AUTONOMIC RESPONSE AND AUDITORY SENSITIVITY IN RELATION TO COMMONLY REPORTED MISOPHONIC TRIGGER SOUNDS

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Overview

- What is Misophonia?
  - *Introduction*
  - *Recent Studies*
- Hypotheses
- Methods and Materials
- Procedure
- ECG Recordings
- Results
- Conclusion

Introduction-What is Misophonia?

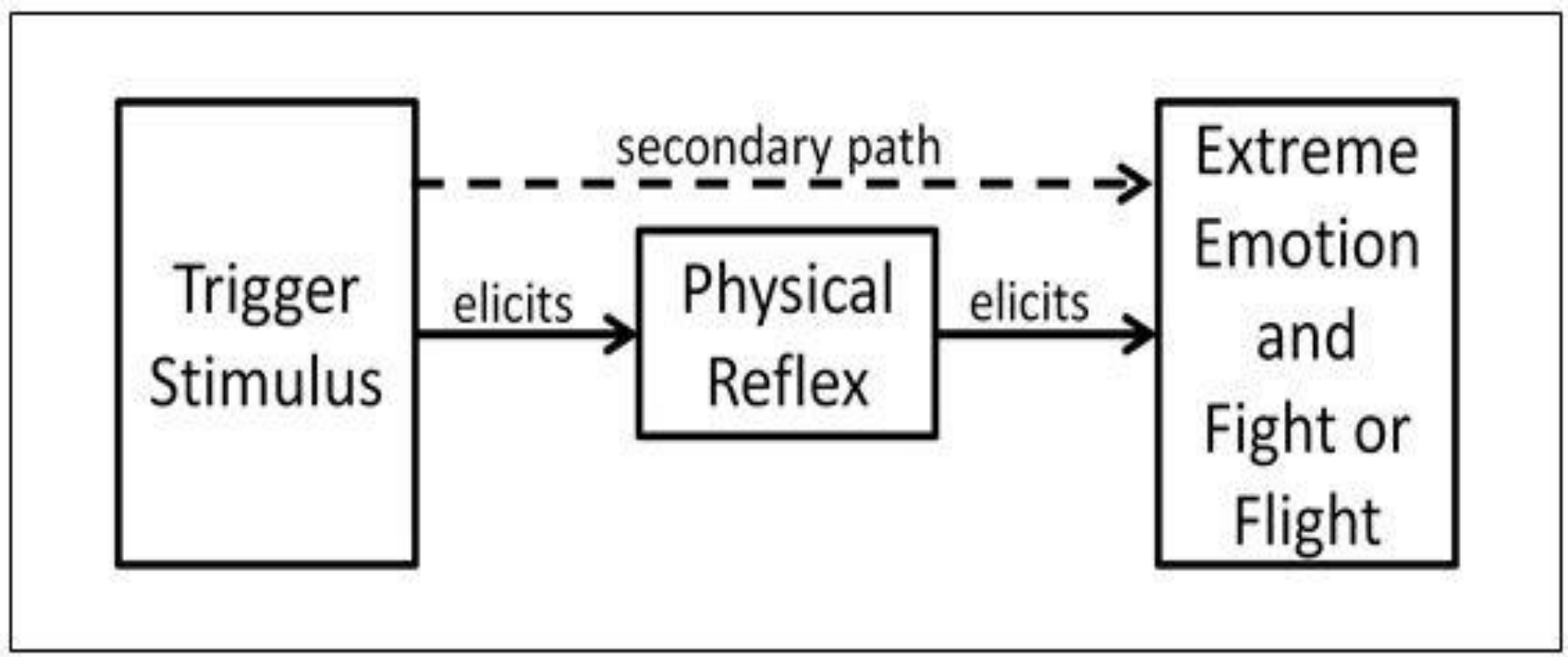
- “Hatred of Sound”
- Jastreboff and Jastreboff 2001
  - *noticed patients labeled as phonophobic were not actually afraid of sounds, but displayed decreased sound tolerance and an aversion or dislike, of certain, quiet, sounds.*
- Edelstein, Brang, Rouw, & Ramachandran 2013
  - *Chronic condition in which every day, quiet, repetitive sounds, provoke strong autonomic arousal and emotional responses.*
- Few studies have tried to define misophonia and its causes.
  - *no broadly used scale or criteria to formally diagnosis*

Misophonia Triggers

- Quiet, everyday repetitive sounds
  - *Chewing, Sighing, Breathing, Clicking, etc.*
- Not just sounds
  - *visual stimuli as long as the image is directly related to the trigger sound.*
- Varying levels of severity
- Avoidance of situations

Introduction

- Dozier (2015)
  - *Classical Conditioning Theory*



Introduction-Neuro Condition?

- Edelstein, M, Brang, D, Rouw, R, Ramachandran, V (2013)
  - *Physiological response of participants to certain auditory stimuli*

- Skin Conductance Response (SCR)
  - *participants were exposed to aversive stimuli (auditory, visual, and combined) to show presence of emotional reactions.*
  - *Misophonic participants showed increased SCR responses to only auditory triggers*
  - *Suggests and supports the theory of misophonia being a neurological disorder involving the auditory and autonomic pathways.*

Table 1 | Summary of qualitative data gathered from interviews of the 11 misophonic subjects (4 males and 7 females, mean age = 35.82; range = 19–65) in Experiment 1, broken down into 18 of the most salient diagnostic categories.

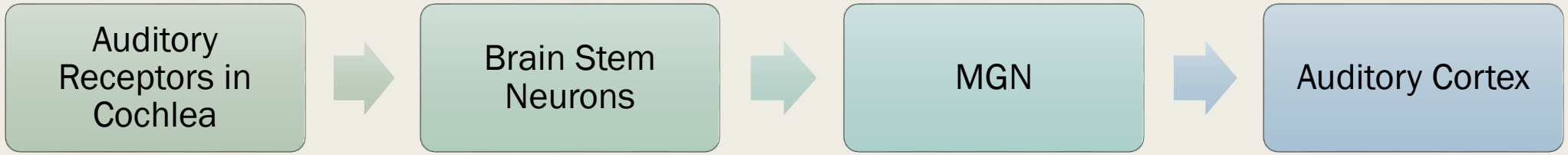
Age of onset	8–10 years old (3)–27% As long as can remember (3)–27% Childhood (3)–27% 17 (1)–9% Early teenage years (1)–9%
Worst trigger sounds	Eating/chewing/crunching sounds (11) Lip smacking (2) Pen clicking (2) Clock ticking (2)
Other trigger sounds	Low frequency bass sounds (8) Pen clicking (4) Footsteps (3) Finger tapping (3) Whistling sounds (3) Typing (3) Lip smacking (2) Clock ticking (1) Plastic bags (1) Repetitive barking (1) Finger tapping (1) Sniffling (1)

Autonomic Nervous System

- Involuntary mediation
  - *Internal organs and blood vessels*
- Sympathetic vs. Parasympathetic
  - *“speed up” for danger*
    - Constricting blood vessels, Increase BMP, Relax airways
  - *“slow down” for vegetative activities*
    - Slow BPM, Constrict airways, Constrict pupils
- Relation of Misophonia?
  - *Increased heart rate*
  - *Skin temperature change?*

Auditory Pathway

- Sound
  - *Audible pressure changes in the air*
  - *Frequency 20 Hz- 20,000 Hz*
  - *Intensity*
- Outer Ear
  - *Pinna*
  - *Canal*
- Middle Ear
  - *Ossicles*
  - *Oval Window*
- Inner Ear
  - *Cochlea*
  - *Auditory Vestibular Nerve*

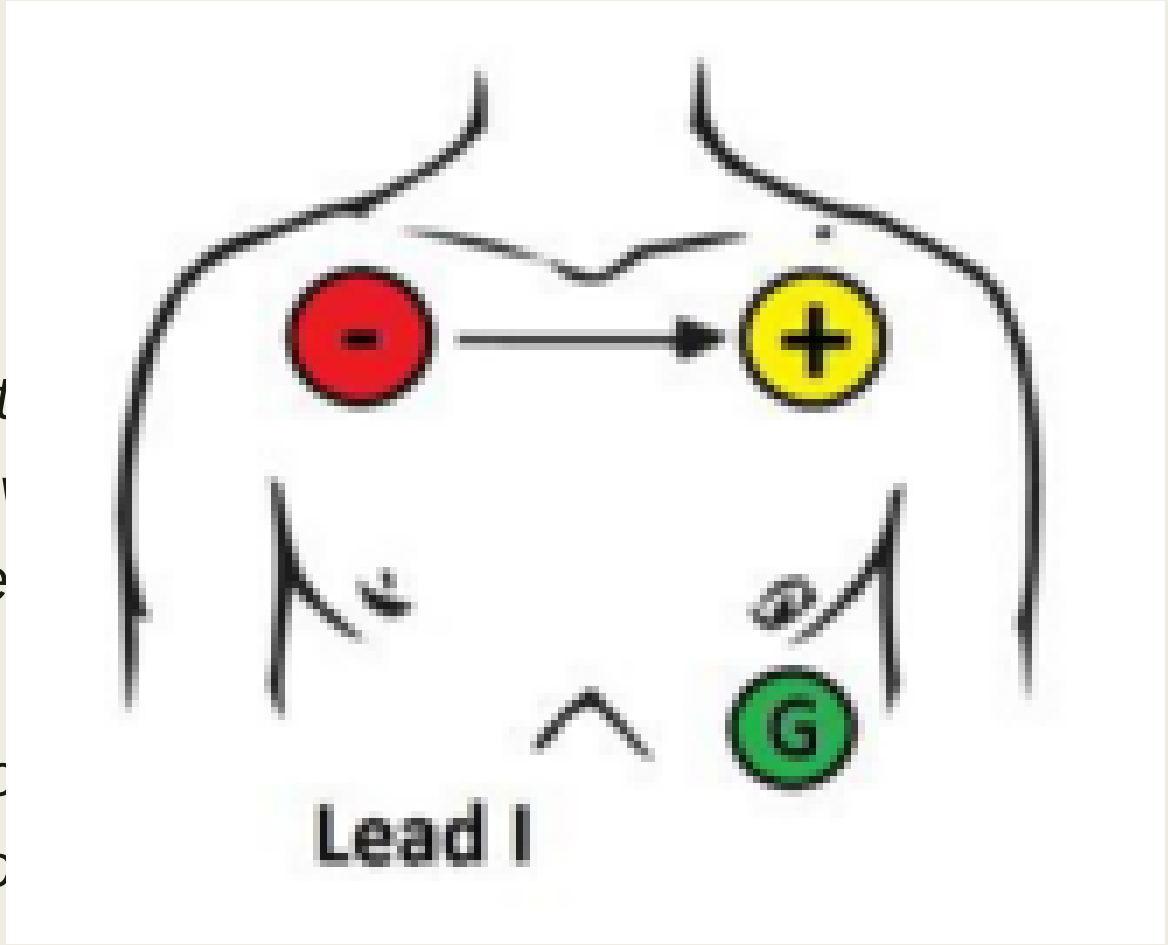


Purpose and Hypothesis

- To try and identify an underlying cause of misophonia through comparison of audio sensitivity, autonomic system responses, and survey measurements.
  - *Goal is to identify a potential link of misophonia to an auditory system abnormality or a relation to the neurological processes of regulating the autonomic responses.*
- **H1:** Participants who score higher on the misophonic scales will have a decreased skin temperature, increased BPM, and increased audio sensitivity.
- **H2:** Participants who demonstrate misophonic tendencies will have more items indicated as frustrating on the sound survey, a higher Misophonia Activation Scale score, and will have an overall decreased mood (increased negativity/decreased positivity).
  - *Trait vs. State*

Methods

- Participants
  - *N=21*
- Equipment
  - *ECG recordings wit*
  - *Skin Temperature*
  - *Stimuli sounds pre*
- Stimuli
  - *Common trigger sc*
  - *Free recordings fro*



Trigger Sounds Stimuli

- 4 sets
  - *Calm: 18.5 s brown noise*
    - Silence breaks included
- 3 sets
  - *3 triggers in each of the 3 sets*
    - Totaled 70s (300ms breaks)

Set 1	Set 2	Set 3
Chip Crunching	Pen Clicking	Eating/Smacking
Heavy Breathing	Wrapper Crinkling	Coughing
Finger Nail Clipping	Drinking/Gulping	High Heel Clicking

Trigger Stimuli Examples

Brown Noise 

Eating Trigger 

Pen Click Trigger 

Questionnaires

- Demographics
  - *Age, gender, race, class, major, hearing disorder*
- NPMS-SF
  - *17 moods*
  - *Current mood*
  - *Pre and post*
- Sound Survey
  - *Specific to sounds*
- A-MISO-S
  - *Adapted*
  - *Activation score for misophonia*

A-MISO-S

1. How much of your time is occupied by sounds that irritate you? (How frequently do the thoughts about irritating sounds occur?) Circle your rating.

None	0
Mild, Less than 1hr/day (occasional thoughts about sounds; no more than 5 times a day.)	1
Moderate, 1 to 3 hrs/day (frequent thoughts about sounds; more than 5 to 8 times a day.)	2
Severe, greater than 3 hrs/day up to 8hrs/day (very frequent thoughts about sounds.)	3
Extreme, greater than 8hrs/day (near constant thoughts about sounds.)	4

2. How much do irritating sounds interfere with your social or work functioning? (Do sounds prevent you from normal functioning/ impair your performance?)

None	0
Mild, slight interference (with social or occupational activities, but overall performance not impaired.)	1
Moderate, definite interference (but still manageable.)	2
Severe (substantial impairment in social or occupational performance.)	3
Extreme (incapacitating.)	4

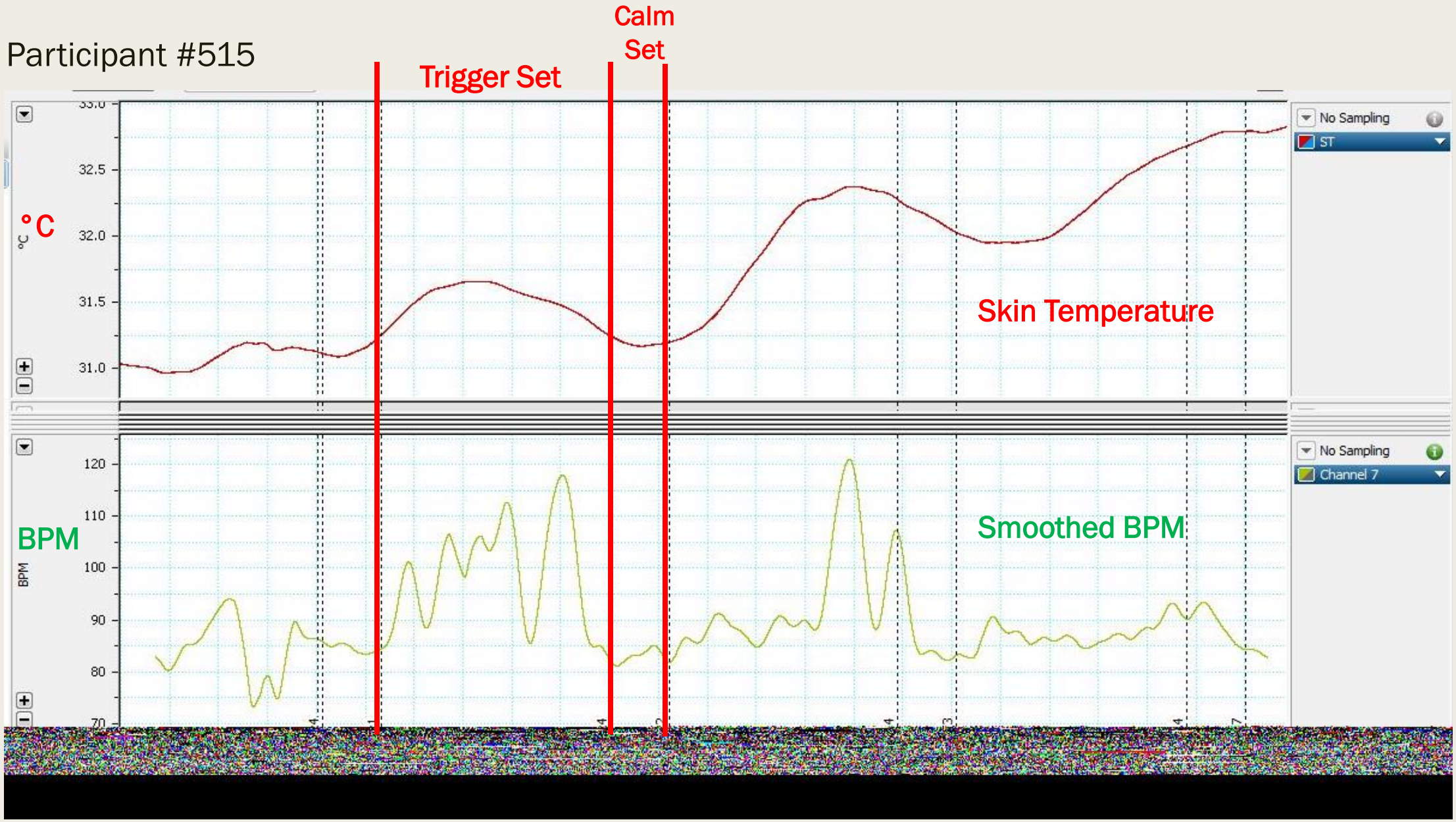
- Adaptation to take away “misophonic sounds”
- Clarification for student level

Procedure

- Audio Sensitivity
  - *20H- 20kHz*
  - *4 spacebar indication*
  - *Averaged*
- Break/explanation
- ECG recording with stimulus presentation
  - *ECG electrode placement*
  - *Temperature measure*
- End surveys and debrief if needed

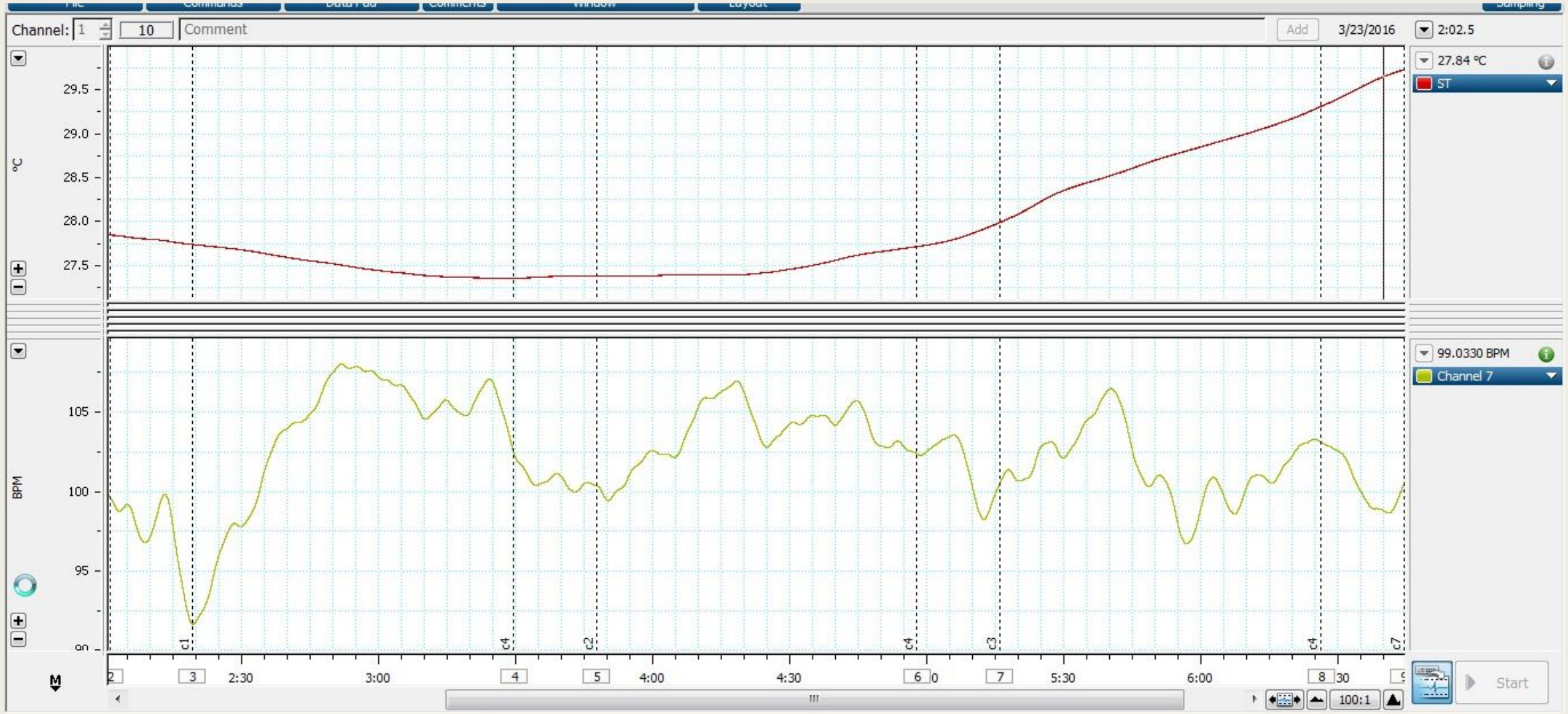
ECG Recording-Ideal

- Participant #515



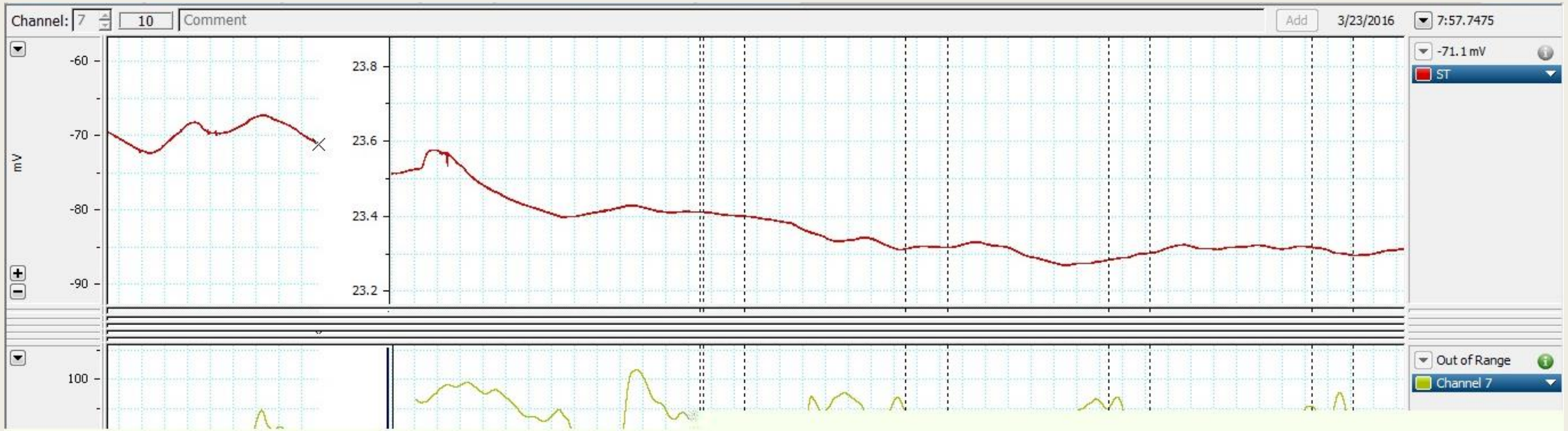
ECG Recording-Typical Patterned Response

- Participant #506



ECG Recording-No Response

- Participant #505



Analysis and Results

- LabChart Reader, Excel, and SPSS

- Physiological Measures:

1. Skin Temperature (rate of change and difference between sets)
   - *Rate of Change: change of temperature over time in the different sets*
2. Heartrate (average BPM and difference between sets)
3. Audio Sensitivity (average high and low ranges)

- Qualitative Measures:

1. Activation Scale Scores
2. Current Mood State (negativity and positivity subset changes)
3. Sound Survey Items (# items rated “3” or above)

		Diff_Temp	Set_rate	Avg_low_audio	Avg_high_audio	Sound_3_and_above	Activation_Score	Change_in_Neg	Change_in_positive
Diff_Temp	Pearson Correlation	0	0.403	-0.242	-.457*	-0.13	-0.148	0.162	0.349
Set_rate	Pearson Correlation	0.403	0	0.091	-0.374	0.257	0.101	0.335	-0.134
Avg_low_audio	Pearson Correlation	-0.242	0.091	0	-0.192	.481*	0.217	-.439*	0.09
Avg_high_audio	Pearson Correlation	-.457*	-0.374	-0.192	0	-0.238	-0.08	0.078	-0.149
Sound_3_and_above	Pearson Correlation	-0.13	0.257	.481*	-0.238	0	0.198	-0.026	0.192
Activation_Score	Pearson Correlation	-0.148	0.101	0.217	-0.08	0.198	0	0.075	-.598**
Change_in_Neg	Pearson Correlation	0.162	0.335	-.439*	0.078	-0.026	0.075	0	-0.263
Change_in_positive	Pearson Correlation	0.349	-0.134	0.09	-0.149	0.192	-.598**	-0.263	0

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

- Diff_Temp + Avg_High_Audio -0.457
  - *Variable*

- Activation_Score + Change_in_positive -0.598
  - *Increase score = decrease positivity*

- Sound_3_and_above + Avg_Low_Audio 0.481
  - *Increase in items = increasing sensitivity*

- Avg_Low_Audio + Change_in_neg -0.439
  - *Decrease in low sensitivity= increase in negativity change*

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Calm_rate	0.2998	21	0.40231	0.08779
	Set_rate	0.3959	21	0.39365	0.0859
Pair 2	Calm_BPM	81.8848	21	12.15112	2.65159
	Set_BPM	81.8976	21	12.63742	2.75771
Pair 3	Avg_Calm	30.7548	21	3.56197	0.77729
	Avg_Set	30.71	21	3.63746	0.79376

Paired Samples							
		Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	Calm_rate - Set_rate	-0.09608	-0.1736	-0.01856	-2.585	20	0.018
Pair 2	Calm_BPM Set_BPM	-0.01286	-1.03724	1.01152	-0.026	20	0.979
Pair 3	Avg_Calm - Avg_Set	0.04476	-0.01917	0.10869	1.46	20	0.16

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Change_in_Neg	21	-0.0952	3.57638	0.78043
Change_in_positive	21	-1.4762	2.71328	0.59209

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Change_in_Neg	-0.122	20	0.904	-0.09524	-1.7232	1.5327
Change_in_positive	-2.493	20	0.022	-1.47619	-2.7113	-0.2411

Conclusions

- The t-tests do prove that the stimuli are working and causing at least a few physiological changes.
  - *Temperature Change Pattern indicates that the misophonic trigger sounds did influence the participants on a physiological level.*
  - *Rise in temperature due to stress mechanism and not simple heart fluctuations.*
- Emotionality Changes from Triggers
  - *Positive subset significant change*
- Perhaps not all correlations are directly related to misophonia
  - *Average Low Audio may be distinct from misophonia*
  - *Sound and Activation not measuring same thing (short term vs. long term)*
- Some Correlations do fit with the theory and help support the hypotheses and direction of current misophonia research.
- Perhaps the physiological measures relate to other processing mechanisms as well
  - *How fast a person takes to “ramp up” and calm down*

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References

- Bear, M. F., Connors, B. W., & Paradiso, M. A. (2007). *Neuroscience: Exploring the brain*. Philadelphia, PA: Lippincott Williams & Wilkins.
- Dozier, Thomas (2015). Etiology, Composition, Development and Maintenance of Misophonia: A Conditioned Response Aversive Reflex Disorder. Psych Thought. 8:1:114-29.
- Edelstein, M, Brang, D, Rouw, R, Ramachandran, V (2013) Misophonia: Physiological investigations and case descriptions. Front Hum Neurosci. 7:296:10.3389
- Jastreboff, P. J., & Jastreboff, M. M. (2000). Tinnitus retraining therapy (TRT) as a method for treatment of tinnitus and hyperacusis patients. *American Academy of Audiology*, *11*(3), 162-177.
- Jastreboff, M.M. & Jastreboff P.J. (2001) Component of decreased sound tolerance: hyperacusis, misophonia, phonophobia. *ITHS News Lett 2* (5–7)
- Jastreboff, P.J.,& Jastreboff, M.M. (2015). Decreased sound tolerance: hyperacusis, misophonia, diplacousis, and polyacousis. *Handbook of Clinical Neurology, 129* (3).
- Jerger, J. (1962) Bekesy Audiometry. Int J Audiol, 1:2: 160-164.
- Schröder, A., Vulink, N., & Denys, D. (2013). Misophonia: Diagnostic Criteria for a New Psychiatric Disorder. *Plos ONE, 8*(1), 1-5. doi:10.1371/journal.pone.0054706
- Schröder, A., van Diepen, R., Mazaheri, A., Petropoulos-Petalas, D., Soto de Amesti, V., Vulink, N., & Denys, D. (2014). Diminished N1 auditory evoked potentials to oddball stimuli in misophonia patients. *Frontiers in Behavioral Neuroscience, 8 (*123). doi:10.3389/fnbeh.2014.00123

Questions?