RAND SPIRO: -- a quick RI. Brian Collins, Aparna Rumshandrun and a lot of the stuff for the program during the show here. And we also have Anne Marie Palensar, Shirley Magnuson and Susanna Hapgood, Nancy DeFrance. Thank you, all. Everything I'm going to show and talk about relates to the work I've been doing since the mid-1980s in cognitive flexibility, theory and the learning environments, cognitive flexibility, hypermedia learning environments based on cognitive flexibility theory. We call this theory of learning a mental representation in its instruction form random access instruction so it was great to hear Ken talk about random access and its affordances. From the very beginning with the Kane Program, the cardiovascular world, the Explorer and others of our programs, we use a model of criss-crossing a landscape is our model of instruction. That's the metaphor comes from the preface to Vichtenstein's Philosophical Investigations. Trying to make sure we don't approach any single subject matter from a single direction but rather criss-cross a landscape of knowledge and experience so that when you look at rich sites within that landscape, cases, examples, conceptual clusters and so on you can return to them later and see them from other contexts, other points of the landscape you're coming from so to speak, and facets of
complexity that are hidden in earlier perspectives become revealed. One of the things it's useful for doing in addition to helping people to notice things they didn't notice before because you're seeing them in a variety of different connections is it builds multi fibrous kinds of relationships, important and complex and sometimes (inaudible) structure domains like teaching instead of strength of a representation being indicated by having a single thread that runs through the whole thing. Rather it's the overlapping multiple fibers that determines the strength of connection. And that provides something very important. Lots of different possible assembly routes for situation adapted knowledge generation to fit the needs of a particular situation, a schema of the moment to deal with a new problem that you're encountering. It's a way of thinking of things as if you had multiple tables of contents in a book, almost infinite ones. Chapter two might be connected to something important in chapter seven of a book but, you know, you're not going to notice those connections. We try to build essentially the capability to generate lots of tables of contents significant to situations for the demands of a problem solving situation of text they're trying to read, a case they're trying to deal with and so on.
Okay. Video. I've argued that we can do more for learning from video than we've done before. We tried to use lots of different channels to get beyond seven plus or minus two limited capacity processing kinds of problems. I'll talk about some of the perceptual enhancements we put on so that people can both deal with complexity and make it tractable. Our goals, changing underlying habits of mind. We've got a lot of data indicating that people have a tendency towards a reductive world view, single answers, single representations, single prototypes, schemas where you need multiplicity in all those different areas. You need context dependent knowledge applications. People tend to prefer context independent ones. Compartmentalization or chapterization, componentialization of knowledge when you need interconnecting (inaudible) law and multiple dimensions and so on. We try to combat those habits of mind, world views, mindsets, ways of thinking, what have you by again using the affordances of the media. I'll talk about some of that work later. First though, I want to show one of our systems that illustrates some simpler things first up to some more complicated ones. First of all, continuing that landscape criss-crossing metaphor, we begin with Crossroads Cases. This is our cherry picking. Yesterday during the question and answer after Fred's
panel, I proposed several criteria for selecting these
dense, rich, effective scenectochies if you will. Worlds
in a grain of sand I've argued sometimes the only way you
can see a world is in a grain of sand. We have a problem
when we're trying to comply complex knowledge how to make
it cognitively tractable, how to make it manageable. Well,
with these cases, once you've invested in seeing two
minutes or three minutes or four minutes and they're all
mini cases, there are lots of different lessons that you
can draw for them. So what you get is an investment that
pays off. We return to these cases and the cognitive
flexibility theory we're visiting is not repeating. So and
then as I'll show at the very end when I talk about our
goal of experience acceleration, once you've work with one
or two or three of these cases enough times, you don't need
to see the whole two, three, four minutes. What you can do
at that point is we show an epitome, something that
epitomizes that case five, ten, maybe 15 seconds tops.
You're reminded of all the rest that you had missed. And
what you can now do is instead of taking seven minutes to
see the three-minute, four-minute case that you might want
to compare and contrast, in that seven minutes, we can do
20, 30 comparisons of highly overlearned rich, dense cases.
We can test to see whether the effect is happening what we
might think of as an along for the ride effect. If you're showing a ten-second epitome from a larger case, you can test to see whether connections are being made from the unshown, larger part of the case. We call that the along for the ride effect.

Anyway, we start with these Crossroads cases, and those are picked according to those five or so principles I articulated yesterday in the discussion session so I'm not going deal with those. I've got the wrong key. Sorry about that. Okay. First step in any cognitive flexibility hypertext system is to do a conceptual variability search. By the way, we do have these, responding to Rogers' earlier question, we do have these as you can see at different levels of abstraction. Sometimes they go to three or more levels of abstractions. We want people to be able to come and find the right access point, higher levels of abstraction for novices, more specificity for more expert people. This program, let's just do a search for scaffolding, is teaching teachers within this professional development setting. We've got a lot of data about how fast they got up the curve to expertise in ways they were thinking that normally would not happen in a typical setting of this sort. One of the instructional strategies we're teaching here is reciprocal teaching developed by
Palensar and Brown. Why a system like that for reciprocal teaching? Well, read about that or any other instructional system, and there are some basic beginner instructional manual kinds of things that you can do. They're codifiable. A ton of it though gets uncodifiable very fast. Gradually shift the scaffolding, you know, with more student responsibility at such and such a point. Well, you can't specify what those points are. Those come with experience. You got to see a lot of different examples. Nobody leaves a one-week workshop on reciprocal teaching and knows what they're supposed to be doing. We had our people leaving with more ready to go experience because we were able to show them the different forms that these things take. So, you know, what's scaffolding? Well, scaffolding is a lot of things, but the first thing you do is we try to teach people to get in this habit of mind there is no definition. It's a Victensteinian notion, meaning is use. You've got to see a lot of different uses, see the patterns, the family resemblance, the partial similarity, partial overlap. Right away you can see that we've got lots of each of these clips. And if you wanted to know what these short ends are, you can just go to the index and get all the information about them. But many examples in this case of reciprocal teaching using
scaffolding. You go through five, six, seven, eight of them right away you know that scaffolding takes different forms and different situations.

So first simple step, we always begin with a conceptual variability search to show this notion that it's family resemblance, not generative definition. We have standard compare and contrast formats so you can now, you know -- I don't know why that's happening -- but anyway what I want to show you though that I think is really interesting is -- damn, let me just put it in reverse for a second -- is this quadrant format. As you know, once you start looking at interactions, two-way interactions are interesting, three-way interactions are interesting, four-way interactions you're really getting to a point where things get interesting. So in this professional development data gathering setting, one of the things we had them do is, all right, groups of two or three use the system, generate a four-part story about scaffolding to show its various forms and so on with an emphasis on, and we do this, of course, in a variety of different domains. It's a useful exercise. Look for surprising similarities. Look for surprising differences. All right? Things that at first might not look like they were both scaffolding and lo and behold, both scaffolding. Surprising similarity. A
surprising different is two things that look like they're the same kind of scaffolding right off the bat, but if you look more closely, the teacher's doing something subtly but importantly different. And since advanced learning is our goal, it's those subtle nuance expert distinctions that we're trying to get at. Surprising similarities, surprising differences. You can see by the way it's real easy to use this to put things into the different quadrants. If you want something in the second quadrant, you just roll over and that one will go into the second quadrant, third quadrant and so on. You can swap them in and swap them out. They each have their own playing bars. You're supposed to be able to see that on the screen, but it's coming up probably too small. You can also see there's lots of resources associated with all these things. If you've seen it enough times, you can see the epitome, the short form so you don't have to watch the whole three-minute scene again, just enough to be reminded which one it is. Commentaries where the, you know, in this case Anne Marie, we also did this questioning the author, another instructional strategy. Linda Kukan did that. In case I forgot to mention Linda Kukan before, she was also integral in this project. So you got people talking about these things. You get to see where in the text they were, the
kids were when they were doing the reading. I'm not going to go through all that stuff. And connections with other cases that seemed to be nice though again we don't need to have these precompiled links of cognitive flexibility systems. It's always been generative. We have themes that generate multiple kinds of linkages by combining those themes so we've never relied on precompiled links. We want people to find their own connections, and we don't want to tell people how to think about these concepts. We want them to see that they have to find the patterns of use of these concepts in a way that anything we would tell them would inhibit them from getting.

Let's see. Very important in all of our systems is the ability to combine themes. Okay. So scaffolding takes a lot of different forms, but then we're giving people, you know, exercises to think about, okay, you learn something about scaffolding. How is that relating to other problems you might have. So they'll think about some problem from their own practice and they'll say, well, you know, one thing is, you know, knowing when is it when I'm going too fast, when I'm going too slow. So now, you can start to build much more complex hypotheses about how all these things work. So, you know, you might look at scaffolding in connection with issues of pacing. And now,
you'll see a set of clips on the left side. The ones in blue are questioning the author. The ones in red are reciprocal teaching. And those are clips that all tell an interesting story about how questions of scaffolding relate to issues of pacing. And you can build these up to three, four, five different conceptual ideas coming together building increasingly complex understandings, testing them out against the data that's in the video itself. And sort of forming a kind of playground in the mind. You know, combinantatorial idea play is so important in coming up with new ideas. Einstein talked about it. Every creative person in history has talked about some sort of play of ideas. What we're trying to come up with here is a conceptual idea playground connected to actualities of practice. And again you could put this into quadrants, framework or pair wise, and you can start to play with increasingly more sophisticated combinations of these key concepts.

I mentioned, let's see, by the way, of course, you can get all these clips indexed and find out about, you know, what each one was, play it, you know, hear more about it. You can build visual essays very quickly. By the way, one name I didn't mention who also has done a lot of this kind of thing and, you know, is Ricki. So, you know, a bow
to Ricki for the things she's done that are somewhat similar to this. I also should mention Sharon Derry has worked with me on some other things that I won't have the time to show I suspect today so but, you know, Sharon has played a big role in all of this. All right. So let's see. I'm not sure where these -- they should all be showing up on one screen. So here we are. We're at this NSF meeting. What we did with our professional development people, we said think of a problem you've had in your practice working in groups of two or three and use the system. This is sort of an end result kind of project to put together your own visual essay. So just very quickly let's say you wanted to use these four clips but you can use any ones you want. Start the visual essay. You put in -- you can switch the orders just like you -- the sequence just like you would with NetFlix. I chose this one first because, you know, so you write your whole thing. It goes on and on and on. With the second clip, you say whatever you want to say about that one. The third clip, whatever you want to say about that one. All right. And you would go on, make it as long as you want. And there you go. You've got a visual essay with a text you can see on the right with scroll bars. You can play it. You can share it. You saw what I just did. I didn't write in all the
text but, you know, the actual technical time to build this visual essay and show it is seconds. And all of these interfaces, the teachers sat down, worked in groups of two or three. We've got all kinds of film about how excited they were, not to mention how quickly they got up the learning curve going talking about things like scaffolding and saying, well, wait, this doesn't fit the definition of scaffolding. And by the end of an hour, they are talking about the most subtle degrees of variation across different ways you would have to place scaffolding across different characteristics of context. They were writing these visual essays right away and so on. All can be played. All can be shared. So that kind of thing.

The last, I think --

ROY PEA: Two minutes.

RAND SPIRO: Let me just say something about experience acceleration, and then I'll just allude quickly to some of the perceptual enhancement stuff that I've shown at IERI meetings, ARA meetings. I think that Kevin was referring to some of that yesterday. So let's see in menu. Okay. I'll just do this really quick. Okay. So now, imagine, all right? You've watched some of these clips chosen because they're rich and teach multiple lessons. The clip might be a minute and a half, might be two
minutes, three minutes, four minutes. How many times do you need to see a three or four-minute clip? Not very many before you're starting to remember pretty much everything inside that clip. All right. Okay. One of the things we do then is we shift to this epitomes mode where what you do is you pick out a family of -- and either the learner or the experimenter or the instructor can do this. And what happens in this mode is you're assuming, first of all, not only have you seen all these clips in their entirety as well as then playing with them in smaller parts as you became more experienced with them. But they're overlearned. You're ready to start working fast at them. So in this mode what you get is only the short form of the longer clip, and you can start making many ways comparisons very, very quickly. It's actually quite impressive. I have to save this. All right. So here we go. And I'm not going to actually be able to -- all right. So in this mode, this is one of the more advanced modes. You can put up to like 12 or 14 or so of these in there, and what you're getting is something like an MTV or, you know, modern day advertising. It's a lot of quick cutting, but it's quick cutting of rich, dense information that you already have overlearned. You're ready to work fast with this rich and dense information. I mentioned the along for
the ride effect. You're able to show that even though we show ten seconds from a two-minute clip, people are making connections from those comparisons between the unshown parts that they had already seen and they're just coming along for the ride because the material is overlearned. So, for example, with science learning, we're trying to show how kids are learning to do controlled experiments and stuff. We can put up 11 of these things, and there'll be one clip about how a little balloon car that's being powered by balloon is moving forward, then it's moving back at the very end of the board. And you're supposed to be trying to measure it. Where do you measure? Cars are bouncing off walls. People are able to see how that's kind of different from the question about the balloon getting stretched by the time they do their fifth measurement. And what's happening then is people are so quickly starting to see what these subtle degrees of difference are in issues of measurement, control and so on in experiments capitalizing on the investment you've already made making orders of magnitude, more comparisons once you reach this more advanced stage than you ever could by comparing a two-minute clip and a three-minute clip. You can make 15, 20 comparisons that are starting to stick. And we've got some data on that.
Bottom line, new media, the digital revolution are making possible a new cognitive revolution. I've referred to it in a new column I'm writing for Educational Technology Magazine and have titled the New Guttenberg Revolution. I would argue that new kinds of thought, kinds of thought by the way that old timers like me aren't very good at because I didn't grow up with MTV and video games, new kinds of thought that are getting closer to the natural speed of thought, the speed which was slowed down when we went to speech and then at the next epochal juncture really slowed down when we got to writing and reading. We're ready to speed that up again and to deal with the kinds of increasing complexity, change and so on that characterize the modern world and for which existing modes of instruction are not well suited.