

Project Deliverable 5

Jocelyn Kavanagh

Research questions:

- Will the dancer be able to differentiate between the different muscle groups?
- Can the dancer tell the difference between the sound of proper form and improper form? Will they remember the sound of proper form over time?
- Will the sonifications be too difficult to interpret in “real time”?
- Is the sonification of all muscle groups at once too overwhelming? Is it clearer and still beneficial to hear one muscle group at a time?
- What are the dancer’s aesthetic opinions about the sonification?

Participants:

I will need intermediate, practicing dancers to perform my evaluation. Luckily, my friends and many of my sister study dance or musical theatre in college. I have reached out to them, and I will be able to run the evaluation in person. We will follow proper social distance protocol, but I live with my sister and see the other two dancers (who are also sisters) semi-regularly so I am not too concerned. I will be able to run the evaluation online as well if anything changes.

Measures:

- Quantitative
 - o Time elapsed during training phase, when participant is confident that they can move on to the evaluation phase
 - o Number of correct understandings of mappings
 - Identifying if form was incorrect/correct
 - Identifying why form was incorrect
 - Response time of answers
 - o NASA TLX
- Qualitative
 - o keywords spoken while “thinking out loud”
 - o comments made during session

Protocol:

- Introduction
 - o I will begin the evaluation by explaining the simulator
 - This system is meant for dancers hoping to improve their physical awareness while rehearsing ballet. The system supports dancers training plies and sautés and offers a minimal intervention mode. While training plies and sautés, the dancer will adapt their movement based on the sonification, hoping to match the sound of the “perfect” plie and sauté provided by the system. The minimal intervention mode provides reminders to the dancer about potential injury inducing movements and reminders about alignment and form.
- Consent
 - o I will then get consent from the participant and explain their role in the study

Project Deliverable 5
Jocelyn Kavanagh

- This is an evaluation of a sonification system. We will be moving through a series of tests to understand the clarity and appropriateness of the system.
- We will calibrate appropriate volume levels before beginning the evaluation, but please be aware that there will be potentially loud and changing sounds. Speak up about discomfort at all times.
- I will be recording your answers for further analysis, but you will remain anonymous. During the interview portion of the evaluation, I will audio record your feedback, so that I can reference it in the future.
- You may take a break or end the evaluation at any time.
- Written and verbal consent to begin the evaluation
 - Consent form will resemble one at base of document
- Training Phase
 - I will be “wizard of oz-ing” through the features
 - I will move at a pace as directed by the participant (remembering to start a timer before beginning the phase)
 - I will set comfortable volume levels for the participant’s headphones
 - I will begin by explaining the mapping and performing the sound
 - Muscle contraction is represented by a shift from a sine wave to a sawtooth wave. It sounds like this *play one muscle group moving from sine to saw*. Here the muscle is not contracted *sine* and here the muscle is contracted *saw*. Does this make sense to you?
 - Each muscle group is mapped to a discrete pitch. The pitches go from low to high along with the body, starting with calves, inner thigh, outer thigh, glutes, core. Here is what each muscle sounds like “this is calves *play contraction of calf muscle only*” Does this make sense?
 - Here is what all of the muscles sound like at one time. This is the typical state of the system; you will always hear all 5 pitches/muscle groups at once.
 - Weight distribution from left to right is mapped to your left and right ear in your headphones. Here is what it sounds like with weight shifted all the way to the right *pan sounds right*, to the left *pan sounds left*, and to the center *pan to center*. Does this make sense?
 - Weight distribution from front to back is mapped to amplitude modulation, so kind of a vibration sound. Here is what that sounds like, *play sweeping amplitude modulation*. The further away from center, the faster the modulation. Here is what it sounds like at the center, here is what it sounds like as you drift away from center. Does this make sense?
 - If there is any sense of danger due to contraction level, you will hear a voice say the muscle group at risk. It will sound like this *play injury of a muscle*. Does that make sense?
 - Alignment is demonstrated by the presence of an additional musical tone. The tone sounds periodically as your alignment shifts. Here is the sound of the tone *play alignment sound*. When your alignment is bad,

the tone will be louder and when it is good the volume will be low. Does this make sense?

- In the sonification of the sauté, the downward pressure is mapped to the envelope of the sound. So, as the dancer has less pressure on her feet, the sound will get quieter. When the dancer is in the air, they will hear nothing. When the dancer returns to her feet and pressure increases, the volume will increase again. Does this make sense?
- Are there any aspects of the mappings you do not understand and wish to review?
- Explain that there is a video display of the current movement. Note that the video will not be updated with the changes muscular and alignment data, it is just there as an aid to conceptualize what is being sonified.
- Whenever the participant is comfortable, I will stop the timer.
- Evaluation phases
 - I will ask the participant to think aloud during the following phases of the evaluation
 - In the following phases, I will press buttons with the perfect form and 5 variations loaded for each mode of the system
 - The participant will wear headphones and watch the video display as during the evaluation phases
- Plie Evaluation
 - This phase will test the participants ability to recognize the sound of a proper and improper plie.
 - I will play the perfect sound of a plie 3 times
 - I will play 5 variations of plies and the participant will say whether the plie is correct or incorrect, and if it is incorrect, why is it incorrect.
 - For this round, the participant will not be reminded of the proper sounding plie
 - If they are incorrect, I will explain to them why and I will ask for their impressions from that
 - I will play through the 5 variations of plies again and the participant will say whether the plie is correct or incorrect, and if it is incorrect, why is it incorrect.
 - For this round, the participant will be reminded of the proper sounding plie before each variation is played.
 - If they are incorrect, I will explain to them why and I will ask for their impressions from that
 - The response time will be recorded, correct answers will be recorded, and think aloud comments will be recorded.
- Sauté Evaluation
 - This will be similar to the plie evaluation, just with the sauté sounds
 - I will play the perfect sound of a sauté 3 times
 - This phase will test the participants ability to recognize the sound of a proper and improper sautés.

Project Deliverable 5

Jocelyn Kavanagh

- I will play 5 variations of sautés and the participant will say whether the sauté is correct or incorrect, and if it is incorrect, why is it incorrect.
 - For this round, the participant will not be reminded of the proper sounding sauté
 - If they are incorrect, I will explain to them why and I will ask for their impressions from that
- I will play through the 5 variations of sauté again and the participant will say whether the sauté is correct or incorrect, and if it is incorrect, why is it incorrect.
 - For this round, the participant will be reminded of the proper sounding sauté before each variation is played.
 - If they are incorrect, I will explain to them why and I will ask for their impressions from that
- The response time will be recorded, correct answers will be recorded, and think aloud comments will be recorded.
- Minimal Intervention mode
 - This phase will be more of a qualitative discussion of the system
 - I will play through 5 of the previous sauté/plié variations in minimal intervention mode
 - This phase will primarily focus on the injury flags and the alignment flags
 - I will ask the participant what they heard and understood during the sonification
 - Correct answers will be recorded
 - I will ask the participant of their impression of this reminder like system
- Comments/Interview
 - The participant will take the NASA TLX
 - I will ask them to picture that they were performing the plié or sauté movements while assessing the system
 - We will then move to an interview, where I will collect key takeaways (I will ask for extended answers)
 - I will record the interview section
 - Please discuss the difficulty of the task. What aspects were too hard to understand or were frustrating?
 - Did you find the system to be too overwhelming?
 - Would you see this system providing use in a studio, or would it be too distracting?
 - Did you enjoy the sounds of the sonification? Was it annoying or too intrusive?
 - What were the most helpful parts of the system? Least helpful?
 - May rephrase or follow up as clearest aspects and most confusing
 - Please provide any additional insights or comments you have about the system.
- Debriefing
 - Thank you for participating in this study

Project Deliverable 5
Jocelyn Kavanagh

Analysis:

To analyze the data, I will calculate the central tendency measures of each of the testing sets: timing of training phase, response time, correct answers, and NASA TLX. This will help me understand qualitatively the difficulty of understanding the system and the cognitive load of the system. The percentages of correct answers will show me how well the participants were able to understand the system across the group, but I will also be able to tell if they improve their accuracy when the “perfect form” sound is repeated. This will more or less act as a control within participants.

I will also look for patterns in the participant feedback. I will compile the most frequency comments and takeaways to find the general perception of the system.

Project Deliverable 5
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Title of Project:

I am asking for your voluntary participation in my science fair project. Please read the following information about the project. If you would like to participate, please sign in the appropriate area below.

Purpose of the project:

If you participate, you will be asked to:

Listen to the sonification simulation, discuss your impressions of the system, perform a listening assessment, and take a mental load survey.

Potential Risks of Study:

You will be listening to potentially loud and rapidly changing sounds, so you may experience auditory discomfort.

Benefits:

This study will help determine the effectiveness and appropriateness of the sonification system.

If you have any questions about this study, feel free to contact:

Jkavanagh3@gatech.edu

Voluntary Participation:

Phone/email: _____

Participation in this study is completely voluntary. If you decide not to participate there will not be any negative consequences. Please be aware that if you decide to participate, you may stop participating at any time and you may decide not to answer any specific question.

Adult Informed Consent or Minor Assent Date Reviewed & Signed:

Research Participant Printed Name:

Signature: