Science Magazine Podcast

Transcript, 19 July 2013

http://podcasts.aaas.org/science_news/SciencePodcast_130719_ScienceNOW.mp3

Promo

The following is an excerpt from the *Science* Podcast. To hear the whole show, visit www.sciencemag.org and click on "*Science* Podcast."

Music

Interviewer – Sarah Crespi

Finally today, David Grimm, online news editor for *Science*, is here to give us a rundown of some of the recent stories from our daily new site. I'm Sarah Crespi. So first up, we have a story on body switching. Virtual reality can be used to place us in a totally new situation or even make us feel like kids again.

Interviewee – David Grimm

Right. You know, we already know that virtual reality can be used to put us in somebody else's body, and actually when we're put in that other person's body, we can even begin to feel things that that person feels. There was a study done last year where volunteers entered the body of a teenage girl, and in virtual reality, the mother slapped the girl. And the volunteers actually claimed that they felt the slap. So we know that virtual reality is more than just an illusion. It can actually have some real world effects. The issue with this new study is trying to figure out can virtual reality actually make us feel differently, not just about the body we inhabit, but about the world around us.

Interviewer – Sarah Crespi

So what specifically did they look at in this case? Were they looking to see more slapping?

Interviewee – David Grimm

There's no slapping here. This is a much less violent experiment. What the researchers did was they put volunteers in one of two bodies. Both of these bodies were very short. One was the body of a 4-year-old child. One was the body of an adult but shrunk down to the size of a 4-year-old child. And the volunteers could actually look at themselves in the mirror in virtual reality and see what they look like. And there's actually a picture of this on the site.

Interviewer – Sarah Crespi

What changed about their feelings or their perceptions when they were placed in this shrunken body?

Interviewee – David Grimm

Well what the researchers had the volunteers do while they were in virtual reality was when they were in either body, they had them judge the size of a variety of cubes. And they had them do this actually before they were in these bodies – just sort of in their own

body – then they put them in these virtual bodies of either a four year old child or just a very small adult. And what they found was that the volunteers that were placed in the body of a child all of a sudden judged those cubes to be a lot bigger than they actually were – what they previously reported them to be. Actually, they were reporting the cubes to be about twice as large as the volunteers that were put in the bodies of the small adults.

Interviewer – Sarah Crespi
So why do they think there's this difference between being a small adult, a kid, and how you see a cube in a room with you?

Interviewee – David Grimm
Well, what they think is that somehow this illusion of being in the body of a child makes us feel like the whole world is bigger. I know if we can remember back to being a child, you know, teachers seemed to tower over us, classrooms seemed really, really big, and then if you ever go back to visit your elementary school as an adult, you say, wow, all of this stuff is really tiny. The chairs are tiny; the desks are tiny. But none of that feels that way as a child. What this study seems to be saying is that there's a way to replicate that experience in virtual reality to actually make us feel like we actually are in the body of the child. And actually one really interesting thing that came out of this study was even after this simulation was over with the volunteers looking at the cube sizes, the researchers asked the volunteers a series of questions. And the volunteers that had been in the body of a child were more likely to identify with child-like traits. For example, they answered yes to questions like, "Are you still in elementary school?" So the effects were pretty profound.

Interviewer – Sarah Crespi
Wow. What does this information tell us about either the way kids work or about how virtual reality works?

Interviewee – David Grimm
Well, what it really suggests is that virtual reality is really more than an illusion. It can really have profound effects on not only how we view ourselves when we're in these virtual environments but also how we view the world around us. One really interesting application is researchers say, well maybe we can use this in the future if somebody commits a crime to actually put them in the virtual reality body of the victim and really get them to feel and empathize with the pain, with the damage that they created.

Interviewer – Sarah Crespi
Sounds like it will make for a good video game. Next up, we have a story on the spread of fertilizer. So it's not obvious to me that putting animal dung on top of recently planted seeds would do any good for my crops, but using manure as fertilizer has been around for a very long time.

Interviewee – David Grimm
And it's only not obvious to you, researchers have thought it wasn't obvious to the first farmers. And they sort of suspected that when farming first developed that farmers didn't

use fertilizer, because hey, how would they know what impact it had? And, actually, the earliest evidence for fertilizer is only about 3,000 years old.

Interviewer – Sarah Crespi
But there's new evidence pushing this date much further back. How did they figure out whether old, old crops had been fertilized?

Interviewee – David Grimm
Well, one of the things about fertilizer is it contains really high levels of nitrogen, phosphorus, and potassium. These are really important plant nutrients, which is why fertilizer is so effective. Well it turns out that the nitrogen in fertilizer has a higher proportion of a rare isotope of nitrogen known as nitrogen-15, which is heavier than the more common nitrogen-14. And researchers can actually analyze how much nitrogen-15 is in a plant versus nitrogen-14, even in samples of very ancient plants. So what they did was they went back to some of these sites, and they specifically looked in Europe, which was where farming spread after it originated in the Near East. They looked at sites that were anywhere between 7,900 and 4,400 years old. And what they found was that indeed, a lot of the samples they looked at had these high levels of nitrogen-15, indicating that these plants had been fertilized.

Interviewer – Sarah Crespi
So this is a much earlier estimate for when we started using manure as fertilizer. But are there any ideas out there about why this came about when it did?

Interviewee – David Grimm
It's an open question. One of the speculations the researchers have is perhaps there were areas of what they call "natural dung accumulation". And what that means is these early farmers were also domesticating livestock, so you had a lot of animals hanging out on their fields. If these animals are hanging out in a certain place for a long period of time, you can imagine that the fertilizer, as it were, is building up. And over the generations, farmers are going to notice that these areas of land have a lot better plant growth than other areas, and perhaps they put two and two together and figured out that fertilizer was a great way to improve the success of their crops.

Interviewer – Sarah Crespi
Right, the grass is always greener.

Interviewee – David Grimm
Right. It got a lot greener.

Interviewer – Sarah Crespi
Finally, we have a story on a new way of levitating. Previously, scientists have been able to use magnets or electrostatic force to levitate things, but those are limited to metals. In the latest research that we're going to talk about today, we're talking about floating things like water, coffee … toothpicks? Where is the magic coming from?

Interviewee – David Grimm
The magic is coming from sound. The problem with the current levitation technologies is two-fold. First of all, as you mentioned Sarah, it only works with metals or materials with magnetic properties, and that's because it relies on electrostatic or magnetic forces. That's a limit, because you want to be able to ideally move other things around in the lab or even beyond the lab and you don't always want it to be metal. The other problem is that the current technologies really just, sort of, hold these materials in place. They levitate them, which is cool, but they are not moving around, which is obviously something you'd want.

Interviewer – Sarah Crespi
So we're actually talking about sound here. This has been known for a while that sound can levitate things, but what's the new finding here?

Interviewee – David Grimm
Well, the new finding, the new advance, is really getting sound to move things around. You can imagine if you've got sound waves, sound waves have pressure, and that pressure, if directed properly, could be used to sort of hold an object into place. The question is how do you move it around? And what the researchers developed is they developed this chessboard-style setup with multiple vibrating plates, and each plate creates its own sound frequency. And by varying the frequency that each plate emits, they can move the acoustic field, as they call it, and the object trapped inside, and that actually allowed the object to move around this chessboard. One of the things they were able to do with this was actually take a droplet of water and a droplet of sodium, and by themselves these droplets are pretty inert, but combine them and it's a very violent reaction that you don't want to be anywhere near. And what they did with the sound was they were actually able to move the two droplets together in midair and have them combine and create this very violent reaction. You can actually see a video of this happening on the site.

Interviewer – Sarah Crespi
Not only are they able to change direction of these things, move them around, but they also are increasing the size of what they can hold up, like a toothpick.

Interviewee – David Grimm
Right. They were actually able to levitate and move around a toothpick as well. Right now, the limitation is that they can only levitate and move objects with about three times the density of water, but they are refining their methods. They really want to be able to move much denser materials, such as steel, and you can imagine the applications that could have. Anybody that remembers *Back to the Future 2* and the hover board, maybe some of us are picturing that right now. But obviously, a lot of applications beyond that as well. And this is a really important first step.

Interviewer – Sarah Crespi
Okay. So what else is on the site this week, Dave?

Interviewee – David Grimm
Well, Sarah, we've got a story about whether apes have autobiographical memories. Do they remember way back in the past and actually picture themselves in various situations like we do? Also a story about how some plant-eating dinosaurs may have lost teeth every one or two days and replaced them. It's a conveyor belt of dinosaur teeth. And finally, for *Science*Insider, our policy blog, we've got a story about new money being allocated to the National Institutes of Health and which diseases are benefiting from that cash. Also a story about why NASA is being urged to go slow on an asteroid capturing project. So be sure to check out all these stories on the site.

Interviewer – Sarah Crespi
Great. Thanks, Dave.

Interviewee – David Grimm
Thanks, Sarah.

Interviewer – Sarah Crespi
David Grimm is the editor for *Science*'s online daily news site. You can check out the latest news and the policy blog, *Science*Insider, at news.sciencemag.org.