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size and weight so that the recipient can catch it correctly. The skills learned in these games can be directly transferred to scientists' work pursuits, says Cibele Falkenberg, a computational-biology postdoc at UConn Health Center who has participated in some of the workshops. For instance, she says, "with communication, you have to make sure you have a connection before you pass the message", which applies to any audience, including co-workers, funding agencies and the public. Convinced of the benefits, improvscience is one of a number of US programmes using improvisation to help hone these skills (see 'Workshops and events').

COMMUNICATIVE COLLABORATION

Researchers sometimes fall short in their communication with each other, despite the importance of collaboration. Holmes thinks that improvisation offers a powerful tool to address this problem — through, for example, the 'yes, and' rule. This basic tenet of improvisation dictates that participants must say 'yes' to any verbal or physical cues that they receive and build on them, rather than trying to shut down a direction that makes them uncomfortable. The rule is important in a research context, in which a 'no, but' stance often dominates — such as when discussing a colleague's results or critiquing a paper in a journal-club meeting.

From a scientific perspective, this critical approach may be appropriate and necessary. But taken too far, Holmes says, it can create a negative group dynamic and make some people hesitant to share ideas for fear of ridicule. And that, in turn, could slow research progress.

To illustrate this problem, in one of her games Holmes asks participants to get into pairs and work together to plan a party. First, members of each pair can respond to each other's statements only by starting with 'no, but'; they then repeat the exercise using the 'yes, and' rule. The 'no, but' approach made it "very difficult to have a meaningful conversation", says Max Staller, a systems-biology graduate student at Harvard University in Cambridge, Massachusetts, who has participated in several improvscience workshops. In stark contrast, the 'yes, and' rule worked so well in planning the fictitious party that he now applies it to his research.

"I try to consciously think about, is there a way to say 'yes, and,'" Staller says. "I make a point in journal club of talking about what's positive about the paper; sometimes we focus too much on the shortcomings, and take for granted the successes."

Holmes also uses games such as 'mirrors,' ▶

COMMUNICATION

Spontaneous scientists

Some think that researchers can improve their communication by flexing their improvisation skills.

BY RACHEL BERNSTEIN

A circle of scientists is gazing skyward, as if watching a ball fly through the air as they play an animated game of catch. But there is no ball — and this game is serious work. It is part of an exercise to help 12 scientists at the University of Connecticut (UConn) Health Center in Farmington to boost their communication skills.

These scientists are engaged in improvisation, a spontaneous, reactive interaction mode more traditionally seen in comedy performances.

Improvisation games and communication both require attention to others and the forging of personal connections, says Raquell Holmes, a cell biologist by training who now spends much of her time running workshops for scientific conferences and research institutions through her company, improvscience, based in Boston, Massachusetts. With that in mind, she has adapted some traditional improvisation exercises, and imaginary catch is one of them.

In this game, participants use eye contact to indicate where the 'ball' is being thrown, and use and read body language to communicate its

► in which partners have to match each other's body movements as closely as possible, and 'emotional bus', in which participants portray an emotion as they board an imaginary bus, and the rest of the 'passengers' must read the emotion and act it out themselves. The point is to train people to be tuned in and responsive to others around them. "It looks like we're just playing, but what we're practising is how to accept the idea that your colleague is giving you something," explains Falkenberg.

AUDIENCE CONNECTION

In some cases, improvisation came to science through the inspired efforts of people who had a penchant for drama. Patricia Ryan Madson, an emeritus lecturer in theatre and performance studies at Stanford University in Palo Alto, California, is no scientist. But when she began teaching improvisational theatre classes to undergraduates in 1991, she found that many of her students were scientists and engineers. It got her thinking about how researchers, too, could benefit from the confidence that practising improvisation inspires and become more comfortable, she says, being "agreeable and helpful and communicative, and making mistakes in a gentle way" that is "not de rigueur in the science world". She found a partner in engineering professor Rolf Faste, and in the late 1990s the two launched an improvisation course that is still offered today.

About 15 years after Madson's initial course, actor and long-time science aficionado Alan Alda came to the idea independently. After hosting a show called *Scientific American Frontiers* from 1993 to 2005, Alda knew he wanted to continue working in science communication. He remembered how his early training in improvisational theatre had boosted his communication skills, and thought it might be valuable for scientists. In January 2008, he tested the idea with a group of engineering students from the University of Southern California in Los Angeles by asking them to explain their research before and after playing improvisation games. "The difference was startling," he recalls. This convinced him that the approach was worth pursuing.

Alda now implements the idea with the Alan Alda Center for Communicating Science at

Stony Brook University in New York, which offers an Improvisation for Scientists course for the university's graduate students and is working to share the curriculum by developing an affiliate network. The first institution to sign up, Dartmouth College in Hanover, New Hampshire, began an improvisation course for scientists in the autumn. The Alan Alda Center also provides workshops for students and faculty members at various conferences and science institutions.

Whereas Holmes's approach focuses primarily on facilitating teamwork, Alda emphasizes



"With communication, you have to make sure you have a connection before you pass the message."

Cibele Falkenberg

communicating with non-experts, whether interacting with the media, policy-makers or the public. But the tools are largely the same: encouraging participants to be attuned to others and adapt their behaviour accordingly.

In one Alda Center activity, one member of a pair speaks about a general topic and the other person tries to anticipate what the first will say, so that the two end up saying the same thing at the same time. "It

sounds impossible," says Colin West, a Stony Brook physics graduate who has taken the Alda Center course, "but when you get into a rhythm, you can anticipate a lot based on body language, and the next thing you know you're chanting in unison."

Researchers who are well practised in such an exercise can use their newly honed receptiveness to help them respond to their audiences. "When you're reading the signals," says Alda, "you have instantaneous feedback about whether they're understanding what you're saying. You can adjust what you say because you're accustomed to adjusting." Alda also uses exercises to practise this skill in a scientific context, including one in which a participant presents his or her research to a 'revolving door' of

MARCELO A. KURODA

IMPROVISATION RESOURCES

Workshops and events

Improvisation resources are still relatively rare. Both improvscience (improvscience.org) and the Alan Alda Center (centerforcommunicatingscience.org) work with researchers and institutions to set up workshops a few hours to a few days long.

Interested researchers can also attend the 'Improvisation for Scientists: Making a

Human Connection' session on 16 February 2014 in Chicago, Illinois, featuring the Alda Center, improvscience and Katie Watson, who specializes in medical humanities and bioethics at Northwestern University in Evanston, Illinois, and is a faculty member of renowned Chicago-based improvisation group The Second City. **R.B.**



The Alan Alda Center in New York uses improvisation exercises to boost science communication.

audiences. In this game, the instructor assigns the audience an identity, such as a high-school class or an academic tenure committee, without telling the speaker. The audience members behave in keeping with their identity, and the speaker has to interpret their cues to tailor his presentation to them — until the instructor assigns the audience a new identity and the speaker has to adjust seamlessly.

These improvisation exercises helped Philip Fernandes, a graduate student in astrophysics at Dartmouth who recently took the Alda Center course. “I realized that when I give a talk, I memorize it completely because I’m terrified I’m going to go blank, so it turns into this robotic reciting,” he says. Fernandes began watching audiences and reading body language. “If I see that I’m losing them, it’s my job to regain their interest.”

But it is not enough to simply be responsive to the audience. Presenters also need to give the audience something that will help them to forge a connection with the speaker and stay engaged. Alda teaches that the best hook is to include one’s personal perspective, regardless of the audience or venue, so that listeners can relate — although some researchers may not be comfortable with this approach at first because “there’s this idea that emotion doesn’t belong in science”, Fernandes notes. After taking the course and seeing how it improved her communication skills, Dartmouth ecology graduate student Jessica Trout-Haney was convinced that Alda’s approach had merit. “Telling a personal story has made giving talks much more authentic, and fun,” she says. Initially, she had concerns that inserting subjective personal details would signify her science was not objective. “But if we don’t connect with the audience, we’re doing a disservice to the science.” Improvisation helps participants to become more comfortable sharing a side of themselves that they may otherwise hide.

In some exercises, participants must trust the first idea that comes to them — and that thought is instinctive and personal.

Students are videoed giving a short research presentation before and after the course to show them their progress. Krithika Venkataraman, a graduate student in molecular and cellular biology at Stony Brook, says that she saw dramatic results. “I was more enthusiastic, more relaxed when I was up on the stage, and I had a smile on my face, which I didn’t have before,” she says. “I was able to face the audience and be energetic and enthusiastic about my science.”

DIVE IN

Trying improvisation for the first time can be nerve-racking, says Christine Urbanowicz, a graduate student in ecology at Dartmouth who took the Alda course. Despite her initial misgivings, she found it rewarding. When the group played imaginary catch during the first meeting, “I kept telling people, ‘don’t pass me the ball, don’t pass me the ball’, even though there wasn’t a ball”, she recalls. But now that she has completed the course, her confidence as a speaker has increased because she knows that she can handle unexpected situations. “Improv allows you to trust yourself enough to know that you’ll be able to figure out where you’re going with your presentation without having it memorized,” she says.

In fact, Urbanowicz has found the experience so helpful that she is spearheading an improvisation group for graduate students at Dartmouth so that she and her classmates can continue to practise and share their skills.

Trout-Haney, for her part, suggests that anyone who is unsure about whether improvisation is useful or right for them should “just take a deep breath and say, ‘yes, and’”. ■

Rachel Bernstein is a science writer based in San Francisco.

PATENTS

Leaving academia

Scientists who patent their discoveries seem more likely to leave academia than those who do not, says a study published on 5 December (B. Balsmeier and M. Pellens *Econ. Lett.* <http://doi.org/qhv>; 2013). The authors examined data for 1996–2005 from a survey of 263 academic researchers in Belgium created by the Organisation for Economic Co-operation and Development, and compared responses about career paths with publication and patent records. They found that for each additional patent, up to a total of two, the scientist was approximately a third more likely to leave academia. The authors speculate that patenting reflects an interest in commercializing results, which is better rewarded outside academia.

BIOMEDICAL RESEARCH

Physician–scientists

The number of US physician–scientists who conduct biomedical research as their primary profession has declined in the past 30 years, according to a report by the Federation of American Societies for Experimental Biology (FASEB) in Bethesda, Maryland. *Physician Scientists: Assessing the Workforce* finds that from 1982 to 2011, the proportion with medical degrees or MD–PhDs doing research fell from 3.6% to 1.6%. It attributes the decline to factors such as longer training periods and rising debt. But MD–PhD holders have an edge in a tight funding environment because of their skill set, says report co-author Howard Garrison, FASEB’s deputy executive director for policy.

WORKFORCE

NIH seeks models

In the wake of its 2012 report on the biomedical workforce (see *Nature* **492**, 167; 2012), the US National Institutes of Health (NIH) is again seeking proposals for computational models of that workforce, with the aim of tracking and mitigating long-term trends that threaten its size and diversity. Such trends include the rising number of biomedical-PhD holders who seek jobs outside academia and the lower numbers of female scientists who stay in academia after PhDs. Michael Sesma, a programme director for the NIH’s National Institute of General Medical Sciences, says that the agency needs models of dynamics, such as how people make career decisions. It will use them to develop grant and other programmes to address problem areas.