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Digital planetariums, virtual environments, fiction, and science interpretation by science educators

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Image de fond : ©RSA Cosmos, logiciel SkyExplorer.

1 Planétariums, immersive fiction media of virtual reality

Immersion in the Universe

According to Jean Davallon (1999), we consider digital planetariums as media proposing an immersive experience. Visitors are immersed in the reconstitution of a reference universe (Belaën, 2003), here, Space (stars, planets, galaxies, and so on.).

Substituting the real by the virtual

Digital planetariums mobilize virtual reality. It produces virtual environments with a particular function: extract yourself from physical reality to virtually change time and place (Fuchs, 2018). These environments show inaccessible objects. According to Renaud (2020), these virtual environments allow the presence of the imperceptible. They substitute the real world with a virtual world.

Imaging invisible and distant objects

To understand this inaccessible universe and invisible objects, astrophysicists build theoretical models. They also provide scientific visualization of these theoretical models (Black Holes for example). These kind of visualization are considered as controlled "fiction".

2 This thesis questions...

Scientific visualization status of virtual environments

Virtual environments are composed of objects represented by scientists. From scientific context to media context, these visuals undergo some transformations.

How are these scientific images transformed into vulgarized images? How are these images integrated into the virtual environments of planetariums?

Digital devices' appropriation by science educators

Even with digital devices, current studies show that live presentations made by science educators are essential to allow visitors to give meaning with delivered knowledge (Urbas, 2014). Little explored to date, this dimension is fundamental in the planetarium field.

How do science educators use digital devices to deliver scientific knowledge thanks to visuals?

Scientific interpretation thanks to fiction

Access to the inaccessible, see the invisible, understand an unestablished knowledge, these are some characteristics of vulgarization of astrophysics. According to Schaeffer (2005), planetariums authorize "suspension of disbelief" to immerse visitors in the world of fictions of science. Scientific educators must allow visitors to enter in the game of the "as if" (as if we could see a black hole).

How do fiction and virtuality allow visitors to understand scientific knowledge?

3 Méthodology

Understanding the virtual environments of planetariums

Scientific visualization in SkyExplorer's virtual environment (semiotic analysis).

Analysis of scientific visualization along two axes:

- Iconicity Scale: analogical relationship of the visuals with the referent object (Moles, 2014);
- Link with the scientific process (Allamel-Raffin, 2006).

Design of the virtual environment

Qualitative interviews with designers of SkyExplorer.

- Media constraints imposed by the software to designers;
- Scientific and technical resources used;
- Anticipation of educators' uses by designers.

Understanding scientific interpretation practices in a planetarium context

Social representations of educators in planetariums

Qualitative interviews with educator in planetariums.

- Social representation of the virtual environment and scientific images;
- Meaning of the uses made by the educators of the software SkyExplorer relative to the images used.

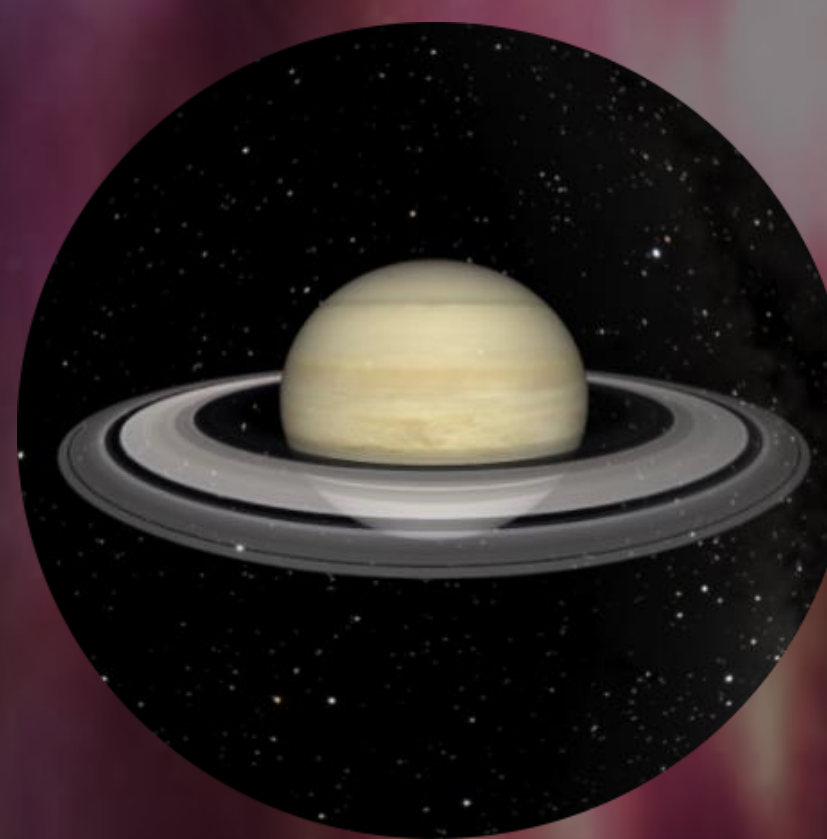
Science Interpretation practices

Observation of educators during planetarium show.

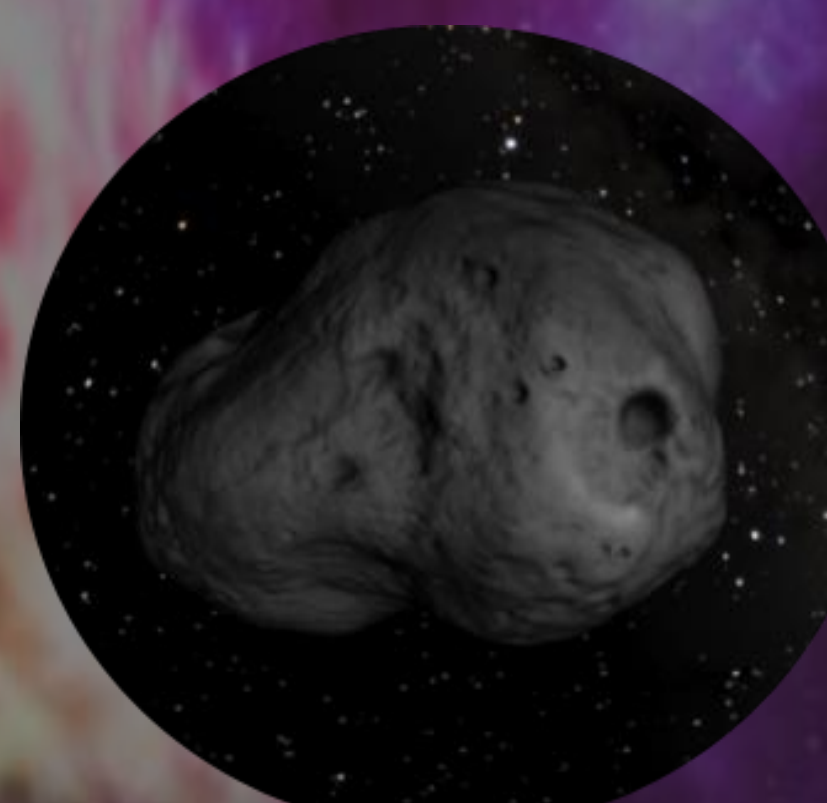
- Which software's features are used? Which are not used?
- Impact of these uses on functions and status of scientific visuals mobilized during a planetarium show.

4 First results - Understanding the virtual environment of a planetarium software, SkyExplorer

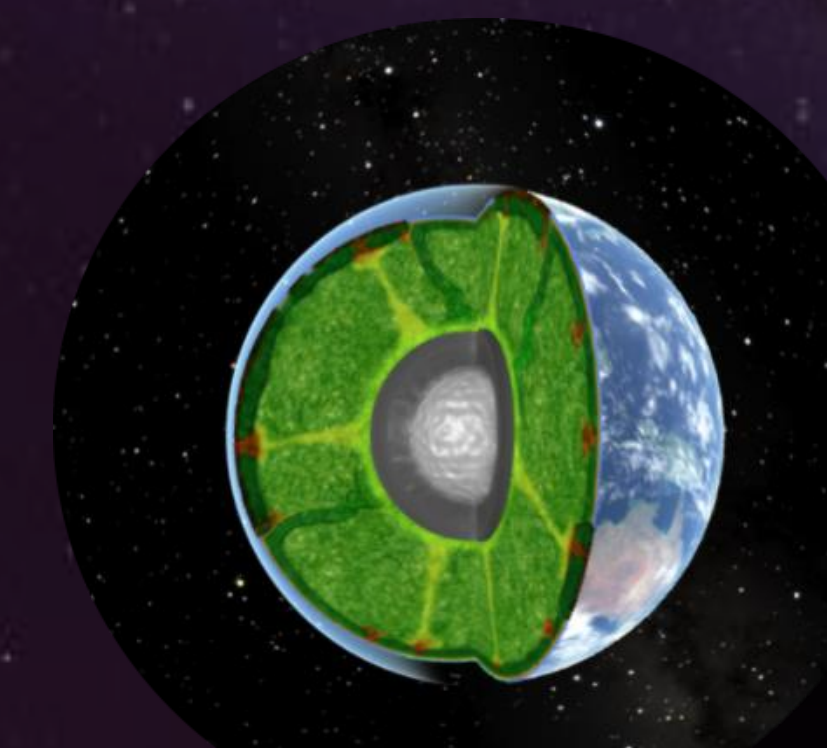
Iconicity scale (Moles, 2014)



Three-dimensional representation with a faithful relationship to the referent. Example: Saturn.

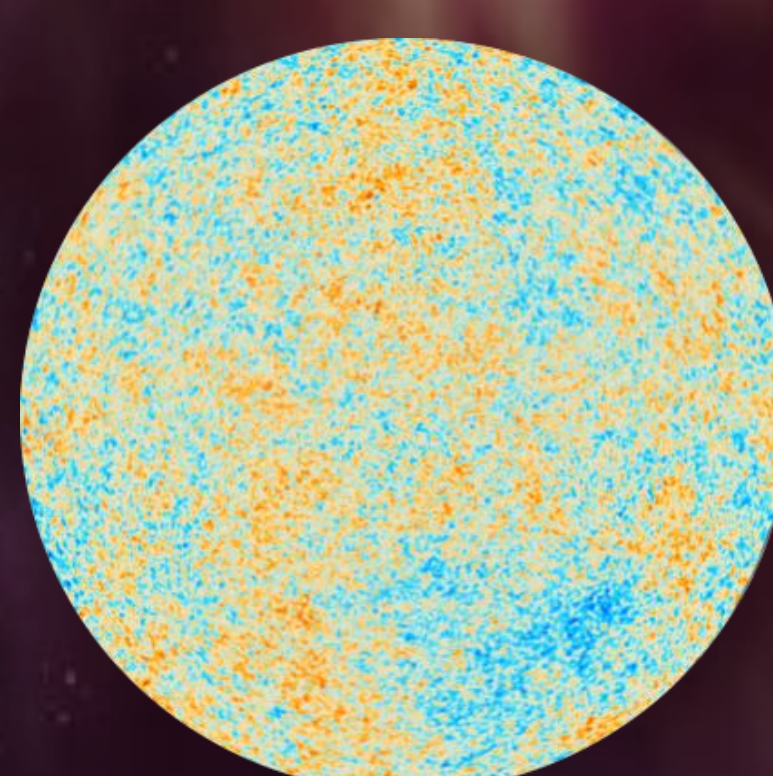


Three-dimensional representation with an archetypal relationship to the referent. Represents a family of objects and not one singular object. Example: Psyche asteroid.



Schematic three-dimensional representation. Example: internal layers of the Earth.

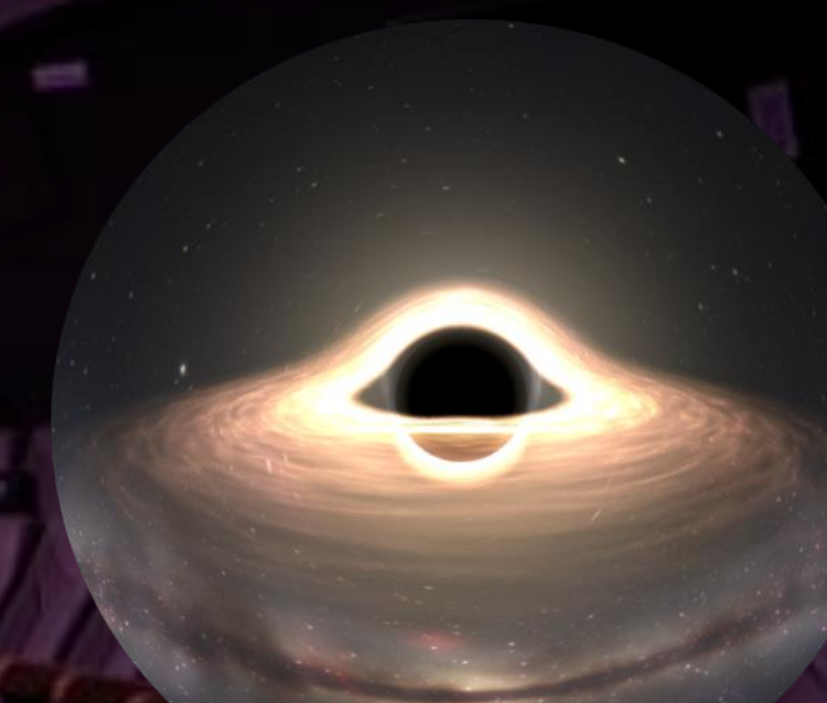
Link with scientific process (Allamel-Raffin, 2006)



Representation from reprocessed data. Example: Cosmic Microwave Background.



Three-dimensional representation relating to a scientific simulation. Example: Milky Way.



Three-dimensional representation relating to scientific modeling. Example: Schwarzschild black hole.

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Image de fond : ©RSA Cosmos, planétarium 3D La Coupole (FR).