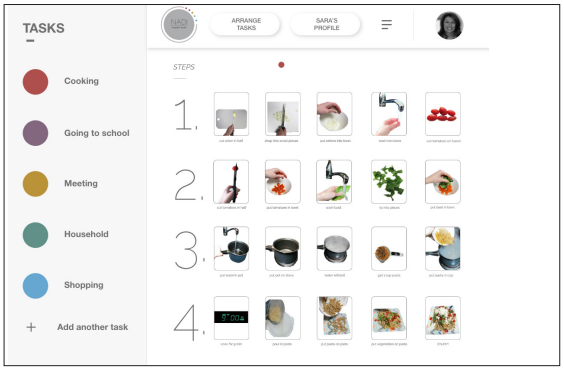
"COOKING" part provides proper solutions by suggesting personalized eating habits and shows how to manage all of the steps.





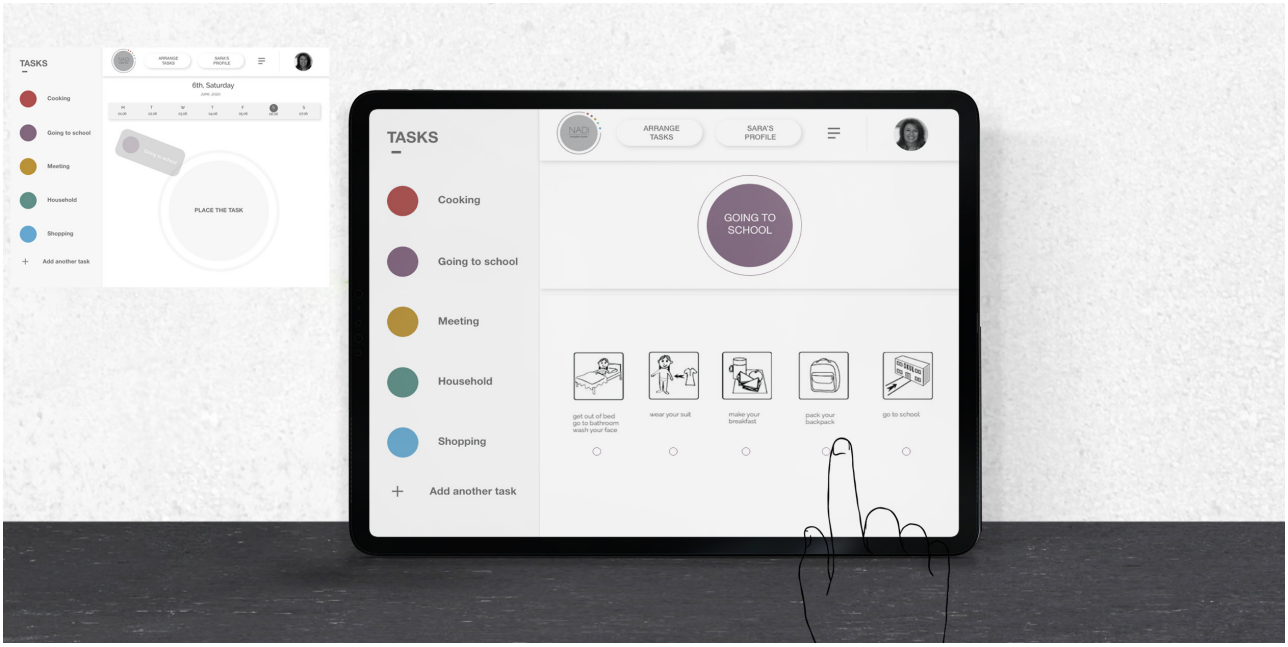




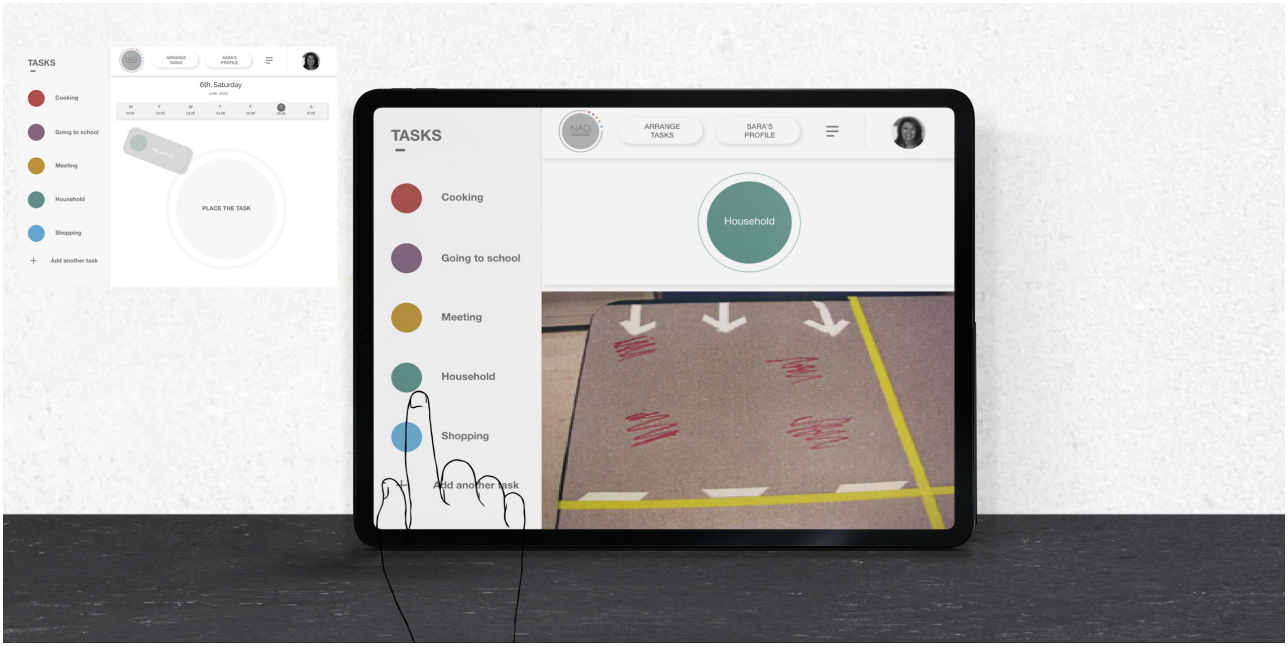


3. The caregiver selects the "COOKING" task in order to arrange the sub-steps based on the level of the ASD of user - visual schema method 1.

The steps of the main tasks should be defined according to the level of ASD. It can show all of the steps in detail or just an image which shows the steps inside by using visual. clues, or basic steps that is needed to follow. It all arranged by the caregiver of the user while entering the general information.



4. When she selects the " GOING TO SCHOOL" task, the user is going to see the sub -steps that are arranged based on her level of ASD - visual schema method 2.



5. When she selects the " HOUSEHOLD" task, the user is going to see the sub -steps that are arranged based on her level of ASD - visual schema method 3.

Physical Interaction

"THE COGNITIVE AND SOCIAL IMPLICATIONS OF THE TUI ARE THAT USERS CAN PROJECT THEIR OWN SYSTEMS OF MEANING ONTO BOTH THE DESKTOP ENVIRONMENT AND THE SOCIAL EXCHANGES OF AROUND TOKENS..."

Darren Edge, University of Cambridge (2008)

Tangible user interfaces have the ability in order to represent and manage information easily for people with ASD. It provides more physical interactions to increase the engagement between the people with ASD and their environment since they have difficulties mostly in understanding and perceiving the things around them. According to the Scaife and Rogers (1996), tangible user interfaces facilitate the external representations if an internal cognitive process via tangibles, which assists autistic children to learn to interpret other people's behaviors and attitudes and provide time and space to advance their inner cognition.

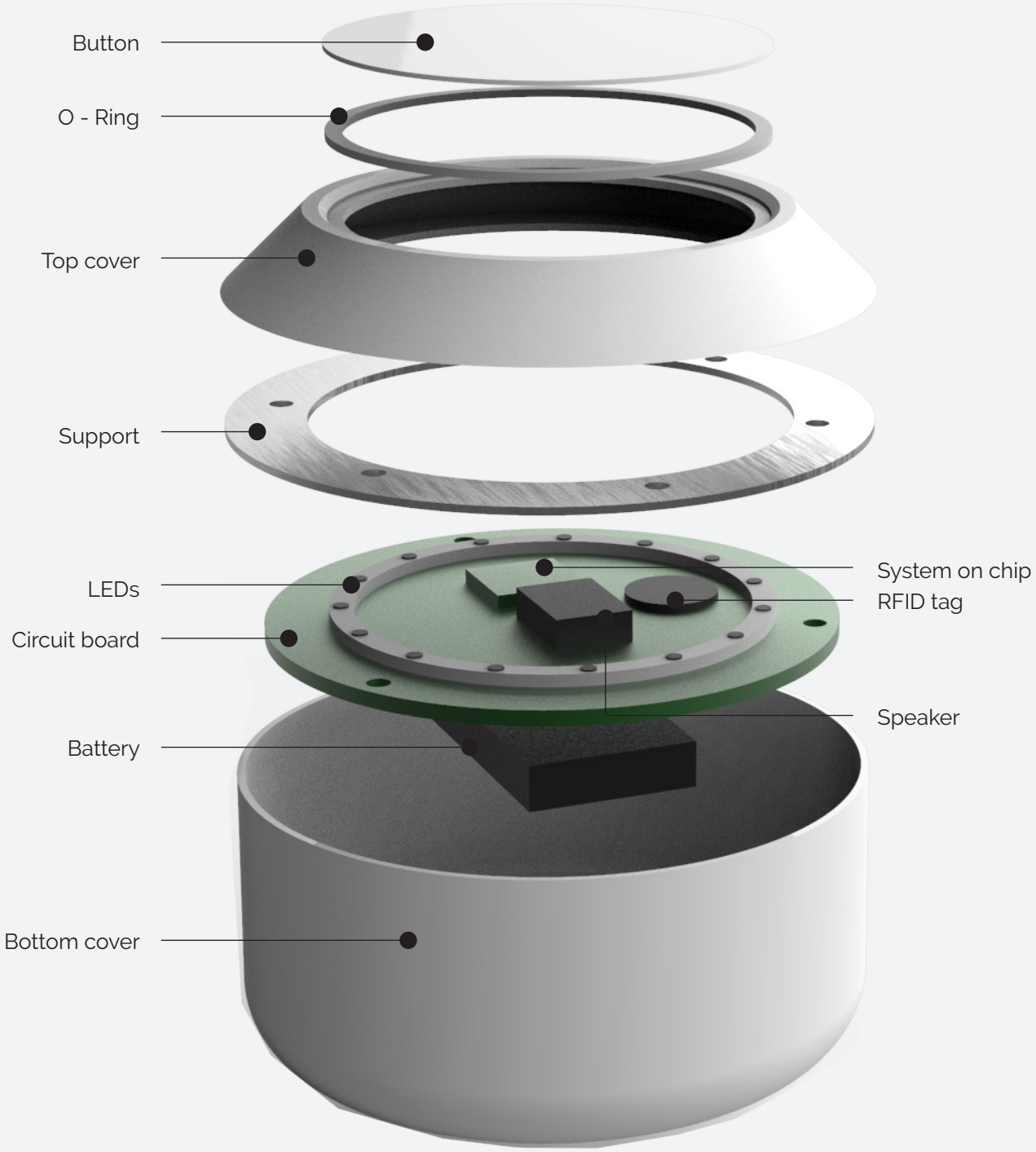
Therefore, in this project, tangible tasks are used in order to create a more manageable and interactive environment for people with ASD. Tasks are defined according to mostly using daily tasks. There will be main tangible interactive button based on these different daily activities. Users can organize his/her day by using these tangible tasks button in order to perceive the steps during the day.

NADI

Physical link to digital information

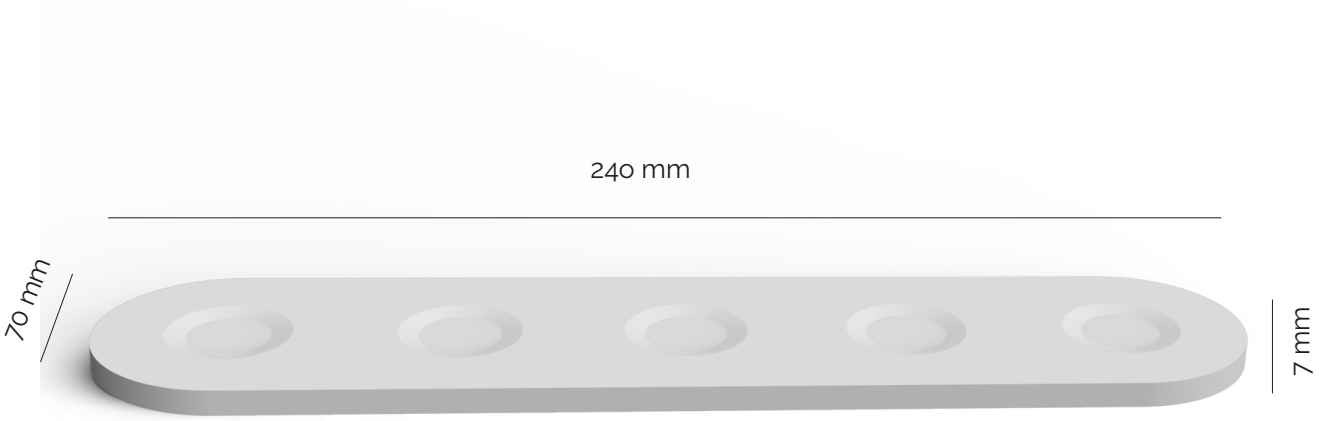
TANGIBLE TASKS

NADI includes a main tangible task management device that assists the user in arranging the tasks before starting the day. It helps to use increase autonomy by supporting to have the ability to make a plan and follow. The user will organize his/her day by using one tangible button that provides more engagement among the functions throughout the system that refers to the five main tasks.


Button
O - Ring
Top cover
Support
LEDs
Circuit board
Battery
Bottom cover
System on chip
RFID tag
Speaker

INTERACTIVE BASE

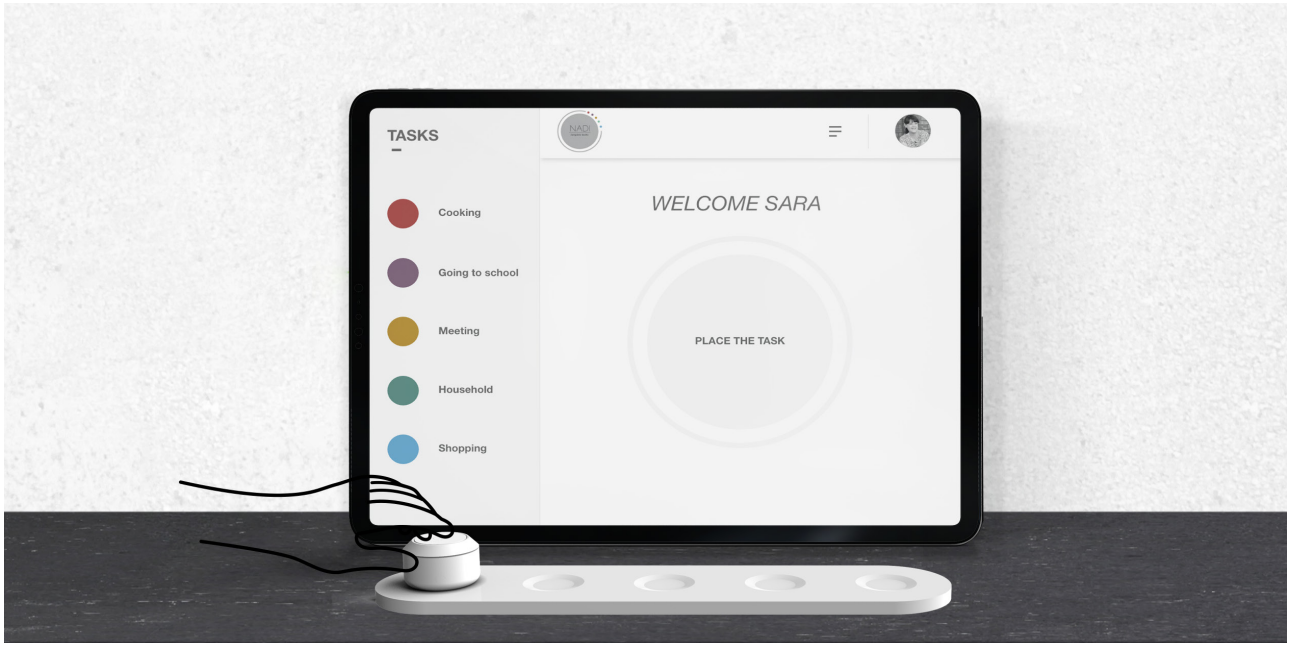
NADI includes an interactive base that contains an embedded RFID reader and LEDs pixel ring. When a token is placed one by one on the mat recognizes the token, making the LED pixel ring light up in the token's color, thus providing visual feedback that the token has been detected.



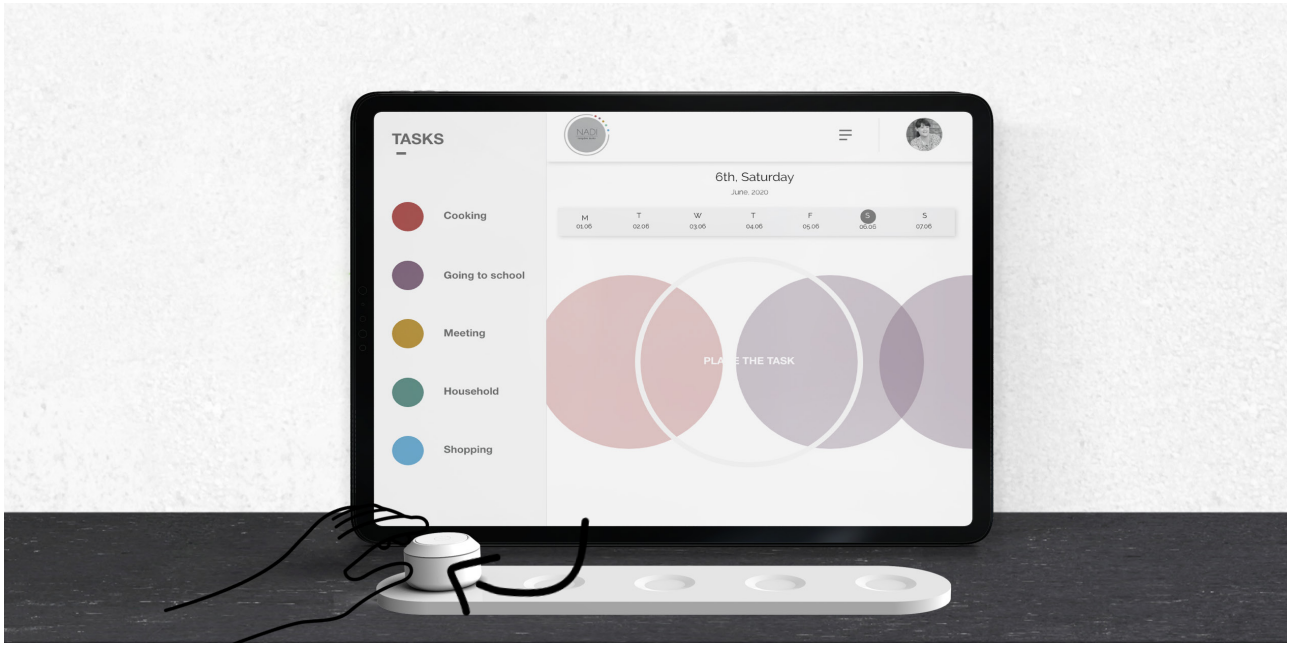

Battery
LEDs
Top cover
Circuit board
Bottom cover
USB cable under
the bottom cover
RFID reader
System on chip

STEP 2

ARRANGEMENT PHASE



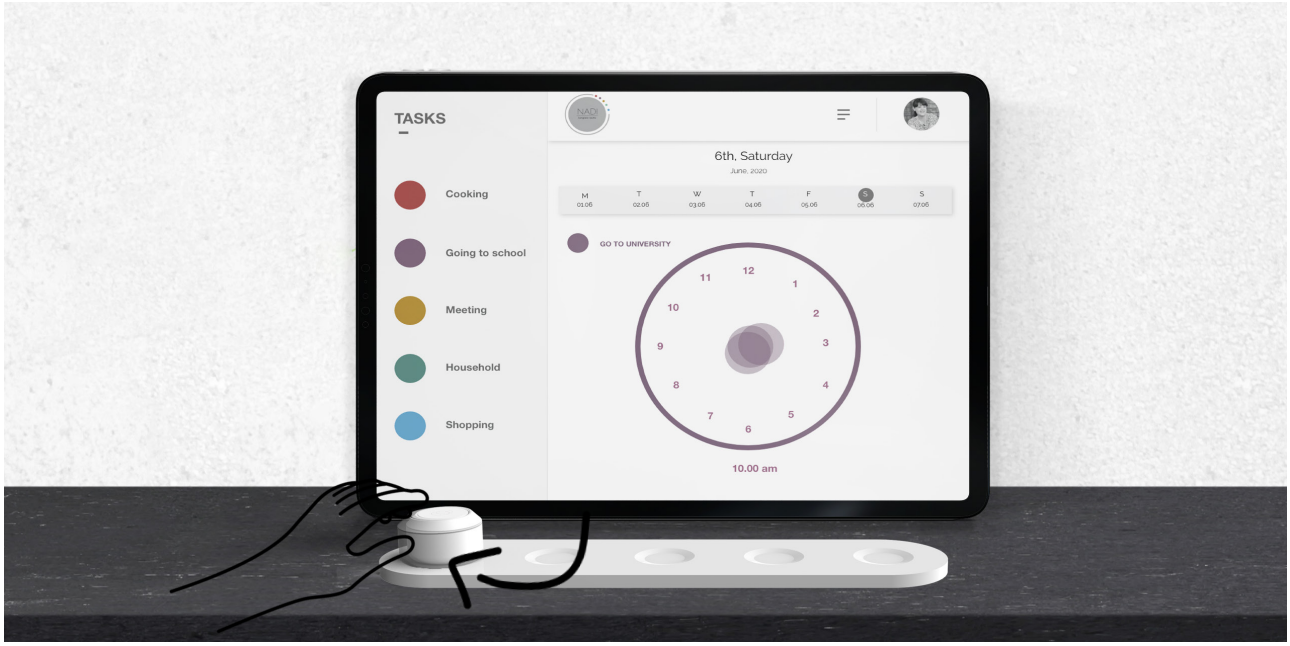
1. . Sara starts to plan her day with the help of her parent.



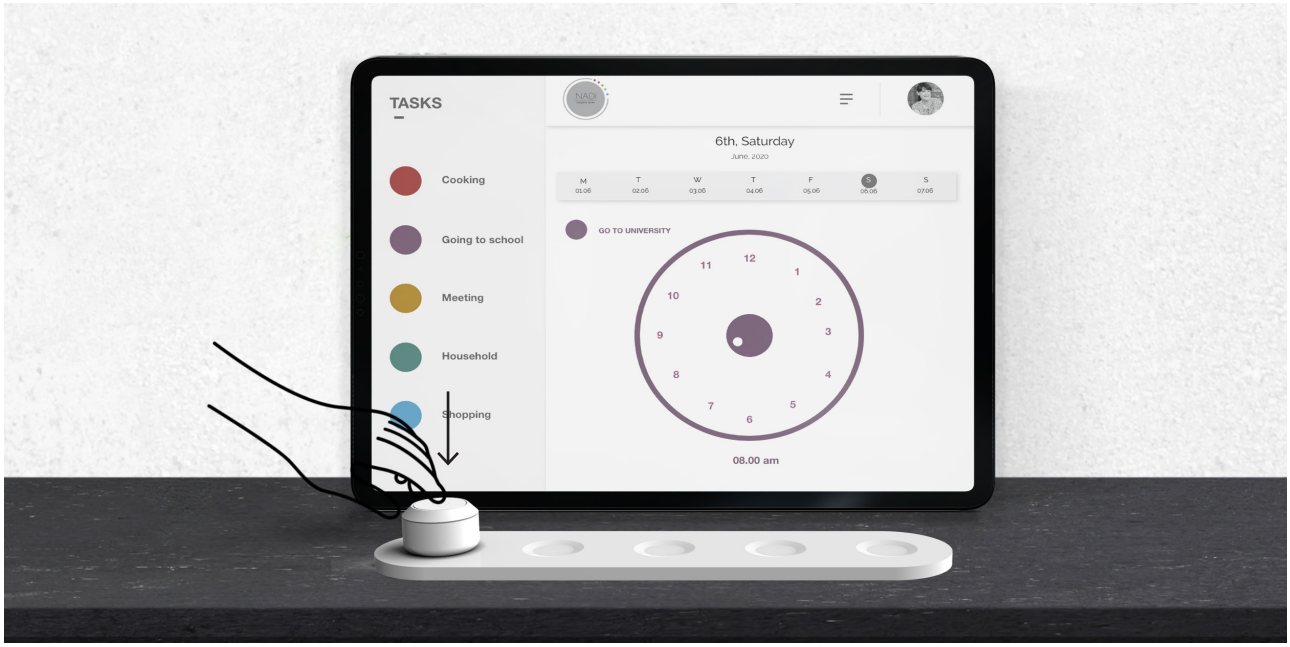
2. She chooses the first task among the others by rotating the NADI.

3. When she chooses, she just pushes the button on the top

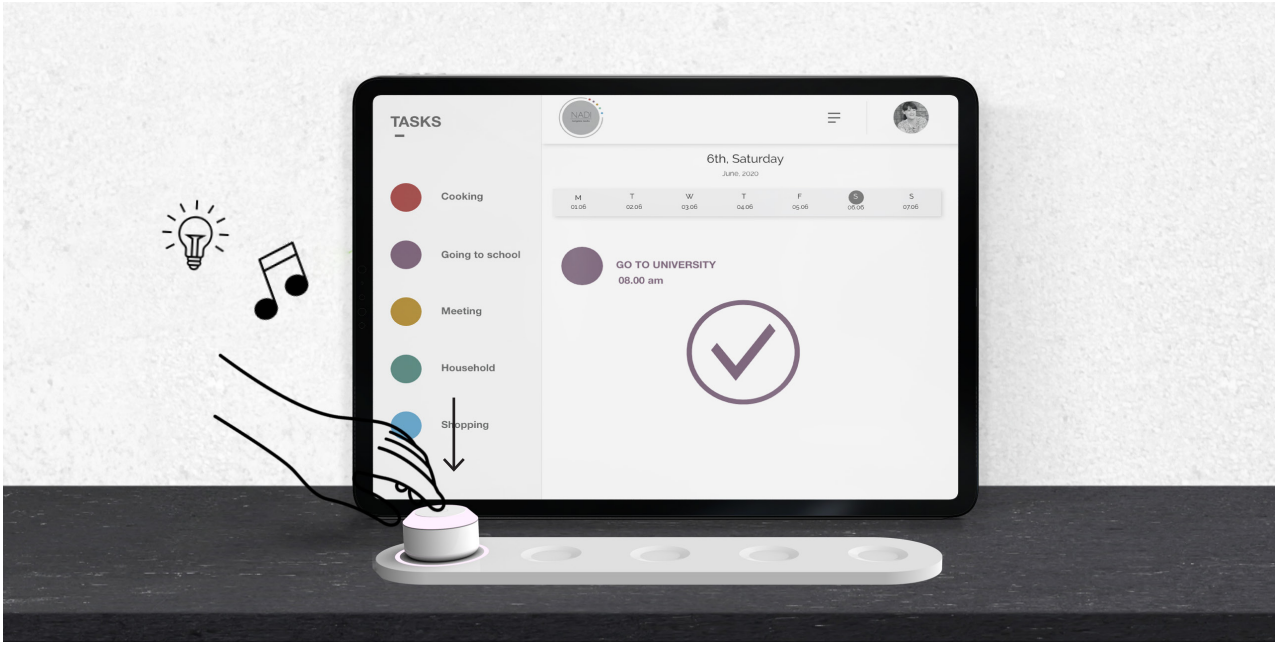
4. She says the sub -steps of the main task that she wants to do by talking with the NADI.



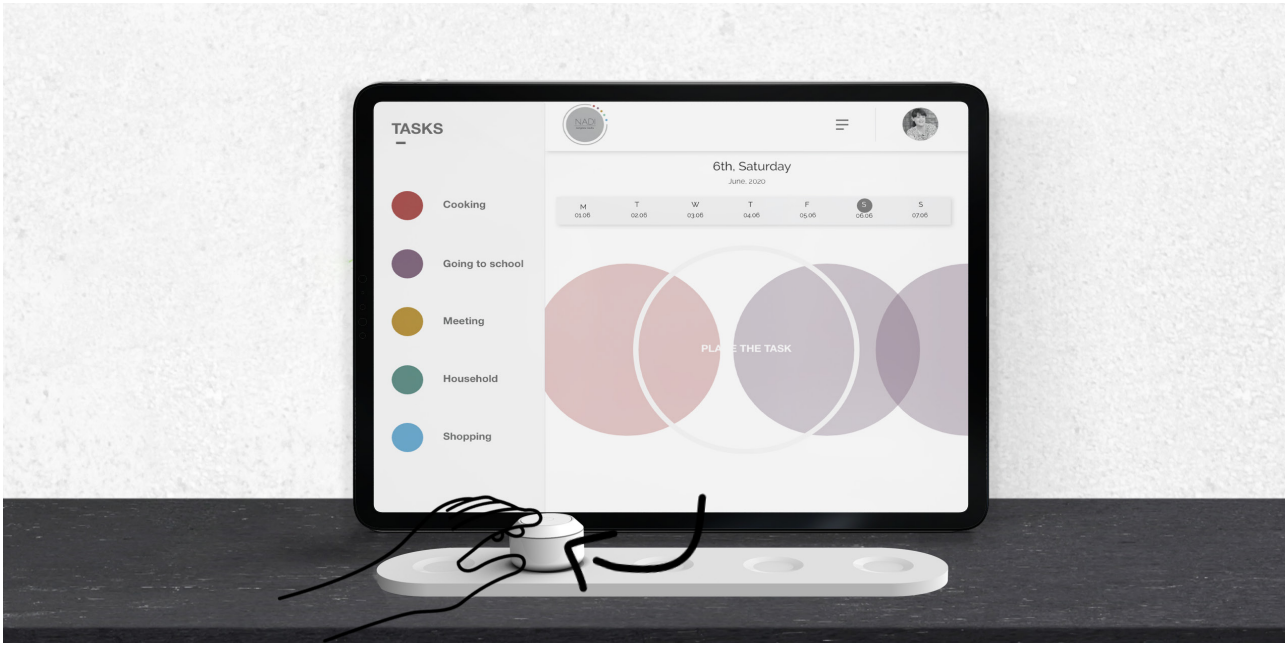
5. She arranges the time by rotating the NADI again.



6. She again pushes the button on the top to arrange the time.

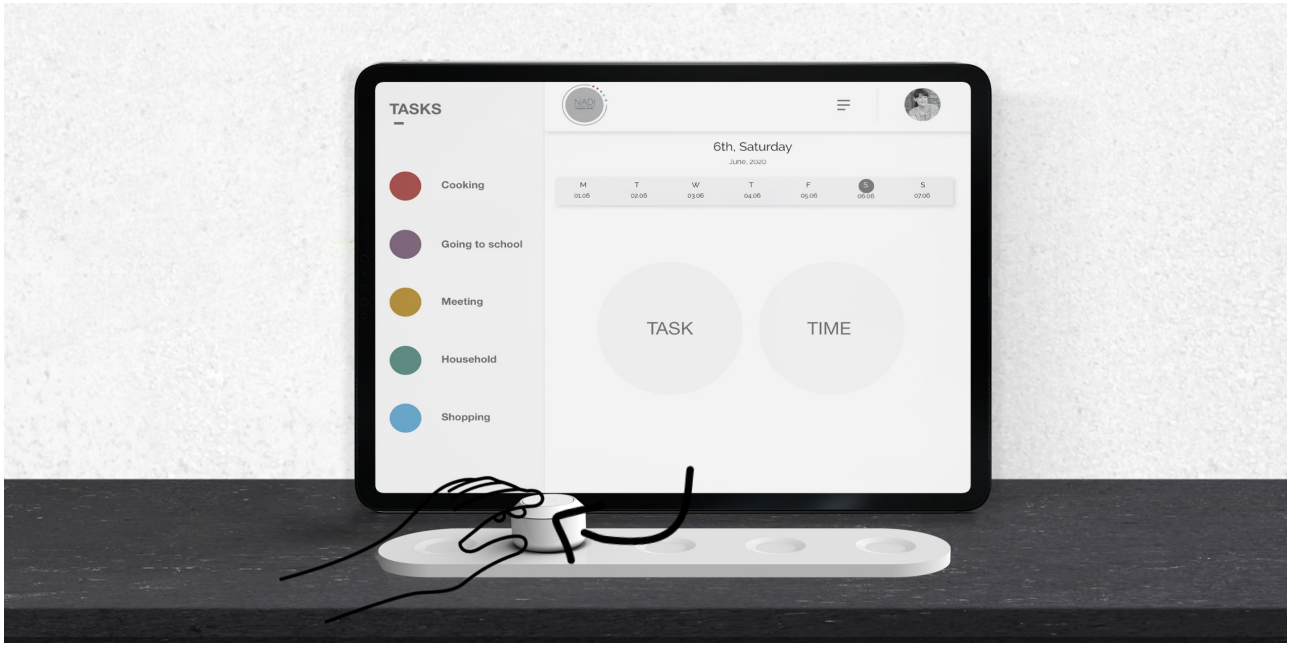


7. She pushes the button again to confirm the task. The music comes up in order to stimulate the multi-sensory process that has arranged before while arranging the main tasks and light, too.

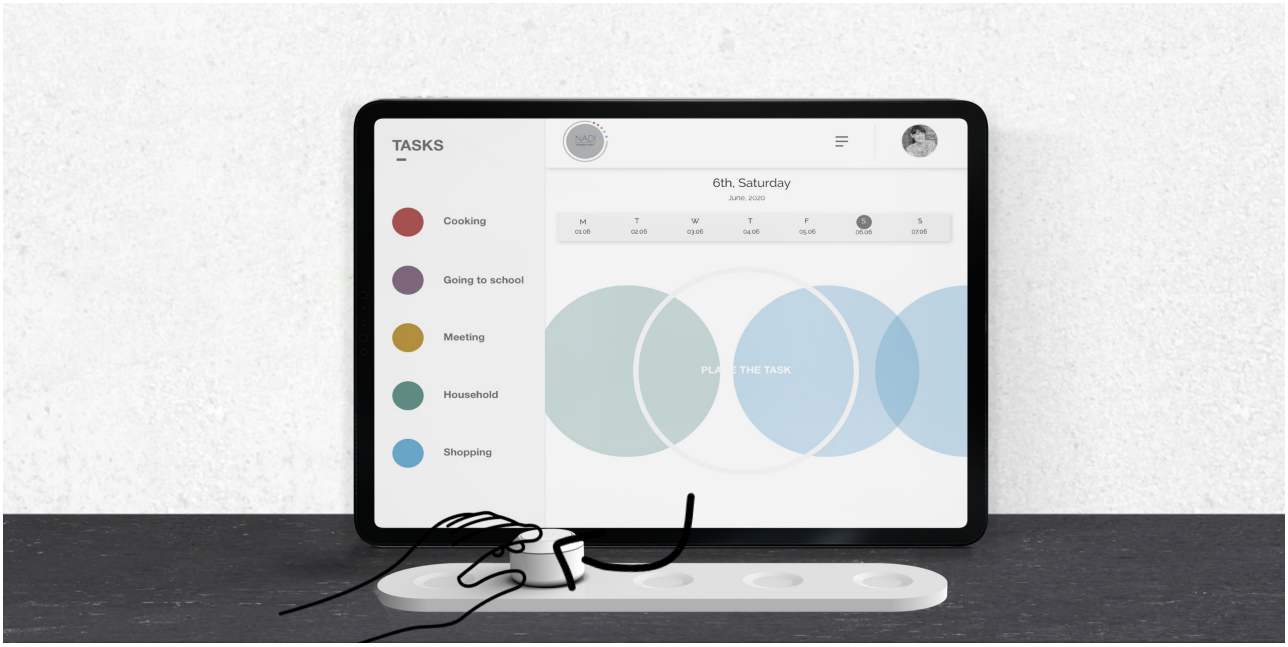


8. Then, she follows the whole process for the next tasks, step by step.

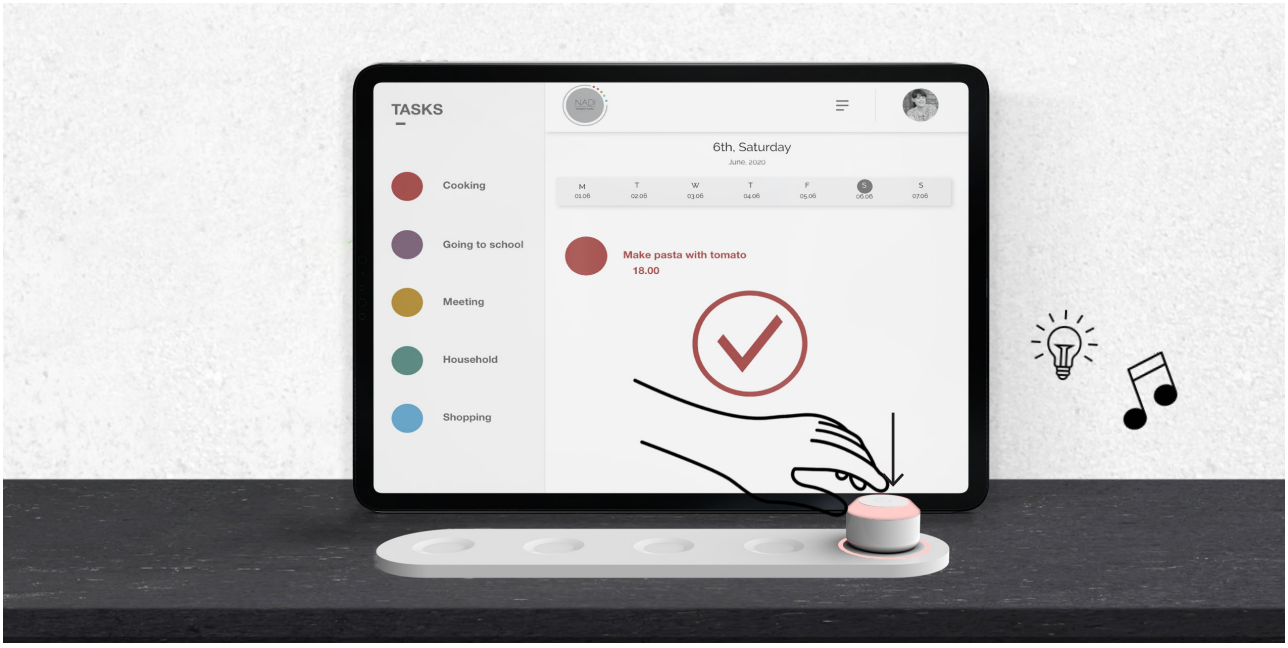
9. If she makes a mistake, she can remove the NADI from the interactive mat **without confirming.**



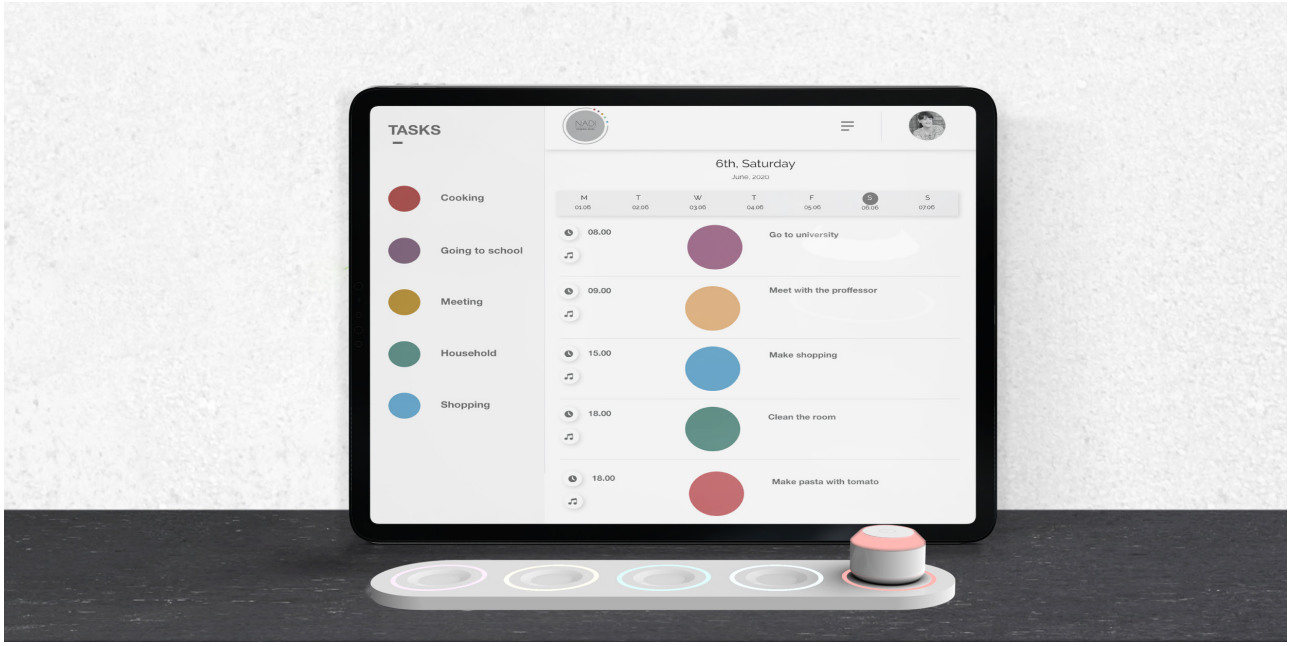
10. Then, she puts again to continue, and the system asks how she wants to continue, with task or time



11. She continues with the process.



12. By following this process, she finishes planning her day



13. The interactive base shows the color of the tasks after she finishes.

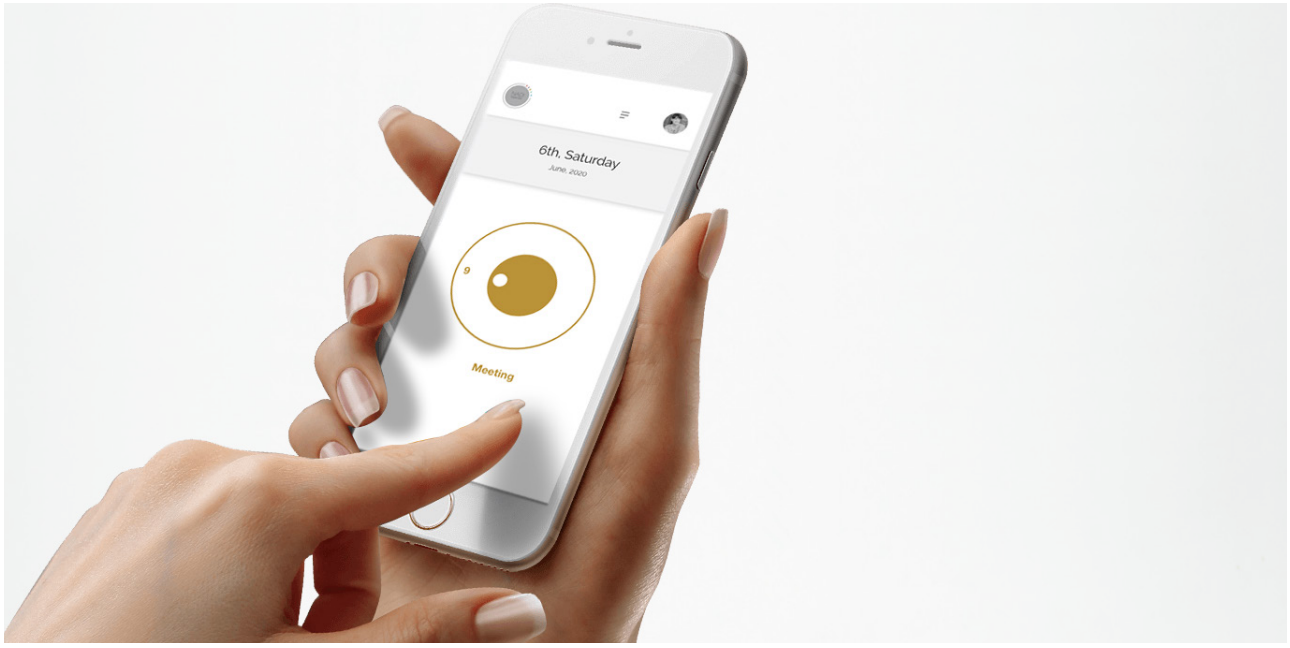
14. If she needs to add more tasks in her system, she put the NADI in the first place of the interactive base. Or, if she wants to change the task that has already saved in the system after confirming, she again puts the NADI on the place that she wants to change. And, the system asks whether she wants to change the task or add a new one.

15. She takes the NADI while she is leaving

STEP 3

DEPARTURE PHASE

1. Outside, NADI reminds the task by using both music and color when the task comes, which triggers the multi-sensory process.



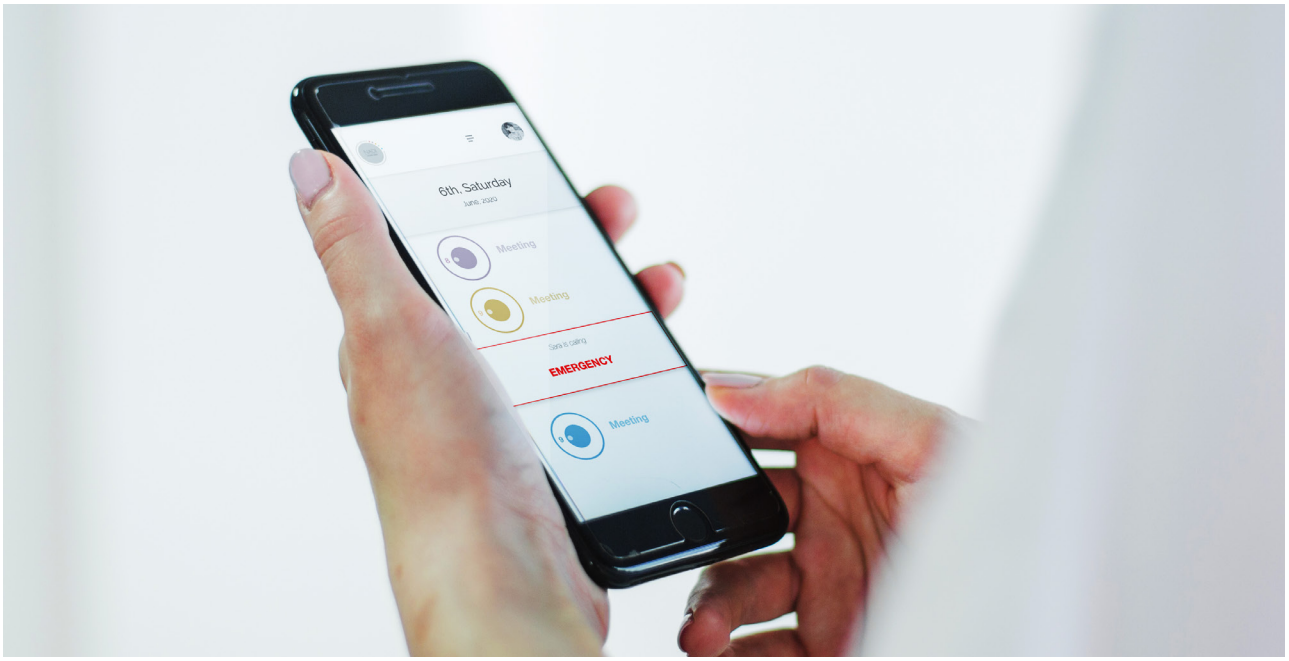
2. She follows the sub - steps of the main task by using digital information to remember the steps if she wants

3. She can push the button on the top to finish the task instead of using the phone.

4. She holds the NADI when she feels anxious during the day, thanks to its personalized material around it.

Emergency situation

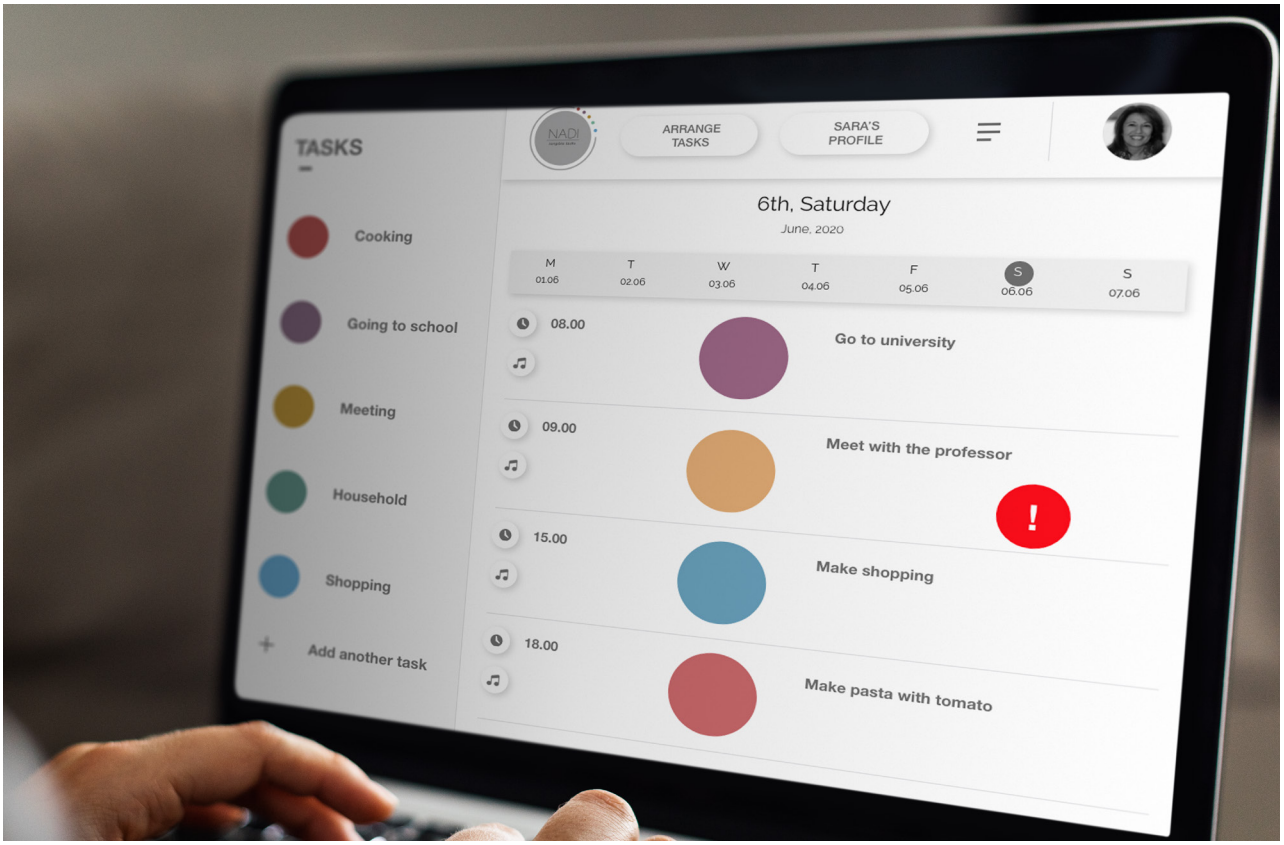
5. She can hold the button for an emergency situation, such as breakdown moments.



6. NADI directly sends a location signal to the emergency contact of the user, and her parent can reach her easily and see when an emergency happens, in which task.

Appointment with Caregiver

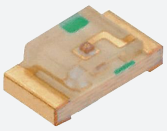
7. When she meets with her special educator, she puts the NADI on the interactive base and educator opens her account to reach her data



8. Educator sees what she has done during the week when she feels anxious, NADI becomes a communication tool to help the user remember and talk about the tasks.

Information of Components

Name	Product	Description
Battery	Li ion 301120 Battery cell (3x11x20 mm) 	Li polymer Battery 3.7V 45mAh Rechargeable Battery
System on chip	DA14681(DIALOG) (WL-CSP53 (3.4 x 3.0 x 0.5mm) and AQFN60 (6 x 6 x 0.9mm) 	An ARM® Cortex™ M0 processor, various embedded memory options, enabling the management of multi-sensor arrays and always-on sensing.

LED	KP-1608MGC 1.6mm x 0.8mm LED, 1.1mm thickness 	It is made of InGaAlP on GaAs substrate light emitting diode which can operate with wide viewing angle and low power consumption.
Speaker	USound - MEMS based speaker 5 mm x 7 mm x 2 mm, frequency range of 2-15 kHz. 	MEMS speakers achieve extremely small dimensions along with low power consumption and very good sound quality by eliminating the coil and magnet found in conventional solutions,

6

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