

Science Live Show UNIVERSE: A Collaboration between Researchers, Students, and Museum

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Science live show UNIVERSE is a weekly program at the Science Museum, Tokyo. We have continuously performed over 1,800 live shows every Saturday afternoon since 1996. The unique feature of UNIVERSE is that it is operated through collaboration between scientists as navigators of live show, students team “Chimons”, and staff members of the museum. The navigator constructs 40-minutes live shows by combining several contents which have been developed by ourselves. Audiences enjoy not only interactive scientific talks by the navigator, but also powerful visuals of scientific real-time simulations and pictures. A guest speaker is also invited in every live show to make a ten minutes talk about his/her scientific research. In addition, international live astronomical observations are carried out through some collaborations with foreign observatories via internet. Our activities of UNIVERSE have progressed continuously since its beginning. We present overview and history of our activities and how we operate and maintain the live show.

1. Introduction

UNIVERSE is a science live show which is a regular program at the Science Museum, Tokyo, Japan on every Saturday afternoon (Fig. 1) [1], [2]. Its unique feature is that a scientist hosts the show as “navigator” and makes fully interactive performance using impressive 3-D simulations and visualizations of science such as astronomy, chemistry and so on. Volunteer students team Chimons plays important roles in operating the live show. Museum staff members also provide technical and clerical supports. The UNIVERSE live show has kept on evolving for more than 19 years in tight and equal cooperation between scientists, students and museum staff members.

2. History

Since the science live show “UNIVERSE” started performances in April 1996, we have kept improving it through try and error process [3]. The theater was originally named “UNIVERSE”, which had 200 inch flat screen and 72 seats. Its projection equipments were a workstation/PC and a video projector. The screen was replaced into that for stereoscopic vision by polarization in 2002. The whole theater has been remodeled into “Synra Dome” with a tilted dome screen and 62 seats in 2008, which is the first permanent fully-digitized 3-D dome theater in Japan. Twelve projectors are used for full-dome pictures with stereoscopic vision. It enables us to demonstrate live shows with deeply immersive visualizations of scientific simulations.

We have two live shows on every Saturday afternoon in the Science Museum, which result in more than 1,800 live shows until the date of the symposium. Total



Fig. 1 Science Live Show UNIVERSE at Synra

number of audience has reached over 88,000. Fig. 2. indicates yearly transitions of number of audience and that of audience filling rate which is calculated by dividing the number of audience by seat capacity. Most of contents and software for the live show have been developed in collaboration between students of Chimons and scientists of navigator.

3. Contents of UNIVERSE

We have various contents for the live show. The navigator makes an original scenario of the day by selecting a few of them and including current topics. The flexible scenario is a merit of live show by scientist. Typical contents are shown as follows.

3.1. Solar System Simulation

Using a three-dimensional simulation software of the universe, Uniview, we show our audiences beautiful full-dome view of the solar system: stars from the ground, fly through the planets of the solar system.

When we use a simulator of gravity, Newton's Apple (NoA) [4], gravitational effects between sun and planets are simulated. Using this software, we make some experiments of gravity, for example, what would happen when the speed of the earth going around the sun become slightly faster, when the sun disappear suddenly, or when one more star with solar mass pass across the solar system.

3.2. Tour to Distant Universe

The navigator take our audiences on travel beyond the solar system to the distance universe using the Uniview software. We fly between stars in the Milky Way Galaxy, nearby and distant galaxies which are placed with real data. The navigator sometimes orders the operator to stop at highlight location in order to make some explanation and show some images of the object.

3.3. Interstellar Cruising

Another software for visualization of data taken by the Hipparcos satellite, HippLiner [5], provides us interstellar cruising with full-dome and 3-D simulation. The audiences enjoy travel between stars at speed close to light.

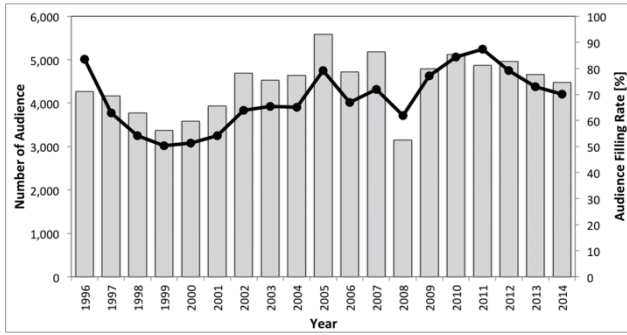


Fig. 2 Number of audience (bar graph) and audience filling rate (line graph) by year.

3.4. *Live Observation via Internet*

In cooperation with astronomical observatories in the United States, we have carried out live observation session via internet. Because Saturday afternoon in Tokyo is Friday midnight in US, we can get real-time astronomical images taken by the observatory's staff. Partner of the session is the Leuschner Observatory from 1997 to 2000, and the Yerkes Observatory from 2000 to now. Audiences enjoy beautiful stellar images right after it is taken and telephone talk between the navigator and the observatory's staff.

3.5. *Three-Dimensional Aurora in Dome*

Full-dome three-dimensional time lapse movies of real aurora borealis are presented by scientist of aurora. Synra Dome is an unique place that audience can recognize the height and the depth of aurora with the real 3-D image taken in Alaska.

3.6. *Molecular Dynamics Simulation*

Contents of the live show are not only simulation of astronomy. Using molecular dynamics simulator which is also developed by a staff of the live show, we show the microscopic phenomena of three states of matter. For example we show a model of NaCl crystal. When the temperature is raised we can show that the atoms of the crystal move faster. If the temperature is above the melting point, the structure of the crystal break into liquid.

Additionally, we display structure and dynamics of some molecules such as water, alcohols, vitamins.

3.7. *Guest Corner*

Every week we invite a guest who is a scientist or a science-related person such as artist or performer. The guest makes 10 minutes presentation about his/her major field. Usually the navigator makes some questions and comments during the talk for helping audience to understand it. We have had hundreds of guests so far.

4. **Traveling UNIVERSE**

We have carried out the live shows also outside of the Science Museum since 1998, which is called "traveling UNIVERSE". It have been played over 100 times all over Japan and a few times abroad. The first oversea traveling UNIVERSE was performed in 2001.

5. Operation by Chimons

Chimons is a team of volunteer students for operation of the science live show UNIVERSE. It was named after the name of an astronomy club in the University of Tokyo because most of original members belonged to it. Chimons usually consists of around 20 undergraduate or graduate students whose majors are not only astronomy but also other science fields, education, engineering, literature, and so on. In total almost 100 students from about 20 universities have worked as members of Chimons so far. They do almost all tasks for the live show as follows.

A live show is operated by three assistants: two of them control the simulation software, sound, light, etc. in the live show and the other takes care of audiences. When navigator of the day inform the detail contents of the show to the mailing list about one week before the live show, assistants confirm the contents and practice operation of the software if they need. They also communicate with the guest of the day via e-mail to confirm place of theater, meeting time, title and content of guest corner, etc. On Saturday, they boot up the computer for operation and prepare the contents at the theater. When the navigator and the guest arrive at the theater, they discuss about how they perform the live show. After the live shows, they report everything in the live shows including name of assistants, contents they performed, and any problems in order to share them with all member of Chimons, navigators and museum staff members. This weekly report is very important because not all members are present at the theater. Most of communications among Chimons member, navigator and museum staffs are on the mailing list. We have monthly face-to-face meeting to share changes and problems and to discuss how we improve them.

Chimons' activities are not limited to operations of the live shows on Saturdays. They have developed software simulating scientific phenomena in response to navigator's requests. Developing contents by ourselves is very important to improve it rapidly. Some images used in the live shows are also made by themselves. Official web site has been made and maintained continuously. Training method for a new member has been developed by Chimons themselves. A new member can learn how to control the live show smoothly and practice operating software several times before he/she debut as an assistant. Traveling UNIVERSE is also arranged by Chimons.

6. Summary

We present 19-years history of the science live show UNIVERSE. Current contents and how we operate weekly live shows are also described. It is a good example of equal collaboration between scientists, students and science museum. UNIVERSE will keep expanding in the future to share the latest result of science and the pleasure of scientific thinking with the public.

References

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