Instructional Message Design: Past, Present, and Future Relevance

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Abstract

Instructional message design explores how various media and delivery systems might be used more effectively to help optimize instructional communications within context-specific instructional situations and learner needs. But use of the term appears to have fallen out of favor over the years since the mid-1990s. A review of the historical and theoretical foundations of instructional message design reveals that, while instructional design generally has shifted from objectivist to more constructivist perspectives on learning theory, the instructional message design field remains firmly rooted in early "transmission oriented" communications models. It appears that instructional message design has also suffered from definitional problems as well, with more recent narrow views of the field focused on media attributes supplanting earlier broad views of the field as an applied "linking science" between theory and practice. And, finally, while findings from studies on media attributes provide designers with some guidance for generally what will *not work* in terms of cognitive processing, the guidelines seldom shed light on what one should actually *do* within a particular learning context. It appears that reestablishing instructional message design as a valid area of inquiry within the field of instructional design will require catching up with recent philosophical shifts in communication theory while adjusting our definitions and research foci accordingly. The chapter concludes with recommendations for a revised guiding theoretical framework based in conversation theory, a broader definitional focus that looks at more than just optimizing cognitive processing, and a new systems view of our approach to research in this area.

Introduction

The research in educational media indicates that any medium used for teaching and learning is only as effective as the design of the message it is intending to communicate. Poorly designed instruction is poorly designed instruction, regardless of delivery mode (Cuban, 1986; 2001). In order to devise technologies that truly make a difference within an instructional communication system, instructional designers must be supplied with development guidelines that are based on the unique ways specific

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groups of learners interact with various communication technologies and media presentations to construct knowledge. Instructional message design, therefore, explores how various media and delivery systems might be used more effectively to help optimize instructional communications within context-specific instructional situations and learner needs. As such, it applies learning theory, communication theory, and systems theory to the design and evaluation of instructional media.

Instructional message design has been described as the "next step" in the instructional design analytical process –moving beyond deciding what methods are best for bringing about desired changes in student knowledge (Reigeluth, 1983) toward specifying the exact form an instructional communication system should take for optimal learning (Grabowski, 1991). But since the mid-1990s, use of the term "instructional message design" appears to have fallen largely out of favor. Database searches for new literature on instructional message design come up more-or-less empty, referring repeatedly back to Fleming and Levie's earlier texts (1978; 1993). Even Wikipedia has no entry for it as of this writing.

So, what has happened to instructional message design? In 1995, Berry noted that some had begun arguing traditional instructional message design orientations were antithetical to the learner-centered approaches that were just emerging at the time. Could it be that instructional message design has become irrelevant as the field's philosophical focus shifted from *instruction* to *learning* instead? Or perhaps instructional message design has been supplanted by other areas of inquiry? While studies identified specifically as instructional message design research have been fairly sparse since the early-90s (Molenda & Boling, 2007), vast empirical work in related areas termed "multimedia learning" and "cognitive load theory" has continued, for example. Or maybe there really is no problem at all but rather the guidelines derived from the instructional message design research done before 1995 are all we need?

This chapter examines these questions by reviewing the theoretical and historical foundations, discussing current issues, and exploring the potential future relevance of instructional message design research as a sub-discipline of our field.

Theoretical and Historical Context

Traditionally, instructional message design has explored the application of communication and learning theories to the design and development of media used for teaching and learning (Bishop, 2001; Bishop & Cates, 2001). This section briefly summarizes these theoretical foundations to provide a context for the discussion of current issues and future directions for instructional message design. For a more complete review of the evolution of learning and communications theories and their impact on the field, readers are

encouraged to consult Driscoll (2005), Reiser (2001a, 2001b, 2012), Richey, Klein, and Tracey (2011), and Saettler (1990).

Communications Theory

Educational technologists have typically viewed teaching-learning problems as communication problems. The traditional instructional message design literature has, therefore, approached the instructional process as an instructional communication system with a set of interrelated parts working together to produce learning (Berlo, 1960).

Communication as transmission. Early communications models focused on the way information is passed from one location to another and have been characterized as *transmission* models (Richey, Klein, & Tracey, 2011). Shannon and Weaver's *The Mathematical Theory of Communication* (1949) was particularly influential in shaping early thinking in the field about human communication.

The Shannon-Weaver model proposed that all communication processes begin when a source, desiring to produce some outcome, chooses a *message* to be communicated. A transmitter then encodes the message using a set of perceptual elements or cues that are assembled in a deliberate way to produce a signal appropriate for transmission over the channel that will be used. After the message has been transmitted, a receiver then decodes the message from the signal transmitted and passes it on to the destination.

According to the model, communication is "perfect" when the information contained in a message affects the receiver in exactly the way intended by the source. Communication is rarely perfect however; spurious information, or noise, can introduce errors at any point in the transmission that make the signal harder for the receiver to reconstruct accurately. Offsetting noise in communication involves adding redundancy to messages. Redundancy is the information that message cues share: the parts that "overlap" (Attneave, 1959). While the word "redundancy" has lately been defined as something that is superfluous or unnecessary (for example, see Mayer's chapter in this volume), in the Shannon and Weaver sense the surplus may not necessarily be uncalled-for. They posited that redundancy in communication systems that helps a receiver separate transmitted information from system noise increases understanding and is, therefore, desirable.

However, Shannon and Weaver (1949) also acknowledged that all channels have limited capacity. That means redundancy not needed by the receiver or that fails to increase understanding may actually impede the flow of new information and, consequently, decrease communication effectiveness. When redundancy exists at the expense of new information, it can introduce its own sort of noise into the system. Thus,

while highly redundant messages can overcome noise in communications effectively, they are not very efficient. When a source anticipates problems in communication, the trick may be in knowing how much and which sort of between-cue message redundancy to include in order to counteract noise. According to the Shannon-Weaver model, striking the right balance in messages between redundancy and new information appears to be the key to successful communication (Reza, 1961).

Communication as interaction. In 1954 Schramm was among the first to alter the Shannon-Weaver model by conceiving of decoding and encoding as activities happening simultaneously by sender and receiver while messages are exchanged interactively and reciprocally. Schramm further suggested that the sender's and receiver's fields of experience play a large role in successful communication. The sender encodes messages based on what is known about the receiver's experience and the receiver's experience impacts message decoding. If there is no commonality in the sender's and receiver's fields of experience, communication does not occur.

In 1960, Berlo's Sender-Message-Channel-Receiver (S-M-C-R) model further expanded thinking about human interactions by focusing on "the ingredients of communication" within each of the four communications elements. Like Schramm, Berlo's model acknowledged the importance of shared experience between the sender and receiver (communications skills, attitudes, knowledge, social systems, and culture) and also emphasized the role of feedback from the receiver requesting clarification for how the message was decoded. But Berlo's model viewed the communications channel as the five human senses rather than a mechanical conduit for messages. Additionally, Berlo's model placed the message squarely at the center of the process and examined the extent to which content elements, treatment elements, and code structure affected communication outcomes.

Learning Theory

Berlo (1960) also suggested that the study of communication processes and the study of learning processes differ only in their point of view. While communication models most often begin with and focus on how messages are constructed and sent, learning models generally pick up with and focus on how messages are received and processed by learners. Designing optimally effective instructional messages must also, therefore, involve understanding learning theory. Thus, in addition to communication theory, traditional instructional message design thinking has also been firmly rooted in the behavioral and cognitive sciences as well.

From behaviorism to cognitivism. The behaviorist orientation prominent in psychology during the first half of the 20th century viewed learning as the ability to perform new behaviors. Organisms respond to

stimuli and, if repeated over time, eventually form stimulus-response bonds or chains. These responses can be strengthened or weakened as a result of whether they are positively or negatively reinforced. Behaviorists suggested, therefore, that knowing what might be going on in an individual's mind in terms of invisible mental processes such as thoughts and consciousness is less important than understanding observable behaviors in relation to the environmental events surrounding them (Driscoll, 2005).

When applied to human learning, the behaviorist orientation suggested that learning is a process of carefully planned steps under the direction of an educator (teacher, instructional designer) who either succeeds or fails at creating the conditions necessary for student learning. Among the critical elements for assuring learning success from this behaviorist perspective was providing immediate reinforcement for student responses. The automated "teaching machine" (Pressey 1926, 1927) that delivered programmed instruction (Crowder, 1960; Skinner 1958) promised a solution to the problem of supplying learners with timely feedback on their progress. The idea was to automate the process of teaching by setting up, in advance, the conditions under which learning will inevitably occur and delivering those stimuli –or messages– via a mechanical device. The machine then provided feedback on the learner's response and, if correct, the learner went on to the next step. If incorrect, however, the learner reviewed the previous material until she got it right. The teaching machine concept advanced further with the advent of early computers in the 1960s and 70s, as most computer-assisted instruction continued to reflect a behaviorist orientation. While computerized drill-and-practice programs and tutorials did capitalize on the new technology's enhanced displays and improved learner interactions, they still presented material in a step-wise fashion, provided immediate reinforcement for learners' responses, and assumed a strong degree of program control over learner control (Saettler, 1990).

By the early 1980s, at roughly the same time microcomputers were also being introduced to the market, the cognitive model of learning began to replace the behaviorist model in the educational technology literature. Cognitivists emphasized knowing rather than responding and viewed learning as an active process of acquiring, organizing, and constructing new understandings from incoming stimuli. In the cognitivist view, therefore, understanding how knowledge is represented in memory is key to the development of instructional theory. Among the key assumptions of the cognitive sciences at this time was the idea that humans receive, process, and store information in ways analogous to computers.

Human information-processing. Like the Shannon-Weaver communications model, Atkinson and Shiffrin's (1968) three-stage information-processing theory has been particularly influential over the years among cognitivist learning theory models. In this explanation of human memory, stimuli coming in from each of the five senses are first handled by a *sensory register*, which filters and then routes the

incoming signals to a second, *short-term store*. Sort-term store (also sometimes called *working memory*) holds information temporarily while it is being encoded as *schema* for permanent storage in the *long-term store*. *Encoding* is the process of building relationships and connections within new material or between new material and existing knowledge structures. Long-term store is both the place where we hold newly encoded schemas and the place from which we retrieve well-established memories.

Information-processing theorists maintain that learning occurs when information that has been transferred to and stored in long-term memory can be retrieved when needed (Atkinson & Shiffrin, 1971; Phye, 1997). It appears, however, that limitations in each of these operations may restrict the amount of data one can consign to long-term storage. For example, in order to acquire or make sense of the constant barrage of sensory information, an individual must decide, often unconsciously, which information to attend to and which to ignore (Broadbent, 1958; Treisman & Gelade, 1980). There is also a limit to the amount of information, or maximal cognitive load, an individual can process in short-term store at any given time (Paas, Renkl, & Sweller, 2003; Sweller, Ayers, & Kalyuga, 2011). And, while there is some evidence to suggest that once information has been moved to long-term store it remains there forever (Nelson, 1971, 1978), it is equally clear individuals certainly can lose access to memories over time (Ausubel, Robbins, & Blake, 1957; Norman, 1969; Postman, 1961).

From this view then, instructional message design should be focused on helping learners process information rather than merely initiating behavioral responses (Saettler, 1990). Winn argued in 1993 that designers had "failed to consider how messages affect what they mean to the individual who receives them in interaction with each person's knowledge of the world" (p. 75). Therefore, to facilitate learners' acquisition, processing, and later retrieval of new material, designers should work to manipulate the attributes of an instructional message to make clear delineations among salient features, organize presentations hierarchically to show relationships, and provide meaningful connections to learners' existing knowledge structures (Salomon, 1979).

In this way, instructional message design emerged as a sub-discipline of instructional design from the intersection of communication and learning theory. And, over the years, principles derived from research in this area have supplied instructional designers with a wealth of useful information important to support "a designer's decision of form" (Smith & Boling, 2009, p. 4).

Current Issues

However, despite considerable changes over the last 50 years in communications and learning theory as well as the available interactive technologies, it appears the underlying instructional message design

concepts have remained essentially the same. In fact, even recent compilations of research-based principles for instructional media designers still rely principally on empirical work done before 1995 (for example see Lohr, 2008; Morrison, Ross, Kalman, & Kemp, 2011). Molenda and Boling (2007) noted that the emphasis continues to be on optimizing the instructional communications system by finding the most effective ways to transmit material to be learned from the source (teacher or designer) to the receiver (learner), with little concern for the more dynamically social and reciprocal nature of most communication transactions. In effect, the assumption is that "meaningfulness" can be determined in advance and –given the right combination of message cues– transmitted successfully to all learners (Sless, 1981).

Philosophical Mismatch

While the shift from behaviorism to cognitivism in the first half of the last century was a sea change in perspectives on learning, both theories were still based on an objectivist belief that knowledge exists independently of learners and learning is the process of transferring that knowledge "from outside to within the learner" (Driscoll, 2005, p. 387). More recently, constructivists have argued that knowledge does not exist independently but is, instead, constructed by learners as they actively seek to make meaning from their experiences. Thus, constructivists view instruction as a process of supporting active knowledge construction rather than transmitting knowledge into an empty vessel. In fact, constructivists like Duffy and Cunningham (1996) have contended that we cannot be certain that "perfect communication" with wholly shared meaning between a sender and receiver is even really possible.

> We can only evaluate whether meaning is shared by testing the compatibility of our individual meanings: exploring implications, probing more deeply. Of course, no matter how much we probe, we can never be sure that the meaning is shared (p. 171).

Instead, the authors suggested we must actively seek to understand the communicators' different perspectives and, in a learning context, seek to understand and challenge the learner's thinking – eschewing the transmission approach to instruction.

So, about the same time many of the seminal works in instructional message design were being produced, Cooper (1993), Jonassen (1990, 1991), Kember and Murphy (1990), and others were arguing that if learners actively construct their own understanding through interactions between their existing knowledge structures and authentic experiences with the world around them, then the field must move away from models based on an objectivist epistemology that places responsibility for learning on "pre-packaged" messages didactically designed to deliver content through some communications medium to passive

recipients. Jonassen (1990) contented:

> It matters little how we represent ideas and less how we present it. *What matters is how the learner is thinking*. Since knowledge is mediated by thinking and not by technologies, our goal should focus on providing cognitive tools for helping learners to construct knowledge, that is, to think more productively (p. 34).

According to Januszewski and Molenda (2008) this philosophical shift to constructivism dramatically changed the orientation of the field. Research interest moved away from "the design of prespecified instructional routines" to be delivered in a variety of communication formats and toward "the design of environments to facilitate learning" (p. 2). Jonassen, Lee, Yang, and Laffey (2005) summed up the growing philosophical mismatch by observing "…the most obvious effect of this influence has been a shift from emphasis on instructional communication systems to an emphasis on practice-based collaborative learning systems" (p. 247).

Definitional Problems

In addition to the growing philosophical mismatch, instructional message design has suffered from definitional problems as well. Some have taken a very broad view of the field as a "linking science" between learning theory and instructional practice (Dewey, 1900 as cited by Fleming, 1993) whereas others have taken a much narrower view, choosing to focus on media attributes and their affordances for improving –or impairing– learners' cognitive processing.

Syntheses of generalized principles. Among the first major works attempting to synthesize basic research into applied instructional message design principles was Fleming and Levie's 1978 *Instructional Message Design: Principles from the Behavioral Sciences.* In it, the authors took a very broad view of instructional message design as the bridge between learning theory research and instructional practice. According to the preface, this text set out to formulate "sets of generalizations stated as principles" from research in the areas of perception, memory, concept formation, and attitude change in an effort to "narrow the gap between research and practice in instructional message design" (p. *vii*). The idea was to provide a research-based conceptual framework that might "inform the creativity of designers/teachers" but "not replace or lessen the need for innovation in instruction" (p. *xiii*).

Fleming and Levie's first edition was roughly organized around the functions of instructional messages within the instructional communications system and, therefore, included chapters on perception principles (helping learners acquire messages), memory principles (helping learners process message content),

concept learning principles (helping learners relate new constructs to existing knowledge structures), and attitude change principles (assuring the delivered message has the desired effect). Fifteen years later the second edition was updated to reflect "the pervasive change in the research literature from the earlier behavioral emphasis to the current cognitive orientation" (Fleming & Levie, 1993, p. *viii*). Nonetheless, the update retained the first edition's organization around message functions, changing the earlier memory principles chapter to learning principles instead and adding three more chapters on motivation, psychomotor, and problem-solving principles.

Works focused on media attributes. While some of the principles suggested in Fleming and Levie's two editions specifically addressed the use of graphics, text, sound, and the like, most of what the authors proposed there were principles that might apply generally to the design of instruction regardless of medium. In contrast, others over the years have approached discussions of instructional message design from the more specific focus on some media attribute (text, sound, color, images) and explored optimally effective ways to utilize the inherent codes or symbol systems possessed by the medium to facilitate cognitive processes (Jonassen, Campbell, & Davidson, 1994; Moore, Burton, & Myers, 1996). Interest at the time in media attributes likely emerged from –and contributed to– the media debates of the 1980s and early '90s over whether media (television, film, radio) could influence learning in-and-of-themselves (for a complete review, see Clark, 2001). Contributions to the field that have taken this media attributes approach have included Jonassen's *Technology of Text* (1982, 1985), Hartley's *Designing Instructional Text* (1986), Houghton and Willow's *The Psychology of Illustration* (1987). Additionally, the first two editions of this *Handbook* included instructional message design sections organized from a media attributes perspective with chapters on static and visual representations, text, audio/sound, and multichannel/multimedia (Jonassen, 1996, 2000).

More recently, Mayer (2001, 2003, 2005, 2008, 2009, 2011) and his colleagues have extended this work by very systematically exploring how the brain processes the attributes of multimedia instructional messages based on three major principles of cognitive theory: the dual channel principle, the limited capacity principle, and the active processing principle (see also Mayer's many collaborations with Clark, Johnson, Moreno, and others). Based on the findings from these studies, Mayer has argued that the three goals of multimedia instructional message design should be to minimize extraneous cognitive processing by eliminating irrelevant presentation elements, manage essential processing, and foster generative processing during learning. To date, Mayer's and others' empirical work has focused primarily on deriving principles for minimizing extraneous cognitive processing and managing external processing. For a more thorough review of the work being done in multimedia learning, see Mayer's chapter in this volume. Having adopted the umbrella term "multimedia learning" to refer to the work being done in this

area, it is not altogether clear whether Mayer and his colleagues intend this to be a subset of instructional message design or, rather, perceive this to be what instructional message design has evolved into – particularly given that most instructional messages now entail multiple media.

Methodological Concerns

Thus, the term "instructional message design" as a subdiscipline of instructional design does not appear to have ever had a precise meaning or a discrete set of descriptive parameters that formed the boundaries for inquiry. At the very least, it appears the research in this area has focused increasingly on highly constrained comparison studies of media attributes. And, while the findings from these studies have given message designers an empirically tested set of guidelines for understanding the potential cognitive processing ramifications of making poor multimedia presentation design choices, Boling (2010), Krippendorf (2006), and others have argued that the principles derived from this research falls short of telling designers specifically what to do in any given situation (see also Archer, 2004; Cross, 2007; Lawson, 2004).

Britt (1997) explained that –through simplification, explicitness, and reformulation– theory-based models derived from a traditional "scientific approach" to inquiry can provide an effective way to sort out the chaos of systems that are too complex to deal with directly, like instructional communications (see also von Bertalanffy, 1950, 1962, 1968, 1975). Because such models show the repeating patterns and relationships among the parts, they can help one understand the true complexity of the problem or situation. However, according Banathy (1991), dynamic social systems such as education appear to have too many interacting variables to be reduced easily to a set of linear, cause-and-effect relationships (see also Banathy, 1996; Banathy & Jenlink, 2004). Changes to one element in the system can influence, to different degrees, many other elements of the system as well. Therefore, from this *systems philosophy* perspective, the nature of each individual system element can be understood only by looking at how it functions in relation to the whole system of which it is a part. Stated differently, systems philosophers contend that, outside of the laboratory's experimental control, there is no such thing as an independent variable.

It was from this viewpoint that Rieber (2005) concluded "Generalization of the results from educational multimedia research to the 'real world' of learning and performing in schools and the workplace should be viewed with considerable caution" (p. 551). Sless (1981) and others have also argued that, in fact, we cannot ever hope to *predict* the consequences of a particular instructional message:

> "Scientific" procedures cannot work because the systems under investigation are governed by meanings and rules related to meaning which cannot be reduced to cause and effect contingencies. The only way such a system can be controlled is by regulating the meanings in the system and rules governing their usage. …control of meanings is diffused within the culture, refracted by personal experience and focused differently within different contexts, all of which are only marginally controlled by the education process (p. 173).

Rowland (2008) suggested that, instead, "a fully developed system of inquiry for educational contexts" will need to exist at the intersection of research and design, with each transforming the other (p. 7). Unfortunately, as Smith and Boling (2009) noted, to date very little applied work has been done to provide concrete guidance in how to translate the designer's specifications into the tangible attributes of an instructional message (see also Gibbons & Yanchar, 2010).

Potential Future Directions

In 2009 Gibbons contended that good designs do not serve a theory, but rather a metaphor. Further, he maintained that the appropriate design metaphor for instruction is conversation –making the design of messages "one of the very most important layers in the future of designer's thinking." If that is true then perhaps instructional message design does still have an important role to play in the future of our field despite the paradigm shifts, definitional issues, and methodological concerns. But what guiding framework should we be following? What is the definition of "message design" within this new context? What questions should we be focusing on now and how should we be pursuing the answers to those questions?

A New Guiding Framework for Message Design

As discussed earlier, instructional message design has traditionally existed at the intersection of learning and communications theories. But while foundational learning theory has shifted to more constructivist approaches, there has not been a similar evolution in our thinking as a field about the nature of communication. Message design remains firmly rooted in the transmission oriented communications model first proposed by Shannon and Weaver in 1949. While there have been many communications models proposed over the years since then, one that appears to hold the most promise for message design within a constructivist paradigm is *conversation theory*.

In 2004 Boyd suggested that educational technology needed to move away from "the conventionally understood psychology of the individual" and, instead, understand the instructional communication system as a conversation among "a collection of psychological individuals… whose presence is variable and hierarchical" (p. 179). Between 1966 and 1996 Gordon Pask developed "conversation theory" as a framework for exploring the complexity of interactions necessary for learners to construct meaning and make knowledge explicit within real life socio-cultural environments. According to Luppicini (2008), conversation theory emerged in opposition to earlier theories that viewed learning as "a set of mental structures and processes that can be analyzed separately and applied to learning and instructional applications" (p. 3).

Pangaro (1996) explained that, at the simplest level, learning from a conversation theory perspective begins with one participant in a group uttering a word like "cup," which is likely to have rather different meanings for the other participants. In order to clarify and agree upon the meaning, a conversation among the participants is necessary. This begins with the first participant clarifying how a cup is used, what it is for, and how it looks. The other participants listen to these views, consider that perspective, and come as close as they can to understanding the first participant's meaning, then share their understanding with the group. If there are conflicts between the other participants' views and the first presented, their views are discussed and considered as well. Once there is consensus among participants' views of "cup," there is said to be "agreement over an understanding." Thus, effective conversation occurs not when meaning is shared, but rather "when beliefs are negotiated through interaction and evolve via goals" (Pangaro, 2008, p. 35).

But conversations need not be only among humans for learning to occur –conversations can also involve technology-based communication systems as well, particularly as the rapid growth of interactive multimodal and social networking technologies offer opportunities not previously possible (Luppicini, 2008). Thus, Boyd (2004) suggested that conversation theory can serve as a framework for the design of technology-based constructivist learning support systems. However, we can no longer conceive of these technologies as the deliverers of a series of previously designed instructional messages but, instead, as tools that must be able to "adopt a role similar to that of action researcher, continually observing, reflecting, and adapting the process" (De La Cruz & Kearney, 2008, p. 124).

A Broader Focus for Message Design

Movement away from an objectivist, linear paradigm of instructional message design and delivery and toward creating technology-facilitated environments that support conversations among learners will likely

also require message designers to think, once again, more broadly about the field. That means allowing for the entire process of "conversation" (not just the sender to receiver transmission) and developing the necessary tools to make meaningful, interactive dialog possible for all participants. Stated differently, we need to find ways to create the technology affordances necessary for participants other than the educator (teacher/designer) to support and represent their thinking while engaged in the discourse.

Like Fleming (1993), Gibbons and colleagues have taken a broader view of design as a "linking science" between theory and practice that focuses on the product rather than the process of design (see Gibbons, 2003, 2009a, 2009b; Gibbons, Nelson, & Richards, 2000; Gibbons & Rogers, 2009a, 2009b). Gibbons observed that many design process models do not provide much in the way of actual operational principles for decision-making when creating a design, often glossing over the "miracle box" labeled "design instruction," "write instruction," or something similar. While Gibbons does not contextualize his ideas within a conversation framework, he does conceive of design within the miracle box as being made up of multiple layers of decision making about what will be the artifact's functions –the content, strategy, control, message, representation, media-logic, and management of the conversation. According to Gibbons and Rogers (2009a), the *Content* layer involves decisions about subject matter, how it will be structured, organized, divided, and the like. The *Strategy* layer comprises the "space, time, event, social, and interaction structures that define occasions through with the learner can experience the content structures" (p. 18). In the *Control* layer, the designer makes decisions about affordances the learner will have available to participate actively in the exchange. The *Message* layer, in this sense, involves the ways in which the system will respond adaptively to the learner's activity –based on predefined message generation and construction systems. *Representation* involves "the rules for converting abstract structures from all of the other domains (layers) into representations that have sensory properties (p. 19). The *Media-logic* layer involves decisions made about the actual delivery system employed in the execution of the representations. And, finally, the *Data Management* layer involves the underlying collection, storage, and data analyses activities needed to support adaptivity of instruction within the system. Each layer is characterized by a set of unique design goals, constructs, theoretic principles for the selection and use of design constructs, design and development tools, and specialized design processes.

According to Gibbons and Rogers (2009b), the design process in this view involves design by "successive constraint placement" on the system rather than strict adherence to some prevailing doctrine. And, while well-known instructional theories have had a great deal to contribute to providing guidelines and rules for the content, strategy, and to some degree the control layers, there are very few formalized guidelines for structuring the message, media-logic, or data management layers.

A New Research Paradigm for Message Design

In addition to redefining the field more broadly to comprise the design of technology affordances aimed at enabling all involved in the conversation to actively participate, message designers also will need to become more mindful of the non-cognitive factors that contribute to meaning-making in human conversation so that we can design adaptive systems that respond appropriately. Grunert (1997) argued that "We must seek frameworks that acknowledge, as the technical framework does not, the social, political, emotional, moral, imaginative, and aesthetic complexity of human interaction in the world" (p. 44). Wilson (2005a; 2005b) agreed and offered four "pillars of practice" that he suggested should underlie a broader view of instructional design research and practice in the future: individual cognition and behavior, social and cultural learning, values, and aesthetics. Wilson suggested these four levels of analysis "reflect more than an expanded view of learning outcomes" and become, instead, "an expanded view of design processes themselves and criteria for evaluating designed products" (p. 10).

The first pillar, *Individual Cognition and Behavior*, requires understanding the way learners think and acquire knowledge and skill. This level has been and continues to be thoroughly researched in instructional design and technology and relies heavily on much of the earlier instructional message design research that has been done over the years. Wilson's second level of analysis, *Social and Cultural Learning*, "turns to issues of cultural context and social support, including peer-to-peer interactions; group identity and motivation; and participation within communities of learning and practice" (Wilson, 2005b, p. 245). Like the first of Wilson's pillars, this area of inquiry has historically been a primary focus of the field under terms such as "learning communities" (Lave & Wenger, 1991); "situated cognition" (Brown, Collins, & Duguid, 1989); "cognitive apprenticeships" (Collins, Brown, & Newman, 1989; Wertsch, 1998); and the like. *Values*, Wilson's third level of analysis, is less well researched in the instructional design field and deals with exploring the underlying values and mores that are communicated in our designed materials. This pillar, as suggested by Krippendorf (2006) as well, "is a turn toward considerations of meaning –*a semantic turn*" (p. xv) that focuses our attention on questions of social justice and equity. Wilson's fourth pillar, *Aesthetics*, involves exploring both the "shape and form of the learning experience, as well as the design of messages within that experience" (Wilson, 2005b, p. 245). Drawing largely from the arts –particularly literary criticism– Parrish (2005; 2008; 2009; 2010) has been exploring the aesthetics of learning experiences and has come up with a set of principles and guidelines for thinking about message design, some of which suggest alternative approaches to the problems of cognitive load and avoiding split attention.

According to Sless (1981), understanding how learners respond to instructional conversations that are

sensitive to values and aesthetics will require a different approach to empirical research that focuses more on the semiotic quality of the exchange and less on its psychophysical qualities. He added:

> …the skilled practitioner is more likely to make sound judgments on the basis of years of experience than the positivist researcher on the basis of precise research. It is therefore imperative that the cumulative knowledge of practice be nurtured (p. 178).

Claiming that precision may be a false goal for the social sciences, Freedman (1985, 1987, 1991) and others who have adopted the systems view over the years suggest an alternative research design (see Ling, 1983; Platt, 1964; Uslaner, 1983; Zeisel, 1982). Rather than attempt to emulate the precision of the natural sciences by making the constraining assumptions necessary to analyze large samples using multiple regression, systems methodology begins by formulating the properties of systems in abstraction, then observes specific cases to test the assumptions made. Freedman contended that although this approach is potentially less precise, it usually will generate answers to the right questions rather than solve the wrong problem. When answers are not forthcoming, one always can go back and modify the original assumptions.

While the systems view adopts a holistic strategy, the primary purpose of this approach to inquiry is to find ways to eliminate the discrepancy between a system's stated goal and that system's actual output (Kidd & Van Cott, 1972). Senge (1990) suggested that the systems approach to inquiry is primarily the science of managing the problems that arise in "real world" situations outside of laboratory controls. The systems approach is a means to organize complexity into a coherent story that can help identify the important variables, illuminate the causes of problems, and indicate potential solutions. Thus it appears that explicating those features of technology most effective for supporting learning may require that we embrace a systems inquiry approach to research in this area (Banathy & Jenlink, 2004; Boling & Smith, 2012; Gibbons & Rogers, 2009a, 2009b; Rieber, 2005; Smith & Boling, 2009).

Conclusion

Sless (1981) observed that "…education is parasitic on the modes of communication available in our culture" (p. 41). Even as we move away from objectivist epistemologies toward more constructivist approaches, it seems communication will still play a central role in the learning environment and, therefore, so too will message design. Reestablishing this area of inquiry as a valid subdiscipline of instructional design, however, will require following the paradigm shifts of the field and adjusting our definitions and research foci accordingly. It may also benefit from a name change.

In 1991 Grabowski differentiated between message design for *instruction* and message design for *learning*. Message design for instruction, she suggested, "deals with attention, perception, and comprehension, as well as, but not necessarily, retention and retrieval" (p. 204). Message design for learning, on the other hand, "addresses the cognitive processes required of retention and retrieval and therefore would be most concerned with the inductive composition of the message" (p. 204). She added that: "Message design for instruction deals with those external factors out of control of the learner which can facilitate learning, while message design for learning deals with those strategies which activate internal factors to have learning actually occur" (p. 205). Perhaps the next edition of this *Handbook* should include a new section called "Message Design for Learning?"

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