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Instructional Message Design: Theory, Research, and Practice (Volume 2)

Miguel Ramlatchan

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**Instructional Message Design:
Theory, Research, and Practice
(Volume 2)**

**Chapter 1: Message Design for Instructional Designers -
An Introduction**

Miguel Ramlatchan, PhD
Old Dominion University

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1. Message Design for Instructional Designers: An Introduction

Miguel Ramlatchan, PhD

Key Points:

- Instructional design is determining the need for an instructional solution, analyzing needs, defining learning objectives, and developing a solution to meet those objectives
- Instructional message design is the application of theory and techniques to communicate with learners as part of that solution.
- Message design through visual communications can include static art (illustrations, diagrams, photographs) or dynamic art (animation, video, virtual reality, and simulations) with or without accompanying audio.

Abstract

Instructional message design is the use of learning theories to effectively communicate information using technology. Design is guided by theories including gestalt, cognitive load, multimedia learning, media selection, media attributes, and general communication systems. Our communication designs can be based on a wide variety of technologies or a combination of technologies. Technology in the form of tools and techniques includes, among others, the study and the use of typography, color, illustrations, photographs, modeled graphics, augmented reality, animation, video, video games, simulations, and virtual reality. This introduction serves as a brief overview of these

theories, tools, and techniques while subsequent chapters in this book will dive much deeper into practical applications in instructional design.

Introduction

Message design is all around us. From the logo on the coffee cup beside me here on my desk, to the layout of your car or truck's dashboard, to the street signs you will pass to and from the grocery store; we see hundreds of examples of message design every day. Message design is the use of text, graphics, and/or pictures to communicate and to specifically address a need or solve a problem (Fleming & Levie, 1993). Thinking back to the dashboard on your car, it communicates your speed, fuel level, and general system status; all important pieces of information that are vital for your trip. That dashboard represents the efforts of the engineers (human performance technologists) who wanted to design a system that communicates to you (the driver) that essential information. That is the essence of message design.

While there are many great references for message design, especially in the context of marketing, advertising, web design, and graphical design, the specific focus of this book is message design in the context of instruction, learning, and education. Instructional design in a single sentence is the process of determining the need for an instructional solution, assessing and analyzing the learning needs of a user/client/student group, defining learning objectives, and developing a solution to meet those learning objectives (Reigeluth, 1999; Richey et al., 2011). The focus of this book is on the latter aspect of this operational definition, the arena of designing, developing, and implementing an instructional solution. **Instructional message design is the real-world application of instructional and learning theories to effectively design the tools and technologies used to communicate, purposefully convey information, and to transfer knowledge to learners.** Similar to Fleming and Levie's (1978; 1993) foundational work in instructional message design, this book also assumes that the reader has a background and is familiar with instructional needs analysis and the basics of instructional design. An excellent reference for the instructional design process is Morrison, Ross, Morrison, and Kalman's (2019) *Designing Effective Instruction*.

The contents and guidance of this book falls within the “Designing the Instructional Message” phase of the Morison, Ross, and Kemp model, or developing how to best present and communicate the information that the learner needs.

Following Fleming and Levie’s original guidance, this book focuses on four key objectives (1978). The authors in this book present empirical research, from the early foundations of each topic to the latest theory and findings. The chapters of this book also focus on the practical application of theory and research. While each of the talented authors in this book have an applied research background, the authors take a non-technical writing approach in each chapter (with some noticeable deviations from classic, academic APA style). The final goal of this book is to present practical examples and real-world best practices for anyone who plays a role in instructional design.

Instructional designers have a wide range of tools and techniques to design instructional messages. Gestalt theory, cognitive load, dual coding, working memory, and multimedia learning theory are among some of the many theories that can be applied as design heuristics. Text, typography, graphics, diagrams, animation, video, multimedia, and simulations are among the many options to present information in our instructional messages.

Instructional Message Design Theory

There are several key theories that guide our instructional message design. These selected theories help describe the cognitive processing of our learners, and thus can be used to define guidelines and best practice.

Gestalt Theory

Gestalt (German for ‘shape’ or ‘form’) theory states that individual components of a picture do not communicate much by themselves, it is only when these individual components are combined do they form a picture (Wertheimer, 1944). A complete image is only able to communicate an idea when the components of that image are integrated and presented together.

Gestalt theory has evolved to now include five key principles (Lohr, 2008). The first principle is **Closure**, or humans will see the whole of an image before we will see the parts (see Figure 1). The second principle is **Contiguity**, or the human eye will tend to follow a path when a path is presented in an image. The third principle is **Similarity**, or the human mind will seek and look for patterns. The fourth principle is **Proximity**, or we will integrate image components into the complete image based on how close or far those components are displayed. The final principle is **Experience**, or we will see an image and tend to relate it to something that we are already familiar with. This principle is very similar to schema theory, which states that when presented with new information, humans will tend to look to connect that new information to previously learned ideas, concepts, or patterns (Bartlett, 1936). Gestalt theory helps explain the cognitive processes that are occurring in the working memory of our learners when they are presented with instructional message designs.



Figure 1. In this classic example of gestalt theory, which do you see first, the two human faces? or the vase?

Cognitive Load Theory

Our learners have finite short-term or working memory resources. While there may be some debate as to the true quantitative measures of working memory, an early insight put these resources somewhere in the range of seven plus or minus two units of memory (Miller, 1956). This limitation on short term or working memory was supported by research that would eventually evolve into cognitive load. Work to identify the difference between novice learners and expert learners realized that the distinction could be that inexperienced students may be expending their cognitive resources early during problem solving exercises (Sweller, 1988). Experts have previous schema, or learned patterns, principles, ideas, and concepts, to pull from long-term memory to help when problem solving. This schema occupies only one of those five to nine working memory units allowing the learner to focus their remaining cognitive resources on solving the problem. Novice learners have not yet developed this schema, and so have to use all of their cognitive resources on solving the problem.

Cognitive load theory continued to develop and is composed of three basic principles (Pass & Sweller, 2014). Cognitive load theory assumes that learners have limited working memory resources, that the contents of working memory fade after a short time, and that humans have a capacity for nearly infinite long-term memory because of schemata, or the storing of information as patterns. Cognitive load describes the capacity of a learner's working memory resources in terms of germane resources, extraneous load, and intrinsic load (Ayers, & Kalyuga, 2011; Sweller et al., 2011). Extraneous cognitive loads are distracting aspects of instructional message design that divert attention, annoy, or confuse learners. Reducing extraneous cognitive load is the primary means by which designers can reduce overall cognitive load and increase learning effectiveness in technology-assisted instruction (Sweller, 2019). Intrinsic cognitive load is the actual message and the inherent difficulty of the subject matter. Intrinsic load can be managed and minimized through strategic chunking techniques, development of schema, and scaffolding (Sentz et al., 2019). Germane resources (often also referred to as germane cognitive load) are the cognitive resources that are available after extraneous load that the learner has available to apply to intrinsic load. The effects of extraneous and intrinsic cognitive load are accumulative, and together reduce the germane resources available for processing of new information in our learner's working memory. The goal of instructional designers is to minimize extraneous

cognitive load, manage intrinsic cognitive load, and to maximize available germane resources to focus on that intrinsic load.

Multimedia Learning Theory

Multimedia Learning Theory evolved from experiments with random treatment groups and digital multimedia with static illustrations with and without text (Mayer & Gallini, 1990). These early results indicate the unique advantages of using multiple media technologies at the same time in the same presentation. Mayer's cognitive theory of multimedia design evolved from this use of text and illustrations and was first based on the dual-coding findings of Paivio (1991), and then integrated the working memory and cognitive load findings of Baddeley (1992) and Sweller (1991). Dual-coding theory states that humans will process video, slides, or animation separately from audio and narration. Learners cognitively combine that information in working memory, then store that information in long-term memory for future retrieval. Humans also have finite short-term and working memory resources, and these limited germane cognitive resources should be guided to focus on intrinsic content rather than extraneous design distractions.

The basic guidelines defined by multimedia learning theory can be summarized into three key ideas (Clark & Mayer, 2016). In general, presenting pictures and text together will be more effective than presenting pictures alone or text alone. Next, instructors and instructional designers should look to reduce or eliminate as much extraneous and nonessential information or distractions from multimedia presentations as possible. Also, to further aid learning effectiveness, multimedia can be personalized using polite, conversational human voices integrated with visuals. Understanding and applying these concepts, especially when looking to effectively deploy multimedia, is a critical aspect of instructional message design.

The Message and the Media

While the affordances of different technology or media allow for different aspects of communication, the instructional message is more

important than the media, technology, or vehicle used to deliver that message. For instance, consider a unit of instruction that describes the inner workings of an electric motor. In this context, an animation that shows the cross section of the motor and what happens inside that motor when it is in motion may be more effective than showing a series of still slides. In this example, an animation may be more effective, though we cannot generalize this conclusion to say that animation is a better tool than static PowerPoint slides. This would be like saying hammers are better tools than screwdrivers. In practice, both tools can be effective depending on the context, application, and the available resources.

Rather than comparing technologies and tools to each other (as in a media comparison study), it is more important to study the efficient and effective use of each tool in a message design context (Clark, 1983). It is also important to focus on which media or technology has features that differ from other options or earlier versions, such as if the new technology offers immediate feedback, user input, customization, ease of implementation, and/or better technical support (Morrison, 1994). The analysis of what technology to use to deliver our message should now also include the heuristics of multimedia learning theory, implications of cognitive load (especially extraneous load), the equivalency to other options, and cost effectiveness (Clark, 2012). This aspect of cost effectiveness is also important to consider, especially from a human performance technology perspective. In terms of instructional systems, cost effectiveness, student satisfaction, instructor satisfaction, learning effectiveness, and accessibility are among the variables to consider in high quality programs (Moore, 2002). In instructional message design, it is important for us to be sure that the vehicle we are using to deliver our message meets the needs of our learners, including accessibility, ethics, equity, quality, cost effectiveness, and learning effectiveness.

The Cone of Experience

The cone of experience describes the attributes of media and technology in terms of the conceptual involvement of the learner (Dale, 1946). While this model was developed in the context of the technology available in the early 20th century, the concept of

engagement is still as relevant today as it was then. The model describes a scale of learning engagement from concrete, cognitively tangible to abstract, intangible experiences. For instance, reading a textbook would be among the most intangible of learning experiences (near the top of the cone). A hands-on cognitive apprenticeship would be among the most tangible of learning experiences (near the bottom of the cone). A cognitive apprenticeship is learning directly from an expert, ideally in a one-to-one setting, in the authentic environment where the lessons learned will be applied (Brown et al., 1989; Collins, & Duguid, 1989). For instance, learning from an experienced auto-mechanic in a professional garage will be a much more engaging experience than reading about changing an alternator from text in a book. In the context of message design, the affordances of a virtual reality simulation should be able to offer a richer learning experience than a PowerPoint presentation (assuming that the resources are available and that the learning objective will benefit from the use of a simulation). Note, this does not mean that one technology is “better” than another - rather the use of different technology in our message designs will inherently introduce differing levels of direct or abstract engagement (see Figure 2).

Dale's "Cone of Experience":

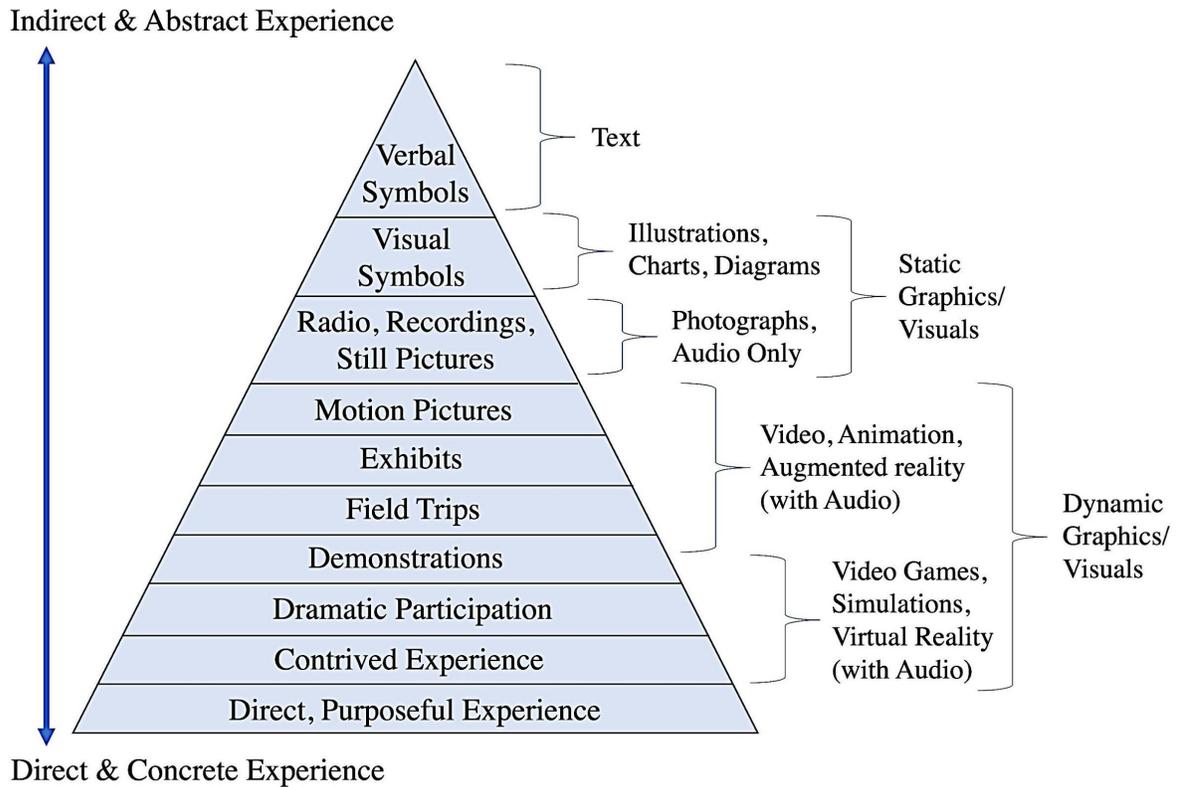


Figure 2. The cone of experience can be used to describe how message design tools and techniques can be used to engage students in terms of indirect and direct experiences (modified from Dale, 1946).

The General Communication Systems model

Signs and symbols are fundamental aspects of human communication (Bruce-Mitford, 1996). Symbols are used by humans to make understanding out of intangible ideas; for instance the letters of the alphabet are symbols for sounds. Signs are used to represent an object or idea, such as the physical signs we see along a highway, or logos that we see on objects and in marketing. A signal can be a method of cueing or gaining attention (Richey et al., 2011). Or, in technical telecommunications terms, a signal is the transmitting and receiving of symbols and signs between a sender and receiver, see Figure 3 (Shannon & Weaver, 1949). In either case, in terms of instructional message design, the success of the message depends on the system used to convey signs, symbols, and signals between our instructors and our learners.

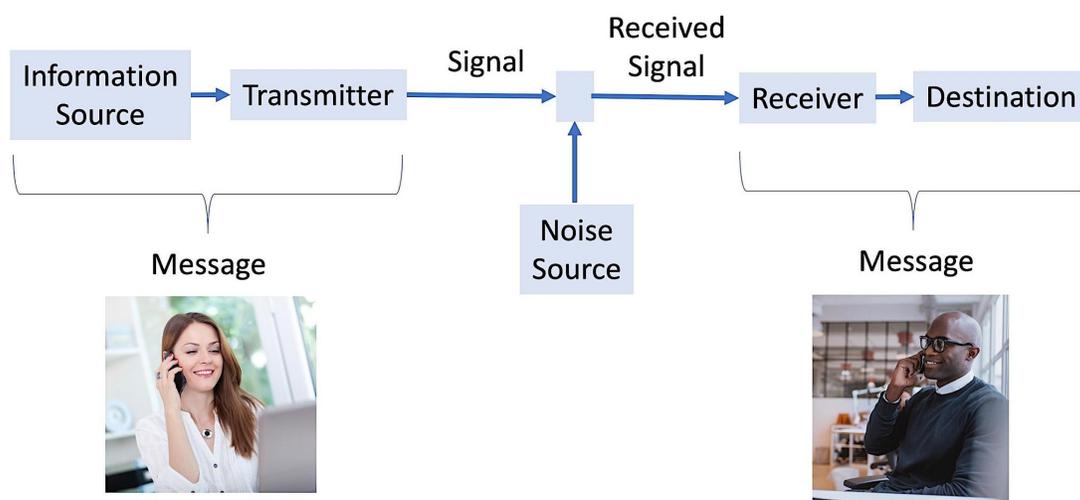


Figure 3. The general communication systems model describes how a message in the form of an information source is sent and received by a destination.

A complete communication system consists of three components: the accuracy of the symbols being received, the accuracy of the symbols delivering the message, and the understanding of the message (Shannon

& Weaver, 1949). The communication process begins with an information source, or a message. The message is encoded; in today's digital communications systems this encoding takes that message and converts it into 1s and 0s. Those 1s and 0s are carried by a signal to their destination. For instance, our message can be converted into digital 1s and 0s and carried by a signal, over a network to the Internet to another network and then to the person who we are sending the message to. There is a receiver at the destination that converts those 1s and 0s back into something that should look like the original message. Along the way that signal can encounter "noise" or interference that can damage the signal and the message. For example, if there is a network or Internet connection issue, the signal from our transmitter to receiver could be disrupted.

In terms of instructional message design, the general communication model describes how the message is sent and received. In conceptual terms, the "signal" could be a live, interactive web conferencing protocol that is transmitting our audio, video, and visual slide presentation, or it could be a textbook or research poster that we have designed. In either case, the noise encountered by our image could be extraneous cognitive load erroneously introduced by an instructor or instructional designer, or a bad Internet connection, or both. The intended message sent may not be the message received or understood at the destination. A goal in instructional message design is to create, design, and utilize a system that would be robust to both technical and cognitive communication issues.

Instructional Message Design Tools and Techniques

Text and Typology

Text can be operationally defined as the main set of written words in a body of writing. A font is a computer-generated text style, and typography is the study, design, and application of text and fonts (Lohr, 2008). Legibility and readability describe how easy it is to read different types of fonts. Legibility is the ease of reading a short set of text. It can be made easier with the use of a more modern, sans serif font like Helvetica. Readability is the ease of reading long sets of text, which can be improved by using a classic serif font like New Times

Roman. A serif font has small strokes at the ends of letters, while a sans serif font does not (Lohr, 2008). Text can also be arranged and organized by headings to guide and ease the readability of content.

There are several other characteristics of a font that contribute to its legibility and readability (Bringhurst, 2004). A font's x-height (the height of the lowercase letter "x" in that font), ascenders and descenders (how much of letters extend above and below the line of text), counter (the filling inside letters), and kerning (the amount of space between letters) can all impact the ease of reading that font (see Figure 4). Other common variables in terms of writing for instructional designs include font size, line spacing, and the selections of a serif or sans serif font. In addition to the many serif and sans serif options, there are decorative fonts, resembling elegant and informal handwriting. However, many of these font types lack legibility and readability in instructional applications. Before the inherent resolution of today's devices and displays, we were taught as instructional designers to never use fonts much smaller than 24-point in virtual classroom applications. While we do not want to make our text illegible, high-definition displays now give us the ability to decrease our font sizes to increase the information that we are able to display. For message design for mobile devices, if learners cannot control the amount of text on their screen then it is best to err on the side of lower text density (Ross et al., 1988).

Hierarchy is used to create headings that organize blocks of text into main sections and subsections (Lupton, 2010). White space between headings, bold and italicized text, capitalized letters in words, and indentations can be used to organize bodies of text and cue readers. Hierarchy in short bodies of text can be accomplished with bullets that create a list of ideas, thoughts, or concepts. This typographical signaling aids in browsing, searching, skimming, and gaining the reader's attention (Waller, 1979).

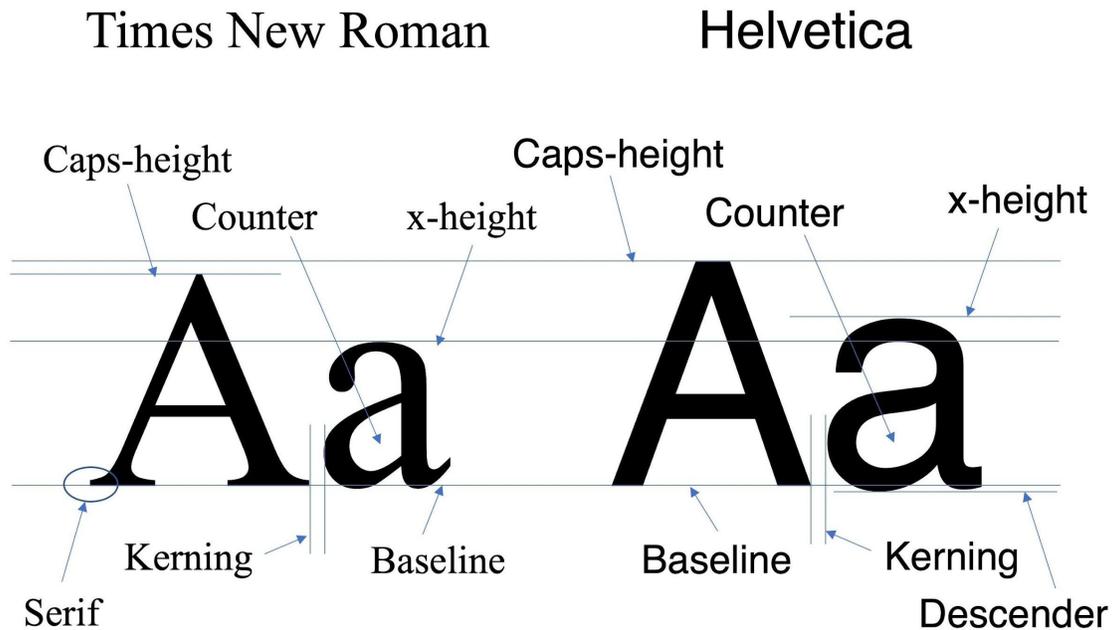


Figure 4. Several aspects of font design can be seen when comparing Times New Roman and Helvetica (note, this figure was made with PowerPoint and a 191-point size for both fonts).

Color

The use of color in message design will have direct and indirect psychological and cognitive implications. For instance, in educational or business contexts I am sure we can all recall the ill-advised use of text color against background color during a presentation. The body of advertisement and marketing knowledge also recognizes the impact of color in message design. Color can be used to gain attention, project professionalism and quality, and induce unconscious decision making (Mohebbi, 2014). Color hue (the color's specific color family) and saturation (the intensity or purity of hue) can enhance positive or negative intentions of message design (Labrecque et al., 2013). In instructional message design, color can also be used to distinguish different aspects of a diagram, for measurement and quantities as in a

chart, for representing reality as in a photograph, and for creating aesthetic appeal (Tufte, 1990).

Another review of the color and psychology research results in a summary of the emotional and potential cognitive implications of different colors in instructional design (Lohr, 2008). Lohr compiles and presents several communicative properties of color. For instance, dark greys and black are thought of as somber or elegant shades, while white and light colors signify purity and innocence. It is thought that red signifies passion or power, while orange signifies happiness and warmth, and yellow signifies brightness and idealism. Greens suggest growth and nature, blues represent tranquility and dependability (and sometimes sadness), violets suggest royalty and nobility, and browns represent duty and reliability. Thus, using a light blue background in web design or for slides could elicit a sense of calmness during a presentation (see Figure 5). However, it should be noted that to remain accessible for our learners, components of our message design elements should complement and support each other. Designers should not try to communicate through color alone.

Black	Elegant, Somber
White	Purity, Innocence
Red	Passion, Power
Orange	Happiness, Warmth
Yellow	Brightness, Idealism
Green	Growth, Nature
Blue	Tranquility, Dependability, Sadness
Purple	Royalty, Nobility
Brown	Duty, Reliability

Figure 5. The choice of color in instructional message design can communicate emotion and elicit perceived meanings based on the customs and backgrounds of the reader (Lohr, 2008).

Text and the color of text inherently work together. In a multi-year study with 218 online participants in the United States, researchers found that the color (black, white, red, orange, yellow, green, blue, purple, or brown) of the text and the font used (Courier, Times New Roman, or Phosphate) together impacted readers' perceptions of how a message communicated friendliness, funness, boringness, dependability, reliability, and prestige (Ramlatchan, 2021). For instance, participants felt that short messages in black Courier communicated dependability, reliability, and boringness, while messages in orange Phosphate were perceived as fun and friendly.

Graphics

Instructional graphics should communicate and reveal data (Tufte, 2001). This operational definition is especially true in instructional design. Visual elements beyond text can be categorized as two main types: static art or dynamic art (Clark & Lyon, 2011). Static art is graphics that do not move, such as illustrations, photographs, and three-dimensional computer models. Dynamic art is visuals that move, change over time, and do not remain static, such as animation, video, and virtual reality. Also, as multimedia learning theory would predict, including narration and sounds in animations, video, and other dynamic visual applications will further enhance learning.

Illustrations.

Graphics, or visual elements designed or constructed to present data, ideas, or concepts, can take the form of diagrams, charts, and pictures. While there is merit to decorative graphics that aid in the professional appearance of a message, or to serve as a cueing aid, care must be taken to avoid adding distracting extraneous load (Morrison et al., 2019). Along with avoiding “chart junk and PowerPoint Phluff” that unintentionally distracts from the content of the graphics, ethical designers should never manipulate the message and graphic design to mislead learners (Tufte, 2003). Well designed charts and illustrations should show data comparison, causality, multiple variables, integration of multiple data types (words, numbers, images, diagrams), documentation and references, and maintain a faithful focus on the content (Tufte, 2006). Diagrams and text should be integrated as much as possible, and diagrams within a text should be positioned as close as possible to the paragraph that describes that diagram (Mayer & Moreno, 2003).

Photographs.

Photographic art is still life, realistic images taken with a film or digital camera (Clark & Lyons, 2011). While the same can be true for complex diagrams and digitally constructed models, photographs are inherently composed of depth, texture, and shade that can be used to direct attention (Lohr, 2008). There may be authenticity implications and benefits of using color photographs in instructional designs as opposed to black and white or grayscale illustrations. However, there could also be cognitive load consequences, especially for novice learners. Photographs have the fundamental attribute of the instructor or students being able to zoom in and see subjects or objects in greater detail (Kemp, 1975). Digital photographs can be used to provide learners with a view of the authentic environment that they will be performing in or learning about (Lohr, 2008). The authenticity of photographs are in line with other learning theories such as situated learning which focuses on the unintentional aspects of education due to the realism of the learning experience (Lave & Wagner, 1990). For instance, a recent study indicated that narration while viewing realistic photographs dramatically influenced viewers in a way that narration (or narration with diagrams) could not (Salerno & Phalen, 2020). Photographs can also provide a cultural and historical context that a diagram or illustration would not.

Modeled Graphics and Augmented Reality.

Modeled graphics are static visuals that are three-dimensional and have been created digitally (Clark & Lyons, 2011). Augmented reality applications would fall into this category. Computer generated images may be more effective than actual photographs, especially when lighting is poor or when backgrounds behind the subject of the photograph can be distracting (Greitzer, 2002). In an augmented reality application the learner is typically able to manipulate a three-dimensional, computer generated object against a realistic space or background (Azuma, 1997). Augmented reality allows users to see the unseen, engage in gamification and learning challenges, make connections to other content or previous learning, and compare and contrast content (Dunleavy, 2014; Yoon & Wang, 2014). For instance, in an educational setting, learners can point their mobile devices at an image and be presented with additional information about that object.

Augmented reality can reduce cognitive load when reducing the spatial effect in instructional lab environments (a college lab environment being essentially a simulation of a real-world environment)(Thees, et al., 2020). Other applications of modeled graphics would include contexts where the learning object cannot be easily photographed and when details beyond typical illustrations are required.

Animation.

An animation is a series of simulated images that change over time, such as at a rate of 30 images per second, to simulate motion (Ainsworth, 2008). Note, this operational definition is different from video, which is a series of real images that when moving at 24 to 30 frames per second is perceived as motion. Animation is helpful when the instructional objectives require learning about an object, concept, or principle that inherently moves or changes over time. As compared to trying to learn from a series of static images, learning about an object over time or that is in motion should be cognitively easier when learning from animation. Also, with all other aspects of instruction being equal, animation with narration will be more effective than animation on its own (Mayer & Anderson, 1991; 1992).

Video.

Similar to the use of static photography for authenticity and realism, video can also be used to record authentic environments especially when audio is also recorded. Video can be used to enhance social presence, for virtual field trips, and to record and collect data (recorded audio and video) from locations that would be logistically challenging or inaccessible. Video in instructional applications will be more effective in terms of social presence when students are able to see video of their instructor in online classes (Jayasinghe, et al., 1997; Ramlatchan & Watson, 2018; Ramlatchan & Whitehurst, 2019). Video can also be useful for novice learners of a process or procedure due to the richness of detail, though video may be less effective with more experienced students (Ganier & de Vries, 2016). Experienced students may not need the details, and so the video may introduce extraneous load from this perspective. Also the moving images in full motion video are also most effective when that video is also accompanied with

its associated audio. Other video applications include tours, whiteboard drawing, portrayals, point of views (such as “how-to” videos), and highlighting (such as the use of digital pens, slow motion, and zooming) (Schwartz & Hartman, 2014). Other research has pointed out the potential fallacy in the assumption that all instructional content can be pre-packaged (Bishop, 2013). Rather, synchronous video and audio collaboration and engagement can be used to foster teaching and learning through social interaction and social presence in online environments. Synchronous online web conferencing also allows instructors and teachers to adjust the agenda of the class in real-time based on live feedback, engagement, and class discussion. The cost-effectiveness, access to, and availability of video applications was especially instrumental for successful online programs during the 2020-2021 COVID-19 pandemic.

Video Games, Simulations, and Virtual Reality.

Several tools and techniques fall into this generalized category of dynamic, computer generated visuals.

Video games. Successful instructional game play using personal computers, game consoles, or mobile devices involves higher order thinking and learning skills as well as collaboration skills that transfer into real-world situations. Playing and learning from early video games involved hand-eye coordination, reflexes, concentration, and visual perception (Heinich et al., 1989, Molenda, & Russell, 1989). As the processing power of devices improved, video games evolved to take advantage of those affordances. Video games soon also included more complex problem solving challenges and strategic planning (Gee, 2003). Video games that involve problem solving now often require players to analyze situations, synthesize solutions, and test the validity of those solutions to be successful. Digital natives, or learners who have never known a world without mobile devices, the Internet, and complex video games, may benefit from neuroplasticity (Prensky, 2006). Neuroplasticity describes how the human brain adapts to stimulus, or how digital natives adapt to and learn from video games. In addition to higher order thinking skills, many video games also now include aspects of research, creativity, communication, and social

collaboration with other players (Qian & Clark, 2016). Or basically, all the major skills required by a modern workforce.

Simulations and virtual reality. Simulations do not need to be computer generated (such as in classroom case studies and role plays). However, in the context of this book, a simulation is the creation of a virtual environment for the integration of learners into a learning situation. The learner is immersed into an authentic problem, where they have to generate and test a solution, and reach a conclusion (Heinich et al., 1982; Molenda, & Russell, 1982). For instance, learning on simulators is less expensive, and introduces less risk, than initial learning on actual aircraft. The skills learned in high fidelity simulators transfer to more advanced learning in actual aircraft (Hays et al., 1992). Some training programs now require that when a simulation can accomplish the same training objective as live flight, it must be used in place of live flight. Hardware simulators, such as aircraft and motor vehicle systems, use displays, hydraulics, and the physical interiors (including the control panels or dashboards) of the systems that they are imitating to simulate the actual system (Gawron et al., 1995; Bailey, & Lehman, 1995; Kuhl et al., 1995). Also, when combined with other techniques, the impact of virtual reality can be further emphasized. For instance, a learning activity with virtual reality can be enhanced by the thoughtful inclusion of text (Albus, et al., 2021). Though care must be taken to not overwhelm and distract learners.

There is ample evidence for the general effectiveness of simulation and simulators, especially in support of other instructional strategies (Rutten, et al., 2012). Additionally, simulations are extremely advantageous when other strategies, such as lab work online and teaching healthcare providers, pilots, and drivers, are unavailable, logistically challenging, or would otherwise be physically dangerous for the learner or patient. Emerging, cost-effective, high resolution, head-worn technologies promise to be a new arena in immersive simulations and message design (Hupont et al., 2015). Virtual reality can employ head worn devices to immerse learners in artificial, computer generated environments or worlds (Freina, et al., 2016). In an instructional context, virtual reality systems can be designed to simulate real-world environments to prepare learners and allow for practice.

Instructional Message Design Applied: PowerPoint®

A discussion on instructional message design would be incomplete without a discussion on Microsoft PowerPoint given its ubiquitous use in academia (and business, and government, and any formal application where information is shared via presentations in meetings). The use of PowerPoint may induce negative opinions and connotations (think the common euphemism “death by PowerPoint” in business meetings). It has even been blamed for the 2003 NASA *Columbia* space shuttle disaster (Tuft, 2003). According to the classic 6x6 rule, a PowerPoint slide should not have more than six words in a line and no more than six lines (Lohr, 2008; Zimmerman, B. & Zimmerman, S. 2009; Zimmerman et al., 2014). However, PowerPoint is a message design tool, and as with any tool there are those who use it well and those who do not use it well (Gabriel, 2008; Herting et al., 2019). This could be especially true for modern iterations of PowerPoint that include the ability to apply many of the text, typography, graphics, and multimedia heuristics described in this book.

There is a lot more that can be done with PowerPoint besides extraneous cognitive load inducing templates and bullets. When it is thought of as more about “design, not software” it can be used to guide a lecture, deliver an effective business presentation, or develop engaging, interactive e-learning modules (Bozarth, 2008). However, PowerPoint can also become a crutch for a presenter and distract from substantive content. A presenter should avoid the urge to read verbatim from slides, avoid irrelevant images, and avoid too many decorative “bells and whistles.” Deviations from the traditional 6x6 rule can also be made to allow for a focus on content and when the slides will also serve as a reference or job aid for the learners. However, care should be taken to avoid extraneous load, such as sounds and overly animated bullet points that do not cue but distract. The intent of this book is to help other instructional designers use tools like PowerPoint, Google Slides, Keynote, Canva, and Prezi more effectively. PowerPoint does not have to be relegated to extraneous cognitive load inducing templates and bullet points.

Conclusions and Future Directions

These are only some of many learning theories and applications of instructional message design, and only serves as an introduction to the topic. Subsequent chapters in this book delve much deeper into the theoretical frameworks and evidence-based best practices associated with the tools and techniques briefly introduced here. Along with the ability and affordances of newly emerging technologies, there are a number of other aspects of message design that can be explored. Future research directions could continue to explore the social presence implications of message design, how motivation can be enhanced through message design, applications in online and distance learning, and customizing learning for differing cultures, age groups of learners, and learners with special needs.

Instructional design is an applied science, where theories and models have practical, real-world applications that benefit learners. Instructional message design draws from several areas and fields of study and describes how designers can create systems, programs, and products that effectively communicate information. Readers and researchers are encouraged to follow-up on the studies presented in this book, either to replicate or to extend these formative message design findings with new research on contemporary tools and technology with samples of today's digital natives.

References

- Ainsworth, S. (2008). How do animations influence learning? In D. Robinson & G. Schraw (Eds.), *Current Perspectives on Cognition, Learning, and Instruction: Recent Innovations in Educational Technology that Facilitate Student Learning* (pp. 37-67). Information Age Publishing.
- Albus, P., Vogt, A., & Seufert, T. (2021). Signaling in virtual reality influences learning outcomes and cognitive load. *Computers & Education, 166*, 1-16.
- Azuma, R. T. (1997). *A survey of Augmented Reality*. *Presence, 6*(4), 355-385.
- Baddeley, A. D. (1992). *Working memory*. *Science, 255*(5044), 556-559.
- Bartlett, F. C. (1932). *Remembering: An experimental and social Study*. Cambridge, MA: Cambridge University Press.
- Bishop, MJ. (2013). Instructional Message Design: Past, present, and future. In J. M. Spector, M. D. Merrill, J. Elam, & M.J. Bishop (Eds.), *Handbook of Research for Educational Communication and Technology* (4th ed., pp. 373-383). New York, NY: Springer.
- Bozarth, J. (2008). *Better than bullet points: Creating engaging e-learning with PowerPoint*. San Francisco, CA: Pfeiffer.
- Bringhurst, R. (2004). *The elements of typographic style* (3rd ed.). Point Roberts, WA: Hartley & Marks, Publishers.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.
- Bruce-Mitford, M. (1996). *Illustrated book of signs & symbols*. New York, NY: DK Publishing.

- Clark, R. C., & Lyons, C. (2011). *Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials* (2nd ed.). San Francisco, CA: Pfeiffer.
- Clark, R. C., & Mayer, R. E. (2016). *e-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning* (4th ed.). Hoboken, NJ: John Wiley & Sons.
- Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research*, 53(4), 45-459.
- Clark, R. E. (2012). *Learning from media: Arguments, analysis, and evidence* (2nd ed.). Charlotte, NC: Information Age Publishing, Inc.
- Dale, E. (1946). *Audio-visual methods in teaching*. New York, NY: The Dryden Press, Inc.
- Dunleavy, M. (2014). *Design principles for augmented reality learning*. *TechTrends*, 58(1), 28-34.
- Fleming, M., & Levie, W. H. (1978). *Instructional message design: Principles from the behavioral and cognitive sciences*. Englewood Cliffs, NJ: Educational Technology Publications, Inc.
- Fleming, M., & Levie, W. H. (1993). *Instructional message design: Principles from the behavioral and cognitive sciences* (2nd ed.). Englewood Cliffs, NJ: Educational Technology Publications, Inc.
- Freina, L., Bottino, R., & Tavella, M. (2016). From e-learning to vr-learning: an example of learning in an immersive virtual world. *Journal of e-learning and knowledge society*, 12(2), 101-113.
- Gabriel, Y. (2008). Against the tyranny of PowerPoint: Technology-in-use and technology abuse. *Organization Studies*, 29(2), 255-276.
- Ganier, F., & de Vries, P. (2016). Are instructions in video format

always better than photographs when learning manual techniques? The case of learning how to do sutures. *Learning and Instruction*, 44, 87-96.

Gawron, V., Bailey, R., & Lehman, E. (1995). Lessons learned in applying simulators to crewstation evaluation. *The international journal of aviation psychology*, 5(3) 277-290.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York, NY: Palgrave Macmillan.

Greitzer, F. L. (2002, Oct). *A cognitive approach to student-centered e-learning*. Human Factors & Ergonomics Society 46th Annual Meeting, Baltimore MD.

Hays, R., T., Jacobs, J. W., Prince, C., & Salas, E. (1992). Flight simulator training effectiveness: A meta-analysis. *Military Psychology*, 4(2), 63-74.

Heinich, R., Molenda, M., & Russell, J. D. (1982). *Instructional media and the new technologies of instruction*. New York, NY: John Wiley & Sons.

Heinich, R., Molenda, M., & Russell, J. D. (1989). *Instructional media and the new technologies of instruction* (3rd ed.). New York, NY: John Wiley & Sons.

Herting, D. C., Pros, R. C., & Tarrida, A. C. (2019). Patterns of Powerpoint use in higher education: a comparison between the natural, medical, and social sciences. *Innovative Higher Education*, 45, 65-80.

Hupont, I., Gracia, J., Sanagustin, L., & Garcia, M. A. (2015, May). *How do new visual immersive systems influence gaming QoE? The use case of serious gaming with Oculus Rift*. In Quality of Multimedia Experience (QoMEX), 2015 IEEE Seventh International Workshop.

Jayasinghe, M. G., Morrison, G. R., & Ross, S. M. (1997). The effect

- of distance learning classroom design on student perceptions. *Educational Technology Research and Development*, 45(4), 5-19.
- Kuhl, J., Evans, D., Papelis, Y., Romano, R., & Watson, G. (1995). The Iowa driving simulator: *An immersive research environment*. *Computers*, 28(7), 35-41.
- Kemp, J. E. (1975). *Planning and producing audiovisual materials* (3rd ed.). New York, NY: Thomas Y. Crowell Company, Inc.
- Labrecque, L. I., Patrick, V. M., & Milne, G. R. (2013). The marketers' prismatic palette: A review of color research and future direction. *Psychology and Marketing*, 30(2), 187-202.
- Lave, J., & Wenger, E. (1990). *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.
- Lohr, L. (2008). *Creating graphics for learning and performance* (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc.
- Lupton, E. (2010). *Thinking with type: A critical guide for designers, writers, editors, and students* (2nd ed.). New York, NY: Princeton Architectural Press.
- Mayer, R. E., & Anderson, R. B. (1991). Animations need narrations: An experimental test of a dual-coding hypothesis. *Journal of Educational Psychology*, 83, 484-490.
- Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology*, 84, 444-452.
- Mayer, R. E., & Gallini, J. K. (1990). *When is an illustration worth ten thousand words?* *Journal of Educational Psychology*, 82(4), 715-726.
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive

- load in multimedia learning. *Educational Psychologist*, 38(1), 43-52.
- Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 63(2), 81-96.
- Moore, J. (2002). *Elements of quality: The Sloan-C framework*. Needham, MA: Sloan-C.
- Mohebbi, B. (2014). The art of packaging: An investigation into the role of color in packaging, marketing, and branding. *International Journal of Organization Leadership*, 3, 92-102.
- Morrison, G. R. (1994). The media effects question: “Unsolvable” or asking the right question? *Educational Technology Research and Development*, 42(2), 41-44.
- Morrison, G. R., Ross, S. J., Morrison, J. R., & Kalman, H. K. (2019). *Designing Effective Instruction* (8th ed.). Hoboken, NJ: John Wiley and Sons, Inc.
- Paivio, A. (1991). Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology*, 45(3), 255-287.
- Paas, F., & Sweller, J. (2014). Implications of cognitive load theory for multimedia learning. In R. E. Mayer (ed.) *The Cambridge Handbook of Multimedia Learning* (2nd ed., pp. 27-42). New York, NY: Cambridge University Press.
- Prensky, M. (2006). *“Don’t bother me mom – I’m learning”*. St. Paul, MN: Paragon House.
- Qian, M., & Clark, K. R. (2016). Game-based learning and 21st century skills: A review of recent research. *Computers in Human Behavior*, 63, 50-58.
- Ramlatchan, M. (2021). *The combined effect of font and font color on*

message design. Unpublished research study. Office of Distance Learning, Old Dominion University, Norfolk VA.

- Ramlatchan, M., & Watson, G. S. (2018). *Enhancing instructor credibility and immediacy in the design of distance learning systems and virtual classroom environments*. Manuscript under review.
- Ramlatchan, M. & Whitehurst, C. (2019, March). *Online student perceptions of social presence in interactive telepresence and web conferencing*. Presentation at the Association of Collegiate Computing Services of Virginia annual conference, Portsmouth, VA.
- Reigeluth, C. M. (1999). *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Richey, R. C., Klein, J. D., & Tracey, M. W. (2011). *The instructional design knowledge base: theory, research, and practice*. New York, NY: Routledge.
- Ross, S. M., Morrison, G. R., & O'Dell, J. K. (1988). Obtaining more out of less text in CBI: Effects of varied text density levels as a function of learner characteristics and control strategy. *Educational Communication and Technology*, 36(3), 131-142.
- Rutten, N., van Joolingen, W., & van der Veen, J. (2012). The learning effects of computer simulations in the science education. *Computers & Education*, 58, 136-153.
- Salerno, J. M., & Phalen, H. J. (2020). The impact of gruesome photographs on mock jurors' emotional responses and decision making in a civil case. *DePaul Law Review*, 69, 633-656.
- Schwartz, D. L., & Hartman, K. (2007). It's not video anymore: designing digital video for learning and assessment. In R. Goldman, R. Pea, B Barron, & S. J. Derry (Eds.), *Video Research*

in the Learning Sciences (pp. 335-348). New York, NY: Routledge.

- Sentz, J., Stefaniak, J., Baaki, J., & Eckhoff, A. (2019). How do instructional designers manage learners' cognitive load? An examination of awareness and application of strategies. *Educational Technology Research and Development, 67*, 199-245.
- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*, 275-285.
- Sweller, J. (1991). Evidence for cognitive load theory. *Cognition and Instruction, 8*(4), 351-362.
- Sweller, J. (2019). Cognitive load theory and educational technology. *Educational Technology Research and Development, 68*, 1-16.
- Sweller, J., Ayers, P., & Kalyuga, S. (2011). *Cognitive load theory: explorations in the learning sciences, instructional systems and performance technologies*. New York, NY: Springer.
- Thees, M., Kapp, S., Strzys, M. P., Beil, F., Lukowicz, P., & Kuhn, J. (2020). Effects of augmented reality on learning and cognitive load in university physics laboratory courses. *Computers in Human Behavior, 108*.
- Tufte, E. R. (1990). *Envisioning information* (2nd ed.). Cheshire, CT: Graphics Press, Inc.
- Tufte, E. R. (2001). *The visual display of quantitative information* (2nd ed.). Cheshire, CT: Graphics Press, Inc.
- Tufte, E. R. (2003). *The cognitive style of PowerPoint*. Cheshire, CT: Graphics Press, Inc.
- Tufte, E. R. (2006). *Beautiful evidence*. Cheshire, CT: Graphics Press, Inc.

- Waller, R. (1979). Typographical access structures for education texts. In P. A. Kolers, M. E. Wrolstad, & H. Bouma (Eds.), *Processing of Visual Language*. New York, NY: Plenum Press.
- Wertheimer, M. (1944). Gestalt theory. *Social Research*, 11(1), 78-99.
- Zimmerman, B. B., & Zimmerman, S. S. (2009). *New perspectives on Microsoft PowerPoint 2007: Brief*. Stamford, CT: Cengage Learning.
- Yoon, S. A., & Wang, J. (2014). Making the invisible visible in science museums through augmented reality devices. *TechTrends*, 58(1). 49-55.
- Zimmerman, B. B., Zimmerman, S. S. & Pinard, K. T. (2014). *New perspectives on Microsoft PowerPoint 2013: Comprehensive*. Stamford, CT: Cengage Learning.