

Mathematics of Music

Week 1: The basics of sound

Welcome to HSSP!

- who are we?
- questionnaire
- attendance and other HSSP requirements

How will this class run?

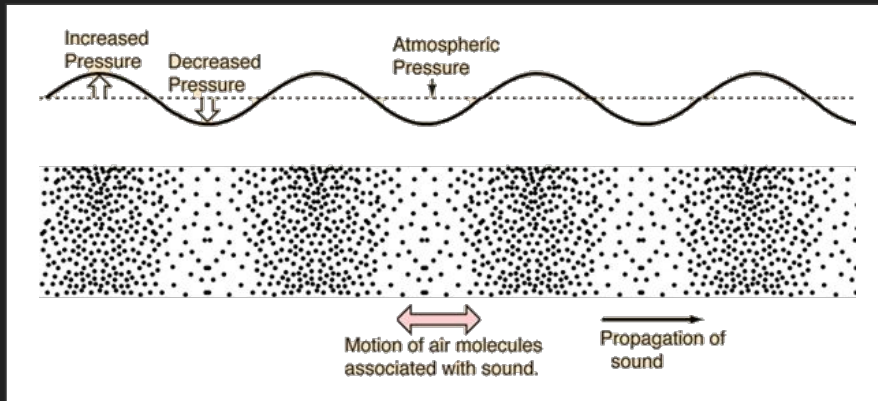
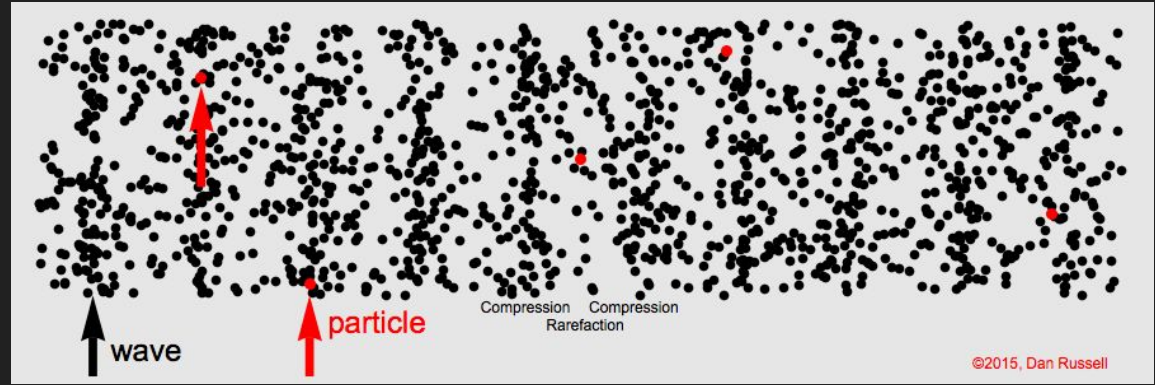
- every week will be one or two new topics
 - helpful to remember previous weeks!
- start easy → end with a challenge
- lots of questions, thinking, and demos!

Before music, let's talk about **sound**

- what is sound?
- how do we make sound? how do we hear sound?



Sound is air molecules moving back and forth



Another similar example: water waves

- we see lines but what are they?
- which way is the water itself moving?

transverse

longitudinal



Let's get into the specifics now

- why do different sounds sound different?
- louder?
- higher?
- it's all about the **sine wave!**

Demo!

(We'll do some listening.)

Remember: the picture you see tells us about **displacement**.

Pitch & frequency, loudness & amplitude

- Frequency = how many peaks of the sound wave hit your ear each second
 - corresponds to higher or lower pitch
- Amplitude = the maximum displacement of an air particle, i.e. how far it makes your eardrum vibrate
 - corresponds to louder or softer
- does 2x amplitude = 2x loudness? what does that even mean? find out in week 2

Beats

- What happens when you add 400 Hz and 401 Hz?
 - 801 Hz?
 - 400.5 Hz?
 - ?? let's find out with a **demo**

- Can you explain what you heard?

Beats

- What happens when you add 400 Hz and 401 Hz?
 - 801 Hz?
 - 400.5 Hz?
 - ?? let's find out with a **demo**

- Can you explain what you heard?
- Tuning!

Let's think a bit more about **frequency**

This can go in many directions!

- What are intervals?
- What are chords?
- How do instruments work?

We'll discuss this more next week!

How fast is the air moving?



Thank you!