Case Study: TactTiles

A customizable sensory therapeutic toy for people with Autism with heightened sensory input.

Abstract

Each person with Autism has a different set of sensory preferences, and there are a limited amount of toys designed specifically for individuals with sensory needs, especially ones that are customizable, multifaceted, and affordable.

"How might we allow people on the Autism spectrum with heightened sensitivity to self-regulate their state of emotion and alertness?"

TactTiles is a box with magnetic, detachable tile sides, each with a different texture or dynamic interactive component. Users can choose which textures to attach to the sides based on their preferences, and store the others inside the box.

Context

Mr. Ryleigh, the student we worked with at the Hartford Autism Regional Program (HARP), fell on the lower-functioning side of the Autism spectrum, which led us to initially design our prototype for the lower-functioning population.

The lower functioning autism group is less understood and more underserved, and therefore it made more sense to us to start here. Upon further research, we determined

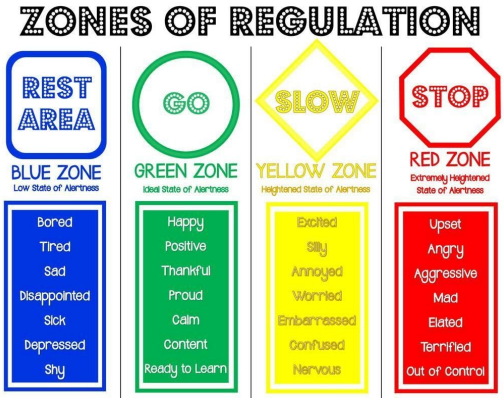
that 1.2 million people fit our target group, which includes people with Autism who are lower functioning and have sensory needs. One current multifaceted solution include baby busy boxes (see below), but these products are not tailored to the complex difficulties of emotional and sensory regulation for people with Autism. Certain toys such as Squigglets, Chewelry, or sensory brushes target these needs better, but are not very customizable and thus do not cater to a variety of sensory needs.





Decision Making Process

We first learned about the zones of regulation from an occupational therapist, pictured below. In general, those with autism move into states of alertness that impinge learning and interaction. The purpose of mood regulation is to assist in keeping people in the “green” zone — in which they are neither under stimulated nor overstimulated beyond an easy calming.



This led us to define our problem statement as a solution to help navigate the difficulty of regulating one’s state of alertness.

"How might we allow people on the Autism spectrum with heightened sensitivity to self-regulate their state of emotion and alertness?"

From there, we identified four main use cases where the box might be used, according to the four occupational therapists and teachers that we interviewed. We chose the occupational therapist office setting after learning about how occupational therapists could use the box to teach self mood regulating skills through pairing.

Occupational Therapist Office	Transportation	Home	Classroom
- Educational purposes - Calming textures - Exciting textures	- Very rounded edges in case it becomes a projectile	- Larger box for full engagement	- Smaller (fidget cube or hand-sized) - Calming textures only

One caveat we discovered when talking to Professor John Collier, Thayer Engineering, is that special needs populations might not have predictable or cohesive user group needs in comparison to neuro-typical user groups. This particularly applies to the Autism user group. It is highly difficult to segment people situated on the Autism spectrum into different profiles, given that Autism manifests itself differently in everyone it affects. Therefore, others in the past have struggled to mass-produce products to address the needs of people with Autism. Nonetheless, we decided that providing a solution for even a select subgroup of people with Autism would make an impact. This also led us to consider the idea of customizable tiles that served as a different solution for each user.

We first set out to determine what form factor the base of the product should be. The box was successful with Mr. Ryleigh, but is a cube fitting for these constraints? Should it be flat in your lap or on a table? Should it be a ball? Should it be a small cube? After speaking with occupational therapists, we determined that a cube would be the best starting point because it allows for customization, as well as portability and storage.

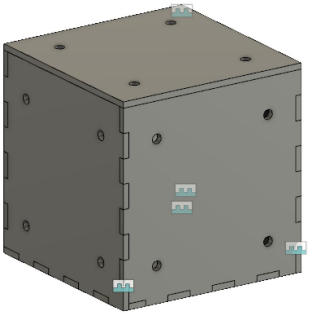
Determining Form Factor

Our objective in the testing for round 1 was to determine what size the box should be and collect data on the popularity of the different textures. We made two rapid prototype bases out of laser cut acrylic and foam core. We attached the foam core tiles via velcro and delivered new tiles that were compatible with the bases to HARP twice a week.

After showing OTs our two prototypes, we learned that the size of the box depended on our target age group. A larger box would be better for a younger age group, as elementary schools often consist of situations in which students do not move around. A smaller box would be helpful for kids that are older, as its portability could help calm them in a neuro-typical school or environment. We decided to pursue the larger box for initial tile testing with younger children the HARP School. If the larger box proved successful, we would apply what we learned form that on a smaller portable model.

Magnetization

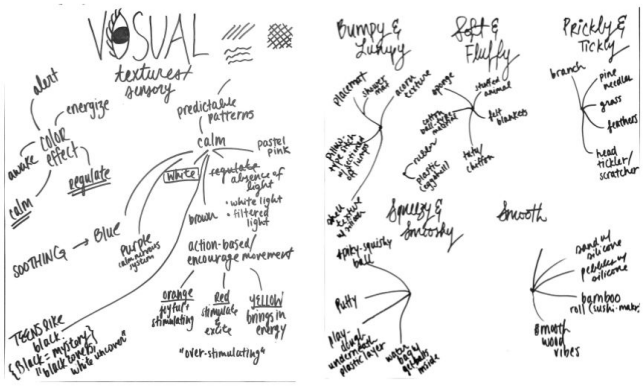
For our second round of prototyping, we decided to magnetize the box for easier manipulation of the tiles. From our experience with the prototypes we used to determine form-factor, we found that the velcro was far too tedious and unreliable. For one thing, the force of the velcro was too difficult for students to remove tiles. And when staff intervened to remove particular tiles, the velcro often peeled off which completely eliminated the modularity.



Our magnetization process consisted of testing our magnets of different sizes and strengths. We wanted the magnets to be strong enough to resist detachment when rubbed against, but not too strong as to be impossible to remove and exchange.

Tile Evaluation

We then set out to develop a methodology that would allow us to decide what the customizable tiles should be. Our group reviewed past Autism texture product categories to determine 6 different categories of textures that might have either calming or stimulating effects (see table below). Our eventual goal was to narrow down popular experiences within each category, so as to provide versatile options that are likely to satisfy most users in our target population.



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Bumpy and Lumpy	Soft and Fluffy	Prickly and Tickly
• Silicone Rock Negative • Silicone Moss Negative	• Corduroy • Chenille • Jo-ann fabric	• Pine needle (p1) • Walnut Positive
Squeezy and Smooshy	**Smooth**	**Dynamic Visual**
• Rubber Pink Anemone • Foam mat	• Rubber Pink Anemone • Felt	• Glitter target wheel • Glitter circle wheel • Sequin (p1)

Cause and Effect Dynamics

During our visit at Keene Perspectives, we learned that the kids love to play with the vertical blinds. They like to pull the blinds to the side, release them, and watch them sway back and forth. Upon further inquiry, Courtney Keene noted that she observes that students are often transfixed by cause-and-effect dynamics. With this in mind, we went back to Couch Lab and created a new set of tiles that could engage students in this way, including a tile that mimicked the motion of the vertical blinds. *(See below)*

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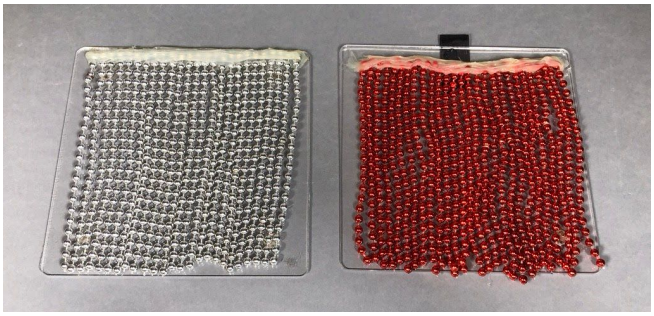

The Refined Prototype

With feedback from our first two rounds of prototyping, we rebuilt our magnetic prototype to be made of wood instead of plastic acrylic. Wood made the box lighter and more durable, and allowed us to test out using whiteboard paint to allow kids to draw onto their box. We also added a carrying handle, which is a rope that doubles as a stopper to keep the lid from over-extending when folded backwards.

We also continued the development of cause-and-effect tiles, playing with gear trains, glitter wheels, fidget spinners, blow-up koosh balls, and mardi-gras beads. In-action GIFs of these tiles can be seen at www.carsongracelevine.com/tacttiles.

Looking Forward

In the short term we are looking to test our boxes long-term at other schools and programs in order to determine which textures are most successful at calming and stimulating our users. We plan to use A/B testing and Vanderbilt's preference assessment testing methodology to ensure that the results are methodical and research backed. If this testing proves a viable solution, we plan to bring this box to market and incorporate the feedback to improve our current prototypes.

Educational Tiles

In our visits, we noticed that several Autism centers provided their kids with large alphabet foam mats that covered the ground of the play area. We also learned about the concept of pairing, which is when a caretaker associates an educational goal with a positive reward. With this in mind, we were curious to evaluate the impact of introducing educational tiles to the box. We hypothesized that by having delightful and educational tiles on the same box, it might be able to facilitate paired learning between the caretaker and student.

In our feedback, we learned that not only did the educational tiles facilitate delightful education of letters, words and numbers, but also practice of physical hand dexterity. The caretakers at HARP regularly integrate fine motor control into the education of their students. We received a video of one particular student, Caity, working with her caretaker to identify letters and place them into their slot. The box facilitated a delightful method of pursuing two learning goals at once. Thus, we are excited to explore other potential delightful educational tiles.

Smaller Boxes for On-The-Go

We would also like to continue to explore the potential for smaller, more portable boxes that students could clip to their backpacks. With our initial prototype (on the right) we learned that these smaller cubes pose more difficulty when implementing modular tiles, as the tiles need to be smaller than the cubes walls in order to fit inside of the cube. Thus, we anticipate that once we have data on the most successful tiles, we could use these textures and dynamics to create a small, non-modular cube.