Modifying A Toy For Use By Child With Cerebral Palsy

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Cerebral Palsy (CP) is a disease that hinders physical ability, but does not necessarily cause mental retardation. A common problem for children with CP is that they cannot play with toys that other children can play with because they lack the fine motor skills required to operate most toys. My goal was to make a toy that could be enjoyed by this type of child with the use of switches that would give him two choices, with two responses, and be visually stimulating.

Background

Cerebral palsy involves "an abnormality of motor function that is acquired at an early age, usually less than a year of age, and is due to a brain lesion that is non-progressive" (1). CP causes physical and sometimes mental impairment, and can be classified by the body parts that have hindered movement as well as the type of hindrance of the movement. The child for which this toy is designed is best described by athetoid quadriplegia. Athetosis refers to inability to control movement, and quadriplegia means that the arms and legs as well as the trunk and neck muscles are affected. He also cannot control the muscles of the mouth to speak. He is capable, however, of making sounds. He is confined to a wheelchair since he has no control of his legs or trunk, but he does have some rudimentary control of his arms. He can move his head towards the direction that he wants, but he can not raise it back up.

The child also has cortical blindness. Cortical blindness is "an apparent lack of visual functioning, in spite of anatomically and structurally intact eyes" (2). In this child's specific case, since his CP affects his ability to speak and communicate, there is no way to know the extent of his cortical blindness. When a child with cortical blindness is exposed to visual stimulation over long periods of time, his chance of improvement is good. Therefore, any toys designed for this child should include visual stimulation. In addition to CP and cortical blindness, the child suffers from developmental delay which is defined as "behind schedule in reaching milestones of early childhood development" (1). He is clearly behind in his physical development. As far as metal development is concerned, though, it is very difficult to know how behind he is or what he is capable of learning. It is unknown, if his mental delays are due to his own incapability or a merely a lack of tools to help him learn and express himself.

The child currently has toys that when he presses a switch, he gets a response – one option, and one response. First design ideas, such as alphabet toys, turned out to be too complicated for the child. He responds mostly to music, so I decided to adapt a musical toy with two options and two results. This toy should help move the child to the next step in his development.

Methodology

To modify this toy, first I had to decide on a particular toy. Then the toy had to be adapted so that it could be operated by the use of switches. Also a stand had to be built to place the toy in the child's range of vision. The modification of the toy will be described first followed by the stand construction.

Toy Modification

The toy needed to create visual and auditory stimulation, while being fairly simple. The toy needed to have only two operations or be able to be reduced to two operations. Dr. Tamondong (Mechanical Engineering Department, University of Alabama) and I decided on Little Tikes Discover Sounds Guitar. This toy has two buttons. The button representing the strings plays a song. The other button next to the lights makes a noise. Also, the guitar flashes four lights when the song button is activated. The goal was to make the toy fully operable by using two grab-n-puff switches. RCA jacks plug into the switches and connect to the toy's

internal circuitry to complete the circuit and activate the toy.

To modify this toy, we unscrewed and opened the toy. Then we drilled a hole in the back to allow the wires of the switches into the toy. Next the toy was tested and discovered to be normally open, momentarily closed. This means that it is important for the wires of the RCA jack not to touch when soldered onto the circuit board. If they were touching, the circuit would always be closed, and the toy would not be able to play after the first time. The switches were also tested, and also found to be normally open, momentarily closed.

Next, the wires of the RCA jack needed to be soldered to the circuits of the toy – one for the music button and one for the noise button. First for the music button, two places needed to be exposed to connect the wires of the RCA jack to complete the circuit. Dr. Tamondong and I had an extra guitar to experiment on. We needed a place close together but not so close that the wires would touch. So we chose the indicated areas in Figure 1.

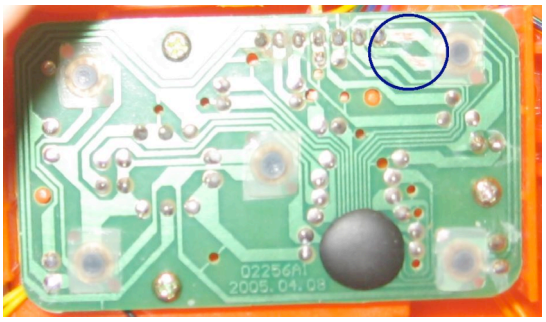

Figure 1: Exposed Areas for Music Button

We then exposed the indicated areas (or any two desired areas) that complete the circuit. The areas can be exposed by scraping the protective covering off the copper. We placed the wire of the RCA jack through the drilled hole with the exposed wire on the inside of the toy, and soldered the bare wire to the exposed area on the circuit board. For the noise button, a similar process was followed. We chose to expose the indicated areas in Figure 2.

The solder acts as an electrical connection. It is important to also have a mechanical connection. We chose to use a hot glue gun. At the drilled hole, we put a glob of hot glue to fix the two wires from the RCA jacks into place. This way, if the wires are tugged on, they will not pull out of the toy.

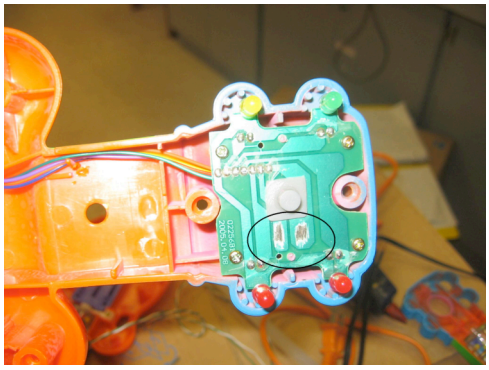

Figure 2: Exposed Areas for Noise Button

Then we put the front of the toy back on and screwed the screws back into place. Then we plugged the two RCA jacks into the grab-n-puff switches. When one switch is squeezed or pressed, music is played and the lights light up; and when the other switch is squeezed or pressed, a noise is made.

Building the Stand

Next the building of the stand will be described. The stand needed to be able to hold a small toy in front of the child's face so that he does not have to move to see the toy or the flashing lights on the toy. The stand will be placed on the child's desk so I took dimensions of his desk, and decided on a stand approximately 20 inches tall and a base 12 inches by 8 inches. These dimensions pose a slight design problem in that the stand and toy may topple.

Sam Tingle (Engineering Technical Services, University of Alabama) and I came up with the stand design. It has a front, base, and two triangle supports to connect the front and base. The front is made of one quarter inch plywood and has dimensions of 20 inches by 12 inches. The base and supports are made of three quarter inch plywood. It is built to the dimensions given, and C-clamps are used to keep the stand from toppling. Also, Velcro was added to attach the switches to the side and the toy to the front. For the client to use the toy and stand, the stand was set on the client's desk. The clamps were used to secure the stand. The toy and switches were attached to the Velcro on the stand. The switches were under the client's

hands, and the toy was ready to be used. The completed design can be seen in Figure 3.

Results

The result of this project is a toy that a client with cerebral palsy can enjoy with the use of switches. I took the toy to the child, and set it up for him to play with. He smiled a lot, laughed, and waved his hands. He really seemed to enjoy the toy and the stimulation. He was capable of using the toy though he did have some trouble keeping the switches in his hands. The children in his class also wanted to play with the toy. His teacher thought that the toy was a very good fit for the child, and that it will help him to learn a new motion – a grab instead of press. It will stimulate him visually and will help him learn to use both hands instead of just one. Also, the toy will be further modified with a strap that will be used to keep the switches in his hands. Hopefully, with time, the child will learn to hold the switches by himself so the toy will promote independence.

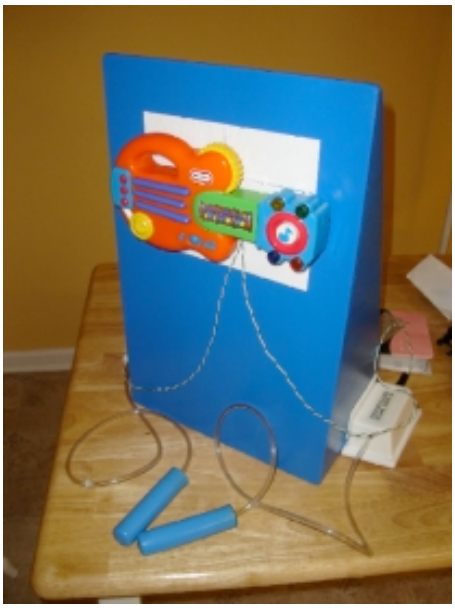

Figure 3: Toy and Stand Ready To Use

Discussion

This toy can be modified and the stand can be made by anyone who has some knowledge of circuitry and woodworking. The toy can be built for a reasonable price. Assuming that some supplies are available such as a drill, wire cutter, a soldering iron and solder, a saw, and paint, and assuming that $25 a piece switches are purchased, the entire project can be built for about $125 plus tax. If scrap wood is used, the entire project can be built for about $85 plus tax. The switches and RCA jacks that I used were donated, and I used scrap wood, but I bought two guitars so this project cost $45.25 plus tax.

The toy can help a client with cerebral palsy by promoting independence. This toy is also an important aid for my client because it will help in his furthered development. He may not be able to develop very much past the point where he is now, but until he is given the chance, his teachers and parents will not know his potential. If my client learns how to use this toy independently, another toy will be built for him that helps him advance further. The toy will also stimulate him visually and hopefully improve his cortical blindness.

Acknowledgements

Thanks to Dr. Beth Todd (Mechanical Engineering, University of Alabama) for helping me set up this project. Thanks to Ms. Judy Leonard (teacher at the RISE Center, University of Alabama) for helping me with deciding on the best ideas for the toy and answering questions to guide me on the best decisions for the toy. Thanks to Dr. James Dudgeon (Electrical and Computer Engineering, University of Alabama) for donating the switches. Thanks to Dr. Virginia Tamondong (Mechanical Engineering, University of Alabama) for help with the electrical aspects of the modification of the toy. Thanks to Sam Tingle and Vic Crawford (Engineering Technical Services, University of Alabama) for help with building the stand.

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