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The Invisible Message

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Abstract

The number and variety of messages conveyed by an instructional experience is astonishing, but most designers are unaware of their number, subtilty, and impact. Many of those messages they would not choose to send if they recognized their existence in practice. The design of invisible and abstract message structures receives less attention from designers today than those parts of the design given to more vivid, colorful, and showy surface structures. Invisible message structures work behind the scenes to produce the smooth surface performances in front of the curtain; they are seldom seen directly, but their power is indisputable. The purpose of this chapter is to shed light on the message construct—a structure implicit in the writings of instructional theorists and design psychologists for decades and across multiple epochs of psychological theory. Without realizing the values conveyed by message design—or the lack of it—designers miss one of their most useful tools for disciplining the everyday design of more interactive, adaptive, generative, and scalable instruction experiences: instructional conversations.

The movie *Wall-E* temps us empathize with a trash compactor and a detector-bot who dance in space with fire extinguishers and relive for us the innocence and exuberance of a first love. How is this done? Certainly it is a work of its own kind of art, but to an instructional designer it presents an inspectable object, full of lessons on the design of disciplined, coherent, intellectually and affectively powerful communication. *Wall-E* and many other animated features show the mastery by their designers of a disciplined message design process that underlies and supplies structure for the colorful, moving surface representation. Their secret is that *they know what they intend to say before they say it.* They are adept at shaping their messages first and then their representations as if they were separate layers of the design. By observing the techniques of the movie makers at incorporating message into products, instructional designers can learn to appropriate more focused and disciplined methods of message capture and expression.

What is message? It is not surface show, physical arrangement, appearance, or exterior features: those things are representations. Messages are invisible and abstract: they are the hand inside the puppet, as it were, and not the puppet itself. Most designers have been taught to design puppets; our purpose in this chapter is to describe how instructional designers can design the hands and only then design the puppets.

Our definition of message is set in the context of a theory of design outlined in *The Architecture of Instructional Design* (Gibbons, 2014, see also Gibbons and Rogers, 2009). In this architectural theory, designs of instructional artifacts actually consist of multiple sub-designs of specific

functions carried out by instructional artifacts. One function common to all instruction is to execute strategic moves; another function is to supply elements of subject-matter, or content.

In this chapter our focus is on the function of messaging and the design of conversational exchanges between learners and instructional sources. During instruction, communications are sent to learners in the form of media representations hoped to convey the intellectual and affective intentions of the designer. Learners respond by sending communications back that can be analyzed to determine the learner's intellectual and affective intentions—messages from the learner. Instructional conversation in any medium, live or technology-based, consists of a constant processing of representation surfaces in order to get to intentions (messages). While representation design is well-documented in the literature of instructional technology, theories and techniques for message design and the manner of conveying intentions and values is largely unexplored.

The literature of instructional technology is full of concern for message design. It can be readily seen in the work of Markle (1964; 1969) and her specificity in describing the content of a programmed instruction frame. A typical Markle frame contained information and a challenge to respond. After a response, a correct answer was revealed, setting up a conversational rhythm between the learner and the program. Conversationality was built-in to the system.

Markle's attention was on the frame. In her book *Good Frames, and Bad*, Markle described in painstaking detail the *composition* of frames in terms of their message constituents—the elements of intended message they contained. Different types of frame were characterized in terms of different message elements that were combined within a frame. One frame could state a rule; another could give an example; another could ask for a particular type of response.

The important lesson of programmed instruction was that whatever the style of the program (and there were many)[1], programming was an exercise in the disciplined arrangement of conversational messages formed in the designer's mind before they were expressed in text or diagrams—the hand within the puppet. The function of each invisible message was to perform a conversational action to which the other conversant could reciprocate with their conversational action. The core of the communication process in a program was for each conversant to understand the actions intended by the other. This was assured for programs through constant testing of individual frames and sequences and the elimination of frames that did not yield readily to interpretation.

The subtitle of Markle's book, *A Grammar of Frame Writing*, made it clear that she was describing a discipline for arranging elements of message within frames, prior to representation:

> This book is called a grammar because it tries to do what a grammar of language would do. It contains a classification scheme of the basic elements (or structures) and

[1] See, for example, Skinner, 1954; Crowder, 1960; Lumsdaine and Glaser, 1960; McDonald et al, 2005.

> operations (or procedures) and a survey of the possible ways of combining these operations and elements into "good" forms. As with many grammars, you could also expect considerable practice aimed at eliminating from your repertoire certain inelegant or unpermitted ways of combining the elements and operations. (Markle, 1969, p. 56)

Merrill too explored the disciplined formation of messages into structures approximating program frames in his Component Display theory (Merrill et al, 1980; Merrill, 1983). Whereas in programmed instruction the challenge was to create a sequence of frames set by the designer, Merrill's challenge in the design of the TICCIT computer-assisted instruction system was to allow the learner to determine the course of the conversation—the order of message exchange. To accomplish this, Merrill devised a system of standard display types, each type characterized in terms of its message composition. Merrill drew inspiration from the RULEG system (Evans et al, 1960, 1962), which categorized message elements in functional terms of rules and examples. To this basic message set Merrill added a rich family of related messages (practice, easier, harder, objective, etc.) accessible to the learner through a specially-designed keyboard that gave the learner full control of the instructional conversation. So oriented toward the learner was this system that literally nothing would happen unless learner asked (see Gibbons & O'Neal, 2014). Merrill's focus was on the structure of a message set for a specific project, so there was little time to generalize the idea of the message as a design construct, and the message construct remained unexplored at the time.

Markle and Merrill both represented an instructional style heavily influenced by the behaviorist foundations that represented the theoretical environment of the times. The message construct was important to the work done in that environment, but it did not emerge as a named research topic.

Somewhat in in parallel with the work of Markle and Merrill, advances in computer technology and the growth of the cognitive science movement stimulated research into the development of intelligent tutoring systems. Within this new theoretical environment, there was a practical need for a theory of message structure, but the message as a design construct was again assigned a place in the background, and the design of mechanisms for intelligent adaptation were given priority. This included emphasis on: (a) program mechanisms and programming languages that permitted intelligent adaptation, and (b) high-level patterns of instructional style, mainly direct versus Socratic styles of instruction. The message in these explorations was simply a vehicle for enabling experiments that were related to higher-level, theory-driven conversational styles and program mechanisms.

Pioneering research by Carbonell (1970) used templated sentence forms into which specific subject-matter elements could be substituted to generate representations, conflating message and representation concerns. The same form that produced "The average yearly rainfall in <Argentina> is <28> inches" could also produce "The average yearly rainfall in <Peru> is <39> inches". These structures could convey intellectual content, but they were unidimensional and limited to only the information-bearing function. They could be formed into interactional sequences, but it would be hard to characterize these austere forms as turns in a normal

conversation, because many of the human elements of message were missing that acknowledged an understanding of and adaptation to the learner as a distinct individual.

Incorporating the human quality into conversational exchanges and adapting to the individual became over time a main pursuit of the intelligent tutoring movement. It resulted in the end in the use of avatars capable of showing expression changes intended to create in the learner the sense of a caring, responsive conversational partner. However, what was and is still missing is a robust theory of conversation by which theories of strategy could be implemented. There is a convergence point where instructional goals at their finest level of granularity and conversational goals must meet for the management of goal-oriented communications.

The organization of an instructional design that involves the convergence of strategy, message, and representation has to be multi-functional and multi-layered because the theoretical base for designing each—strategy, message, and representation—is different. A strategy function operates according to rules and theories of strategy that have roots in the psychology of learning. A message formation function requires theory that decomposes higher-order strategic goals to smaller, more conversational goals to guide expression. These take the form of messages to be conveyed. Then a representation function must draw upon representation theory to convey as faithfully as possible the intent of the message. Wenger (1987) might consider this a chain of transformations for ensuring "epistemic fidelity":

> For the purposes of this discussion, let us define a *representation* of knowledge very broadly as a *mapping* of knowledge onto a physical medium. It is useful to be able to speak about knowledge that is the source of this mapping, and we will use the adjective *epistemic* to refer to this "disembodied" level. Whether such an epistemic level really exists in some Platonic sense is not the point here. The claim is, rather, that the distinction between the epistemic and representation levels is *useful* in designing and evaluating models of communicable knowledge. (Wenger, 1987, p. 312, emphasis in the original)

Wenger points here to a gulf between the formation of an intention to communicate and the formation of a representation capable of communicating. This gulf is spanned using principles and theories of message design as we have defined it.

A notable example of spanning this gulf can be found in the Steve intelligent tutoring demonstration developed by Lewis Johnson and Jeff Rickel at the University of Southern California (Rickel & Johnson, 1997; Johnson & Rickel, 2000). Steve's design depends heavily on the driving of representations by messaging rules, which are in turn driven by strategic rules. Steve's artifacts—strategy, messaging, and representations—are generated or constructed in real-time during instruction. Steve operates in the virtual world of a ship's boiler room. "Steve" is a graphical avatar/instructor capable of either guiding instruction or responding to learner questions, including, to a certain extent, "Why?".

What is remarkable about the Steve simulation is the broad spectrum of messaging devices employed and made manifest in representations that preserve the values of the message. Steve uses gestures, direction of gaze, body position, motions, and pauses in close coordination with strategic purposes. When demonstrating a procedural step, Steve looks at the student while speaking, pauses and looks at the location of the action to be performed, makes the action, then lifts gaze back to the student before proceeding. The effect is the closest approximation to a live tutor's behavior in terms of what could be called presence. Steve is a rule-driven simulation in which the message-driven avatar actions not only execute an intellectual, content-related strategy but also mimic to the senses a caring, aware person.

Social learning theory provides a final illustration of the value of the message layer as an independent functional area of designs. It capitalizes on the use of learners to create message content and the ordering of messaging simply by controlling the categories of the messages learners can use. CSILE (Computer-Supported Intentional Learning Environment, Scardamalia et al, 1987; Berieiter & Scardamalia, 1989; Scardamalia, 2004) provides instructors with a controlled discussion and problem-solving environment in which contributions of students to the solution of problems are constrained by category. Categories may vary depending on the type of problems students are challenging and may either be supplied from a standard set or tailored by the instructor.

The typing of messages in CSILE raises the question of how many types of message there might be, which in turn suggests the possibility that the number might be very great. This is the conclusion supported by conversation analysis, a content-agnostic, synthetic theory of conversation analysis and structure (Sindell & Stivers, 2013). Schegloff, a major proponent of conversation analysis, proposes that each turn in a conversation (including, of course, instructional conversations), performs one or more actions. Levinson (2013) notes that a single conversational turn may perform multiple actions and that the number of possible actions is, indeed, very large and grows through experience. A young person may be aware of many actions, but a mature person, having more experience, understands the action performed by the nuanced utterance at a dinner table, "Has anyone seen the salt?". This question may not draw a response from a youngster, but from an adult the response will bring a salt-shaker to hand.

Room permitting, a much more detailed argument for the message layer and its design as a semi-independent element of an instructional design could be made. Gibbons and Boling (in preparation) make this argument in a monograph that explains in much more detail the concept of message design, its place within an architectural theory of design, and the practical theory of conversation analysis and its structural facilitation of instructional conversation design.

Numerous implications arise from the concept of message layer design: the possibility of a more explicit and detailed description of the use of message in successful instructional products; the possibility of providing guidance to instructional designers for the design of more interactive and conversational artifacts; a new view of possible alternative orders of design

decision-making; new design team disciplines and the increased use of team specialty skills in message explication; the possibility for everyday designers to consider innovative design patterns that are more adaptive and generative; increased incorporation of non-verbal message representations to reduce cognitive demands; increased ability and incentive to incorporate more human-like value and presence in designs; increased ability to embed more nuanced messages expressing the value of the learner to the learner; increased emphasis on short passages of direct messaging interspersed with application analysis and feedback; and an increased likelihood of faithfully communicating knowledge and skill structures.

We feel these are goals worth pursuing.

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