



LSVT Global[®] Virtual SLP Mini-Conference

**Title: Building a Data Base for Automatic Speech
Recognition in Parkinson's Disease**

**Presenters: Lorraine Ramig, PhD, CCC-SLP
Bob MacDonald, PhD**

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LSVT Global's Virtual SLP Mini-Conference
 Building a Data Base for Automatic Speech Recognition in Parkinson's Disease




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Logistics


- ✓ Handouts are available in control bar
- ✓ Microphones are all muted
- ✓ You can type in questions at any time, we will answer at the end

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Polling Question:
Who is joining us today?

- LSVT LOUD certified professional or student
- SLP professional, not LSVT LOUD certified
- SLP student, not LSVT LOUD certified
- Other





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BUILDING A DATA BASE FOR AUTOMATIC SPEECH RECOGNITION IN PARKINSON'S DISEASE




Lorraine Ramig, Ph.D., CCC-SLP, Bob MacDonald, Ph.D., Heather Hodges M.A., CCC-SLP, Pan-Pan Jiang, Ph.D., Ona Reed, M.A., SLP-CF, Jennifer Spielman, M.M., M.A., CCC-SLP, and Julie Cattiau, M.S.





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Speaker Introductions



Lorraine Ramig, Ph.D., CCC-SLP
Dr. Ramig is Chief Scientific Officer (CSO) and Co-Founder of LSVT Global, Inc. She is a Research Professor at the University of Colorado-Boulder and an Honorary Adjunct Professor at Columbia University-Teachers College, NYC and a Research Scientist at the National Center for Voice and Speech-Denver. Her research has been funded by the National Institutes of Deafness and Communication Disorders (NIH-NIDCD) for over 20 years. She has received ASHA Honors. Dr. Ramig and her colleagues pioneered LSVT LOUD, an evidence-based treatment for Parkinson's Disease with application to other neurological disorders.




Bob MacDonald, Ph.D.
Dr. MacDonald manages partner relationships and data collections for Project Euphonia. He also works on projects applying machine learning to medical images for applications such as cancer diagnostics.




Heather Hodges, M.A., CCC-SLP
Ms. Hodges received her master's degree from the University of Colorado. She been part of Dr. Ramig's research team since 2004. In addition to studying neurogenic voice and speech disorders and being LSVT LOUD faculty, Ms. Hodges also worked at National Jewish Health in Denver, CO treating a variety of speech, language and swallowing disorders in adult and pediatric populations with specialty expertise in upper airway disorders for 13 years.

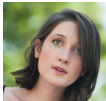
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Pan-Pan Jiang, Ph.D.
Technical Program Manager for Google's Project Euphonia



Jennifer Spielman, M.M., M.A., CCC-SLP
Jennifer Spielman, is an expert in the area of voice and speech disorders associated with Parkinson disease and worked for over 10 years as a Research Associate for the University of Colorado-Boulder and the National Center for Voice and Speech. She is currently the director of Front Range Voice Care, a private voice therapy practice in the Denver, Colorado area.



Ona Reed, M.A., SLP-CF
Ona received her master's degree from Hofstra University. She has been a general assistant to Dr. Ramig since 2015 and is currently completing her CFY with Aveanna Healthcare treating a speech, language, and swallowing disorders in the pediatric population.



Julie Cattiau, M.S.
Julie is a Product Manager in Google AI. In her current role, she focuses on building speech recognition technologies that could help people with speech impairments communicate more easily. Julie has a master of science in computer science from French engineering school Telecom ParisTech.

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DISCLOSURES

Non-financial relationships include a preference for the LSVT LOUD as a treatment technique.


Financial Relationships include:
Dr. Ramig is employed as Chief Scientific Officer and has ownership interest in the for-profit company LSVT Global, Inc. She is in full compliance with Federal Statute 42 C.F.R. Part 50, Subpart F (see <https://grants.nih.gov/grants/policy/col/index.htm>). She has fully disclosed any conflict of interest and her conflict-of-interest management plan has been approved by the Office of Conflict of Interest and Commitment at the University of Colorado, Boulder and she is in full compliance. Dr. Ramig reports grants from the National Institutes of Health during the conduct of the study.
Dr. MacDonald is an employee of Google Inc. and owns Alphabet stock.
Ms. Hodges is a paid consultant for LSVT Global, Inc. She receives lecture honorarium and travel reimbursement for LSVT LOUD Training and Certification Courses and webinars.
Dr. Jiang is an employee of Google Inc.
Ms. Reed is an employee of LSVT Global, Inc.
Ms. Spielman has been a paid consultant for LSVT Global, Inc. since 2012. She currently receives consulting fees for research and training projects.
Ms. Cattiau is an employee of Google Inc.

All speakers are in full compliance.

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PROJECT EUPHONIA


Project Euphonia is an early-stage research project initiated by Google to increase accessibility to automatic speech recognition (ASR) by speakers with impaired speech associated with disorders such as Amyotrophic lateral sclerosis (ALS), Down Syndrome and Parkinson's disease (PD). The goal is to allow these speakers with disordered speech to interact with everyday technology (e.g., smart devices, computers, phones) to maintain their independence, safety and enhance communication and quality of life. Project Euphonia has a commitment to make technology work better for everyone.



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STEP ONE

The first step in this process is to teach speech recognition algorithms to understand disordered speech. While there is a vast literature on automatic speech recognition algorithms (Ghahremani et al, 2014; Ortmanns, Ney, & Aubert, 1997), to teach these algorithms to understand disordered speech, they need sufficient speech samples from disordered speakers (Young & Mihalidis, 2010; Codreanu, 2019).



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COLLABORATION

Because of our over twenty years of research on speech and voice in PD (e.g., **Ramig et al., 1995; Ramig et al., 2001a, 2001b; Ramig et al., 2018**), including years of gathering acoustic data on patients with PD and training them to use technology, as well as having access to a large PD community, our research team at LSVT Global was invited to collaborate on Project Euphonia.

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1

Describe the rationale for acquiring speech data to contribute to increasing accessibility to speech recognition for patients with Parkinson's disease

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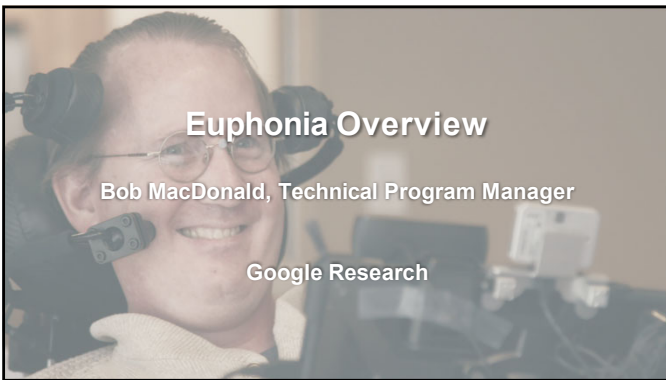
Recognize challenges to improving patient participation and fidelity of data

3

Design an approach to improve patient participation and acquisition of speech data

OBJECTIVES

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Euphonia Overview

Bob MacDonald, Technical Program Manager

Google Research

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For people who have difficulty pronouncing words due to disabilities, communication is an ongoing challenge.

Prevalence of neurologic conditions in the US

Condition	Prevalence
ALS	20k
Stroke	800k
Multiple Sclerosis	400k
Cerebral Palsy	750k
Parkinson's	780k
Traumatic Brain Injury	5.3m

Source: National Institute of Neurological Disorders and Stroke, Centers for Disease Control and Prevention, National Parkinson Foundation, National Multiple Sclerosis Society, American Stroke Association, American Speech-Language-Hearing Association, National Traumatic Brain Injury and Spinal Cord Injury Archives

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Voice activated technologies don't work well either for people with non-standard speech.

Hey Google, play my Rise and Shine playlist

All right, your playlist called Rise and Shine. Playing on Google Play Music.

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Project Euphonia

Use AI to help people who have difficulty speaking because of disabilities communicate and gain independence

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Can we make speech recognition work better for people with impaired speech?


Maybe, if we have (a lot of) examples!



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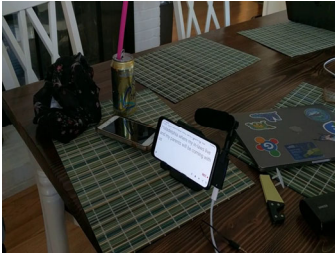
An example of an outreach campaign we did



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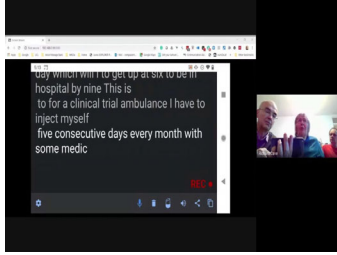
We also work with individuals who have neurologic conditions like ALS, to develop prototypes useful to them



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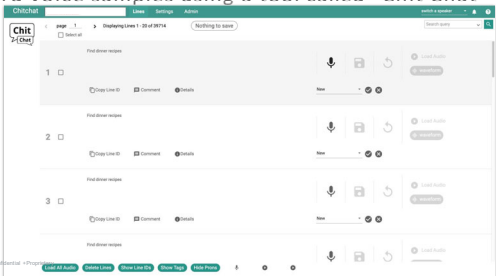
We also work with individuals who have neurologic conditions like ALS, to develop prototypes useful to them



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We are looking for volunteers with atypical speech to record voice samples using a tool called "Chit Chat"



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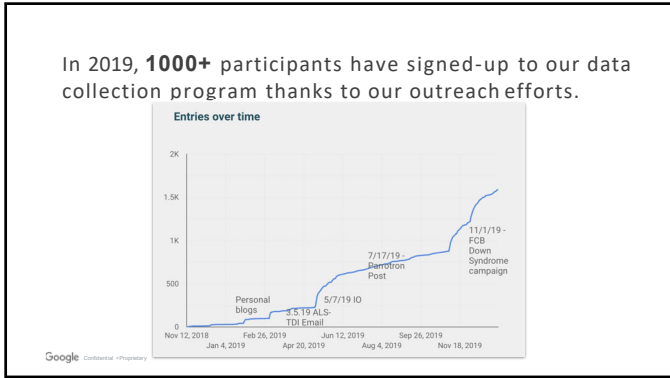
Participants are asked to read a series of short sentences. This can be done in as many sittings as needed.

Who are you talking about? I have no idea. Is he coming? Is she cooking? Are you working today? Show me. It was nice of you to come today. I can't figure it out. It's amazing. Do you agree? I don't remember it being all that hard. I don't like to. "Ah, now I see." It's here. Talk to you soon. Will it hurt? Would you mind spelling that for me? What kind is it? Can we plan our day for tomorrow? Do it. Nice to talk to you. When will you come back?	I feel the same way about it. Fraction makes perfect. I really feel bad. But that there. Can I get a new one? What are you doing? Just like a dream. What do you have to do? That's the last resort. Can you repeat what you just said? I don't doubt that. How's that? What then? How long does it take? Are you working tomorrow? I might check that out tomorrow. I'm not going to take it. Should I take it? I like it better. Hey I take a message. I think that's good. I noticed it.
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Examples of phrases that we may ask participants to read

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Ultimately our goal is to improve ASR and make Google products work better for people with impaired voices.

Google Home Voice Access Google Assistant Google Search

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Anyone 18 or older can record samples. The first step is to fill out a form so Google can get it touch: [interest form](#)

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Learn more by visiting our website!

g.co/Euphonia

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Pilot Study	Phase 1	Phase 2
Objectives <ul style="list-style-type: none"> LSVT studies Project Euphonia and learns participant data entry LSVT identifies process Establish participant ability to generate usable speech samples in Chat recording environment INDEPENDENT use of Chat was NOT successful Process <ul style="list-style-type: none"> Recruitment through PD organizations Twenty-five (25) participants with Parkinson's disease Outcome <ul style="list-style-type: none"> Problems: Technical, user, cognitive, and motor Dropouts and unusable data: 6 out of 25 succeeded INDEPENDENT use of Chat was NOT successful Revised Process <ul style="list-style-type: none"> Develop intake and screening process for technology and participant cognitive and motor skills KEY: Add Mentors, speech clinicians with vast experience with PD to screen and guide the participants through the process and motivate to increase likelihood of obtaining usable data. 	Objectives <ul style="list-style-type: none"> Expand recruiting process Improve participants' ability to generate usable speech samples in Chat Process <ul style="list-style-type: none"> Mentors went through project through a participant's lens to determine needs and their solutions for use of technology with goal of reducing drop-out rate and participant frustration Screened larger number of participants and Mentors assigned by participants Mentors addressed range of technology problems (e.g. great set-up, registration, Chat, optimal recording technique) Mentors trained participants on "oh chat" and had overnight and provided motivation throughout the process Initial phases followed by additional phases and usability 800 presses Outcome <ul style="list-style-type: none"> Data successfully collected on 24 out of 25 participants 20 initial phases that were able to begin the 100 presses to daily determine usability (esp. for more motivated) 10 MENTOR participants DATA was NOT successful Need to modify protocol (more challenging) Recruit participants with more severe speech disorders Revised Process <ul style="list-style-type: none"> Recruit participants post Deep Brain Stimulation (DBS), progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBD), low normal hearing (see table) More revisions of Chat protocol to include 195 initial recordings including paragraph level reading and cognitively/learned spontaneous speech 	Objectives <ul style="list-style-type: none"> Recruit individuals with more severe speech disorders, reach out to organizations who support these participants (total 8 major PD organizations) Assist participants in generating usable speech samples in Chat Process <ul style="list-style-type: none"> Screened several for speech disorders, technology, cognitive and motor challenges and home support Mentors assigned interested participants who appeared appropriate (e.g. speech difficult to understand even if attempts to be clear or slower was made) Mentors trained and motivated participants and home support on Chat and had overnight throughout the process. Overnight includes monitoring program, listening to sample of recordings to ensure usability, troubleshooting background noise and "interference" (i.e., the fact that there was nothing, mishearing technical difficulty) Outcome <ul style="list-style-type: none"> Intake, recruiting, screening, training and overnight successful Initial, screening and training was streamlined Recording regularly resulted in meeting target of subject number 10 DATA usable data successfully collected on 20 participants 20 of 25 DATA 195 phrases usable for speech recognition from participants with mild, moderate, severe and profound speech disorders have been generated! Establish participant groups: WNL, Moderate to Severe, Profound!

FIGURE 1

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PILOT SUMMARY

- Six (6) out of 25 participants were successful
- INDEPENDENT** use of Chat was **NOT** successful
- Mentors were needed

Pilot Study

Objectives

- LSVT studies Project Euphonia and learns participant data entry
- Initiate PD recruiting process
- Establish participants' ability to generate usable speech samples in Chat recording environment
- INDEPENDENT** use of Chat was **NOT** successful

Process

- Recruitment through PD organizations
- Twenty-five (25) participants with Parkinson's disease

Outcome

- Problems: Technical, user, cognitive, and motor
- Dropouts and unusable data: 6 out of 25 succeeded
- INDEPENDENT** use of Chat was **NOT** successful

Revised Process

- Develop intake and screening process for technology and participant cognitive and motor skills
- KEY: Add Mentors, speech clinicians with vast experience with PD to screen and guide the participants through the process and motivate to increase likelihood of obtaining usable data.

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Phase 1

Objectives

- Expand recruiting process
- Improve participants' ability to generate usable speech samples in Chat Chat

Process

- Mentors went through project through a participant's lens to determine hurdles and best solutions for use of technology with goal of reducing drop-out rate and participant frustration
- Recruited larger number of participants and Mentors support for participants
- Matched screened participants for potential background, cognitive, and motor challenges
- Mentors addressed original technology problems (e.g., great set up, navigation, Chat Chat, optimal recording workflow)
- Mentors trained participants on "told chat" method overnight and provided instruction throughout the process
- Initial phrases followed by additional phrase set, could total 500 phrases

Outcome

- Data successfully collected on **24 out of 25** participants
- 29 initial phrases that were short in length and not enough to really determine usability (esp. for more mild pts)
- 8/17 Many patients' data were too good!** Performance!
- Need to modify protocol (more challenging)
- Recruit participants with more severe speech disorders

Revised Process

- Recruit participants post Deep Brain Stimulation (DBS), progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBD). See revised recruiting flow table
- More awareness of Chat Chat protocol to include 20 initial recordings including paragraph, read, reading and cognitive/behavioral spontaneous speech

PHASE 1 SUMMARY

- Data successfully collected on **24 out of 25** participants.
- 29 initial phrases that were short in length was not enough to really determine usability (esp. for more mild pts)
- BUT!** Many participants' data were **too good!** Performance!!
- Need to modify protocol (more challenging)
- Recruit patients with more severe speech disorders**

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PHASE 2 SUMMARY

- Recruited individuals with more severe speech disorders by reaching out to organizations who support these participants (total 8 major PD organizations)
- Majority of participants were diagnosed with PSP, MSA, and CBD
- Mentors trained and motivated participants throughout the project
- As of today, **58,719** phrases of usable speech have been recorded

Phase 2

Objectives

- Recruit individuals with **more severe speech disorders**, reach out to organizations who support these participants (total 8 major PD organizations)
- Assist participants in generating usable speech samples in Chat Chat

Process

- Mentors screen for speech disorders, technology, cognitive and motor challenges and home support
- Mentors registered interested participants who appeared appropriate (e.g., speech difficult to understand even if attempts to be louder or slower were made)
- Mentors trained and motivated participants and home support on Chat Chat and had oversight throughout the process. Oversight includes monitoring progress, listening to samples of recordings to ensure usability, troubleshooting background noise and "interference" (i.e., the dull buzz that was annoying, troubleshooting technical difficulties)

Outcome

- Initial, recruiting, screening, training and oversight **successful**
- Initial, screening and training was streamlined
- Recruiting primarily resulted in **meeting target** of subject numbers
- To date, usable data successfully collected on 31 participants
- As of today, **58,719 phrases** usable for speech recognition from participants with mild, moderate, severe and profound speech disorders have been generated!
- Establishing participant groups: MSA, Moderate to Severe, Profound

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RECRUITMENT



LSVT

Are you frustrated when you talk to technology?

Who: Participants with speech impairments with Parkinson's disease (with or without deep brain stimulation) and related conditions (e.g., multiple system atrophy, progressive supranuclear palsy, corticobasal degeneration, essential tremor) who are recording conversations with their LSVT and having trouble and have performance challenges in their day-to-day communication.

What: Record samples of your speech for analysis with a speech clinician online 24/7/365.

Where: Conducted on the phone, in the comfort of your own home.

Compensation: \$500 for 20-30 sessions completion.


Why: LSVT's Project Reconnect aims to improve remote speech recognition technology, designed for patients with progressive speech disorders. This technology has the potential to help patients live better as a "normal" person. LSVT Global is now enrolling participants who are interested in this exciting research.

How: The Reconnect Alliance Project Reconnect program will help you get involved with LSVT and help you get involved with LSVT.


www.lsvtglobal.com

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- Go through the research process from a speech-language pathologist point of view as well as through the lens of a participant
- Screening participants was similar to screening clinically
- Strategies for teaching the program to participants matched what we do as clinicians: Modeling, Scaffolding, Practicing, Patient Demonstration, and Assigning "homework"
- Being Proactive was key to head off issues before they happen
 - i.e. Registration, Multiple Exposures, Joining in for 1st session +
- Humanize the technology experience



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THANKS PARKINSON'S COMMUNITY!

- Eli Pollard, World Parkinson Coalition
- Carol Walton, Parkinson Alliance
- Joanna Teters and David Kemp, Cure PSP (PSP, MSA, CBD)
- PMD Alliance
- Davis Phinney Foundation
- Michael Okun, MD, U Florida Health

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