

Transcript for "Information Processing and the Brain"

Over the last 20 years, advancements in technology have enabled new methods for studying how the brain functions. This has given us new insights into how people learn. In this program, Dr. Jeanne Ormrod discusses how neuropsychology can help us to understand the information processing functions of the brain and how this relates to cognitive theories of learning.

A big component of cognitivism as an approach to learning is information processing theory. Information processing theorists focus on the specific things that are going on inside the head as somebody learns or behaves. And, if you look at some of the research, it gets incredibly picky in terms of very minute cognitive processes that are going on, and those are really not very useful to an instructional designer, but the bigger picture is highly important in terms of what particular cognitive processes are going on. For example, to what are people paying attention? What kinds of things draw their attention? In what ways do they think about something? What kinds of meanings do they attach to something? How do they interpret something? What do they think about in terms of, "What can I do with that information?" All of these things are part of information processing.

When cognitivism as a perspective arose, largely in the '60s and in the '70s, the thinking was initially that we probably think a lot like computers think, and we developed a computer metaphor for thinking. So what you will see in classic cognitive theory and information processing theory is words that have that computer metaphor. For example, we talk about storage of information in the brain or in the mind. We talk about retrieval of information from the mind. Those are from the computer metaphor.

We have found that the computer metaphor doesn't work very well. It seems that we don't think the way computers do. People don't work—don't think in that "one thing leads to another automatically" kind of way. We tend to branch out in a lot of different directions all at once. Simultaneously things are going on in a way that, traditionally, a computer doesn't do, so the computer metaphor has largely broken down.

In the past maybe 15 or 20 years, neuropsychologists have acquired a lot of mechanisms for studying thinking and brain function in a way they didn't have when cognitivism first arose. For example, we now have something called fMRI (Functional Magnetic Resonance Imaging), which involves basically putting a kind of big hat with lots of wires to measure different signals in the brain, while asking a person to do something—a very simple task, maybe recognize a picture or remember a word or something of that nature—and then look at brain patterns. Where's the activation in the brain?

And so we're starting to get to the point now where we can connect what's happening with the brain and what we see a person doing behaviorally in terms of what they remember, how well they can solve problems and so on. But right now, most of what we know about learning that's of use for an instructional designer comes not from brain research but from studies of people's learning and behavior. When we look at learning from the perspective of information processing, we make a distinction between storage and retrieval: storage

being when you're actually acquiring the information and retrieval when you already have it. Now, they're not as distinct as you might think in one important way, and that is, how easily you retrieve it depends quite heavily on how you stored it to begin with. For example, if you store something, if you're learning something and you decide that the best way is just to say it to yourself over and over and over again, something we call *rehearsal*, then it's going to get there, maybe, going to get into long-term memory in a way that's probably going to be very difficult for you to remember later on, as opposed to if you learn it—if you store it initially by relating it to things you know and relating to situations in which you might use it. Then later on when you do need that information, it's going to be a lot easier to recall it because you know where to look.

There are a number of ways in which we store information in long-term memory. There's not just a single way. Information that we remember takes a lot of forms. For example, some of it's in a verbal form. We store it as language, in words. It sometimes is stored in underlying meanings, a sort of a general gist of what just happened. Sometimes it's in images. We do seem to have an amazing capacity to remember what we see, largely in an image form, but in general, visual imagery is a highly effective way of remembering things. People can remember things for a long time if they have a vivid visual image of it. One of the things that we know from research is that if you get information in two different ways and you store it in two different ways—we use the term *encoding*, or "to store in different formats"—that if you encode it in two different ways, it tends to be much more memorable than if you only encode it in one way. For example, we know from research with online learning environments that when learners see something and hear something both, they remember it a lot more effectively than if they just saw it or just heard it. Now, we have to be careful here, because we don't want to overload people and give them too much at once. And so we have to keep things fairly simple, but one easy way to do this is to have a diagram they're looking at and then a simple verbal narrative that they hear that describes what they're looking at in a simple, memorable way. This is much more effective than just having the picture or just having the verbal message.

One of the reasons we don't really use the computer metaphor any more—well, at least not much—in talking about how people learn is that there's one critical way in which people are different from computers, and that is that we have feelings as well as thoughts. And a lot of our thinking and learning has emotional overtones, and sometimes they're very subtle, such as, "This is interesting," or, "This is potentially exciting," or, "I'd like this." Sometimes it's a much more dramatic emotional overtone such as, "This makes me really angry. I can't believe these people do this." Or, "I am really excited about this idea. I can't wait to go try it." Computers don't do that. They don't have the emotional component, and so that's something that instructional designers need to keep in mind is the very human nature of learning with those emotional overtones.