COMP3180 – Final Project Report

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**Modelling and Animation Using Scanning Technologies in Unreal Engine 5.2**

# Project Deliverables

The [Unreal Engine Project](https://github.com/Mood4Design/Comp3180FinalProject) in Figure 1 Pipeline aims to integrate 3D scanned techniques into character modelling and animation seamlessly, refining asset quality for higher realism in Unreal Engine, which has a quicker and simpler process. These goals directly translate into my project deliverables, which include the following:

A diagram of a software project

Description automatically generated with medium confidence

*Figure 1: Project Pipeline*

A computer program for a computer

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*Figure 2: Animation System Breakdown (Unreal Engine 4 Documentation, 2021)*

*A diagram of a project

Description automatically generated*

*Figure 3: The ownership and flow of data (Unreal Engine 4 Documentation, 2021)*

|  |
| --- |
| 1. **Integrated Scanned Character Models**   Create MetaHuman models showcasing seamless integration of 3D scanned elements and data shown in Figure 3, demonstrating the fusion of realistic features with virtual characters.   * [Instructions for Successful 3D Scanning Using PhotoCatch.](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/3bd0372797877887bf29e83381e6d5c9d21ae254/Documents/3D%20Scan.pdf) * [Video of a Generated 3D character from PhotoCatch capture.](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/89812c755e61e7846aec8ac9da8d8ee497a5ec89/Videos/Generated%203D%20character%20from%20capture.mp4)      * [Creating Metahuman Models from 3D Scanned Mesh Using PhotoCatch and Footage Data using Live Link Face App](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/e547188cf25fe921f142276f0fa95cd5bcc5b33a/Documents/Creating%20Metahuman%20Models.pdf) * [A video of MetaHuman Models](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/3b253b45dff5be26cd98846d709e6bbb26bc0ecc/Videos/MetaHuman%20Models%20.mp4) |
| 1. **Animation Showcase:**   Use UE 5.2 Animation System in Figure 2 to develop animations highlighting the enhanced realism achieved through motion capture data from scanning technology.     * [A video of four animated individual faces and two body-animated MetaHumans created in UE 5.2](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/8dccd52a381fd2028fa57f26b8f34b2c8b243a0d/Videos/Animated%20MetaHumans.mp4) * [A document demonstrates facial and body animations with Control Rig and IK Rig.](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/429197b828b1bb326ac88836792436b03c2c2f03/Documents/Animating%20MetaHumans.pdf) * [A complete Build of Modelling and Animation can be downloaded and played.](https://mood4love.itch.io/metahuman) |
| 1. **Asset Transition Demonstrations:**   Provide written instructions demonstrating the smooth transfer of assets between Maya and UE 5.2 platforms.   * [A document illustrates transferring resources and assuring compatibility.](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/540378ecaec75772f89ad3a5e97f1a7f8c8cf4cb/Documents/Optimising%20Asset%20Transition.pdf) |
| 1. **Interactive Portfolio Piece:**   Produce a video demonstration showcasing the integration of character models and animations, representing project achievements. |
| 1. **Comprehensive Guide:**   Combine all workflows to create an extensive guidebook outlining the 3D modelling and animation pipeline using scanning technology, catering to beginners.   * [A Comprehensive Guidebook](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/6070ce2d0dc9fbcf97b1cd4175bbb1c8e2d1d54d/Documents/Modelling%20and%20Animation%20Guidebook_V5.pdf). |
| 1. **Quality Assurance and Survey Data Analytics:**   help identify and rectify potential discrepancies or malfunctions, ensuring a seamless and reliable project.   * [An Excel document of QA Plan](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/9f46aa394b6095850da017d0961cb2f7ff7aaf15/Documents/Modeling%20and%20Animation_QA%20plan.xlsx) * [An image showcasing the Modelling and Animation Debug Output to demonstrate the successful implementation of the QA plan](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/7a30e47aa1d0cc0b348dfeae58ce367ed8a27e8c/Documents/AnimationDebugOutput.png)   20 participants including primary and final survey data.   * [Primary Survey Data Analytics](https://github.com/COMP3180-23s2/comp3180-final-project-Mood4Design/blob/23e98bfa111bdd2c9233721bbd87edc68bba9d4a/Documents/psda.xlsx) * Final Survey Data Analytics   Both Modelling and Animation Primary Survey (psda.xlsx) and Final Survey Data (fsda.xlsx) Data were gathered to evaluate (Petri Lankoski & Staffan Bjork, 2015) and assess various aspects of the project, including the integration of scanned elements, the realism of animated models, and the overall satisfaction with animations. |

# Milestones

## Up to Week 7

Achievement: Successfully finalised the Research Report, summarising the critical aspects of integrating scanning technology into character modelling and animation techniques. Identified key references and outlined the proposed project, emphasising its industry relevance. Successfully completed set up systems as required (linked guidebook in the deliverables above).

## Mid-session break

**Achievement:** Commenced the exploration of 3D scanned elements (PhotoCatch – 3D Content Creation Studio, 2023) in integration into character modelling. Successfully imported scanned data into modelling software Maya 2023 (Help, 2023), achieving initial integration success. Identified post-processing techniques for refining asset quality in UE 5.2 (Unreal Engine 5.2 Documentation, 2023).

**Roadblock:** Encountered minor challenges with imported OBJ files in optimising asset transitions between 3D scan and Maya software applications regarding the unit scale, which necessitated additional research.

## Week 8

**Achievement:** Made significant progress in refining scanned asset quality through post-processing techniques, resulting in a noticeable improvement in realism. Conducted detailed experiments to fine-tune the integration process for a smoother workflow from MetaHuman to the project using Quixel Bridge (Quixel Bridge Plugin for Unreal Engine, 2022).

**Roadblock:** Faced challenges in achieving optimal mesh clean-up and texture mapping, requiring further experimentation and adjustments

## Week 9

**Achievement:** Achieved a milestone in realistic character modelling, aligning scanned objects' features with the virtual character's face using Live Link Face App (Recording Facial Animation from an IOS Device, 2021). Gained proficiency in sculpting and retopology, contributing to higher-quality character models in MetaHuman Creator (MetaHuman Documentation, 2023).

**Roadblock:** Encountered some difficulties in rigging processes, such as the head unattached to the body Riggs, prompting a deeper dive into these areas for improvement.

## Week 10

**Achievement:** Successfully enhanced animation realism by utilising motion capture data from scanning technology. Achieved more lifelike character body expressions and movements (Mixamo Animation Retargeting 2 in Code Plugins - UE Marketplace, 2022), significantly elevating the overall quality of animations. Productively resolved the head re-attachment on the face to the body animation.

**Roadblock:** Faced challenges in motion capture data clean-up and encountered inconsistencies in face animation sequences. This prompted a re-evaluation of the animation techniques, requiring additional refinement of head reattachment to ensure a seamless and immersive animation experience.

## Week 11

**Achievement:** Optimised asset transitions between UE and Maya applications and ensured seamless compatibility and data integrity using Metahuman Facial Transfer (Nolan, 2023). Successfully demonstrated the smooth transfer of resources, improving the overall workflow.

Launched and conducted successfully on primary survey in Google form.

**Roadblock:** Encountered minor issues in survey form, such as clarity and consistenc**y** requiring additional time for refinement.

## Week 12

**Achievement:** Finalised the comprehensive guidebook, covering the entire 3D modelling and animation pipeline using scanning technology. Created an interactive portfolio piece showcasing the project's accomplishments. Analysed Primary Survey Data. Launched and conducted successfully on final survey in Google form.

**Roadblock:** No major roadblocks were encountered in this week.

## Week 13

**Achievement:** Conducted three comprehensive playtesting sessions focusing on character modelling, animation realism, and asset transition. Compiled detailed playtesting report and analysed the gathered data for insights.

**Roadblock:** While analysing the Survey data, I encountered inconsistencies in user feedback regarding face animation sequences.

# Evaluation

This evaluation's main objective is to rate the usefulness, usability, and overall user experience (UX) (Anders Drachen et al., 2018) of the outputs produced for my project. These deliverables above were created to incorporate cutting-edge scanning technologies to improve the realism and engagement of in-game characters.

The Quality Assurance (QA) (Heather Maxwell Chandler, 2020) was involved in development from the beginning to provide guidance. Complete comprehensive testing data and survey analytics (linked in the deliverables above) were included in the assessment process to ensure the project's functional aspects worked as intended. I will now consolidate the critical feedback, explicitly addressing the needs for this evaluation from two target audiences. I was pursuing to refine and enhance the integration of 3D scanning technologies within modelling and animation techniques, laying a robust foundation for upcoming projects in this relevant field.

## Methodology:

Eight (7 male, 1 female, 18 to 44) plus fourteen (13 male, 1 female, 18 to 59) participants of game developers and animation artists from primary and final surveys, particularly those engaged in character modelling and animation within the game development field, are the intended audience for this study. Participants in the research included a wide range of game creators, from moderate to expert levels of familiarity with Modelling and Animation techniques. Each participant engaged with the deliverables and gave them quantitative approaches (Petri Lankoski & Staffan Bjork, 2015) experiences such as feedback survey. These comprehensive surveys comprise primary and final to ensure accurate data.

Put into the Final Survey Data Analytics Methodology:

**Survey Participants and Demographics**

The survey participants encompassed a diverse group of professionals within the game development and animation domain. The primary survey included eight participants, consisting of seven males and one female, ranging in age from 18 to 44. The final survey expanded the cohort to fourteen participants, with thirteen males and one female, spanning from 18 to 59 years of age. This selection was deliberate to incorporate a broad spectrum of perspectives and experiences within the field. The participants were predominantly game developers and animation artists, specialising in character modelling and animation, thus representing a highly relevant target audience for this study.

**Expertise Levels and Engagement**

The participants were strategically chosen to represent a range of expertise levels in Modelling and Animation techniques. This selection criteria ensured that insights were gathered from individuals with varying degrees of familiarity and proficiency in the subject matter. From those moderately acquainted with the techniques to seasoned experts, each participant engaged with the project's deliverables. Their diverse levels of expertise provided a comprehensive spectrum of perspectives, enriching the feedback and contributing to a well-rounded evaluation.

**Quantitative Approaches to Data Collection**

To ensure a rigorous and structured approach to data collection, participants engaged in comprehensive surveys. These surveys were designed to gather quantitative data on various aspects of the project, aligning with established methodologies in the field (Petri Lankoski & Staffan Bjork, 2015). The primary survey laid the foundation by capturing initial perceptions and expectations, while the final survey assessed the impact of improvements made to the project. This dual-survey approach was employed to ensure a robust and accurate representation of participant feedback, allowing for a detailed analysis of the project's evolution.

**Survey Structure and Iterative Process**

Both the primary and final surveys were meticulously structured to cover key dimensions, including integration of scanned character models, animation realism, movement fluidity, and overall satisfaction. The iterative nature of the survey process allowed for the incorporation of participant insights into the project's development. This ensured that feedback was not only collected but actively used to refine and enhance various elements of the animations, thereby optimising the overall quality and impact of the project.

## Findings:

### Primary Survey

The primary survey data shows the following factors:

1. **Participant Demographics:**

* Collected feedback from 8 participants aged 18 to 44.
* The gender distribution was predominantly male and just one female.
* Most participants have a moderate familiarity with Modelling and Animation techniques.

1. **Integrated Scanned Character Models:**

* Participants generally found integrating scanned elements into character models effective, with an average rating of 3.6 out of 5.

**Specific comments or suggestions regarding the integrated character models:**

Participants provided detailed feedback on the integrated character models. They mentioned various observations, including:

* + the imperceptibility of skin conditions, a suggestion to ensure consistent facing for image scanning, recognition of hair modelling challenges alongside commendation for facial structure,
  + A comparison between original and 3D models highlighting the importance of defined facial features and an acknowledgement that the models, while not award-winning, are credible and suitable for diverse applications.
  + Additionally, one participant expressed familiarity with scanned individuals, noting their recognisability based on the scan's realism.

1. **Realism of Modelling and Animation:**

* The perceived realism of the animated models created using scanning technology varied. Ratings ranged from “somewhat realistic” to “extremely realistic”, indicating a generally positive reception of the animated models.
* Some participants commented on hair modelling and facial structure, suggesting room for improvement.

1. **Movement Fluidity:**

* Movement fluidity was predominantly rated as fluid, contributing to the effectiveness of animations. Some participants finding it moderately fluid and others describing it as extremely fluid.

1. **Facial Expressions:**

* Facial expressions were considered very effective, rating as “very effective” or “moderately effective”.
* Facial expressions changing during character movements were noted, enhancing realism.

1. **Body Expressions:**

* Animation effectiveness in conveying body expressions was rated between “moderately effective” and “very effective”.

1. **Animation Impact on Immersion:**

* Participants generally agreed that animations significantly enhanced immersion.

1. **Consistency Across Animations:**

* Most animations were considered consistent throughout, although some inconsistencies were noted.

1. **Animation Complexity vs. Performance:**

* Participants reported slight performance degradation due to animation complexity, particularly regarding frame rate and responsiveness. It is caused by memory being exhausted in the PC.

1. **Overall Satisfaction with Animations:**

* Overall satisfaction with the quality and impact of the animations was positive, with ratings averaging 4 on a scale of 1 to 5.

1. **Extra Feedback on Modelling and Animations:**Participants provided valuable feedback on specific aspects of the modelling and animations:
   * They noted that movements triggered significant changes in facial expressions, found the modelling engaging and capable of enhancing immersion, appreciated the quality of dance animations, and acknowledged the realism and suitability of the models.
   * One professional participant also suggested focusing on the presentation and perception of models through animation for future evaluations.

There is some minor hair clipping during animations, but it otherwise looks pretty good!

It can be easily fixed by change layer form -1 to 0.

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| --- | --- |
| 1. **Integrated Scanned Character Models:** | * **Utility:** I found the integrated scanned character models highly useful for achieving a higher level of realism in their game projects. I appreciated the seamless blending of scanned elements with virtual characters. * **Usability/UX:** The process of incorporating scanned elements was intuitive, with clear instructions provided. I constructed a smooth workflow, indicating a positive user experience. |
| 1. **Animation Showcase:** | * **Utility:** The animation showcase was deemed extremely valuable, demonstrating the enhanced realism achievable through motion capture data from scanning technology. This feature was seen as a game-changer in character animation. * **Usability/UX:** Participants found the animation tools intuitive, allowing for precise control over character movements. The results were deemed highly realistic and engaging. |
| 1. **Asset Transition Demonstrations**: | * **Utility:** Maya is still a prevalent application, and many game artists may not be familiar with MetaHuman in UE. The demonstrations addressing asset transitioning between software applications were considered essential to users. They highlighted the importance of this skill in ensuring compatibility and preserving data integrity. * **Usability/UX:** The provided instructions and video tutorials were clear and concise, aiding participants in overcoming workflow challenges. This contributed positively to the overall usability. |
| 1. **Interactive Portfolio Piece**: | * **Utility:** The portfolio piece was recognised as a crucial tool for showcasing project accomplishments to potential employers and partners. Participants saw it as an effective means of communication. * **Usability/UX:** The interactive nature of the portfolio piece was appreciated, allowing users to explore and engage with the project's achievements. Navigation was smooth, providing a positive user experience. |
| 1. **Comprehensive Guide**: | * **Utility:** The guidebook covering the entire 3D modelling and animation pipeline using scanning technology was viewed as an invaluable resource. Participants noted its relevance to beginners. * **Usability/UX:** The guidebook's structure and content received positive feedback. Users found it easy to navigate, and the step-by-step approach was commended for its clarity. |

## Conclusion:

The evaluation results indicate that the deliverables successfully met their intended purpose in an industry context. They were found to be highly useful, intuitive, and conducive to a positive user experience. The integration of scanning technology into the character modelling pipeline was particularly well-received, showcasing its potential to revolutionize the game development process. These findings validate the project's objectives and underscore its contribution to advancing the field of game character modelling.

\* (For detailed raw results and participant feedback, please refer to the attached appendix or visit the project repository.)

# Learning Goals Reflection

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| 1. **Mastering Scanning Technology Integration**: | **Reflection:**  I have made significant progress toward perfecting the integration of scanning technologies into the character modelling pipeline because this objective was a major priority throughout the project. I've become proficient at swiftly combining 3D characters, attaining accurate representation, and producing a smoother workflow via consistent practice and experimenting. |
| 1. **Refining Scanned Asset Quality**: | **Reflection:**  There were several difficulties in achieving this aim, especially during the post-processing stage. Understanding techniques like noise reduction, mesh clean-up, retopology, and texture mapping was necessary to achieve acceptable quality. Although challenging, this objective encouraged me to strengthen my abilities in scanning data optimisation for more robust character models. |
| 1. **Achieving Realistic Character Modelling**: | **Reflection:**  It was a pleasant learning experience to develop character models that adhere to technology requirements while preserving fidelity to the original scanned artifacts. I have developed a good sense of observation and a comprehension of the character modelling process. |
| 1. **Enhancing Animation Realism**: | **Reflection:**  Researching animation techniques employing motion capture information from scanning technologies was a worthwhile learning experience. It enabled me to create realistic character animations that significantly increase player immersion. Achieving animation realism was essential to comprehend the subtleties of character expressions and movement. |
| 1. **Optimising Asset Transition**: | **Reflection:**  Assuring compatibility and data integrity required developing expertise in the seamless flow of resources between software programs. My ability to manoeuvre through various technologies used in character creation substantially improved despite the attention necessary to maintain a seamless workflow. |

Even the scanned model with PhotoCatch is quite a good quality, but compared with the Live Link Face app, the model still needs to improve in vertices smoothing on temple area using Maya. They look different because the character filming and eye look-forward positions vary.

In general, this project has helped me acquire sophisticated character-creation skills. Each learning objective presented a distinct obstacle that encouraged me to investigate fresh methods, devices, and strategies. Even while there were some difficult times, especially when perfecting scanned materials and ensuring that asset transitions were flawless, overcoming these difficulties was immensely beneficial. In addition to giving me technical know-how, this project improved my capacity for problem-solving in the context of character modelling and animation. These abilities will be crucial in developing engaging and realistic game experiences as the gaming industry develops.

# Industry Relevance and Future Work

The skills acquired through this project hold significant potential for application in the gaming industry. The integration of scanning technology into the character modelling pipeline can greatly enhance the realism and immersion of games. Moving forward, I envision several avenues for applying and expanding on what I've learned:

1. **Professional Game Development**: I aim to use these abilities in game production, helping to produce high-calibre titles that push the envelope regarding realism and user involvement. The knowledge acquired in integrating scanning technologies and sophisticated character modelling techniques would be priceless in this context.
2. **Freelance and Independent Projects**: I now possess the information necessary to work on independent game development projects or accept freelance jobs. This project allows me to investigate original concepts, test cutting-edge technology, and develop advanced gaming experiences.
3. **Further Research and Specialisation**: I am inclined to delve deeper into the realm of scanning technologies and their applications in various industries beyond gaming. This could involve research collaborations, attending conferences, and contributing to academic discussions in this evolving field.
4. **Continuous Learning and Skill Enhancement**: As technology continues to advance, staying updated with the latest tools and techniques is crucial. Regularly engaging in courses, workshops, and industry events will be a priority to ensure I remain at the forefront of game development trends.
5. **Mentoring and Knowledge Sharing**: It is valuable to impart my expertise and experience to others through mentoring initiatives, conferences, or the creation of tutorials and articles. It not only aids others in their educational endeavours but also strengthens my knowledge and skills.

Reflecting on the process of self-directed learning, I've recognised the importance of structured research and experimentation. Setting clear learning goals, conducting thorough literature reviews, and dedicating time to hands-on experimentation were key components of this process. In the future, I aim to refine my research skills, particularly in identifying and assessing emerging technologies that have the potential to disrupt the gaming industry.

Additionally, time management and organisation greatly influenced this project's success. In the future, I want to use better project management strategies to ensure that tasks are given enough time and resources.

Overall, working on this project has been a rewarding educational experience that has given me advanced character-creation skills and a greater appreciation for scanning technology's possibilities. Moreover, it has emphasized the value of ongoing education and flexibility in a rapidly changing sector.

# Appendices

You can include any supporting data, tables, or screenshots here that would otherwise break the flow of the document or blow out your word count. Material included in this section should be referred to in the text and contribute meaningfully to the document.

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