Unit 75: Flash for Computer Games

NQF Level 3: BTEC National

Guided learning hours: 60

Unit abstract

Flash, as a game development platform for casual games, is an authoring tool which has grown considerably in power over the years. Flash can be used to create games as simple as noughts and crosses or as complicated as a real-time multiplayer game. Flash simplifies the visual side of programming computer games, works on almost every computer, and has a powerful and reasonably straightforward ActionScript programming language. Flash is a very good environment for learning basic game programming ideas.

Programming is what makes games interactive. The ActionScript language built into Flash lets the developer do anything that can be done with animation and many things that cannot be done by using animation techniques alone.

In this unit the learner will examine what is going on behind the scenes of a Flash game and how ActionScript is used to create and control objects directly rather than relying only on the Flash environment to control objects via animation. Learners will investigate how Flash is used in the creation of an interactive game. They will understand how Flash can control game physics and how Flash can be used to develop 2D and 3D isometric games for mobile devices and the web. Learners will use Flash tools and ActionScript to create a game.

Learning outcomes

On completion of this unit a learner should:

1 Understand the application of Flash to game development

2 Be able to use Flash tools for game programming

3 Be able to use ActionScript for game programming

4 Be able to produce a Flash game.

Unit content

1 **Understand the application of Flash to game development**

Flash for game development: Flash's integrated development environment (IDE); Flash Player

Game programming in Flash: advantages for game programming; ActionScript compared to animation; limitations of Flash; plug-ins; Flash variants and players, eg Flash Lite; coding conventions (file-naming, camel-case, punctuation, indentation); PC platforms (Flash); mobile platforms (Flash Lite)

Making games: making artificial worlds; importance of interactivity; objects; programmer as 'hidden' player

Planning Flash games: story; input devices; graphics; sound; importance of gameplay; game plan (main character, look and feel, game screens, screen objects, role of objects, behaviour of objects); game flowcharts

2 **Be able to use Flash tools for game programming**

Flash environment: workspace (stage, timeline, toolbar and panels, preferences, help)

Basic tools: drawing, eg pencil, line, pen, brush, shapes; free transform, eg rotate, skew, distort, scale, envelope, ruler and guidelines; editing, eg lasso, eraser, undo, copy, paste, duplicate, insert, delete, aligning, grouping, ungrouping

Objects: symbols, eg instances, duplicating symbols, swapping symbols, editing, grouping; buttons (creation, library, button states, code)

Colour tools: colour, eg colour properties, eyedropper, creating custom colours, colour swatches, stroke and fill

Text tools: text, eg editing, moving, rotating, reshaping, scrolling, creating textblocks, converting text to shapes

Animation: frame label; frame rate; timeline (playhead, layers, frames, frame rate, keyframes, onion skinning, markers); frame manipulation, eg copying, deleting, reversal; testing movies; frame by frame animation; tweening (shape, motion)

Assets: importing, eg raster images, vector images, sound files, video files, movie clips; resizing; asset libraries

Advanced tools: scenes; guide layers; masking, eg mask layers, animated masks; timeline effects, eg blur, drop shadow, expand, explode, transform, transition; nesting movie clips; interactivity, eg scripting, behaviours, actions, triggers, buttons, rollovers, playback control, preloaders

Saving and exporting: saving; publishing; optimising; file formats; reasons for formats

3 **Be able to use ActionScript for game programming**

Basic: object-oriented programming, eg class, class definition, instances, properties and methods; syntax; pseudocode; testing; bugs and crashes

Advanced: events; sprites; movie clips; objects, eg properties, functions, characteristics, dx and dy properties, onEnterFrame events; game boundary checking, eg effects, wrapping, x and y coordinate values, stage width, stage height, stopping at boundary; cursor substitution; mouse tracking; artificial intelligence (AI); scorekeeping (text fields, winning and losing states); keyboard input, eg trawling, inspecting, key object, keyboard handler; audio output, eg sound object, sound effects, compression, importing; animated sprites, eg computer control, direction constants, sprite properties, turning, moving; user-controlled sprites, eg keyboard input, checking for motion keys, controlling sprites; cloning movie clips; firing weapons; collision testing, collision testing, eg checkCollisions() function

Vectors: vector conversion; vector projection in motion; centre of gravity; vector paths; calculating vectors, eg dx, dy, angle, length; following mouse

Text: static; dynamic; input; associating variables; reading input

Random numbers: math objects; dice

Decision making: conditions; false conditions; ELSE clause

Game physics: math concepts, eg velocity, acceleration, calculating distance, vectors, compensating for gravity, random integers, Newton's laws, objects in motion, traction

Repeated behaviours: loops; arrays; creating sprites dynamically; custom objects

4 **Be able to produce a Flash game**

Game design: planning considerations, eg genre, interpreting creative brief, storyboarding, asset management

Assets: graphical (sprites, backgrounds); behavioural (effects, objects, ActionScripts); sound, eg effects, music, ambience, dialogue; file types, eg bmp, gif, tiff, jpg, wav, midi, aiff, au, smp, MP3, ra, vox

Production: assets; ActionScripts; animation; game world; testing (alpha and beta, user testing)

Publishing: executables, eg PC platforms (Flash), mobile platforms (Flash Lite)

Reflective practice: compared with original intentions; fitness for purpose; sources of information, eg self-evaluation, testing, documentation, comments from audience, comments from peers, comments from tutors, comments from client

Grading grid

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all of the learning outcomes for the unit. The criteria for a pass grade describes the level of achievement required to pass this unit.

Grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 describe the application of Flash to game development expressing ideas with sufficient clarity to communicate them and with some appropriate use of subject terminology	M1 explain the application of Flash with reference to well-chosen examples expressing ideas with clarity and with generally appropriate use of subject terminology	D1 fully explain the application of Flash with supporting arguments and elucidated examples expressing ideas fluently and using subject terminology correctly
P2 apply Flash tools for game programming working within appropriate conventions and with some assistance	M2 apply Flash tools for game programming to a good technical standard showing some imagination and with only occasional assistance	D2 apply Flash tools for game programming to a technical quality that reflects near-professional standards showing creativity and flair and working independently to professional expectations
P3 apply ActionScript for game programming working within appropriate conventions and with some assistance	M3 apply ActionScript for game programming to a good technical standard showing some imagination and with only occasional assistance	D3 apply ActionScript for game programming to a technical quality that reflects near-professional standards showing creativity and flair and working independently to professional expectations

continued

Grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P4 produce a Flash game working within appropriate conventions and with some assistance.	M4 produce a Flash game to a good technical standard showing some imagination and with only occasional assistance.	D4 produce a Flash game to a technical quality that reflects near-professional standards showing creativity and flair and working independently to professional expectations.

Essential guidance for tutors

Delivery

It is suggested that teaching follows the order of the learning outcomes, starting with an introduction to the application of Flash to game development and following that with a study of Flash tools and ActionScript. Learners should be introduced to basic concepts of game physics and should have opportunities to examine and practise how these concepts are implemented in ActionScript. Learners can then produce a game in Flash incorporating scripts for interactivity.

This unit could be taught through a variety of activities, such as lectures, group discussions, Flash game play, practical sessions and demonstrations. The largest proportion of time should be spent in practical sessions using Flash and especially ActionScript. Using Flash will demonstrate to learners how 2D sprites can be used to give an illusion of 3D and how scrolling backgrounds are used to give an illusion of animation or movement. Learners will be expected to have a good working knowledge of Flash to produce and test a playable game. This can be achieved through practical demonstrations and exercises.

Formal lectures and independent study will be the main method used to develop understanding of the application of Flash. Learners will need access to Flash games (from websites, mobile devices or on disk) in order to study how Flash can be applied within the computer games industry. Learners should have the opportunity to study the use of Flash Lite for mobile games, since the mobile market is developing rapidly.

Learners must have access to Flash software to experience the use of Flash tools and the application of ActionScript to promote gameplay and interactivity. When providing Flash games for study, the .fla files should also be provided so that ActionScript commands and their effects can be studied.

Teaching of ActionScript is best done in short, carefully structured stages, each stage being reinforced with small practical projects which, when completed, allow progress to other stages. Tutors should strive to build a progressive library of games with corresponding ActionScript so that early, simple examples of script can be built upon, leading to the development of more powerful and usable scripts for games.

The production of a Flash game should be viewed as an opportunity to put into practice the skills and knowledge learned throughout the unit and should be viewed as the major piece of work for the unit. It is expected that learners follow good game design habits when producing their game. This is best achieved through learners planning their games on paper first before using Flash. Learners should record their planning and developmental work, as this can be used towards reflective practice. Learners may require access to other software (for example, a graphics package in order to prepare suitable assets).

Reflective practice is an important part of games development and design. Learners should be encouraged to compare their completed game with their original intentions. This can be achieved through self-evaluation (using techniques such as peer and client testing) and recorded in a report.

Assessment

Evidence for assessment

Evidence for achievement of learning outcome 1 of this unit can be drawn from presentations both written and oral. Oral presentations must be recorded for the purposes of internal and external verification. The learner may present researched information; research could include extracts from books, journals, articles, material published on the internet or trade publications. Evidence relating to learning outcome 1 might also be presented in the form of wiki articles created by learners.

Evidence for achievement of learning outcomes 2 and 3 may be drawn from the final game produced as evidence for learning outcome 4, but in this case there must be additional supporting evidence explaining why tools have been chosen and how they have been used, and explaining in detail what ActionScript has been used and why. Checklists of available tools or scripts showing where they have been used are in themselves not sufficient to demonstrate achievement of learning outcomes 2 and 3; again, these must be supported by additional annotation explaining their use. Documentation could be presented as annotated screen grabs or via screen capture software with voiceover. Comprehensive, authenticated logs supported by other materials might be alternative suitable vehicles.

For some elements of this unit, and for some learners, a formal *viva voce* assessment might be appropriate. When more than one learner in a cohort is assessed in this way care must be taken to ensure that all learners are asked equivalent questions, and that all are given equal opportunities to expand or clarify their answers. Interviewers must also ensure that questions are not phrased in such a way as to provide or suggest an answer. Formal *vivas* should be recorded for the purposes of internal and external verification and at least 50 per cent of such assessments must be internally verified.

Application of grading criteria

When applying the grading criteria, tutors should follow the advice given below. Please note that any examples of evidence given here are indicative only. This advice is not exhaustive and the examples need not specifically be included in a learner's work in order for that learner to achieve the exemplified grade.

Pass

To achieve a pass grade, learners must achieve all the criteria at pass level.

P1: learners will describe the application of Flash to game development including reference to Flash as an integrated development environment (IDE) and discussing advantages and limitations of Flash for game programming. Additionally, learners will describe the basics of making games and planning requirements for Flash games.

P2: learners will have generated a Flash game which uses some of the key characteristics of the software in simple and conventional ways. At this level learners' use of the software tools will be basic and restricted to tools such as environment, drawing, text, colour, animation, saving and exporting. Learners will, as a minimum, have identified where tools have been used. This evidence could be presented via a document with screen grabs and annotation, or perhaps screen capture software with voiceover.

P3: learners will have applied elementary ActionScripts which provide some player interactivity and control, and which enable a basic level of gameplay. At this level learners' application of ActionScript will be basic — for example, scripts to control animation, control movie clips, make user controlled buttons, play sounds and identify keyboard input.

P4: learners will have achieved a finished working game which is playable though limited and conventional. The final product will not have realised learners' full intentions but work on the game will have been purposeful and the outcome will reflect some interpretation of the brief, some elementary planning of game design and will evidence the deliberate application of Flash tools and ActionScript. Some attempt to reflect on the product will have been made, moving some way beyond merely describing their work. Some user testing of the final product must be evidenced, typically by inclusion of user comments within reflective practice. At the pass level, evaluative comments will be assertions that are not supported by evidence or exemplification.

P1 and P4: when expressing themselves orally, learners' language skills will be sound and they will be able to express themselves with sufficient clarity to be understood, though vocabulary — and in particular technical vocabulary — will be limited, and register will not always be appropriate to the situation or audience. When expressing themselves formally in writing, learners' skills will be basic, typically with frequent errors of spelling and punctuation and occasional lapses in grammar and syntax. Generally, language skills will be adequate for learners to communicate simple ideas or deal with straightforward material.

P2, P3 and P4: learners at the pass level may need frequent assistance and support, though they will take note of and make use of this help when it is given. If they are in frequent need of such help but fail to make positive use of it they should not be considered for a pass grade for this unit.

Merit

To achieve a merit grade, in addition to achieving all the criteria at pass level, learners must achieve all the criteria at merit level.

M1: learners will explain the application of Flash to game development including reference to Flash as an integrated development environment (IDE) and explaining advantages and limitations of Flash for game programming. Additionally, learners will explain game design basics and planning requirements. All explanations will be supported by well-chosen examples. At this level, learners will explain coding conventions and will exemplify their explanation of game making basics by reference to examples of Flash games.

M2: learners will have generated a working Flash game which uses the software application tools competently and in an imaginative way, making use of conventions but not slavishly copying them and reflecting their understanding in the implementation of their ideas. At this level learners' use of the software tools will extend beyond the basic. Learners will have identified where tools have been used and will have attempted to justify their selection. This evidence could be presented via a document with screen grabs and annotation, or perhaps screen capture software with voiceover.

M3: learners will have applied ActionScripts which competently provide player interactivity and control, enabling gameplay in an imaginative way, making use of conventions but not slavishly copying them, and reflecting their understanding in the implementation of their ideas. At this level learners' application of ActionScript will extend beyond the basic — for example scripts to set and maintain player scores and scripts to detect and deal with collisions, perhaps implementing laws of motion or gravity effects. Learners will have identified where scripts have been used and will have attempted to justify their use. This evidence could be presented via a document with screen grabs and annotation, or perhaps screen capture software with voiceover.

M4: learners will have generated a finished working Flash game which is playable and imaginative, showing some confidence in the application of skills. The final product will approach learners' full intentions and work on the game will reflect a methodical approach, some imagination in interpretation of the brief, some planning of the game design and production, and will evidence a competent application of Flash tools and ActionScript. There will be some evidence of testing during production. A careful reflection on their product will have been made, explaining choices and decisions and exemplifying these explanations through relevant reference to their own work. Some comments from others will be included in learners' reflective practice, including reference to test results.

M1 and M4: when expressing themselves orally, learners' language skills will be good and they will be able to express intentions and ideas clearly using, for the most part, the right word in the right context, including technical vocabulary and the kind of language used in the industry. When expressing themselves formally in writing, learners' skills will be sound with typically few lapses in grammar and syntax, though there might be some errors of spelling and punctuation. Generally, language skills will be good enough for learners to be able to express fairly complex ideas and to handle material of moderate difficulty.

M2, M3 and M4: learners will show facility and some confidence in relation to skills and the handling of the software. Work will be approached methodically and with adequate preparation. Processes will be undertaken with care and, generally speaking, thought will be put into the work. Though learners might still be working within recognisable generic creative conventions, codes and conventions whether aesthetic or technical, will not be slavishly copied but will be employed with some inventiveness. Learners at this level might well need occasional support, particularly when trying to apply more sophisticated techniques or working in more difficult circumstances. As with the pass grade learner, they will make use of any support provided.

Distinction

To achieve a distinction grade, in addition to achieving all the criteria at pass and merit level, learners must achieve all the criteria at distinction level.

D1: learners will fully explain the application of Flash to game development and will address all points listed in the unit content. At this level the evidence will be lucid, using explicit examples to provide clear explanation for points being made to support their opinions. Learners will justify points made using supporting arguments or evidence, developing ideas critically (ie, comparing, assessing and discriminating). They will draw out of an example precisely what is about it that that exemplifies the point it illustrates.

D2: learners will have been able to generate a fully working original Flash game showing creativity and flair, drawing clearly on their interpretation of the brief and the ideas they have generated. At this level learners will use the Flash application tools with confidence and autonomy to produce their game. Learners will fully document their use of the Flash tools used to produce their game. This evidence could be presented via a document with screen grabs and annotation, or perhaps screen capture software with voiceover.

D3: learners will have generated and applied ActionScripts which provide more complex player interactivity and control, enabling gameplay in an imaginative way with some qualities of originality. At this level learners' application of ActionScript will evidence technical excellence. Learners will fully document their use of the ActionScript used to produce their game. This evidence could be presented via a document with screen grabs and annotation, or perhaps screen capture software with voiceover.

D4: learners will have produced a fully working original Flash game showing creativity and flair demonstrating full confidence in application of skills. The final product will meet and may exceed initial intentions and their work will be highly creative and of quality approaching professional standards showing technical excellence in relation to skills. At this level, learners' work will demonstrate care in design and planning for their game and will evidence technical excellence in application of Flash tools and ActionScript. Learners will evidence thorough and systematic testing of their game throughout its development including alpha, beta and user testing. Learners will reflect accurately and critically on their own work with detailed reference to elucidated examples of that work. This reflection will consider comments from others gathered during testing.

D1 and D4: when expressing themselves formally in writing, learners' skills will be good with typically quite complex sentence structures, very few grammatical errors and infrequent errors in spelling and punctuation. Generally, language skills will enable learners to express complex ideas and to handle difficult material.

D2, D3 and D4: technical and production skills will approach the professional standard and work produced will bear comparison with professional work. Distinction level learners will apply their technical skills not just with imagination but with ingenuity and even elegance, and codes and conventions will be used with occasionally surprising results. In all practical activity they will be capable of working autonomously and effectively. The term 'working independently' should not be understood to mean producing poor quality work autonomously, nor that the learners do what they want, when they want, how they want. It means that they are able to work on their own initiative, do not need constant support or supervision, give the work their full commitment, work positively and cooperatively with others, and meet deadlines. In other words, they have the kind of self-management skills that would be expected of them in a professional context. Note also that this criterion should not be taken to mean that learners do not seek advice or that they work without discussing things with their tutor, but rather that they are not dependent upon the support of others and that when they take advice they weigh it carefully for themselves.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units/qualifications

This unit can be linked to *Unit 18: Digital Graphics for Interactive Media*, *Unit 63: Web Animation for Interactive Media*, *Unit 69: Object-Oriented Design for Computer Games* and *Unit 70: Computer Game Design*.

There are opportunities to relate the work done for this unit to Skillset National Occupational Standards in Interactive Media as follows:

- IM1 Work effectively in interactive media
- IM2 Obtain assets for use in interactive media products
- IM3 Prepare assets for use in interactive media products
- IM5 Design user interfaces for interactive media products
- IM6 Use authoring tools to create interactive media products
- IM7 Code scripts to provide functionality for interactive media products
- IM8 Determine the implementation of designs for interactive media products
- IM13 Conduct user testing of interactive media products
- IM20 Design electronic games
- IM22 Test electronic games
- IM24 Create 2D animations for interactive media products.

Essential resources

This unit will require access to appropriate hardware and Adobe Flash software and any other relevant industrial standard software. Learners should have access to relevant software manufacturers' manuals, textbooks, the internet and a library of examples of current Flash Games and ActionScripts.

Indicative reading for learners

Books

Besley K — *Flash MX 2004 Games Most Wanted* (APress, 2004)

Harris A — *Beginning Flash Game Programming for Dummies* (Wiley Publishing, 2006)

Hoekman R — *Flash Out of the Box* (O'Reilly, 2004)

Makar J and Sosinksy B — *Macromedia Flash MX Game Design Demystified* (Macromedia, 2004)

Moock C — *Essential ActionScript 2.0* (O'Reilly, 2004)

Moock C — *Essential ActionScript 3.0* (O'Reilly, 2007)

Rhodes G — *Macromedia Flash Professional 8 Game Development* (Charles River Media Game Development, 2006)

Rosenzweig G — *Macromedia Flash MX Actionscript for Fun and Games* (Que, 2002)

Ulrich K — *Macromedia Flash 8 for Windows and Macintosh: Visual QuickStart Guide* (Peachpit Press, 2006)

Websites

www.adobe.com	the website of this software manufacturer contains useful information and resources, including training materials, forums, downloadable trial software and players, news etc
www.ferryhalim.com/orisinal	free Flash games resource
www.flashadvisor.com	Flash games resource, tutorials, animations, ActionScripts, Flash movies and sound loops
www.flash-game.net	a resources site with more than 3000 free games and online games including sports games, action games, puzzle games, flash games and multiplayer games
www.flashkit.com	a resources site for Flash developers which includes reviews, sound loops and tutorials
www.kidzonline.org/TechTraining/video.asp?UnitQry=2D%20Animation	Kidz Online (KOL) is a high-tech digital video production and distribution organization with unique and robust online learning
www.tutorialized.com/tutorials/Flash/Games/1	Flash games resource, tutorials, animations, ActionScripts

Key skills

Achievement of key skills is not a requirement of this qualification but it is encouraged. Suggestions of opportunities for the generation of Level 3 key skill evidence are given here. Tutors should check that learners have produced all the evidence required by part B of the key skills specifications when assessing this evidence. Learners may need to develop additional evidence elsewhere to fully meet the requirements of the key skills specifications.

Communication Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• describing the application of Flash to game development and discussing advantages and limitations of Flash game programming	C3.1a Take part in a group discussion.
• giving a presentation on the application of Flash to game development.	C3.1b Make a formal presentation of at least eight minutes using an image or other support material.
Information and communication technology Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• investigating advantages and limitations of Flash game programming	ICT3.1 Search for information, using different sources, and multiple search criteria in at least one case.
• producing a Flash game.	ICT3.3 Present combined information such as text with image, text with number, image with number.

Improving own learning and performance Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• producing a Flash game.	LP3.1 Set targets using information from appropriate people and plan how these will be met. LP3.2 Take responsibility for their learning, using their plan to help meet targets and improve their performance. LP3.3 Review progress and establish evidence of their achievements.
Problem solving Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• producing a Flash game.	PS3.1 Explore a problem and identify different ways of tackling it. PS3.2 Plan and implement at least one way of solving the problem. PS3.3 Check if the problem has been solved and review their approach to problem solving.