Ice breakers:

I easily accept and adopt new technologies and ideas! (TRUE or FALSE)
What's something that presenters do that bothers you?
How were you taught audiometry?
How did you learn audiometry?

Simulated audiometry: Overview and promising applications

Shae D. Morgan, PhD, AuD, CCC-A, FAA

Associate Professor; Director – Program in Audiology
University of Louisville

Co-owner
Audiology Technology Solutions, LLC, creators of Theta

Disclosures

Associate Professor at the University of Louisville

Co-owner of Audiology Technology Solutions, LLC which owns the Theta Audiology Simulator

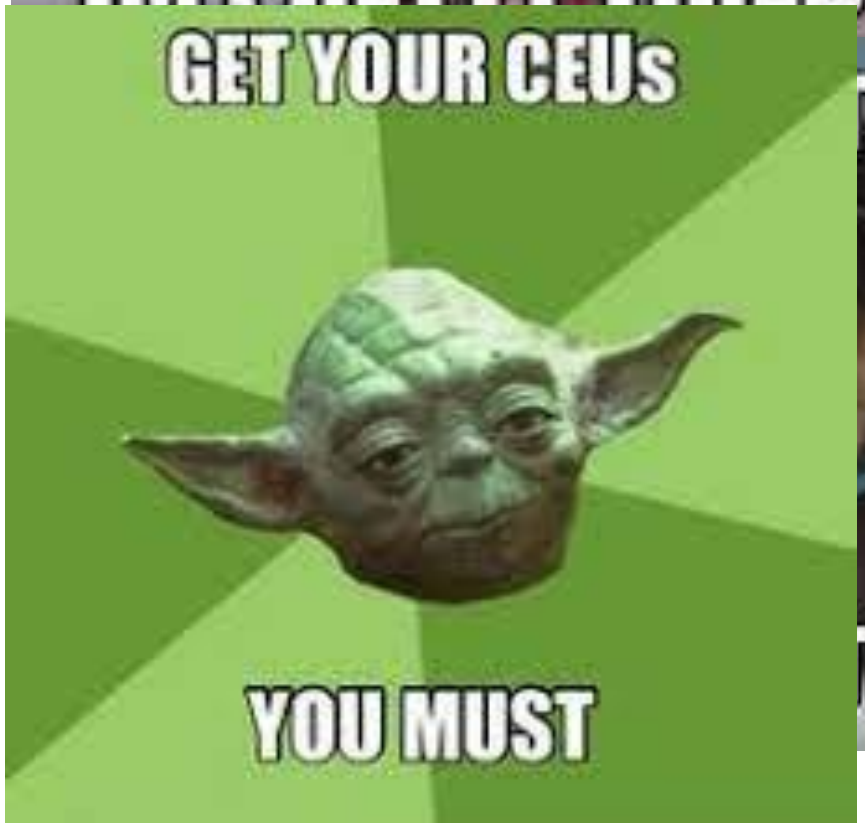
Theta developer/programmer

Invited HAA speaker – registration, honorarium

Ping-pong player, tinkerer, rock climber, dad

IM PRETTY TIRED

I WANT TO....



GO HOME!!!!

Who is this talk for?

Everyone

Learning Objectives

1. Learners will be able to discuss different kinds of audiometry simulators
2. Learners will be able to assess implementation of simulation for educational/learning experiences
3. Learners will be able to highlight applications for simulated audiometry in clinical practices

Overview:

1. Introduction to simulators and audiometry simulation
2. Using simulation to teach
3. Using simulation in your clinical practice
4. Wrap-up/summary

Audiogram of the Day

audiologysimulator.com
click “audiogram of the day”

Svec, A., & Morgan, S. D. (2022). Virtual audiology education tools: A survey of faculty, graduate students, and undergraduate students. *The Journal of the Acoustical Society of America*, *151*(5), 3234-3238.

	Educational pricing	Period	Web-based (no download)	Air conduction	Bone conduction	Masking	SRT/WRS/SAT	Tympanometry	ART	OAEs	Evoked Potentials	Otoscopy	Case history	Patient Avatar/image/interaction	Automated Scoring	Summary/report	Training mode/assistant	Psychometrics tracking	Student behavior analysis	Community case contributions	Patient response variability	Multiple language support
AvatarAudiometer	free	-	x	x	x	x																
CounselEar	free	-	x	x	x	x																
Theta (CLASS)	$25	1 year	x	x	x	x	x	x	x			x	x		x	x	x	x	x	x	x	
AudSim Flex	$19.99	-		x	x	x									x	x	x					
Otis - TVP	$168[+]	1 year		x	x	x		x				x	x	x	x	x	x		x		x	x
Virtual Audiometer	$49	-		x	x	x	x	x					x	x	x	x						
SimHERA	$125[+]	1 year		x	x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	
SimHBA	$45[+]	1 year		x	x	x	x	x	x	x			x	x	x	x	x	x		x	x	
SmartVS	$150[+]	1 year		x	x	x	x	x	x	x	x	x	x	x		x		x		x	x	

[+]variable pricing available for shorter/longer time periods

AudioCARL

Introduction to Theta

https://audiologysimulator.com

Theta Overview topics:

- Home page/login
- Designer
  - Show all elements
  - Audiogram
    - Save picture
    - Split audiogram
    - Overlays
  - Practice/exam fixed/template
- Assess
- Explore
- Settings and realism
- Submissions/Report
- Resources

Introducing Theta 3

re-designed and built for your simulation needs

Theta 3 brings you updated features, responsive design, and best-in-class audiometry simulation.

Theta is an audiology simulation web application designed to help individuals practice and evaluate clinical skills.

Create audiometric profiles and test them using an audiometer simulator. Practice audiology skills including air and bone conduction threshold testing, masking, speech tests, otoscopy, tympanometry, report writing, and more.

Log In

Design

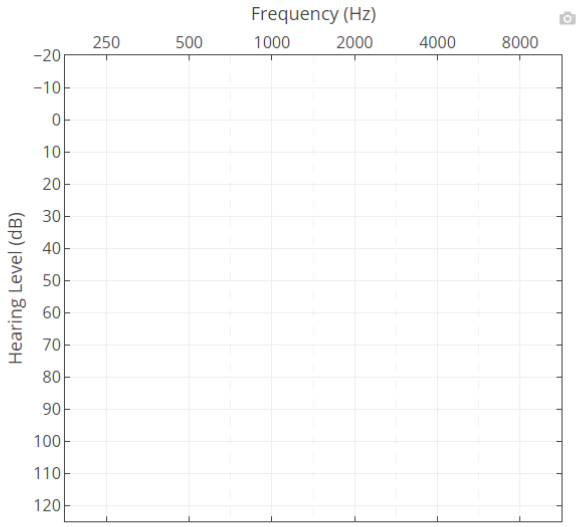
Design a profile and use the simulator to test your design.

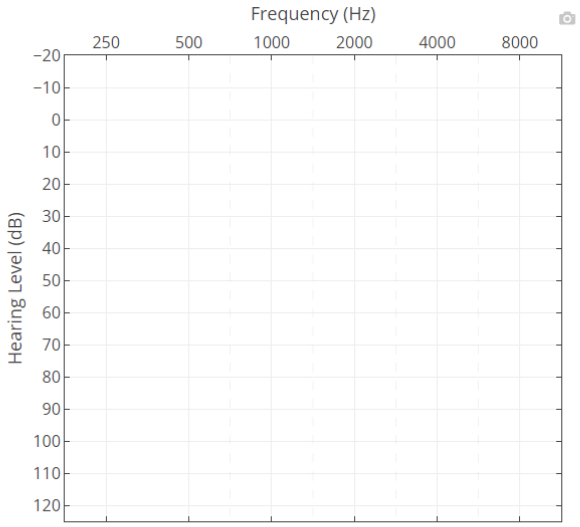
Assess

Choose from pre-made and custom assessments to test your skills

Explore

Find pre-designed templates

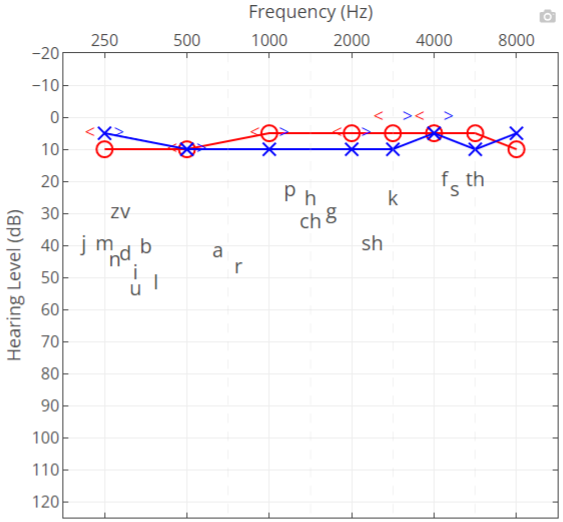




					250	500	750	1000	1500	2000	3000	4000	6000	8000				
PTA	0	-10	SDT	AC-R	0	0	0	0	0	0	0	0	0	0	PTA	0	-10	SDT
SRT	0	60	MCL	BC-R	0	0	0	0	0	0	0	0	0	0	SRT	0	60	MCL
WRS	100	100	UCL	AC-L	0	0	0	0	0	0	0	0	0	0	WRS	100	100	UCL
				BC-L	0	0	0	0	0	0	0	0	0	0				

Degree (min)	normal	Create Audiogram	normal	Degree (min)
Degree (max)	normal	Random Audiogram	normal	Degree (max)
Config	flat	Split Audiogram	flat	Config
Type	sensorineural	Symmetrical	sensorineural	Type
WRS	excellent	Auto WRS	excellent	WRS

Template
Practice
Save
Begin
Start Over



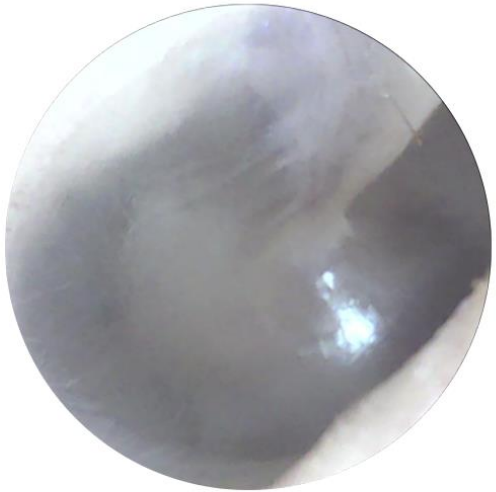
					250	500	750	1000	1500	2000	3000	4000	6000	8000				
PTA	7	0	SDT	AC-R	10	10	5	5	5	5	5	5	5	10	PTA	10	-5	SDT
SRT	5	65	MCL	BC-R	5	10	0	5	5	5	0	0	0	5	SRT	15	55	MCL
WRS	100	110	UCL	AC-L	5	10	10	10	10	10	10	5	10	5	WRS	100	110	UCL
				BC-L	5	10	0	5	5	5	0	0	0	5				

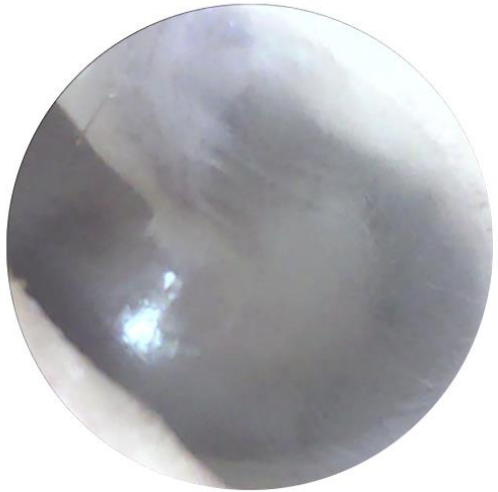
Degree (min)	normal	Create Audiogram	normal	Degree (min)
Degree (max)	normal	Random Audiogram	normal	Degree (max)
Config	flat	Split Audiogram	flat	Config
Type	sensorineural	Symmetrical	sensorineural	Type
WRS	excellent	Auto WRS	excellent	WRS

Case Information

Feedback

◄ ►





Right

Within normal limits

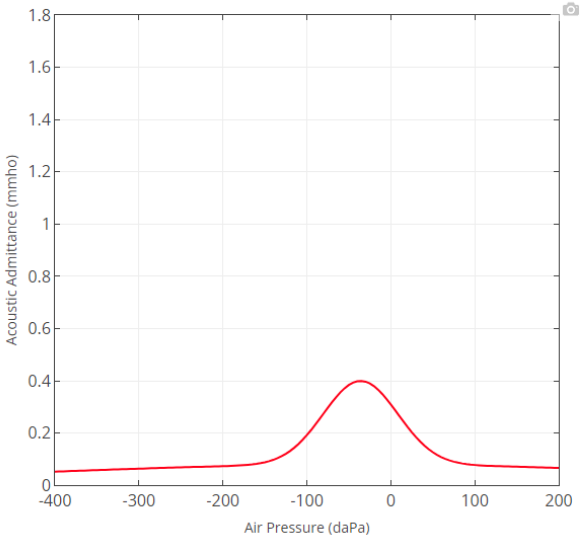
WNL/R/WNLR00.png
WNL/R/WNLR01.jpg
WNL/R/WNLR02.jpg
WNL/R/WNLR03.jpg
WNL/R/WNLR04.png
WNL/R/WNLR05.png

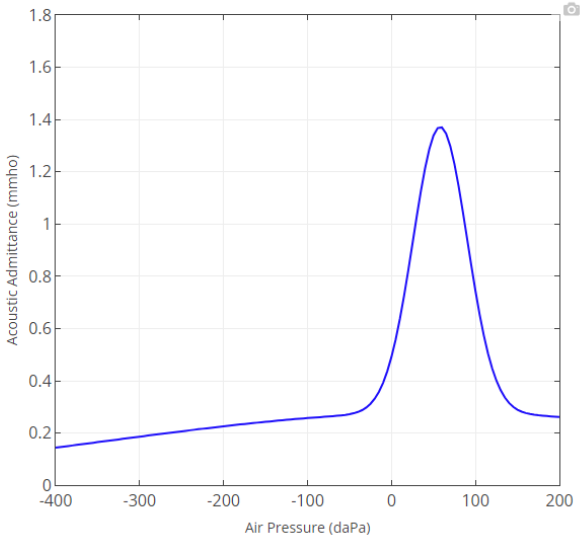
Left

Within normal limits

WNL/L/WNLL00.png
WNL/L/WNLL01.jpg
WNL/L/WNLL02.jpg
WNL/L/WNLL03.jpg
WNL/L/WNLL04.png
WNL/L/WNLL05.png

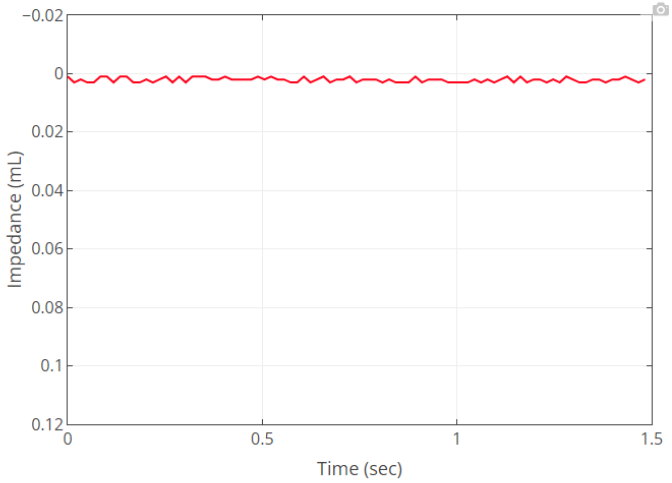
Timer: 00:00:47

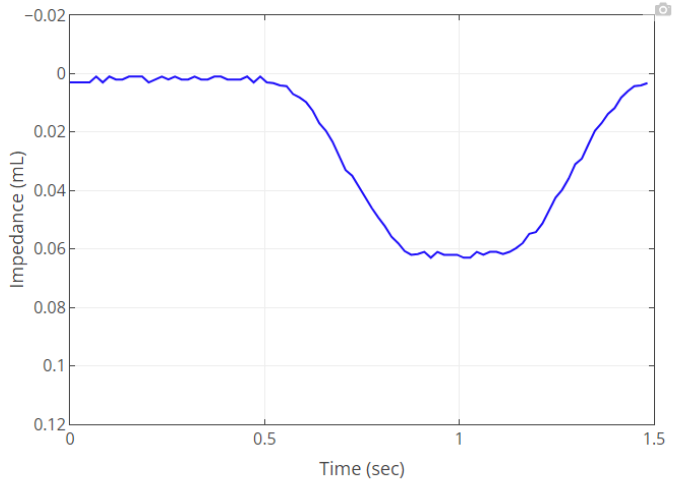




Right		Classification	Classification		Left
Peak Pressure	-36	-	-	58	Peak Pressure
Admittance	0.4			1.37	Admittance
Ear Canal Volume	1.4	▶	▶	1.4	Ear Canal Volume
Width	120			87	Width

Timer: 00:00:23





Right	500	1000	2000	4000
ipsi				
contra				
ipsi	DNT	DNT	DNT	DNT
contra	DNT	DNT	DNT	DNT

Left	500	1000	2000	4000
ipsi				
contra				
ipsi	DNT	DNT	DNT	DNT
contra	DNT	DNT	DNT	DNT

Frequency (Hz)

1000

Level (dB HL)

90

Run

Impressions

Feedback

◀

Template

Practice

Save

Begin

Start Over

Settings and realism

https://audiologysimulator.com

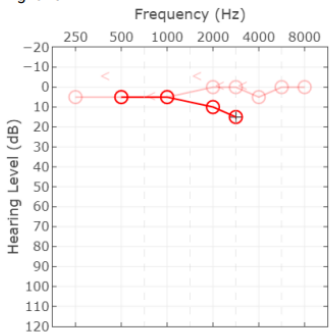
CLASS Report: User ID not specified (User email not specified)

Instructor (Course): Morgan (AUD101)

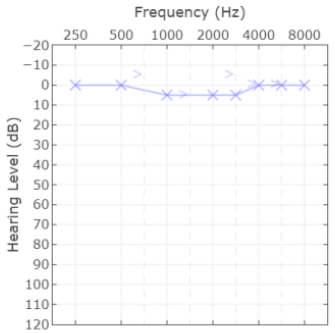
Time spent (mins): 6

Score: 6/52 = 12%

Right Ear



Left Ear



Thresholds - True and Saved

kHz	.25	.5	.75	1	1.5	2	3	4	6	8
AC-T	5	5		5		0	0	5	0	0
AC-S		5		5		10	15			
Pts	0	1		1		0	0	0	0	0
BC-T		-5		5		-5	0	0		
BC-S										
Pts		0		0		0	0	0		

Thresholds - True and Saved

kHz	.25	.5	.75	1	1.5	2	3	4	6	8
AC-T	0	0		5		5	5	0	0	0
AC-S										
Pts	0	0		0		0	0	0	0	0
BC-T		-5		5		-5	0	0		
BC-S										
Pts		0		0		0	0	0		

Masking (Top - AC, Bottom - BC)

kHz	.25	.5	.75	1	1.5	2	3	4	6	8
ML										
ID										
Pts	0	1		1		1	1	0	0	0
ML										

Masking (Top - AC, Bottom - BC)

kHz	.25	.5	.75	1	1.5	2	3	4	6	8
ML										
ID										
Pts	0	0		0		0	0	0	0	0
ML										

Program Warnings and Violations

Flag	Number
Right - AC	Right - AC
Stimulus too short (<3 pulses) at 1000 Hz.	2
Modified-Hughson Westlake violation: User identified threshold only once at 1000 Hz.	1
Modified-Hughson Westlake violation: User went down by 20 dB at 1000 Hz.	1
Modified-Hughson Westlake violation: User went down by 5 dB at 1000 Hz.	1
Modified-Hughson Westlake violation: User went up by 15 dB at 2000 Hz.	1
Stimulus too short (<3 pulses) at 3000 Hz.	1
Modified-Hughson Westlake violation: User went down by 5 dB at 6000 Hz.	1
Stimulus too short (<3 pulses) at 8000 Hz.	1
Stimulus too short (<3 pulses) at 250 Hz.	1
Left - AC	Left - AC
Modified-Hughson Westlake violation: User went down by 5 dB at 500 Hz.	1
Right - BC	Right -

Using simulation to teach

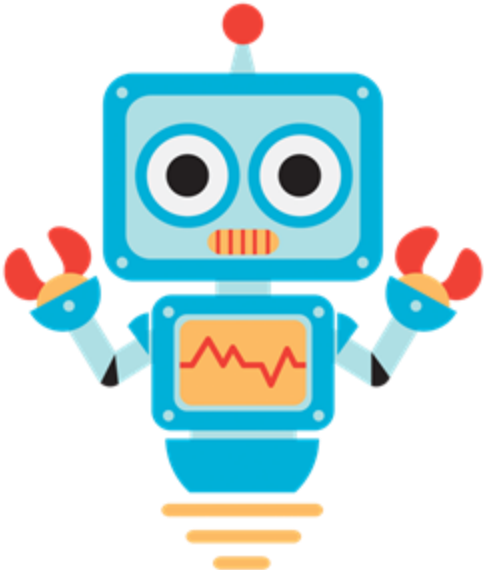
Overview

Clinical Simulation

Build clinical confidence

Training and remediation

What is Clinical Simulation:



1. Standardized Patients
2. Simulation technologies
    a. virtual patients
    b. digitized mannequins
    c. immersive reality
    d. task trainers
    e. **computer-based interactive**

What it is NOT:

- Lab activities
- Observational experiences (i.e., video clips, watching live or recorded sessions)

https://www.asha.org/certification/certification-standards-for-aud-clinical-simulation/

Computer-based Simulations

ASHA Guidelines/requirements:

- **Supervision does not need to be synchronous!**
- Monitor time spent in a session (use an average, or track via the program)
- Group work is treated the same as in traditional clinic
- Clinical hours can only be counted **one time per unique simulation case**.
- 25% observation requirement (via some debrief or direct supervision)

Example simulation lesson plan

Instruction/lecture and supplement:

- Presentation of new material
- Assignment of a clinical simulation activity
- Completion of the clinical simulation activity
- Debriefing exercise

Alternative simulation lesson plan

Experiential learning:

- Assignment of a clinical simulation activity
- Completion of the clinical simulation activity
- Debriefing exercise
- Presentation of new material

Debriefing activities

Activities may include:

1. Face-to-face discussion,
2. Self-reflection with feedback,
3. Written self-evaluation with feedback

Theta Academy

Theta Academy Manual v3-0.pdf

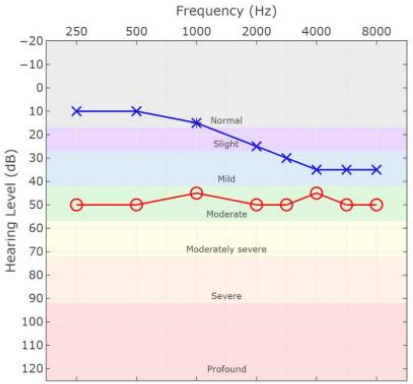
33 / 83 | 100%

32

33

34

35



Since we usually test in 5-dB steps, the following 5-dB step values can be used when determining the degree of hearing loss:

Normal	**<20 dB HL**
Slight	**20 to 25 dB HL**
Mild	**30 to 40 dB HL**
Moderate	**45 to 55 dB HL**
Moderately severe	**60 to 70 dB HL**
Severe	**75 to 90 dB HL**
Profound	**>90 dB HL**

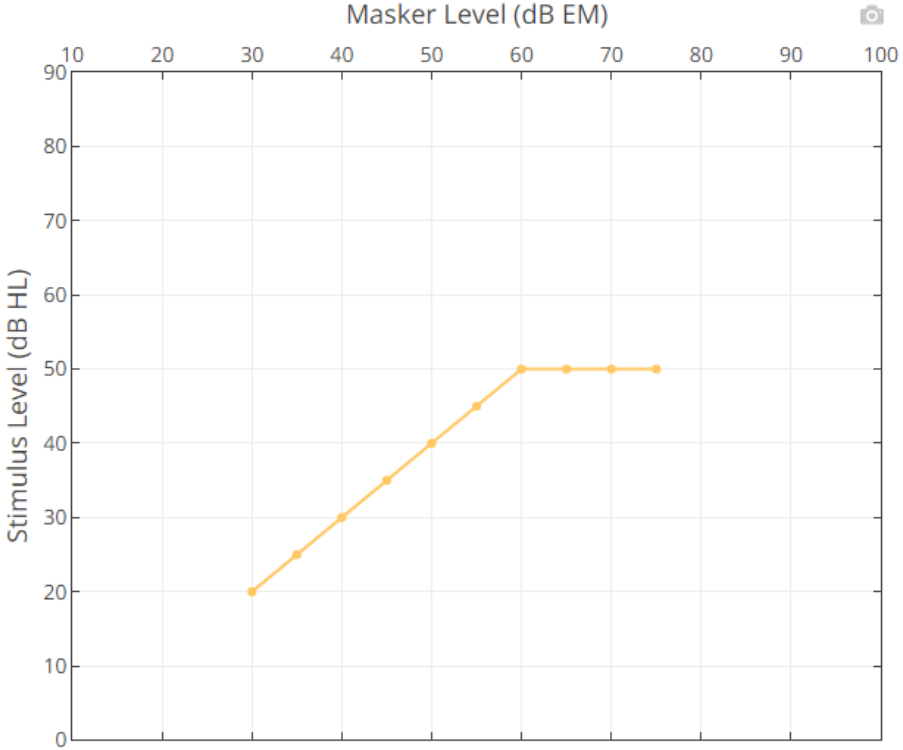
Note: The degree of loss for this listener would be moderate hearing loss in the right ear and mild hearing loss in the left ear. When hearing level is worse at some frequencies than it is at others, it is appropriate to report two degrees of hearing (e.g., normal-to-mild in the left ear).

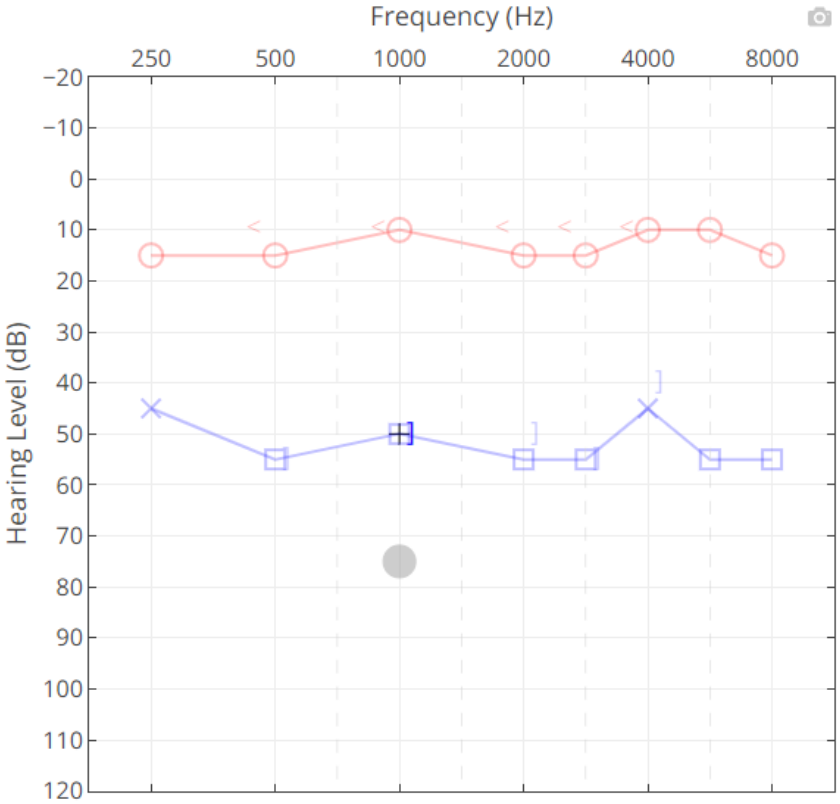
Type of hearing loss

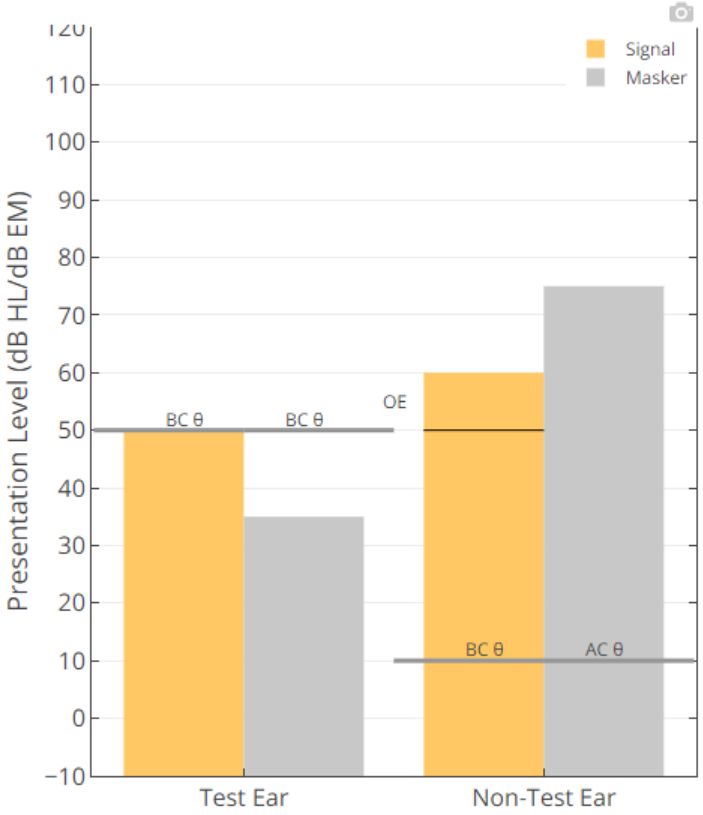
The type of hearing loss refers to the hearing pathway or mechanism responsible for any loss:

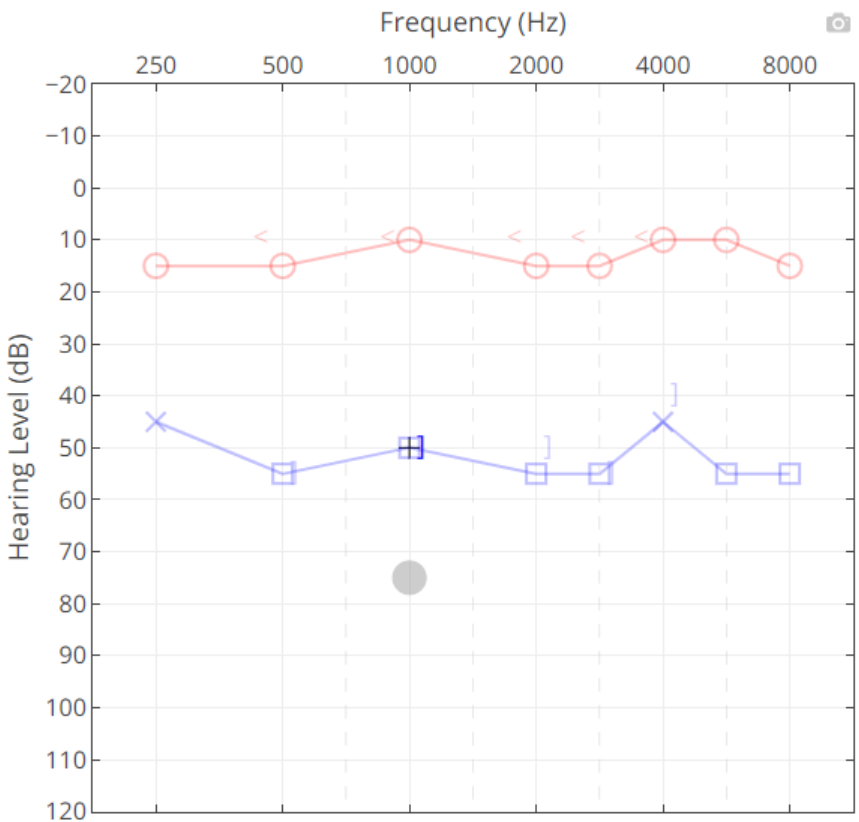
What's one audiometry concept that you try to understand/teach?

Theta Concepts and Masking Demo


Masker Level (dB EM)
10
20
30
40
50
60
70
80
90
100
Stimulus Level (dB HL)
0
10
20
30
40
50
60
70
80
90


Frequency (Hz)
250
500
1000
2000
4000
8000
Hearing Level (dB)
−20
−10
0
10
20
30
40
50
60
70
80
90
100
110
120


Signal
Masker
Presentation Level (dB HL/dB EM)
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
BC θ
BC θ
OE
BC θ
AC θ
Test Ear
Non-Test Ear


Frequency (Hz)
250
500
1000
2000
4000
8000
Hearing Level (dB)
−20
−10
0
10
20
30
40
50
60
70
80
90
100
110
120

Using simulation in your clinical practice

Applicant review

Takes 45 minutes
Resumes all look excellent

Can’t mask

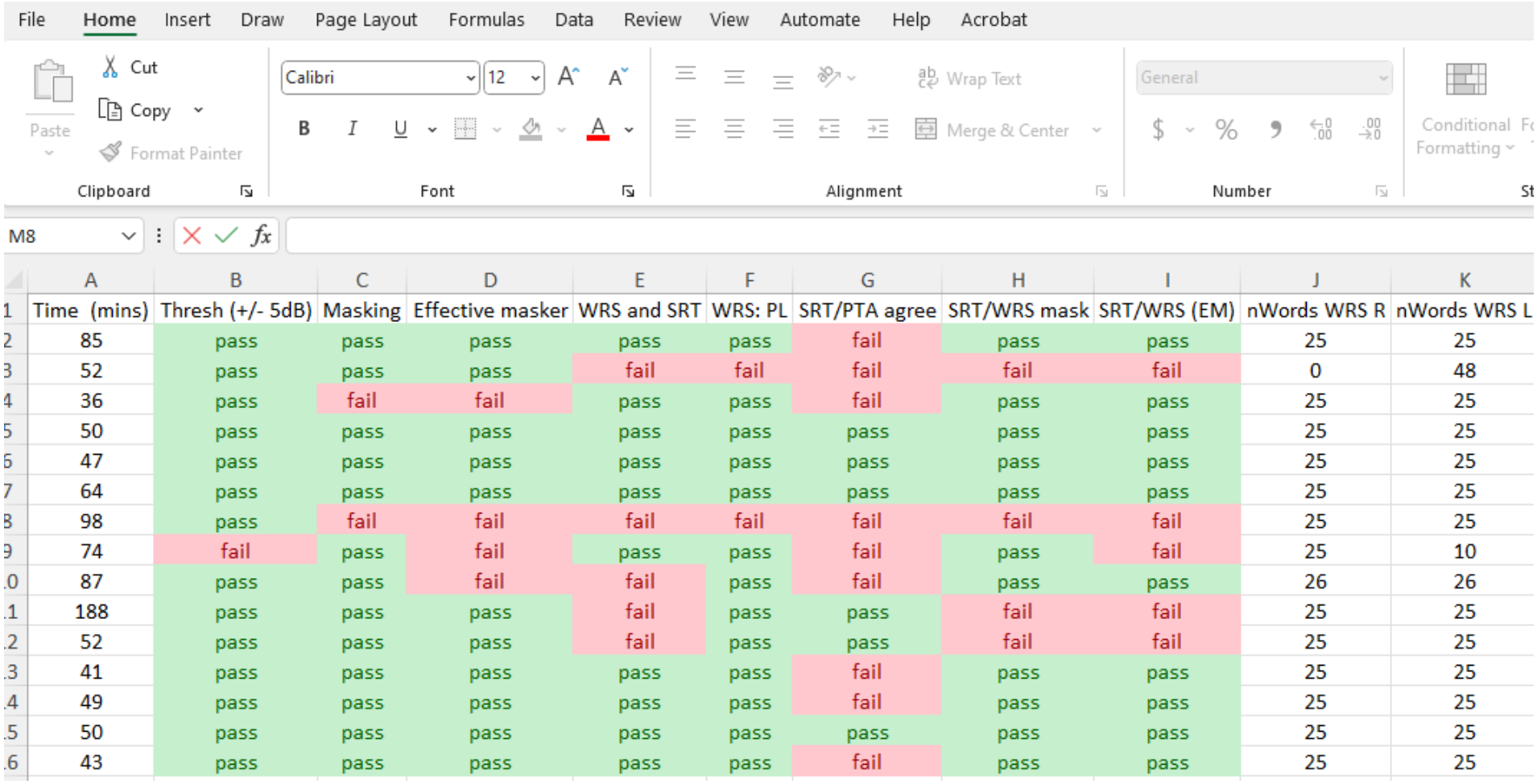
Follows best practices

Doesn’t familiarize SRT

Provider evaluations/verification

Individual performance analysis

- View threshold searches
- Check masker levels
- Check SRT and WRS testing procedures
- Examine flags



	A	B	C	D	E	F	G	H	I	J	K
1	Time (mins)	Thresh (+/- 5dB)	Masking	Effective masker	WRS and SRT	WRS: PL	SRT/PTA agree	SRT/WRS mask	SRT/WRS (EM)	nWords WRS R	nWords WRS L
2	85	pass	pass	pass	pass	pass	fail	pass	pass	25	25
3	52	pass	pass	pass	fail	fail	fail	fail	fail	0	48
4	36	pass	fail	fail	pass	pass	fail	pass	pass	25	25
5	50	pass	pass	pass	pass	pass	pass	pass	pass	25	25
6	47	pass	pass	pass	pass	pass	pass	pass	pass	25	25
7	64	pass	pass	pass	pass	pass	pass	pass	pass	25	25
8	98	pass	fail	fail	fail	fail	fail	fail	fail	25	25
9	74	fail	pass	fail	pass	pass	fail	pass	fail	25	10
10	87	pass	pass	fail	fail	pass	fail	pass	pass	26	26
11	188	pass	pass	pass	fail	pass	pass	fail	fail	25	25
12	52	pass	pass	pass	fail	pass	pass	fail	fail	25	25
13	41	pass	pass	pass	pass	pass	fail	pass	pass	25	25
14	49	pass	pass	pass	pass	pass	fail	pass	pass	25	25
15	50	pass	pass	pass	pass	pass	pass	pass	pass	25	25
16	43	pass	pass	pass	pass	pass	fail	pass	pass	25	25

Theta SimuHear Demo

Limitations and Wrapping up

Simulation does not replace real-world training!!

Summary

1. There are many options out there for clinical simulation
2. Audiometry simulation mimics real-world listeners, and a variety of simulators exist
3. Audiometry simulation and analysis can help your practice recruit candidates, evaluate providers, and identify targeted remediation

I'm happy to answer any questions regarding clinical simulation or Theta!

UofL: shae.morgan@louisville.edu **Theta:** audiologysimulator@gmail.com