Description of Course
This course will introduce scientific evidence for the perception of speech sounds, neurobiological basis, neuroimaging evidence, classical and modern theories of speech perception, development (emergence) of speech, and the effect of aging and disorders on the ability to perceive speech. This is an advanced graduate level course. Graduate-level requirements include more extensive independent reading and mastery of scientific writing.

Instructor and Contact Information
Instructor: Aneta Kielar, Ph.D.
Office: SLHS 332
Telephone: 520-621-5105
Email: akielar@email.arizona.edu
Office Hours: Wednesday 3-4 p.m. or by appointment

Course Format and Teaching Methods
Seminars, independent reading, literature review, in-class discussion, presentations, written assignments and papers. This is an advanced graduate seminar course. Students are responsible for reading the assigned materials before each class meeting, prepare questions, and participate in class discussions. Each student will lead two or more in-class discussions on the assigned topic.

Course Objectives and Expected Learning Outcomes
1) Students will became familiar with perception of speech sounds
2) Students will examine neuroanatomy of speech perception
3) Students will examine behavioral and neuroimaging literature relevant to speech perception and discuss findings in the seminar format
4) Students will examine models/theories of speech perception
5) Students will describe how speech perception can be differentially disrupted with damage or abnormal development of the related brain systems.
6) Students will use a scientific writing style to describe and evaluate scientific claims in peer reviewed journal articles and book chapters
7) Students will present and discuss scientific literature
8) Students will propose and write up a research proposal

Absence and Class Participation Policy
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at http://catalog.arizona.edu/policy/class-attendance-
participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: [http://policy.arizona.edu/human-resources/religious-accommodation-policy](http://policy.arizona.edu/human-resources/religious-accommodation-policy).

Absences preapproved by the UA Dean of Students (or dean’s designee) will be honored. See [http://policy.arizona.edu/employmenthuman-resources/attendance](http://policy.arizona.edu/employmenthuman-resources/attendance).

Participating in the course and attending lectures and other course events are vital to the learning process. As such, **attendance is required at all lectures and discussion section meetings**. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences. Lecture notes, book chapters, journal articles, and other reading materials will be made available on the D2L website or other websites. In addition, the D2L website may also be used for messages and announcements related to the course.

**Required Texts or Readings**

Students will be responsible for the materials on the reading list posted on D2L. The required readings must be completed before each class.

**Assignments and Examinations: Schedule/Due Dates**

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
<th>Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>40</td>
<td>Wed Feb 22</td>
</tr>
<tr>
<td>Exam 2</td>
<td>40</td>
<td>Mon April 3</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50</td>
<td>TBA</td>
</tr>
<tr>
<td>Participation in discussions</td>
<td>40</td>
<td>Contributions to class discussion</td>
</tr>
<tr>
<td>Leading Discussions</td>
<td>60</td>
<td>This will involve in-class presentations on the assigned topics based on the readings posted on D2L</td>
</tr>
<tr>
<td>Thought Papers</td>
<td>12</td>
<td>This is a short reflection on the topics discussed in class. No longer than 1 page</td>
</tr>
<tr>
<td>Final Paper Outline</td>
<td>18</td>
<td>Prepare outline of your research proposal. Details posted on D2L</td>
</tr>
<tr>
<td>Final Paper</td>
<td>40</td>
<td>Original research proposal on one of the topics discussed in class. Topic must be approved by the instructor. (5 pages max) Details on D2L</td>
</tr>
</tbody>
</table>

**Final Examination or Project**

The date and time of the final exam or project, along with links to the Final Exam Regulations, [https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information?audience=students&cat1=10&cat2=31](https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information?audience=students&cat1=10&cat2=31), and Final Exam Schedule,
Grading Scale and Policies

Course grades will be based on the sum of three exams, in class presentation, participation points, commentaries/thought papers, and the final paper (max 300)

- Two midterm exams: 40 points each = 80
- Participation in discussions = 40
- Thought papers = 12
- Leading discussions = 60 (30 points each)
- Final Paper outline = 18
- Final Paper = 40
- Final Exam = 50

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>90% or better</td>
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<tr>
<td>B</td>
<td>80%-89.99%</td>
</tr>
<tr>
<td>C</td>
<td>70%-79.99%</td>
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<tr>
<td>D</td>
<td>60%-69.99%</td>
</tr>
<tr>
<td>F</td>
<td>50%-59.99%</td>
</tr>
</tbody>
</table>

University policy regarding grades and grading systems is available at [http://catalog.arizona.edu/policy/grades-and-grading-system](http://catalog.arizona.edu/policy/grades-and-grading-system)

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at [http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete](http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete) and [http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal](http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal) respectively.

Dispute of Grade Policy If you wish to question the grading of any test or paper, the request must be made in writing (e.g., via email) to the instructor within 1 week of the date that the test or paper was returned to the class (whether or not you attended that class). The assignment will be entirely re-graded, which may result in a higher or lower final grade. After a test or paper has been re-graded, the final grade is non-negotiable. The only exception to the regarding policy is mathematical errors.

Scheduled Topics/Activities

List topics in logical units in a weekly/daily schedule, including assignment due dates and exam dates.

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>Discussion Leader</th>
<th>Assignments</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wed, Jan 11</td>
<td>Introduction</td>
<td>AK</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mon, Jan 16</td>
<td>MLK</td>
<td></td>
<td>NO CLASS</td>
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<tr>
<td></td>
<td></td>
<td>Main Components of speech</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Wed Jan 18</td>
<td>Neuroanatomy of Speech Perception</td>
<td>AK</td>
<td>A: 1-8</td>
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<tr>
<td>3</td>
<td>Mon Jan 23</td>
<td>Speech sounds: perception of vowels</td>
<td></td>
<td>Student presentations</td>
<td>B: 1-12</td>
</tr>
<tr>
<td>4</td>
<td>Wed Jan 25</td>
<td>Speech sounds: perception</td>
<td></td>
<td>Student presentations</td>
<td>C: 1-9</td>
</tr>
<tr>
<td>Time</td>
<td>Date</td>
<td>Topic</td>
<td>Assignment</td>
<td>Presentations</td>
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<tr>
<td>5</td>
<td>Mon Jan 30</td>
<td>Categorical perception and VOT</td>
<td>Student presentations</td>
<td>D: 1-9</td>
<td></td>
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<tr>
<td>6</td>
<td>Wed Feb 1</td>
<td>Top-down influence: context and prediction</td>
<td>Student presentations</td>
<td>E: 1-8</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mon Feb 6</td>
<td>Co-articulation and speech code perception</td>
<td>Thought paper</td>
<td>Student presentations F:1-5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Neuroimaging of speech and language</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Wed Feb 8</td>
<td>Imaging of speech: I electrophysiology EEG/ERP</td>
<td>Student presentations</td>
<td>G: 1-6</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mon Feb 13</td>
<td>Imaging of speech: II electrophysiology EEG/ERP</td>
<td>Student presentations</td>
<td>H: 1-6</td>
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<tr>
<td>10</td>
<td>Wed Feb 15</td>
<td>Imaging of speech: Functional MRI</td>
<td>Student presentations</td>
<td>I: 1-7</td>
<td></td>
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<tr>
<td>11</td>
<td>Mon Feb 20</td>
<td>Imaging of speech: MEG</td>
<td>Thought paper</td>
<td>Student presentations J: 1-6</td>
<td></td>
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<tr>
<td>12</td>
<td>Wed Feb 22</td>
<td><strong>Exam 1</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>Special Populations I</strong></td>
<td></td>
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<tr>
<td>13</td>
<td>Mon Feb 27</td>
<td>Infant and child speech perception, Development and critical period: Part I</td>
<td>Student presentations</td>
<td>K: 1-11</td>
<td></td>
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<tr>
<td>14</td>
<td>Wed March 1</td>
<td>Infant and child speech perception, Development and critical period: Part II</td>
<td>Student presentations</td>
<td>L: 1-7</td>
<td></td>
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<tr>
<td>15</td>
<td>Mon March 6</td>
<td>Speech perception across life-span and aging</td>
<td>Student presentations</td>
<td>M: 1-6</td>
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<tr>
<td>16</td>
<td>Wed March 8</td>
<td>Cross-language and second-language speech perception, effect of bilingualism</td>
<td>Thought Paper</td>
<td>Student presentations N: 1-8</td>
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<tr>
<td>Mon March 13</td>
<td>Spring break</td>
<td>No class</td>
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<tr>
<td>Wed March 15</td>
<td>Spring break</td>
<td>No class</td>
<td></td>
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<tr>
<td></td>
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<td><strong>Special Populations II</strong></td>
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<tr>
<td>17</td>
<td>Mon March 20</td>
<td>Speech perception with hearing impairment and cochlear implants</td>
<td>Student presentations</td>
<td>O: 1-12</td>
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<tr>
<td>18</td>
<td>Wed March 22</td>
<td>Speech perception with acquired brain disabilities</td>
<td>Student presentations</td>
<td>P: 1-12</td>
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<td>19</td>
<td>Mon March 27</td>
<td>Music-language connection and speech perception</td>
<td>Student presentations</td>
<td>Q: 1-10</td>
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<tr>
<td></td>
<td>Date</td>
<td>Event</td>
<td>Instructor</td>
<td>Assignment</td>
<td>Presentations</td>
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<tr>
<td>20</td>
<td>Wed March 29</td>
<td>Speech perception in noise and interference: applications</td>
<td>Thought Paper</td>
<td>Student presentations</td>
<td>R:1-7</td>
</tr>
<tr>
<td>21</td>
<td>Mon April 3</td>
<td><strong>Exam 2</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>22</td>
<td>Wed April 5</td>
<td>Analysis-by-Synthesis</td>
<td>Student presentations</td>
<td>S: 1-10</td>
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<tr>
<td>23</td>
<td>Mon April 10</td>
<td>Motor theory: Part I</td>
<td>Student presentations</td>
<td>T:1-7</td>
<td></td>
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<tr>
<td>24</td>
<td>Wed April 12</td>
<td>Fuzzy-logical model</td>
<td>Thought Paper</td>
<td>Student presentations</td>
<td>U: 1-4</td>
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<tr>
<td>25</td>
<td>Mon April 17</td>
<td>Trace Model and Cohort Model</td>
<td>Student presentations</td>
<td>V: 1-7</td>
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<tr>
<td></td>
<td></td>
<td><strong>Beyond sensory input</strong></td>
<td></td>
<td></td>
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<tr>
<td>26</td>
<td>Wed April 19</td>
<td>Word segmentation</td>
<td>Student presentations</td>
<td>W:1-6</td>
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<tr>
<td>27</td>
<td>Mon April 24</td>
<td>From speech signal to word recognition</td>
<td>Student presentations</td>
<td>X:1-4</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Wed April 26</td>
<td>Right hemisphere and hemispheric dominance: role in speech perception</td>
<td>Student presentations</td>
<td>Y:1-8</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Mon May 1</td>
<td>Guest Lecture: Dr. Julie Miller</td>
<td>Thought paper</td>
<td>Z:</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Wed May 3</td>
<td>Special topics: Methodology, evolution, and new directions</td>
<td>Last day of Classes</td>
<td>Student presentations</td>
<td>ZZ:1-6</td>
</tr>
</tbody>
</table>

**Bibliography**

List of readings is posted on D2L and attached at the end of this document.

**Classroom Behavior Policy**

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and **not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).**

**Students are asked to refrain from disruptive conversations with people sitting around them during lecture.** Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.
Threatening Behavior Policy
The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations
Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit http://drc.arizona.edu.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://www.library.arizona.edu/help/tutorials/plagiarism/index.html.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor’s express written consent.

Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Late Assignments, Make-up Exams
In the case of an unexpected emergency or severe illness (e.g. vomiting, fever, highly contagious illness) that prevents you from handing in an assignment on time or taking an exam, you must inform instructor by email within 24 hours (preferably sooner). Late papers will lose 1 letter grade (10%) per day that they are late. Make-up exams will only be given under extremely extenuating circumstances. Make-up exams will be given during the final exam period and may be given in oral form. Documentation (doctor’s note, newspaper article, police report) will help your cause.

Test Taking Etiquette
All students must abide by the following rules during tests:
1) Be on time. Entering late is disruptive to other students. If you arrive late, you may be asked to wait until there is a seat available that you can reach without disturbing any other students (end of row, etc). **No tests** will be handed out after the 1st student leaves the classroom.

2) **You may not leave and re-enter the room for any reason during a test.**

3) Do not hold up your test to read it. This is easily mistaken for showing your answers to a friend. All tests must remain flat on the table the whole time.

4) Keep your eyes on your paper or on the test preceptor. Looking elsewhere is easily mistaken for cheating, and is likely to be treated as such.

5) Close your bag and place it under or behind your seat during tests.

6) Cell phones must be turned off and put away. If your cell phone rings, buzzes, beeps or otherwise makes an appearance, we will regard it as a possible occurrence of cheating and treat it accordingly.

7) Follow obvious rules: No unauthorized cheat sheets, no talking, etc.

8) We reserve the right to generate new rules.

**UA Nondiscrimination and Anti-harassment Policy**

The University is committed to creating and maintaining an environment free of discrimination; see [http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy](http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy). Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

**Additional Resources for Student**

UA Academic policies and procedures are available at [http://catalog.arizona.edu/policies](http://catalog.arizona.edu/policies).

Student Assistance and Advocacy information is available at [http://deanofstudents.arizona.edu/student-assistance/students/student-assistance](http://deanofstudents.arizona.edu/student-assistance/students/student-assistance)

**Confidentiality of Student Records**

[http://www.registrar.arizona.edu/ferpa/default.htm](http://www.registrar.arizona.edu/ferpa/default.htm)

**Subject to Change Statement**

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.
**Reading List for Speech Perception SLHS 568.**

Requited readings are marked with *. Some section contain more items to serve as an additional background and further reading. Discussion leaders for each week should be familiar with ALL of the assigned readings for the relevant sections.

**Main Components of Speech**

**A. Neuroanatomy of Speech Perception**


**B. Speech sounds: perception of vowels**


C. **Speech sounds: perception of consonants**


D. Categorical perception and VOT


E. Top-down influence on speech perception: context and prediction


lexical information from degraded speech. Brain Research, 1153, 134-143. *


F. Co-articulation and speech code perception


Neuroimaging of speech and language

G. Imaging of speech: electrophysiology I (EEG/ERPs)


**H. Imaging of speech: electrophysiology II**


**I. Imaging of speech: Functional MRI**


5. Ghislaine Dehaene-Lambertz et al. (2005). Neural correlates of switching from auditory to speech perception, 24, 21-33,*

7. Pascale Tremblay et al. (2016). Neural sensitivity to syllable frequency and mutual information in speech perception and production. Neuroimage, 136, 106-121. *

J. Imaging of speech: MEG


Special Populations I:
K. Infant speech perception Development and Critical period: Part I


9. Houston, D M. Speech Perception in Infants: Chapter 17. 417-488.**


L. Infant/child speech perception Development: Part II


3. Vouloumanos, A. et al. (2013). Listen up! Speech is for thinking during infancy. TICS, 18, 642-646. *


M. Speech Perception across Life-span and Aging


N. Cross-language and second-language speech perception, bilingualism


Special Populations II

O. Speech perception with hearing impairment and cochlear implants


P. Speech perception with acquired brain disabilities. Speech perception and language impairment

Aphasia/Stroke


Autism

**Stuttering/Developmental**


**Other neurological disorders**


**Q. Music-language connection and speech perception**


R. Speech perception in noise and interference: applications


Models of Speech Perception

S. Analysis-by-Synthesis and Motor theory: Part I

Analysis-by-Synthesis


**Motor theory: Part I**


**T. Motor Theory: Part II**


U. Fuzzy-logical model


V. Trace Model and Cohort Model

Trace Model


Cohort Model


Beyond sensory input

W. Word Segmentation
of distal prosody, proximal prosody, and semantic context on word segmentation. Journal of Memory and Language 63, 274–294


X. From speech signal to word recognition


Y. Right hemisphere: Role in speech perception


of body, brain and cognition, vol. 21, NOS. 4–6, 568–584.
http://dx.doi.org/10.1080/1357650X.2015.1096940

perception: what’s wrong, what’s right and what’s left? TICS, 16(5), 269-276.*

5. Astrid Schepman, Paul Rodway & Hayley Pritchard. (2016). Right-lateralized unconscious,
but not conscious, processing of affective environmental sounds. Laterality: Asymmetries of

hemisphere dominance in speech perception? Brain & Language 127, 36-45. *

and Language, 37, 220-231.*

Indications of Implicit Attitude. Brain and Language, 24, 185-203. *

Z. Guest Lecture: Dr. Julie Miller
Readings: TBA

ZZ. Special topics: e.g., methodology, evolution, and new directions

1. Asif A. Ghazanfar1, & Daniel Y. Takahashi. (2014). The evolution of speech: vision,
rhythm, cooperation. Trends in Cognitive Sciences, 18(10), 543-553.


the human temporal lobe. TICS, 18(9), 472-478.


TICS, 9(8), 389-396.