**The Other Side of Normal: What is Super-Human Hearing?**

**Arts & Sciences 1138.\*\*, Freshman Seminar**

**Spring Semester 2017**

**Tuesday 11 - Noon**

Instructor: Lawrence L. Feth (feth.1@osu.edu )

Department of Speech and Hearing Science

110 Pressey Hall, 1070 Carmack Road

# Course Description

Dozens of super heroes from Superman and Supergirl to Daredevil and Wolverine are said to possess super-human hearing, but what does it mean to have listening capabilities beyond “normal limits”? This seminar will begin by discussing “normal” hearing. What are the limits of the typical young adult with two ears and a brain? To do that we will need to ask and answer the age old question: “If a tree falls in the forest and there is no one around to hear it, did it make a sound?” Next, we will investigate how the human ear delivers sound energy to the brain, and how we measure the hearing capacity of normal human listeners. Then, we will break into small groups to discuss examples of people with what appears to be super-human hearing.

# Texts

No textbooks will be required. Copies of required readings will be available on the CARMEN site for the seminar, or downloaded from electronic sources through the library.

**Course Policies**

* Attendance for each of the 1 hour seminar sessions is expected. Absences will require a written explanation and may count against participation grades.
* Class participation is expected for each session. All members of a project group are expected to contribute equally to the completion of the project.
* A written report is required of each student enrolled in the seminar. It must represent the work of only the student submitting it.
* Each student will participate in a group project. The project will receive one grade.

# Grading

The seminar will be graded S/U. Each student will accumulate up to 100 points for the course. Seventy points or more are required to earn a grade of Satisfactory. No extra credit will be available for absences or missed assignments.

* The written report will count 35 points, and must be uploaded to the CARMEN site in Word format before the last day of classes for the semester.
* Presentations will count 35 points for each participant.
* Attendance and participation will count 30 points.

**Academic Misconduct**

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (<http://studentlife.osu.edu/pdfs/csc_12-31-07.pdf>).

**Students with Disabilities**

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

#### Weekly Schedule

**Week 1: Introduction to the Course**

* Course Goals & Objectives
	+ List superheroes and their capabilities
	+ Form working groups and begin to select project topics

**Week 2: Introduction to Sound**

* What is Sound?
	+ Sound as a form of energy
	+ Generation of Sound
	+ Propagation of Sound
	+ Measuring and describing sound

Reading: Chapter 4 “Acoustics The Science of Sound” in Daniloff, Schuckers & Feth, The Anatomy and Physiology of Speech and Hearing: An Introduction (PDF on CARMEN)

**Weeks 3 & 4: Introduction to the Ear**

* How do we hear what we hear?
	+ The flow of sound energy in the outer and middle ear
	+ Sensory Transduction
		- Hair Cells and Neurons
		- The brain

Reading: Chapter 9 “Audition The Sense of Hearing” in Daniloff, Schuckers & Feth, The Anatomy and Physiology of Speech and Hearing: An Introduction (PDF on CARMEN)

**Weeks 5, 6, & 7: Introduction to Hearing**

* Basic Auditory Capabilities
	+ Sensitivity and dynamic range
		- What is the weakest sound we can hear under the best listening conditions?
		- What is the strongest sound our ears can “tolerate”?
	+ Frequency response and frequency selectivity
		- What is the lowest frequency we can hear?
		- What is the highest frequency?
		- How do we tell one frequency from another?
	+ Temporal Factors in hearing
		- Temporal acuity – What is the smallest time difference between two sounds that we can detect?
		- Temporal summation – How long does the ear process sounds?
	+ Binaural Hearing
		- Why do we have only two ears in a 3-D world?
		- How do we locate sounds in space?
	+ Psychoacoustics and Sound Perception
		- Measuring Behavior
			* Classical Psychophysics – Fechner
			* Modern Psychophysics
				+ Signal Detection Theory – Green & Swets
				+ Magnitude Estimation – Stevens

Readings: Chapters 1 and 8 in Durrant and Feth, “Hearing Sciences: A Foundational Approach” (PDF on CARMEN)

**Week 8 & 9: Discussion & Summary of Normal Limits on Human Hearing**

* Typical questions to be addressed:
	+ What do the terms “ultrasonic” and “infrasonic” mean?
	+ What are the limits on hearing sensitivity? On dynamic range?
	+ What does “normal hearing” mean?
	+ What would constitute “Super-human” hearing?

**Week 10: First group presentation**

* What person or group are you reporting? (For example, People with ‘Perfect Pitch’)
	+ What is this special ability?
	+ How does it differ from “ordinary mortals”?
	+ How would you verify that this ability exists?
	+ Is it innate or learned?

**Week 11: Second group presentation**

* What person or group are you reporting?
	+ What is this special ability?
	+ How does it differ from “ordinary mortals”?
	+ How would you verify that this ability exists?
	+ Is it innate or learned?

**Week 12: Third group presentation**

* What person or group are you reporting?
	+ What is this special ability?
	+ How does it differ from “ordinary mortals”?
	+ How would you verify that this ability exists?
	+ Is it innate or learned?

**Week 13: Fourth group presentation**

* What person or group are you reporting?
	+ What is this special ability?
	+ How does it differ from “ordinary mortals”?
	+ How would you verify that this ability exists?
	+ Is it innate or learned?

**Week 14: Wrap-up Discussion – What did we learn about the information processing capacity of the human ear – brain system?**