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With the current explosion in the use of video conferencing, 'in person' meetings for business may become things of the past

Ringing in a virtual world

S ANANTHANARAYANAN

The need for isolation, in the wake of the Covid-19 pandemic, has magnified the role of the Internet.

Pandemics of the past, perhaps more serious than the present one, took years or decades to spread, and for means of control to be put in place. In contrast, the current-day mobility of people, air travel, greater activity and crowding within cities, have helped Covid-19 engulf the world within a space of months. And, at the same time, our higher scientific understanding and skills, and most of all, means of instant communication, have enabled response and measures that could match the challenge modern economy has created.

Along with the speed of research into the virus, vaccines, and sharing of data and information, technology has helped the world of commerce and industry to adjust very quickly to working without travel and face-to-face meetings. Offices of all kinds, commercial or government, have introduced "work-from-home", and meetings and multi-party consultations, which are a vital element in management, are being carried out by means of the video conference. With shopping areas closed and public transport largely unavailable, in cities, at any rate, e-commerce and ordering on the Internet have become the rule. Education has moved to the Internet and the web, are daily events.

The e-commerce portals, which accept orders from individual clients who connect from their computers or mobile phones, have been around for some years. In these applications, the portal can accept connections from multiple clients, and process their orders, all at the same time, -- presenting to each user the merchandise on supply and then recording their order. Once complete, the customer is connected to a bank or a credit card operator, to make the payment, and physical supply is initiated.

The video conference is more complex. The connection is not separately between clients and the portal, but with all the clients presented on the same screen. And then, there are both the living image, and voice, that are transmitted, for display to all participants, as a conference. The use of the technology has become common and the word, "workplace" does not mean a fixed location any more.

With the periods of lockdown, and restrictions, "coming in to work" is no longer feasible in most organisations. With employees being permitted, or required, to work over the Internet, organisations have recognised the benefits, economy and flexibility of doing entirely away with the fixed office. While there is every possibility that pre-Covid conditions would continue for a long time, even if they are relaxed, it looks like a great percentage of employees would now work from wherever they can connect electronically to the office or their colleagues. The sooner organisations recognise and adapt to this change, the more competitive and successful they would be.

Even traditional face-to-face encounters, like court proceedings and arbitration, are now taking place through the video conference. While the Supreme Court is efficiently disposing of cases, this manner of working helps courts with benches in different cities. As hearings are now through the Internet, judges do not have to travel and more cases are being disposed of.

While business and commerce have readily adapted to video conferencing, a criticism with its use in courts and tribunals is that observing the demeanour of a witness, or for a witness to see how the judge or an advocate reacted to her deposition, is generally not possible -- as the setting is no longer the court, but the participants in their own homes. "You only see a flat picture, without eye contact, and coordinated movement, which we have in face-to-face communication," was considered the reason that "teleconferencing", as it was known some years ago, did not take the place of people travelling to meet.
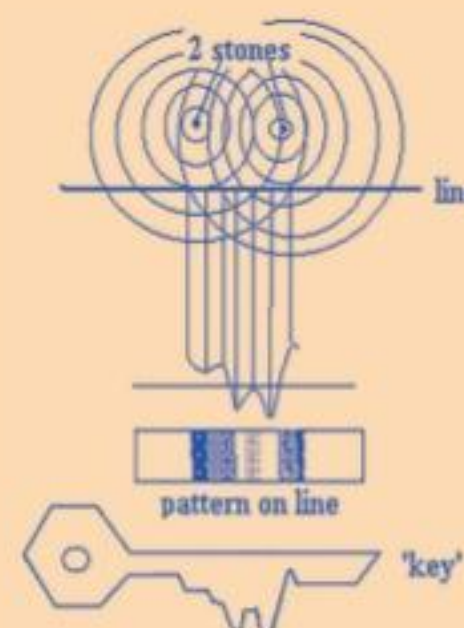
This gave rise to the idea of "tele-immersion", the creation of a "shared virtual space", where one saw not faces on a screen, but "moving sculptures" in a life-like 3D space. The idea dated from 1968, when Ivan Southerland, an American scientist regarded as the pioneer of computer graphics, created a "virtual world", where participants wore helmets with a pair of display screens, one before each eye. The helmet sensed movements, as the participant moved through the virtual location, and the images in each of the screens were what should be seen by each eye, to create the "3D" effect. This was followed by "virtual reality", which combined separate "virtual worlds", head-mounted displays projecting images of the different participants, over a computer network.

An early version, in 1989, was RB2, or "Reality built for two", which enabled the participants to see representations, called "avatars", of each other. These were simple, cartoon-like figures created by computer graphics, but their movements were transmitted, to convey a sense of presence, emotion and locus of interest. Tele-immersion was demonstrated in principle by computer scientist-writer, Jaron Lanier in 2000.

Presenting "whole scene" pictures for each eye, several times a second, involved sets of cameras and processing, at either end and communication bandwidth that was not easy at the time. A good part of the processing was by algorithms that treated the images as "overlapping triads", so that only the data of changes had to be transmitted. Nevertheless, "latency" introduced by optical fibres, and reassembly of huge numbers of data packets received over the Internet, did not allow the technology to proceed beyond video games.

HOLOGRAPHIC DISPLAY

Closer to the vision of real-time 3D is the *switchable holographic display*, developed at the University of Cambridge a few years ago. The hologram is a transparent sheet that contains a pattern that records the light that falls on the sheet from two sources – one is an illuminating laser and the second is the reflected light from the object illuminated. As light from the two sources reaches the sheet at slightly different times, there is interference of light waves, which causes a pattern of highs and lows. The result is capture of images in 3D, in the sense that when the sheet is later viewed under the same laser, the images can be seen in depth, seeing "around" objects as one moves from one end of the sheet to another.

The Cambridge team reported in the journal, *Physica Status Solidi*, the use of a new pixel element, which could be rapidly switched from one state to another. The hologram pattern could then be refreshed, several times a second, so that movements in the image being transmitted could be seen by the viewer without the need for helmets or goggles, at either end. The quality of images, however, was low. A team at the Data Storage Institute in Singapore, has done better, with an array of "spatial light modulators", but it is a work in progress.

With the current explosion in the use of video conferencing, however, research in the field is bound to accelerate, and meetings "in person" may merge into history!

The writer can be contacted at response@simplescience.in

Hologram

Incident light and light from an object can be likened to ripples caused by two stones dropped in a pond. The ripples interfere when they meet and would "add or annihilate". There would thus be a pattern of "high and low" along any line drawn across the wave train.

Now, if this pattern along the line were converted into a "key", with teeth where there were "downs" and gaps where there were "ups", then the key could reproduce the pattern from which it was made.

If "waves" were again created by pushing the key into the water, the "expanding pattern" would be just like it was in the original case, because the pattern along the line preserves the history of how the pattern was produced.

RACHEL LEIHY & STEVEN CHOWN

Need to protect its isolation

Humans are encroaching on Antarctica's last wild places, threatening its fragile biodiversity

Since Western explorers discovered Antarctica 200 years ago, human activity has been increasing. Now, more than 30 countries operate scientific stations in Antarctica, more than 50,000 tourists visit each year, and new infrastructure continues to be developed to meet this rising demand.

Determining if our activities have compromised Antarctica's wilderness has, however, remained difficult.

Our study, published last week in *Nature*, seeks to change that. Using a new "ecological informatics" approach, we've drawn together every available recorded visit by humans to the continent, over its 200 year history.

We found human activity across Antarctica has been extensive, especially in the ice-free and coastal areas, but that's where most biodiversity is found. This means wilderness areas – parts of the continent largely untouched by human activity – do not capture many of the continent's important biodiversity sites.

ONE OF THE WORLD'S LARGEST INTACT WILDERNESSES

So just how large is the Antarctic wilderness? For the first time, our study calculated this area and how much biodiversity it captures. And, like all good questions, the answer is "that depends".

If we think of Antarctica in the same way as every other continent, then the whole of Antarctica is a wilderness. It has no farms, no cities, no suburbs, no malls and no factories. And for a continent so large, it has very few people.

But Antarctica is too different to compare to other continents – it should be held to a higher standard. And so we define "wilderness" as the areas that aren't highly impacted by people. This would exclude, for example, tourist areas and scientific stations. And under this definition, the wilderness area is still large.

It's about 13,598,148 square kilometres, or more than 99 per cent of the continent. Only the wilderness in the vast forested areas of the far Northern Hemisphere is larger. Roughly, this area is nearly twice the size of Australia.

On the other hand, the inviolate areas (places free from human interference) that the Antarctic Treaty Parties are obliged to identify and protect are dwindling rapidly.

Our analyses suggest less than 32 per cent of the continent includes large, unvisited areas. And even that's an overestimate. Not all visits have been recorded, and several new traverses – crossing large tracts of unvisited areas – are being planned.

WILDERNESS AREAS HAVE POOR BIODIVERSITY VALUE

If so much of the continent remains "wild", how much of Antarctica's biodiversity lives within these areas?

Surprisingly few sites considered really important for Antarctic biodiversity are represented in the "unimpacted" wilderness areas.

For example, only 16 per cent of the continent's Important Bird Areas (areas identified internationally as critical for bird conservation) are located in wilderness areas. And only 25 per cent of protected areas established for their species or ecosystem value, and less than seven per cent of sites with recorded species, are in wilderness areas.

This outcome is surprising because wilderness areas elsewhere, like the Amazon rainforest, are typically valued as crucial habitat for biodiversity. Inviolate areas have seemingly even less biodiversity value. This is because people have mostly had to visit Antarctic sites to collect species data.

In the future, remote sensing technologies might allow us to investigate and monitor pristine areas without setting foot in them. But for now, most of our knowledge of Antarctic species comes from places that have been impacted to some extent by people.

HOW DOES HUMAN ACTIVITY THREATEN ANTARCTIC BIODIVERSITY?

Antarctica's remaining wilderness areas need urgent protection from increasing human activity.

Even passing human disturbance can impact the biodiversity and wilderness value of sites. For example, sensitive vegetation and soil communities can take years to recover from trampling. Increasing movement around the continent also increases the risk people will transfer species between isolated regions, or introduce new alien species to Antarctica.

SO HOW CAN WE PROTECT IT?

Protecting the Antarctic wilderness could be achieved by expanding the existing Antarctic Specially Protected Areas network to include more wilderness and inviolate areas where policymakers would limit human activity.

When planning how we'll use Antarctica in the future, we could also consider the trade-off between the benefits of science and tourism activities, and the value of retaining pristine wilderness and inviolate areas.

This could be done explicitly through the environmental impact assessments required for activities in the region. Currently, impacts on the wilderness value of sites are rarely considered.

We have an opportunity in Antarctica to protect some of the world's most intact and undisturbed environments, and prevent further erosion of the continent's remarkable wilderness value.

Rachel Leihy is a PhD candidate, Monash University, and Steven Chown is a professor of biological sciences, Monash University, Australia. This article was first published in www.theconversation.com

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Sustainable vaccines

Greater global cooperation and financial investment by rich countries is required to tackle vaccine-preventable diseases according to academics.

In a commentary article published in the journal *BMJ Global Health*, the authors say that the Covid-19 pandemic has disrupted vaccination campaigns, threatens to increase the future vaccine-preventable disease burden and overwhelm healthcare systems. They call for greater investment in vaccination programmes by rich countries to be operationally prioritised and distributed equitably to achieve outcomes that are in their interests too.

Lead author, Itamar Megiddo of the department of management science at the University of Strathclyde in the UK, said, "Many countries have halted vaccination programmes and campaigns, including for measles and polio, where vaccination has had a transformative impact on the burden of disease. This, combined with the economic effects of the Covid-19 pandemic, means future vaccine financing is unclear.

"Low- and middle-income countries (LMICs) and global funders must trade-off between increasing vaccination coverage, continuing disease elimination campaigns, and introducing new, more expensive vaccines. For example, if a vaccine is developed for Covid-19 without increased Development Assistance for health funding, its deployment could also exacerbate financial pressures on health systems, hence, the burden of vaccine-preventable diseases will increase as a consequence of the current pandemic, especially in LMICs."

Conventional health economics suggest LMICs should spend money on health interventions deemed cost-effective. If a donor also invests funds in the most cost-effective activities, it will crowd out domestic funding as the recipient country will still not spend on cost-ineffective interventions.

The authors suggest that a donor-country (DC) model whereby the donor focuses its spending on these "just below cost-effectiveness" vaccines, would result in more vaccines being funded, and bring down the cost of these interventions and help the country move towards self-sufficiency.

The researchers illustrated this by looking at Gavi, the Vaccine Alliance – a public-private partnership – which is the main distributor of vaccine-specific donor funding, contributing $1.52 billion in 2018 (54 per cent of donor vaccine-funding). Its aid has helped increase vaccination coverage across the world and the Alliance aims to co-fund vaccination programmes in countries with the end goal of helping them become self-sufficient.

However, the authors note that this policy is based on rules that, though transparent, have no theoretical underpinnings and do not clearly lead to an equitable allocation. Further, financial and institutional sustainability remain challenges for many graduating countries – an issue the Covid-19 pandemic may exacerbate.

A recent study of co-financing by Gavi of diphtheria, tetanus, pertussis, and hepatitis B vaccines in Ghana and an analysis of comparator countries revealed that where the DC model suggests the transition to self-sufficiency should be gradual, in practice, it seems sporadic with the proportion of Gavi's spending fluctuating up and down.

Megiddo said, "Vaccine-preventable diseases are an international, cross-border issue that requires global cooperation to achieve the best outcomes. High-income country funding to increase vaccines' coverage in LMICs is both indispensable and in the interest of high-income countries themselves since they can benefit from reduced infections coming into the country, helping to avoid the need for travel restrictions and associated negative economic impacts.

Defeating the world's vaccine-preventable diseases requires cooperation, but without fairness, cooperation cannot be sustained. Recent theoretical advances show why rich-poor financial transfers will be required as part of any financing solution, and also how such funds can be operationally prioritised and disbursed equitably.

The authors also included researchers at the University of Ghana, Imperial College London, the Center for Global Development Europe, London School of Hygiene & Tropical Medicine and the University of Cambridge.