Notebook of rough notes taken over the duration of this computing project. Based off weekly meetings with Dr David Greenwood. Student no: 100237819

Character animation Rig Project INFO

- the project is more of a document (50 pages) so you gotta KNOW about blender and what you doing and make it Interesting for them and me.
- Rigging → provides a tool/interface for animation. Like the middle between modelling and animation
- Character Animation → is vague, could be anything that shows personality
- You'll be using a mesh (doesn't have to be triangulated e.g. could be Quads)
- Optimal level of project could be like FULL human moving motion

★ PYTHON API – Every button in blender has a matching Python function, you can see if you hover over. This is where the small bit of vector maths will occur. NumPy is the library for 3D maths in Python.
★ Look on Github for examples and make private REPO to store your code for you and David
- David is sick at Python so ask him for stuff

(easier to access)

- Blender has a nice 2D Package so could do it in 2D
- Everything is light so Surface Book 2 is calm for this project, and do in Labs

★ Links to get started knowing what you'll need (don't need to know all of blender)

* [Basic Rigging](https://www.youtube.com/watch?v=ERASeO1sBZk)
* [Lo-poly Rigging](https://www.youtube.com/watch?v=srpDewAUU8U)
* [Lo-poly Character](https://www.youtube.com/watch?v=4OUYOKGI7kD)

C
O

- Use notepad to take notes about blender
- Blender guru on YouTube has a good series too that david linked. and there's other blender python help on Utube and Github and google

- Project written in Latex! Overleaf
- Davids office is → office SCI 2.16a
- Don't need ethics approval X
- Always use Havard referencing
- Literature review should have 40 sources

MOSCOW Analysis

MUST = armature, model, scene
SHOULD = IK, appealing
COULD = Texture map, Autorig, use more maths
Won't = VFX, audio, cinematics

Report

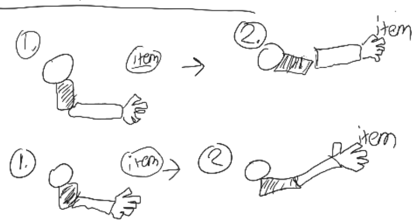
- Make a section about how Python API works. Use this Github Repo →

- Report Structure so far
  - Title
  - Abstract + Acknowledments
  - Contents
  - Lit Review
  - How python works

Demo/inspection

- Use Gifs for IK and other
- Don't do much live code, pre recordings!
- Minimize text on slides, more pics
- Use a pre recorded mp4 & Animatio

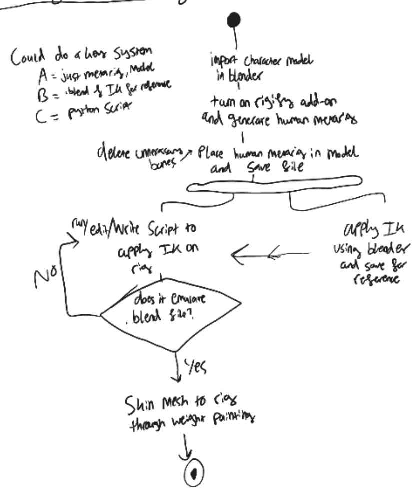
Forward and Inverse kinematics



Notes

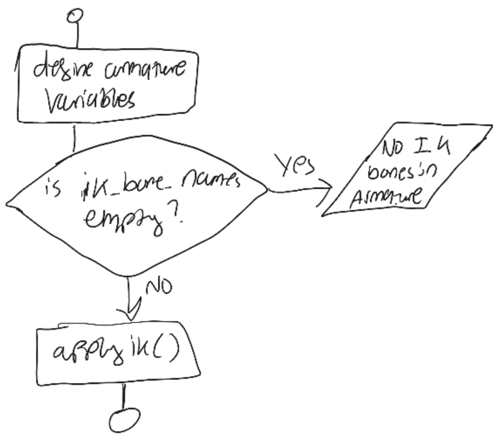
- Include table & Supplementary material
- reference other studies in conclusion
- Evaluation could use Likert Scale Survey? or a PYTHON unit test

Workflow Draft



Flowchart draft

- Check_armature func



Backflip KEYFRAMES

KARATE SIDEKICK KEYFRAMES

- Try doing things in blender first - Live armature then see python
- UV editing for materials
- Use that stackexchange code for mark
- check for tutorials on python applying IK in Script

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26th Oct

- Put Lit review in final report Project on Overleaf so you can basically start final report now

2nd Nov

- South Park is a good example of 3D → 2D
- Check email for animation powerpoint David sent → has definitions
- Conclusion: on track but a long way to go.

23rd Nov

- Unit testing in Python is great as you can test a portion of isolated code
- Final report could have user testing to give opinion on the rig
- Uncanny Valley is relevant to Lit review

30th Nov

- For Progress report: flowchart or activity UML diagram to show pipeline of work, rather than a useless UML
- Anime character should have various poses that it fluidly switches to.
  ↳ Look into toon Shader
- Could compare Shaders - start with 2 spheres in different Shaders
- Use GITHUB for project

7th Dec

- Good Progress on Progress report
- When Studying practice Space repetition
- Unit test could be find mean of Vertices in the Blender cube
- refresh yourself on Computer Graphics

11th Jan

- Use Pycharm for Scripts and (update) save to Github repo
  Use Command line in Blender to rerun, use those commands in Github python help
- Do lots of Python Blender now and document

18 Jan

You're using windows so how to add blender to path
how to run on command line with all that blender.exe (windows specific) --background
how to pass arguments on the command line with the --, makes like commands appear in blender
how to add add on to blender when you went Edit and Properties for logging (why and what is logging)
unittesting and mention the test folder
__init__.py

25 Jan

- Upload light Geometry, 2D anime
- Build with scripts - make a scene
- By next week
- Make a head with moving eyes
  ↳ Upload head dain

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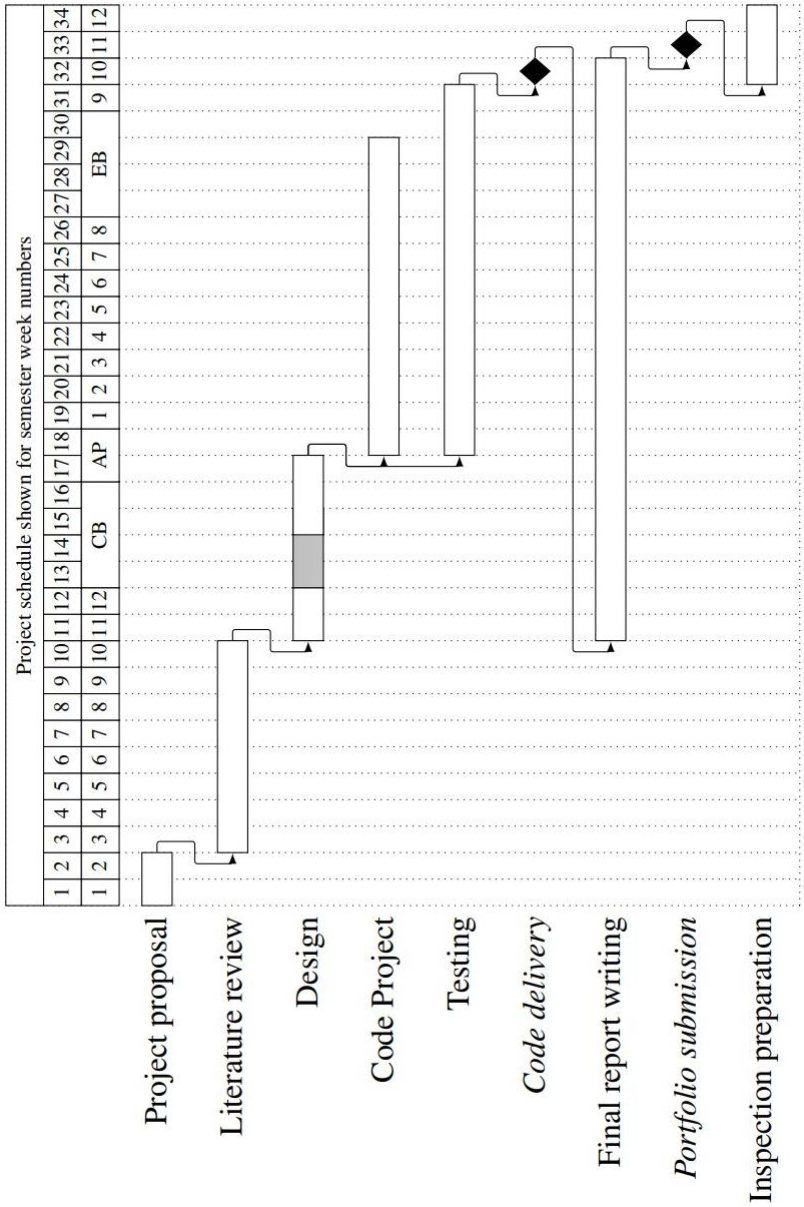

Project Gantt Chart ← was followed until the end. But coding took about 2 weeks longer

LATEX SECTION NOTES FOR FINAL REPORT:

\section{Character Rigging}\label{Rigging}

%Need python pseudocode or listing for any mathematical tings you may probs need to do on rig script

%before was just practice. Use model, rig model, do poses, say intentions with model e.g. anime ninja character. Why rig before you stylise the character?

%unfinished

As introduced in section \ref{sub:rig}, rigging is the process of creating armatures to deform the 3D geometry.

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Rigging can be considered a tool for an animator; it grants easy access and control over a complicated model. Thus, this section helps bridge the gap between art and programming. Working with \cite{turbosquid} head model in section \ref{Python} granted foundational knowledge in rigging with Blender and Python. This section comprises all the previous knowledge and executes a functional rig on the character model using Blender's Rigify add-on and inverse kinematics (section \ref{sub:IKFK}). Rigging \cite{kakashi2015}'s model is more advanced than the rigging in section \ref{sub:rig}.

%rigify sec?

Rigify involves using armatures with a large intricate system of bones and generating rig controls, the final model is full-body, and weight painting will be more complex.

\subsection{Workflow}\label{sub:workflow}

%highlight the overview of how I will be doing this shit, maybe with a DIAGRAM - google workflow diagram, could have some conditionals in there like

%Include miniscual details maybe like how you do the symmetry X thing for easier workflow.

%basically, use rigify for metarig, use script to get IK (deform box unticked), set automatic weight paints and weight paint, start posing- diagram this and have conditionals

%Note: turn rigify addon ON

The rigging process is as follows:

build scene in python...

...

skin mesh to rig

weight paint preciesly

enter pose mode to create poses that generate character animation

\subsection{Rigify}\label{sub:rigify}

%The free auto rig generator that can make them poses work

%understanding IK and FK handles - Mention inverse and forward kinematics

%IK-RK stretch toggle, 1/green thinhg is FK, 0/red if IK. IN RIGIFY

%COULD do a thing where you show rigging using rigify, then do your own rig from scratch by coding inverse kinematics or forward kinematics using utube vid

%COULD show what you have done with rigify and how it rigs, then do yo own

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%mention metarig "armature", system of bones to imitate a human skeleton but for 3D rigging. More info at - https://docs.blender.org/manual/en/latest/addons/rigging/rigify/metarigs.html

%rigify creates a new rig to control the body, mention in scripting or IKFK that I will just use one for simplicity

Rigify is a built-in Blender Add-On

\subsection{Human Movement}\label{sub:movement}

%I described rigging as skeleton in human in section..., this is how you get realistic/fluid movement

%My character is a humanoid so despite its cartoonish nature, it needs to move like a human realistically to convey the idea of a human character moving

%Using IK and/or FK i can achieve human movement because...

\subsection{Inverse and Forward Kinematics}\label{sub:IKFK}

%IK picks a target and everything follows, whereas FK moves each bit independently,

%IK moves something and everything of its root moves after, FK moves something and everything above it moves too

%Big part of how to emulate human movement and big part of rigify addon. IK is best for human movement imo

%https://ashemclemore.blogspot.com/2019/05/ikblender-span-display-block-overflow.html - IK in blender for beginners

%Space out the definitions or any equations for better effect

%Could show figures on how you did it in blender then show minted listings of the key functions that do it in python and reference the script as it'll be in suplementary material

\subsection{Scripting}\label{sub:script}

%python helps speed up tasks that would be longwinded just in blender

%OR could show a key minted listings of key python functions here and explain how rigging in python works like the difference between edit_bones and pose_bones, toggling EDIT or POSE. How the script works and purpose and reference it. so like edit_bones are the hierarchy of bones you can access only when the MODE=EDIT

%mention searching blender official source code for rigify

%mention armatures head and tail. important to how its applied in script

%main script has reusable functions and can be reusable on other .blend files with armatures

%mention your issues, like realising selecting active object means selecting an object not an armature, so need armature object data.

\subsection{Weight Painting}\label{sub:weightpainting}

%mention skinning - linking mesh to rig

%Now that the script works, skin mesh by making sure its positioned right, CTRL P for automatic weights, and do some advanced weight painting - show figures of the issues with hair and how you weight painted the resolution

%RESEARCH how to weight paint with clothes and cite it

\section{Character Animation}\label{CA}

%DEMONSTRATE How will you bring this character to life! refer to lit review section

%%%Reference manga university book for the poses that you will do - and other martial artists scholarly

Following the 11 principles of animation in \ref{lit:ani}

\subsection{Action Poses}\label{sub:Aposes}

%Reference manga university book for the poses that you will do

%Figure of sketched poses on microsoft whiteboard

%jump build up, Jump, kick, super hero landing, punch, ninja pose?

full body poses that represent some sort of emotion and action that is identifiable and attractive

\subsection{Emotive Poses}\label{sub:Eposes}

%\subsection{Eevee Animation}https://www.overleaf.com/project/617976c718bfe1ff8b478c06

\section{Evaluation}\label{Eval}

Use academic method of testing character animation and test on subjects with bar chart or something

It is hard to evaluate this as it is subjective

Why have 2 testing methods?

\subsection{Subjective Testing}\label{sub:subjective}

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%survey? bar chart results?

\subsection{Academic Testing}\label{sub:academic}

\section{Conclusion}\label{Con}

%COULD make a separate addon to make a custom panel to aid with rigging like how rigify does - https://medium.com/geekculture/creating-a-custom-panel-with-blenders-python-api-b9602d890663

%Talk about reusability of the script and if it can be used for another model

%Talk about efficiency

%Talk about the success, have I accomplished attractive character animation?