SUMMARY STATEMENT

PROGRAM CONTACT: [redacted]

(Privileged Communication)

Release Date: **02/21/2019**
Revised Date:

Application Number: **1 R21 DC018070-01**

Principal Investigator

MUNSON, BENJAMIN R

Applicant Organization: [redacted]

Review Group: **LCOM**
Language and Communication Study Section

Meeting Date: **02/11/2019**
Council: **MAY 2019**
Requested Start: **06/01/2019**

RFA/PA: **PA18-489**
PCC: **HR05**
Dual IC(s): **MD**

Project Title: **Race, Ethnicity, and Speech Intelligibility in Normal Hearing and Hearing Impairment**
SRG Action: **Impact Score:13 Percentile:3 +**
Next Steps: **Visit https://grants.nih.gov/grants/next_steps.htm**
Human Subjects: **30-Human subjects involved - Certified, no SRG concerns**
Animal Subjects: **10-No live vertebrate animals involved for competing appl.**
Gender: **1A-Both genders, scientifically acceptable**
Minority: **1A-Minorities and non-minorities, scientifically acceptable**
Children: **3A-No children included, scientifically acceptable**

Project Year	Direct Costs Requested	[redacted]
1	[redacted]	[redacted]
2	[redacted]	[redacted]

ADMINISTRATIVE BUDGET NOTE: The budget shown is the requested budget and has not been adjusted to reflect any recommendations made by reviewers. If an award is planned, the costs will be calculated by Institute grants management staff based on the recommendations outlined below in the COMMITTEE BUDGET RECOMMENDATIONS section.

1R21DC018070-01 Munson, Benjamin

RESUME AND SUMMARY OF DISCUSSION: This application proposes a project to develop a large, racially and ethnically diverse corpus of audio-visual (AV) speech stimuli and to examine the effects of speaker race and ethnicity on speech intelligibility for normal hearing (NH) and hearing impaired (HI) adults. This project addresses an interesting and important issue, and if successful would provide much needed information on whether the impact of race/ethnicity on intelligibility is due to hearing impairment or age. This project would also produce a valuable, innovative corpus. The investigative team is outstanding and has the needed expertise for this project. The approach is excellent, with careful attention to important details and a strong recruitment plan. The direct comparison of expectation-driven and prediction-driven hypotheses and the use of eye-tracking were noted as particular strengths. The panel noted minor weaknesses, including that potential difficulties with AV speech by older adults is not sufficiently addressed and that young adults with hearing loss are excluded. Overall, this is an innovative and interesting project addressing a needed area using a rigorous approach, and it is likely to have a high impact on the field.

DESCRIPTION (provided by applicant): Hearing impairment (HI) affects a large proportion of older adults: 25% of 65-74 year olds, and 50% of people 75 and older have a HI that is sufficiently severe to be disabling [36,42]. The primary complaint of individuals with HI is difficulty understanding speech. Suboptimal speech communication by people with HI is a likely reason why they suffer from broader behavioral and physical health problems [35,53]. Understanding the factors that affect speech perception by people with HI, and finding methods to overcome the speech perception difficulties that these individuals face, is of great societal importance. Because of changing US demographics, communication between older individuals with HI and younger individuals—including those in caregiving and service-delivery roles—is increasingly likely to be between individuals of different races and ethnicities [44,54]. This presents a potential unique problem to individuals with HI. Research has shown that a talker's speech can become less intelligible to normal hearing (NH) individuals when they become aware of a talker's race or ethnicity by seeing a picture of the talker [6,37,48]. Given ongoing demographic changes, these findings have potentially profound implications for our understanding of speech perception by older adults with HI, as their communication with younger individuals is likely to be across lines of race and ethnicity. This may provide an additional challenge to speech perception beyond the challenge posed by the sensory loss itself. The proposed project seeks to remove two barriers to conducting large-scale studies of effects of race and ethnicity on speech perception by older adults with HI. One barrier is that there are no existing audiovisual corpora of speech stimuli that are produced by ethnically and racially diverse individuals. In specific aim 1, we will build a new corpus of audiovisual speech stimuli produced by individuals from diverse races and ethnicities. This corpus will include both standard-of-care sentences used in research on HI [26], and a new set of sentence materials designed specifically for this project. This corpus will be made available to the public at the conclusion of funding. The second barrier is that the previous studies have not determined the specific mechanism that explains why talker race and ethnicity affect speech intelligibility. In specific aim 2, we will use stimuli from specific aim 1 in a series of intelligibility experiments with younger listeners with NH, older listeners with NH, and older listeners with HI, using both behavioral and eye-tracking responses. We will also collect information on individuals' attitudes toward individuals of different races and ethnicities, as well as the ethnic and racial diversity in their peer groups. Results from this specific aim will help us better understand the mechanisms that underlie effects of race and ethnicity on speech intelligibility, and whether the speech perception of older adults with HI is disproportionately poorer in interactions with racially and ethnically diverse interlocutors. Given ongoing demographic changes and the high incidence of hearing impairment, these results will be of high

PUBLIC HEALTH RELEVANCE: Recent research has shown that speech intelligibility can change when a listener becomes aware of a talker's race and ethnicity. This project will build a corpus of audiovisual speech stimuli produced by ethnically and racially diverse talkers, determine the locus of

effects of talker race and ethnicity effects on speech intelligibility, and determine the extent to which talker race and ethnicity affect speech perception by older listeners with hearing impairment (HI). Given the large percentage of the population that has HI (50% of people over 75), and the large and growing percentage of the US population of the US that is Latinx (~17%) and non-white (~37%), these findings are of great public health relevance.

CRITIQUE 1

Significance: 2
Investigator(s): 1
Innovation: 1
Approach: 3
Environment: 1

Overall Impact: This application addresses a significant public health issue – difficulty understanding speech in individuals with hearing impairment, which can contribute to poor health. The proposal has two elements: 1) to create a novel audiovisual corpora of speech stimuli produced by speakers that are ethnically and racially diverse, which does not currently exist and 2) to assess intelligibility using these stimuli with younger and older individuals with and without hearing impairment. This will provide key information about whether previously reported poor performance in older individuals with hearing impairment once they are aware of a speakers' different race/ethnicity is a function of age or a function of hearing impairment. This work addresses potential increased communication challenges with an aging population with hearing impairment and shifting sociodemographics.

1. Significance:

Strengths

- This application addresses a significant public health issue – difficulty understanding speech in individuals with hearing impairment, which can contribute to broader social-emotional and physical health problems.
- In anticipation of increasing interaction across racial and ethnic groups, exploring the underlying factors on speech intelligibility are critical.
- Audiovisual signals may provide rich information to the listener, and can potentially ameliorate some of the effects of HI by showing visible speech articulation.

Weaknesses

- If older adults with HI show poorer comprehension with speakers from different ethnic/racial backgrounds, it is not immediately clear how this is remediated.

2. Investigator(s):

Strengths

- The Investigator has an impressive record of productivity in a range of areas of study relevant to the current proposal.
- The Investigative team have a set of strengths well suited to the proposed work. Among them: Dr. Oxenham with speech intelligibility in populations with hearing loss, including cochlear implants and Dr. Nelson in evaluation and development of tests to measure speech recognition in those with hearing loss.
- Consultants include Dr. Winn, who has expertise in eye tracking and pupillometry necessary for the project; Dr. Simpson brings experience about implicit attitudes and their impact on behavior

and Dr. Davies-Venn a background working with individuals with hearing impairments, particularly health outcomes. Dr. Davies-Venn will also assist in recruiting older adults with HI. Dr. Babel will assist in development of materials and testing of AV stimuli.

Weaknesses

- No major weaknesses noted.

3. Innovation:

Strengths

- Assesses speech intelligibility deficits due to social factors, a novel area of study.
- A corpus of AV speech that has speakers of different racial and ethnic backgrounds allows for an assessment of the assumption that AV speech is better than A speech in degraded listening conditions.

Weaknesses

- No major weaknesses noted.

4. Approach:

Strengths

- A corpus of speech stimuli produced by speakers that are ethnically and racially diverse does not currently exist. This is a meaningful resource that will make this and future projects (it will be shared) more ecologically valid.
- Direct testing of the expectation driven and attention driven hypotheses, which have both been proposed as an explanation for social factors in speech intelligibility.
- The inclusion of socially meaningful phonetic variation.

Weaknesses

- Older adults tend not to be as skilled at using visible speech to repair a degraded auditory signal as one would hope. It is possible that older adults comprehend less well both because of social factors and are less good at using visible articulation compared to young adults with HI.
- Never using the same sentence twice means that it won't be possible to estimate visual gain, which may vary by age group.
- Familiarity with colloquialisms will vary by listener age.
- There may be an effect of speaker familiarity on perception and gaze that interacts with race or ethnicity. That is, a watching a speaker of a different race may lead to different patterns of gaze on time 1, but once there is some familiarity with the speaker, the gaze pattern could more closely approximate gaze for a within-race speaker.

5. Environment:

Strengths

- The environment appears very well suited to the proposed work.

Weaknesses

- No major weaknesses noted.

Study Timeline:

Not Applicable (No Clinical Trials)

Protections for Human Subjects:

Acceptable Risks and/or Adequate Protections

- Will there be a consent form for the speakers establishing consent for their images to be used?

Data and Safety Monitoring Plan (Applicable for Clinical Trials Only):

Not Applicable (No Clinical Trials)

Inclusion of Women, Minorities and Children:

- Sex/Gender: Distribution justified scientifically
- Race/Ethnicity: Distribution justified scientifically
- For NIH-Defined Phase III trials, Plans for valid design and analysis: Not applicable
- Inclusion/Exclusion of Children under 18: Including ages <18; justified scientifically

Vertebrate Animals:

Not Applicable (No Vertebrate Animals)

Biohazards:

Not Applicable (No Biohazards)

Authentication of Key Biological and/or Chemical Resources:

Not Applicable (No Relevant Resources)

Budget and Period of Support:

Recommend as Requested

CRITIQUE 2

Significance: 2
Investigator(s): 1
Innovation: 2
Approach: 1
Environment: 1

Overall Impact: The proposal is to build a corpus of audio-visual sentence stimuli produced by a racially and ethnically diverse group of speakers and to investigate the extent and nature of racial and ethnic effects on intelligibility (REI) as perceived by younger normal hearing and older normal and impaired hearing adults. The hypothesis that REI will interact with assessments of speech perception deficits in older populations is well motivated by recent work in sociophonetics. The work is intellectually coherent and will result in an important tool for future research on and assessment of speech perception. The approach is impeccable. Over all, this is an extremely strong application that will lay the

foundation for future research on assessment and intervention for speech perception deficits. The proposed work is also timely given the changing demographics of the United States.

1. Significance:

Strengths

- Impaired speech perception is extremely common in older adults.
- The focus on racial and ethnic effects on speech intelligibility (REI) as perceived by older adults is highly significant given that people from under-represented minority groups within the United States are nonetheless over-represented in the caregiving workforce for older adults.
- The proposal to build a large corpus of AV speech stimuli using racially and ethnically diverse individuals and to make this corpus publicly available to researchers will advance assessment of speech perception deficits in the population.
- Recent work in sociophonetics, including work completed by a member of the research team (Babel), provides a strong scientific foundation for the hypothesis that REI will interact with the assessment of speech perception deficits in older adults with and without hearing loss.

Weaknesses

- No major weaknesses noted.

2. Investigator(s):

Strengths

- The PI is a pioneer in the field of sociophonetics.
- The research team brings critical expertise in audiology, implicit bias testing, audiovisual processing, and work with older adults.

Weaknesses

- No major weaknesses noted.

3. Innovation:

Strengths

- Investigation of race and ethnicity effects on speech perception in older adults is innovative.
- The proposal to build a large corpus of AV speech stimuli using racially and ethnically diverse individuals is innovative.
- The proposal to make the corpus publicly available could shift current research practice.
- The focus on REI challenges theoretical frameworks adopted to explain speech perception deficits in the elderly.
- The proposed method for building sentences for the corpus (mining social media) is innovative.

Weaknesses

- No major weaknesses noted.

4. Approach:

Strengths

- The focus on socially-meaningful, but otherwise neutral sentences is a strength.
- Building a corpus of AV sentence stimuli produced by a racially and ethnically diverse group of speakers is a strength.
- The proposed size of the corpus is a strength.
- The careful attention to characteristics of the sentences to be included is a strength.
- The recruitment strategy is a strength.
- The comparison of performance in AV to A-only listening tasks is a strength.
- The addition of eye-tracking measures will provide interesting information about how perceivers' use of audio-visual cues to speech perception might interact with REI.
- The statistical analyses are well thought out.

Weaknesses

- No major weaknesses noted.

5. Environment:

Strengths

- The PI and research team all have access to adequate laboratory facilities.
- The intellectual environment at [redacted] is a strength of this application with its dense population of experts in auditory processing and speech perception.
- The large metropolitan area of [redacted] with its diverse population is a strength.

Weaknesses

- No major weaknesses noted.

Study Timeline:

Not Applicable (No Clinical Trials)

Protections for Human Subjects:

Acceptable Risks and/or Adequate Protections

- Protections for human subjects has been adequately considered.

Data and Safety Monitoring Plan (Applicable for Clinical Trials Only):

Not Applicable (No Clinical Trials)

Inclusion of Women, Minorities and Children:

- Sex/Gender: Distribution justified scientifically
- Race/Ethnicity: Distribution justified scientifically
- For NIH-Defined Phase III trials, Plans for valid design and analysis: Not applicable
- Inclusion/Exclusion of Children under 18: Excluding ages <18; justified scientifically
- The sample demographics are well justified.

Vertebrate Animals:

Not Applicable (No Vertebrate Animals)

Biohazards:

Not Applicable (No Biohazards)

Authentication of Key Biological and/or Chemical Resources:

Not Applicable (No Relevant Resources)

Budget and Period of Support:

Recommend as Requested

CRITIQUE 3

Significance: 1
Investigator(s): 1
Innovation: 2
Approach: 2
Environment: 1

Overall Impact: All current publicly available AV speech databases consist of predominantly white speakers. This application seeks to remedy that by, in Aim 1, developing a database of AV speech that is racially/ethnically representative and gender balanced. This is sorely needed. Focusing on only race and gender misses an opportunity to be even more inclusive, given the difficulty of post-hoc additions to such a database. For example, there is no inclusion of transgender individuals or of individuals with physical, mental or cognitive disabilities. The potential impact of such a database would be even more powerful. In Aim 2, the AV speech database would be used to compare intelligibility measures from young NH controls, elders with NH and elders with HL. The applicant proposes not to include young participants with HL because the incidence is much lower. However, such individuals exist (and should therefore not be excluded prima facie) and would, in fact, be necessary to separate REI effects due to age cohort from REI effects due to HL and difficulties with speech comprehension.

Study Timeline:

Not applicable (No Clinical Trials)

Protections for Human Subjects:

Acceptable Risks and/or Adequate Protections

Data and Safety Monitoring Plan (Applicable for Clinical Trials Only):

Not applicable (No Clinical Trials)

Inclusion of Women, Minorities and Children:

- Sex/Gender: Distribution justified scientifically
- Race/Ethnicity: Distribution justified scientifically

- For NIH-Defined Phase III trials, Plans for valid design and analysis: Not applicable
- Inclusion/Exclusion of Children under 18: Excluding ages <18; justified scientifically

Vertebrate Animals:

Not Applicable (No Vertebrate Animals)

Biohazards:

Not Applicable (No Biohazards)

Authentication of Key Biological and/or Chemical Resources:

Not Applicable (No Relevant Resources)

Budget and Period of Support:

Recommend as Requested

THE FOLLOWING SECTIONS WERE PREPARED BY THE SCIENTIFIC REVIEW OFFICER TO SUMMARIZE THE OUTCOME OF DISCUSSIONS OF THE REVIEW COMMITTEE, OR REVIEWERS' WRITTEN CRITIQUES, ON THE FOLLOWING ISSUES:

PROTECTION OF HUMAN SUBJECTS: ACCEPTABLE

INCLUSION OF WOMEN PLAN: ACCEPTABLE

INCLUSION OF MINORITIES PLAN: ACCEPTABLE

INCLUSION OF CHILDREN PLAN: ACCEPTABLE

COMMITTEE BUDGET RECOMMENDATIONS: The budget was recommended as requested.

Footnotes for 1 R21 DC018070-01; PI Name: Munson, Benjamin R

+ Derived from the range of percentile values calculated for the study section that reviewed this application.

NIH has modified its policy regarding the receipt of resubmissions (amended applications). See Guide Notice NOT-OD-14-074 at http://grants.nih.gov/grants/guide/notice-files/NOT-OD-14-074.html. The impact/priority score is calculated after discussion of an application by averaging the overall scores (1-9) given by all voting reviewers on the committee and multiplying by 10. The criterion scores are submitted prior to the meeting by the individual reviewers assigned to an application, and are not discussed specifically at the review meeting or calculated into the overall impact score. Some applications also receive a percentile ranking. For details on the review process, see http://grants.nih.gov/grants/peer_review_process.htm#scoring.

MEETING ROSTER

Language and Communication Study Section
Biobehavioral and Behavioral Processes Integrated Review Group
CENTER FOR SCIENTIFIC REVIEW
LCOM
02/11/2019 - 02/12/2019

Notice of NIH Policy to All Applicants: Meeting rosters are provided for information purposes only. Applicant investigators and institutional officials must not communicate directly with study section members about an application before or after the review. Failure to observe this policy will create a serious breach of integrity in the peer review process, and may lead to actions outlined in NOT-OD-14-073 at https://grants.nih.gov/grants/guide/notice-files/NOT-OD-14-073.html and NOT-OD-15-106 at https://grants.nih.gov/grants/guide/notice-files/NOT-OD-15-106.html, including removal of the application from immediate review.

CHAIRPERSON(S)

[redacted]