



Use and Rationale of Media Types In Performance-Centered Design

by Dave Schubert

Performance-centered design (PCD—also known as EPSS or PS) has generally accepted attributes that distinguish it from “bolt-on” helper-type systems. As we move toward standardization in media types through adopting MPEG-4, for example, incorporating rich media becomes less problematic for design of distributed systems. In particular:

- The rationale for incorporating media within the design of EPSS includes performance enhancement, cognitive theory, government incentives, and standardization.
- There are greater opportunities for different and richer media types in EPSS.
- We can enhance the number and effectiveness of the generally accepted PCD attributes by employing rich media in concert

with protocols for embedding PS interventions into applications (for example, through operating system messages and similar technologies).

Rationale

Silos or Synergy?

Traveling the country roads of Wisconsin in the 1970s, I noticed a correlation of relative performance (and therefore, likelihood of survival) of various farms by the number, age, and configuration of their silos.

Farms with small or old silos hinted of “mom-and-pop” farms that were doomed (except as a “hobby” farm); other farms opted to haphazardly bolt on silos in areas most convenient for their quick construction leaving the basic work processes separate and uncoordinated. This methodology was an

improvement (due to the advanced features of the newer silos) but did not address true performance problems. The most productive farmers were those who physically clustered their silos, choosing their location by where they would be most effective and connecting them to many of the farm buildings. Farmers adjusted their workflow around this cluster, developing a synergy in performance and huge increases in output.

Organizational performance improvement through PCD can be viewed in the same manner: “With walls built between HR groups, managers are often forced to seek help from each group individually, and then they must make some decisions about how to piece the puzzle together to get the results they need” (Rosenberg, 1996, p. 376).

Gloria Gery was one of the first to coalesce this concept into her three categories of EPSS enhancements: external, extrinsic, and intrinsic. Like farm silos, to best harness the synergy of PCD, we want to bring media types into the design process as an intrinsic component of that design. Gery states that “the designers’ goal for a performance-centered system is to integrate as much as 80% of the required performance support as intrinsic support...” (1995, p. 53).

Dickelman puts this into the design process context when he explains: “The general rule, however, is that Usability Engineering should be planned and executed early in the development cycle and applied iteratively as a process for continuous improvement until goals are met” (Dickelman, 1997).

Synchronization Begets Synergy

The ideal way to boost user performance is to find a way for the PCD instrument (including its media) to synchronize with the user needs in real time. Web design allows for tools such as javascript to accomplish this goal, but what of synchronization between desktop applications and performer needs? Operating system (OS) messaging provides a solution. In discussing OS messaging (and related technologies), Dickelman wrote:

There are, however, logical representations of user actions that manifest themselves as messages communicated between the presentation layer and application layer of software. Every program generates these messages. The “Cheshire Cat” is therefore a behind-the-scenes program that intercepts the messages. Further, it is able to interpret the messages in terms of what the user needs to complete the task, and provide it—even if it means doing the task for the user (Dickelman, 1998).

Synchronization between information and need is a key component in achieving worthy performance. Use of the “Cheshire cat” concept in concert with appropriate media is an underutilized means for accomplishing this goal.

Accessibility Issues

The US Congress strengthened the Rehabilitation Act in 1998 with Section 508, bringing increased accessibility to anyone in contact with US government agencies. Section 508 deals specifically with electronic and information technology (EIT) and seeks to remove many of the barriers performers have in being able to obtain and use information quickly and easily. The government’s website describes Section 508’s purpose as follows: “However, for most products—such as software, web pages, and computers—achieving compatibility with assistive technology is the goal of the standards” (About Section 508, n.d.).

Further, it seeks to use the strength of the US government’s purchasing power as a “bully pulpit” to encourage development of technologies that will make accessibility a reality for all. Vendors interested in working with the US government must adhere to this law: “Contractors interested in selling EIT to the Federal government are responsible for designing and manufacturing products which meet the applicable Access Board’s technical provisions” (Section 508 Acquisition FAQs, n.d.).

To date, most products and services meeting Section 508 requirements have dealt with external (extrinsic) solutions, rather than built-in (intrinsic, or embedded) solutions, which provides great opportunities (and incentives) for vendors.

Multilingual Work Environments

Recently a consulting project required coordination between myself, India (where the developer was), and the Cayman Islands (the client). Fortunately, everyone spoke English. This is not always the case.

As our world shrinks due to improved communication and information technology, the need increases for intrinsic, multi-lingual support. A solution is the use of alternate media tracks providing appropriate language to each performer. The Cheshire cat program can call up the appropriate track, depending on the language preferences of the computer.

What’s the Holdup?

The adage that a picture is worth a thousand words begs the question why media aren’t used more. Historically, two constraints answer this question.

Speed

Until the turn of the 21st century, “linking” has assumed the use of text (hence the term “hypertext”). This assumption developed because computer speed (including computer processors, Internet, and networking) wasn’t sufficient to reliably transmit and receive high-resolution media. This is becoming moot with the continual rollout of broadband Internet, high-speed Ethernet, wireless networking, and continuing increases in computer processor speed.

Standardization

The other constraint holding back use of media was standardization. While this issue will never be fully resolved, two standards should make increased media type use easier: MPEG-4 and XML.

Of particular importance is the standard developed in 1999 by the Motion Picture Experts Group (MPEG) for handling media types on all types of connection speeds (MPEG-4).

More than 20 major companies including IBM, Sun, Real Media, Apple, and Cisco have agreed to adopt MPEG-4 as their standard media standard. The Internet Media Streaming Alliance (ISMA) has also become a strong advocate of this standard.

The CTO of America Online, William J. Raduchel, said:

The exciting promise of streaming media can be realized only if we have a single standard for consumers, service providers, network operators, equipment suppliers and content providers. Having a standard, interoperable implementation will remove many of the existing barriers to delivering exciting new offerings to consumers and businesses (ISMA).

The key factor is division of the media types used for narrative versus illustrative purposes...a model that uses audio to describe and graphics to illustrate.

The MPEG-4 standard covers media type capture, authoring, editing, distribution, playback, and archiving. MPEG-4 delivers high quality to mobile phones and Personal Digital Assistants (PDAs) as easily as it does to corporate networks. MPEG-4 contains better audio quality than MP3s. Media “objects” that are supported include video, virtual reality, still images, and animation (such as Flash). MPEG-4 has a text-to-speech interface, which makes it invaluable for accessibility incorporation of media. MPEG-4 includes what are called “sprites” that can act like the application Cheshire cat in communicating between media tracks, which make this standard especially well positioned to facilitate interactive media at all levels.

Types of Media

For purposes of this article, media is divided into the following four categories, listed in ascending order of utility for PCD:

- **Static:** Both text and static images are considered media types under this categorization. Both provide information to the performer using the same sensory channel, competing for the performer’s comprehension.
- **Time Based:** A traditional view of video, audio, and animation that is an improvement over static media. Training departments have learned to use much of this type’s potential. Still, it is far from optimum due to its linear nature (time-based), which has a beginning and ending. Performers want specific information when they need it. Performance is lost when synchronization is lacking. Searching along a timeline is not the answer.

- **Interactive:** Interactive media may include any of the previous media types within the framework, so long as there is potential for user-media interaction. Text, animation, and video can all become interactive. This is the point where media provides real value to the performer. Performers are able to jump directly to the information they need and begin to have some control. MPEG-4 chapter tracks, interactive buttons, virtual reality simulations, and tutorials are examples that can answer performer needs when embedded into the design.
- **Synchronized:** The final ingredient is synchronization. This means providing the correct media at the correct time by intercepting OS messages without a Cheshire cat program. Proper design process (using intrinsic embedding of appropriate media) also synchronizes it to user needs.

How Should Media Be Used?

A typical document or web page contains a large amount of text with a few static graphic images. This template has been used since printed books were first illustrated. With increased availability of more interactive media types, a new model should be considered. The basis for a new approach can be gleaned from Mayer when he explains his theory of multimedia:

A cognitive theory of multimedia learning assumes that the human information processing system includes dual channels for visual/pictorial and auditory/verbal processing, that each channel has a limited capacity for processing, and that active learning entails carrying out a coordinated set of cognitive processes during learning (2001, p. 41).

Learning potential is diminished when one of these information channels (visual/pictorial and auditory/verbal) is overused. The key factor is division of the media types used for narrative versus illustrative purposes. This highlights a distinction between the traditional book model (text + still graphics, with text explaining the graphics) and a model that uses audio to describe and graphics (static, timeline, interactive, or synchronized) to illustrate. Mayer continues, describing a common barrier to information acquisition:

...meaningful learning cannot be fully carried when the visual channel is overloaded—that is, when pictures and printed words compete for limited cognitive resources in the visual channel. Because both enter the information processing through the eyes (2001, p. 140).

Intuitively this makes sense, for seasoned teachers know the impact of graphics with audio in presentations, from slideshow presentations incorporating narration to VHS video programs. Other research, including on the “modality effect,” substantiate Mayer’s theory: “...Effective cognitive capacity may be increased if both auditory and visual working memory can be used to process incoming multimedia messages” (Mayer, 2001, p. 140).

Guild and Garger agree: "We also know that many successful learners can function in more than one modality. The ability to bring a multi-modal approach to learning has tremendous payoff..." (1998, p. 119).

Mayer's theory would require implementation of audio *and* visual material to optimize understanding (learning) in PCD. This split allows the performer to listen to narration while viewing the graphical workspace, optimizing each channel. This is a significant concept if the goal is to create the best environment for real-time learning within EPSS-PCD design.

PCD Attributes and Media Types

Gery (1995) suggests 19 attributes exhibited (in part or whole) by performance-centered EPSS. Media types can play a role in the fulfillment of these attributes. The following attributes are of particular interest for media use:

Institutionalize. Interface layout and sequencing is key in this attribute's enactment. Media comes into play here through interactive (and synchronous) tutorials and other job aids. An interactive tutorial provides just-in-time training, all accessible from or within the interface. Buttons would access task-specific tutorials, not requiring the usual search and frustration typical without our Cheshire cat support.

Contain Embedded Knowledge. Tutorials, knowledge databases, cue cards, and wizards may all be embedded within the interface.

Use Metaphor. Visual imagery is the best way to quickly establish a metaphor in any application. Media players all look (through use of graphics) like various incarnations of television sets. This intuitively provides context and expectations for the user. In the example of media players, it suggests sound and video, but not interaction or virtual reality, thus limiting the scope of the metaphor's utility. Choice of a metaphor becomes extremely important because of this, requiring proper analysis and design for all aspects of the EPSS.

Show Evidence of Work Progression. This overlooked attribute may be accomplished using either processing channel: a graphical representation within the interface illustrating the task progress, or an audio file associated with each step in the work process that activates on completion of each step. Further direction can be placed within the narration to help guide the performer in maintaining work context and progress.

Provide Support Resources: Support that does not break the task context has been the basis for many extrinsic support

systems. The typical helper or wizard in many applications are examples. If integrated with synchronicity (our Cheshire cat) would fare well with the new MPEG-4 layering technologies to augment the effectiveness of knowledge databases. Many helpers now are being built this way for individual consumer software.

Accommodate Performer Diversity With Layers. It is unlikely that Gery originally considered performer access issues, as the laws strengthening it didn't come to pass until the late 1990s; however, the concept of layers accommodating diversity does seem appropriate for this subject. Three needs are apparent: performers using different languages, blindness or partial sight impairment, and hearing impairment.

Development tools allow quick creation of multiple sound tracks to accommodate different languages. Our Cheshire cat can determine which track to load according to each computer's operating system language preferences. This same procedure holds for vision-impaired situations.

Hearing impairment can be accommodated using media in two ways: scrolling narration text tracks called by the Cheshire cat or by specific access-enabled software (such as browsers). Also, a designer may wish to include an alternate (larger) image that appears when a performer holds a mouse over an image. This accommodates a limited space (as the default setting) within the interface, yet (through customization of preferences) can provide the hearing-impaired user images sufficient to understand (or read).

Allow Customization. Typical customization deals with interface features and options. In the same manner, much of what is discussed above regarding media layers should be adjustable to performer needs in application preferences.

Consistent Use of Visual Conventions. This attribute's association with media types is intuitive and already well accepted due to current software and website design standards.

Summary

There are many reasons to consider incorporating rich media into PCD appliances, including cognitive, accessibility, and performance rationales. A slightly different categorization of media types has emerged that fosters PCD. Viewing media in this manner helps the designer focus on central aspects when designing: performer needs and synchronization with those needs. Finally, media can be incorporated to augment and enhance traditional EPSS attributes.

Altering course is never easy, whether it be in the process of design, use of media, or river rafting. Currents abound, barriers frequently appear, and weather sometimes cancels the trip. This is true as much in organizations as on rivers. The chief question then is whether the journey ever begins or it languishes in "planning stages," having been scuttled early in the process. 🍄

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Dave Schubert returned to the United States this year after working in the Cayman Islands, Mexico, and two other countries since the mid-1990s. Dave has 12 years experience in training and course design related to applied science and motor skill development. Exposure to different cultures, work environments and language developed his interest in enhancing cross-cultural interactive design while avoiding outward complexity. His passion for digital photography, desktop virtual reality, and other interactive media play into that interest. In an effort to broaden his perspective he worked as a website and multimedia designer for two years. Dave is currently attending (online) the Instructional and Performance Technology (IPT) Master's degree program at Boise State University. He is also looking for creative new challenges. Dave may be reached at cyberdiver@mac.com.

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