Ellie Copestake

2022-2023 Design Project

Reflection

Having started this course partway into my second year, I am able to note a significant difference in the independence level on this course compared to my previous one.

I can choose my own project, follow my own timeline (within deadlines) and a vast majority of my learning has become independent.

I chose to hand-write my notes, as I feel this allows me to be more chaotic in my note taking. This boosts morale and overall efficiency as I research.

Reflection

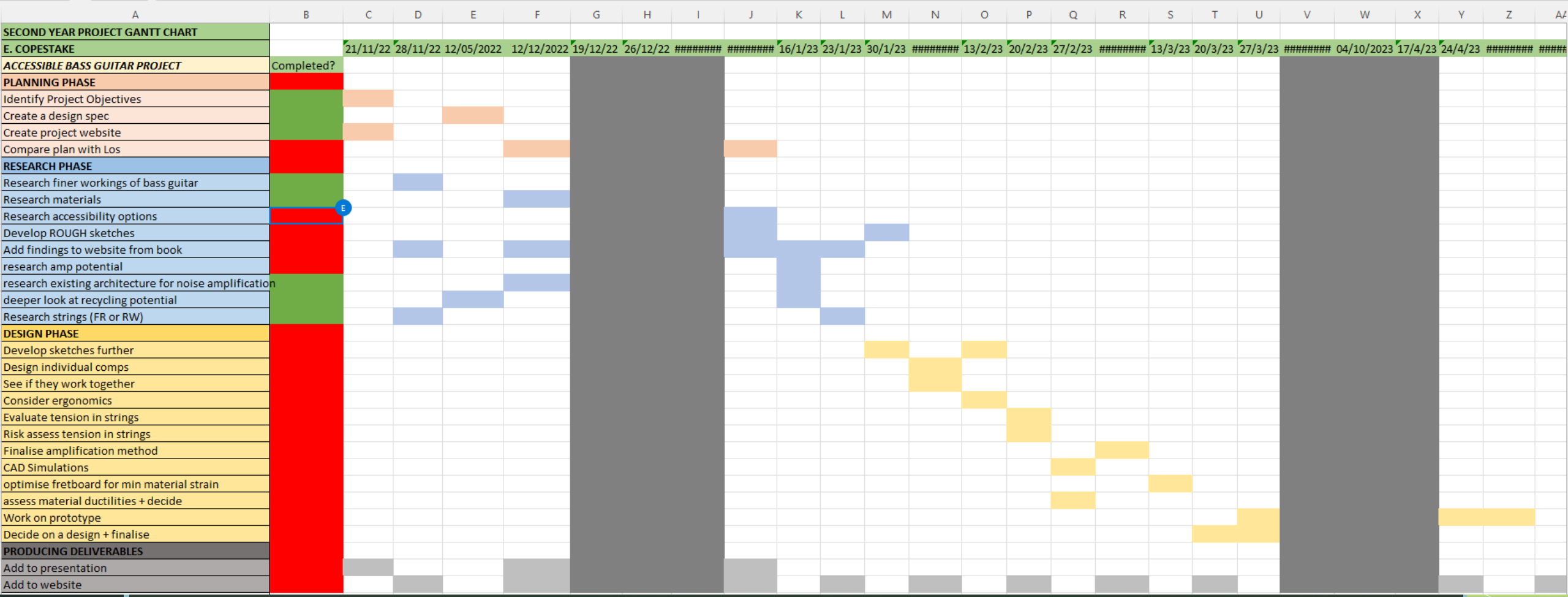
Because of this, I have been able to develop vital skills such as personal time management, initiating tasks independently, knowing when to ask for help and (soon) collaboration with my peers.

Mission Statement

Due to the ongoing cost of living crisis and the general rising expense of all the equipment needed for electric instruments, learning a new instrument has become virtually inaccessible for many poorer communities. There are studies available that demonstrate a link between learning a musical instrument and seeing an increase in general mental wellbeing. In a post-pandemic world, I believe that cost of living and mental wellbeing should have taken priority for those in charge.

I aim to design a bass guitar prototype which can be played and used as a beginner's instrument without the necessary purchase of additional components. This way, the world takes one step closer to accessible instruments becoming a reality. I aim for my product to be relatively cheap but well-built in order to make a good starter instrument.

Gantt Chart



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	**SECOND YEAR PROJECT GANTT CHART**																										
2	**E. COPESTAKE**		21/11/22	28/11/22	12/05/2022	12/12/2022	19/12/22	26/12/22	########	########	16/1/23	23/1/23	30/1/23	########	13/2/23	20/2/23	27/2/23	########	13/3/23	20/3/23	27/3/23	########	04/10/2023	17/4/23	24/4/23	########	#####
3	***ACCESSIBLE BASS GUITAR PROJECT***	Completed?																									
4	**PLANNING PHASE**																										
5	Identify Project Objectives																										
6	Create a design spec																										
7	Create project website																										
8	Compare plan with Los																										
9	**RESEARCH PHASE**																										
10	Research finer workings of bass guitar																										
11	Research materials																										
12	Research accessibility options																										
13	Develop ROUGH sketches																										
14	Add findings to website from book																										
15	research amp potential																										
16	research existing architecture for noise amplification																										
17	deeper look at recycling potential																										
18	Research strings (FR or RW)																										
19	**DESIGN PHASE**																										
20	Develop sketches further																										
21	Design individual comps																										
22	See if they work together																										
23	Consider ergonomics																										
24	Evaluate tension in strings																										
25	Risk assess tension in strings																										
26	Finalise amplification method																										
27	CAD Simulations																										
28	optimise fretboard for min material strain																										
29	assess material ductilities + decide																										
30	Work on prototype																										
31	Decide on a design + finalise																										
32	**PRODUCING DELIVERABLES**																										
33	Add to presentation																										
34	Add to website																										

Gantt Chart Discussion

I am on track according to my Gantt chart. I have chosen to visually map my progress with a Done/Not Done column. An activity that has a green square in the column has been completed. Uncompleted activities have a red square.

S.M.A.R.T Objectives

Objectives are 'SMART' if they are specific, measurable, achievable, (sometimes agreed), realistic (or relevant) and time-bound, (or timely).

My S.M.A.R.T objectives for this project are to have a comprehensive design for several components of the bass guitar, to reach out to Harley Benton for professional development, and to produce a website portfolio of all my work.

If I were going to be more ambitious, I would aim to produce at least one physical component of the guitar. However, due to time and money constraints it is unclear whether this will be possible. I decided to include development on my Gantt chart, but I doubt a fully finished prototype is on the cards.

Deliverables

In terms of deliverables I aim to be able to produce:

- A detailed website portfolio of my progress
- Several component designs towards the final product

DE501

Design Specification

The product will be the design for a bass guitar that is able to produce around 60dB, as perceived by the user, without need for an external amplifier. The body should mimic that of an electric bass guitar with **[SPECIFY]** considerations for internal architecture. The product must NOT be as [thick] as an acoustic bass guitar.**[SPECIFY HOW THICK]** The action should be no more than 5mm higher than that of a standard electric bass guitar. The action varies per string, but on average this should not exceed 7.4mm from the fretboard. The body should be mostly hollow with internal architectural considerations for natural sound amplification. **[OUTLINE BODY DIMENSIONS HERE]** The product must come with round-wound strings, as these are the most adaptable. The strings should be relatively easy to remove and replace to accommodate for maintenance and user preference. The tension of the strings must be fully adjustable to allow for tuning. **[OUTLINE MATERIALS] [NECK LENGTH]**

The target audience of this product should be beginner musicians, or those wanting to do solo practice without having to set up several components. As such, the feel of the guitar must mimic the standard electric bass within considerations. The skills acquired while learning this instrument must be easily transferrable.

The selling value of the product should not exceed £250.00. **[ADJUST ONCE PRICE WEIGH-UP IS COMPLETE. DO NOT EXCEED £400.]**

The final product produced of this project should be a comprehensive design for the bass guitar. (with the possibility of a maximum of one physical component depending on available material access.)

The product's lifespan will depend on maintenance done by the user, but without proper maintenance (storage, upkeep, care, etc) the bass guitar (excluding the strings) should survive for up to 3 years (HEAVILY dependant on usage- look into predictability). The product should be relatively easy to re-manufacture in the event of failure. The product should be made of the highest realistic percentage of recycled materials.

So far for DE501 I have only produced a skeleton of a Product Design Specification. This PDS needs to be finalised once I have completed other segments of my plan.

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DESIGN PHASE
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Risk assess tension in strings
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PRODUCING DELIVERABLES
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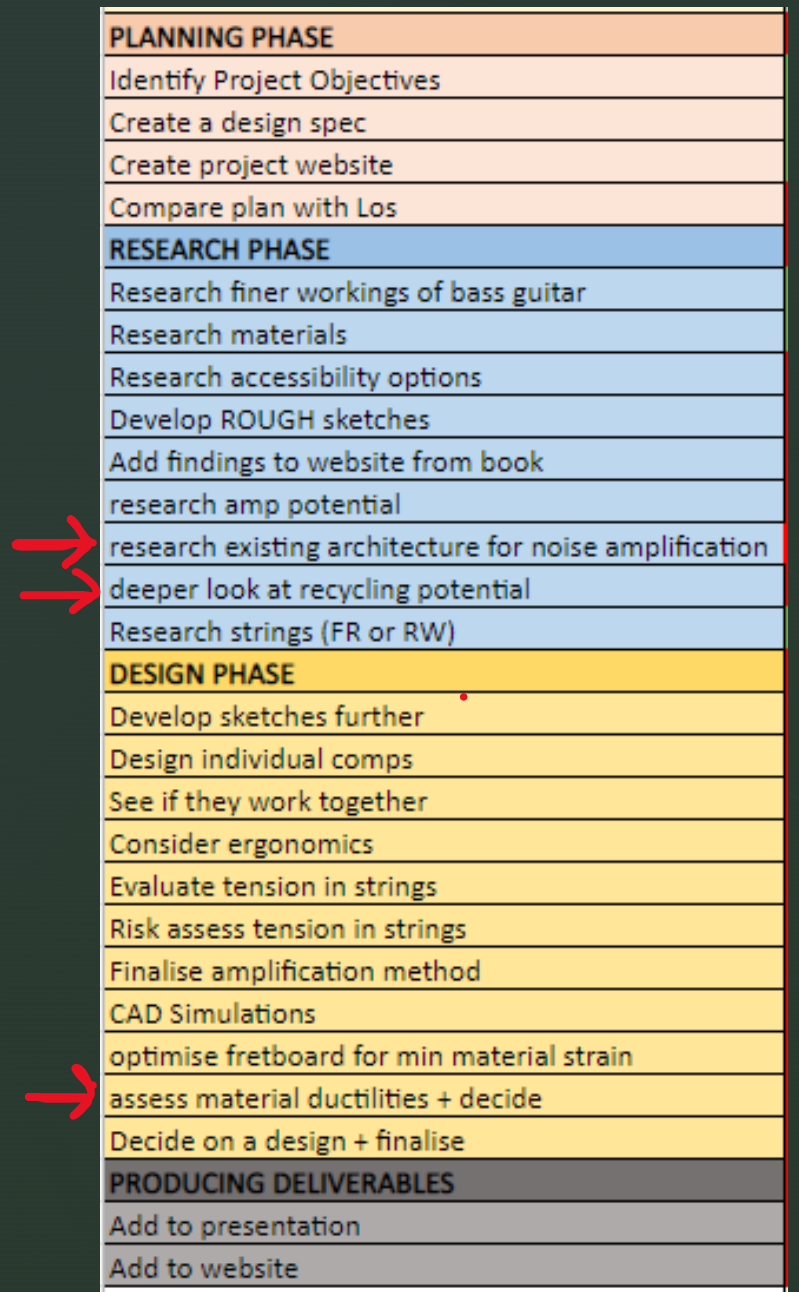
DE501

Here are the parts of my plan that fit into the DE501 Learning Objectives.

On the CAD simulations I will design a generic model for the bass body shape and apply up to 90 Newtons of force. I will do this to ensure that the bass will not collapse if the applied force exceeds the average 70N.

By doing this, I can see how the body may warp and where the highest stresses are so that I can add structural reinforcements to the body.



DE502

Here are the parts of my plan that fit into the DE502 Learning Objectives.

In taking a deeper look at recycling potential, I discovered that it would be very difficult to gain *recycled* wood for the body and neck of the bass. However, *reclaimed* wood (for example, the intact wood found in scraps and dumps) can be obtained for cheap and used to form the body.

Strings are fully recyclable. The miscellaneous components (such as the pegs, the nut, the frets) cannot be recycled due to their materials.

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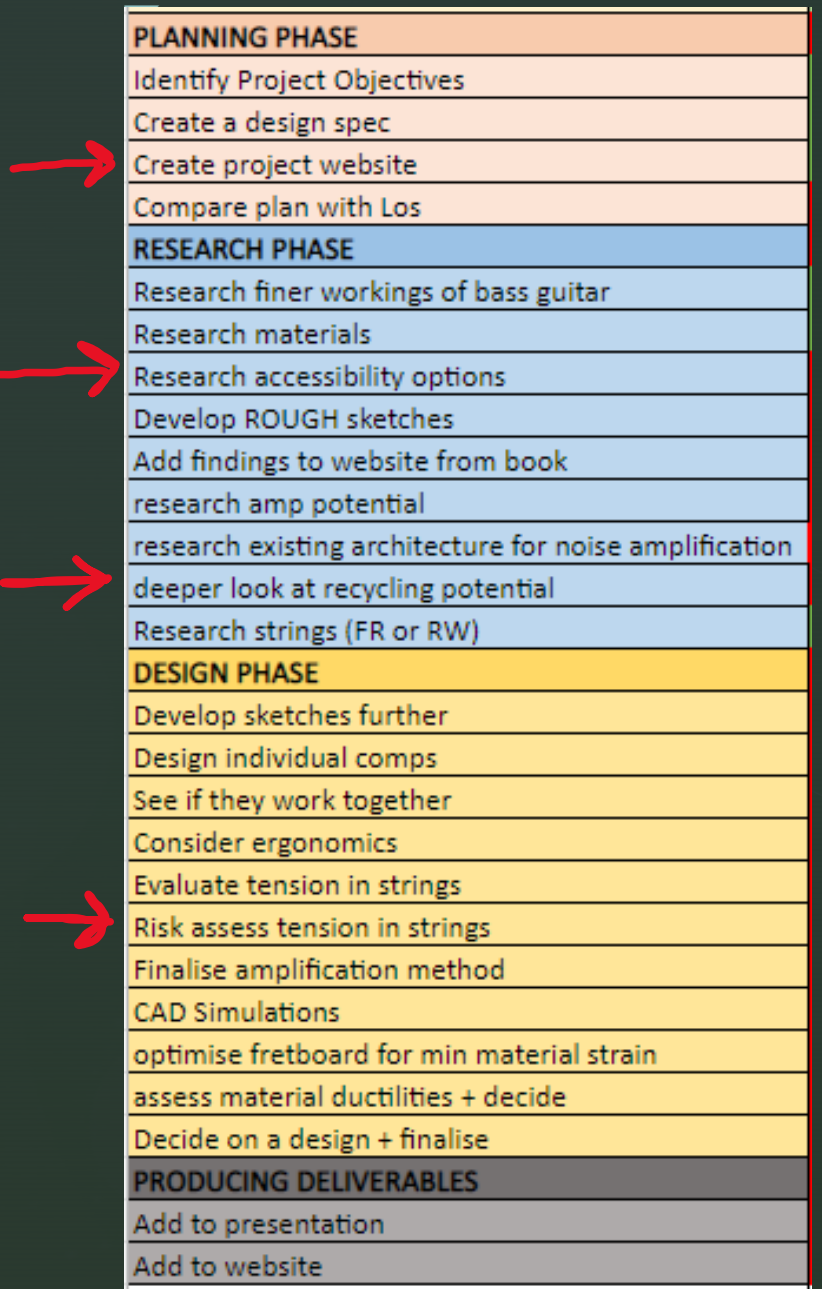
DE503

Here are the parts of my plan that fit into the DE503 Learning Objectives.

To consider ergonomics I intend to go to a musical instrument store and test out as many differently-shaped basses as I can. This way, I can get a feel for which shapes are most and least comfortable.

I will then conduct a survey aimed towards bass players to expand my research pool and gain more general opinions about several components of the product.



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DE504

Here are the parts of my plan that fit into the DE504 Learning Objectives.

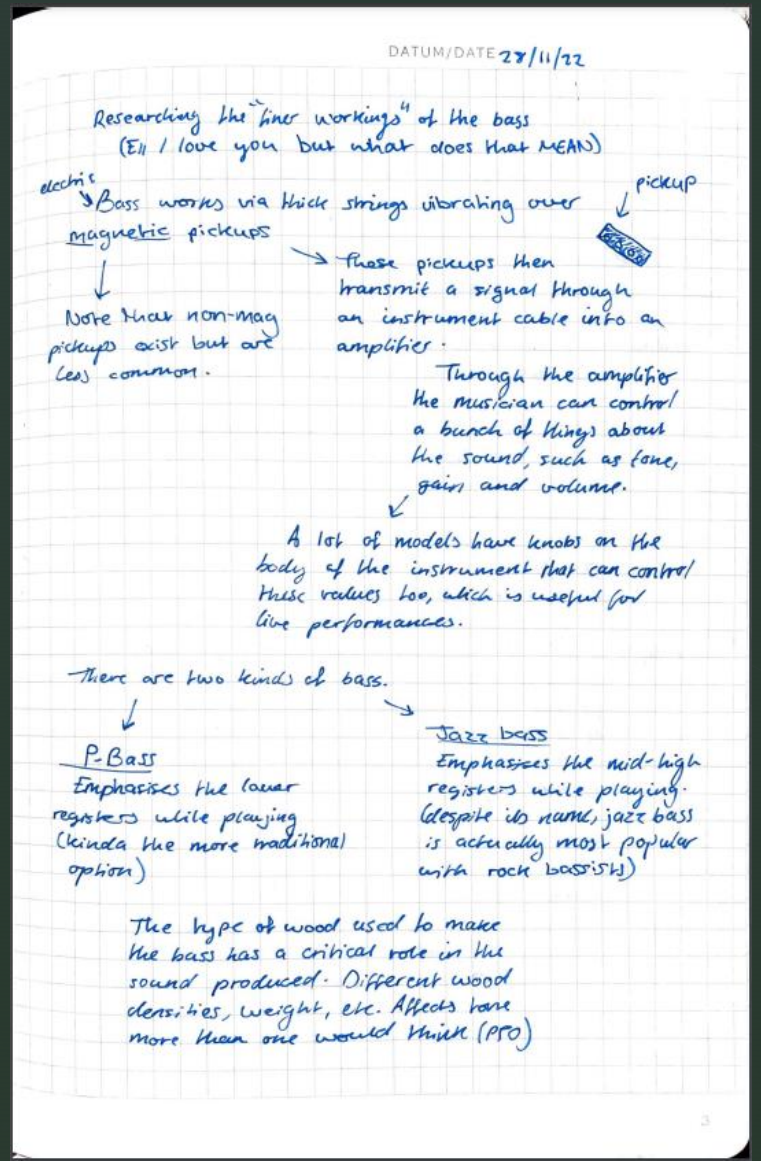
I will risk assess the tension in the strings by performing tests to see how much tension the strings alone can bare before they snap, as well as some research into how much damage a snap would potentially cause to the human body.

Strings snapping is a common occurrence in string instruments and is rarely harmful to the player, but that doesn't mean that the risk can be disregarded.

Research Tidbits

As of the presentation date I am beginning to move out of my research phase and integrating into my design phase for this project. To assist me in providing evidence for the work I've been doing for the past few weeks, I have scanned in my handwritten notes and will walk through them now.

Research Tidbits (how the bass works)



DATUM/DATE 27/11/22

Researching the "inner workings" of the bass
(Ell / love you but what does that MEAN)

electric Bass works via thick strings vibrating over magnetic pickups → pickup

Note that non-mag pickups exist but are less common.

These pickups then transmit a signal through an instrument cable into an amplifier.

Through the amplifier the musician can control a bunch of things about the sound, such as tone, gain and volume.

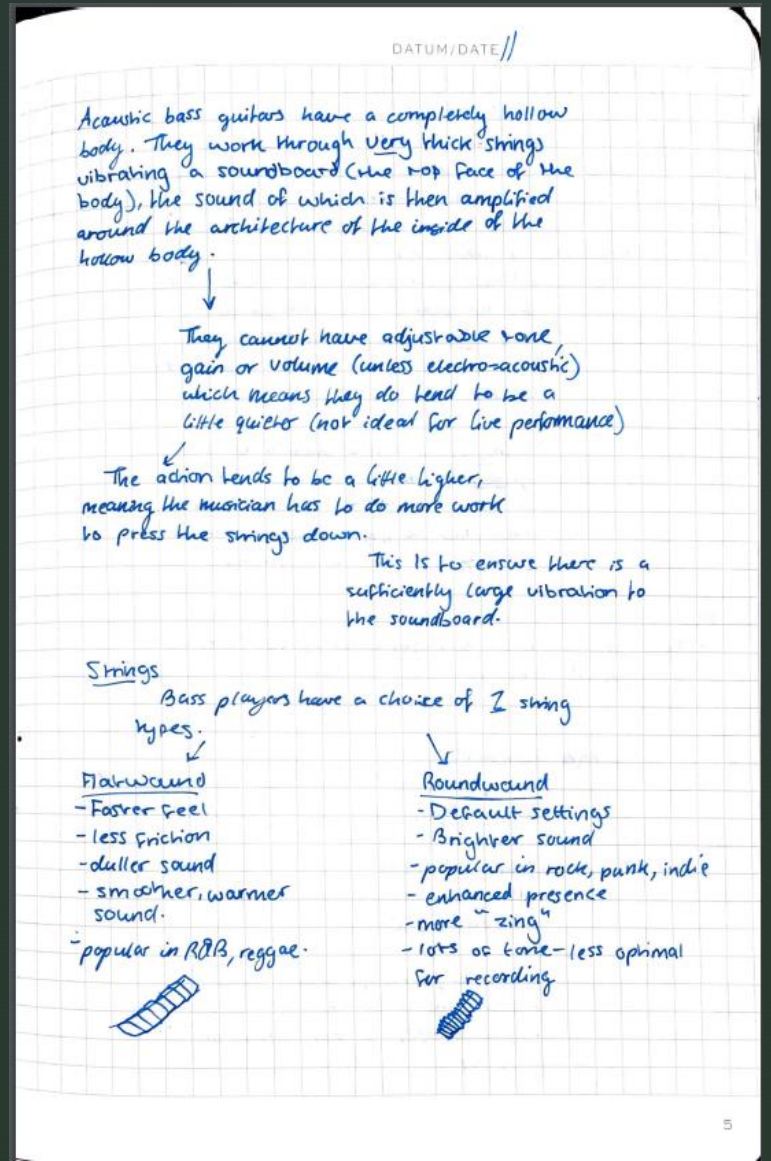
A lot of models have knobs on the body of the instrument that can control these values too, which is useful for live performances.

There are two kinds of bass.

P-Bass
Emphasises the lower registers while playing (kinda the more traditional option)

Jazz bass
Emphasises the mid-high registers while playing. (Despite its name, jazz bass is actually most popular with rock bassists)

The type of wood used to make the bass has a critical role in the sound produced. Different wood densities, weight, etc. Affects tone more than one would think (PTO)



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Acoustic bass guitars have a completely hollow body. They work through very thick strings vibrating a soundboard (the top face of the body), the sound of which is then amplified around the architecture of the inside of the hollow body.

They cannot have adjustable tone, gain or volume (unless electro-acoustic) which means they do tend to be a little quieter (not ideal for live performance)

The action tends to be a little higher, meaning the musician has to do more work to press the strings down.

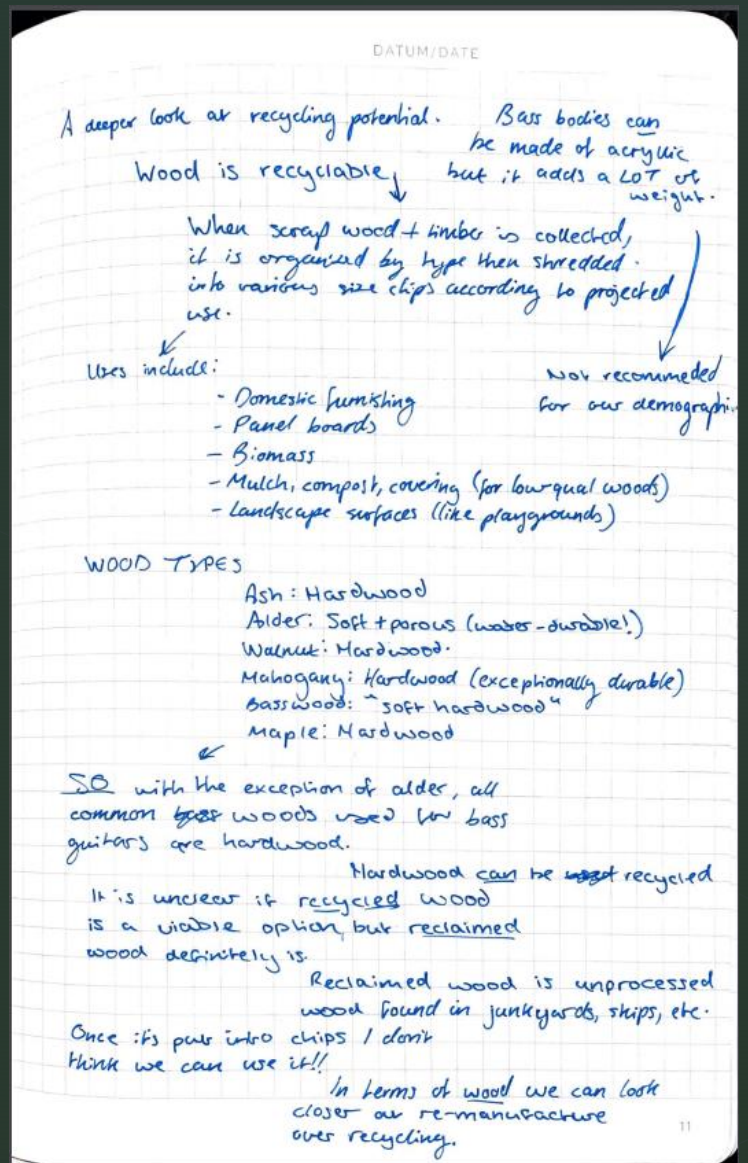
This is to ensure there is a sufficiently large vibration to the soundboard.

Strings
Bass players have a choice of 2 string types.

Flatwound
- Faster feel
- less friction
- duller sound
- smoother, warmer sound.
- popular in R&B, reggae.

Roundwound
- Default settings
- Brighter sound
- popular in rock, punk, indie
- enhanced presence
- more "zing"
- lots of tone - less optimal for recording

Research Tidbits (recycling potential)



DATUM/DATE

A deeper look at recycling potential.

Bass bodies can be made of acrylic but it adds a LOT of weight.

Wood is recyclable

When scrap wood + timber is collected, it is organized by type then shredded into various size chips according to projected use.

Uses include:
- Domestic furnishing
- Panel boards
- Biomass
- Mulch, compost, covering (for low qual woods)
- Landscape surfaces (like playgrounds)

Not recommended for our demographic

WOOD TYPES

Ash: Hardwood
Alder: Soft + porous (water-durable!)
Walnut: Hardwood.
Mahogany: Hardwood (exceptionally durable)
Basswood: "soft hardwood"
Maple: Hardwood

SO with the exception of alder, all common ~~bass~~ woods used for bass guitars are hardwood.

Hardwood can be ~~wood~~ recycled

It is unclear if recycled wood is a viable option, but reclaimed wood definitely is.

Reclaimed wood is unprocessed wood found in junkyards, ships, etc.

Once it's put into chips I don't think we can use it!!

In terms of wood we can look closer at re-manufacture over recycling.

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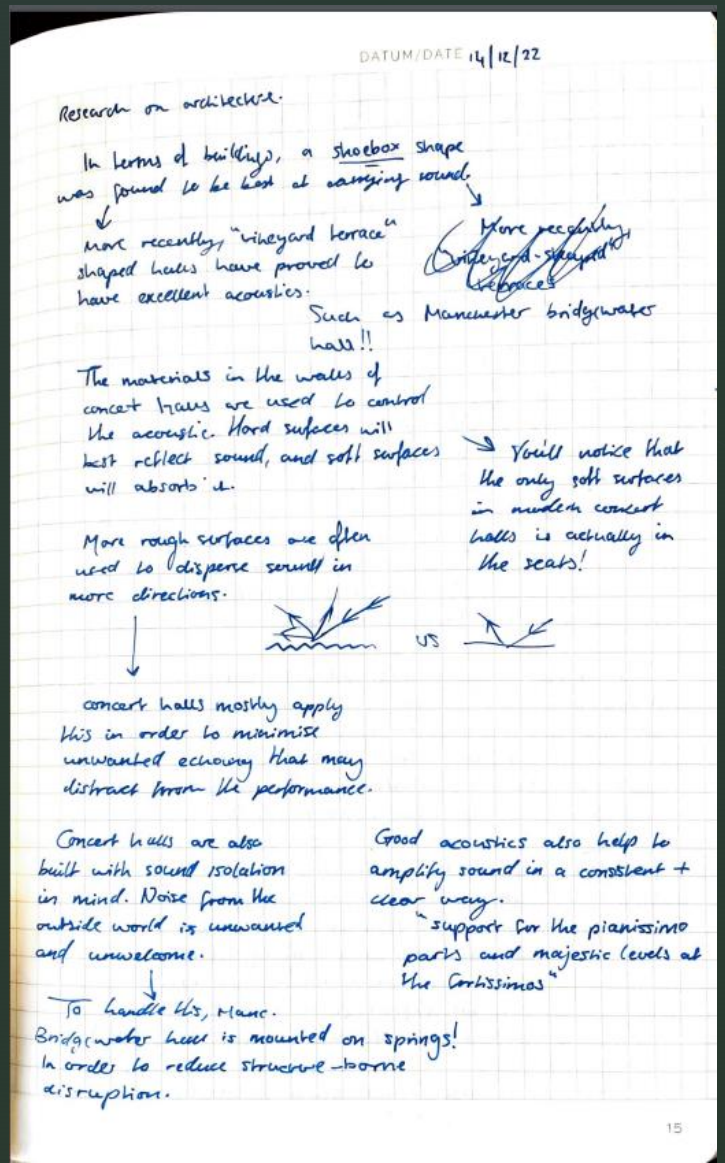
Research Tidbits (architecture)



DATUM/DATE 14/12/22

Research on architecture.

In terms of buildings, a shoebox shape was found to be best at carrying sound.

More recently, "vineyard terrace" shaped halls have proved to have excellent acoustics.

More recently Interwoven-shaped balconies

Such as Manchester bridgewater hall!!

The materials in the walls of concert halls are used to control the acoustic. Hard surfaces will best reflect sound, and soft surfaces will absorb it.

You'll notice that the only soft surfaces in modern concert halls is actually in the seats!

More rough surfaces are often used to disperse sound in more directions.

vs

concert halls mostly apply this in order to minimise unwanted echoing that may distract from the performance.

Concert halls are also built with sound isolation in mind. Noise from the outside world is unwanted and unwelcome.

Good acoustics also help to amplify sound in a consistent + clear way.

"support for the pianissimo parts and majestic levels at the fortissimos"

To handle this, Manc. Bridgewater hall is mounted on springs! In order to reduce structure-borne disruption.

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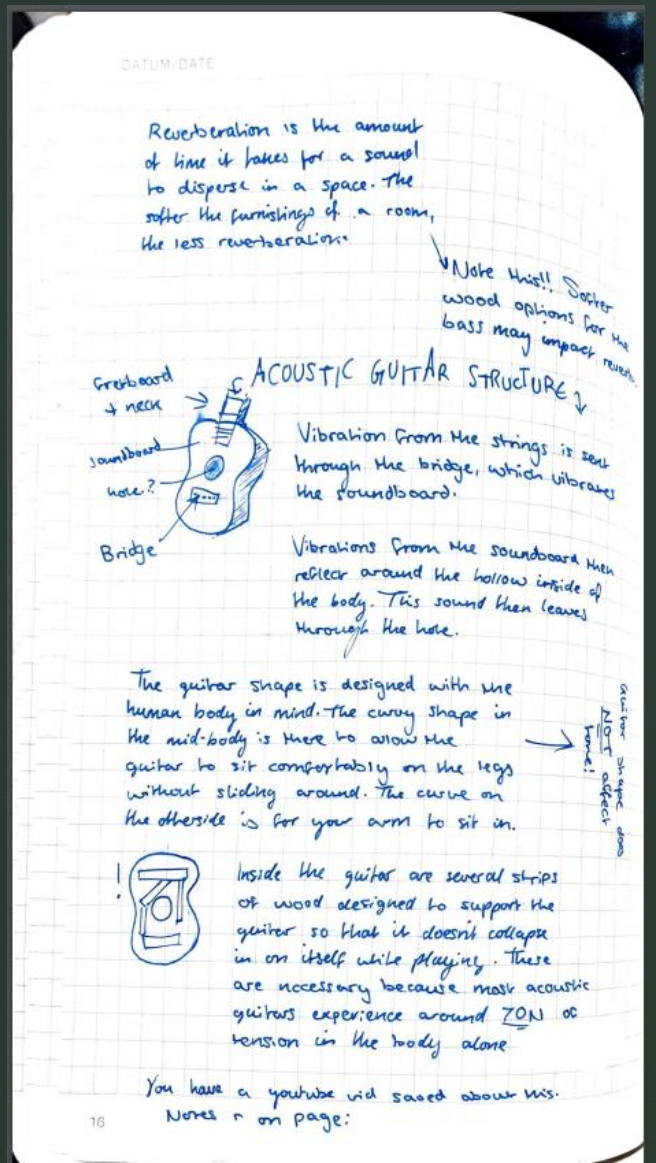

DATUM/DATE

Reverberation is the amount of time it takes for a sound to disperse in a space. The softer the furnishings of a room, the less reverberation.

Note this!! Softer wood options for the bass may impact reverb.

ACOUSTIC GUITAR STRUCTURE

Fretboard + neck

Soundboard

Hole?

Bridge

Vibration from the strings is sent through the bridge, which vibrates the soundboard.

Vibrations from the soundboard then reflect around the hollow inside of the body. This sound then leaves through the hole.

The guitar shape is designed with the human body in mind. The curvy shape in the mid-body is there to allow the guitar to sit comfortably on the legs without sliding around. The curve on the otherside is for your arm to sit in.

Guitar shape does affect tone! NOT

Inside the guitar are several strips of wood designed to support the guitar so that it doesn't collapse in on itself while playing. These are necessary because most acoustic guitars experience around TON of tension in the body alone

You have a youtube vid saved about this.

Notes r on page:

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What next?

The next stage in my plan according to my Gantt chart is to conduct further research and begin to develop very rough sketches for some components of the bass guitar.

As well as this, I intend to expand my Gantt chart to include writing a short essay on engineering ethics, as well as filling some gaps in the learning objectives.

What next?

As well as this, I am going to start looking into reaching out to bass guitar manufacturers (namely Harley Benton, as that is the model of bass that I own and am basing measurements off) in hopes to develop a network and professional skills.

That's all for now!

THANKS