Cambridge International AS & A Level Information Technology

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For examination from 2017

Topic 17 Animation

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Introduction

How to use this guide

The aim of this guide is to facilitate your teaching of Cambridge International AS & A Level Information Technology, syllabus topic 17, Animation. The guidance and activities in this resource are designed to help teachers devise programmes of study for animation that provide teaching time devoted to theory work and opportunities for practical exercises.

Learning objectives

After reading this guide you should be able to teach the following learning objectives:

17. Animation

- create and evaluate an animation that meets the requirements of its intended application and audience
  - place objects
  - place an image
  - use frames
  - set key frames
  - use timings
  - use layers
  - show and hide objects
  - resize objects
  - use coordinates to move and place objects
  - understand the use of tweening and what effect it creates
  - use tweening (motion tweening) to create a smooth transition between frames
  - use morphing (shape tweening)
  - understand the use of morphing and what effect it creates
  - use morphing to create a smooth transition between images
  - add text
  - change the opacity of objects and text.

Prior knowledge and preparation

Before you begin teaching this topic:

- Make sure you understand the concepts mentioned in the introduction to the theory section and particularly the keywords.
- Undertake some further study of the concepts using the resources suggested. This will be needed to provide depth to your knowledge, and so that you can encourage students to explore these topics further than the examples provided.
- Tackle all the tasks and develop some extension material or additional tasks.

1. Key Terms

Word/phrase	Meaning
Animation	The process of taking individual drawings or digital elements to create an illusion of movement when played back in sequence. Animation in its simplest form could be thought of as a child's flipbook. A complex example could be a new animated feature length film featuring entirely computer animated characters.
Frame	One individual drawing within an animation.
Frame rate	Animations are made up of a series of frames played back to create the illusion of movement, the speed of this playback is the frame rate. Frame rate is usually expressed in terms of the number of frames in a second (fps). This can have a huge impact on the quality of the animation or the fluidity of movement. Consider security CCTV cameras which often only record at 2 frames a second to save digital storage space. Movement of 2 fps will appear very jerky when played back. In comparison a modern cartoon animation on television would commonly be around 30 fps which gives a much smoother movement in the animation.
Key Frame	A key frame is one individual frame within an animation. However, key frames have particular significance, they are pivotal points in the animation, and are defined throughout the animation by the animator. They often signify the two points between where an element of an animation starts and ends. For example, a football being kicked. The first key frame would be before it is kicked in its starting position. The next key frame would be its end position. The animation software would the produce the frames in-between using tweening.
Morphing	The process of taking an object and transforming it to another. Animation software handles the complexity of the transition by automatically producing all the frames in-between the first key frame and the last key frame, slowly transforming on object to another frame by frame. This complex process is dealt with by the computer and hidden from the animator.
Motion tweening	Motion tweening often refers to the movement of an object over a series of frames. An object can be placed in key frame one and moved to a different position in key frame two. A motion tween will perform the necessary calculations and produce the frames in-between. Animation software often allows the generation of a motion path where the animator can draw a path for the object to follow.
Onion skinning	The term given to showing several of the previous frames when working on a new frame. This gives the animator a lot of functionality as they can see where the object has been before without having to actually play the animation. This gives the animator more control over the changes they want to make to the next frame in the sequence. Most computerised animation software will have the facility to onion skin.
Opacity	Traditionally described as the amount of light an object can allow to pass through it. In terms of digital animation, it could be referred to as simply how transparent an object appears to be. This can be used in animations to create a variety of different effects such as fading in and out.
Persistence of vision	Is an optical illusion where the human eye is fooled into thinking a series of still images represent one image which is moving.
Rendering	Rendering is the process the animation software uses to show an animated scene with all it components. This is a complex process and requires a lot of computer

	processing power to take all the layers, objects and tweens to build one stand-alone animation into a viewable format.
Rotoscoping	Rotoscoping is an animation technique where the animator will trace over footage of something frame by frame, often a subject of real life which has a complex movement pattern. For example, a horse galloping or a martial artist performing a complex aerial kick. It allows real world movements to be imported into animations which would otherwise be difficult to capture and emulate. Advanced motion capture techniques are now often used where an actor can perform a movement with sensors placed on their body. The sensors are used to record their movement and can then be transferred to a completely digital character.
Shape tweening	Similar to motion tweening but applying specifically to shapes. A shape tween will perform all the calculations required to produce the frames in-between two key frames. For example, take a shape in key frame one such as a circle. In key frame two it could be a square. The shape tween will morph from the first shape to the second producing the tweened frames between each of the key frames.
Stage	In animation terms the stage is the area where objects, etc. are placed which can be seen once the animation is rendered. Similar to a stage in a theatre which also has wings where actors wait to come on stage, the equivalent in an animation are the areas around the edge of the animation stage. Objects can be placed there, but only objects placed on the stage will be seen in the final product.
Symbol	Used in some pieces of animation software. Symbols are a feature of many Adobe animation packages such as Flash and Animate CC. A symbol can take many forms such as a graphic, movie clip, drawing object, etc. One of the benefits of symbols is they can be stored in a library and then reused in the animation. A symbol can be easily deployed to the stage several times then have its attributes such as colour and size changed very easily. For example a symbol could be a tree which is then reused multiple times to create a forest with the benefit of drawing or importing the tree only once.
Timeline	Time is an important element of all animations. Animations work by the play back of frames over a set period of time. Virtually all animation software will contain a timeline where the animator can see what is on the stage at different time points within the animation.
Tweening	Tween is short for in-between. Tweening therefore, refers to the frames the animation software automatically creates between two key frames. In the key frame example above the tween frames would be the ones in-between the footballs starting position and end position. If this sequence took place over 50 frames, two would be key frames created by the animator and 48 would be generated by the software using its tween functionality.

2. Theory

Animation

The term animation refers to the process of linking together a series of still images to create the illusion of movement. This uses the concept of "persistence of vision" which fools the human brain into an illusion that the images are moving. The human brain retains a visual image for a fraction of a second after is it removed which makes objects appear to move.

One of the simplest forms of animation is a flip book. Most small children have drawn a stickman on a page of a flip book, then on the following page copied the drawing except for a small change to the position of a limb, and then repeated the process multiple times across pages. The flipping of the pages then creates the illusion that the stickman is moving, when in actual fact we are seeing a series of still images and the illusion of movement.

Animation has now become common place in the multimedia and entertainment industry. This technique is often seen in cartoons, and as technology has developed it has allowed the production of highly complex animations and feature length films.

There are several different types of animation and the following four are the most important:

- **Traditional 2D hand drawn animation**. The oldest form of animation used until the development of Information Technology. This is where the animator draws each frame separately and then they are photographed and played back to the viewer in sequence at higher speed.

- **Stop motion Animation.** This is where physical objects are photographed one frame at a time. The object is then moved and the next frame is recorded. The earliest origins of this method can be traced back to the use of puppets. Stop motion has been made very famous via a number of feature length films which contain tens of thousands of separate frames to produce a feature length film. A variation on this is known as "Claymation" which involves the use of objects made from modelling clay or similar.

- **Key frame animation.** The term tween is actually used to describe the creation of animations where the computer creates a lot of the frames for the animator. Tween refers to "in-between". The animator will set two key frames and the software will generate all the frames in between the two key frames over period of time designated by the animator. This is advantageous over the traditional 2D hand drawn method where all frames must be created by the animator. Shape tweening and motion tweening are common methods used within this type of animation.

- **3D animation.** 3D animation can be seen as the cutting edge of animation. In this type of animation powerful computers are used to create objects that can be easily manipulated in a 3D environment. Motion capture is now often used to record the movement of real people or objects. This real life movement is then processed and applied to a digital version where it can be manipulated and rendered with different attributes. This has been used in many new films and computer games where the characters are completely computer generated. 3D animation and motion capture have now replaced, in many cases, the traditional method of rotoscoping.

This qualification concentrates exclusively on **key frame animation software.**

Software

For the purpose of the practical tasks provided with this guide and set for this qualification, virtually all animation software, whether commercial or open source, would be sufficient.

One example of open source software is Synfig Studio. Synfig Studio is compatible with Windows, Apple and Linux operating systems and is free to download from various sources on the internet.

There are also many commercial software packages that provide different levels of sophistication. Examples of these are Adobe Animate and Serif Draw Plus. Cambridge doesn't endorse any particular brand of software, and virtually all animation software will contain the same basic tools and capabilities, although they may be located in different menus and toolbars within the software.

In addition to the production of an animation we need to consider the settings for saving and publication. Once your animation is complete it must be exported so it can be viewed or shared with others who do not have the same software you used to create it. Once exported in you chosen format, animations can be viewed either stand alone or in many instances as part of a web page. Most software will allow you export your animation in a variety of different formats. The most common being Flash SWF (small web format) which is the most commonly used format used for animations on web sites, although it should be noted that animations can also be exported in a variety of video formats. The choice of which format is dependent on the intended hardware used to display it and also the intended audience.

3. Animation tasks

Theme – A space animation

These tasks are designed to be undertaken as a learning process covering most of the objectives listed above. Learners should be encouraged to use the tasks to explore the menu items and tools available in the animation editing software. Learners should be encouraged to experiment with the different tools and seek out video tutorials available elsewhere on the internet, which will give them further practical examples which they can follow.

Often there is more than one way to satisfy the requirements of the task. At first, the exercises should be about exploring a variety of options and not about determining the most efficient methods. Learners should be encouraged to use the guides but undertake their own research into the software techniques they are using.

If the animation software allows, it is better to undertake and save these tasks as a complete project rather than individual tasks. This will enable learners to revise and polish their work. The animation for each can still be saved for publication as required.

Task overview

In each guide you will learn to:

Task 1: Working with layers, images, objects, text and frames	Task 2: Shape tweening / morphing and using key frames
1. Select a suitable stage for your animation 2. Customise the view to allow full access to the tool bars 3. Set up layers and give them names 4. Import images 5. Draw objects and modify their attributes 6. Resize images 7. Add text 8. Lock layers 9. Show hide / layers 10. Convert to symbols.	1. Insert key frames 2. Produce a shape tween 3. Play back your animation.
Task 3: Adding motion tweens	**Task 4: Tweens, opacity, coordinates and exporting**
1. Add a motion tween 2. Add positional key frames.	1. Add further motion tweens 2. Fade objects by changing their opacity 3. Understand coordinates 4. Export your animation and understand the file types.

4. Further resources

Animation software

Adobe Software. www.adobe.com . Adobe offer a free 7-day trail of Animate CC.

Synfig open source animation software. http://www.synfig.org/cms . Synfig is free to download and offers a huge range of tools for producing animations. The web site offers downloads of Synfig which are compatible with Windows, Apple and Linux operating systems. Synfig is supported by a number of quality tutorials and lessons which can be found on YouTube.

Video tutorials

General searches of YouTube, or other video sharing websites, using the name of your animation software, plus the technique you are using, are extremely useful for consolidation of knowledge and independent learning. For example, "*Animate CC create a shape tween*" or "*Synfig add a new layer*". Both produce a range of suitable tutorials.

Some useful tutorials (on YouTube) to use in conjunction with this task are:

Create a motion tween:
https://www.youtube.com/watch?v=dGWc1nUM_fc

Create a shape tween:
https://www.youtube.com/watch?v=O1Z1j417eyk

Create a motion path:
https://www.youtube.com/watch?v=DRCNOPD874o

Create a basic animation:
https://www.youtube.com/watch?v=gyj6XoiHl1E

Fading in and out:
https://www.youtube.com/watch?v=rceOYJDH4PE

5. Further study

It is recommended that learners are encouraged to research the following questions or complete the following tasks independently.

1. What factors need to be considered when exporting an animation?
2. Describe a motion tween and make your own practical example to illustrate this.
3. Research how to add a motion guide. Then explain what a motion guide is and make a practical example.
4. Produce a tween where text morphs into a shape. (Clue - you may need to look at the break apart tool in some software).
5. Produce an animation of a stick man where his limbs are on separate layers. Animate him to walk across the screen.
6. If your software supports symbols or similar, produce a planet Earth using blue and green then convert it to a symbol.
7. Access your library and build a galaxy with ten planet Earths around a Sun. Use the free transform tool to adjust the attributes of the planets to different colours and sizes.
8. Produce an animation using the rocket.png, where the rocket moves from the top of the stage to the bottom but is spinning as it falls.
9. Find the starting coordinates of the rocket, Sun, planet and shooting star in your animation.
10. Use a video sharing website to try to find a video tutorial on how to do the skills outlined in the learning objective section of this document. Work collaboratively with peers to ensure all elements are covered. Save the links in your favourites in your web browser.
11. Produce a space character such as an alien or spaceman in a graphics software of your choice. Ensure it is exported with transparent background. Import your space character into your animation software as an extra layer and animate.

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