

**HUMAN-POWERED, ILLUMINATED RUNNER'S VEST**

**MOBILE DEVICES DISTRACT CHILDREN FROM SOCIAL INTERACTION**

An Undergraduate Thesis Portfolio  
Presented to the Faculty of the  
School of Engineering and Applied Science  
In Partial Fulfillment of the Requirements for the Degree  
Bachelor of Science in Mechanical Engineering

By

Trevor Cook

April 28, 2020

## **SOCIOTECHNICAL SYNTHESIS**

In many industrialized countries, children are being allowed to spend too much time on mobile smart devices and the only power limiting their exposure to mobile devices is the amount of charge in the battery. Although a ubiquitous commodity, battery research and design is constant and includes: selection of materials, issues of disposability, and novel charging mechanisms. The purpose of the technical research was to build a product that can generate its own electricity using body movement to power a device or charge a battery. The solution was to design a vest that generates electricity using a linear generator and using that energy to power LED strips on the front and back of the vest. The STS research was aimed at studying how the distraction of mobile smart devices affect children by hindering their time for unstructured play and social development. Children spend much of their time on mobile devices and other media, so if there are negative consequences stemming from that, it is important for caregivers and educators to know what those are. The technical and STS topics are loosely coupled. If the technology from the technical project was developed more, then children may be able to use mobile devices longer without a charge and therefore exacerbate the negative effects.

The guidelines for the technical research project were to create a product that generates electricity using body movement to power a device or charge a battery. The first step was to consider different possibilities of generating power by body movement. There were several runners and hikers on the project team, so a secondary goal was to be able to generate power while simply walking or running. The method was to design the product, build the design, and then test the physical device. If the design was faulty or inadequate, the design would be tweaked and the whole process would restart. Once there was an iteration that was deemed

acceptable, the product would hypothetically be ready for manufacture and the technical research of the team would be finished.

When running or hiking, there is some slight vertical movement of the body relative to the ground. The design team decided to harness that potential energy into electrical energy by using linear generators. A linear generator works by allowing a free-moving magnet to pass through coils of wire, inducing an EMF and therefore generating power. The linear generators are placed perpendicular to the ground on the vest so that when the body moves up when running or hiking, the magnet also moves up through the coil of wire. Then the magnet moves back down from the force of gravity. Each time the magnet passes through the coil, it generates power. After building the design and testing it, there was not enough vertical movement of the body while running or walking to provide significant movement of the magnet, so little power was generated. However, it was enough to power the LEDs, which require very small amount of power.

The research question being studied in the STS report was how the distraction of mobile smart devices affect children by hindering their time for unstructured play and social development. This research aimed to shed light on the consequences of too much time spent on mobile devices and media in general during young ages along with the importance of unstructured play. In order to accomplish this, a variety of different professionals and research were studied. The majority of the sources used were from physicians or doctorates that study child development. One interview was performed in person with a University of Virginia Professor, Dr. Amrisha Vaish, who specializes in ontogenetic emergence of the moral emotions, cognitions, and behaviors that make children successful cooperators.

It was found that the most important of what time spent on mobile devices and other media takes away from is unstructured play and interactions with caregivers, other adults, and other children. Unstructured play is vital for children to explore their environment, develop creativity, and figure out how the world works. Interactions with other children provides a foundation for the emergence of social skills and emotional intelligence. Interacting with caregivers is possibly the most important as children tend to mimic them and learn from explicit instruction. It was concluded that caregivers and educators should limit the time children can spend on mobile devices and provide the time and tools for unstructured play.

The technical research project proved that the vest could generate enough electricity to power LEDs, but would not be enough to significantly charge a mobile device. It should be noted, however, that if the technology were improved, it could be a method of increasing the range and time that children can spend on mobile devices without needing an outlet to charge from. Even if such a technology was available, caregivers are recommended to limit the time they allow their children to be on mobile devices. In addition, they should be sure to provide explicit instruction when conflict or other learning situations arise.

## **TABLE OF CONTENTS**

### **SOCIOTECHNICAL SYNTHESIS**

#### **HUMAN-POWERED, ILLUMINATED RUNNER'S VEST**

with Katarina Catallo, Jacob Fishman, Garrett Hanrahan, Kyle Peter, Clayton Tondreau  
Technical advisor: Mike Momot, Department of Mechanical Engineering

#### **MOBILE DEVICES DISTRACT CHILDREN FROM SOCIAL INTERACTION**

STS advisor: Catherine D. Baritaud, Department of Engineering, and Society

### **PROSPECTUS**

Technical advisor: Mike Momot, Department of Mechanical Engineering;  
STS advisor: Thomas Seabrook, Department of Engineering and Society