

CATSS Newsletter - Center for Applied and Translational Sensory Science  
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## University of Minnesota: Driven to Discover

CATSS: Center for Applied and Translational Sensory Science

**CATSS Newsletter**  
March, 2018

### **FROM THE DIRECTOR: CATSS Stats**

CATSS has continued to grow and thrive since its launch in the summer of 2015. Here are some notable accomplishments and numbers from the past year:

- A five-year, \$3 million NSF NRT training grant in sensory science was obtained in conjunction with the Center for Cognitive Sciences (2017-2022). Six paid fellows and 15 additional trainees are participating in grant activities this academic year.
- A graduate minor in Sensory Science was approved and will go to the Board of Regents this month for final approval.
- A Grand Challenges course, *GCC 5022: The Human Experience of Sensory Loss*, co-taught by CATSS leadership, began this Spring term.
- CATSS continues to collaborate with external agencies serving people with sensory loss, including Hearing Loss Association, Vision Loss Resources, Abiitan Senior residences, Augustana Learning Laboratories, and others.
- We are collaborating with seven or more private industries (NirX, Starkey, GN ReSound, Sonova, Second Sight, Envoy Medical, and others). Several of these companies will be engaging our NRT trainees in internships.
- **The CATSS labs are in full-time use!** During fall 2017 and now in spring 2018, our booths are scheduled frequently into the evenings and weekends. Average use of the facilities over the past six months has exceeded 55 hours per week. We'll be looking for ways to expand.
- The CATSS lab facilities are used by five different colleges, and we are serving students from six colleges through the training grant. Of the 30+ projects that are ongoing in CATSS, about ten of them are inter-collegiate efforts:
  - **College of Liberal Arts (CLA).** Psychology and Speech-Language-Hearing Sciences are busy users of CATSS. Several of the projects are interdisciplinary, involving other colleges like academic health and engineering.
  - **Academic Health Center (AHC).** Ophthalmology and Otolaryngology are involved in research with their residents/fellows and faculty, in collaboration with CLA faculty and private industry.
  - **College of Science and Engineering (CSE).** St Anthony Falls Laboratories is a frequent user in CATSS, with two projects ongoing. In addition, Computer Science & Engineering and Biomedical Engineering are involved via students funded on the NRT grant.
  - **College of Education and Human Development (CEHD).** Two users currently conduct research in movement disorders in CATSS, and students are involved in the training grant.
- This year we welcome two new college participants:
  - **Veterinary medicine (Raptor Center).** Some ground-breaking work on raptor hearing has been completed in collaboration with CSE and CLA.
  - **College of Biological Sciences (CBS).** We have written grants for postdoctoral fellows who, if funded, will be housed in CATSS.

These are busy and exciting times. Be sure to stop by some time soon.

### **NRT PROGRAM UPDATE**

The new, interdisciplinary "Graduate Training Program in Sensory Science: Optimizing the Information Available for Mind and Brain," run jointly by CATSS and the Center for Cognitive Sciences, conducted a winter workshop for the NRT cohort on Jan 11-12, 2018. Topics covered included grant writing, communicating science to the general public, an introduction to "design thinking", and round table

discussions ranging from career options in industry to living with sensory loss. The workshop was one of several professional/educational development events offered to NRT trainees.

## NEW SENSORY SCIENCE COURSE GCC 5022: The Human Experience of Sensory Loss: Seeking Equitable and Effective Solutions

This new course focuses on the visual, auditory, and other sensory pathways that convey information about the world to the mind and brain. Millions of people worldwide experience deficits in sensory function that affect their quality of life. The focus is on the characteristics of healthy sensory functioning as well as how sensory disorders can affect personal identity, impede information processing, and alter brain structure and function. The course addresses the demographics and risk factors for sensory disabilities, the implications of these disabilities for activities of daily living, the history of society's response to sensory disability, as well as societal, ethical, and personal attitudes toward sensory disabilities. Translational and applied approaches for addressing sensory disabilities are explored. Each class session is co-taught by a pair of CATSS-affiliated instructors, representing multiple scientific and social perspectives.

GCC 5022

A major goal of the course is to view sensory function and impairment from multiple perspectives—cognitive science, neuroscience, medicine, engineering, society, consumers, ethics, and social justice. The course combines lectures, discussions, and student-led presentations of research papers. It includes hands-on demonstrations of assistive technology and panel discussions with people with visual and hearing disabilities. During the semester each student (or pair of students) are required to develop a mini research proposal to address a real-world issue related to sensory impairment.

### **Optimizing the Argus® II Retinal Prosthesis System for Visual Functioning**

- By Yingchen He and Liz Anderson

The Argus® II Retinal Prosthesis System, developed by Second Sight Medical Products, Inc., is the first and only FDA-approved retinal implant for people who are blind due to retinitis pigmentosa (RP). Approximately 250 patients worldwide have been implanted with this device, and the University of Minnesota's Sandra Montezuma has implanted eight patients to date, with more scheduled. A research team led by Dr. Montezuma (with post-doc Yingchen He, PhD and Natalie Huang, MD) is working on several projects in CATSS, with the ultimate goal of developing ways to evaluate and optimize the Argus II for visual functioning.

#### **PROJECT 1: Objective measurements of visual responses**

Following device implantation and activation, a critical step in maximizing the efficacy of the device is to optimize the mapping from visual input to electrode stimulation. Currently, the only means for adjusting the mapping comes from patient's subjective reports of perceived brightness and localization of a large square on a computer screen. These measurements are long and tedious for patients, and the judgments are often difficult for those who have not experienced vision for long periods of time, even decades. A patient may sometimes report seeing light without electrical stimulation, possibly due to high expectations or to spontaneous phosphenes. Consequently, the subjective responses do not always accurately reflect actual brain activity. There is great need for an objective and reliable measurement of brain activity to guide the device optimization and to evaluate long-term changes in the brain induced by the device.

Argus II EEG Testing

This project aims to develop such a measurement using electroencephalogram (EEG) testing to map the visual responses induced by electrical stimulation in Argus II patients. In this study, visual patterns that stimulate the upper/lower part of the retina were presented, and subjects' cortical responses were recorded.

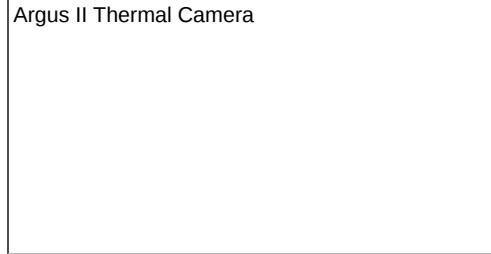
Results indicated evidence for preserved retinotopic mapping in these patients.

**PROJECT 2: Application of a thermal camera in Argus II**

The Argus II camera provides visual experience based on light and dark contrast in the real world. In daily life, however, a natural scene is often visually cluttered. Given the low resolution provided by the Argus II, with its 6 x 10 electrode array, it is challenging for patients to interpret the visual input in a crowded environment.

In many cases, heat-emitting objects such as persons or animals are of greater interest, relative to the rest of the scene. While it may be hard to discern these objects from the background based on their brightness level, a thermal camera can potentially separate them from the environment based on their temperature. To assess the value of adding a thermal sensor to the Argus II, a prototype of thermal glasses was developed by Second Sight, and evaluated in an experimental setting.

The study investigated the trade-off between field-of-view and resolution in Argus II wearers using the thermal camera. Subjects were asked to identify the locations of two cups with hot water, and to reach for the cups. The tasks were completed either with the normal zoom, same as the standard Argus II camera, or with zoom-out, which provided three times field-of-view as the standard one. The results showed that better resolution is more helpful than larger field-of-view for the current generation of Argus II.



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