Towards a Formal Education of Visual Effects Artists

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Figure 1: *Still frame from the "Final Major Project" student film "Völuspá" (2022), showing various visual effects.*

Abstract

The rapid growth of the visual effects industry over the past three decades and increasing demand for high quality visual effects for film, television and similar media, in turn increasing demand for graduates in this field have highlighted the need for formal education in visual effects. In this paper, we explore the design of a visual effects undergraduate degree programme and discuss our aims and objectives in implementing this programme in terms of both curriculum and syllabus.

1. Introduction

"Visual effects" (VFX) is a vital element of modern filmmaking, as well as being an essential element in other areas of media production. It encompasses a wide range of tools, techniques and software workflow practices used to create realistic, as well as sometimes highly stylised environments, creatures, and digital special effects on screen [Abo00].

The visual effects industry has experienced rapid growth over the last 30 years, with advances in technology and increasing demand for high-quality effects in films, television shows, video games [OZ20], and other forms of media such as architectural, archaeological, and medical visualisation. The demand for visual effects graduates with the necessary skills, knowledge, and practical hands-on experience has also risen, creating a competitive job market.

Visual effects artists and practitioners are often expected to have a strong foundation in both technical and creative skills which is where formal education and training are crucial. Formal education in visual effects can provide aspiring artists and practitioners with the necessary skills [Cre17], knowledge, and experience to succeed in this competitive industry.

Degree programmes and certification courses can cover a wide range of production focussed topics, including asset creation disciplines (modelling, sculpting, UV layout, texturing, rigging etc…) animation, simulation, and compositing. Additionally, formal education in visual effects can provide students with a solid understanding of industry standards and best practices, as well as the opportunity to gain hands-on experience working on real-world projects, e.g. in the form of industry set briefs.

The visual effects industry is a dynamic and rapidly growing field that requires a combination of technical and creative skills [OZ20]. Formal education and training can provide aspiring artists

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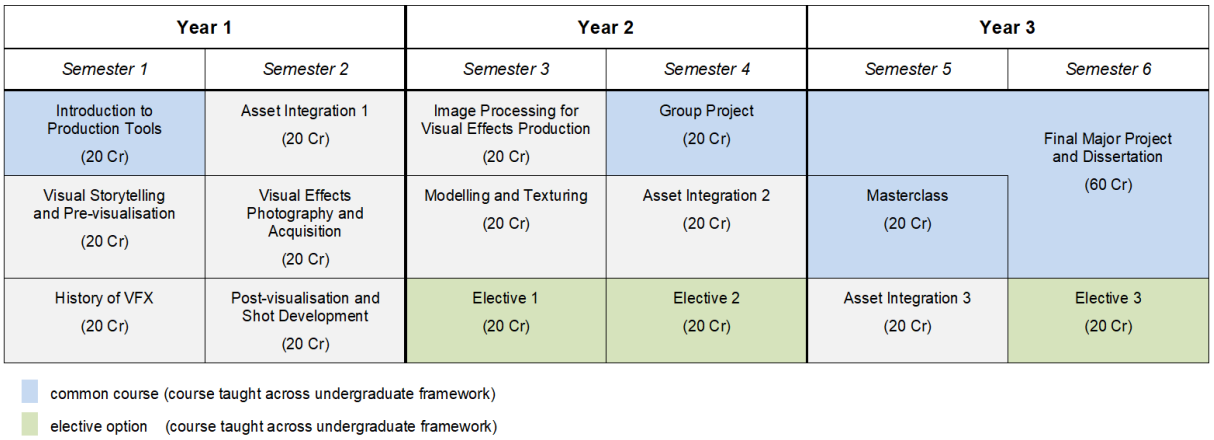

Figure 2: *Overview of our BA (Hons) Visual Effects undergraduate programme (each 20 university credits course is equivalent to 10 ECTS credits in the European Credit Transfer and Accumulation system).*

and practitioners with the knowledge and practical foundation they need to succeed in this competitive field and make a meaningful contribution to the industry.

2. Degree Programmes in Computer Animation and Visual Effects

In January 2011, NESTA, the National Endowment for Science Technology and the Arts, published its "Next Gen" report [LH11] on the state of UK education targeting the computer animation, visual effects and video game industries, which called for additional and enhanced provision of higher education for artists in these fields.

Since then, a large number of visual effects programmes have been established – a search for the key phrase "visual effects" among undergraduate degree programmes on the UK's Universities and Colleges Admissions Service (UCAS)[1] website returns 188 programmes related to visual effects, offered by 69 higher education providers, and many of these higher education providers with undergraduate programmes also have postgraduate offerings for visual effects. Many degree programmes in the UK are highly specialised and have a fairly narrow subject focus – they could be called "Boutique" programmes (analogous to elective/optional, highly specialised "Boutique" courses) – and visual effects degree programmes can be counted among them.

Visual effects education provision is not limited to higher education providers and can be found internationally[2]. However, despite the large number of available programmes and providers, there exists hardly any literature describing these degree (or training) programmes or the curricula of the courses included within these in depth.

The majority of the literature that is available tends to focus on individual courses or assignments, which are often embedded within computing, media computing, new media or similar programmes [OVP*15, Hil15, JMW19, DeP13], often presented in the education events at the annual SIGGRAPH and Eurographics conferences, such as the education panels that are frequently held at SIGGRAPH educator's fora [RFA19, Mei22, SEM*22, RA22].

Only rarely is there any literature on dedicated programmes, two exceptions being Palmer et al. [PRD16], who discussed their approach and methodology for designing curricula for computer animation and visual effects degree programmes, yet did not provide a description of the designed curricula or syllabi themselves, and the programme described by Sundstedt and Lanner [SL12], a "Technical Artist in Games" undergraduate degree programme, which incorporates elements that are also relevant to visual effects. Another of these rare examples is the Master of Fine Arts in "Digital Production Arts" postgraduate programme which Davis and House [DH11] discussed in some detail, and which was designed to provide education in the fields of computer animation, visual effects and computer games.

A somewhat more detailed discussion of a program design, providing an in-depth look at the curricula and syllabi for a set of degree programmes specifically created for degree-level education in the fields of computer animation, games and visual effects was presented by Comninos et al. [CMA10], describing the undergraduate degree programmes at the National Centre for Computer Animation (NCCA) at Bournemouth University (UK), which since its foundation in 1989 has been a pioneer of higher education provision in these fields. The latest degree programme in the NCCA's undergraduate framework is the BA (Hons) Visual Effects, which we discuss in this paper.

3. The Visual Effects BA programme of the NCCA

Our BA (Hons) Visual Effects (BAVFX) programme (Figure 2) covers the main aspects of the visual effects post production pipeline [Chu11, Dun14] and the theory, principles and practice of producing visual effects assets and shots (Figure 1). It is tailored

[1] https://ucas.com
[2] see *The Rookies*: https://discover.therookies.co/schools/best-visual-effects-schools-in-the-world/

towards students who have a strong interest in the feature film visual effects industry and associated disciplines, and who have a strong desire to work in the feature film visual effects industry. The programme has run since the 2018/2019 academic year and complements the other programmes of the NCCA's undergraduate framework, which only cover some basics of the visual effects disciplines, whereas the BAVFX programme is designed to go provide a much more in-depth and detailed exploration of these.

BAVFX is a three-year undergraduate honours degree programme – the first cohort of students graduated in summer 2021 (at the time of writing, approximately 40 students have graduated from the programme) – and incorporates an optional "sandwich" industry placement year between years 2 and 3. The entry requirements are 112–128 UCAS tariff points[3] gained from a minimum of two UK A-levels or equivalent secondary school leaving qualification, including 32 UCAS points achieved in an art, design, mathematics or technology subject, including 'Art', 'Computing', 'Fine Art', 'Graphic Design', 'Mathematics', 'Media Design', 'Photography', 'Physics' or similar. Applicants also have to submit a portfolio of observational artwork (life drawing, portraits, still life, anatomy studies) in a variety of different traditional media, and they are encouraged to include high quality observational digital artwork (digital painting, and well executed 3D renders of photo-realistic CG assets), as well.

The BAVFX programme consists of courses that cover the VFX pipeline and component disciplines related to pre-visualisation, post visualisation and shot development, these including rotoscoping and plate prep [Dun14], matchmove [BCJ*16], modelling [Paq08], UV mapping (creating a UV layout [MYV93]), texturing [Van03], look development [Amb19], lighting [Bir14], rigging [Bea12], digital matte painting [Mat11], scripting [Kaz16], image processing and compositing [Wri01]. Not limited to these, the courses of the programme also include supporting elements, such as the theoretical underpinnings of moving images, the history of visual effects, visual storytelling, as well as visual effects photography and acquisition. In addition to a set of core courses, the programme offers several elective courses that facilitate the students' customisation of their education to favour either a more technical or more artistic flavour.

Whereas graduates from the other programmes in the NCCA's undergraduate framework are only expected to develop an understanding of the basics of the visual effects pipeline, the aim for graduates from BAVFX is to have gained a much more detailed understanding of the visual effects pipeline, specifically related to the knowledge and production of feature film visual effects. Over the course of their studies they are expected to create a high quality demonstrative portfolio and showreel of VFX, enabling them to gain employment in the VFX industry. As such, the programme does not cover areas of production that are not specifically related to feature film visual effects, which are covered by our other undergraduate degree programmes, instead, focusing on the creation of modern visual effects, following common practices in the feature film visual effects industry. At the very heart of the programme lie photo-real asset generation and integration of these assets with live action photographed footage.

3.1. BAVFX programme structure

The BAVFX provides opportunities for students to develop and demonstrate knowledge, understanding and skills allowing them to complete projects and solve problems associated with visual effects and to develop creative solutions at a professional level.

The first year of the programme aims to provide Visual Effects students with fundamental knowledge and understanding of the underlying principles and practice of visual effects production, as well as knowledge of the history of visual effects production pre-dating the use of computers. At the conclusion of the year, they are expected to be able to evaluate and interpret different approaches to visualising ideas or concepts presented to them in the form of scripts, storyboards, or scenes, while placing visual effects work in a historical and aesthetic context.

The second year deepens the students' knowledge and exposes them to practical limitations, in terms of time and the resources required, that need to be overcome to successfully complete a given project. On completion they are expected to be able to demonstrate knowledge and critical understanding of well-established principles and skills for visual effects production [Cre17] and practically implement their knowledge in the form of production-led projects and/or personal artistic briefs. They are also expected to have gained sufficient expertise, allowing them to choose the appropriate tools for specific aesthetic outcomes and research in visual effects.

In their final year, students are expected to demonstrate practice-based research skill, with a capstone project acting as a platform for cross disciplinary productions, encouraging collaboration across the programmes of our undergraduate programme framework.

3.2. Support Infrastructure and Facilities

The creation of visual effects require substantial resources. Students of the BAVFX not only provided with access to computer labs equipped with powerful workstations and professional production software, such as Adobe Creative Cloud[4], Autodesk animation tools[5], Houdini[6], Mari[7], Nuke[8] or Unreal Engine[9], but also have access to camera equipment, a green screen studio and virtual production facilities.

3.3. The courses of the BAVFX

3.3.1. Year 1

The first year of the programme consists of six courses, each worth 20 credits (equivalent to 10 ECTS credits), one of which is a

[3] https://www.ucas.com/undergraduate/what-and-where-study/entry-requirements/ucas-tariff-points

[4] https://www.adobe.com/uk/creativecloud.html

[5] https://www.autodesk.co.uk/solutions/3d-animation-software

[6] https://www.sidefx.com/

[7] https://www.foundry.com/products/mari

[8] https://www.foundry.com/products/nuke-family

[9] https://www.unrealengine.com/

Figure 3: *An example of coursework created in the "Introduction to Production Tools" course, following the visual effects pipeline for the integration of photorealistic CG elements (in this case a drinks can) into a photographic backplate.*

course that is common to all of the NCCA's undergraduate degree programmes, namely "Introduction to Production Tools" (Figure 3). This course, which was discussed in detail by Redford et al. [RFA19], aims to introduce students to relevant principles and practices employed with essential software tools used in the production of 3D computer animation and visual effects, equipping them with "tool literacy" [DeP13], i.e. a basic understanding and practical knowledge of the tools necessary to complete an effective, realistic, 3D animation and visual effects project to a set brief. As this course provides the foundation on which most of the other courses in the programme rest, it is placed at the very start of the programme and runs throughout the first semester.

Parallel to this, also it the first semester, run the "History of VFX" and "Visual Storytelling and Pre-visualisation" courses, the former – delivered as a mixture of lectures and screening sessions (showing movies that employ the effects covered in the lectures) – being used to expose students to historical methods employed in the creation of film effects. The course demonstrates how these methods have influenced current film making processes in terms of modern visual effects techniques and practices. It also aims to demonstrate the evolution of filmmaking and effects techniques with regards to standard types of environments and assets, specifically environment and creature effects, that have been created for feature films, by covering the development of special effects (SFX), including glass painting, model sets, rear projection, stop-frame animation and the use of motion control cameras, and plotting their evolution into modern VFX.

The "Visual Storytelling and Pre-visualisation" course augments the foundation laid by the "Introduction to Production Tools" course by providing students with a fundamental grounding in terms of film vocabulary and film language, as well as principles of visual narrative design and construction. Delivered as a combination of weekly lectures, seminars and film screenings, the course will equip them with the tools necessary to visually convey story ideas. By employing the gained understanding of visual structure, form and design, students will be able to effectively communicate a visual narrative, and this knowledge and understanding of key concepts, principles and tools will enable them to pre-visualise and communicate ideas effectively for every visual production assignment they are likely to encounter during the course of their study, as well as in their future careers.

Building on these foundations, in semester 2, the "Visual Effects Photography and Acquisition" course aims to provide students with a sound understanding of the core principles and technical image requirements for modern visual effects, teaching them how to acquire high quality live actions elements for visual effects projects. In this course, teaching and group learning (in groups of six to seven students) largely takes place in Agile Learning Spaces equipped with a green screen, cameras and studio lighting, combining elements of lectures (outlining principles of visual effects acquisition), seminars and practical group working, and making use of relevant equipment for the purposes of demonstration and practice. At the end of this course, students are expected to be familiar with the procedures and protocols for safely setting up and executing live action studio or location shoots, having acquired a range of practical skills for the successful execution of visual effects shots, such as camera operation, lighting, tracking and set survey.

In the "Post-visualisation and Shot Development" course, students draw upon the experience of pre-visualisation tools and techniques, software tools and camera technology used in other courses to generate a so-called "post-vis video". Comprised of weekly lectures, seminars and workshops this course exposes students to the practice and experience of working with and handling large data files, keeping track of changes/versioning and adapting and responding to frequent changes requested clients, resulting in the creation of a post-vis video sequence. Under guided supervision, students explore best practices for backing up and keeping track of data, relevant naming conventions, as well as production pipeline organisation and workflow. This knowledge, practice and experience will be instrumental in enabling students to respond to the challenges of subsequent production-based projects that they will encounter within the programme and in their future careers.

Finally, the "Asset Integration 1" course [Red20], further develops the students' understanding of the visual effects asset creation and integration pipeline (Figure 4). Building on the skills and knowledge gained in the "Introduction to Production Tools" course, it exposes students to more advanced asset creation techniques for modelling, the preparation of UV maps, texturing, lighting, shading, rendering, simulation, and compositing. Asset integration is a major part of the professional practice of any visual effects artist, and it is therefore essential that students constantly develop their knowledge and ability in the creation and integration of assets, and in working with live action plates. Delivered as a set of weekly lectures, accompanied by workshops for practicing the learned material, the course further develop the students' abilities to work to specific shot requirements and limitations, specifically in terms of photo-real integration of assets into background plates.

3.3.2. Year 2

The second year of the programme, again, consists of 6 courses (at 20 credits/10 ECTS credits each), four of which are core courses (unless stated differently, delivered via weekly lectures, and workshops), one being a group project spanning the whole undergraduate framework and involving the creation of a short computer animation or interactive artefact (e.g. a computer game)

Figure 4: *"Asset Integration 1" student submission, showing an empty background plate (top), and a CG chrome coffee pot, composited into the live action photographed background (bottom).*

[And13, AS20] (delivered in the form of weekly supervisory small-group tutorials), with the other three being unique to the visual effects programme, and the remaining two being elective (optional) courses that are also shared across the other undergraduate degree programmes of the NCCA.

Among the core courses that are bespoke to the visual effects programme, the "Modelling and Texturing" course in the 3rd semester aims to further develop the students understanding of the visual effects modelling and texturing pipeline, exposing students to more advanced asset creation techniques for hard surface and deformation modelling, UV unwrapping for multiple tile workflow, texturing using hand painting techniques for hard surface assets, and texturing using projection methods for hard surface and character based assets. Modelling and texturing is a major part of the professional practice of any visual effects artist, and it is therefore essential that students constantly develop their knowledge and ability in the creation and integration of assets, and in working with highly detailed models and textures. Consequently, the course further develops the students' abilities to work to specific asset requirements and limitations (as one would encounter in industry), focusing on the creation of photo-real assets for use in the visual effects live action integration pipeline. In addition to lectures and workshops, the course also incorporates weekly review sessions ("dailies" – a common industry practice), where students will have the opportunity to present their work-in-progress for review and feedback from academics and peers.

As image processing is a fundamental part in the 2D visual effects pipeline (itself paramount for the completion of a visual effects shot), involving a broad range of tasks aimed at the technical manipulation of 2D live action plates for digital compositing purposes, also in semester 3, the "Image Processing for Visual Effects Production" course covers two important areas: First, there is rotoscoping and related prep-work, which allows a visual effect artist to prepare acquisition footage and elements for digital compositing, which is complemented by green screen matte extraction and compositing, which allows a visual effect artist to extract elements which are shot in front of a green screen for digital compositing in background plates.

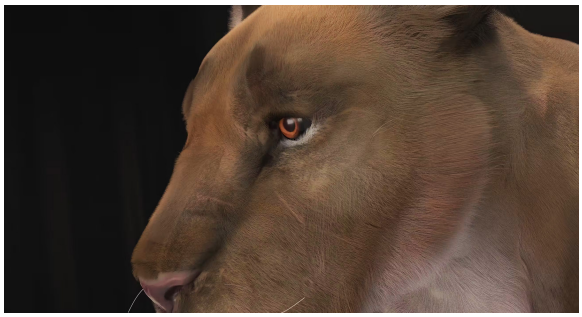

Figure 5: *Student work, demonstrating fur simulation.*

In the 4th semester, the "Asset Integration 2" course, continuing from "Asset Integration 1" in semester 2, extends the students understanding of the visual effects asset creation and integration pipeline with additional elements, such as image tracking. On completion, students are expected to have gained knowledge and experience in preparing hard surface assets to a medium level of detail and complexity, as well as in the integration of these assets into live action plates using render pass composition and moving backplates. The course delivery augments lectures and workshops with a combination of online tutorials and weekly or bi-weekly "dailies" review sessions. The elective options in the second year, one of which students are required to select for semester 3, with the other one taking place in semester 4, are all delivered via weekly lectures and supporting workshops. Among these, the following are the most relevant ones for our visual effects programme.

The "Technical Effects" course aims to develop the students' understanding of the visual effects technical effects creation and integration pipeline. For this, it exposes students to various areas of technical effects, such as rigid body dynamics, particle systems, fluid dynamics systems and the simulation of natural phenomena (e.g. fire and smoke), as well as character effects, such as those provided by fur and cloth simulation systems (Figure 5).

The "Rigging and Animation for Visual Effects" option exposes students to the visual effects rigging and animation pipeline is intended to enable students to progress into a wider and more varied area of the visual effects discipline. The course covers techniques for rigging and animating different types of character and non-character based assets, including vehicles, mechanically based hard-surface assets and bi-pedal/quadrupedal character based assets, as well as relevant workflow practices.

Look development [Amb19], lighting, and rendering [Bir14] is a fundamental part of the production pipeline as it allows the development of the photorealistic aspect of CGI integration in Visual ef-

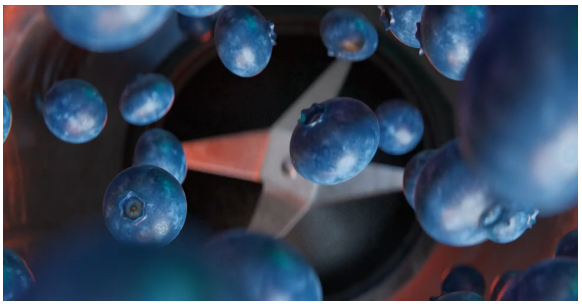

Figure 6: *Still frame from t "Final Major Project" short animation "The Taste of War" (2022).*

fects, and is covered by the "Lighting and Rendering" course. This focuses on three main bodies of knowledge, the first of these being the look development of computer generated assets for material creation, the second involving the preparation of live action images for the purpose of relighting computer generated assets and matching lighting between these assets and a live action background, and the third consisting of the rendering of the computer generated assets in preparation for compositing onto a live action background plate.

Finally, the "Real Time Graphics Systems" course introduces students to the infrastructure of interactive virtual environments, namely game engines, which in recent years have also been employed in visual effects, being used at the core of virtual production systems or for pre-visualisation [OZ20]. The course covers not only the use of engines for creating game worlds, but also examines underlying and related technologies, methods and techniques, such as scene management, game AI and VR. Practical workshops in this course mainly employ the Unreal Engine.

3.3.3. Year 3

After successful completion of the second year of their studies, the programme provides students with the possibility to embark on an industry placement during an optional "sandwich year", after which they will return for the final year of their programme. In this final year of the programme, there are four courses, only one of which is unique to the BAVFX programme, with the other three – one of these being an elective 20 credit (10 ECTS) course – being shared across our undergraduate framework.

The course that is unique to the BAVFX programme is the 20 credit (10 ECTS) course "Asset Integration 3" in semester 5, which is a continuation of "Asset Integration 2", providing a more in-depth examination of previously learned material, expanding on the knowledge gained and the techniques covered in its predecessor courses, and extending this towards set extension creation methods and techniques.

The 20 credit (10 ECTS) semester 5 course "Masterclass" is an industry led project, in which students are tasked with completing work to a brief set by industry contacts of the NCCA. The range of briefs provide exemplars for typical project tasks found in the computer animation, video game and visual effects industries. Students are required to select one of the briefs set by one of the industry

Figure 7: *"Digital Matte Painting" student work showing the original backplate (top) and the final digital matte painting (bottom).*

partners and complete this to a professional standard – the exact nature of the briefs changes every year and depends on the industry partners participating in that particular year.

The "Final Major Project and Dissertation" course is a 60 credit (30 ECTS) capstone course that spans across semesters 5 and 6. This course marks the culmination of production work and acts as the integrating component of techniques that students have learned and skills they have gained throughout their three years of study. Major projects take the shape of individual projects or of group projects, with groups being formed from final year students across our undergraduate framework, and aim to produce work of high quality that demonstrates the technical, creative, and professional skills of a graduate. Typically these projects result in short computer animated films, visual effects sequences, computer games or tools (Figures 1 and 6). This nature of the course is largely self-study, with a small number of supporting lectures and seminars on topics, such as research methods or dissertation writing. Students are supported by an allocated academic supervisor in weekly or bi-weekly individual (or small-group) tutorials.

The elective option for the final year runs during semester 6. Of these, the "Digital Matte Painting" course [RA22] was designed specifically as an option for visual effects students, aiming to develop the students' knowledge and understanding of the theory and practice of the post production discipline of digital matte painting (Figure 7). The course focuses on different techniques (e.g. 2.5D dummy geometry modelling, line-up, and image projection techniques) for creating digital environment assets and sets and facilitates the students' development of their ability to create photo-realistic digital environments in 3D, starting from a variety of different 2D reference images and resources and aims to allow students to develop their 2D digital painting techniques and abil-

ity with regards to creating high quality photo-realistic digitally painted images.

"CG and Animation for Cultural Heritage", which has previously been described by Anderson et al. [AAF21], investigates different forms of cultural heritage and the application of computer graphics and animation techniques and methods for interpretation and preservation of cultural heritage, particularly focusing on virtual heritage and methods that can be employed to aid the public presentation of cultural heritage.

Finally, "Digital Fabrication" aims to provide hand on knowledge of 3D printing technology and its application in arts and design. This course allows students with prior knowledge of 3D modelling to explore existing digital fabrication technologies and exposes them to relevant modelling methods and tools as well as to production specifics, including the state of the art and recent advances in hardware.

4. Reflection

The NCCA is well respected by the visual effects, computer animation and computer games industries and has been accredited by ScreenSkills Select[10], as well as being certified by The Rookies[11] and Houdini[12]. It is also an Unreal Academic Partner [13]. This reputation is also reflected in international rankings, e.g. in 2022, Animation Career Review[14] ranked Bournemouth University as number 3 within the Top 25 International Animation Schools, and in their ranking of the Best Visual Effects School in the world, *The Rookies*[15] ranked Bournemouth University as number 1 in the UK and 17th in the world.

Reflecting on experience of the BAVFX programme so far, from an academic perspective, the programme has been largely successful in providing students with an extensive and rounded education in the field of visual effects. It is apparent that students entering the programme with little to no knowledge of visual effects production tools and techniques are leaving the programme equipped with the knowledge and practical hands-on experience needed to enable them to enter the workplace as competent practitioners in their chosen area of specialisation, or as a generalist visual effects artist. Students graduating from the programme have gone on to start successful careers in the feature film visual effects industry, as well as other areas of visual effects production such as television, commercials, and games.

Feedback from graduating students has been generally positive when considering both unofficial ad-hoc feedback in the form of casual conversations and "Student Voice" feedback sessions, as well as student comments in the official (UK-wide) National Student Survey[16], such as "I feel I can go out into the world and get a job" or "I've enjoyed what I have done and learnt a lot of skills".

4.1. Future perspectives for the BAVFX

Workflow methodologies utilised by visual effects artists and practitioners are constantly evolving and being incrementally refined, as are the software and hardware tools which are being used to implement these practices. Therefore, there is a constant need for degree programmes to update not only the content being taught, but also the tools and techniques used to teach it.

Workflow methodologies utilised by visual effects artists and practitioners are constantly evolving and being incrementally refined, as are the software and hardware tools which are being used to implement these practices. Therefore, there is a constant need for degree programmes to update not only the content being taught, but also the tools and techniques used to teach it.

Elements of the programme that need to evolve further, primarily include focussing on the incorporation of virtual production practices, both from the perspective of the on-set photographic acquisition of footage, and the creation and implementation of real-time environments and assets, building on elements currently taught in the "Real Time Graphics Systems" elective course. There is also a need to further evolve the programme by incorporating AI generated images into its delivery, both as a tool for teaching the process of generating and refining concept art, and for more production focussed elements like 3D modelling and texturing that require the use of high quality concept art and detailed reference images.

5. Conclusions and Future Work

In this paper, we have explored the design of our BAVFX undergraduate honours degree programme, charting its curriculum and presented the syllabi of its courses, detailing the aims and objectives for each of these in the hope that they may be of use for other educators. We have also briefly discussed our experiences of implementing this programme and highlighted elements for future development.

Going forward into the next 6 year validation phase of the BAVFX degree programme, there are a few areas that would benefit from modification in order to improve the overall structure and delivery of the programme. In its current design the programme has multiple courses that take a generalist approach to the visual effects production pipeline, namely the three "Asset Integration" courses. Yearly delivery of these generalist courses over the past 5 years has shown that some students undertaking them inevitably focus more of their time and effort onto areas of the pipeline that are taught at the beginning of the course e.g. modelling and texturing, and neglect those that are taught at the end e.g. compositing. An alternative to this generalist approach would be to deliver courses that cover one or two of the individual disciplines, but cover them in a little more detail. The only potential drawback to this is having to simultaneously deliver courses that cover disciplines that would normally occur one after the other in the visual effects pipeline.

[10] https://www.screenskills.com/training/screenskills-select/
[11] https://discover.therookies.co/schools/rookies-certified-schools/
[12] https://www.sidefx.com/schools/
[13] https://www.unrealengine.com/en-US/academic-partners
[14] https://www.animationcareerreview.com/
[15] https://discover.therookies.co/rankings/
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