

# E-learning and the Two Lane Brain

Avoiding building or buying E-learning that creates mental gridlock

Brom Kim, MA 9/24/2009

# [DRAFT]

*Brain science proposes that we have a single channel for processing linguistic input, whether it arrives as speech or writing.*

*When learners are presented with too much speech and writing simultaneously, the message of the instruction may be negated via sensory overload.*

*Unfortunately, creating this mental gridlock is all too easy, and widespread with the proliferation of rapid authoring E-learning software.*

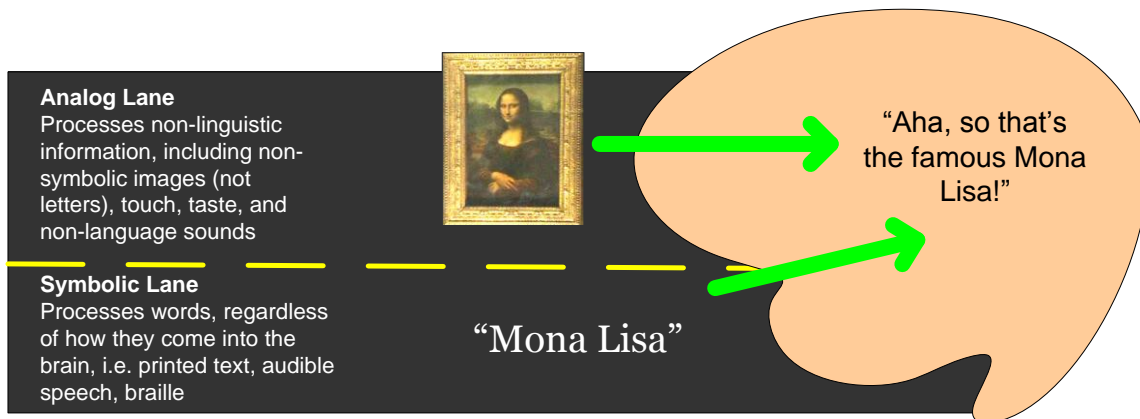
*This article discusses theories underlying these issues, gives readers additional criteria for evaluating learning products, and suggests design and development solutions.*

[Dual Coding Theory](#) proposes two types of input, analog and symbolic. In simple terms, Symbolic input is linguistic, meaning words that we read and speech that we hear. In the diagram below, the words “Mona Lisa” whether they are read aloud, or printed comprise symbolic input.

Analog information refers to non-linguistic sensory input, meaning non-letter shapes, colors, non-speech sounds, and other input. In the diagram below, the image of the Mona Lisa is an analog input.

Similar to Dual Coding Theory, [Working Memory](#), proposes the existence of a visual-spatial sketchpad, and a phonological loop. The sketchpad takes in images, and the loop repeats words verbatim, like a broken record until their meaning can be extracted.

Dual Coding and Multimedia theory suggest that using both the analog and symbolic ‘lanes’ at the same time helps learners, since learners get one input per primary input channel, an analog picture, and a symbolic name. The name is associated with the picture, resulting in a combined, associated memory.



So far so good, but problems occur when the single symbolic lane is overloaded with simultaneous overload of written text and spoken speech.

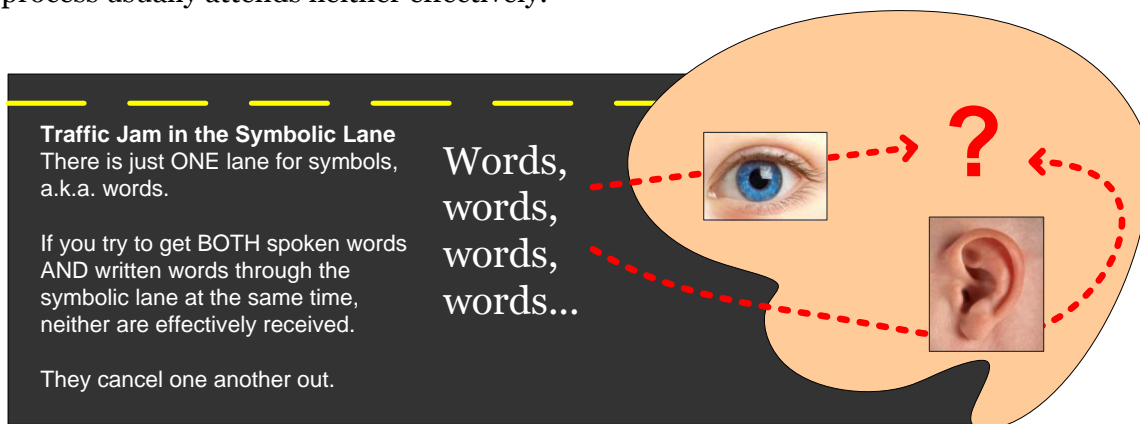
This is not to say that text and speech together are universally ineffective. I believe that proximity, cognitive load, the amount of information presented, pace, and other factors are important.

That is, as long as the brain can keep up, and is not trying to process a lot of both types of linguistic input simultaneously, text and speech coexist happily.

Unfortunately, as anyone who has experienced instructional amnesia after suffering through the dreaded several hundred words per slide talking PowerPoint knows, the ability to put words and text together on slides doesn’t necessarily equate with the skill to do so effectively.

Current multi-media authoring tools, including Captivate, Articulate Presenter, and others, offer great capability. But with power comes responsibility.

Attempting to get too much speech and text through the single symbolic lane at the same time creates instant mental gridlock. The brain attempts to follow along by rapidly switching attention back and forth between audio and visual language, and in the process usually attends neither effectively.



Symbolic content, or the words that instructional designers so carefully write, has to make it into the phonological loop for its meaning to be extracted. If split attention

prevents meaning from getting into memory, no learning occurs. Worse yet, learners will probably be frustrated and turned off, and ROI will be negative.

Multi-tasking is a myth for humans, and is more accurately characterized as ‘fast attention switching’. Learning new things requires focused attention. Split Attention Theory explains the big “HUH?” that often occurs after poorly constructed talking E-learning.

So is all talking E-learning bad? Absolutely not. The human voice, the means that we learned by for millennia, is still the most powerful training tool in the world. The effectiveness of its implementation with more modern instructional tools, like writing, just depends on how well materials are designed.

What business would pay to have something created, for their employees to sit and watch, with minimal benefit, and negative ROI?  
The learning and development industry is full of big-budget products designed and built to greater and lesser degrees, exactly as described above, in a way that short-circuits learning on a fundamental cognitive level.

I believe that a major cause of this is that the standard interface and development process of most development tools, which usually goes something like, Step 1. Build slide, Step 2. Add voice to slide. While most authoring tools can absolutely be used soundly, it is usually less convenient and intuitive to do so.

Also, decision makers on content purchases are usually experts in content, but less so learning theory, so materials are often evaluated primarily on content, rather than from the standpoint of a learner experiencing the material for the first time.

This can have disastrous consequences, as self-paced E-learning programs are akin to video in that they are expensive to modify and adapt. Each time a poorly designed self-paced program runs, the negative impacts are compounded. Conversely, the benefits and ROI of investment in good design are also reaped every time a well designed program is run.

Implications for the above theoretical discussion are straightforward, especially when considered along with Howard Gardener’s VARK learning styles. For those who are unfamiliar, VARK stands for visual, auditory, reading, and kinesthetic.

Based on current learning style distribution studies, 60-80% of the population is primarily visual, so inclusion of full transcripts, worksheets, and cheat sheet summaries is important. Bulleted slides alone don’t cover this need, as bullets are usually incomplete, meaningless fragments without spoken elaboration.

Visual, image or video content should also be distinguished from text. As discussed above, images and text are processed differently via the analog and symbolic channels, so diagrams, and flowcharts are another important addition.

Speech is very useful, and obviously benefits auditory learners, but it must be balanced against text on screen via timing, separation from heavy text content, and learner controls. The ability to turn voiceovers on and off, pause, and methods of controlling audio are important.

For kinesthetic, experiential learners, and everyone else, tactile ‘fidget widgets’ including rollovers, buttons, drag and drop interactions, discussions, and simulations are beneficial.

While we all have preferences, we also all have some degree of all three major learning styles, visual, auditory, kinesthetic. Even visually impaired learners can and do conceptualize and process relevant content spatially, with the visual cortex.

E-learning has tremendous reach. It easy, today, to send the same content to thousands of learners with a few clicks. The question is, will those clicks bring heaven sent help, useful learning, or coffin nails. Leaving the instructional effectiveness of a program unconsidered is a high-risk proposition.

Here's a quick cheat sheet of questions that might be asked by organizations seeking to maximize ROI consistent with this article. Note that this is only one set of criteria with which to evaluate materials.

- **Are text and speech presented in large amounts simultaneously, such that it is difficult to follow either?**

- **What is the primary learning style targeted?**

Bulleted talking PowerPoint primarily targets the reading and auditory styles, but visual is the most common dominant learning style.

- **Are full transcripts available?**

The option to read full transcripts is important for visual and reader learners, faster than voiceover in most cases, and preferred by many audiences, especially ones with limited time, who often include the executives who may be footing the bill for the program...

- **What is the nature of the graphics included? Are graphics primarily decorative, or are useful flowcharts and diagrams included.**

Decoration is fine where less attention is required, such as on agendas, intros, or wrap-ups, but the presence of distracting 'chart junk' where a more relevant diagram, flow chart, or other visual aid belongs, amounts to distracting, useless cognitive noise.

- Multi-media theory may be considered the opposite of split attention theory. Presenting relevant images with appropriate speech or text is more effective than speech or text alone.

**Are the animations in the program instructive, or merely decorative?**

The latter have very limited value, considering development cost.

- **Is there any support provided for the kinesthetic learning style?**

Having something to handle, even with a mouse cursor is important for everyone, and especially so for audiences who work with their hands, where this learning style may be present in much larger proportions than in society at large.