

Dissemination of nanogeoscience using virtual reality and sonification: a low-cost, immersive and inclusive experience

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Most of the geochemical processes involving nanogeoscience take place at scales far beyond of our daily life. This brings an interesting challenge for the general public perception and understanding of geochemical phenomena mainly at nano and microscales. To improve this perception, we have explored perceptive experiences and emerging technologies involving scientific visualization through virtual reality and sonification. The idea of perceptual exploration is to experience physical systems (from atoms to galaxies) on the same scale as our physical perception. In this way, it is possible to interact and sensing the world on a give scale (nano or astronomical) and to create an intuition about the structures, sizes, space and dynamic processes in this scale. We couple multiscale molecular simulations with a gamming virtual reality system to provide to the participant an immersive experience at nanoscale. Our VR and sonification examples of nanoworld were built based on first principles calculations and molecular simulations in our group regarding nanogeoscience phenomena presented in previous Goldschmidt conferences (nanostructures and nanoporous media, rock-oil-brine interfaces, growth and dissolution processes) and also examples on the nature of chemical bonds and nanostructures architecture (1). The virtual reality experiences were based on NOMAD-VR software running on HTC-VIVE head-mounted display and VR glasses using smartphones. We have also applied sonification techniques to molecular simulations to enhance the VR immersive experiences and data visualization. Sonification is a process to convert data in sound, which can be systematic and reproducible. This technique offers interesting opportunities not only to represent scientific data in an alternative way to images but it provides some material for creating new ways of music composition and also turning the science dissemination process more inclusive (2). These low-cost immersive experiences were tested in several events with scientific and non-scientific audience and also for high school students. Based on a questionnaire survey among the attendees, our demonstrations show that VR combined with molecular simulations and sonification can be an interesting and attractive tool to improve the perception of the nanogeoscience phenomena for the general public, especially for the younger generation.

- 1) <http://agencia.fapesp.br/virtual-reality-permits-immersion-in-the-world-of-atoms-and-molecules/29448/> (accessed March 28th, 2019).
- 2) <https://somifusp.wixsite.com/criatividade> (accessed March 28th, 2019)

