Sonification Station Instructions
Prepared by Mike Petersen
I would be very grateful if anyone running the station could jot down a few notes about their experience talking to people while running the station, and any answers to questions below.

Learning outcome
Sonification is a new technique for interacting with data that requires minimal training but is a rich medium that allows us to experience data in a new way.

Suggested Script
Introduction:
The demonstration is three galaxies that have been rendered as sounds that accompany the images. The sonification strategy we are using here emphasises symmetry in galaxy images: symmetry means how you could 'fold' or 'rotate' a galaxy and it would look nearly the same. Most galaxies show some form of symmetry, which is the product of their formation history – we can learn about how galaxies evolve over time based on their symmetries. In this demonstration, you will be learning

Demonstration walkthrough:
1. First sonification is of a distant galaxy imaged by JWST. This galaxy is fairly simple in appearance; try listening for the pitch of notes (e.g. are they high or low?). When the notes start over the the lowest notes, we are hearing new symmetries in the galaxy.
2. Sonification of a distant barred galaxy. For this demonstration, more high notes are played because the structure is more detailed. As the sounds play, try focusing on the high notes. What happens? Finer structure is added as the notes get higher.
3. Sonification of a perturbed (looking?) galaxy. Ask the viewers if they notice anything different when looking at the image after hearing the sonification. I notice much more symmetry in the galaxy than I previously thought.
4. Audio-only version. Now the sonification is just the audio, while looking at galaxy images. Don't be discouraged if you don't get it 'right': the point is to listen to the sonifications and hear what is unique. The reason the right galaxy (bottom sound) has more high notes is because the sonification is representing the strong bulge in this galaxy. The reason the left galaxy (upper sound) sounds complex is because of the warped feature in the galaxy: it takes a lot of low structure to represent!

Key talking points:
- Sonification is a new technique with a goal to render data in sounds.
- Sonification can prompt us to experience the data differently and notice new features that we might not have otherwise seen.
- There are many ways to sonify a galaxy – we've chosen one possible representation that emphasises symmetries.
- Sonification can include the low-vision community in astronomical research.
- The strategy followed by these sonifications emphasises symmetries in the galaxies, but many other strategies are possible.

Questions for engaged visitors: The italics are just clarifications for you, no need to ask
- What is the last song you listened to (or a song you have recently listened to, or a favourite song)?
    - o *This question is to coarsely gauge how well this particular harmonic sonification goes over with an audience.*
- Do you notice the volume of notes changing?
    - o *The volume is changing from note to note, reflecting the significance of the note.*
- Do you notice any repeated notes?
    - o *The notes start over when a new symmetry starts; this is difficult to get at first (in my opinion), but then seems more obvious later.*
- Do you find the numbers in the images distracting? Are there any other annotations that would have been helpful?

Troubleshooting instructions
1. The laptop has a specific open days user, 'Roe Open Days', with password 'roeopendays'.
2. To bring up the sonification demo, navigate to

https://michael-petersen.github.io/roe/sonification/tutorial/tutorial.html