

Design principles for pedagogic multimedia

Abstract

This paper offers a framework of guidelines for designing multimedia learning systems. These guidelines concentrate on techniques for achieving pedagogic synergy between audio commentary and visual elements. The framework derives from the author's experience of producing and appraising multimedia packages, mainly at the UK Open University.

The Design Framework

A multimedia presentation might include video clips containing their own commentary. Screenwriting principles for video clips can be found in Koumi (2006, Part 3).

However, when the rest of the multimedia presentation also contains an audio commentary, further screenwriting principles are required. The current literature contains only a handful of practicable principles (Koumi, 2005). The framework of such principles is adapted from Koumi (2006, Ch. 8)

Use of language

- 1 Long sentences, which normally contain conditional clauses, are difficult to understand. So convert every long sentence into two or more short ones.
- 2 Avoid using words that are difficult to say or to hear – for example, where the last consonant of a word is the same as the first consonant of the next word, e.g. the *seventh theme* or, the *last task*
- 3 Write *conversational speech*, to be spoken and listened to, *not* sounding as if it is being read from a script.

Layout and build-up of the screen

- 4 Maintain a consistent layout between the different types of images. For example, text on the left, video window on the right, equations or diagrams just below the corresponding image.
- 5 Students cannot easily process dense visual layout while listening to commentary: the layout should be uncluttered and

easy-to-follow. Concerning text, a rule of thumb is to use only 25% of normal print density.

- 6 A standard technique is to *develop* a screen line by line, synchronising with the narration.

However, this could irritate students if each line is easy to follow, because they might prefer to **choose** whether or not to read ahead, rather than being forcibly blinkered.

Relationship of screen text to audio commentary (assuming there are diagrams as well as text)

- 7 Why use text at all if the narration is explaining the diagrams?

Some explanation of content could be repeated as text. Such text can serve as visual reference points, which anchor learners' attention and prevent the learner's mind from wandering. They can also serve as visual reminders.

- 8 But avoid too much text. In some multimedia sequences the text duplicates the entire narration. Yet, literate students can read faster than you can speak. So they would process the visual and audio sources asynchronously, causing mutual interference. Both phonological interference and semantic interference. Hence the screen text should *précis* the narration, rather than duplicate it.

Also, to help students marry the two, the text should *reproduce key words* of the narration rather than *paraphrasing* it. If a screen says "basic ideas", narration should not paraphrase this and say "fundamental notions". Instead the narration should reproduce the key text words "basic" and "ideas". For example, should say "first I'm going to consider the **basics**, that is, the **ideas** that are fundamental to the subject. The narrator's tone of voice can help further by *stressing* these key words.

Reducing the amount of text also reduces the danger that students would miss critical diagram changes while attending to text.

- 9 Design screens to be a full outline of the topic, sufficient for your busy colleagues to grasp without having to listen through the audio commentary. These colleagues are subject matter experts whose memories may need refreshing, so if the screens are sufficient for them, they should also be sufficient for the students (aspiring experts) when they revise (see 26).

You can achieve a full outline with an economic amount of text. This is because the text gains new meaning once students have listened to the commentary

- 10 If you find that it is not possible to make screens sparse enough to be followed during listening to the audio, then you have chosen the wrong medium. Audio commentary can be too difficult to follow and integrate with the images, if either the images or the learning task are complex enough to require self-paced study. In that case, you should have chosen the print medium. This is the preferred medium when the learning task is complex and requires self-paced, concentrated reflection.

The images and the commentary should reinforce each other

- 11 Indicate clearly where to look on the screen. This often requires a visual cue such as highlighting a part of a diagram when it is mentioned. Alternatively, it may be natural for the narrator to orient the learner's gaze by saying, *at the top of the screen* OR *after the peak of the graph*.

- 12 Highlighting an item when it is mentioned (as above) is an example of the images synchronising with the corresponding words – which is appropriate in many situations.

In contrast, on many occasions, the words should precede or follow the corresponding images, as follows.

- 13 The images should come first whenever students need a visual reference on which to anchor the points in the narration. For example when the images are mathematical expressions that are difficult to listen to unless they can be seen.

- 14 In contrast, there are occasions when the narration should come first, in order to prepare the viewer for the images, such as:

In the next video clip, concentrate on how the ice-skater positions her arms so as to speed up her spin <CLIP STARTS WITH SKATER'S ARMS HELD WIDE, THEN PULLED IN.

- 15 Give students time to perceive the images. For example, give time for their eyes to settle on a new screen before commenting on it.

Educational narrative (*judiciously balance structured exposition against independent exploration by the student*)

The efficacy of narrative structure has been proposed by many writers, such as Gudmundsdottir (1995), Gibson (1996), Laurillard

(1998), Laurillard, Stratford, Luckin, Plowman and Taylor (2000). The guidelines outlined below are examples of design principles for narrative structure.

- 16 **Hook:** (capture and sustain attention): e.g. capture attention with surprises; sustain attention with suspense.
- 17 **Signpost:** indicate where the story is going, what is happening next, why it is happening, what to look out for.
- 18 **Facilitate concentration:** e.g. short pauses for contemplation; encourage prediction.
- 19 **Encourage/scaffold constructive learning,** e.g.
 - spoken words should not be a literal duplication of the images (because you want to encourage students to make the picture-word connection for themselves)
 - concretise: that is, relate to (hence *activate*) students' previous knowledge
- 20 **Elucidate:** maximise clarity, moderate the load, pace and depth.
 Regarding load, pace and depth, do *not* overload students with too many teaching points or too fast a pace, or too much intellectual depth. The appropriate teaching load, pace and depth depends on the level and prior knowledge of the students (e.g. regarding depth, deal with the specific before the general, especially for children).
- 21 **Texture:** e.g. insert occasional light items, vary the format whenever it seems natural to vary the mood, exploit the characteristics of audio, i.e. tone of voice, sequence, pacing, phrasing, timbre, sounds of real-world
- 22 **Reinforce:** (e.g. give more than one example of a concept, use *comparison* and *contrast*).
- 23 **Consolidate** learning, e.g. through students solving end-of-chapter problems.

Navigational Guidance and Student Control

- 24 If the multimedia package is on DVD (or CD-ROM) specify in the printed study guidance which DVD to play. Conversely, at the start of the DVD, specify in a screen-text announcement which part of the course goes with the DVD.
- 25 On the DVD, follow the above announcement with a *Contents page* from which learners can access the different sections

(normally in whatever order they wish). The *Contents* page should record where students have been, by ticking or highlighting the title of each section that has been accessed.

- 26 When students are re-visiting a *screen*, for revision purposes, they do not always want to listen to the audio track. User choice of whether to hear the commentary can be achieved by including a *skip* button (next to the *audio-bar*), with which learners can jump to the end of the current audio file. This would also skip past the graphics build-up, jumping straight to the full-screen graphics (see 9).

Conclusion

Given all the above, it should be clear that you cannot design a perfect picture-word presentation with your first draft: you need several draft designs and script discussions.

References

- Gibson S (1996) *Is all coherence gone? The role of narrative in Web design*, *Interpersonal Computing and Technology*, 4, 2, pp7-26. Retrieved April 2005 <http://www.helsinki.fi/science/optek/1996/n2/gibson.txt>
- Gudmundsdottir S (1995) *The Narrative Nature of Pedagogical Content Knowledge* in H. McEwan and K. Egan *Narrative in teaching, learning and research*. New York: Teachers College, 24-38. Retrieved April 2005 from <http://www.sv.ntnu.no/ped/sigrun/publikasjoner/PCKNARR.html>
- Koumi J (2005) *Pedagogic design guidelines for multimedia materials: a mismatch between intuitive practitioners and experimental researchers* http://www.eurodl.org/materials/contrib/2005/Jack_Koumi.htm
- Koumi J (2006), *Designing video and multimedia in Open and Flexible learning*, RoutledgeFalmer
- Laurillard D M (1998), *Multimedia and the Learner's Experience of Narrative*, *Computers and Education*, 31 (2) 229-242
- Laurillard D M, Stratford M, Luckin R, Plowman L and Taylor J (2000), *Affordances for learning in a non-linear narrative medium*, *Journal of Interactive Media in Education*, 2000 (2). Retrieved April 2005 from <http://www-jime.open.ac.uk/00/2/laurillard-00-2-paper.html>
- Taylor J, Sumner T and Law, A (1997) *Talking about multimedia: a layered design framework*, *Journal of Educational Media*, 23(2/3) 215-241