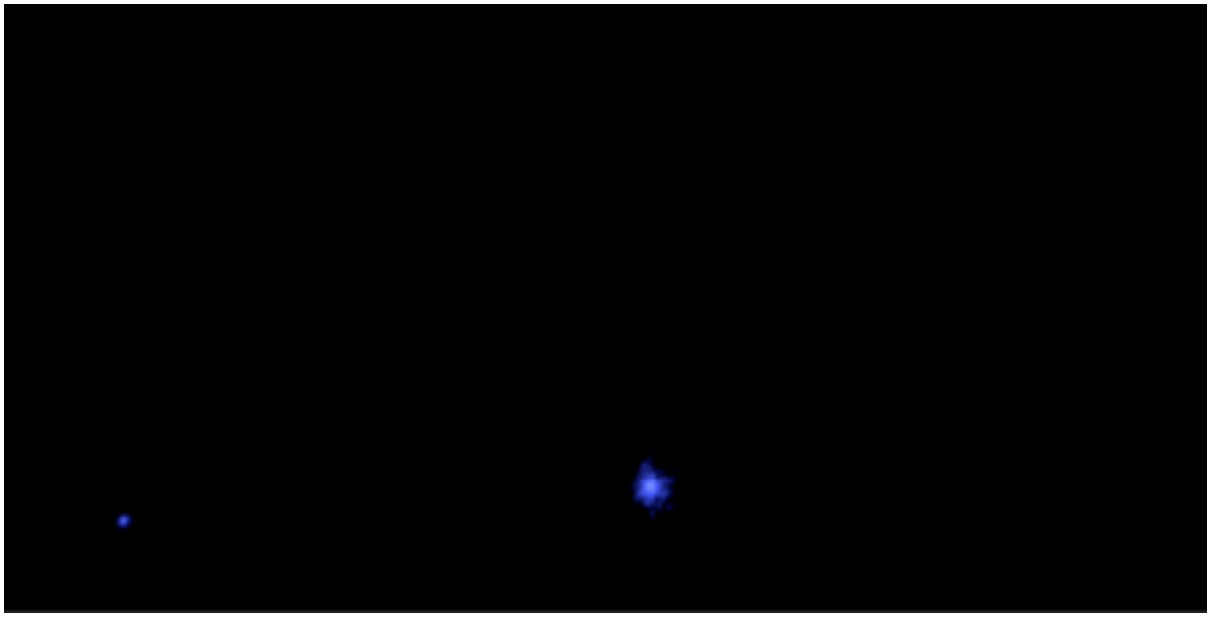
cosmos

a study on the movement of the planets in our solar system



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In this semester I became interested in stars filling the space called the universe.

I have quite a lot of experiences of working with audio - visual media, but this time I tried a new Unity3D scripting - C # challenge. Although it is similar to C ++, it has become attractive to other languages. And I wanted to try using the VR system once and for all, I was able to be a GMU digital lap and began to make VR-interactive audio visual works. I was happy.

At first I tried to study the solar system to which the earth belongs.

The Solar System is the gravitationally bound system of the planets and the Sun plus other objects that orbit it, either directly or indirectly. Of the objects that orbit the Sun directly, the largest eight are the planets, with the remainder being smaller objects, such as dwarf planets and small Solar System bodies. Of the objects that orbit the Sun indirectly, the moons, two are larger than the smallest planet, Mercury.

The Solar System formed 4.6 billion years ago from the gravitational collapse of a giant interstellar molecular cloud. The vast majority of the system′s mass is in the Sun, with the majority of the remaining mass contained in Jupiter. The four smaller inner planets, Mercury, Venus, Earth and Mars, are terrestrial planets, being primarily composed of rock and metal. The four outer planets are giant planets, being substantially more massive than the terrestrials. The two largest, Jupiter and Saturn, are gas giants, being composed mainly of hydrogen and helium; the two outermost planets, Uranus and Neptune, are ice giants, being composed mostly of substances with relatively high melting points compared with hydrogen and helium, called volatiles, such as water, ammonia and methane. All eight planets have almost circular orbits that lie within a nearly flat disc called the ecliptic.

The Solar System also contains smaller objects. The asteroid belt, which lies between the orbits of Mars and Jupiter, mostly contains objects composed, like the terrestrial planets, of rock and metal. Beyond Neptune′s orbit lie the Kuiper belt and scattered disc, which are populations of trans-Neptunian objects composed mostly of ices, and beyond them a newly discovered population of sednoids. Within these populations are several dozen to possibly tens of thousands of objects large enough that they have been rounded by their own gravity. Such objects are categorized as dwarf planets. Identified dwarf planets include the asteroid Ceres and the trans-Neptunian objects Pluto and Eris. In addition to these two regions, various other

small-body populations, including comets, centaurs and interplanetary dust clouds, freely travel between regions. Six of the planets, at least four of the dwarf planets, and many of the smaller bodies are orbited by natural satellites,[f] usually termed "moons" after the Moon. Each of the outer planets is encircled by planetary rings of dust and other small objects.

<Solar system data sheet>

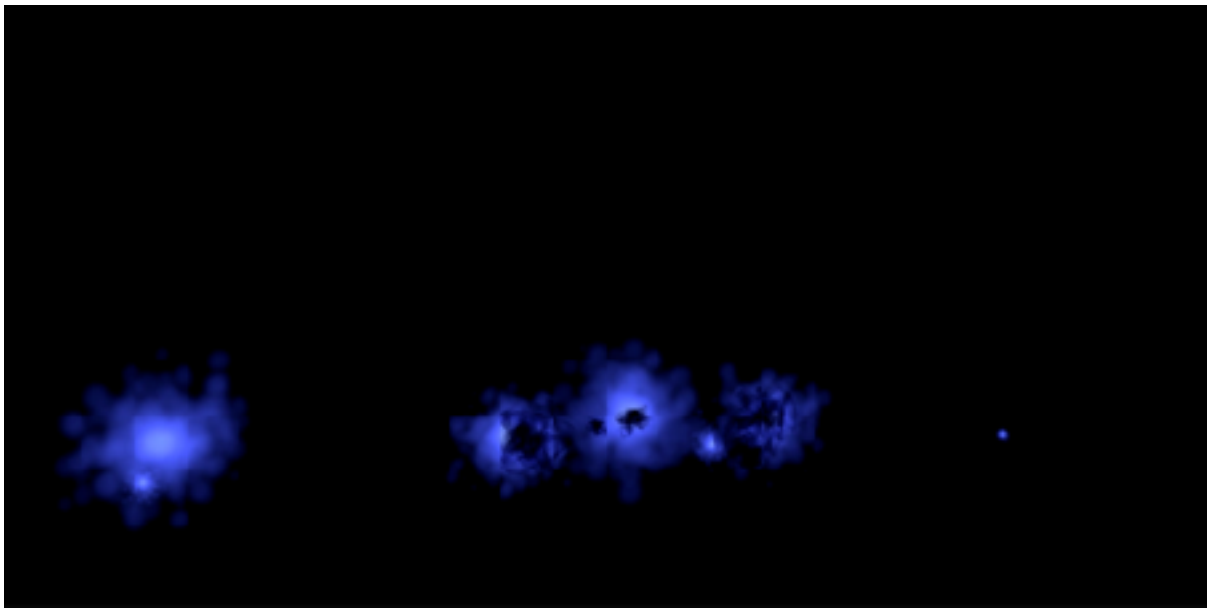
	MERCURY	VENUS	EARTH	MOON	MARS	JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
Mass (10^{24}kg)	330	4.87	5.97	73	642	1898	568	86.8	102	0.0146
Diameter (km)	4879	12,104	12,756	3475	6792	142,984	120,536	51,118	49,528	2370
Density (kg/m^3)	5427	5243	5514	3340	3933	1326	687	1271	1638	2095
Gravity (m/s^2)	3.7	8.9	9.8	1.6	3.7	23.1	9.0	8.7	11.0	0.7
Escape Velocity (km/s)	4.3	10.4	11.2	2.4	5.0	59.5	35.5	21.3	23.5	1.3
Rotation Period (hours)	1407.6	-5832.5	23.9	655.7	24.6	9.9	10.7	-17.2	16.1	-153.3
Length of Day (hours)	4222.6	2802.0	24.0	708.7	24.7	9.9	10.7	17.2	16.1	153.3
Distance from Sun (10^6 km)	57.9	108.2	149.6	0.384 *	227.9	778.6	1433.5	2872.5	4495.1	5906.4
Perihelion (10^6 km)	46.0	107.5	147.1	0.363 *	206.6	740.5	1352.6	2741.3	4444.5	4436.8
Aphelion (10^6 km)	69.8	108.9	152.1	0.406 *	249.2	816.6	1514.5	3003.6	4545.7	7375.9
Orbital Period (days)	88.0	224.7	365.2	27.3	687.0	4331	10,747	30,589	59,800	90,560
Orbital Velocity (km/s)	47.4	35.0	29.8	1.0	24.1	13.1	9.7	6.8	5.4	4.7
Orbital Inclination (degrees)	7.0	3.4	0.0	5.1	1.9	1.3	2.5	0.8	1.8	17.2
Orbital Eccentricity	205	7	17	55	94	49	57	46	11	244
Obliquity to Orbit (degrees)	34	177.4	23.4	6.7	25.2	3.1	26.7	97.8	28.3	122.5
Mean Temperature (C)	167	464	15	-20	-65	-110	-140	-195	-200	-225

I decided to sonificate this data.
Once I saved the data using max coll, I decided to write that data with some parameters of the sound. Each planet has identification sound which was designed with supercollider. With the VR glasses people can among the planets and hear the sound. Interruptions between planets

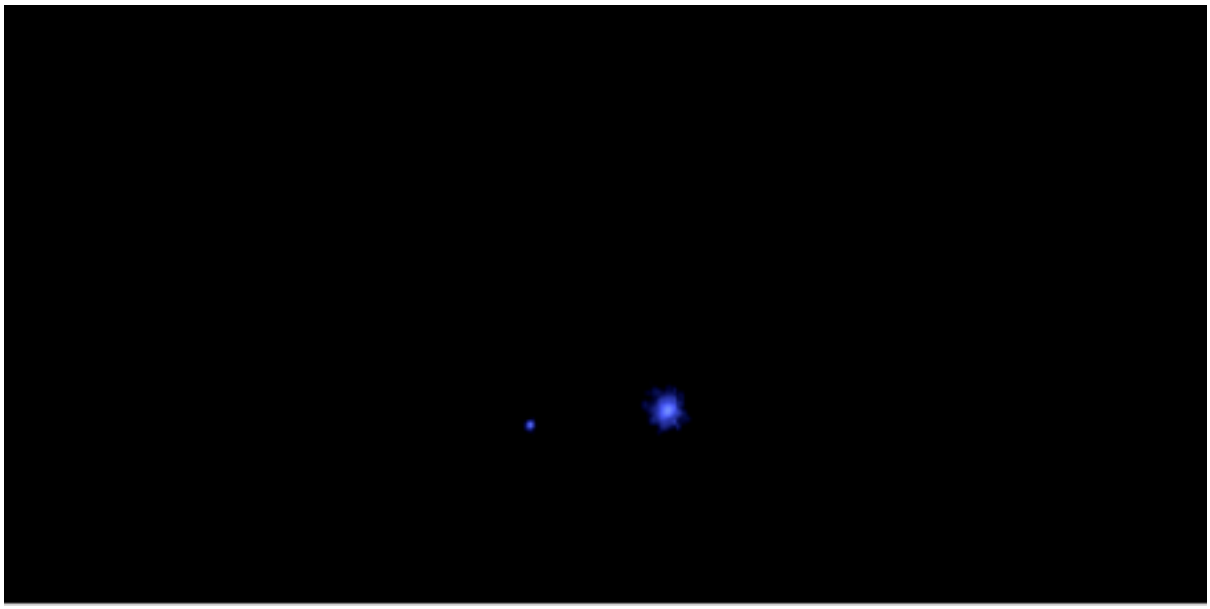
change according to the position of people, so I also gave interaction to it. Visual design is Unity 3D using C#, and calculated the orbiting function with C#. The position of the planet was transferred with OSC to Max, and its position also caused interplanetary interference and made the sound modify. The position of the person was tracked by 2 virtual walls, C# read it and sent to Max. That is, all controls are done in Max, which is a method to transfer data to OSC in supercollider, to generate and modulate the sound.

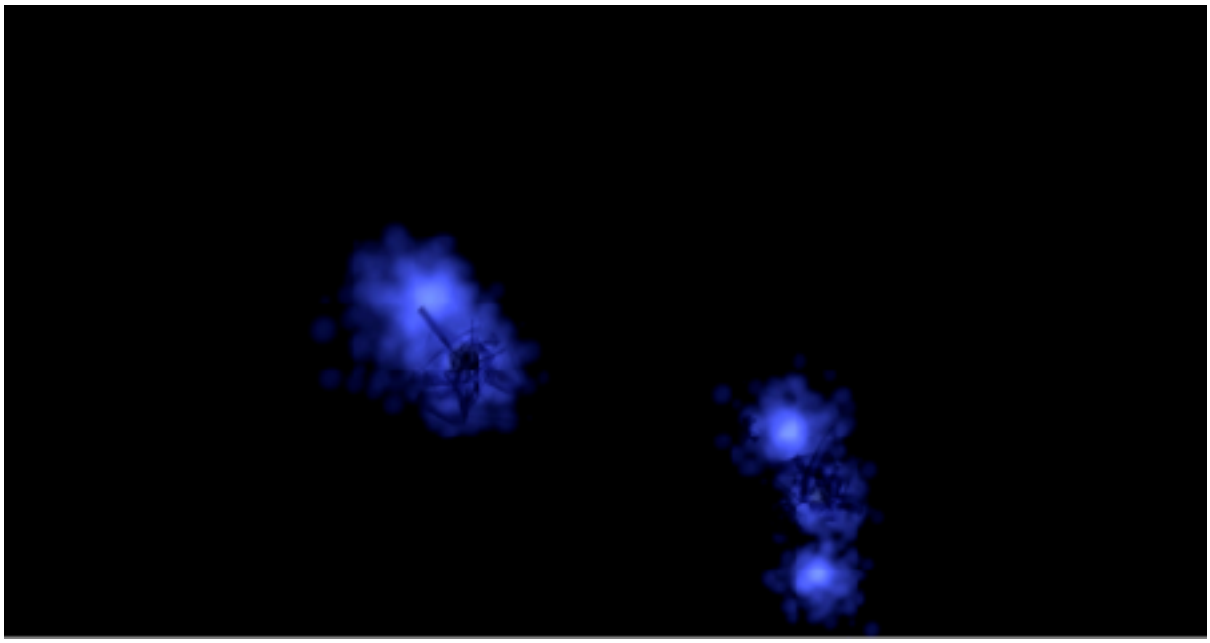
<C# codes>

<Visuals with VR Glasses - Planets and their moons>

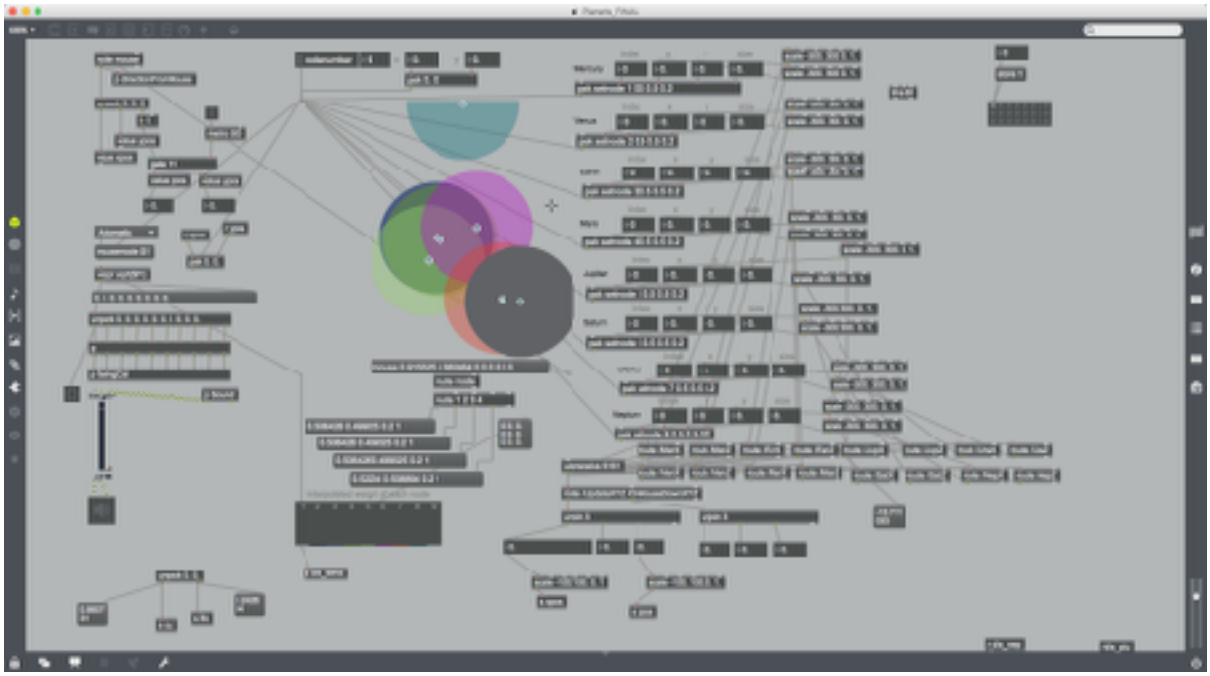


<The Earth and Neptune from the far view>

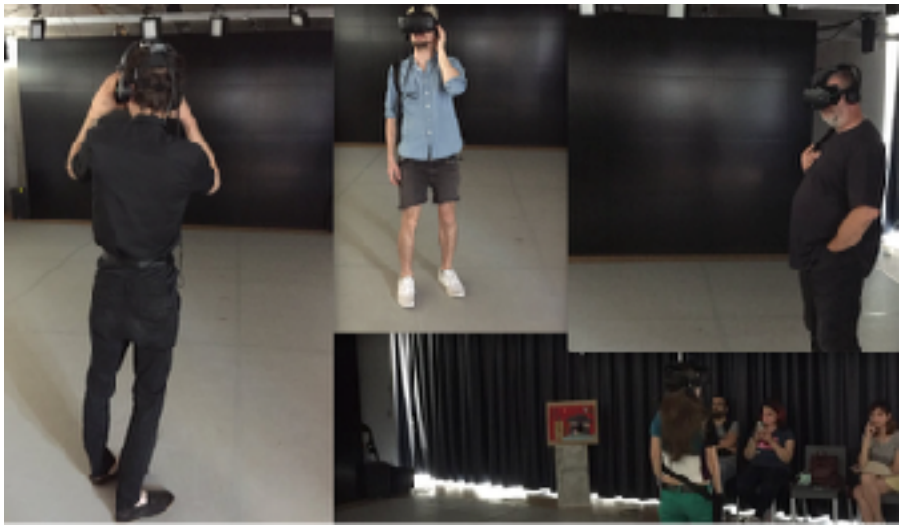




<Max Patch - Supervisor>



A lot more people came than I thought. It was a shame that there were many people who came to see my work and returned a lot because the time given to me was only two hours. The exhibition was easy. Once I had simplified the system with one Max patch, one Super Collider patch and one Unity 3D application, it automatically tracks the person's coordinates, Max receives it to OSC and sends it to supercollider again. It was refreshed without error or bug so that it could work perfectly. However, one point that I want to revise is that planets are to be considered the most ideally seen when a 180 cm person looks, considering the people's different heights as the average value, thus either a shorter or a taller one should bend their knees. It was a little bit of inconvenience. I thought that next time I have to complement the input by entering the height with the GUI of the application. Also, there are problems



<Summaery 2018, Digital Bauhaus Lab>

that distances outside the tracking area are not close to Earth, Mercury, Venus, and planets other than Jupiter, which decelerate the orbit of the planet at a fixed rate. Although it seems that it can be solved by widening the tracking range, it seems that I can not do it now due to the limit of the exhibition space. Next time I must complement with a big space. Like other pieces of mine but a bit more, this piece would be unforgettable to me forever. All the sleepless night I had gave me the best present. I will keep trying making experiments.

Video Links :
https://vimeo.com/292074847
https://vimeo.com/292075035

Password : criticalVR