VIEWPOINTS RESEARCH INSTITUTE

2015 Aspen Institute
Kennedy Center Arts Summit
with Alan Kay and Sarah Lewis

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MALE VOICE 1: One of the cool things Alan once said was when he was at Xerox PARC, he was doing the Dynabook, which is really the prototype for not only laptops, but the iPad. But it was for individual creativity. It's for a kid to take in the woods almost and make something beautiful with, because he believed tools are empowering and empowerment means to be able to create art.

But he was working at a research center owned by Xerox. And so his boss, one of his bosses there, I think it was, kept saying, Well, how is this really going to help us? What's the future going to be like? You know, give me a report on the future. And Alan's answer was the best way to predict the future is to invent it. Alan Kay has done that. Thank you, Alan.

MR. ALAN KAY: So let me just get started one more time here. So I'm very happy to be invited here. This talk will be a little bit different. It starts in the same domain that this conference has been about, but is going to be a little bit different in the way it approaches the ideas here. And I'd like to dedicate this talk to Jerome Bruner. Many of you will know this name. Jerry is now in his hundredth year of advancing civilization, one of the most amazing people we've ever met. We love you, Jerry. And Howard Gardner was a student of Jerry's, as we all were in way or another.

And I'd like to start off just by saying this talk is kind of a budget of metaphors because I'm going to have to go from areas that we're a little bit familiar with, like this old metaphor from actually the 19th century about human memory, which is actually not so far from what actually goes on. That rain comes down, hits randomly on the ground, one little place, some stuff gets moved, the moving of that stuff makes a little channel. The channel funnels the rain more efficiently in the area, and pretty soon you get one of these. And we can wander around in it. And this pink context can actually seem to be everything that is in our world. If we grew up in the Grand Canyon, we might never even think to look up. It's all around. And we wouldn't even know it was pink because, as McLuhan said, "I don't know who discovered water, but it wasn't a fish."

And so this first idea is this idea that we are always embedded in a context. We're rarely aware of the extent of the context. And because of our limitations in a variety of different ways, even the context that we're embedded in, we only get to experience a little bit of its influence at any given time.

So here's an experiment you can do. You can actually do it with your thumbs. You don't need quarters. If you hold up one quarter or one thumb twice as far away as the other and look at them, it turns out on your retina, the one that's further away will be half the size on your retina. And Descartes actually peeled the back of an ox's eye in order to see if a biological lens worked the same way as a glass. Walter knows all this. And, yes, it does.

But, in fact, that eye is connected to a pachinko machine, known as our brain, and those optic, those signals in the optic nerve go to a lot of different places, about a dozen different places. And that brain is actually active. And the process that it gives rise to is made up of two things. One is our beliefs. I've colored it pink like the Grand Canyon. These are the things that we both genetically think are true and that we culturally think are true. And those beliefs affect what we like to call reality, but is actually a waking dream. We are, in fact, hallucinating all of the time. And if you've ever tried an isolation chamber tank in the sixties—they're coming back, by the way—tried them, about 15 minutes in there without any ability to detect any sensing information at all, you start hallucinating and go on the equivalent of an LSD trip, because this waking dream is not just made up of our beliefs, but it actually requires constant reference to the world around us in order to more or less stay on track. Otherwise, it starts acting like a sleeping dream.

And so what happens to those two quarters is we know those two quarters and our two thumbs are the same size. And so we pass the information from our retina through our beliefs, and in our waking dream, the one that's half the size on our retina comes out being about 80% of the size of the one that's closer to us. And this was one you cannot shake. It is really hard to shake it. You can mount the quarters on a ruler to make everything—it is really, really hard. And there's dozens and dozens and dozens of these.

And so, basically, we cannot even see what's on our retina. And what that means is that in the context of the word "sanity," the best we can be is what Korzybski terms unsane. We are always unsane, and we may be worse than that. So this is one idea of the influence of context here. And McLuhan had a great line. He said "Until I believe it, I can't see it." This is much more the case than the way that line tends to go.

And right outside my hotel a few days ago in New York, this happened—the guy with the hammer. And as reported by the New York Times, Mr. O'Grady said he looked like he was trying to get away from the officers when he was shot. I saw another. Mrs. Kalza [phonetic] said, "I saw a man who was handcuffed being shot. I am sorry. Maybe I'm crazy, but that's what I saw." And take a look at the upper right-hand corner. Here's the guy chasing the cop with the hammer and here's the other cop shooting him. I don't see any handcuffs. In fact, dozens—because it was captured by a camera, this is going to lead into what science is all about, which is absolutely getting away from what we like to think about the world.

We have to use instruments to get around with what's wrong with our brains. And those instruments are not just physical instruments, but some of the instruments are actually instruments to help us see things that cannot be seen. So, fortunately, this was all captured and we got this perfect record published in the New York Times and with the video on YouTube so you can actually check it out yourself and see that these memories, which were right after it happened, were actually manufactured by what people believed.

[Video playing]

Okay. What is that look on her face? What is the look? She's frightened out of her mind because that pink world that she was in suddenly got violated. And it got violated, and that violation was detected by a fast-working system that's part of the way our brain deals with things. We have to deal with real-time things, and a good way to deal with real-time things is with pre-stored patterns. We've got zillions of them. Most things we do in real time are dealt with in a more skillful way than a cognitive way. And the transition here was some release from that. And then she's so happy. Ever had this happen to you?

Now, she could have been listening to a piece of music and had the same reaction. It's like, Holy shit. Where am I? What's going on here? Well, the fear reaction not only gets adrenaline going because you might have to run or fight, but because you might have to fight, it also gets dopamine and other neurotransmitters that are actually opiates. And so the fear reaction actually dopes you up so you can contend with danger without feeling pain. And when your cognitive system says, Hey, there's no danger, you're coked up. And all of a sudden, you have this fantastic feeling. This has been studied very carefully over the last 20 years, using PET scans and functional MRIs. And so it's a very interesting thing to think about.

And Daniel Kahneman wrote the book, Fast Thinking and Slow Thinking. Again, a metaphor calls the fast thinker System 1 and the slow thinker System 2. And just so we remember that these are metaphors, here's a classical book called, Maps of the Mind. It has about 40 different theories of mind in it, not all of them incompatible with each other. It doesn't even matter what the theories are. The important thing is to realize that no matter what you throw at the mind, there are other points of view on it. And so System 1 and System 2 is really a useful metaphor.

But here's the cool thing about System 1 and also the dangerous thing about System 1 is it doesn't matter if you know you're safe. These kids absolutely would not get on that rollercoaster if they thought there was any chance of them dying. But look at them. If we were to stand next to a door and I slam the door like this, you would have this reaction even though you know it's just me slamming a door, because System 1 is set up to respond, among other things, to loud noises. Genetically, it's set up to respond to reptiles. It's hard to shake that.

So one way to think about it is that System 1 is fast reacting and slow to train, as anybody who's ever learned a musical instruments knows. You play a musical instrument primarily with System 1 as far as all the technical stuff goes. And it takes awhile to train it. And System 2 is much faster at learning, but it's much slower to react, because it actually has to think about things. So you can do peekaboo over and over and over again. And one of the ways of thinking about what the arts and the sciences are partly

about, the joy there is the joy of this kind of surprise and this kind of release.

So now I'm going to make the Grand Canyon into a flat plane. I have an ant thinking its way along. The ant can run into an obstacle, it can plan its way around it, it can do many, many things—all the trappings of thinking—and it never realizes it's only thinking pink thoughts. But the ant can wander along or be led along, it could have a little blue thought. And what the ant has learned up to this point is critical because the ant has been to school, the ant has gone to church, the ant has been indoctrinated into the pink world. Kersplat—that little blue thought gets wiped out. But every once in awhile, you're taking a shower, you're in a concert, you're in some place where you're a little bit disassociated, you can get a Whoops. That Whoops puts you into a different context than the one you're in. I'll call this the blue context.

It can be a little bit different from the one you're in. It can be enormously different from the one you're in. And the basic reactions to this are the reactions of that teacher. So the simplest one, for instance, is a joke. The joke is leading somebody down the garden path and then revealing it's about something else. But discovery—aha. And there's, in music, you have mm, ah, and ah, and ooh. I didn't want to try and define art here, so I'm just going to stay with these sounds. These are the sounds that people make when they are taken out of one context and put into another. And I don't need to go any further.

The important thing about if you're creating or running into one of these ideas from somebody else is the idea might be terrible. It's independent. Just because you had this epiphany doesn't mean much. In fact, many people who had these in the old days would start religions on the basis of them because they seemed to come from heaven. But, in fact, most ideas are mediocre down to bad. And I think everybody here understands why. It's just hard to have a good idea.

And another part of this, and this goes against the myth, particularly the American myth of doing everything spontaneously, it can take a long time to have those Whoops's. It can take years of bashed [phonetic] ground to have those Whoops's. Coolidge, who is a theatrical critic as well as a poet, wrote in a review, "People go to bad theater

hoping to forget television, but they go to good theater, tingling to remember." And so everybody here who has done theater knows that what you're doing is try to set up what's called the magic mirror in theater, which is to beam the audience's intelligence back out at them. You're trying to wake them up. You can't tell them anything. Like I can't tell you anything, but I can get you to think of thoughts that you might not have thought when you walked into the room. You already have them, but they're masked by other things that you're doing.

Paul Hindemith in a composer's world was the guy who came up with—the first time I saw this phrase in the fifties—co-creation, because that's what he says is happening when you're listening to music is you're co-creating along with the composer. And if it's completely random, you get upset. If it's completely predictable, you get bored. But if the composer puts in things that you didn't anticipate but you can instantly see that they actually were part of this larger scheme, you get catapulted into this other world. The composer is showing you something that you didn't anticipate, but yet it fits into this thing. So I think this is a good idea.

This two-plane model is an idea of Arthur Koestler called bisociation. He was particularly interested in the Whoops—having a foot in both worlds, but I think you can see you don't have to have a foot in both worlds. You don't have to have an analogy that takes you from one to the other. And then, of course, people like Richard Feynman have pointed out for many, many years that, Hey, these are the same, this is what scientists feel. Scientists have all of these reactions. And so by any reasonable sense of things, the science, and mathematics, and technology are arts. Like the rest of them, some of them are more recent and they're a little bit different in a way I'm going to try and show you.

But first, to get away from the words here and back to something that's a little more sensual, one of my friends is a glassblower. And we were fooling around—this is called a gather. And it's just one of the most beautiful things. I mean, it's beautiful to blow glass, but a gather. He held this thing up like this and he said, You know, if I could, I would take a bite out of this, because he loved it. And when you're in love, you want to merge with your beloved. That's another way of thinking about art. This is the way

scientists think about science. And so that adds another exclamation to all the rest of these.

So sensuality, these are dominant ones of touch, the earliest forms of sensing. Most of them are in the senses of the arts we know today. And I apologize to the artist who made this for only drawing on it for a couple of seconds as an example. It is really ugly to not take the time to enjoy each one of these. Here's another visual thing. And if I'd known what was going to happen this morning, I would have done this a little bit differently, but...

[Video playing]

There we see something marvelous happening in time, visuals, and music together. And I'd like the sound up quite a bit more for this next one. Music doesn't actually need visuals. That music actually really was aided by Baryshnikov, I think.

Imagine now, instead of having these lights here, that we're all in San Marco Cathedral in Venice with our eyes closed and we might hear something like this.

[Music playing]

I just love this music from the late sixteenth century. It's the most incredible stuff, but it's still sensual. It's invisible—Leonardo called music the science of the invisible—but it's audible. Walter's got all this stuff covered in his books.

But here's a great story. That's Einstein at age 4. And when he was recovering from an illness, he was given one of these. And here's what he said, "I can still remember that this experience made a deep and lasting impression on me." Something deeply hidden had to be behind things. And here's the problem, the problem with what we're talking about here with science and technology is that almost everything important about it is not just invisible, it's non-sensual.

My friend, Frank Oppenheimer, many of you will have known him in the past, did this marvelous place called the Exploratorium. And the Exploratorium, when it originally started out, had 500 exhibits, each one devoted to just one thing, which is the world is not as it seems. And the sponsors complained. They said, We wanted a science museum and you made an ash [phonetic] pit. There were all these

children running around, bashing on things. And Frank said, "You don't understand. The gateway to science is to understand that the world is not as it seems in the most profound fashion." You have to start from there, because otherwise you're constantly being distracted by how the world does seem. And so these are the arts of nonsense and the arts of non-story for the most part. They're narratives about scientists, but scientific knowledge, mathematical knowledge, this really isn't in a narrative form. It's actually what von Neumann called relationships about relationships. And I'll look at that in a little bit.

And it's not about this. This is what this form here is made here. We are around a campfire right now. And I'm using oral means and we heard that oral means are very important, and they are. They're important for telling stories and those are. I don't want to replace those. A lot of our joy about being human beings is about the stuff I've been talking about, but I'm talking about something different, something really different. It's an additive, one of the biggest additives the human race has ever come up with. And every part of it has to be approached through this non-sense way of dealing with things.

And here's one of my favorite. So this is back in the 18th century. I have one of these. I love this. This may be it's last trip because they're made out of paper on here. So this is, well, 200-some-odd years ago in the late 18th century. People in coffee shops in England and Europe had these little globes. They could take them out. And they would talk about what the earth looked like from space. They knew, because when we went out there, just as was described. The most interesting thing to scientists was there was no surprise. It looked just exactly the way Chesley Bonestell had painted those pictures. It looked exactly the way the earth had been mapped out. No surprises of any kind. And the picture on the right is engineering. The picture on the left is science. So we can think of this as the birth of a baby, being able to find out things that you can't find out by really direct means.

And here's a nice picture of how India was mapped, and using various instruments, chronometers, sextants to find out where you are and fiadalights [phonetic] to measure things around. And it was done by piecing together evidence. And a critical idea here is that the, you can think about what science,

math, and engineering are from considering this diagram. The content of all these areas is kind of like this. It's a system. There isn't really a narrative here. It's more complicated than a narrative. There's no place to begin and end. Everything is related.

In mathematics, you can get this point to be in the same place because you're not reasoning about the real world in mathematics. You're only reasoning about how relationships work with each other abstractly. In science, you can never get those points together and, in engineering, you can never get those points together for two different reasons. So you have this idea of tolerance. And yet, what you get out of this is plausibility. So India is represented here and in the maps today as plausibly similar to a very, very high degree with what's actually there. It's not exact, but it's better than any form of falsehood from the past.

And here's one of the great books of all time. Most people have never read it. Most people are never trained to read it. And yet, it had as big an impact on human thought as anything a person could think of. I put it in the top five. Every part of this is a beautiful thing. And yet, you have to understand some mathematics, you have to actually be willing to plow through it. It takes some years of preparation. It has all the trappings of what it takes to appreciate classical music and other developed forms. And if you don't do that—for instance, one way of thinking about, if System 1 isn't fluent with a lot of the trappings of this stuff, System 2 never gets a chance because there's just too much stuff there.

Similarly, what's interesting about magnetism isn't what the iron filings show or even what Faraday and Oersted found out that by putting a current through a wire, a magnetic field is somehow created that acts as though a magnet has happened. What's interesting here is that the only descriptions that we know of this that are any good are in the forms of mathematics that is a very, very cold dessert to learn how to eat, because what you're envisioning here is not anything that is physical. You're envisioning what the relationships of this particular kind of mathematics have. So, as Galileo said, "The language of nature is written in mathematics," and most people don't read that language.

Similarly, and what's interesting in molecular biology—this is Charles Darwin as a younger man, Endless Forms Most Beautiful—the problem is the wave lengths of light are such that the detail that's shown here had to be simulated because we can't see them directly even with a light microscope. It would have to be found out the same way the world was mapped and by using electron microscopy, which, unfortunately, kills the animals in order to see some of the details on them.

Computing. So much similar to what biology is about, modern biology. I wound up getting degrees in both of them, and there are so many parallels on them. And as beautiful as this wafer is, it has nothing to do with computing. As beautiful as silicon transistors are, it has nothing to do with computing. You can make computers out of rope. You can make computers out of paper clips. What's really beautiful about computing is what it can do and how it actually does it abstractly.

So a metaphor here is the computer is an instrument, like a musical instrument whose music is ideas. When Ada said the analytical engine, we use algebraic patterns the way the jacquard loom weaves flowers and leaves. She understood what the extent, because it's the projection out of the mere machinery that counts.

So here's an image of four intertwined systems that we live in because now we're getting, one of the lingua franca, if we're talking about these areas that this session is about, is actually systems. It's not really even just science or engineering. So on the right there is the system of the universe, nature. In the middle in the back is our social systems. On the right-hand side is our technological system. That is a self-portrait of the internet. And then there's us. So we could call this the systems that we live in and the systems we are. There's a way of thinking about all of these ideas.

And the thing that most closely approaches this is writing. And see, I would disagree with Megan—and she didn't actually make it up. The internet is not the most important thing. It's the most important thing since the printing press. Writing is much more important than either of those. The printing press is a great amplifier for it. And part of it is that getting fluent, getting System 1 again, fluent with

what it means to become a reader and a writer changes us cognitively.

And here's something that we did as a systems design quite a long time ago. And it's just wonderful that you can—if I've got it here. I love that you can just hold the thing up. And it's an operating system for us. You could think of it as the TCPIP for the human race as a start, not a perfect system. But what was interesting is not just the result, but actually how they arrived at the result. And the Constitutional Convention, by the way, I recommend James Madison's notes, which are the most comprehensive notes taken on this secret proceeding. They set things up in really interesting ways and occasionally with correctives to try and damp out the natural tendencies of human beings. And they did it in a fantastic way. And it's something we should talk about because this is, this process of making progress in the face of disagreement is almost a lost art.

I got this from Walter's book. "We are sent hither to consult, not to contend." And then here's his famous statement. "And then the thing to realize is that every time we do one of these things we are just making a new context. So it's a gully and we shouldn't act as though it's sacred and not to be changed."

Time is short here, but I could not find a way of not digressing for one second. Just because that's the nature of this stuff. So I think many people have learned about the Constitution and everything else, but there were 55 people. They weren't there all at the same time. But at any given time, there were 20 to 40. How did they vet the drafts? Think about it. The thing that's in the Library of Congress is written out by hand. So did they have 40 people copying each draft? No way. They typeset overnight each draft. They used the next technology, the technology that they weren't going to write the official thing in, the technology they could have actually used to put out the thing, but it just wasn't official. It was too new. But in order to make it readable, they, each draft—and this is a copy of the first draft of the thing—was done like this, with plenty of room for making notes, and cross-outs, and everything else. It's something to think about about technology.

So the problem, of course, is us. And, as I've been portraying us, we are kind of like cave people with brief

cases. In our brief cases, are remnants of our hunting and gathering past, a distaste for the other in concentric circles going out from our siblings, our family, our neighborhood, our country. All of these lead to rivalries of various kinds. We love revenge. We just decide to take revenge on the Boston Bomber. Instead of a spear, we have an atomic weapon. And the combination of these two is disastrous. We have the same old brain. We have to ask what's a better context for it. Surely, not pink. And that brain can also think itself out of the context that it's been in. We've done it several times. We just haven't made it stick with the larger population. We have not been able to improve the Constitution to the extent that it needs to be improved. And we have not been able to improve our conception and vision of what we should be. Thank you.

[Applause]

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