IU DAY

Play, Where Ideas Come From

Video transcript

[TedxIndianaUniversity logo and words appear: ALL TOO HUMAN]

[Image of Simon DeDeo and words appear: SIMON**DEDEO]**

[IUSA, IU Grand Challenges, Hutton Honors College, Indiana University Foundation logos and words appear: IU Research]

Simon DeDeo speaks: I want you to imagine, it's 12:30 at night. You close your eyes to sleep, you think about the bus driver that morning, nice guy. You think about how you embarrassed yourself because you were impatient in line, or you were late to class, or because you sent the email that you really should have left in the drafts folder, right? Never send an email from the drafts folder. You think, and it keeps you up. You get worried, I check my phone, but no, you don't. The room is dark, it's cool. You're under the covers, and as the anxieties, and the embarrassments fade. As the thoughts about what you did or didn't do, what you want or didn't want, what you got or didn't get.

As those disappear, something else comes to take its place. Something else that might be a conversation you have. A conversation without words, with somebody who doesn't exist. You might imagine diagrams, or cities. You might tell stories. You might in this state, solve a problem and you realize, and if the problems important enough, then it might jolt you awake. If it doesn't and those minutes before you sleep, your mind is at play.

[PowerPoint slide appears with image of a park with sunshine streaming through the trees]

Just as much as when you were a child, playing in a park on a Sunday afternoon. Just as much as when you're engaged in the activities that get your adult life meaning, because play is larger than a playground. Play is what we do when the universe forgets to give us a task.

This is weird, right? As a scientist I spent most of my time, we spend most of our time talking about activities that have a purpose. We have departments of economics, and political science. We have schools of business, and because we spend so much time talking about those things and not talking about play, we forget that play exists. Play permeates our lives.

[PowerPoint slide appears titled “Human behavior in the absence of goals” with a horizontal arrow across the page marking time from seconds to centuries and a list of activities under “seconds”: appreciation of complex artworks, dressing, greeting & leave-taking]

From the seconds to the centuries, we play when we appreciate a beautiful piece of art. We play, some of us, when we get dressed in the morning. We play when we figure out how to say, "Hello," to our friends.

[PowerPoint slide titled “Human behavior in the absence of goals” appears listing additional play activities under the timeline arrow between “minutes and hours”: jazz improvisation, dancing, improv comedy, meditation, production of a complex artwork, tea ceremony, Quaker meeting, “college bull” session, certain forms of sexual intimacy, Dungeons and Dragons (D &D) campaign]

We play when we hear jazz, we play when we dance. We watch people play on stage when they do improv comedy. We play in our spiritual lives, when we meditate.

We play when somebody invites us to dinner, and a conversation lasts for three hours. We play when we stay up all night in a college dormitory room talking. We play not just when we appreciate art, but when we make it. We play when we do Dungeons and Dragons. Okay, a dark secret is, scientists, sometimes we have a job, we're testing hypothesis. But most of the time what we're doing is we're trying to get money so we can just play. We just want to do it, we just want to play, we're curious. It's really hard to write grants and get money to do that, so we say something else.

We play, right? We play, we go on the internet, and we make up fake names, and we argue.

[PowerPoint slide titled “Human behavior in the absence of goals” appears listing additional play activities under the timeline arrow between “months and decades”: (certain forms of) intimate human relationships (love; friendship; marriage; &c.); (some) collaborative online projects; scientific experimentation (in absence of hypothesis or speculation); a single intellectual or artistic life; “hobbies”]

If we're lucky we play in our most intimate human relationships, in love, and friendship, and marriage, and child bearing. We play if we're lucky over the course of an entire life in our hobbies. Play exceeds us.

[PowerPoint slide titled “Human behavior in the absence of goals” appears listing additional play activities under the timeline arrow “centuries”: pure mathematics; lyric poetry; (certain forms of philosophy); (some) musical traditions]

: Civilizations play, cultures play, when they discover mathematics, when they write poetry, when they philosophize, when they play music.

[PowerPoint slide appears titled “Human behavior in the absence of goals” with quote from John Dewey: "An attitude of freedom, free from subordination to an end imposed by external necessity”]

I say we don't talk so much about play, it's not entirely true, people do talk about it. Here's John Dewey, John Dewey educational philosopher invented the lab school at the University of Chicago. He describes play as, "an attitude of freedom, free from subordination to an end."

We're not the only animals that play.

[PowerPoint slide appears titled “Human behavior in the absence of goals” with quote from John Dewey: "An attitude of freedom, free from subordination to an end imposed by external necessity”; and quote by Gordon Burghardt: “the animal is not strongly motivated to perform other behaviors. Not starving, not preoccupied with mating, setting up territories, or competing for resources.”]

Gordon Burghardt talks about how the non-human animals pay, when they're not governed by evolution, where they're not preoccupied with the four F's, right? Fighting, fleeing, feeding, and reproductive success." Aristotle, it's a biology joke. Aristotle ... There's no that many.

[PowerPoint slide appears titled “Human behavior in the absence of goals” with quote from John Dewey: "An attitude of freedom, free from subordination to an end imposed by external necessity”; quote by Gordon Burghardt: “the animal is not strongly motivated to perform other behaviors. Not starving, not preoccupied with mating, setting up territories, or competing for resources”; and quote by Aristotle: “The enjoyment of music comes near to being…a final aim of action because it is sought not for the sake of future good but for itself.” *as appearing in Michael Harris a mathematical apology]*

Aristotle talks about play, he doesn't call it play, he calls it, "Idleness," he praises it, it's very un-American. For Aristotle, music comes the closest to true idleness. The idleness of a gentleman, one day when the robots do it all for us, we will all have to read Aristotle. When I wanted

to understand play, I actually, I didn't look at music cause I'm terrible at music, I can't read musical scores. I turned to mathematics instead, that's surprising, right? Mathematics, it seems like the least playful thing. You have a spreadsheet, if the numbers don't add up, everybody's fired.

Mathematics actually, it turns out that's old mathematics, that's like 400 years ago. Mathematics was still tied to the real world. Let me tell you what mathematics has been up to in the last 400 years.

[PowerPoint slide appears titled “Banach-Tarski Pardox” with image of one green ball, pieces of a green ball above an arrow pointing to two green balls with quote: “Given a solid green ball in 3-dimenisional space, there exists a decomposition of the ball into a finite number of disjoint subsets, which can then be put back together in a different way to yield two identical copies of the ball.” figure credit: Benjamin D. Esham/user.bdesham.wikipedia]

: This is a piece of mathematics called the, "Banach-Tarski Paradox." It says that if you take an orange and peel it into five pieces, and you're really careful about how you peel it, you can reassemble it to cover two oranges of equal size. That makes no sense, right? I mean if it was true, it would revolutionize how we harvested oranges. I'm not saying it's wrong, it's just the rules the mathematicians follow were no longer constrained by a need to describe or answer to reality. This leads to the Calvinball problem.

[PowerPoint slide appears titled “The Calvinball Problem” with images of a *Calvin & Hobbes* comic strip attributed to *Calvin & Hobbes,* Bill Waterson and snippets of five scholarly mathematical articles regarding the decomposition of spheres]

Do you know Calvinball? Bill Watterson, the great cartoonist. Theorist to play you might say, and his most playful creature of all, Calvin and his imaginary tiger Hobbes. They play this game, it's called, "Calvinball." The problem with Calvinball is that every move in the game, the rules change. The game evolves just as fast as it's played.

If mathematics no longer has to answer to the real world, that you can peel an orange into five pieces and get two, well what stops it from becoming just a system governed entirely by whim? I said I wanted to study mathematics, I couldn't cause the mathematicians were too disorganized. I got the next best thing, like second rate, is the string theorists.

[PowerPoint slide appears titled “The String Theory” with an image of a web page from Cornell University titled “High Energy Physics-Theory”]

String theory comes out of physics, physics is like getting hit by balls and Styrofoam cups sticking to you. The string theorists were given a simple problem. Just tell me, take a quantum mechanical object like an electron, and just tell me the gravitational field. They said, "No problem, we'll be back." It turned out, it took them longer than they expected. They still haven't solved the problem, they try the obvious things, and the less obvious things. Now they proceed almost entirely by indirection.

The stories they tell have no connection to experimental evidence. The things they predict can never be tested, even if the large hadron collider in Switzerland was the science of the solar system, whether or not you include Pluto, right? Now, for some very smart people this is a total disaster, right? I don't take a position on this.

[PowerPoint slide appears titled “The String Theory” with an image of a web page from Cornell University titled “High Energy Physics-Theory”; two images of books: *Trouble with Physics* by Lee Smolin and *Fashion Faith and Fantasy in the New Physics of the Universe* by Roger Penrose]

For me it's great. The less that string theorists tried to answer to the world, the less they try to describe the world, the more the playful aspect of science is brought to the floor for them.

[PowerPoint slide appears titled “The String Theory” with an image of a web page from Cornell University titled “High Energy Physics-Theory”; two images of books: *Trouble with Physics* by Lee Smolin and *Fashion Faith and Fantasy in the New Physics of the Universe* by Roger Penrose; and an image showing 26,714 String Theory articles were published from 1992-2003]

: We got this data, we got 10 years of string theory, 26,000 articles, right? Super fun. Now, I'm not going to read, I'm not going to read all those articles. I don't think anyone's read them all. Here's one of them.

What we're going to do, we're just going to project it down, like this is beautiful idea. We're just going to take a projection, just look at the shadow. Forget me, look at my shadow. It captures some of me, we're going to project it out. I'm just going to ... It's awesome, I'm just going to count this out.

[PowerPoint slide appears titled “Shadows of Play” with images of a tall statue and its shadow; a scholarly article titled “Exploring The Lambda Model Of The Hybrid Superstring”; and an image of a string of words and numbers separated by parenthesis]

: It took this guy hundreds of hours. I'm just going to turn it into a list of words, and I'm going to look how the patterns of word usage shifts. I'll tell you what happens, right?

[PowerPoint slide appears titled “Quantifying Play” with an image of scholarly article titled “Exploring The Lambda Model Of The Hybrid Superstring”]

We can look, in other words, at how this article, the way those physicists use words,

[PowerPoint slide appears titled “Quantifying Play” with images of four scholarly articles on the left with an arrow pointing to an image of a scholarly article titled “Exploring The Lambda Model Of The Hybrid Superstring” on the right]

how those related to what came before. Then I can also talk about how those patterns relate to what comes next. I can tell you how this article deviates from what came in the past.

[PowerPoint slide appears with an image of a square with notched lines: the x and y axis of the square are numbered 6, 8,10,12,14; the word “hep-th” appears above the top line of the square; the words “Surprise given Future (bits)” appear along the y axis and the words “Surprise given Past (bits)” appear along the x axis; a mass of green dots are clustered inside the square from the center to the top-left corner.]

It's on the X axis here, each of these dots is a paper. On this screen is hundreds of thousands of physicist hours, right? It will be gone in a second, I'm sorry. On the X axis here, the further along you get, the more innovative, the more the article differs from what came before. On the Y axis, conversely on the Y axis, is how much it differs from the future. What does that mean? If you're really different than the future, that's a polite way of saying that you've been forgotten, right? "Wow, you're really different from what's going to happen next." It's almost a threat.

Okay, so let’s do a little science together, right? We'll do some hardcore ... Whoa,… What does this mean? This is the first law, well done, right? You're all stats majors now. Well done.

[PowerPoint slide appears with an image of a square with notched lines: the x and y axis of the square are numbered 6, 8,10,12,14; the word “hep-th” appears above the top line of the square; the words “Surprise given Future(bits)” appear along the Y axis and “Surprise given Past (bits)” appear along the x axis; a mass of green dots are clustered inside the square from the center to the top-left corner. And a quote: first law of play “What is new is quickly forgotten”]

: This is the first law of play. The first law of play is really simple, what is new is quickly forgotten. You know this, because when you did that math problem set and the grad student was like, "Wow, that's really innovative. I've never seen anyone solve a problem like that before." Doesn't mean you did a good job, right? Means no one solved it that way before, and they're never going to solve it that way again.

[PowerPoint slide appears with an image of a square with notched lines: the x and y axis of the square are numbered 6, 8, 10,12,14; the word “hep-th” appears above the top line of the square; the words “Surprise given Future(bits)” appear along the Y axis and the words “Surprise given Past (bits)” appears below the x axis; a mass of green dots are clustered inside the square from the center to the top-left corner; a diagonal black line through the middle of the square. And two quotes: first law of play “What is new is quickly forgotten” and “what hasn’t been seen before won’t be seen much again”]

That's the first law of play, what hasn't been seen before, won't be seen much again.

Let's zoom in a little bit, let's take some of these.

[PowerPoint slide appears with an image of a square with notched lines: the x and y axis of the square are numbered 6, 8,10,12,14; the word “hep-th” appears above the top line of the square; the words “Surprise given Future(bits)” appear along the Y axis and the words “Surprise given Past (bits)” appears below the x axis; a mass of green dots are clustered inside the square from the center to the top-left corner; a diagonal black line through the middle of the square. And two quotes: first law of play “What is new is quickly forgotten” and “what hasn’t been seen before won’t be seen much again”. And an image of a scholarly article and an arrow pointing to a dot below the diagonal black line way out on the x axis.]

Look at this guy, right? Look at this guy here. He's way out on the X axis, he's really new. He's doing something that hasn't been seen before, but notice he's below the black line. Which means in fact, that he wasn't forgotten. This article has 101 citations, top five percent of all the articles in our database in terms of how much it got cited. That's a lot of likes, if you're an academic. This is the second law of play, right? Well it's true that what's new is quickly forgotten, some of what is new becomes what drives the future of the system. The system selects from the new to decide what to do next.

Think about this like a dinner party.

[PowerPoint slide appears titled, “The String Theory” with an image of a web page from Cornell University titled “High Energy Physics-Theory” and four scholarly articles on the left and an image of a dinner party on the right.]

A dinner party, where everybody is just talking randomly is no fun. It's not a good party, you need some kind of inertia in the system to slow it down. People need to talk to each other. If everybody just says something new, some set of words that no one's ever said before ... "Really, what?" At the same time if this three hour dinner party goes on, and on, and on and you're still talking about the same thing, it's a terrible dinner party. This is a story about how the conversation of string theory evolves, how it decides where to go next. If you can date string theory, if you call it a part of mathematics, it's been going on some Archimedes. In that case it's a 3,000 year dinner party.

Look, once we discovered we could do this, by, "This is what I did with all the money that you paid me at Indiana, thank you."

[PowerPoint slide appears with collage of photo images of Jaimie Murdock, Collin Allen, Rebecca Spang, Alexander Barron (IU), Jenny Huang, Brandi Heuberlin (IU/SFI), and others and multiple charts and graphs.]

We were like cats in a drum of flightless birds, right? We just went nuts, and we studied all the kinds of activities. The most important activities, at least I think are important. Science, poetry, Jenny studied, "How does Yates play? How did Robert Crilley play? How did Gwendoline Brookes play?" Jamie and Collin looked out, and they began this. Jamie and Collin began by looking at how Charles Darwin ... Trustafarian, like a get a job, right? He played in science until he discovered evolution. Alexander studied how people learned to play when their country emerges from dictatorship. How people talk when they become free.

We learned a huge amount, I'll just tell you one story we learned from Wikipedia with Brady. Who here doesn't know what Wikipedia is? You're lying. I know you write papers, and you stick Wikipedia in them. You get caught, "Because Collin, I've seen that before, right?" Yes, it's true. It's something that survived, but you didn't do it. Wikipedia, right?

[PowerPoint slide appears with an image of a Wikipedia article on George W. Bush and an image of six blue rectangles across the top of the slide each with a line segment pointing to the next blue rectangle.]

Most edited article on this gentleman, George W. Bush. When I began there's this 44,000 edits. People just keep changing it, they keep developing, and altering, and adding to, and taking out what's in that article because they're trying to figure out what the point of Wikipedia is. Nobody actually knows what the point is, right? It's not just to help you write your papers. Maybe it's some kind of weird Star Trek encyclopedia Galactica. Maybe it's a blog. Nobody knows. They're trying to figure it out.

If you tried, actually if you looked up, "What's the purpose of Wikipedia?" It's actually, it's really hard to find. You can't find it.

[PowerPoint slide appears with an image of a Wikipedia article on George W. Bush; an image of six blue rectangles across the top of the slide each with a line segment pointing to the next blue rectangle; a chart with years 2002, 2004, 2006, 2008, 2010, 2012, 2014 on x axis and numbers 0, 5,10,15 on y axis and words “Pages to Past Surprises (bits)” along y axis and spikes of black lines inside the square.]

Anyway, if you look at how this system evolves over time, you see these spikes. On the X axis is time, right? It's just evolved over time. You see these spikes of innovation. In fact, those spikes seem to come not quite at regular intervals. We don't know causes them. They're not caused by something outside, they're not associated with actions. When people change the page, it's modified in a way that hasn't been seen before.

[PowerPoint slide appears with a chart with years 2002, 2004, 2006, 2008, 2010, 2012, 2014 on x axis and numbers 0,5,10,15 on y axis and words “Pages to Past Surprises (bits)” along y axis and spikes of black lines inside square and thick red vertical lines extending from top of square pointing to the highest spikes inside the square; words “Paradigm shifts writ small” appear on the left]

We see these sort of paradigm shifts, right? Writ small, right? This is just the George Bush page, it's not the Kafejnica Model of the Universe, but it'll do. We say, "Where do those bursts come from?" In 2004 what happened there, what was going on? What caused the novelty to enter the system?

[PowerPoint slide appears with a chart with years 2002, 2004, 2006, 2008, 2010, 2012, 2014 on x axis and numbers 0,5,10,15 on y axis and words “Pages to Past Surprises (bits) along y axis and spikes of black lines inside square and thick red vertical lines extending from top of square pointing to the highest spikes inside the square; words “Paradigm shifts writ small” appear on the left; snapshot of code activity on Wikipedia page]

We have one answer, the answer is arguments, fighting, conflict. It's really strange. It turns out that associated with the introduction of novelty in the system is disagreement, is people fighting. In fact, fighting so badly that they sometimes get thrown off the system. Maybe this is a law of play, right?

To play well, doesn't always mean to agree with your friends. We don't quite know what the nature of the arguments is. Some arguments are destructive, but others aren't. If we can understand how people discuss, and fight, and complain, and debate. If we could understand that, maybe we can understand how to make play better.

[PowerPoint slide appears with an image of a statue of a young female dancer on the left and a dinner party on the right]

We recognize play instantly in a child. This is kinesthetic play, this is the play of an engineer testing a structure. The play of a dancer learning her skeleton. Once we see that, once we see the rubric, we can see how the things we do as adults fall in the same pattern.

The kinds of activities that we think are not being driven by an external goal, that seem to have no purpose, have a logic to them. It's why, by the way, you can't throw out your stuffed animals from when you were a child. They move you, they move us in ways that we can't quite explain, right? The clothes you wore when you were a child, the bed you slept in, even photographs of you with your parents. "Forget it, throw it out. I don't care. Sorry mom." Somehow these creatures move us, because these were the first things that we played with. These toys, the things we made them say, and think, and do. The ways we made them move, how we shared them with others.

Somehow this is how we became who we are, and we can't, we can't get rid of them. What moves me is that these things balancing on a log, talking over dinner, playing as a child, remembering what it was like to tell stories. What moves me is that those intimate moments of a human life, somehow, they seem somehow contained in the logic of the things that we think distinguish us most grandly from the other animals. The things that we think are the purpose of survival itself. The things that we want to do when all of our goals are satisfied. Play, thank you.

[Audience claps and Simon DeDeo exits stage]

[Logo words appear: ALL TOO HUMAN]

[Transcript ends]