Instructional videos and animations

1. Overview

Video instructions are often used to accompany testing kits used by people at home or in the community. They are easy to access by people (through YouTube or a website).

Research has shown that:

. instructional videos may be difficult to follow if they are too fast or too complex

. they can be designed so that they support comprehension and support learning

. the cognitive load caused by the transient nature of information in videos needs to be managed.

2. What we know

1	**Instructions are more effective when divided into manageable steps**	Videos segmented into small sections reduce the cognitive load, and therefore are easier to remember and learn from. Effective instructions mirror the ways events are organised in people's minds, and research has shown that when asked to describe events in time or how to do something, people describe them as a sequence of discrete steps, structured around objects and actions (Zacks et al., 2001).

Further, the amount of information that people can hold in their working memory is limited. Segmenting (or 'chunking') the information into meaningful groups supports people in remembering and making sense of the instruction, and avoids cognitive overload (Moreno, 2007). |
| **2** | **Non-essential information gets in the way of understanding** | When learning from multimedia materials, the cognitive processing of unnecessary words, graphics and design elements reduces the capacity to process essential content. Interesting but irrelevant details or elements distract viewers and reduce the effectiveness of learning materials (Mayer et al., 2001). By removing unnecessary content, cognitive resources can be dedicated to processing essential information (Mayer, 2019). |
| **3** | **Learner-paced animations are more effective than system-paced animations** | Animations and videos have a 'transient nature': the content is transitory and disappears, which puts pressure on working memory, as viewers are absorbing new content in the video while trying to keep the preceding content in their memory.

Giving people the option to go at their own pace contributes to effective learning, as learners are more able to pause the video until they are ready to absorb new content (Hasler et al., 2007). |
| **4** | **Keep related words and images together** | It's easier to integrate mutually referring information in different modes when they are close to each other. This applies to mutually referring pictures and text (or animation and narration), which are better integrated when they appear close in time (temporal contiguity); and to written text and image, which are better integrated when they are located close to each other (spatial contiguity) (Moreno & Mayer, 1999; van Merrienboer & Kester, 2005). |

5 Consider design variables in animation

Spinillo (2017) lists design variables for animation and text-image relationships, including scene transition, image style and views (for example sectional or exploded) and use of visual cues. Mayer and Moreno's (2002) principles for content representation in animation are affirmed in Spinillo's comprehension study with users on animated instructions for an oral suspension medicine.

6 Visual cues guide the attention of viewers and help them identify, select and extract relevant information

Visual cueing – signalling with colour, arrows, and movement – is an effective means of focusing attention and guiding the viewer where to look. However, care must be taken so that cueing elements do not distract viewers or lead to other kinds of extraneous cognitive load (Ayres & Paas, 2007; Tversky et al., 2008).

7 Native speakers learn better with video and narration

Instructional videos foster learning when they show moving pictures in a way that can be integrated with descriptions of what is happening (spoken or written text). Both video and written words are processed through the visual cognitive channel, and narration is processed through the auditory channel.

When images are combined with visual text, this risks overloading the visual channel (modality effect - Moreno & Mayer, 1999). Studies with native speakers have shown that video with spoken text results in better learning than video with written text (Mayer et al., 2020).

8 The use of written or spoken text will also depend on whether the instructions are learner-paced or system-paced

Learner-paced instructions allow learners to go at their own pace, for example to pause the instruction while they absorb the information before moving on to the next content. In system-paced instructions (for example a continuous video), the pacing of the instructions is given by the system.

This puts pressure on working memory, so spoken text presents an advantage because it can be absorbed at the same time as moving images with less effort than written text. However, if instructions are learner-paced, this advantage is lost and visual text results in better learning (Tabbers, 2002).

9   Keep it human

Viewers learn better when conversational language is used, with narration by a human voice, and when the video is shot from first-person perspective using human hands (embodiment principle and personalisation principle – Mayer, 2005). These social cues promote a response from the viewer which fosters a deeper processing of the instructional material. The viewer is more motivated to engage in the material, resulting in better learning.

3. Recommendations

- Create bite-size segments and allow time between them, or divide the video/animation into segments that can be activated/played/started by the viewer.

- Whenever possible, avoid combining written and spoken text in instructional videos.

- Present key information in both voice over and image, and make the narration and image go close together in the video.

- Use conversational language.

- Use a human voice.

- Film the video from a first-person perspective.

- Use human hands.

- Use number, arrows, colour, and other forms of cueing to signal key information.

4. References

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