

Coherence Analysis

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Introduction

Of the principles discussed in this course, the Coherence Principle is backed by the second greatest number of experiments and has the second highest median gain in transfer (Mayer, 1999, p. 618), behind only the Multimedia Principle and the Chunking Principle, respectively. The purpose of this paper is to discuss the Coherence Principle, provide examples of its application and misapplication, and to examine its relationship to other multimedia principles.

What is the Coherence Principle?

The Coherence Principle states that students learn better "when extraneous material is excluded rather than included" (Mayer, 1999, p. 620). The general idea behind this principle is that the inclusion of related – but not core – information in multimedia tends to do more harm than good. This tangentially related information can take the form of words, images, or sounds.

On its face, this may seem like a logical extension of both the visual split-attention principle and especially the auditory split-attention principle (Mayer, 1999, p. 619). All three of the principles can overload working memory through either the visual or auditory channels. Violations of the Coherence principle, however, have the added problem of potentially creating incorrect associations between audio and visual elements of the material. That is, the conceptual relationships and connections that the materials is intended to build between core pieces of information might instead be connected to the extraneous pieces of information.

Successful Example

One of my first multimedia projects in the EdTech program was a short video that taught the principles of troubleshooting open circuits (Bushong, 2010). In this video, I used PowerPoint to animate the flow of current through a circuit, and to show how a disruption of that current at any point can stop all flow in the system. The illustrations were very direct, the text was minimal, and the only sound was my own voice narration. The material was as simple as it could possibly be, but still covered all of the relevant information.

<http://www.youtube.com/watch?v=6FVi34icCD8>

I've shown this video to multiple classes, and the results have been very positive.

Unsuccessful Example

Unfortunately, one year later in my Edutainment class, I violated the coherence principle on multiple levels in a short video on making a digital comic (Bushong, 2011). The purpose of the video was to show a workflow for creating a comic.

<http://www.youtube.com/watch?v=Z3qh2GS0A0Q>

While the comic video does cover the desired information, it violated the Coherence Principle in the following ways.

Extraneous graphics

This video was filled with extraneous graphics. From the animated space station backgrounds during my initial dialogue, to the graphical representation of my characters, to the unnecessary animation of the Adobe Bridge logo at 7:48, I provided an enormous number of distractions. These extra graphics certainly distracted the learner from the relevant information, but they also likely disrupted the learner from making the connections that I sought in making the video (Clark & Mayer, 2008, p. 142).

Extraneous words

In addition to the extraneous graphics, I realize now that I added whole sections of narration to the video that was added solely for interest and elaboration (Clark & Mayer, 2008, p. 148). Specifically, the explanation of my characters that began at 1:39 was completely unnecessary, and could have simply been replaced with the following:

" For the purpose of my comic, I created four character with diverging, and often conflicting, personalities."

Such a replacement would have reduced 84 seconds of fluff to a tight 5 second description that segued straight into the storyboarding.

Extraneous sounds

The most egregious of my violations came in the form of background music during my narrations. I included background music in nearly every segment, and it added no real value to the product. I would have been much better off simply leaving it out.

As I reflect on this video, I realize that my worst violations of the Coherence Principle stemmed from my own desire to "show off" my work. I intended the show to be entertaining, but I also wanted it to be useful for teaching the process. My own ignorance of multimedia principles coupled with my own arrogance led me in the wrong direction.

The Relationship Between the Coherence Principle and other Multimedia Principles

While the Coherence Principle is intertwined with most of the principles we have learned so far, I think the strongest connection is to Contiguity Principle, the Modality Principle, and the Redundancy Principle (Clark & Mayer, 2008, pp. 77-131).

Relationship with the Contiguity Principle

When comparing coherence with contiguity, the most important word of the definition is "corresponding." Students benefit from having words and corresponding graphics close together, but are hindered when non-corresponding (i.e. extraneous) graphics and words are close together. In this sense, non-coherence is worse than non-contiguity because it actively confuses the learner.

Relationship with the Modality Principle

The relationship between coherence and modality is in the alignment of words to the graphics. If either the words or the graphics are extraneous, then they will misalign and confuse the learner. By staying on-task

Relationship with the Redundancy Principle

If multimedia has both audio and corresponding text, then it has redundancy. While the coherence principle deals specifically with extraneous words, the core problem of "clogging" the visual or auditory channel is similar with both of these two principles; the only difference seems to be the relevance of the information. With that in mind, violation of the Coherence Principle is probably worse than simple violation of the Redundancy Principle, as it can create incorrect connections between weakly related points.

One More Relationship: Chunking

While we haven't discussed the Chunking Principle (Mayer, 1999, p. 620) in great detail yet, Mayer's description shows a very tight relationship between the Chunking Principle and the Coherence Principle. Specifically, adherence to the Coherence Principle will always bring one closer to adherence to the Chunking Principle because it will naturally keep the segments shorter.

The Relationship Between the Coherence Principle and Fundamental Theories of Psychology

The justification *for* extraneous material lies in arousal theory (Clark & Mayer, 2008, pp. 138-148). It is the idea that emotional arousal will motivate the learners to put more effort into the learning. Based on the cognitive theory of multimedia learning, however, the working memory of both the audio and visual channels have a limited "bandwidth." Flooding either channel with too much information can cause the whole system to shut down and reduce the overall transfer of information.

To be clear, the Coherence Principle is not mutually exclusive from arousal theory; it simply says that the audio used to arouse interest should be directly related to the learning material and should not provide a distraction. If the core material of the lesson is arranged properly and delivered to an audience that extracts arousal *from the material*, then the learners can simultaneously benefit from arousal theory and the Coherence Principle. The important thing is that the arousal comes from the material, not extraneous information.

The desire to violate the Coherence principle is often rooted in good intention, and It is a common temptation to add unnecessary depth to a lesson. The idea behind such a temptation is that "if some is good, more is better." The key problems defined in the text are distractions, disruptions, and seduction of the extraneous information. Clearly we would find completely unrelated information to be a major distraction. Once we admit that, they it's easier to accept that *any* extraneous information provides a minor distraction and disrupts the learning process.

When it comes to multimedia, less is often more. Or, more precisely, less is just right.

Personal Opinions on the Coherence Principle

I generally agree with the Coherence Principle as it is described in the text. I don't think anything was left out from a cognitive perspective, but I think the emotional response to certain materials – like background music – should not be completely ignored.

As I have progressed through the EdTech program, I have learned a lot about how the theories behind games and other multimedia can influence the learning process. As a gaming enthusiast and amateur designer, however, one of my goals in this program is to explore the corollary: how learning theories can influence the game design process. For this reason, the emotional interest to learning is often just as important to me as the cognitive interest.

With that in mind, I think it is very important to provide a very clear definition of what constitutes "extraneous." In a game or film, for example, the soundtrack provides the viewer with an audible anchor for memories and nostalgia long after the experience is over. In the entertainment industry, this emotional interest has value; the background music does not contribute to the transfer of information (Moreno & Mayer, 2000), but can certainly aid the recall of information and emotions of the time. In my own experience, I've found that listening to a soundtrack while reading a work of fiction helped me to remember my own emotional reactions to the work while listening to the same soundtrack many years later.

So while the evidence clearly shows that writers slow their production when listening to music (Clark & Mayer, 2008, p. 140), an open area of research might be to measure whether future listening of the same music helps the writer to "recover" the initial state of mind after a long period of time.

References

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