e-Learning and the Science of Instruction

Proven Guidelines for Consumers and Designers of Multimedia Learning

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8

Applying the Personalization Principle

USE CONVERSATIONAL STYLE AND VIRTUAL COACHES

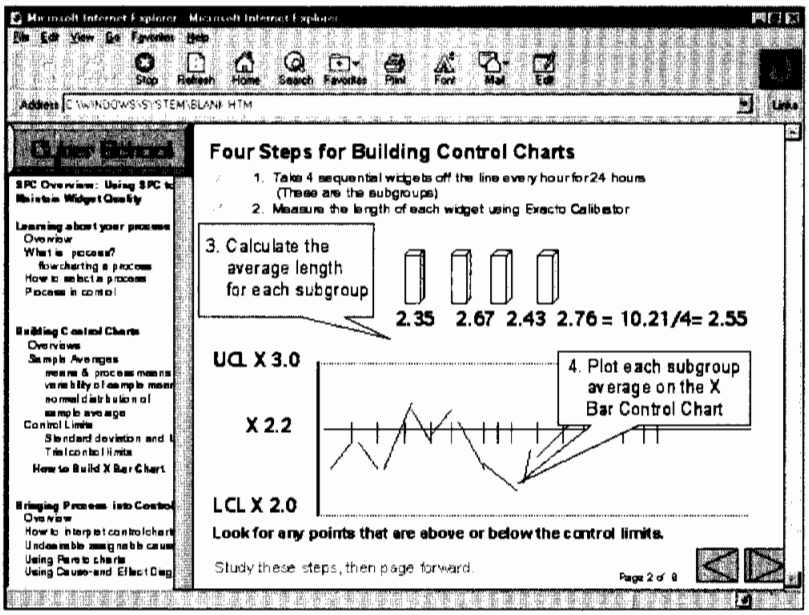
CHAPTER PREVIEW

SOME e-LEARNING lessons rely on a formal style of writing to present information. In this chapter we summarize the empirical evidence that supports a conversational style of writing that uses first- and second-person language. A learning agent is an onscreen character who helps guide the learning processes during an instructional episode. While research on agents is quite new, we present evidence for the learning gains achieved in the presence of an agent as well as for the most effective ways to design and use agents. The psychological advantage of conversational style and learning agents is to induce the learner to engage with the computer as a social conversational partner.

DESIGN DILEMMA

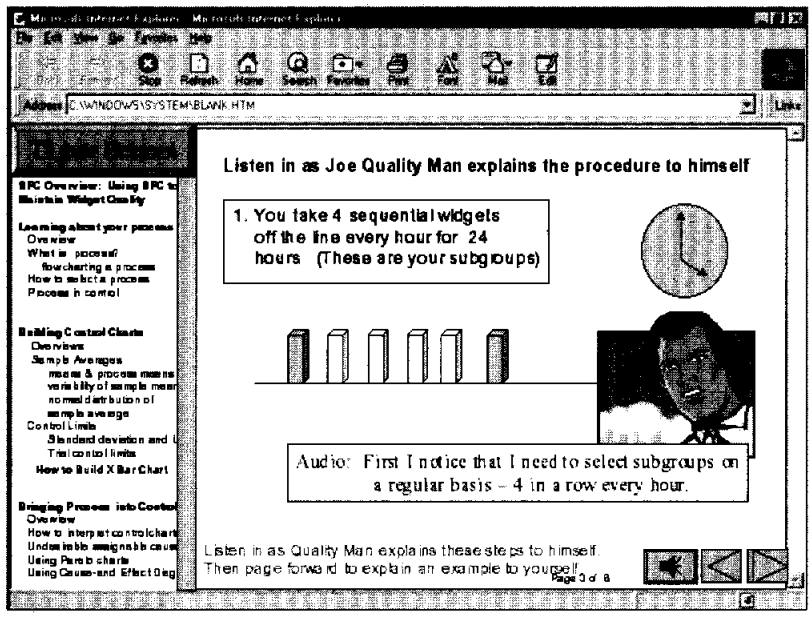
Suppose your team has just developed a prototype e-learning lesson on quality management processes for your company. As team leader you review the storyboards before sending them for programming. As you read them you feel a little uncomfortable with the tone borrowed from the reference materials used to research some of the content. You fear that the formal writing style may cause some employees to feel alienated from the computer as a training environment and therefore not try as hard as they could to understand the material. For example, as seen in Figure 8.1, the textual explanation that goes along with the graphics is written in an impersonal style. In a bid to make your e-learning course more personal, and hence more engaging for the employees, you decide to reword the script slightly. For example, you use more first- and second-person constructions. You also decide to add a coach in the form of Joe Quality to provide helpful tips (see Figure 8.2).

Figure 8.1. Use of Impersonal Language to Present a Procedure.



Happy with your revisions, you show your training director what you have done. She becomes quite upset. Stunned with the informal style you've created, your

Figure 8.2. Use of Personal Language and an Onscreen Coach to Explain a Procedure.



director thinks its better to keep things formal. "After all, the new quality initiative is serious business. Using such informal language and a cartoon makes it all seem a bit too Mickey Mouse for my taste," she says. "These are adults; they will be insulted by having a cartoon character talk to them!" How can you resolve this conflict between your intuition that conversational style and a friendly coach will stimulate learning and your director's intuition that it will stifle learning?

Personalization Principle One: Use Conversational Rather Than Formal Style

Does it help or hurt to change printed or spoken text from formal style to conversational style? Would the addition of a friendly onscreen coach distract from or promote learning? In this chapter, we explore research and theory that directly addresses these issues.

Consider the procedural demonstration shown in Figure 8.1. As you can see, the explanatory text uses a formal style. The overall feeling is quite impersonal. Now, compare this with the demonstration in Figure 8.2. In this case, the text presents exactly the same information but uses a more personal writing style by adding second-person pronouns and an onscreen coach. Together the resulting instruction more closely resembles human-to-human conversation. Of course, learners know that the character is not really in a conversation with them, but they may be more likely to act as if the character is like a conversational partner. Based on cognitive theory and research evidence, we recommend that you create or select e-learning courses that include some spoken or printed text that is conversational rather than formal.

Let's look at a couple of e-learning examples. The screen in Figure 8.3 is giving safety rules for handling of pyrotechnics. Note that both the onscreen text and the audio are very formal. A simple rewrite uses second-person pronouns to make the text more conversational: "You should be very careful if

Figure 8.3. Formal Language Used in Text and Narration.

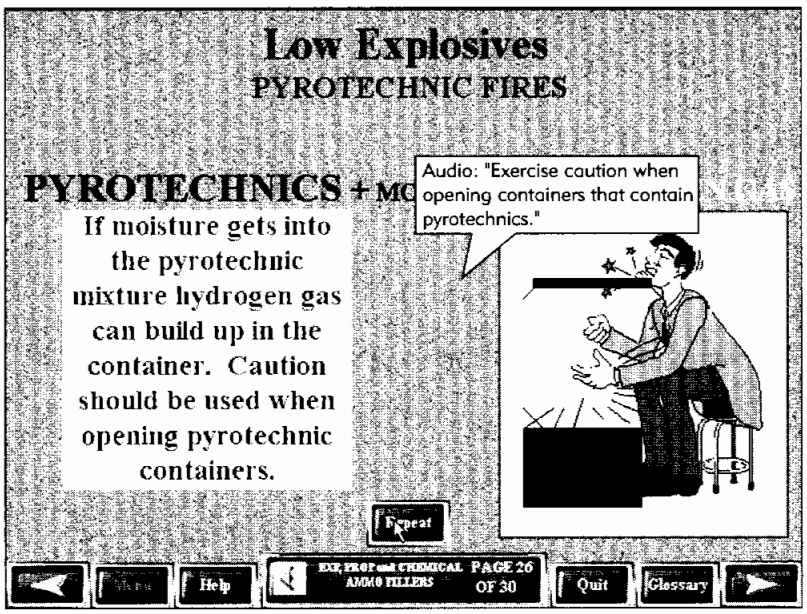
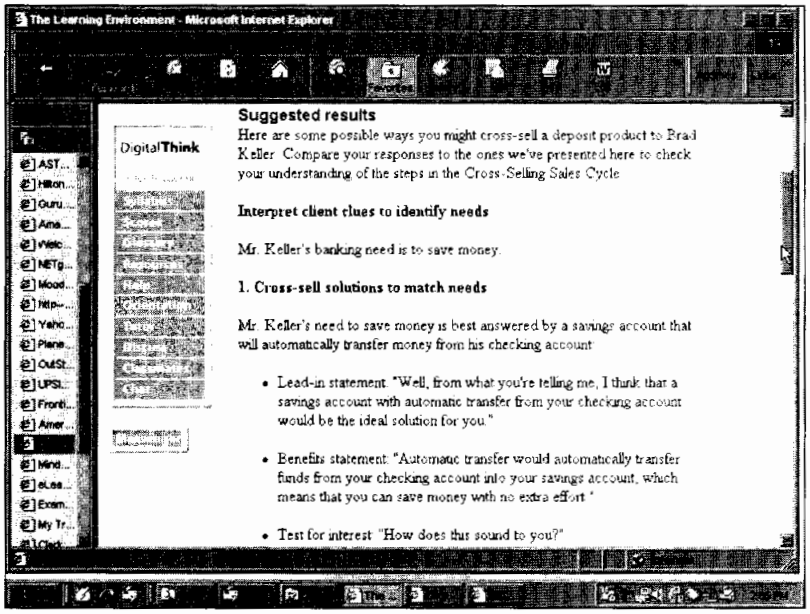


Figure 8.4. Conversational Language Used in Text.
With permission from DigitalThink.



you open any containers with pyrotechnics." In contrast to the pyrotechnics lesson, the text under "Suggested Results" shown in Figure 8.4 uses second- and first-person language to give feedback to an exercise.

Psychological Reasons for the Personalization Principle

Let's begin with a common sense view that we do not agree with. The rationale for putting words in formal style is that conversational style can detract from the seriousness of the message. After all, learners know that the computer cannot speak to them. The goal of a training program is not to build a relationship but rather to convey important information. By emphasizing the personal aspects of the training—by using words like "you" and "I"—you convey a message that training is not serious. Accordingly, the guiding principle is to keep things simple by presenting the basic information.

This argument is based on an information delivery view of learning in which the instructor's job is to present information and the learner's job is to acquire the information. According to the information delivery view, the training program should deliver information as efficiently as possible. Formal style meets this criterion better than conversational style.

Why do we disagree with the call to keep things formal and the information delivery view of learning on which it is based? Although the information delivery view seems like common sense, it is inconsistent with how the human mind works. According to cognitive theories of learning, humans strive to make sense of presented material by applying appropriate cognitive processes. Thus, instruction should not only present information but also prime the appropriate cognitive processing in the learner. Research on discourse processing shows that people work harder to understand material when they feel they are in a conversation with a partner rather than simply receiving information (Beck, McKeown, Sandora, Kucan, and Worthy, 1996). Therefore, using conversational style in a multimedia presentation conveys to the learners the idea that they should work hard to understand what their conversational partner (in this case, the course narrator) is saying to them. In short, expressing information in conversational style can be a way to prime appropriate cognitive processing in the learner.

Evidence for Using Conversational Style

Although this technique as it applies to e-learning is just beginning to be studied, there is already preliminary evidence concerning the use of conversational style in e-learning lessons. In a set of five experimental studies involving a computer-based educational game on botany and a multimedia lesson on lightning formation, researchers (Moreno and Mayer, 2000b) compared versions in which the words were in formal style with versions in which the words were in conversational style. For example, Figure 8.5 gives the introductory script spoken in the computer-based botany game; the top portion shows the formal version and the bottom shows the personalized version. As you can see, both versions present the same basic information, but in the personalized version the computer is talking directly to the learner. In five out of five studies, students who learned with per-

Figure 8.5. Formal Versus Informal Lesson Introductions Compared in Research Study.

From Moreno and Mayer, 2000b.

Introductory Portion of Text Spoken in a Botany Computer Game

Formal Version

"This program is about what type of plants survive on different planets. For each planet, a plant will be designed. The goal is to learn what type of roots, stem, and leaves allow the plant to survive in each environment. Some hints are provided throughout the program."

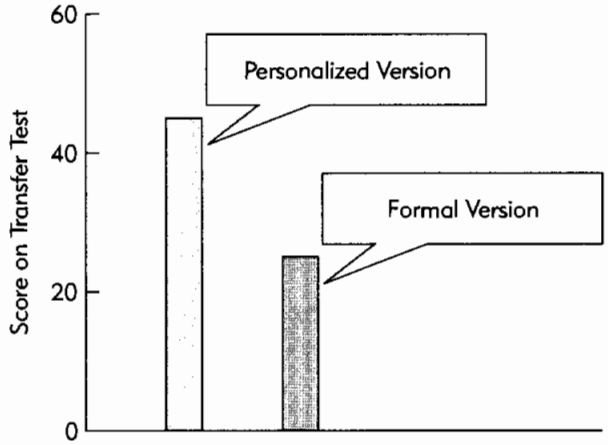
Personalized Version

"You are about to start a journey where you will be visiting different planets. For each planet, you will need to design a plant. Your mission is to learn what type of roots, stem, and leaves will allow your plant to survive in each environment. I will be guiding you through by giving out some hints."

sonalized text performed better on subsequent transfer tests than students who learned with formal text. Overall, participants in the personalized group produced between 20 to 46 percent more solutions to transfer problems than the formal group. Figure 8.6 shows results from one study where improvement was 46 percent and the effect size was 1.55, which is considered to be large.

Figure 8.6. Better Learning from Personalized Narration.

From Moreno and Mayer, 2000a.



These results should not be taken to mean that personalization is always a useful idea. There are cases in which personalization can be overdone. For example, consider what happens when you add too much personal material, such as, "Wow, hi dude, I'm here to teach you all about _____, so hang on to your hat and here we go!" The result can be that the advantages of personalization are offset by the disadvantages of distracting the learner and setting an inappropriate tone for learning. Thus, in applying the personalization principle it is always useful to consider the audience and the cognitive consequences of your script—you want to write with sufficient informality so that the learners feel they are interacting with a conversational partner but not so informally that the learner is distracted or the material is undermined. In fact, implementing the personalization principle should create only a subtle change in the lesson; a lot can be accomplished by using a few first- and second-person pronouns.

Complementary results come from related studies. For example, people read a story differently and remember different elements when the author writes in the first person (from the "I/we" point of view) than when the author writes in the third person (he, she, it, or they) (Graesser, Bowers, Olde, and Pomeroy, 1999). Recent research summarized by Reeves and Nass (1996) shows that, under the right circumstances, people "treat computers like real people." Part of treating computers like real people is to try harder to understand their communications. Consistent with this view, Mayer, Sobko, and Maatone (in press) found that people learned better from a narrated animation on lightning formation when the speaker's voice was human rather than machine-simulated.

Personalization Principle Two: Use Onscreen Coaches to Promote Learning

In the previous section, we provided evidence for writing with first- and second-person language to establish a conversational tone in your training. A related new area of research focuses on the beneficial effects of onscreen coaches, called *pedagogical agents*, on learning.

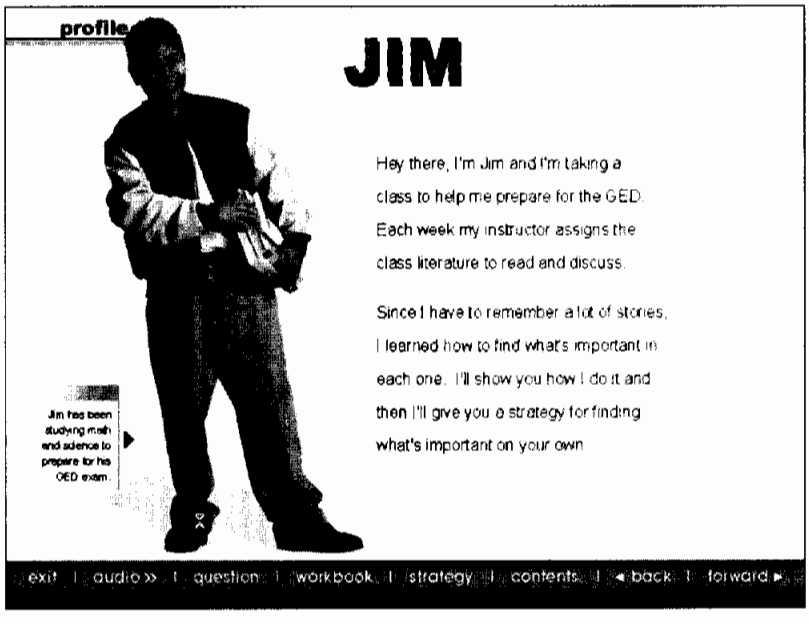
What Are Pedagogical Agents?

Personalized speech is also an important component in animated pedagogical agents developed as onscreen tutors in educational programs (Cassell, Sullivan, Prevost, and Churchill, 2000; Moreno, Mayer, Spires, and Lester, 2001). Pedagogical agents are onscreen characters who help guide the learning process during an e-learning episode. Agents can be represented visually as cartoon-like characters, as talking-head video, or as virtual reality avatars; they can be represented verbally through machine-simulated voice, human recorded voice, or printed text. Agents can be representations of real people using video and human voice or artificial characters using animation and computer-generated voice. Our major interest in agents concerns their ability to employ sound instructional techniques that foster learning.

Onscreen agents are appearing frequently in e-learning. For example, Figure 8.7 introduces Jim in a lesson on reading comprehension. Thoughout

Figure 8.7. Onscreen Coach Used to Give Reading Comprehension Demonstrations.

With permission from Plato Learning Systems.



the lesson, Jim demonstrates techniques he uses to understand stories and then learners apply Jim's guidelines to comprehension exercises. Figure 8.8 from a course on commercial bank lending uses a coach to provide guidance about evaluating a loan application.

Figure 8.9 shows a screen from a guided discovery e-learning game called Design-A-Plant in which the learner travels to a planet with certain environmental features (such as low rainfall and heavy winds) and must choose the roots, stem, and leaves of a plant that could survive there. An animated pedagogical agent named Herman-the-Bug (in lower left corner of Figure 8.9) poses the problems, offers feedback, and generally guides the learner through the game. As you can see in the figure, Herman is a friendly little guy and research shows that most learners report liking him (Moreno and Mayer, 2000b; Moreno, Mayer, Spires, and Lester, 2001).

Figure 8.8. The Coach Provides Guidelines for Researching a New Bank Loan Application.

With permission from Moody's Financial Services.

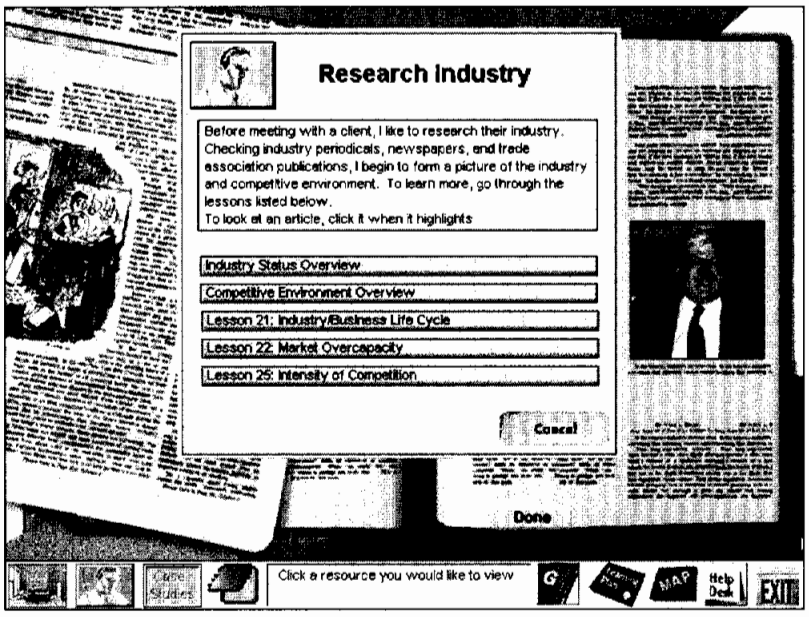
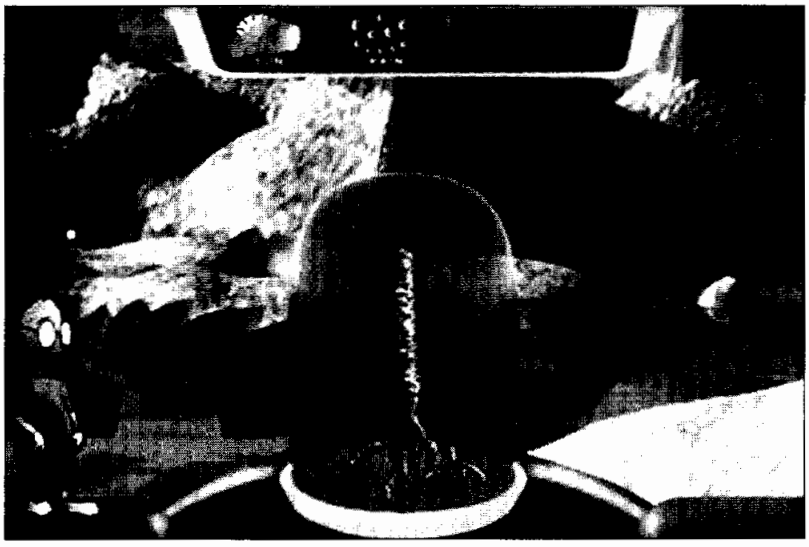


Figure 8.9. Herman-the-Bug Used in Design-A-Plant Instructional Game.
Moreno, Mayer, Spires, and Lester, 2001.



In another program an animated pedagogical agent is used to teach students how to solve proportionality word problems (Atkinson, 2002). In this program, an animated pedagogical agent named Peedy provides a step-by-step explanation of how to solve each problem. Although Peedy doesn't move much he can point to relevant parts of the solution and make some simple gestures, as he guides the students. Peedy and Herman are among a small collection of agents who have been examined in controlled research studies.

Computer scientists are doing a fine job of producing life-like agents who interact well with humans (Cassell, Sullivan, Prevost, and Churchill, 2000). For example, an onscreen agent named Steve shows students how to operate and maintain the gas turbine engines aboard naval ships (Rickel and Johnson, 2000); an onscreen agent named Cosmo guides students through the architecture and operation of the internet (Lester, Towns, Callaway, Voerman, and Fitzgerald, 2000); and an onscreen agent named Rea interacts with potential

home buyers, takes them on virtual tours of listed properties, and tries to sell them a house (Cassell, Sullivan, Prevost, and Churchill, 2000).

In spite of the continuing advances in the development of onscreen agents, research on their effectiveness is just beginning (Atkinson, 2002; Moreno and Mayer, 2000b; Moreno, Mayer, Spires, and Lester, 2001). Let's look at some important questions about agents in e-learning courses and see how the preliminary research answers them.

Do Agents Improve Student Learning?

An important primary question is whether adding onscreen agents can have any positive effects on learning. Even if computer scientists can develop extremely lifelike agents that are entertaining, is it worth the time and expense to incorporate them into e-learning courses? In order to answer this question, researchers began with an agent-based educational game, called Design-A-Plant, described previously (Moreno, Mayer, Spires, and Lester, 2001). Some students learned by interacting with an onscreen agent named Herman-the-Bug (agent group), whereas other students learned by reading the identical words and viewing the identical graphics presented on the computer screen without the Herman agent (no-agent group). Across two separate experiments, the agent group generated 24 to 48 percent more solutions in transfer tests than did the no-agent group.

In a related study (Atkinson, 2002), students learned to solve proportionality word problems by seeing worked-out examples presented via a computer screen. For some students, an onscreen agent spoke to students, giving a step-by-step explanation for the solution (agent group). For other students, the same explanation was printed as onscreen text without any image or voice of an agent (no-agent group). On a subsequent transfer test involving different word problems, the agent group generated 30 percent more correct solutions than the no-agent group. Although these results are preliminary, they suggest that it might be worthwhile to consider the role of animated pedagogical agents as aids to learning.

Do Agents Need to Look Real?

As you may have noticed in the previously described research, there were many differences between the agent and no-agent groups so it is reasonable to ask which of those differences has an effect on student learning. In short, we want to know what makes an effective agent. Let's begin by asking about the looks of the agent, such as whether people learn better from human-looking agents or cartoon-like agents. To help answer this question, students learned about botany principles by playing the Design-A-Plant game with one of two agents—a cartoon-like animated character named Herman-the-Bug or a talking-head video of a young male who said exactly the same words as Herman-the-Bug (Moreno, Mayer, Spires, and Lester, 2001). Overall, the groups did not differ much in their test performance, suggesting that a real character did not work any better than a cartoon character. In addition, students learned just as well when the image of the character was present or absent as long as the students could hear the agent's voice. These preliminary results suggest that a lifelike image is not always an essential component in an effective agent.

Do Agents Need to Sound Real?

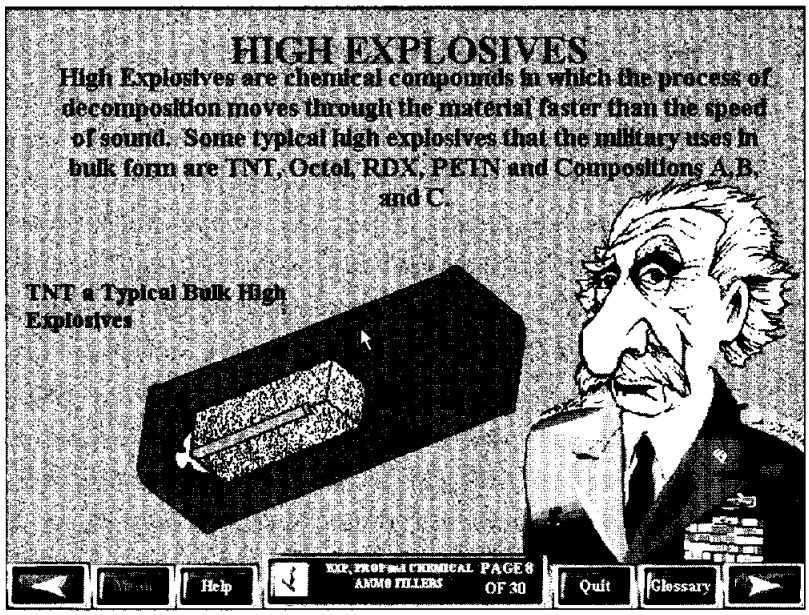
Even if the agent may not look real, there is compelling evidence that the agent has to sound conversational. First, across four comparisons (Moreno, Mayer, Spires, and Lester, 2001; Moreno and Mayer, in press), students learned better in the Design-A-Plant game if Herman's words were spoken rather than presented as onscreen text. This finding is simply an indication that the *modality effect* (as described in Chapter Five) applies to onscreen agents. Second, across three comparisons (Moreno and Mayer, 2000b), students learned better in the Design-A-Plant game if Herman's words were spoken in a conversational style rather than a formal style. This finding is simply an indication that the *personalization effect* (as described in this chapter) applies to onscreen agents. Finally, Atkinson (2002) found some preliminary evidence that students learn to solve word problems better from an onscreen agent when the words are spoken in a human voice rather than a

machine-simulated voice. Overall, these preliminary results show that the agent's voice is an important determinant of instructional effectiveness.

Although it is premature to make firm recommendations concerning onscreen pedagogical agents, we are able to offer some suggestions based on the current state of the field. We suggest that you consider using onscreen agents, and that the agent's words be presented as speech rather than text, in conversational style rather than formal style, and with human-like rather than machine-like articulation. Although intense work is underway to create entertaining agents who display human-like gestures and facial expressions, their educational value is yet to be demonstrated.

We further suggest that you use agents to provide instruction rather than for entertainment purposes. For example, in Chapters Nine and Ten we illustrate ways to use an agent to help learners ask questions of themselves when studying expository text and to self-explain worked examples. The cartoon general in Figure 8.10, for example is *not* an agent since he is

Figure 8.10. General Character Plays No Instructional Role So Is Not an Agent.



never used for any instructional purpose. Likewise there is a common unproductive tendency to insert theme characters from popular games and movies who are added only for entertainment value and serve no instructional role. These embellishments are likely to depress learning, as discussed in Chapter Seven.

Based on the cognitive theory and research we have highlighted in this chapter, we can propose the *personalization principle:* First, present words in conversational style rather than formal style. In creating the script for a narration or the text for an on-screen passage, you should use some first- and second-person constructions (that is, involving "I," "we," "me," "my," "you," and/or "your") to create the feeling of conversation between the course and the learner. However, you should be careful not to overdo the personalization style because it is important not to distract the learner. Second, use onscreen agents to provide coaching in the form of hints, worked examples, demonstrations, and explanations.

DESIGN DILEMMA: RESOLUTION

Now that you have some justification for personalization, we can return to the dilemma you encountered at the start of this chapter concerning the design of your e-learning course on quality processes. When your training director balks at including some personalized words and a friendly coach in your e-learning course, you can explain that your goal is to create a sense of conversational communication in learners. According to cognitive theory, you explain, when learners see the computer as a conversational partner, they will try harder to understand what the computer is saying. If the director is not convinced by your explanation of cognitive theory, you can point out that there is a growing body of research evidence that people learn more deeply when important instructional methods such as demonstrations or worked examples are presented by a pedagogical agent speaking in a personal manner. You also suggest that since the physical appearance of the agent is not that important to the learning outcome, you plan to test several different representations to see which appeals most to the learners.

WHAT TO LOOK FOR IN e-LEARNING

- ☐ Instructional content presented in conversational language using "you," "your," "I," "our," and "we."
- ☐ Coaching provided via conversational narration from onscreen characters (agents).
  - ☐ Agents may be visually realistic or line art.
  - ☐ Agent dialog presented via audio narration.
  - ☐ Voice quality and script should be natural and conversational.
  - ☐ Agents serve a valid instructional purpose.

COMING NEXT

This chapter completes the basic set of principles dealing with best use of media elements in e-learning. These principles apply to training produced to inform as well as to increase performance; in other words they apply to all forms of e-learning. If your training goal is to build job-specific skills, your e-learning should provide practice opportunities. In the next chapter we will look at how practice should be designed to best promote learning and will show you how to apply the principles described in Chapters Three through Eight when you design practice exercises.

Suggested Readings

Mayer, R.E., Sobko, K., and Mautone, P.D. (in press). Social Cues in Multimedia Learning: Role of Speaker's Voice. *Journal of Educational Psychology.*

Moreno, R., Mayer, R.E., Spires, H., and Lester, J. (2001). The Case for Social Agency in Computer-Based Teaching: Do Students Learn More Deeply When They Interact with Animated Pedagogical Agents? *Cognition and Instruction, 19,* 177–214.

Moreno, R., and Mayer, R.E. (2000). Engaging Students in Active Learning: The Case for Personalized Multimedia Messages. *Journal of Educational Psychology, 93,* 724–733.

Reeves, B., and Nass, C. (1996). *The Media Equation: How People Treat Computers, Television, and New Media Like Real People and Places.* New York: Cambridge University Press.