

## **1. Project title, Principal Investigator name, title and location**

*Project:* Processes underlying immature auditory perception during adolescence

*Principal Investigator:* Julia Jones Huyck Ph.D., Associate Professor & Program Coordinator, Speech Pathology and Audiology, Kent State University, and Voluntary Adjunct Assistant Professor, Department of Anatomy and Neurobiology, NEOMED.

*Location:* Speech Pathology & Audiology Program, Kent State University (1325 Theatre Drive, Kent, OH)

## **2. Abstract of project**

Hearing and listening are critical to how adolescents communicate, learn new information, and engage with technology and culture; however, performance on auditory perceptual tasks takes a long time to become mature. Because few studies of auditory perception have centered on typically developing adolescents, little is known about the mechanisms underlying this immaturity. This project will evaluate the extent to which auditory stimulus encoding and various cognitive processes contribute to immature auditory perception during adolescence, using a combination of perceptual testing, neuropsychological and language testing, eye-tracking, and auditory evoked potentials (electrophysiology).

## **3. Significance of the project**

Despite growing evidence that older children and adolescents have immature auditory perception (Buss et al., 1999; Hartley et al., 2000; Johnson, 2000; Wightman and Kistler, 2005; Bishop and Dawes, 2008; Lutfi et al., 2010; Wightman et al., 2010; Banai et al., 2011; Ross et al., 2011; Buss et al., 2017; Huyck and Wright, 2017; Huyck, 2018; Huyck and Rosen, 2018), most developmental studies only evaluate children up to 9 to 12 years of age and do not span the entire age range from early adolescence to adulthood. Thus, little is known about the processes underlying the prolonged maturation of hearing and listening abilities. The scarcity of information about auditory perception by typically developing adolescents provides little basis of comparison for adolescents with communication disorders. Thousands of children and adolescents in the United States have normal hearing thresholds but report difficulty on some listening tasks, either due to bottom-up perceptual deficits, language disorders, top-down cognitive issues, or some combination thereof (Loo et al., 2013; Bellis and Bellis, 2015; Moore, 2015). The lack of knowledge of the processes underlying the prolonged maturation of hearing and listening abilities in typical listeners can lead to difficulties in the diagnosis of auditory processing disorders (Loo et al., 2013; Ludwig et al., 2014; Moore, 2015). This project will yield experimental protocols that will be applicable for the development of diagnostic tests regarding auditory processing in adolescents and young adults and provide insights for the development of rehabilitation strategies to treat disorders affecting auditory processing in this population.

## **4. Goals and objectives**

The goal is to evaluate the extent to which auditory stimulus encoding and various cognitive processes contribute to immature auditory perception during adolescence.

*Learning objectives:*

- The fellow will become familiar with the medical research environment by actively participating in lab meetings and departmental journal clubs.
- The fellow will learn to collect data on auditory learning from adolescents and adults using custom computer programs.
- The fellow will learn to administer neuropsychological tests to assess cognitive skills.
- The fellow will learn to collect auditory evoked potentials and eye-tracking data.

## **5. Research methods to be used**

*Human Subjects:* All procedures are approved by the Institutional Review Board at Kent State University (IRB #15-355 & #20-299). 10- to 23-year-olds will be recruited from northeast Ohio through flyers and letters sent home from local schools. Participants will have normal hearing as confirmed by a pure tone audiogram. They will be excluded if they (or their parents) report that they have a history of hearing loss, language impairments, learning disabilities, attention deficit/hyperactivity disorder, traumatic brain injury, or other major neurological problems. Participants will be compensated for their time with gift cards. Study procedures pose minimal risk.

Auditory perception, sensory encoding and temporal processing will be measured using combination of perceptual testing, pupillometry and blink-rate to index cognitive processes engaged during active listening, auditory evoked potentials to index temporal and spectral encoding during unattended stimuli, and standardized neuropsychological and language tests.

In the event that Kent State's campus is closed to research with children in summer 2021 due to the pandemic, the project will involve analysis of data collected both in-person and online.

## **6. Proposed method of data analysis**

Most data will be collected via custom computer programs. Some listening tasks and standardized tests will require manual scoring. Data will be analyzed using hierarchical regression and linear mixed models.

## **7. Fellow's contribution to overall research**

The bulk of the data collection from our juvenile participants will occur over the summer. Summer 2023 will be the first full summer that these data are being collected. Therefore, assistance with data collection from teens is critical to the success of the project. Data collection is time-intensive because each participant must come in four times for about 2 hours each time. In addition, two fellows, students, or lab employees must be present at each session.

## **Summer Research Fellow Training/Mentoring Plan**

Research will be conducted in Dr. Huyck's laboratory, which is part of the Speech Pathology and Audiology Program at Kent State and the Hearing Research Group (HRG) in the Department of Anatomy and Neurobiology at NEOMED. Dr. Huyck's lab emphasizes professionalism, enthusiasm, and scientific rigor. The fellow will receive training from Dr. Huyck and her collaborators/students in data collection and/or analysis. Lab members meet weekly to develop new projects, address technical concerns, and discuss results and related research. The fellow will meet individually with Dr. Huyck on a weekly basis.

If there are regular meetings of the Hearing Research Group (HRG), in the summer of 2023, the student will attend those meetings as well.

## **For more information on this project please contact:**

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