WHAT DOES A MARS SUNRISE SOUND LIKE?

Astronomy is a discipline that is instinctively associated with vision. Since Galileo invented it in 1610, we have been using the telescope to look at stars and planets – one was even launched into space almost thirty years ago (NASA's Hubble Space Telescope), to gain the best possible pictures of galaxies and nebulas.

Pictures, however, are not just for the eyes. Scientists are increasingly using alternative techniques to investigate images and to detect patterns and anomalies, explore singularities and hidden structures.

Turning pictures into music using R&E networking

Dr Domenico Vicinanza of Anglia Ruskin University, and Dr Genevieve Williams from the University of Exeter, are using a technique called data sonification to analyse scientific data in their labs. They stress that listening to data through sound and music is an entirely natural way for us to experience pictures as melodies and rhythms, and in fact we are naturally better at picking out patterns and anomalies with our ears than with our eyes!

Through sound, we can also perceive multiple streams of data at one time, providing a multidimensional representation of a data set. Image sonification allows certain properties of the picture, for example the existence and shape of clusters, the abundance of a specific colour, the recurrence of a particular brightness pattern, to be portrayed as sound and melodies.

As an example of how sonification can be used to communicate and explore science from a different perspective, the two scientists used this technique to create a very special piece of music that was premiered at NASA's booth at Supercomputing 2018 (SC18).

Mars rover records its 5,000th sunrise on the red planet

Opportunity is a robotic exploration rover that has been providing photographic data on Mars for NASA since 2004. On February 16 2018, Opportunity captured the 5,000th sunrise witnessed on Mars – marking the equivalent of 5,137 Earth days' continuous operation of the rover*.

To create their piece of music, Dr Williams and Dr Vicinanza analysed this picture – pixel by pixel – looking at brightness and colour information and combining this with terrain elevation, assigning to each element a specific pitch and rhythm.

Within the piece, the quiet, slow harmonies are a consequence of the dark background and the brighter, higher pitched sounds towards the middle of the piece are created by the sonification of the bright sun disk.

This special piece of music was presented using both conventional speakers and vibrational transducers so the audience could feel the vibrations with their hands, thus enjoying a first-person experience of a sunrise on Mars.

Dr Vicinanza, who is also a Senior Research Engagement Officer for GÉANT said: "We were absolutely thrilled to present this work about such a fascinating planet. Image sonification is such a flexible technique to explore science and it can be used in several domains, from studying certain characteristics of planet surfaces and atmospheres, to analysing weather changes or detecting volcanic eruptions."

Dr Williams added: "The process of sonification is relevant for science because it gives us a different medium through which to explore data. In health science, for example, it can provide scientists with new methods to analyse the occurrence of certain shapes and colours, which is particularly useful in image diagnostics."

The sonification process used the EGI (**www.egi.eu**) computing infrastructure, connected through the GÉANT network (**www.geant.org**) and its European NREN partners. This created a mesh of computers working together seamlessly. Only distributed grid computing like this can provide the high-bandwidth needed to turn millions of pixels into sound waves. These collaborative computing networks can be used to accelerate scientific discovery across many domains.

To learn more, visit
impact.geant.org/Mars

Picture
Dr Domenico Vicinanza on the NASA booth at SC18