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Draw Me a Picture: Instructional Visual Displays in the Academic Law Library

Grace Lee

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DRAW ME A PICTURE: INSTRUCTIONAL VISUAL DISPLAYS IN THE ACADEMIC LAW LIBRARY

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Submitted to
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to fulfill course requirements for Current Issues in Law Librarianship, LIS 595,
and to fulfill the graduation requirement of the
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TABLE OF CONTENTS

I.	Introduction.....	1
II.	Looking to the Cognitive Theory of Multimedia Learning.....	3
	a. Cognitive Load Theory (CLT).....	3
	b. The Different Cognitive Loads.....	4
	c. Lowering the Loads.....	6
	d. The Multimedia Principle & Defining Visual Information.....	7
	e. The Split-Attention Principle.....	8
	f. The Redundancy Principle.....	10
	g. The Personalization Principle.....	12
	h. The Segmenting Principle.....	12
	i. The Modality Principle.....	13
	j. Limitations of CLT.....	14
III.	Implications for Academic Law Librarianship.....	14
	a. Research Guides	14
	b. An Experimental IVD: Updating Federal Regulations.....	16
	c. Challenges.....	18
	d. Possible Uses.....	19
IV.	Conclusion.....	20

I. Introduction

“Learn to adjust yourself to the conditions you have to endure, but make a point of trying to alter or correct conditions so that they are most favorable to you.”¹

Adapting to changing conditions while simultaneously influencing them in some manner would be ideal, but how does one actually do that? And what are the conditions? For academic law libraries currently, the conditions are manifold. In the proximate, the persistent depression in the legal job market, the high level of law school student debt, and the decline in law school matriculation continues to exacerbate already declining law school budgets.² Though there are smidgens of improvement in economic forecasts for the legal industry, alarming titles to news pieces, such as those on the recent merger of Hamline University School of Law and William Mitchell College of Law, illustrate that the ambiance of crisis still remains.³ Yet, law libraries are expected to provide the same or more services with less money, staff, and other resources.⁴ The law library as a “place” is shifting towards a conceptual model rather than a physical space.⁵ In several examples around the country, libraries have transitioned to “learning commons,” academic law libraries included.⁶ The latest issue of the *Law Library Journal* contains a debate about whether or not academic law libraries are doomed.⁷

In the backdrop, experts, pundits, casual bloggers—essentially everyone—discusses technology and its effect on society daily. Some lament, as conservative columnist George Will did, that “adults are decreasingly distinguishable from children in their absorption of entertainments and kinds of entertainments . . . [T]his is progress: more sophisticated delivery of stupidity.”⁸ Others point to the Flynn effect (illustrating a steady rise in global average IQ scores) and mull over whether our foibles for entertainment enabled by advances in technology contribute to this overall increase in intelligence.⁹ The rise of “big data” and more recent growing popularity of data visualization tools has sparked intense debates on personal

¹ In an example of how everything is not available on the Internet, I was unable to locate the original source for this quotation. Various other sources attribute this quotation to William Frederick Book, a professor of psychology and vocational education. I searched in HathiTrust and the University of Washington Libraries Collection, but had no success.

² NAT’L ASS’N FOR LAW PLACEMENT, EMPLOYMENT FOR THE CLASS OF 2013—SELECTED FINDINGS (2013), <http://www.nalp.org/uploads/Classof2013SelectedFindings.pdf>.

³ Jordan Weissman, *The Great Law School Bust is About to Claim its First Victim*, Slate (Feb. 18, 2015), http://www.slate.com/blogs/moneybox/2015/02/18/hamline_william_mitchell_merger_the_law_school_bust_claims_its_first_victim.html. Despite the alarming nature of the title, the article notes that the merger of Hamline and William Mitchell is not exactly a death knell for law schools in general—four separate law schools already served the Minneapolis metro area and Hamline and William Mitchell had considered merging for a while.

⁴ SCOTT D. BAILEY & JULIE GRAVES KRISHNASWAMI, THE FUTURE OF LAW LIBRARIANSHIP, IN LAW LIBRARIANSHIP IN THE DIGITAL AGE, 485, 485 (Ellysa Kroski ed., 2014).

⁵ *Id.*

⁶ See Beth Holland, *21st Century Libraries: The Learning Commons*, Edutopia (Jan. 14, 2015), <http://www.edutopia.org/blog/21st-century-libraries-learning-commons-beth-holland> (discussing the trend of libraries reinventing themselves as “learning commons”).

⁷ Compare James G. Milles, *Legal Education in Crisis, and Why Law Libraries Are Doomed*, 106 LAW LIBR. J. 507 (2014), with Kenneth J. Hirsh, *Like Mark Twain: The Death of Academic Law Libraries Is an Exaggeration*, 106 LAW LIBR. J. 521 (2014).

⁸ STEVEN JOHNSON, EVERYTHING BAD IS GOOD FOR YOU, at xii (2005).

⁹ See TORDEL KLINGBERG, THE OVERFLOWING BRAIN 13-15 (2009); see generally *id.* at 1-15.

information privacy and how we can now use technology to discover patterns and meaning in data we could not before.¹⁰

The conditions are confusing and overwhelming for academic law librarians and other legal information professionals. They struggle with constant technological changes in information delivery, overabundance of information, and pressure to innovate and add value to pre-existing services. All with shrinking budgets and resources.

So it is not altogether surprising that the notion of change and innovation are at the forefront of scholarship regarding legal education. Law professor produced scholarship regarding the use of neuroscience, cognitive psychology, and educational psychology to inform law school pedagogy and instruction has proliferated in the past six to eight years.¹¹ Much of the literature in terms of law school pedagogy covers use of assessments, encourages metacognition, promotes using story narrative and visual imagery to encourage cognitive learning about the law. Phenomena identified as critical issues include, inter alia, the prevalence of multitasking, distraction, the driving demand for instant feedback, diminishing abilities in reading comprehension, and the overarching concern for how advances in technology have changed and are changing the way humans process information. Recommendations include the creation of concept maps, comics, storyboard narratives, games, self-explanatory exercises, and emphasis on assessment. The majority of law-related literature on this topic also focuses on the instruction of traditional law classes (ie torts, contracts, etc.) rather than instruction of legal research.

It is an opportune time then to likewise explore alternative means of providing legal research services, support, and training. Times of crisis provide opportunities to take risks. By their very definition crises are upheavals that usually critically threaten preexisting investments/stakes/interests—colloquially put, there’s not a whole lot to lose anyhow. Many law librarians seek methods in which to add value and promote existing services and enrich law students in a manner different from core law school classes. For example, an issue specifically plaguing legal research is the lack of contextualization and awareness of overarching legal concepts while conducting legal research, which contributes to the general shortcomings of new lawyers as legal researchers.¹² In addition, law librarians must contend with serving a variety of patrons with diverse needs.

Many of the recommendations contained in the literature regarding teaching core law curriculum applies to law librarians since most of the recommendations address live instructor teaching and many law librarians teach legal research classes. But law librarians also impart information and provide services through various methods outside of the classroom. In an environment where technology allows us to find and present information in hitherto impossible ways, we need to examine whether such approaches apply to the provision of legal research

¹⁰ See generally Cesar A. Hidalgo & Ali Almosawi, *The Data-Visualization Revolution*, Sci. Am. (Mar. 17, 2014), <http://www.scientificamerican.com/article/the-data-visualization-revolution/> (discussing the rise of data visualization techniques).

¹¹ See generally Benjamin V. Madison, III, *The Elephant in Law School Classrooms: Oversue of The Socratic Method as an Obstacle to Teaching Modern Law Students*, 85 U. DET. MERCY L. REV. 293 (2008); see generally Deborah J. Merritt, *Legal Education in the Age of Cognitive Science and Advanced Classroom Technology*, 14 B.U. J. SCI. & TECH. L. 39(2008); see generally Hillary Burgess, *Deepening the Discourse Using the Legal Mind’s Eye: Lessons from Neuroscience and Psychology that Optimize Law School Learning*, 29 QUINNIPIAC L. REV.1 (2011); see generally Scott DeVito, *The Power of Stories and Images in Law School Teaching*, 53 WASHBURN L.J. 1 (2013); see generally Shailini Jandial George, *Teaching the Smartphone Generation: How Cognitive Science Can Improve Learning in Law School*, 66 ME. L. REV. 1 (2013).

¹² See Yasmin Sokkar Harker, “*Information is Cheap, But Meaning is Expensive*”: *Building Analytical Skill into Legal Research Instruction*, 105 LAW LIBR. J. 79, 83-85 (2013-14).

support. As the visual aspect of information provision has proven popular recently, this paper explores how law librarians can incorporate visual displays into academic law library services.

II. Looking to the Cognitive Load Theory of Multimedia Learning

For those familiar with Dervin's sense-making theory, the parallel between the evolution of the user-centered approach to information service and the use of cognitive psychology to develop learner-centered instructional designs is evident.¹³ The current use of cognitive load theory (CLT) to inform instructional design is premised on a belief that instruction should be designed in light of how the human mind works.¹⁴ Given how technology now makes pictorial representations and various types of media-driven instruction possible, it is more important than ever to take a learner-centered approach rather than a technology-centered approach. Instructional design should focus on helping people learn with the aid of technology, rather than simply providing access to technology.¹⁵ This makes understanding human cognitive architecture central to instructional design.

The following sections provide a brief (and admittedly at times, grossly reductive) overview of CLT, multimedia learning, and a few basic related principles. Advanced principles applicable to highly specialized situations (e.g. visual displays for students with learning disabilities) have been omitted as they are beyond the scope of this paper, which intends to provide an initial point of discussion rather than an in-depth analysis of the topic.

Cognitive Load Theory (CLT)

Cognitive load theory (CLT) models the processes and structures of human cognition after those associated with evolution by natural selection.¹⁶ Using this approach, the theory posits that human information processing relies on two types of memory: long-term memory and working memory.¹⁷ Boiled down, the key characteristics distinguishing long-term memory from working memory are (1) the role in human cognition, (2) the type of information processed, and (3) capacity.¹⁸

Long-term memory holds nearly all the information that determines human cognitive activity.¹⁹ Research indicates that we draw upon long-term memory to “perceive, think, and solve problems as single entities rather than as a group of rote learned facts.”²⁰ The well-established finding that experts in a particular field typically possess a “vastly superior memory to novices for problem” suggests that long-term memory’s store of information is very large,

¹³ See generally Brenda Dervin & Michael Nilan, *Information Needs and Uses*, 21 ANN. REV. OF INFO. SCI. & TECH. 1986 3-33s. (1986).

¹⁴ Richard E. Mayer, *Introduction to Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 1, 6 (Richard E. Mayer ed., 2d ed. 2014).

¹⁵ *Id.* at 13-15.

¹⁶ See Fred Paas & John Sweller, *Implications of Cognitive Load Theory for Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 27, 27-37 (Richard E. Mayer ed., 2d ed. 2014) (discussing five basic principles that cognitive load theory normally uses for describing the information processing characteristics of human cognitive architecture and evolutionary biology).

¹⁷ See *id.* at 29-39 (defining and characterizing long-term memory and working memory).

¹⁸ See *id.* at 29-37.

¹⁹ See *id.* at 30.

²⁰ Renae Low, Putai Jin & John Sweller, *Some Instructional Consequences of Logical Relations Between Multiple Sources of Information*, in LEARNING THROUGH VISUAL DISPLAYS 23, 25 (Gregory Schraw et al. eds., 2013).

perhaps boundless and permanent.²¹ As its names suggests, long-term memory warehouses previously acquired information, knowledge, and experiences.²² However, exactly when or how long ago a particular piece of information was stored is irrelevant.²³ What matters is how the information is stored.²⁴ Information in long-term memory can be returned to and retrieved at will after attention is directed to other matters, either for a short or long period of time.²⁵

In contrast, human information processing relies on working memory to consciously interpret and handle information (both novel and previously stored).²⁶ We employ working memory to preserve information while we process the same or other information.²⁷ For example, say a task asks that you search for a particular face in the crowd.²⁸ In order to search for the face, you have to remember it in order to match it to someone in the crowd.²⁹ The place where you stored the image while you were searching for the face? Your working memory. When it comes to novel information, working memory can only hold approximately seven elements of information and only for about 20 seconds (without the use of rehearsal or other techniques).³⁰ However, no such limitations apply when working memory draws information from long-term memory.³¹ Therefore, the more novel information is, the more working memory limitations pose an issue.³² As information becomes more familiar and organized in long-term memory, the less the limitations of working memory matter.³³ Take an example drawn from legal education. An unfamiliar fact pattern includes something about person A lunging towards person B. A 2L using his/her working memory can (hopefully) draw upon his/her recollection of the elements of assault store in long-term memory and use it to analyze and compare them against the fact pattern. In contrast, a brand new 1L has to look up assault first. This means that for the 1L, the limitations of working memory's capacity for novel information matters more as s/he has to remember more new novel information.

The Different Cognitive Loads

The instructional implications derived from CLT use the theory of limited working memory to inform instructional design. CLT posits that there are three "loads" or taxes on working memory

²¹ See generally Paas & Sweller, *supra* note 16, at 30 (regarding studies conducted with expert and novice chess players demonstrating that capacity to memorize board configurations from real games distinguished more able players from less able) (alteration in original).

²² See *id.*; see generally *id.*, for a discussion on CLT defining learning as a change in long-term memory and therefore that the instructional goal should be to change long-term memory.

²³ KLINGSBERG, *supra* note 9, at 37.

²⁴ *Id.*

²⁵ See *id.* at 36, for a description of the difference between episodic and semantic memory.

²⁶ Paas & Sweller, *supra* note 16, at 34.

²⁷ See Low et al., *supra* note 20, at 25 (defining working memory); see also KLINGSBERG, *supra* note 9, at 33-35 (explaining working memory through examples).

²⁸ See KLINGSBERG, *supra* note 9, at 40, for an examples that inspired that one used in this paper.

²⁹ *Id.*

³⁰ Paas & Sweller, *supra* note 16, at 33; see generally Paas & Sweller, *supra* note 16, at 33, for a discussion on how such limitations on working memory may actually benefit humans as an unlimited working memory may be counterproductive.

³¹ See Paas & Sweller, *supra* note 20, at 34.

³² *Id.*

³³ *Id.*

that dictate the acquisition, storage, and use of information.³⁴ Examining the different types of loads as defined by CLT provides guidance for reducing them.

Intrinsic cognitive load refers to the “natural complexity” of the information that must be processed.³⁵ Natural complexity in turn is determined by “element interactivity.”³⁶ Element interactivity describes the degree to which separate units or parts of the information being processed must be analyzed in relation to one another for understanding/interpretation.³⁷ For example, learning what courts exist in a particular jurisdiction involves fairly low element interactivity since learning the existence of each court can be understood independently of other courts. Learning about mandatory versus persuasive authority involves greater element interactivity because by its very nature, it is about learning how one court relates to another in terms of authority. And then learning the holding of a particular case involves very high element interactivity as U.S. common law is at its very essence, fact-specific and requires matching elements of the law to contextual characteristics. For the most part, the intrinsic cognitive load of a given task is fixed.³⁸ However, one can alter it in two limited ways: (1) by changing the task or (2) by changing the knowledge level of the learner.³⁹

As the name suggests, anything that generates unnecessary element interactivity causes extraneous cognitive load.⁴⁰ Thus, instructional designs that require learners to devote their limited working memories (with respect to novel information) to process elements irrelevant to actual knowledge acquisition decrease the effectiveness of the design and learning.⁴¹ What constitutes extraneous cognitive load depends on multiple variables, such as the nature of the task, modality of instruction, and prior knowledge of the learner. To build on the previous example, say that the explanation of courts in a particular jurisdiction was presented in a report on courts in several jurisdictions, and includes a historical background of each. In addition, the information about the courts was presented in a manner that made it difficult to readily identify and parse out the information about the specific jurisdiction you are interested in (i.e. the report is one block of text). This type of situation involves a high extraneous cognitive load.

Rather than being a separate load, germane cognitive load refers to the difference between working memory resources devoted to intrinsic cognitive load and extraneous cognitive load.⁴² Thus, germane cognitive load can also be interpreted as “effective” cognitive load because greater germane cognitive load translates to more working memory resources allocated to processing information relevant to instruction/learning.⁴³ In terms of determining how to efficiently allocate cognitive load through instructional design, germane cognitive load is less an area to affect change and more a theoretical concept for understanding how cognitive load is spread within working memory.

³⁴ See generally *id.* at 28-29, for background on how evolutionary theory influences human cognitive architecture and for a description of the difference between biologically primary and secondary information. Note that when the word “information” is used in this paper, it refers to biologically secondary information.

³⁵ *Id.* at 37.

³⁶ *Id.*

³⁷ *Id.*

³⁸ *Id.* at 38.

³⁹ *Id.*

⁴⁰ *Id.*

⁴¹ *Id.*

⁴² *Id.*

⁴³ *Id.*

The table below summarizes each category of cognitive load:⁴⁴

Category	Source	
Intrinsic	Caused by interacting elements that are intrinsic to the task and must be processed simultaneously. Cannot be altered other than by changing the nature of the task or by increasing knowledge.	Courts that exist in a particular jurisdiction
Extraneous	Caused by interacting elements introduced by an instructional design. This cognitive load should be reduced by altering the instructional design.	Historical background included in description of courts in a particular jurisdiction (when all the learner needs to know is what courts exist)
Germane	Refers to working memory resources dealing with intrinsic rather than extraneous cognitive load, thus facilitating learning.	As applied to examples in this table, the germane cognitive load in the first example is greater than the example directly above

Lowering the Loads

The notion that working memory is limited across various dimensions and that different types of loads tax it would have little impact on instructional design without the additivity hypothesis. The additivity hypothesis states that intrinsic and extraneous cognitive loads comprise a zero sum construct in working memory (with respect to novel information). This means that more of one translates to less of the other within the limited capacity of working memory.⁴⁵

As mentioned above, the intrinsic cognitive load for a given task is fairly fixed. However, intrinsic cognitive load “can be reduced by knowledge held in long-term memory because knowledge allows many interacting elements to be considered as a single element.”⁴⁶ Hence, the reason why learner knowledge affects the intrinsic cognitive load of a task. Think back to the example of the 1L and 2L analyzing a fact pattern with respect to the law of assault. As the 1L internalizes the law of assault, it becomes part of her/his long-term memory. Now as knowledge organized into long-term memory, the limitations of working memory with respect to novel information no longer apply.⁴⁷ S/he is at lower risk for overloading her/his working memory capacity.

Though possible, lowering intrinsic cognitive load is mostly a longitudinal strategy, and harder to substantially affect when instructing students on new topics.⁴⁸ A substantial component of educational instruction involves information new to the learner and since intrinsic cognitive load is fixed except for particular circumstances, lowering extraneous cognitive load is the logical course of action. An important consequence of CLT and limited working memory is that

⁴⁴ *Id.* at 39.

⁴⁵ *Id.* at 38.

⁴⁶ Low et al., *supra* note 20, at 27.

⁴⁷ See Paas & Sweller, *supra* note 16, at 24 (discussing how the limitations of working memory only applies to novel information).

⁴⁸ See generally, Richard E. Mayer & Celeste Pilegard, *Principles for Managing Essential Processing Multimedia Learning: Segmenting, Pre-training, and Modality Principles*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 316, 316-39, for discussion on methods of reducing intrinsic cognitive load in new learners.

the beneficial effects of decreasing extraneous cognitive load are most evident when intrinsic cognitive load is high. If a task is low in element interactivity, then intrinsic cognitive load is low. This leaves more room in working memory for extraneous cognitive load. So in situations where extraneous cognitive load is high, but intrinsic cognitive load is minimal, the learner may be able to cope fine with the task since s/he has enough space in total working memory to process all the required information.⁴⁹ In a nutshell, the effects stemming from extraneous cognitive load only become an issue when “one is dealing with complex material that imposes a heavy working memory load due to its intrinsic nature.”⁵⁰

The Multimedia Principle⁵¹ & Defining Visual Information

Whereas CLT provides a macro-level framework for approaching instructional design in general, the multimedia principle uses the framework to offer micro-level recommendations specifically regarding the use of instructional visual displays in instructional design. The multimedia principle states that instructional designs combining words and pictures result in deeper learning than design using words or pictures alone.⁵² Words and pictures are qualitatively different, but can complement one another. The principle is deceptively simple and many education professionals likely regard it as a patently obvious truth.

However, the sheer combination of words and pictures alone does not render an instructional design successful. Many of us can look to our own experiences with desultory PowerPoint presentations as evidence of this. A fundamental hypothesis of the cognitive load theory of multimedia learning is that “multimedia instructional messages that are designed in light of how the human mind works are more likely to lead to meaningful learning than those that are not so designed.”⁵³

Researchers and scholars have developed a considerable body of literature based on this fundamental premise regarding the relations between various modes of information during instruction.⁵⁴ Most of this work has focused on the instructional consequence of the various permutations of visual and textual information. However, research concerning how information is physically presented as of now is still less developed and in some respects, still inconclusive.⁵⁵ There is a plethora of literature dispensing advice on creating eye-catching and pleasing visual designs and aesthetics. However, many of these are not grounded in a cohesive theory of how we process information and learn. The advice tends to rely more on what is known about how we perceive color, what draws attention, and so forth. What we need is a “research-based

⁴⁹ See Paas & Sweller, *supra* note 16, at 38.

⁵⁰ *Id.*

⁵¹ See Richard E. Mayer, *Cognitive Theory of Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 43, 59-60 (Richard E. Mayer ed., 2d ed. 2014). Note that Richard E. Mayer, who is largely responsible for coining the term, “cognitive load theory of multimedia learning,” refers to three types of demands on cognitive capacity that are analogous to intrinsic, extraneous, and germane cognitive loads. The terms he uses are respectively, essential processing, extraneous processing, and generative processing. Though not perfect synonyms, the underlying principles remain the same between his terms of art and those in traditional CLT. The literature does not regard them as conflicting theories and I have opted to use the terms from traditional CLT for simplicity’s sake.

⁵² *Id.* at 43. The term “multimedia” in the principle refers to the combination of words (written or spoken) and pictures as opposed to the types of technology used to present instructional materials.

⁵³ *Id.* at 44.

⁵⁴ See Low et al., *supra* note 20, at 24, for a definition of “modes.”

⁵⁵ *Id.* “Logical relations” indicate the manner in which two sources of information such as, for example, a diagram and related text, refer to each other.

understanding of how people learn from words and pictures and how to design multimedia instruction that promotes learning.”⁵⁶

To that end, we must define what is meant by visual information and pictures as opposed to textual information. In the context of this paper, instructional visual displays (IVDs) are graphic representations of information communicated to learners.⁵⁷ Though there is a lack of agreement on the types and classification of IVDs, they tend to share five characteristics:⁵⁸

1. Displays reduce the amount of information to a more manageable amount, thereby promoting cognitive economy
2. Displays are intended to organize or summarize information in a manner that enables the viewer to readily grasp the intended big conceptual picture
3. Displays are intended to draw the viewers’ attention to the most salient aspect of the information
4. Displays facilitate inference-generation by highlighting the significant inter-relationships among component variables
5. Displays often provide an explicit visual model that can be used as an internalized mental model of events or processes, or used as a retrieval structure in memory to facilitate recall or future learning

Other terms, such as “infographics,” were eschewed in favor of IVDs because the term IVD captured the purpose of visual information to inform learners of logical relations between component parts and foster learning.

The Split-Attention Principle

The split-attention principle (also known as the spatial contiguity principle) strikes at the heart of extraneous cognitive load. The principle states that instruction design, including multimedia instruction, should avoid designs that require learners to split their attention between, and mentally integrate, multiple sources of information.⁵⁹ In the context of an IVD comprised of graphics and printed text, learners tend to read one portion of text, then look for the corresponding portion of the graphic, and then switch back to reading the text, and repeat this matching process.⁶⁰ Learners expend much cognitive effort visually scanning in this type of matching exercise, which in itself does not relate to the goal of the instruction material. It constitutes extraneous cognitive load. Instead, materials should be formatted so that disparate sources of information are physically and temporally integrated. Eliminating the need to

⁵⁶ Richard E. Mayer, *Introduction to Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING, *supra* note 14, at 7.

⁵⁷ Gregory Schraw, Matthew T. McCrudden & Daniel Robinson, *Visual Displays and Learning: Theoretical and Practical Considerations*, in LEARNING THROUGH VISUAL DISPLAYS 1, 4 (Gregory Schraw et al. eds., 2013).

⁵⁸ See Gregory Schraw & Eugene Paik, *Toward a Typology of Instructional Visual Display*, in LEARNING THROUGH VISUAL DISPLAYS 97, 99 (Schraw et al. eds., 2013) (showing eight types of IVDs, some of which are textually based, but still distinguished from textual information).

⁵⁹ Paas & Sweller, *supra* note 16, at 36.

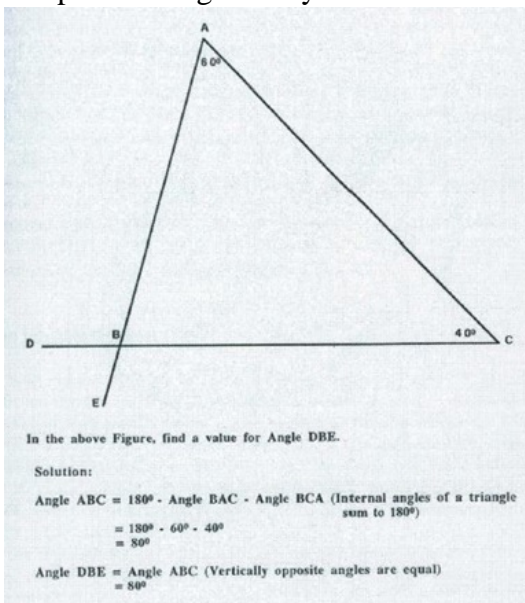
⁶⁰ See generally Richard E. Mayer & Logan Fiorella, *Principles for Reducing Extraneous Processing in Multimedia Learning: Coherence, Signaling, Redundancy, Spatial Contiguity, and Temporal Contiguity Principles*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 279, 283 (Richard E. Mayer ed., 2d ed. 2014) (discussing the results of eye movement studies).

integrate multiple sources of information “reduces extraneous cognitive load and frees resources for learning.”⁶¹

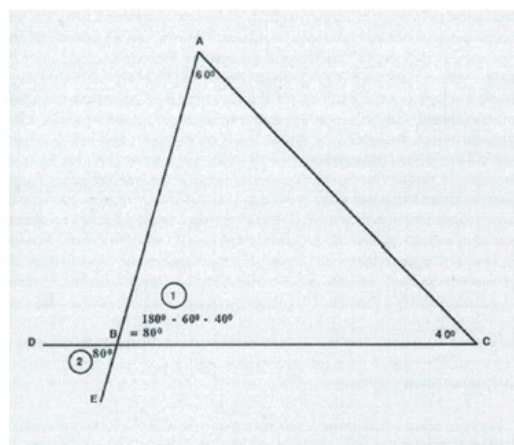
The split attention effect only occurs when learners must “mentally integrate several sources of physically or temporally disparate information, where each source of information is essential for understanding the material” and unintelligible on its own.⁶² If the sources of information merely repeat each other and can be understood in isolation, then a redundancy effect develops rather than a split-attention effect.⁶³ Redundancy and the correlative effect will be discussed in the following section.

Keep in mind that the split-attention effect occurs when learners must search between sources that are separate prior to mental integration.⁶⁴ These sources need not be physically separate—the act of locating relevant referents is what causes the effect.⁶⁵ Therefore, in situations where words are spoken with pictures, presenting them sequentially rather than simultaneously leads to a split attention effect.⁶⁶

For IVDs with a graphic and separate written text component, a strategy of physical integration defeats the split-attention effect. Note again that the component sources of information must be unintelligible in isolation. Physical integration means minimizing the distance between the logical referents. This concept is traditionally illustrated by the following example from a geometry lesson:⁶⁷



Left: Split-Attention Example



Above: Integrated IVD Example

⁶¹ Paul Ayres & John Sweller, *The Split-Attention Principle in Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 206, 206 (Richard E. Mayer ed., 2d ed. 2014); see also Mayer & Fiorella, *supra* note 60, at 280, for discussion of the coherence principle that states people learn more deeply from a multimedia message when extraneous material is excluded.

⁶² Ayres & Sweller, *supra* note 61, at 206.

⁶³ *Id.* at 208.

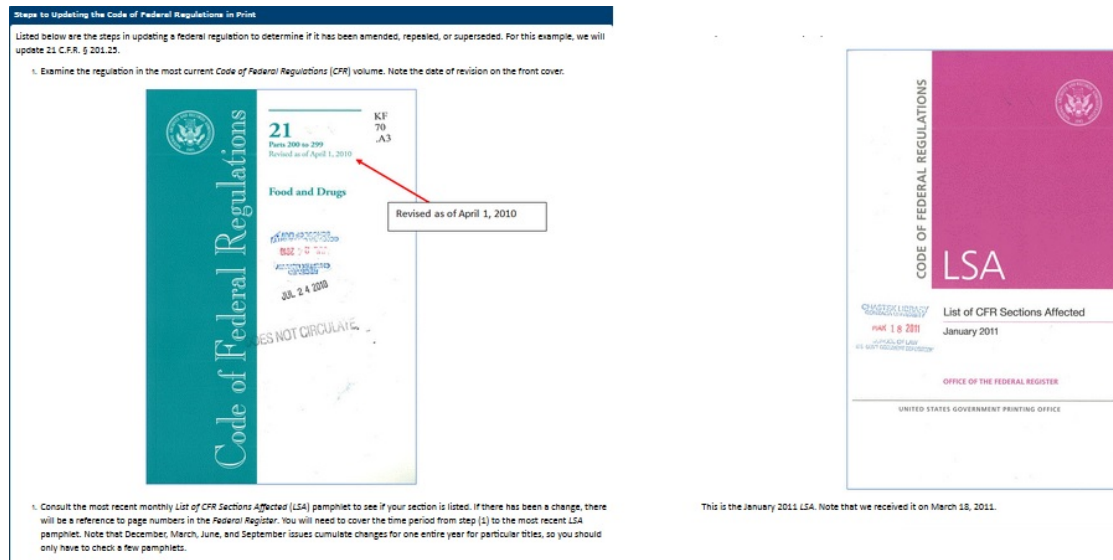
⁶⁴ *Id.* at 215.

⁶⁵ See *id.* at 216; see Mayer & Fiorella, *supra* note 60, at 280-89 (calling this effect a temporal contiguity principle).

⁶⁶ Ayres & Sweller, *supra* note 61, at 215-17.

⁶⁷ *Id.* at 210-12.

Here is an example from legal research of a partially-integrated IVD that still exhibits some split-attention characteristics:⁶⁸



Gonzaga University School of Law Research Guides: Updating the Code of Federal Regulations in Print
(<http://libguides.law.gonzaga.edu/updatingcfrprint>)

Strategies that direct attention can also combat visual search and the split-attention effect.⁶⁹ Methods to direct or signal attention include the use of color-coding and pop-up boxes or hover text (with respect to online materials).⁷⁰

The Redundancy Principle

The redundancy principle is counterintuitive, and perhaps even repugnant to those engaged in legal research instruction. Unlike in branding and marketing, CLT research indicates that educational messages are not always more effective when repeated.⁷¹ The principle asserts that “redundant material interferes with rather than facilitates learning.”⁷²

Like the split-attention effect, the redundancy effect (from which the eponymous principle derives) exists only under set conditions. Redundancy occurs when (1) identical information is presented concurrently in two or more forms or media or (2) additional information is used to

⁶⁸ Gonzaga University School of Law Research Guides: Updating the Code of Federal Regulations in Print, updated Apr. 16, 2013 (<http://libguides.law.gonzaga.edu/updatingcfrprint>).

⁶⁹ Ayres & Sweller, *supra* note 61, at 218-19.

⁷⁰ *See id.* at 219-20 (discussing student helping themselves when faced with split-attention IVDs); *see* Mayer & Fiorella, *supra* note 60, at 285, 291-96 (describing this as signaling and discussing past research on the topic); *see generally* Tamara van Gog, *The Signaling (or Cueing) Principle in Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 263, 263-75 (Richard E. Mayer ed., 2d ed. 2014) (showing research about how segmenting and then creating visual cues can minimize split-attention effects).

⁷¹ *Cf.* Dennis Payne, *How Many Contacts Does It Take Before Someone Buys Your Product?*, *Bus. Insider* (Jul. 12, 2011), <http://www.businessinsider.com/how-many-contacts-does-it-take-before-someone-buys-your-product-2011-7> (discussing the importance of repeated contacts in marketing).

⁷² Slava Kalyuga & John Sweller, *The Redundancy Principle in Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING 247, 247 (Richard E. Mayer ed., 2d ed. 2014).

unnecessarily enhance or elaborate essential information.⁷³ The identical information must be understandable in isolation for the redundancy effect to occur.⁷⁴ Redundancy manifests in many forms, such as picture/text, repetition of actual objects, and written/spoken text.⁷⁵ Lastly, the redundancy principle only applies in situations where the intrinsic cognitive load is high/complex enough to warrant minimizing extraneous cognitive load.⁷⁶

Gut instinct probably tells us that repeating the same information increases the likelihood that we will remember it—stowing it away in our long-term memory and using it later when needed. However, repeating the same material or re-visiting/reviewing it is different from redundancy.⁷⁷ Redundancy refers to “presenting the same material in multiple formats that require coordination” while reviewing material signifies returning “on a subsequent occasion to the same material that needed to be learned.”⁷⁸

A fundamental principle drawn from CLT is that “[N]ovel information should be presented in a manner that reduces an unnecessary working memory load.”⁷⁹ By requiring coordination of “redundant information with essential information,” redundancy increases working memory load and violates this principle.⁸⁰ An early example of how coordination of redundant information increases extraneous load and wastes cognitive capacity comes from a study on children learning to read.⁸¹ The study presented one group of children with a flashcard with a word printed on it and a corresponding illustration of the word. The word was read aloud to the children. Another group was subjected to the exact same conditions, but for the illustration. The group of children with illustrated flashcards underperformed compared to children to who had no illustrations on their flashcards. In this situation, the written word and how it was said/pronounced were essential for learning to read. The illustrations provided on the flashcards repeated the same information that the children already knew and was irrelevant to learning how to read. Coordinating say, the written word “cat” with a picture of a cat *and* hearing “cat” involved more working memory load than necessary.

In the case of an IVD with a graphic and explanatory text, redundancy occurs when both sources of information present essential information that can be understood in isolation. Learners viewing IVDs that integrate redundant explanatory text typically read the text while examining the diagram. They expend working memory load on reading and coordinating the text with the diagram when either one alone would have sufficed. Ironically, when sources of information are redundant, then splitting them apart can reduce extraneous cognitive load as it is then easier to ignore the redundancy.⁸²

The redundancy principle’s implication for IVDs is straightforward. Eliminate redundant materials and components wherever possible. However, all evaluations regarding redundancy depend on the learner’s perspective. What constitutes information intelligible in isolation for one learner may not be comprehensible at all to another learner. Information that is non-essential for one learner is absolutely essential for another. Designing instruction material with respect to the

⁷³ *Id.* at 247-48.

⁷⁴ *Id.* at 257.

⁷⁵ *Id.* at 251-56.

⁷⁶ *Id.* at 258.

⁷⁷ *Id.* at 260.

⁷⁸ *Id.*

⁷⁹ *Id.* at 248.

⁸⁰ *Id.* at 247-48.

⁸¹ *Id.* at 250.

⁸² *Id.*

redundancy principle requires an analysis of what material is likely to be redundant for a particular learner group.⁸³

The Personalization Principle

The personalization principle falls into a set of principles based on social cues. Social cues influence germane cognitive load. Recall that germane cognitive load describes working memory resources devoted to dealing with intrinsic cognitive load or the essential component of information. Influencing germane cognitive load involves (1) freeing working memory to allow the learner to dedicate resources to intrinsic cognitive load and (2) designing multimedia instruction in ways that increase the learner's motivational commitment to active cognitive processing.⁸⁴ The personalization principle is one of the social considerations that affects learner motivation.⁸⁵ The underlying idea behind it and other social considerations is that multimedia instructional techniques that increase a learner's feeling of personal relationship with the instructor increase the learner's motivation to engage in cognitive processing.⁸⁶

Under the personalization principle, people learn more deeply when the words in a multimedia presentation are in conversational style rather than formal style. Two major techniques for creating conversational style are (1) to use "you" and "I" rather than to rely solely on third-person constructions and (2) to add sentences in which the instructor makes direct self-revealing comments to the learner.⁸⁷ According to the personalization principle, incorporating a conversational style in an IVD (if it includes visual text) would affect the emotional state of a learner and prime him/her to engage in cognitive processing. Even the choice of font is thought to impart some form of emotion.⁸⁸

The Segmenting Principle

The segmenting principle attempts to affect intrinsic cognitive load. Recall that intrinsic cognitive load is fairly fixed and only altered by (1) changing the learning task or (2) changing the knowledge level of the learner(s). Segmenting attempts to do the former, and states that presenting material in learner-paced segments is more conducive to learning than presenting material as a continuous unit.⁸⁹ Research on the segmenting principle has tended to focus on multimedia instruction involving animation or a slideshow in combination with text (either spoken or written).⁹⁰ As with many of the principles and in line with the characteristics of intrinsic cognitive load, segmenting is only useful when the material is unfamiliar and complicated for the learner.⁹¹ Otherwise, the learner possesses "enough cognitive capacity to

⁸³ *Id.* at 259

⁸⁴ Richard E. Mayer, *Principles Based on Social Cues in Multimedia Learning: Personalization, Voice, Image, and Embodiment Principles*, in *THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING* 345, 346 (Richard E. Mayer ed., 2d ed. 2014).

⁸⁵ *Id.* In Mayer's construct, three other social cues/principles exist. They are not applicable for the purposes of this paper, so they have been omitted from the discussion.

⁸⁶ *Id.* at 348.

⁸⁷ *Id.* "Self-revealing comments" refer to statements that reveal the instructor/speaker's state of mind, opinion(s), feeling(s).

⁸⁸ James Hart, *Making the Horse Drink*, 19 *AALL SPECTRUM* 13, 16 (2014).

⁸⁹ Mayer & Pilegard, *supra* note 48, at 316.

⁹⁰ *See id.* at 326-29.

⁹¹ *Id.* at 337.

process the lesson.”⁹² Applied to IVDs, the principle suggests analyzing learner disposition/knowledge in relation to instructional messages to determine if and how complex material should be segmented.

The Modality Principle

Similar to the multimedia principle, the modality principle holds that under certain well-defined conditions, presenting some information in visual mode and other information in auditory mode can expand effective working memory capacity and reduce the effects of an excessive cognitive load.⁹³ The principle refers to a cognitive load learning effect that occurs when a mixed-sensory (partly visual and partly auditory) presentation of information is more effective than a single-sensory (either visual or auditory alone) presentation of the same information.⁹⁴

The modality effect occurs when multiple sources of information that must be mentally integrated before they can be understood result in superior learning using spoken/auditory information rather than written/visual information.⁹⁵ If the sources of information are intelligible in isolation, then receiving a mixed-mode presentation results in redundancy effects rather than a modality effect.

The modality effect stems from the dual-channel assumption, based on Paivio’s dual-coding theory and Baddeley’s model of working memory.⁹⁶ The assumption states that “humans possess separate information processing channels for visually/spatially represented material and auditory/verbally represented material.”⁹⁷ These channels function independently and are subject to limited capacities. However, research supports that if information is spread across the dual channels instead of one channel, the constraints of working memory can be mitigated. The modality effect supports exploration of instructional designs that combine visual and spoken components and therefore, multimedia learning.

An important boundary condition of the modality principle stems from failures to find a modality effect.⁹⁸ Though the research into explaining such failures is ongoing, one hypothesis consistent with CLT suggests that the complexity of the auditory information affects whether a modality effect occurs.⁹⁹ Under conditions where auditory and visual text materials are complex and/or lengthy, working memory may be overloaded, thus eliminating any load-alleviating effects.¹⁰⁰ For long and/or complex statements, a visual-only presentation may be superior to an audio-visual presentation.¹⁰¹

⁹² *Id.*

⁹³ Renae Low & John Sweller, *The Modality Principle in Multimedia Learning*, in *THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING* 227, 227 (Richard E. Mayer ed., 2d ed. 2014).

⁹⁴ *Id.*

⁹⁵ *Id.* at 227-28.

⁹⁶ See *id.*, for more information on dual-coding theory.

⁹⁷ Mayer, *Cognitive Theory of Multimedia Learning*, in *THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING*, *supra* note 51, at 47.

⁹⁸ See generally Mayer, *Introduction to Multimedia Learning*, in *THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING*, *supra* note 14, at 23 (defining “boundary conditions” as “[C]ircumstances under which a design principle is most likely to apply and least likely to apply.”).

⁹⁹ Low & Sweller, *supra* note 93, at 239-40.

¹⁰⁰ *Id.* at 239.

¹⁰¹ *Id.* at 240.

Limitations of CLT

CLT and its description of human cognitive architecture yield an array of principles with implications for instructional design. But a number of boundary conditions limit the applicability of many of them. The modality principle and split-attention principle depend on sources of information being unintelligible in isolation. In addition, the modality principle is negated (or even reversed) when the auditory component is complex. The redundancy principle only occurs when information is repeated or non-essential. All of the principles are premised on limited working memory and therefore, assume a situation where the intrinsic cognitive load is high. The related major limitation of CLT is that all the principles and their particular conditions require an evaluation based on learner perspective. Whether an instructional message involves low or high intrinsic cognitive load is entirely dependent on the learner and his or her context.

This shifting notion of intrinsic cognitive load causes a host of boundary conditions that are currently being researched. One of them is the expert reversal effect. The expert reversal effect is an outgrowth of the redundancy principle. Learners that are more experienced and have greater familiarity with a particular instructional message may suffer from a redundancy effect while novice learners would find the same instructional message novel and essential. The presentation formats that are optimal for novices may hinder the relative performance of more experienced learners.¹⁰²

Another overarching limitation of CLT is that most of the research conducted on multimedia learning focused on instructional messages in non-ambiguous or closed systems. Examples include math problems, engineering problems, and medicine. This brings into question whether principles derived from CLT can apply to legal research instruction and other areas involving more theory than discrete processes.

In addition, a fundamental assumption in the background of CLT is that strategies that reduce cognitive load “prompt or support deep processing.”¹⁰³ Under CLT, reducing extraneous load creates positive conditions (increases germane load) for deep learning, but it does not directly cause it.¹⁰⁴ Conditions and strategies to encourage schema construction and student metacognition lie outside the purview of this paper, but it is important to recognize this assumption as a potential limitation of CLT.

III. Implications for Academic Law Librarianship

Research Guides

Law librarians have adapted to the digitization of information and this “age of information” with a panoply of e-learning tools.¹⁰⁵ Many create webinars and simulations, others provide virtual reference services, write blogs, produce podcasts, and create research guides. Often in addition to teaching classes that support the research needs of their institutions. Some of these e-learning

¹⁰² Slava Kalyuga, *Knowledge and Working Memory Effects on Learning From Visual Displays*, in *LEARNING THROUGH VISUAL DISPLAYS* 75, 78-79 (Schraw et al. eds., 2013).

¹⁰³ Alexander Renkl & Rolf Schwonke, *Static Visual Displays for Deeper Understanding*, in *LEARNING THROUGH VISUAL DISPLAYS* 165, 171-72 (Schraw et al. eds., 2013); cf Mayer, *Introduction to Multimedia Learning*, in *THE CAMBRIDGE HANDBOOK FOR MULTIMEDIA LEARNING*, *supra* note 14, at 19-20.

¹⁰⁴ Renkl & Schwonke, *supra* note 103, at 171-72.

¹⁰⁵ Emily Janoski-Haehlen, *Library Instruction in the Information Age*, in *LAW LIBRARIANSHIP IN THE DIGITAL AGE* 315, 316 (Ellyssa Kroski ed., 2014).

tools and support services, such as webinars, already incorporate many of the suggestions outlined in Part I of this paper. However, the traditional bailiwick of academic law librarianship is decidedly devoid of visual information and surfeit of textual information. Apart from in-person tutorials/instruction and webinars, there is a dearth of visual information in the academic law library, as would be expected. Much of helping patrons with legal research needs is most efficiently accomplished through in-person interaction—it is certainly faster to show someone how to do something than write an instruction manual.

Despite the growing prevalence of online tutorials and webinars, the traditional legal research guide still endures. Legal research is notoriously complex and amorphous. Librarians use guides to summarize and condense information, distilling processes down to their most salient points—even when the reality is that there are a multitude of salient points.¹⁰⁶ Research guides stand in for times when law librarians are unavailable. Even when a law library produces videos to demonstrate legal research methods, these usually complement a guide or text on a web page—they are not usually the only form of guidance available in a librarian’s absentia. And the vast majority of guides have no visual/graphical component.¹⁰⁷

Considering that many librarians continue to create legal research guides despite their time-consuming nature and the current negative perception of library guides (in general, not simply legal ones), we should question whether there is a way to improve them.¹⁰⁸ Prior recommendations to improve library guides based on CLT principles include:¹⁰⁹

- Balancing aesthetics, practicality, and usability
- Font choice
- Using terminology that is clear & consistent
- Using conversational style
- Increasing interactivity by using polls, feedback forms and tutorials
- Breaking down the research process into smaller parts
- Adding a human element, such as pictures
- Reducing clutter
- Scrolling
- Tying guides to courses
- Keeping text to a minimum
- Providing clear descriptions of each guide’s purpose
- Include video clips or visual components as another source for learning skills
- Providing links to relevant subject listing

These recommendations mostly focus on the surface level of how content in general is presented (many with the LibGuide platform in mind). The suggestions apply to legal research guides as well, but they do not address the use of visual displays to aide in understanding the content of the guides.

¹⁰⁶ Take for example, any legal research guide on the topic of compiling federal legislative histories.

¹⁰⁷ Schraw & Paik, *supra* note 58, at 101-03.

¹⁰⁸ Jennifer Emanuel, *A Short History of Library Guides and Their Usefulness to Librarians and Patrons*, in USING LIBGUIDES TO ENHANCE LIBRARY SERVICES 3, 5-6 (Aaron W. Dobbs et al. eds., 2013); see Ingrid A.B. Mattson, *Untapped Potential: A Study of Academic Online Legal Research Guides*, 32 LEGAL REFERENCE SERVICES Q. 247, 251-52 (2)13 (describing four categories of legal research guides).

¹⁰⁹ Jennifer J. Little, *Cognitive Load Theory and Library Research Guides* 15, INTERNET REFERENCE SERVICES Q. 53 (2010); Hart, *supra* note 88, at 13-16; Veronica Bielat et al., *Integrating LibGuides into the Teaching-Learning Process*, in USING LIBGUIDES TO ENHANCE LIBRARY SERVICES 121, 126-27 (Aaron W. Dobbs et al. eds., 2013).

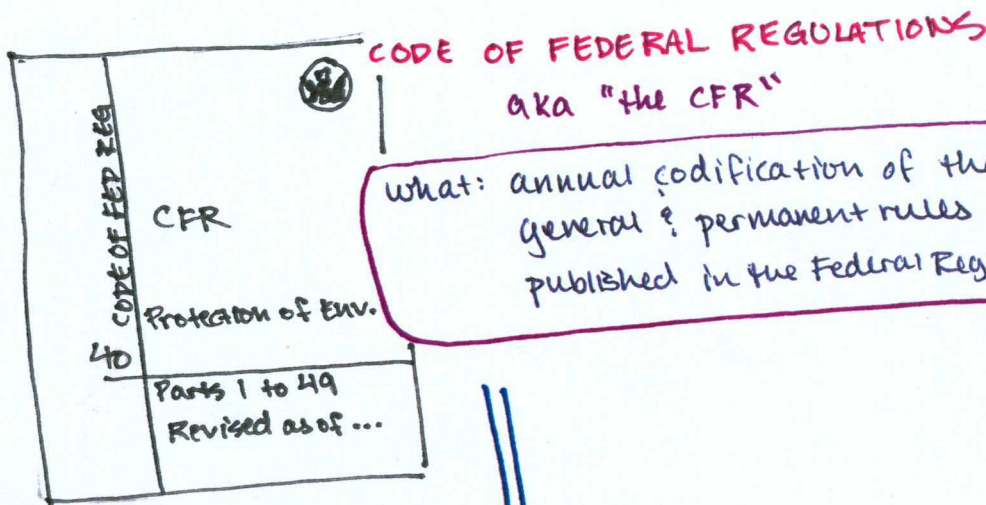
An Experimental IVD: Updating Federal Regulations

What follows in this subsection is my attempt at utilizing the CLT principles discussed in Part I to create an IVD of a process-oriented legal research guide.¹¹⁰ I chose a process-oriented research topic because the process quality lends itself to visual graphic that shows discrete steps. Updating federal regulations is a common legal research topic and is a sufficiently puzzling process to warrant a guide. The IVD's target audience is patrons relatively unfamiliar with updating federal regulations.

¹¹⁰ See generally Mattson, *supra* note 108, at 251-52 (categorizing types of legal research guides).

UPDATING A FEDERAL REGULATIONS

(simplified)



What: annual codification of the general & permanent rules published in the Federal Register

DO YOU NEED TO READ SOMETHING IN THE CFR?
AND DO YOU HAVE A CITATIONS?

NO

YES

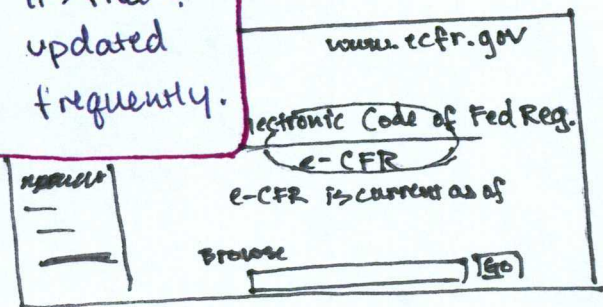
Go to guide on finding Federal Regulations

DO YOU WANT TO USE AN AUTHENTICATED SOURCE?

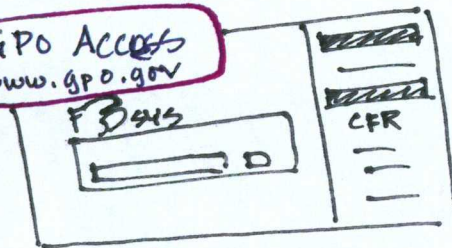
NO. I just want to know what the rule/reg says. I don't need to cite to it later

YES. I have to cite to the reg eventually, so yeah, I should use an authenticated version

Use the eCFR!
It's free & updated frequently.



GPO Access
www.gpo.gov



NOW YOU KNOW WHAT THE RULE/REG SAYS.
DO YOU NEED TO UPDATE IT?

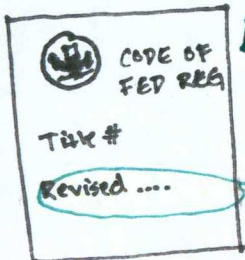
NO! Who cares whether the regulation is current, you're a risk taker! Go ahead, don't check to see if anything's changed.

DO NOTHING MORE

YES: I need to know what the rule/reg looks like now.

GREAT! BUT BEFORE MOVING ON YOU HAVE TO KNOW HOW CURRENT THE RULE/REG YOU READ IS.. FIND THAT INFORMATION BY:

(1) LOOKING AT THE FIRST PAGE OF THE TITLE



OR

(2) LOOKING AT THE TOP RIGHT HAND CORNER OF THE PDF OF THE TITLE



PRINT OR ONLINE?

ONLINE

PRINT

UNOFFICIAL

OFFICIAL

Westlaw
Lexis
Bloomberg

"Browse CFR Parts Affected from the Federal Register"

CODE OF FEDERAL REGULATIONS		
---	Title 1	PDF / REGS
---	---	---
---	Title 2	---
---	---	---
---	---	---
---	---	---
List of CFR sections Affected		

See the guide on updating the CFR in print

ONCE YOU ACCESS THE "CFR PARTS AFFECTED FROM THE FEDERAL REGISTER" CHOOSE A DATE RANGE THAT COVERS THE TIMEFRAME OF WHEN THE REG WAS LAST PUBLISHED AND NOW

CHECK YOUR TITLE TO SEE IF THERE'S BEEN ANY PROPOSED OR FINAL RULES AFFECTING YOUR REGULATION

YOU'VE UPDATED YOUR REG!

Combining a graphic depicting the process with explanatory/guiding text in proximity to the relevant step fulfills both the multimedia principle (words + pictures = deeper meaning) and the split-attention principle. The split-attention principle dictates that sources of information in an IVD should be placed in logical proximity to one another to reduce extraneous cognitive load caused by unnecessary visual scanning. This suggestion holds as long as the sources of information are unintelligible when viewed in isolation. For a patron relatively unfamiliar with updating federal regulations, the arrows (the visual/graphical component of the IVD) are integral to understanding the questions and which step comes next. All descriptions are placed in relative proximity to the steps.

Using informal, conversational language that uses “you” in conjunction with language denoting a non-serious character creates a personalization effect. The handwritten nature of the IVD re-emphasizes the conversational tone of the overall IVD in an effort to encourage the learner to engage in cognitive learning.

Removing alternate methods, such as how to update in print, serves as an attempt to segment and keep the level of intrinsic cognitive load from being too high. Updating federal regulations is an activity extremely high in intrinsic cognitive load for those unfamiliar with the process. Providing all the possible options one could take from each node would quickly overload a novice legal researcher. The IVD is already complex without all pathways.

The IVD does not provide much background source information describing the various sources used. Nor does it constitute a comprehensive overview of how one updates a federal regulation. This editorial move reduces the information in the IVD to essential information, albeit for a few particular methods of updating a regulation. Since the information sources are unintelligible in isolation and information is not repeated, the IVD avoids the redundancy effect. In turn, this alleviates the cognitive load on working memory by minimizing extraneous cognitive load and managing intrinsic cognitive load.

The IVD does not incorporate the modality principle. It could if it was converted to a narrated animation, which is exactly what some academic law libraries do. However, videos can be impractical for learners depending on their personal environment. So most legal research guides that have videos use them as a secondary format rather than a primary.

Challenges

This experimental IVD yields an absurd result and highlights the challenges of applying an IVD approach (or “conversion”) to legal research. First, the IVD is too... twee. Law schools are professional schools, with an emphasis on “professional,” engaged in generating members of a likewise conservative industry. Academic law libraries usually share some of this attitude by virtue of serving their parent institutions. In comparison, this hand-drawn IVD looks amateur.¹¹¹

The IVD’s biggest issue is that it is entirely too reductive. One of the key skills law librarians try to inculcate, at least in law students, is the ability to use multiple pathways/methods to obtain desired information. Typically, part of the mission of academic law librarians is to prepare law students for whatever resources they may have (or more importantly, not have) once they graduate. This experimental IVD shows a limited number of pathways and leaves out the oh-so-important information about sources. In addition to failing to inform users of the universe of

¹¹¹ See generally Wendy MacNaughton, *Should I Check Email?*, in *THE BEST AMERICAN INFOGRAPHICS 2013* (Gareth Cook ed., 2013), for an example of a flowchart structure that inspired and influenced the design of the experimental IVD in this paper.

pathways, as a visual display, this IVD possesses the ability to mislead the unsuspecting. As with infographics, creators of IVDs must choose information to include and exclude. In so doing, they actually create a product with a particular viewpoint. For those not as knowledgeable, such as public patrons for whom a standalone IVD might be intended, they may believe that the IVD depicts the only appropriate method of accomplishing the task.

This reduction and potential to mislead may also result in patrons using the same methods (outlined in an IVD) despite the unsuitability of that method to changed circumstances. This may occur, even with awareness of other search strategies.¹¹² Even worse, a decision tree IVD could obviate the practice of reflecting on what is happening during the search—patrons may no longer focus, reflect, and create heuristics that enforce cognitive engagement if they follow rote directions, impeding analytical skill development.¹¹³

Applicability also presents issues. Legal research encompasses so much.¹¹⁴ Some topics, such as this one lend themselves to a step by step process. Flowcharts in cases such as these break down complicated processes and by taking each step “the way to move forward is revealed to be self-evident.”¹¹⁵ However, many other areas, for example, drafting contracts, have no specific hierarchical process. Designing an IVD to accommodate such areas of legal research poses a challenge perhaps not worth taking.

This raises the issue of cost. Creating an IVD takes time. Law librarians (or other creators) must evaluate target learner characteristics and develop an instructional design that avoids many pitfalls while reflecting human cognitive architecture. Designing a slick and professional IVD requires a set of skills. All these things take time and in some ways, others already do this. Look at any commercial database or the e-CFR. Arguably, there is no need to create “costly” IVDs in-house when law libraries can provide live and online demonstrations conveying the same information.

Possible Uses

Despite all the shortcomings outlined above and despite my own misgivings regarding whether I applied CLT principles to the IVD correctly, I believe that the exercise of creating one proved useful and hints at some ways law libraries can re-invent and improve existing services. The fear of creating law students/patrons who simply follow rote directions and only know of one method of legal research is easily mitigated by creating separate IVDs for each type of pathway. Doing so would mean heeding the advice of the segmenting principle and avoiding cognitive overload. Though in this case, a decision tree was used, it would not necessarily result in rote learning with no sense of the legal research landscape. Learners may actually better discern the context of their legal research processes more readily through a visual display that shows relationships than by

¹¹² See generally Marcia Bates, *An Introduction to Metatheories, Theories, and Models*, in THEORIES OF INFORMATION BEHAVIOR 1, 4-7 (Karen E. Fisher et al. eds., 2005) (briefly introducing “satisficing behavior” and describing it as “good enough” decision making as opposed to optimal decision making).

¹¹³ See generally Harker, *supra* note 12.

¹¹⁴ See generally DAVID HOWARTH, LAW AS ENGINEERING 159-61 (2013) (noting that “[A] glance at the leading academic law journals reveals that legal research is not a single activity but a number of different activities. Some research is straightforward social science...[A] related type of research concerns history of legal events...[B]ut much legal research is aimed not at explaining or predicting behaviour that just happens in part to be classified into legal categories but rather at exposition or criticism of the law itself.”).

¹¹⁵ David Byrne, *Introduction* to THE BEST AMERICAN INFOGRAPHICS 2013, at xiii, xiv (Gareth Cook ed., 2013).

reading about it.¹¹⁶ IVDs that are decision trees, like this experimental one, may enhance learning by forcing students to become cognitively active. Cognitive activity occurs when a learner tries to make sense of what s/he is viewing.¹¹⁷ Meaningful learning occurs during cognitive activity even if a learner appears to be behaviorally inert.¹¹⁸

Decision tree IVDs may also alleviate decision fatigue/overload. Research indicates that after making a certain number of decisions per day, we appear to reach a limit, after which we experience neural fatigue and lack the energy to make more decisions, regardless of importance.¹¹⁹ Legal research necessitates so many decisions, most of which are *not* trivial. Law librarians know this and care about it. However, it is not entirely clear whether anyone else does. Sometimes people simply want to know what to do, not why they should do something.

The amateur nature of my experiment and the “cost” associated with creating it need not apply to or inhibit others. My result is hand drawn for the sake of simplicity and taking CLT principles and the current popularity of artisan designs to an extreme. Others do not have to be made in such a fashion. There are programs designed to help those with rudimentary programming and design skills create the own slick, professional IVDS.¹²⁰ Libraries could even crowdsource a set of IVDS and share them, thereby reducing time spent in creating them. As law librarianship shifts more towards a conceptual model, we might find ourselves cooperating with those who possess the skill sets we need to create products attuned to our needs.¹²¹

This implicates the real value of this exercise of creating an IVD. Though the experimental IVD was couched in terms of how visual information could improve legal research guides, there is no reason to think of them strictly as things that exist in a static form on a law library web page. Webster defines tools as “something used in performing an operation or necessary in the practice of a vocation or profession” or “a handheld device that aids in accomplishing a task.”¹²² Under this definition, legal research guides certainly constitute tools as they provide a “list of resources to assist on specific topics designed to help with research needs.”¹²³ But law librarians today create apps, games, and other tools that leverage the notion of functionality embodied in the definition of tools.¹²⁴ Similarly, IVDs could take on various formats, be it a poster, rudimentary mobile app, or even the basis for a game.

IV. Conclusion

Incorporating cognitive load theory (CLT) principles into instructional visual displays (IVD) is challenging, more so for a field where visual representation has historically played little to no

¹¹⁶ Admittedly, the experimental IVD misses out on substantiating the contextual relationship between sources because it lacks such information. However, the IVD still imparts a sense of a system and its relevant components.

¹¹⁷ Mayer, *Introduction to Multimedia Learning*, in THE CAMBRIDGE HANDBOOK OF MULTIMEDIA LEARNING, *supra* note 14, at 21-22.

¹¹⁸ *Id.*

¹¹⁹ DANIEL J. LEVITIN, THE ORGANIZED MIND 5-6 (2014).

¹²⁰ See Brad Zomick, *How It's Made: Learn How to Create Your Own Infographic with Designer Mike Wirth*, Skilled Up: Graphic Design (Feb. 28, 2013), <http://www.skilledup.com/articles/create-your-own-infographic-mike-wirth/> (presenting resources and methods for creating infographics).

¹²¹ See generally The Stanford Center for Legal Informatics: CodeX, for an example of a joint law and technology project (<http://codex.stanford.edu/>).

¹²² “tool.” Merriam-Webster Online Dictionary, 2015. <http://www.merriam-webster.com> (10 May 2015).

¹²³ See Carol A. Watson, *Reference Services in a Library*, in LAW LIBRARIANSHIP IN THE DIGITAL AGE 235, 244 (defining legal research guides).

¹²⁴ See Janoski, *supra* note 105.

role.¹²⁵ However, these “principles are not intended to be immutable laws, but rather should be consistent with the cognitive theories of learning which suggest when principles should be most (or least) effective.”¹²⁶ We live in a time where the response “tl;dr” characterizes many peoples’ reaction to long-form prose—particularly when engaged in information-seeking.¹²⁷ I am absolutely guilty of the same behavior myself. Consider this prevalent attitude with the fact that “forces that have made it possible for infographics to proliferate have also made us hungry for them. We are deluged with information, and infographics promise to make sense of it.”¹²⁸ Given these types of forces, law libraries have to explore different methods of efficiently conveying much of the same information that they have historically provided.¹²⁹ Even if areas of the law are profoundly *not* amenable to instructional visual design “treatment,” investigating opportunities to apply it at the very least provides a starting point for experimentation in general.

Conclusions should end with strong statements of opinion. I confess that I am not sure whether the experimental instructional visual display in this paper even constitutes an instructional visual display; whether I have appropriately applied cognitive load theory principles of multimedia learning; or if I have created anything unique at all. But I do have a strong hope that others can use my attempt here to create something better and different, or even to justify going a different direction altogether.

¹²⁵ See generally Elizabeth Porter, *Taking Images Seriously*, 114 COLUM. L. REV. 1687 (discussing the growing use of imagery in the law and legal practice).

¹²⁶ Richard E. Mayer, *Fostering Learning Through Visual Displays*, in *LEARNING THROUGH VISUAL DISPLAYS* 47, 67 (Gregory Schraw et al. eds., 2013).

¹²⁷ An Internet shorthand for “too long; didn’t read.”

¹²⁸ Gareth Cook, *Foreword* to *THE BEST AMERICAN INFOGRAPHICS 2013*, at ix, ix (Gareth Cook ed., 2013).

¹²⁹ See Patrick J. Charles, *How Do You Update the Code of Federal Regulations Using FDsys?*, *PERSP.: TEACHING LEGAL RES. & WRITING* (ThomsonReuters Legal Solutions), Winter/Spring 2012, 128, for an example of another (and better) graphic-heavy guide to updating federal regulations.