

## A MULTIMEDIA REPRESENTATION OF THE INCREASE OF GLOBAL WARMING FROM 1940 TO 2016

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### Abstract

*76* is an audiovisual work that, based on actual environmental data, proposes a multimedia artistic representation of the increase of the Earth temperature over the last seven decades. After a general overview of the piece and an explanation of the data themselves, brief definitions of the concepts of “climate change” and “audiovisualisation” will be proposed. Later on, the work will itself will be discussed.

### Introduction

*76* is a multimedia fixed work composed of high-definition visuals and a stereo audio track. It is 3’,56” long and it offers an artistic representation, both visive and auditive, of the rising Earth temperature. Based on actual scientific data, it takes into account the anomalies—positive or negative ones—registered by NOAA and published by NASA and comprising, at the time of writing this paper, the years from 1880 to 2016 [1]. From this series, the time interval considered for the realisation of the work ranges from 1940 to 2016. This choice is because except for some sporadic years—such as 1946-51, 1954-56, 1964-68 and some other few—the temperature has more often registered a positive anomaly, with 2016 that reached one of +0,9363 °C, being recorded as the hottest year to date and second only to 2020 [2].

Besides the artistic, data-driven visuals, which will be explained later on, *76* offers a clear visualisation of the data processed from time to time. Bottom and centred, there is a numeric representation of the value of the actual temperature from 1940 (+13,99 °C) to 2016 (+14,86 °C). This number is linearly interpolated from the data of the year

considered to the data of the following one. Therefore, its changing rate is proportional to the difference in °C occurring between the two years. Moreover, on the upper-left corner, the year taken into account is reported; each year has a duration, in the artwork, of 3”.

Lastly, the name of the piece itself is derived from the interval of years considered, which is composed of 76 years.

### Climate change

Climate change is a convenient way to describe spectra of different phenomena caused mainly by anthropisation and humans’ activities. The increasing of the global average temperature—besides being the core data of this work—is perhaps the most significant and observable phenomenon, with several direct consequences such as ice-melting, rising of sea levels and warming of waters. Moreover, there are also indirect ones, such as changes in the food chain and animals’ biological cycles due to seasonal imbalances [3]. Alterations of Earth temperature are the result of a perturbation of the planet’s energy balance; and once this system is perturbed, feedbacks arise, enhancing or suppressing the perturbation [4]. The consequence of this cycle is the generation of the aforementioned phenomena, on the top of which can be added sudden atmospheric events, such as the recent water storms and heatwaves which strained the European inland.

### Temperature anomaly

Accordingly to [5], it can be described as «how much warmer or colder than the long-term average [...] something is». Therefore, it reports how much the Earth temperature registered the

most recent year differs from the long-term average.

### Audiovisualisation

Audiovisualisation is a term that can be used to describe the «Simultaneous sonification and visualisation of the same data source [...]» [6]. The duplication of data over these two different media reinforces the listener-viewer’s experience, which takes the shape of an augmented sonification. The relationship sounds-images has been deeply explored in the artistic context, and so is still being. It traces its origins back to the first half of the past century, with works-experiments such as *An Optical Poem* (Oskar Fischinger, 1938), and is nowadays explored by multimedia artists such as Ryoichi Kurokawa and many others. However, audiovisualisation has a practical meaning out of the artistic domain too, being employed in tools like spectrosopes and oscilloscopes.

In *76* both audio and video are related to the data. However, it is easier to identify this relationship in the images, rather than in sounds. Indeed, images have been designed to offer first of all a descriptive visual experience, and then an artistic one. On the contrary, audio was created with the primary purpose to express a concept artistically while describing a series of data in the background.

### The genesis of the artwork

As *76* is based upon a series of data, it is from their collection and adaption to the scope of the project that its realisation began. Subsequently, the video was the first of the two media created and, on top of that, audio was designed and added at a later stage.

### Video

The video is composed of three main parts: the main visuals, centred; the top-left corner label showing the year considered and the bottom, centred one showing the value of the linear interpolation between the year considered and the following one. While the sole purpose of the latter is to show in a clear way the data processed, the former is itself related to the concept of audiovisualisation, as it changes the

colour of its background as the temperature increases. Starting from a white glow, it reaches an intense red one.

However, the most important part of the artwork is the globe placed in the centre. It is an artistic representation of the Earth realised—by layering one on the top of the other—different particle systems. As the different years are processed, their recorded temperature and anomaly determine the size of the portion of the model that has to be greyed, glitched and distorted, representing the amount of alteration of the climate equilibrium. As for the label reporting the temperature, the greyed area is linearly interpolated between the year taken into account and the following one. Therefore, it is ever-changing.

The size of the greyed area reaches its minimum in 1956, with a temperature of +13,70 °C—yet it still has a slight impact on the Earth model—, and suddenly ramps up, with the following two years almost touching +14 °C. During the last years of the series, all the Earth goes covered, as the temperature is far above +14 °C. Following this reasoning, it is self-explanatory why the visuals start with the Earth obscured for almost a quarter, as the first year considered, 1940, registered a +13,99 °C.

### Audio

Audio offers an artistic representation of the dramatic process of global heating while following the evolution of the visuals. It was designed by using as sources three important speeches related to climate and its protection. One is of Barack Obama [7], and one is of Leonardo DiCaprio [8], both recorded at the 2014 Climate Summit. Moreover, there is also a sharp and courageous speech held by young Swedish activist Greta Thunberg at the Austrian World Summit 2021 [9]. These materials have been manipulated to represent the current situation where, although many people are fighting for climate justice, the overall, global response to this emergency is often fragmented, weak or ineffective. Furthermore, these speeches have been altered using audio effects, by mapping different parameters to the temperature data. For

example, this is why Obama's speech slowly morphs into a monophonic bassline as temperature increases.

### References

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- [8] [https://www.youtube.com/watch?v=vTyLSr\\_VCcg](https://www.youtube.com/watch?v=vTyLSr_VCcg). [Accessed: 17 July 2021].
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### Weblink

<https://drive.google.com/file/d/1KT9jKAnnQ39m9yCJcqKRSbn7SQ3IS2V8/view?usp=sharing>

### Author Biography

Enrico Dorigatti is a sound designer and sound artist based in Italy. He has a strong interest in multimedia, music, technology and the contact points between them. After a diploma as an IT specialized technician, he obtained a Bachelor's Degree and a Master's Degree in electronic music. During his studies, he attended many masterclasses held by, among the others, Daniel Teruggi, James O'Callaghan, Alvis Vidolin, David Pirrò, Antonio Camurri, Barry Truax. He is the developer of URALi, a software library designed to provide easy to access and easy to use audio synthesis and manipulation functionalities to Unity programmers. This ongoing project was presented at the XVI SMC conference, as part of the scientific program. URALi is at the ground of several artistic works such as Life, an auto-generative multimedia software performed, among other occasions, at the XXII CIM and the Biennale d'Arte Contemporanea di Salerno 2018. Other of his works have been selected and performed nationally and internationally in festivals and conferences. From late 2019, as a sound artist and sound designer, he has been part of Movimento Creative Label, an Italian creative collective. In 2021 he has been resident artist for Art Stays (SLO).