Course Description

3D Asset Pipeline Course

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3D Asset Pipeline Course

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Abstract

This course incorporated students from the University of Lincoln and from the University of Applied Sciences in The Hague, The Netherlands.

The aim of the Erasmus project was to foster knowledge exchange and collaboration between students and staff from different institutions, from different nations. Using blended and flipped learning; practical workshops; and, synchronous and asynchronous collaborative group work, students and staff from both institutions responded intensively to a creative challenge.

With little to no experience of 3D modelling; 3D texture painting; Physically Based Rendering; and, game engine practices, students had to devise, plan and produce an interactive Urban 3D Game Environment.

Three separate executable files were exported from Unreal Engine 4 and presented to peers and staff alike for testing a feedback.

Although The Hague University of Applied Sciences are not part of the immediate OnCreate consortium, they are an extended partner and have collaborated on additional projects with the University of Lincoln.

Course Description

Brief

You are to research, design and create a selection of elements in order to create an interactive scene within a game engine.

Deliverables

The theme for the scene is “everyday urban”. Your scene is expected to

include:

1x building facia
1x main large prop
2x medium props
3x detail props

You can take inspiration from miniature models or dioramas:
http://www.bbc.co.uk/news/in-pictures-39030785
https://www.google.co.uk/search?q=urban+dioramas

The idea is to create simple 3D models (which is why we have selected urban architecture) and add detail with both your decoration props and materials/textures painted onto your models in order to create a scene demonstrating them. Each scene needs to be interactive in some way that is relevant to the models and theme of everyday urban.
The interaction can be free form or guide the player through a simple narrative. The choice is yours.
On the final day (Friday), all of the scenes will be available in the form of an expo for other students/staff to explore.

Approach

A suggested approach based on the existing knowledge of participants plus the workshops are being delivered as part of the collaboration:

1. Gather primary research from your local surroundings (photos, sketches , plans, etc.) and create a moodboard shared with your group
2. Be inspired but do not copy/recreate any building/prop you reference
3. Start sketching out the blueprints for your facia and props
4. Decide as a group which sketches to adopt for the production process
5. Consider linking the assets i.e. “abandoned industrial unit”– a small factory frontage with discarded machinery and storage (for the main & medium props). Detail props could include lighting

objects (outdoor and indoor lamp with bulb) or light switches or aircondition conduites. The trick with your medium and detail props is that many instances can be used to add rich and purposeful detailing to your facia. The large prop will be more of a “one off”.

6. Devise a story for the scene and plan for player interaction
7. Implement the interaction and build/decorate the scene in the Unreal Game Engine

Collaboration Mode

- **Parallel Assignments:** Student groups from different universities work on the same assignment.
- **Synchronous Collaboration:** Collaboration using live tools like chat, google docs live editing and online conferencing software.
- **Asynchronous Collaboration:** Using asynchronous communication tools like forums, shared documents, shared folders.
  A particular interesting form of asynchronous collaboration are Design Thinking processes where each partner builds on the existing work of the other partner.

Duration, Intensity & ECTS

As with all student participation in OnCreate courses, the 3D Asset Pipeline course for Lincoln students was an extracurricular commitment. This is due to the inflexibility and inability of most British HE curriculums to support the ease of swapping credits for ECTS. This did not prevent participation however, it just meant extra incentives were required to promote and recruit to the course as an extracurricular activity (see Experience Report).
In extracurricular mode, the duration of the course was 2 months:

The Pre Workshop Phase was based on a part-time, low intensity model of delivery, which consisted of 3 x 2 hour physical studio sessions across 3 Weeks.

The Workshop phase was based on a Full time, high intensity model of delivery which consisted of 3 x full working days, in a physical workshop environment.

Platforms

Facebook

Originally, it was hoped that Eliademy would act as a centralised platform from which to communicate with the various collaborators; extend the physical learning environment into a virtual one; supply flipped learning materials to precede workshop content; and, link various parties from different institutions.

Unfortunately, at the time of the course commencement Eliademy did not work so we used a closed Facebook group as our collaborative central platform from which to communicate and share ideas as well as resources and information.

Padlet

Additionally, we used Padlet for collaborative and synchronous/asynchronous moodboard generation. This offers functionality that is beyond that offered by other platforms and offers valuable tools for online collaboration or as a supplementation tool for physical workshops and ideation processes. Importantly, the sharing tools also allow for page embeds or hyperlinks to share non-editable access for third parties and/or publicly facing exhibition.

Open Broadcaster Software (OBS) & Quicktime Screen Recorder

Both of these tools were used to record bespoke, audio visual guides to supplement the third party content that was curated for the flipped-learning resources. Both are freely accessible, with Quicktime Recorder restricted to Apple Mac OS platforms, whereas OBS is cross platform. Both can record from any microphone input that is connected to your computer and can also record keystrokes and mouse clicks.

The OBS software also has the ability to broadcast live as well as record and has various options to refine both video and audio-based content. OBS also has the ability to overly additional camera and video inputs, alongside the active desktop. Both audio compressors and noise gates can be added to refine the audio recording quality and optimise signal to noise ratios. The noise gate is particularly good at attenuating room level noise and sound pollution, making this software versatile and flexible when recording in any situation; negating the need for studio-like conditions.

Method

Although in theory the course was supposed to be collaborative and online in nature, it quickly became apparent that it is difficult for students from both institutions to maintain the same level of parity to commitment when one group is working on the project as part of their formal curriculum and the other as an extracurricular activity.

Therefore, no OnCreate evaluation methods were used for this venture. Not even the Course Design could be evaluated because Lincoln students were guests on The Hague's curriculum so it would be inappropriate to comment here.

This Course Description is still relevant however because of the information regarding management of such disparity in collaboration and the tools/processes as described. See the Experience Report section for more information.

Other methods

One thing that is notable about this project was the two phase approach to the delivery. The aim with this idea was to delineate skills development from ideation and production phases. It was hoped that by front loading the software skills in this way - using both physical workshops and flipped, virtual guided learning - that the focus of the physical collaboration in Phase 2 could be liberated from these restraints.

It was hoped that the combination of flipped learning and supportive workshops in this first phase would facilitate better collaborative practices in the later stages.

Additionally, by delineating each member of the physical groups in Phase 2 into clearly allocated production role(s), it was hoped that efficient production workflows and responsibilities would be nurtured and maintained throughout.

For more detail regarding the relative success of the above methods see the Experience Report later in this document.

Curriculum

The course was split into two-phases:

1.) Pre Workshop (Distance Learning Skills development and with supporting, Physical sessions)

2.) Intensive Workshop (Intensive, collaborative workshops in Situ (All students from both institutions)

The first phase (pre-workshop) begin three weeks before the workshop in The Hague. A summary of the learning, production schedule and curriculum content is as follows:

Pre-workshop Phase

During the 3 week build-up to The Hague workshop, the basics of the craft were delivered via flipped learning where new content and tasks were released each week. Participants were expected to keep up-to-date with the learning, reading and research/preparation tasks.

The aim was to host all content online at Eliademy * with short reading lists and video tutorials to give participants the skills required to contribute to all aspects of the brief.

* NOTE: *Due to the limitations and lack of functionality of Eliademy at the time of course commencement, a closed Facebook group was used as a central repository and communication platform.*

Week	Theme & Activities
Week 1	**Task Intro & 3D Modelling Primer** Content: • Presentation to include details of the following: The assignment, an outline the rationale and benefits, where to seek inspiration and 3D modelling principles/terminology • Reading list for concepts surrounding 3D asset production, PBR and 3D modelling principles

Week 1: Tasks	**Research Tasks:** 1.) Introduce yourself to your group/partner – exchange basic info and establish a communication methodology 2.) Start gathering reference materials including some original reference photos - establish a mood board **Learning Tasks:** 1.) Install software on your own computers or computers you will be bringing to workshop 2.) Complete the reading for this week 3.) Undertake learning outlined by the video tutorial playlist
Week 2	**Preparation for Texturing & Material Creation** Content: • Presentation to include details of the following: principles of texture mapping 3D surfaces and node-based content creation • Reading list for concepts surrounding UVW mapping and PBR material creation and effective material design
Week 2: Tasks	**Research Tasks:** 1.) Decide upon the scope (see assignment details) of your response and produce initial sketches of content you intend to create **Learning Tasks:** 1.) Complete the reading for this week 2.) Undertake learning outlined by the video tutorial playlist
Week 3	**3D Painting & Exporting** Content: • Presentation to include details of the following: principles of painting models in 3D, asset narrative and preparing for export • Reading list for 3D painting workflow and considerations for real-time applications (game engines)

Week 3: Tasks	**Research Tasks:** 1.) Select the most appropriate sketches and ideas from last week and create concept art for each model - considering that this process will be your group's 'instruction manual' for the production process **Learning Tasks:** 1.) Complete the reading for this week 2.) Undertake learning outlined by the video tutorial playlist

Intensive Workshop Phase — The Hague, The Netherlands

Day	Theme & Activities
Day 1	**Research, Ideation & Production** Content: • Presentation to include details of the following: : Re-exposition of the assignment for the benefit of all participants from both institutions: outline the rationale and benefits, where to seek inspiration • Tour the local area to gain inspiration from the urban environment and take photographs • Gather lookbook material from photos taken and online searches • Start to flesh out, design and produce the primitive shapes for the urban environment
Day 1: Tasks	**Research Tasks:** 1.) Introduce yourself to your group/partner – exchange basic info and establish a communication methodology 2.) Start gathering reference materials including some original reference photos -– establish a mood board **Learning Tasks:** Install software on your own computers or computers you will be bringing to workshop Use primitives to block out shapes in Blender Use Unreal Engine 4 to set-up new project and scene.

	Familiarize yourself with the basic tools/interface in Unreal Engine 4 (The Netherlands)
Day 2	**Production** Content: • Presentation(s) to include details of the following: : principles of texture mapping 3D surfaces : node-based content creation : lighting methodologies within Unreal Engine 4
Day 2: Tasks	**Research Tasks:** 1.) Decide upon the scope (see assignment details) of your response and produce initial sketches of content you intend to create 2.) Research lighting methodologies in Unreal Engine 4 (The Hague/Lincoln) 3.) Research and Develop triangulation, uv unwrapping and .fbx export workflows from Blender to Unreal (Lincoln) **Learning Tasks:** 1.) Produce lighting changes and day/Night cycles in Unreal Engine 4 (The Hague) 2.) Build topology based on reference photos and designs (Lincoln) 3.) Unwrap and export models to Substance Painter 4.) Paint models
Day 3	**Finishing and (potentially) publishing to asset market place** Content: • Export models and textures to Unreal • Build environments in modular pieces and apply lighting models • Export .exe files for interactive play/presentation
Day 3: Tasks	**Research Tasks:** 1.) Select the most appropriate methodology for Blender>Substance>Unreal workflow

Day 3: Tasks	**Learning Tasks:** 1.) Complete the painting and optimization of models for Unreal (Lincoln) 2.) Export models and textures to Unreal (Lincoln) 3.) Build environments in modular pieces and apply lighting models (The Hague) 4.) Export .exe files for interactive play/presentation (The Hague)

Experience Report

Jon Holmes, Lecturer, Lincoln University

From my experience it was clear that during the second phase of the project that students from Lincoln were confident in their ability to problem solve, explore and conduct 'fail-fast' ideation, due to the fact that they had committed to the first phase of skills development prior to the trip to The Hague. The combination of flipped learning and supportive workshops in this first phase had facilitated better collaborative practices in the later stages.

In short, Flipped learning proved to be a highly effective way of preparing students with skills-based knowledge of software. This then liberated the workshops for creative working, problem solving and peer/staff level support. A combination of bespoke audio/visual resources alongside the curated, third party content complemented each other well; with the bespoke resources offering specific context to the in session activities and helped to frame the third party content.

Additionally, by delineating each member of the physical groups in Phase 2 using clearly allocated production role(s), efficient production workflows and responsibilities were not only nurtured but maintained throughout. This not only provided efficient production management and project completion, but also fostered professional working practices that were both attainable and maintainable for the student participants, which further validates the value to the students and their future career aspirations.

Furthermore, it was clear from both my experience and the student

experience that Collaboration was at its best when students from both institutions were in attendance in one, physical space. The collaboration only truly became effective when the online work was complemented by synchronous,physical activities and interaction.

Also, it was noticeable that The intensive nature of the activities in both Phases 1 and 2, seemed to promote better retention of knowledge than that of extended, semester-long activity. The distance travelled was the same if not exceeded than that achieved, for example, by similar level students on a 12 week course of study.

Moreover, in terms of platforms, the Facebook group was highly effective as both a repository and as an synchronous/asynchronous platform for collaboration. Engagement by students was very good and the readily available nature of Facebook seemed to mitigate any barriers to active student participation. Facebook proved to be a flexible platform from which to post various forms, formats and containers of information whether it be date driven, video based or audio content. This said, Facebook does not support all formats natively and relies on other repositories and third-party platforms to make this learning platform functional;, for example, Google Docs, youtube, Padlet.

Lastly, Padlet itself proved to be a valuable platform for both synchronous and asynchronous moodboard and lookbook generation for both in-workshop and online groups. With little to no lag, students could either work individually or as a collaborative team to work on ideation processes, across difference media. For example, as well as text-based notes, images, audio files and/or videos could be added to illustrate points and provoke conversations. Additionally, the non linear nature to the ‘free-form’ layout and functionality of Padlet, leant itself to non-hierarchical mind mapping and ideation processes. The sharing Padlets was also flexible, offering both hyperlink and embed options to allow easy communication and exhibition via multiple platforms.

Student Feedback and Reflection

Student A

I applied to this opportunity because, despite my lack of knowledge on the subject, I have a clear and strong interest in the use and creation of 3D assets, especially in video gaming and film visual effects, and greatly appreciated a chance to explore this field further. I knew this opportunity would be highly beneficial for my confidence, and only further confirm my passion for digital media, but I also hope to experience intensive workshops that I prefer to work within, as opposed to the weekly workshops I enjoy in university.

Before we ventured to the Netherlands, we attended four workshop-type meetings in which we learned the basics to using the software 'Blender'. Each week we were tasked to create a simple model, slowly increasing in difficulty depending on how quickly we became used to the controls. Not only did we learn how to use this program, we were also introduced to texture painting, watching videos and tutorials to gain an idea on what we would be tackling when at The Hague. I had personally never used or seen these types of software, making my experience extremely enjoyable and inspirational. Whilst my interest was strong, I had little opportunity to sit and discuss these programs with other like-minded people, comparing projects and discussing tips, as well as sharing examples of work that would fit our interests.

When in Holland, my group and I were partnered with a student named Anon, who helped to make out elements come to life. His knowledge of Unreal Engine was limited, but he quickly learned to use it whilst we were perfecting our contributions to the project. Despite being paired with just one other student, we were able to collaborate with the other two students who volunteered their time to this project, making friends along the way. Because some of the other Dutch students found the software easier to understand, Anon relied on them for advice, and we took inspiration from their work that influenced our final project within the game engine.

I am extremely grateful to have been selected to take part in this exchan-

ge. Within a month I have gone from knowing nothing about Blender and Substance Painter to knowing the basics and experimenting with different aspects of the software, opening my mind to the possibilities of this field of work.

I have also had a chance to work with people I have not met previously, not only in Lincoln, but abroad. Whilst most of my networking comes from the university and its staff, the students who took part became friends, showing us around the city and working collaboratively in a working environment.

This industry will require us to work with different people with different ideas, and being part of this activity gave me an idea of what this would be like. In university, whilst I can gain advice and critique from other students, having to work out creative differences with strangers and sharing ideas that I felt strongly about inspired me to put myself out there more, breaking my nerves around turning this passion into a career.

Student B

I decided to apply to the Netherlands trip to gain experience in more areas of digital media, not only out of interest, but to help me determine what I would like to do in my final year of university and in a career.

Our task for when we arrived in Holland was to build a 3D urban and run-down building to eventually create an asset pack for a gamer to use. Prior to the trip, we had several two hour workshops which greatly opened my eyes to the potentials you could reach with just a single piece of software. We spent the majority of the workshops using Blender as this was the fundamental part of creating our 3D models.

When we got to the Netherlands we teamed up with three Dutch students who would bring the 3D models we made to life, by using a software that they had recently become familiar with. We had three days to build, substance paint, and then export our buildings for the Dutch students to animate.

My favourite part of the building experience was substance painting because it really brought the objects you made to life through various layers of materials and textures. A grey 3D object would turn into something so realistic and all because of an incredibly smart software that luckily isn‘t too hard to use!

Working with the Dutch students was lovely because not only did we make new friends, we experienced their culture, taught each other some common lingo and really learnt a lot from them in general. Their friendliness was humbling and I am glad to say that I keep in contact with them via social media.

Overall I could not have faulted this trip. I was so nervous to go away with people I didn‘t really know, especially after having not flown for over 11 years, but Jon, James, and the other students I went with made it a lot easier. Both Jon and James are incredibly talented and would still help you willingly and complaint free, even if you shouted them for help 20 times in an hour (which I can say from experience)!

Student C

When offered this opportunity, I knew 3D modelling was something that I wanted to look into for my final year. I wanted to attempt to get into the visual effects industry or the games industry and both benefited heavily from being knowledgeable in 3D so I jumped at the chance.

I was lucky enough to be chosen and soon enough we were knee deep in blender learning on a weekly basis. Blender itself was relatively easy to pick up to make basic shapes. The difficulty was in making an object look as accurate as possible in as little faces as possible. Having only a short amount of time to learn this in the scheduled sessions, I was surprised at how fast I personally picked it up, especially having used no 3d modelling software before. Before the trip, we had made a replica CRT model and learned how to unwrap a model ready for texturing. We had only just touched upon texturing Using B2M and Substance painter as well as the unreal engine.

Everything we needed to know was on a spark page that we all could ea-

sily access. Although, I will say a note about a power adapter needs to be added for next time. (My personal fault really, should be common sense eh?)

When we got to Hauge and took our first trip to the Uni. We met the Dutch students who would be learning Unreal ready for our 3d Models to program in. Though the original plan had changed from having other students learn the same as us, we now were able to not worry about the reduced time because of Kings Day as much. The Dutch were very friendly and were more than happy to tell us about their culture as well as show us round. Unfortunately, when it came to the work, we were pressured for time to have all the textures and models ready to go. Yet all of our groups got their work up for everyone to see.

It's crazy to look back on it and realise how much we did concerning we had started completely from scratch. The skills I have learned from this I will be using within my 3rd-year project, the software knowledge means I know what I need to practice on over summer.

The crash course in this is the absolute way to learn to learn 3D modelling. Working with the Dutch students was an amazing experience both cultural and educational. If any 2nd-year students for the year 2017-2018 are doubting it, I would highly recommend the go for it!

Student D

The reason I wanted to participate in the workshop and trip to Hague was to learn the skills that might prove very much useful in my career. I was worried that we wouldn't get to learn 3D modelling in Digital Media module as there was no mention of it before. As well the fact that we were told that we weren't going to learn any new software skills in second semester so I grabbed the opportunity to do so. Oh, and I have never been to Netherlands before.

3D modelling was entirely new to me prior to the workshops we had before the trip. I have never even opened Blender before so the whole experience was fresh. Luckily, I got in grips with the software surprisingly

fast even though I haven't had much time between workshops to practice it at home, because all the major deadlines were due in for that period. Modelling was my biggest fear that I wouldn't be able to wrap my head around the process, but the tools in Blender are quite simple to use so it wasn't hard to eventually understand the process. I wish I had more hands-on Substance painter where, due to time constraints in Hague, had to leave to my group mate Anon so I could have worked on Neon effect in Unreal.

I enjoyed working with the Dutch student Anon, he understood what me and Anon planned to do and he had the patience for any issues we encountered. He said he was relatively new to Unreal software, but by the time we got to inserting the models into the program he proved he was a fast learner. Overall I enjoyed working with him, no complaints.

Like I said in the introduction, all these skills I learned in Hague will prove useful in my career, but I think the most important one was communication, socialising, breaking the language barrier to get ideas across and to form a group understanding of the goal we were trying to achieve. I believe this skill will prove very much useful in the future as more collaborations like this will undoubtedly be inevitable in this line of work. With that being said, having learned Blender and Unreal we will surely have an advantage in our 3rd year Digital Media project. I am planning to do a project that will involve 3D modelling at some stage in the development. Other than that, I might start making and selling textures in the summer since I have all the tools and knowledge available for me, because of The Hague trip.

In conclusion, I think these sorts of working trips are very valuable for any student, so there should be more so more students have a chance to participate. Unlike we did in the VR workshop with Anon and Anon, where we collaborated with Finnish university over a Skype call – it was a disaster, we could barely communicate with one another, there were so many problems with the connection that we eventually disbanded the whole collaborative part of the workshop to work on our own project. I experienced two ways of international collaboration and one proved the other

how important it is to be physically with the group that we are collaborating with.

Student E

Studying at the University of Lincoln has increased my passion and knowledge of digital media. I wanted to take this opportunity to explore and learn skills specifically applied to 3D. I applied for the opportunity to learn communication skills working and collaboration with students from The Hague as it is an essential part of the media industry. Working with a variety of people increases skill base and knowledge, therefore, I wanted to take this opportunity to learn from the tutors, and from other students. Not all skills are taught in timetabled sessions, therefore I wanted to take part in this extracurricular activity to broaden my knowledge and increase my skill base.

Prior to the visit to The Hague, I learnt skills in the software blender. I had never used blender before, but the tutors taught me how to create objects using a selection of shapes to the maximum level of realism as possible. Starting off by creating simple objects such as a fridge, then learning to develop our skills by creating more complex objects such as an older television monitor.

We learnt skills were learnt in The Hague from tutors such as how to use the software Substance Painter, in order to texture paint the 3D models we created in blender. Other important skills people don't usually think about is how to correctly import and export models and materials. This was further taught to us as well developed our assets.

Working with an international team improved my communication skills along with other technical skills. I learnt how to work around a brief and constantly communicate with my other two group members in order to create a professional looking piece. Working with the international students taught us skills such as how to use the software Unreal. This was the software that help our texture painted 3D models and added interaction.

This experience will help me in the future greatly as it has improved my ability to communicate efficiently in a group work project. Furthermore, it has increased my technical skill base, something that I wish to complete further projects in.

This nature of collaboration has proven beneficial to myself and other group members. It has given us the opportunity to learn entertaining and creative technical skills and work within an industrial working environment on realistic projects.

Student F

Looking back at the application process for the trip, I have to admit I was quite nervous, at the start of second year I had gotten quite a taste for 3D modelling and painting, I ended up watching quite a few conference talks on substance painter and game engines, something which I mentioned in my application. I attended some guest lectures as well, hosted by 3D environment artists and character animators, after talking about it at some length with my tutors and peers decided that I was going to apply, and spent a considerable amount of time pouring over my application.

Once I heard that I had been accepted, I was over the moon, originally it was quite a daunting prospect, since I knew that the workload was going to be quite heavy in the lead up, but I was ready for a new learning experience. The tutorials made by Jon were really helpful to watch before the actual workshops, as I definitely felt they gave me a headstart when approaching the software. Both Jon and James were incredibly helpful throughout the workshops, and I really felt my skills with modelling improved over a very short timespan.

When the flight to Amsterdam finally rolled around I was very excited at the prospect of getting to experience a bit of European culture (and beer), upon arriving we met the Dutch students that we were going to work with, and spent the day walking around the Hague gathering reference material, they were all very friendly and it almost shocked me how little of a cultural barrier there was. Despite only learning 3D modelling in depth for over a month I think myself and the other students were very surprised

at how far we had come in terms of skill level, where only a month prior we were making basic shapes, we were now fully modelling buildings and various detailed props, as well as the concepts behind texturing, something that had slightly alluded me, but thanks to the help of the tutors and other students, is now a skill I can proudly say that I have learned.

The skills I developed a foundation for during this time have really resonated with me and completely altered my career aspirations, once I sank my teeth into the software I found it very hard to put down, I'm now finding myself spending most of my free time watching tutorials on blender and substance painter, I don't think I'll be able to play a video game again without thinking about how the models and textures were done. I also got to spend a bit of time talking with some of the tutors in the Hague, one of whom I had quite a detailed conversation about artificial life programs and algorithms, getting to speak with educators on such detailed and complex subjects was a very rewarding experience.

Overall, I think the trip was a very worthwhile experience, as it has certainly helped me in gaining both skills and knowledge, as well as giving me very high hopes for a future career in 3D. Both Jon and James were very accommodating throughout the trip, getting a good balance of work and culture into the experience, which made the experience very enjoyable and something that I will remember long into the future.

Video Evidence

Here is a brief montage video to celebrate the collaboration between Level 2 LSFM students, Lincoln and students from the University of Applied Sciences in The Hague, The Netherlands:
https://vimeo.com/216981004

Material

Intro to Normal Maps in Blender (And Why Games Use Them) –
https://youtu.be/GyfVQmoFX4c
PavWork 07: Substance Painter Textures and Materials –
https://youtu.be/iv5iBLF7Fuk
Substance Painter Tutorial – Fundamentals 01: Physically Based Rendering
https://youtu.be/S1A0YqdRhe4

Blender UV Mapping – https://www.youtube.com/playlist?list=PLyelx0Ts-mSpdSoVNlkGo7LAk3mhfxbMhd
Unreal Development Kit – https://www.youtube.com/user/UnrealDevelopmentKit/playlists
Introduction to Blueprints | v4.8 | Unreal Engine – https://www.youtube.com/playlist?list=PLZlv_N0_O1gY35ezlSQn1sWOGfh4C7ewO
The Secret Ingredient to Photorealism – https://youtu.be/m9AT7H4GGrA
Blender Basics – http://www.thecuriousengine.co.uk/?project=blender-basics-short-video-guide-series

Literature

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Bergmann, J and Sams, A. (2014), Flipped Learning: Gateway to Student Engagement, Int Soc for Tech in Education.

Erkens, C et al. (2008), The Collaborative Teacher: Working Together as a Professional Learning Community, Solution Tree.

Material

Literature