Unit 11: Digital Graphics and Animation

Level: **3**
Unit type: **Internal**
Guided learning hours: **60**

Unit in brief

Learners will study the principles, processes and implications of using digital formats to produce and process graphics and animation to meet identified requirements.

Unit introduction

Digital graphics and animation are widely used for a range of purposes, including creating special effects in television programmes and films, the making of cartoons and producing content for games and web pages for the purposes of education and simulation. Understanding how to plan, produce and manipulate digital content is crucial in ensuring that digital products match their intended purpose. As an animator, you will need to have determination, an eye for detail and the ability to plan and create high-quality digital graphics and animation products.

In this unit, you will cover the fundamental principles of digital graphics and animation. You will explore the implications of representing graphics in digital form and the processes and techniques used to develop effective digital graphics and animation. You will design, create, test and review digital graphics and animations, in readiness for inclusion in a digital product, to meet a range of identified requirements.

Through studying this unit you will apply skills and knowledge relevant to a variety of disciplines, including graphics, art and film making. You will develop the skills and knowledge that will be of benefit in a range of apprenticeships and higher education courses aimed at helping you to progress to employment in the creative computing industry, in a role such as a user interface developer or a cinematics artist.

Learning aims

In this unit you will:

A Investigate the purpose and principles of digital graphics and animation

B Design digital graphics and animation products to meet client requirements

C Develop digital graphics and animation products to meet client requirements.

Summary of unit

Learning aim	Key content areas	Recommended assessment approach
A Investigate the purpose and principles of digital graphics and animation	**A1** Digital image representation **A2** 3D image representation **A3** Digital animation techniques **A4** Uses and applications of digital graphics and animation	A report on the techniques used to produce, store and represent graphics and animation in digital format and the impact of using digital formats to produce these types of product.
B Design digital graphics and animation products to meet client requirements	**B1** Digital graphics and animation planning and design **B2** Design documentation **B3** Digital graphics and animation processes and techniques **B4** Reviewing and refining designs	A design specification showing the planning, preparation and design of digital graphics and animation products that meet client requirements. Digital graphics and animation files that fulfil the design specification accompanied by supporting development and testing documentation. A report evaluating the digital graphics and animations against the design specification.
C Develop digital graphics and animation products to meet client requirements	**C1** Digital graphics and animation processing techniques **C2** Testing digital graphics and animation **C3** Reviewing digital graphics and animation **C4** Quality characteristics **C5** Skills, knowledge and behaviours	

Content

Learning aim A: Investigate the purpose and principles of digital graphics and animation

A1 Digital image representation

Characteristics, application and implications of using digital data to represent digital images.

- Raster images:
  o 2D arrays
  o dimensions
  o sampling
  o colour modes
  o bit depth
  o resolution
  o compression (lossy, lossless).
- Vector images:
  o geometrical primitives (points, lines, curves, polygons)
  o paths
  o nodes
  o voxel.

A2 3D image representation

Principles and application of representing 3D images in digital format.

- Coordinate systems:
  o left- and right-handed
  o local
  o 3D world
  o 3D viewport
  o camera
  o geometrical primitives (points, lines, voxel).

A3 Digital animation techniques

Characteristics, application and implications of using digital animation techniques to create and process 2D and 3D animated images.

- Key frames.
- Tweening.
- Motion capture.
- Wire framing.
- Coordinate systems (2D and 3D).
- Environmental physics.
- Behavioural animation.

A4 Uses and applications of digital graphics and animation

Uses and applications of digital graphics and animation and the effect on content, format and characteristics.

- Target audience.
- Purpose, e.g. education, entertainment, illustration.
- Target platform.
- Target medium, e.g. digital, print.
- Interactivity.
- Legal and ethical considerations applicable to the equivalent legislation in England, Wales and Northern Ireland, e.g. privacy, security, use of content created by others.

Learning aim B: Design digital graphics and animation products to meet client requirements

B1 Digital graphics and animation planning and design

Techniques and processes to consider when planning and designing digital graphics and animation.

- Digital processing and editing techniques.
- Compression formats and techniques.
- Quality characteristics, e.g. image quality, compatibility, user experience, usability.

B2 Design documentation

- Requirements of the brief, including audience, purpose and client requirements.
- Organisation/company research.
- Legal and ethical considerations applicable to the equivalent legislation in England, Wales and Northern Ireland, e.g. licencing, data security, privacy.
- File naming and storage location.
- Sources of images.
- Product design:
  - characters
  - background imaging
  - sound and effects
  - scripts, storyboards, storylines, timeline storyboards, mood boards, mind maps
  - timings, key frames, frame numbering, frame naming and frame rates
  - perspectives
  - dope sheet for instructions for animation/filming
  - long sheet for running time and sequencing.
- Intended platform/media for delivery.
- Hardware requirements, to include:
  - specification of target platform (input, processing and output requirements)
  - specialist input devices, e.g. motion capture, virtual reality, laser scanning, CT scanner
  - specialist output devices, e.g. virtual reality, e-paper, holographic
  - locater devices, e.g. absolute or relative, direct or indirect, discrete or continuous.
- Software requirements, to include:
  - tools required
  - target file formats, types and sizes
  - product compatibility
  - codecs.
- Additional assets required for digital graphics and animation:
  - original photographs
  - images or logos that can be edited or transformed to become part of the digital character
  - sound files (music, sound effects, speech).
- Test plans to check correctness, presentation, compatibility and other quality characteristics.
- Technical constraints, e.g. file types, software licensing.

B3 Digital graphics and animation processes and techniques

Processes and techniques used in the editing and production of digital graphics and animation products and their implications.

- Mathematical principles and processes:
  - algorithms
  - composite transformations
  - coordinate systems
  - image arithmetic
  - rotation (2D and 3D)
  - scaling (2D and 3D)
  - translation (2D and 3D).
- Graphic processing and editing techniques:
  - translation
  - scaling
  - rotation
  - composite transformations
  - 3D viewing
  - file size, e.g. quality of image, frame disposal, auto crop.
- Compression formats and techniques.
- User experience:
  - quality
  - compatibility
  - usability
  - hardware requirements
  - software requirements.

B4 Reviewing and refining designs

Working with clients and others to improve the quality, effectiveness and appropriateness of designs.

- Gathering feedback from client(s) and potential users.
- Communicating with clients, e.g. email, verbal communication.
- Scheduling and documenting meetings.
- Agreeing and adjusting timescales.
- Refining ideas and solutions.
- Updating design specification documentation based on review and feedback.

Learning aim C: Develop digital graphics and animation products to meet client requirements

C1 Digital graphics and animation processing techniques

Selection and use of digital graphics and animation processing tools and techniques.

- Graphic tools:
  - freehand draw
  - grouping
  - colour balance
  - filters
  - selection
  - hue and saturation
  - masking
  - layering
  - retouching
  - opacity/transparency
  - editing and combining paths.

- Animation tools:
  - frame rates
  - onion skinning
  - tweening
  - transitions
  - camera angles
  - movement
  - picture duration
  - rendering.
- Storing digital graphics and animation:
  - file formats
  - compression
  - target device/platform
  - user requirements
  - quality characteristics.
- Storing and using other digital assets, e.g. audio, video.
- Hardware and software requirements.

C2 Testing digital graphics and animation

- Test digital graphics and animation for functionality, compatibility, stability and acceptance.
- Obtain feedback from others, e.g. effectiveness, presentation, and purpose.
- Make improvements to digital graphics and animation in response to testing and feedback from others.

C3 Reviewing digital graphics and animation

- Quality of digital graphics and animations.
- Suitability for audience and purpose.
- Suitability against the original requirements.
- Legal and ethical constraints applicable to the equivalent legislation in England, Wales and Northern Ireland, e.g. privacy, security, use of content created by others.
- Technical constraints.
- Strengths and potential improvements.
- Optimising digital graphics and animations, e.g. paltering frame rates, exporting to different file formats, updating/replacing assets, applying different tools or effects, using different compression methods.

C4 Quality characteristics

Quality characteristics of digital graphics and animation that can be measured against client requirements.

- Image quality.
- Sound quality.
- Special and visual effects.
- Accuracy.
- Compatibility.
- Usability.
- Stability.
- Functionality.
- Costs.

C5 Skills, knowledge and behaviours

- Planning and recording, including the setting of relevant targets with timescales, how and when feedback from others will be gathered.
- Reviewing and responding to outcomes, including the use of feedback from others, e.g. IT professionals and users who can provide feedback on the quality of the digital graphics and animation products and their suitability against the original requirements.
- Demonstrate behaviour and its impact on outcomes, including professionalism, etiquette, supportive of others, timely and appropriate leadership, accountability and individual responsibility.
- Evaluating outcomes to help inform high-quality, justified recommendations and decisions.
- Evaluating targets to obtain insights into own performance.
- Media and communication skills, including:
  - o the ability to convey intended meaning, e.g. written (email, design documentation, recording documentation, reports, visual aids for use in presentations), verbal communication requirements (one to one and group, informal and formal, situations)
  - o use of tone and language for verbal and written communications to convey intended meaning and make a positive and constructive impact on audience, e.g. positive and engaging tone, technical/vocational language suitable for intended audience, avoidance of jargon
  - o responding constructively to the contributions of others, e.g. supportive, managing contributions so all have the opportunity to contribute, responding to objections, managing expectations, resolving conflict.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate the purpose and principles of digital graphics and animation		
A.P1 Explain the characteristics of digital graphics and animation and methods of processing them in digital format. **A.P2** Explain the impact of using different tools and techniques to process and manipulate digital graphics and animation in digital formats.	**A.M1** Analyse how the representation of digital graphics and animation in digital format impact on their usability and accuracy.	**A.D1** Evaluate how the representation of digital graphics and animation in digital format impact on their usability and accuracy.
Learning aim B: Design digital graphics and animation products to meet client requirements		
B.P3 Produce designs for digital graphics and animation products that meet client requirements. **B.P4** Review the designs with others to identify and inform refinements.	**B.M2** Justify decisions made, showing how the design will fulfil its purpose and client requirements.	**BC.D2** Evaluate the design and optimised digital graphics and animation products against client requirements. **BC.D3** Demonstrate individual responsibility, creativity, and effective self-management in the design, development and review of digital graphics and animation products.
Learning aim C: Develop digital graphics and animation products to meet client requirements		
C.P5 Produce digital graphics and animation products to meet client requirements. **C.P6** Test digital graphics and animation products for accuracy, functionality, compatibility and stability. **C.P7** Review the extent to which the digital graphics and animation products meets client requirements.	**C.M3** Optimise digital graphics and animation products to meet client requirements.	

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of two summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aims: B and C (B.P3, B.P4, C.P5, C.P6, C.P7, B.M2, C.M3, BC.D2, BC.D3)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to hardware and software resources that will allow them to use a selection of tools and techniques, as given in the unit content, to produce digital graphics and animation products.

There are a number of propriety and open source resources available, including:

- animation software (for example Adobe Flash®, Sketchbook Pro®, Blender™)
- image editing software (for example Photoshop®, Pencil, Synfig Studio)
- 3D-modelling software (for example 3D Studio Max®, Maya™, Modo™, ZBrush®, AutoCAD®, Cinema 4D™, Blender™).

Essential information for assessment decisions

Learning aim A

The evidence must include characteristics and techniques used for processing and creating graphics and animation in digital format. This must be supported by examples of how these are used. The evidence will include an analysis of how the different techniques could be used and the effect they would have on digital files, and, where appropriate, the effect on the user.

For distinction standard, learners will provide a clear and balanced evaluation of how the characteristics of digital image data impact on the use and representation of digital graphics and animation. The evidence will also include an analysis of how the techniques used to create and process digital graphics and animations affect their appropriateness, accuracy of representation and usability. The evidence will demonstrate high-quality written/oral communication through the use of accurate and fluent technical vocabulary, which supports a well-structured and considered response that clearly connects chains of reasoning.

For merit standard, learners will analyse how the tools, techniques and principles of digital image representation impact on the production and outcomes of digital graphics and animation and the products for which they are intended. Learners should consider how mathematical principles, such as geometry and co-ordinate systems, impact on the digital output and, where appropriate, the impact on the user. Learners will consider the implications of computational processes, such as compression, environmental physics and behavioural animation, and how they are used to produce and edit digital representations of objects and/or actions. Learners should also analyse how the intended uses and applications of digital images and animations, and relevant legal and ethical considerations, would impact on the choice of tools and processing techniques. The report will be technically accurate and demonstrate good quality written/oral communication.

For pass standard, learners will explain how digital data is used to represent image data and the impact this has on the way in which images are stored, manipulated and used. Learners must identify techniques used to create, edit and process digital graphics and animation, and explain how these techniques and processes affect digital images. Learners will identify some of the mathematical and computational processes that are used in digital graphic and animation production and the effect this has on digital images. Learners will explain how the intended uses and applications of digital products (including target audience, purpose and target platform) impact on the tools and techniques used to develop digital graphics and animation. Learners must demonstrate an understanding of the key legal and ethical considerations that affect the user and development of digital content. The evidence will discuss how file formats affect digital products and how these can be used. The evidence may have some inaccuracies and the review of the impact may be unbalanced.

Learning aims B and C

Learners must provide evidence of planning and developing a number of different digital graphics and at least one animation. Depending on client requirements, the products learners produce could be suitable for inclusion in a larger digital product. For example, the client may require content for an e-learning package that may include graphics for different purposes, such as navigation buttons, icons, illustrations assets for educational games, and animations such as animated banners, educational cartoons or cut-scenes in games. The digital graphics and animations should be of sufficient complexity to show the use of a range of appropriate processing techniques.

Learners should produce a range of digital images as well as a number of brief animations, or one extended animation of sufficient length and complexity, to demonstrate competency in the use of the skills and techniques listed in the unit content.

For distinction standard, learners will draw on, and show synthesis of, knowledge across the learning aims in evaluating how the decisions and processes, applied throughout the planning, development and testing stages, impacted on the effectiveness of the digital graphic and animations. Learners will make suitable and reasoned justifications of decisions made in comparison to alternative solutions.

Learners must provide a thorough evaluation of the effectiveness of the content produced against the design and client requirements. The evaluation will be supported by evidence from all stages of the planning, development and review processes in order to reach valid conclusions as to how the chosen processing techniques provided more appropriate digital content in comparison to alternatives. Learners will provide well-considered, justifiable suggestions for future improvements to the digital graphics and animation.

The evaluation must contain a systematic and accurate review of learners' skills and performance and the impact that this had on the effectiveness of the solutions. Evaluation of behaviours must consider learners' use of 'soft skills' in relation to the vocational context of the project, such as managing and liaising with other members of the team or clients and time management. Learners will evaluate their own behaviours throughout the project and the impact they have on the outcomes. Learners will take individual responsibility for their own work, for example identifying potential issues and resolving these, reviewing their work and making improvements, keeping their work safe and secure and showing responsible use of quoted materials. Learners will show creativity, for example, through evidence of taking innovative approaches to problem solving and through the originality of their solution. Learners will refer to tangible evidence to support their evaluation, such as meeting notes, correspondence and time plans.

For merit standard, learners will apply their knowledge through the selection and application of appropriate tools and techniques to plan, design, develop, test and optimise digital graphics and animations that effectively meet client requirements. The sourcing, development and testing stages must be well documented with clear justification of decisions and selections made throughout. Learners will make clear references to the client's requirements, target product and platform, and consider legal and ethical issues as appropriate.

Learners must provide a clear, accurate and robust justification of how the chosen mathematical and computational processing techniques will ensure the digital graphics and animations are appropriate for the use for which they were intended.

Learners will source a wide range of digital content in readiness for processing and editing with appropriate, dedicated editing software. The evidence will demonstrate accurate and appropriate use of 2D and 3D image creation and editing tools. Learners must produce digital content that is fully optimised for use in the identified target product and that fully meets the client's requirements.

For pass standard, learners will apply understanding through the planning, sourcing and processing of digital content to produce graphics and animations to meet identified requirements. Learners will explain the content (and related computing) requirements of an identified client. Learners should provide a project brief that clearly outlines the purpose of the digital graphics and animation. Depending on client requirements, the digital graphics and animation may be required for inclusion in another digital product. Learners will explain how digital graphics and animation techniques, as well as mathematical and computational processing methods, will be used to meet the client's requirements. The project brief should consider the appropriateness of different possible techniques and formats and the impact these would have on the user experience. Learners must show some awareness of the legal and ethical considerations related to sourcing and producing digital content.

Learners will source a range of digital content in preparation for processing with appropriate editing software. They must identify and source raw content that they will use and explain the reasons for choosing the elements that were used, and the editing decisions made during production and development. Learners will provide a clear record of the sources used and demonstrate an understanding of the implications of relevant legal and ethical issues in their selection and use of particular content.

Learners must provide documentation for the planning, development, production, and quality assurance of their digital graphics and animation, and must explain the decisions made during the project to ensure they met the project brief. Learners will produce a number of 2D and 3D images for inclusion in the specified digital product. Learners will produce content that meets the requirements of the client and that is appropriate for the identified product, however some small issues of optimisation and/or rendering may persist.

Learners must provide a review of whether their work meets the client's requirements, considering positive and negative aspects of the outcomes, although their review may be unbalanced and/or superficial. Learners will use relevant feedback, such as client feedback, to make suggestions regarding possible alternative solutions that could be implemented.

Links to other units

This unit links to:
- Unit 12: Digital Audio
- Unit 13: Digital Video
- Unit 14: Computer Games Development
- Unit 15: Website Development
- Unit 16: Object-oriented Programming
- Unit 17: Mobile Apps Development
- Unit 24: Software Development
- Unit 25: Web Application Development
- Unit 27: 3D Modelling.

Employer involvement

This unit would benefit from employer involvement in the form of:
- guest speakers
- technical workshops involving staff from local organisations/businesses
- contribution of design/ideas to unit assignment/scenario/case study/project materials, including own organisation/business materials as exemplars where appropriate
- feedback from staff from local organisations/businesses on plans/designs/items developed
- opportunities for observation of organisational/business application during work experience
- support from local organisation/business staff as mentors.