

# “Divina!” a Contemporary Statuary Installation

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## *Abstract*

In 2021, the year of the 700th anniversary of Dante Alighieri’s death, the ASTRO Laboratory of the Pisa University Department of Civil Engineering have set up, in collaboration with the Tuscany Regional Council, the contemporary statuary installation “Divina!” based on the work of the great poet. This installation leads users to ponder, from a technological standpoint, the way in which the means of communication are used and the importance of preserving and conserving the roots of linguistic evolution.

## *Keywords*

Divina Commedia, interaction of technologies, facial recognition, contemporary statuary installation.



## Introduction

The year 2021 was characterized by several initiatives aimed at commemorating the 700th year since the death of Dante Alighieri, occurred in exile in Ravenna between September 13 and 14, 1321. Among these initiatives, the Authors wanted to pay homage to the universally acknowledged father of the Italian language and bring to the attention of Italians the enormous artistic and literary heritage bequeathed to the posterity by Dante. In this context, the ASTRO Laboratory of the Pisa University Department of Civil and Industrial Engineering, have joint efforts with the Tuscany Regional Council, the innovative startup and Pisa University spinoff ACAS3D Soluzioni Digitali and Follia Lab to set up the artistic and technological installation *Divina!*

The project team included very heterogeneous skills (experts in Italian linguistics, engineers-topographers, specialists in the creation of installations and platforms for the use of digital content and in the production of creative concepts). The sciences and the arts involved have allowed many alternative interpretations of the installation, always with a view to celebrating the modernity of the *Divina Commedia* over the centuries.

"Divina!" indirectly puts the accent on a link between Dante and technology, often overlooked but nonetheless definitely recognizable throughout his opus, and also one of the elements that makes the Poem such a relevant work, still able to attract readers after 700 years and counting.

This installation provides food for thought on the importance of preserving and conserving, of keeping the roots in the path of evolution and innovation, in communication and dissemination. In this perspective, "Divina!" intends to lead users to think about the centrality that each person has in the growth of language, being themselves generators of disclosure.

For these reasons, the Authors have tried to replicate, in a contemporary key, the way in which the *Divina Commedia* has spread from the 14th century to the present day, from transcriber to transcriber, from person to person.

The goal was to reinterpret both the work and the poet in a digital reality, with a logic of play and immersive media experience, which would contribute to its dynamic interactive propagation: with the subtle irony of Dante's character, it is easy to imagine that, if the *Divina Commedia* had been conceived nowadays, it would most likely be a video game environment [Caroti et al. 2021].

"Divina!" encompasses transversal skills, the foundations of which were shared, with due philological respect, to make the spirit of all those involved in the project coexist in this installation.

A multidisciplinary working team was set up to achieve the objectives.

Andrea Piemonte and Gabriella Caroti coordinated the project through the ASTRO Lab. They supervised the digital encoding of the *Divina Commedia* and the development of the user interfaces, preparing the hardware and software for facial recognition and the design of the website dedicated to the installation.

Federico Caprioli played the role of technical director and took care of logistics, thanks to his consolidated experience in managing multidisciplinary teams for the creation of installations and platforms for the use of digital content acquired through ACAS3D Soluzioni Digitali.

Marco Cisaria and Michela Belli were in charge of the artistic direction of the project, thanks to their experience in the production of creative concepts and artistic installations.

Giuseppe Patota, professor of Italian Linguistics at the University of Siena-Arezzo and member of the *Accademia della Crusca*, provided scientific validation of the compatibility of the artistic idea with humanistic aspects.

## Artistic Concept

The *Divina Commedia* is one of the longest-lived and most widely distributed literary works in the world. To date, the work does not exist in its original form and, since it was produced before the invention of printing, it was transcribed by hand. Among all the man-

uscripts that have come down to this day there are many different versions. The cases of diversification are many and vary from simple orthographic changes, to complete distortions of the text.

The *Divina Commedia* has represented an innovative and dramatic vision of the contemporary reality of the time, managing to be both *COMMEDIA* and *DIVINA*, walking a thin line that divided fantasy and religion.

The work "Divina!" reinterprets the great writing of Dante, on the occasion of its 700th anniversary, bringing to the public a "metaphorical and artistic key" of what has arguably been the first collective poetic work ever made.

Divina! takes inspiration from the dynamism of the writing and from the diffusion that the *Divina Commedia* has had in the world, while also keeping in pace with the times. Based on this, the Authors seeled to replicate the way in which the *Commedia* has spread, from voice to voice and from hand to hand, transforming itself in a statuesque, dynamic and interactive work.

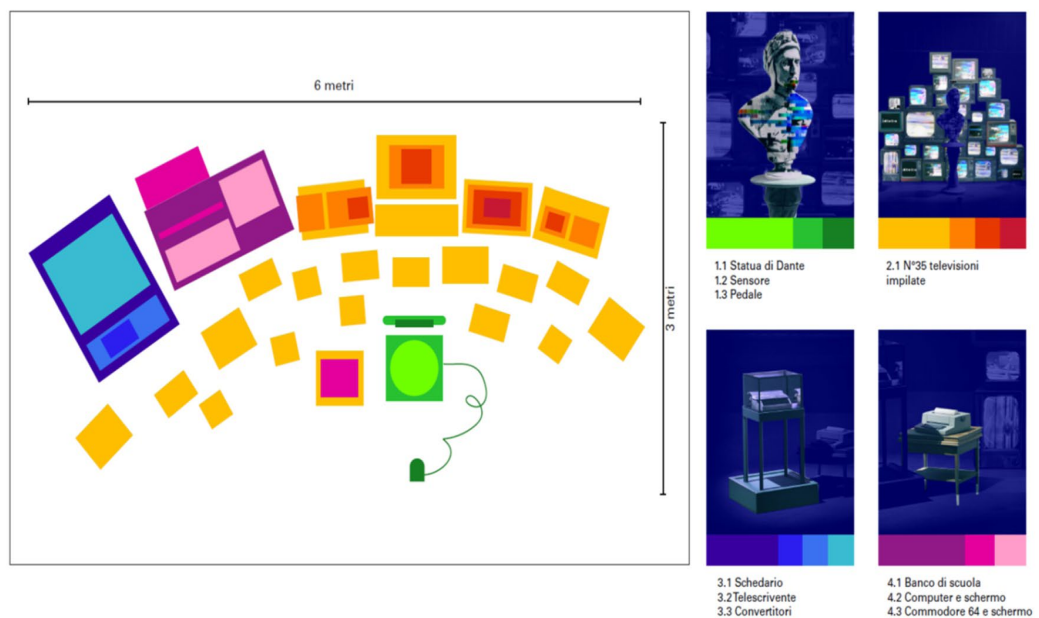


Fig. 1. Graphic concept of the installation DIVINA!

The "Divina!" experience was created to be installed in an indoor location open to the public and consists of a physical avatar of Dante that relates to a single user at a time.

The physical/analog avatar contains digital sensors that, through facial recognition, encode the face of users and transform it into a code, generating 3 lines of unique code, each corresponding to a portion of the face. The code of each portion is then processed by the avatar in order to make it correspond to a verse of the *Divina Commedia* digitized and properly encoded.

In this way, maintaining the tercet structure, a new tercet, built with three verses belonging to three distinct real tercets, is produced, corresponding to a mathematical elaboration of the users' face that, although with a surreal drift, retains its apparent poetic and "Dantesque" sense.

A printer prints the tercet on a sheet of paper for users convenience, and a teleprinter prints on a continuous form all the new unpublished tercets, recreating a new unpublished version of *Divina Commedia*

The experience lived in presence by users has also a reference to a virtual web environment where they can relive/continue their experience and where they have the chance to read or reread the cantos from which the single verses of their personalized tercet have been extracted.

## Technological Component

The technological component is an essential part of the installation: users can witness the evidence of a century of communication systems that interact and converse, transmitting to each other pieces of the *Divina Commedia*.

Latest-generation technology used in the project includes an Intel sensor for facial recognition and a videogaming computer, whose processing and graphic performances are suitable for complex photogrammetric elaborations.

Next to this PC there is a computer mainly dedicated to video games of the '80s, the Commodore 64.

A series of cathode ray tube televisions from the '50s, '60s and '70s then serve as a temporal link to a teletypewriter from the '40s.

The signal generated by the contemporary Intel sensor is translated, sent and displayed by seemingly obsolete communication systems, thanks to their shared binary language roots.

## Facial Recognition Sensor

On the market there are many solutions for facial recognition, starting from simple webcams up to more advanced and complex systems. The system included in Divina! uses the RealSense ID sensor, designed by Intel exclusively for facial scanning and boasting a recognition accuracy of 99.76% (Fig. 2). The sensor does not provide for storage of captured images. Its compact and lightweight design and form factor, which allows for ease and flexibility of installation, were evaluated as additional advantageous features [El Bouazzaoui et al. 2021; Li et al. 2021; Celakil et al. 2021].

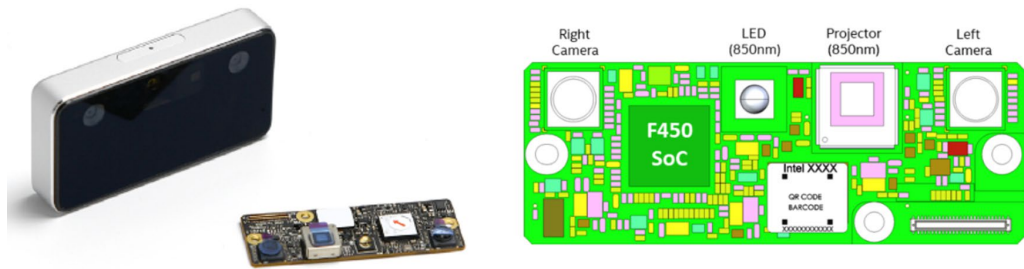


Fig. 2. Intel RealSense: sensor.

Intel RealSense ID uses a specialized neural network that utilizes input data from an active depth sensor. This neural network ensures accurate and secure facial recognition, thanks in part to its built-in anti spoofing technology, which ensures that no photos, videos, or masks can be used for recognition. The processing of the acquired data is divided into two phases. The first is the enrollment process, in which the device stores encrypted facial impressions on the database. A facial fingerprint is defined through mathematical and geometric modeling for notable points of the user's face. The second step is the authentication process, in which the device generates the facial fingerprint and compares it with all the facial fingerprints enrolled in the database. Finally, it returns whether authentication was forbidden or allowed with the enrolled user id.

Describing the sensor in more detail, it is composed of an optical system, consisting of two RGB cameras and an infrared (IR) emitter. The pair of cameras (HFOV 59°; VFOV 80°; DFOV 90°), thanks to the fixed grip base, allow a three-dimensional restitution of the acquired face. The infrared optical system includes both an LED to illuminate the scene in low light conditions and a regular pattern projector for 3D triangulation.

The coexistence of RGB and IR systems allow the sensor to work regardless of the type of lighting of the scene and without the need for a dedicated background. In addition, the

use of feed-forward type networks with supervised learning [Alemayoh et al. 2021] allows for operation even with no need for users to stand still during authentication and ensures a claimed repeatability of 99.76% in subject authentication. The hardware and the neural network are closed systems that cannot be modified in the design phase. It is possible, instead, to modify the user interface and to manage communications between sensor and PC. An ad hoc software interface has been built for the installation, which manages communications with users during the approach to the installation, the identification and the conclusion of the experience. Through the same interface, the unique code generated by the Intel sensor is used to generate the “Divina\_ID”, a 9-digit alphanumeric code. This code is generated by an algorithm that randomly selects from a digitized and encoded version of the *Divina Commedia* three verses belonging to three distinct tercets. Approaching the installation, the user is encouraged to repeat the experience multiple times so that the consistency of the unique face-tercet association can be verified.

### Vintage Technology

As mentioned earlier, the installation complements the latest facial recognition sensor with vintage technology components. One of these is the Commodore 64 PC/video game console. The console was put in communication with the modern PC via the 24pin user port. In order to interface this outdated port with the USB of the PC it was necessary to build a special adapter that first converted the user port in a 9-pin serial and then in a USB (Fig. 3). It was then necessary to write two softwares to put in dialogue the two computers: one in C++ for the PC and one in BASIC for the Commodore.

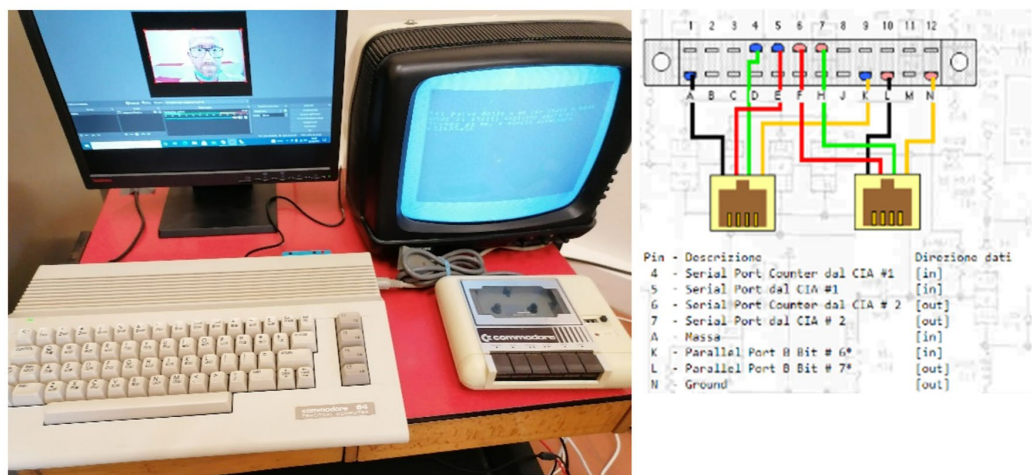


Fig. 3. Commodore 64 and 24 pin port scheme.

The new tercet assigned to the particular FaceID is thus transmitted from the PC to the Commodore and displayed on its screen and on the central television of the installation. Since the Commodore is a computer of the '80s, the video output standard is already analog via RCA coaxial cable (in those years, computers frequently used a normal CRT television rather than a dedicated monitor). Therefore, it was not necessary to use a video format converter; otherwise, an intermediary is required to display an MP4 video file residing on a USB stick on all the other televisions in the installation. A media player reads the mp4 file from the stick and outputs video on HDMI format; an HDMI-SCART converter then acts as a conduit for an analog-to-digital converter with RCA output.

The representation of the last generational leap between technological components occurs with one of the most fascinating elements of the installation: the Olivetti teletypewriter (Fig. 4). It is an automatic electromechanical device for receiving and writing texts.



Fig. 4. Olivetti Teletypewriter.

In the first half of the 20th century, teletypewriters were widely used in radio transmissions of postal messages. They were also used extensively during the Second World War (as evidenced by the images in many films) because they were well suited to applying special encryption to messages.

The format in which the teletypewriter receives and sends a message is typical of radio transmissions and is of the audio type. A two-tone audio signal is sent through the headphone output of the sound card. This signal is transmitted on two distinct frequencies: 1496Hz on the main one with a 425Hz shift on the other. The baud rate is 50bd (equivalent to 60 wpm – transmission speed of words per minute). The transmission protocol is RTTY, which uses a so-called Mark & Space encoding. The desktop PC, where the new tercet is generated, sends an RTTY-compliant signal to the teletypewriter via the headphone output of the sound card.

To make the PC communicate with the teletypewriter there are two pieces of software that act as language mediators. The first, MixW, is used by amateur radio operators to manage service messages between the PC and the teletypewriter and to encode text messages. The second is used to automate the process, as MixW is designed to be used with manual text input by an operator. This software, written in Visual Basic, simulates a virtual operator by importing the text of the new tercet to be printed and executing the appropriate MixW routines.

**ALFABETO TELEG. INTERNAZIONALE  
N°1 PER APPARATI BAUDOT.**

Caratteri		Segnali					Caratteri		Segnali					
Lettere	Cifre	Emissioni del codice					Lettere	Cifre	Emissioni del codice					
		1	2	3	4	5			1	2	3	4	5	
A	1	○	●	○	●	○	Q	/	○	○	○	○	○	○
B	8	○	○	○	○	○	R	—	○	○	○	○	○	○
C	9	○	○	○	○	○	S	.	○	○	○	○	○	○
D	0	○	○	○	○	○	T	(1)	○	○	○	○	○	○
E	2	○	○	○	○	○	U	4	○	○	○	○	○	○
F	10	○	○	○	○	○	V	.	○	○	○	○	○	○
G	7	○	○	○	○	○	W	?	○	○	○	○	○	○
H	+	○	○	○	○	○	X	.	○	○	○	○	○	○
I	(5)	○	○	○	○	○	Y	3	○	○	○	○	○	○
J	6	○	○	○	○	○	Z	:	○	○	○	○	○	○
K	( )	○	○	○	○	○			○	○	○	○	○	○
L	=	○	○	○	○	○			○	○	○	○	○	○
M	)	○	○	○	○	○			○	○	○	○	○	○
N	(1)	○	○	○	○	○			○	○	○	○	○	○
O	5	○	○	○	○	○			○	○	○	○	○	○
P	%	○	○	○	○	○			○	○	○	○	○	○

00001  
00010

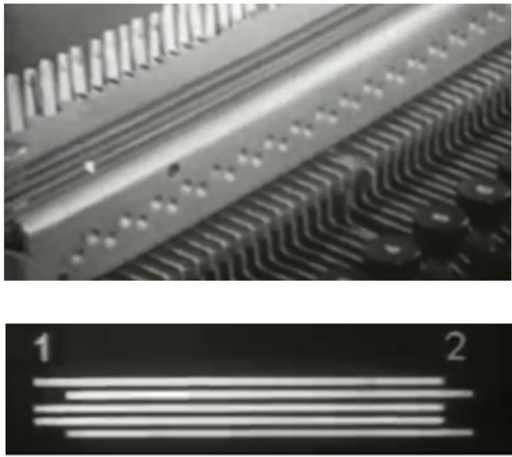


Fig. 5. Baudot alphabet and mechanical selection bars.

As regards the language used, Mark & Space coding is very similar to a perhaps better known language, i.e. Morse code. The packets of 0 (Mark) and 1 (Space) contained in the message sent (the alphabet used is the international 5-bit encoding called “Baudot”) determine the movement of a switch into two possible positions: “Position 0” and “Position 1” (Fig. 5).

In the teletypewriter, the switch positions result in the movement of 5 toothed bars into 2 possible positions. The number of possible combinations of bar positions is 25, which corresponds to 32 positions: these correspond to the 32 possible characters that the teletypewriter is able to write for each position of the carriage (one for letters and one for numbers and symbols).

### User Experience Conclusion

At the end of the use of the installation, users can retrieve from the printer their own personalized tercet with their own unique code with which it is possible to continue the experience on a dedicated web site ([www.divina700.it](http://www.divina700.it)). On this site, by entering their code, users can read the canto from which each verse of their tercet was taken (Fig. 6). The installation thus becomes also a means to invite and encourage the re-reading of three, or possibly more, cantos of the *Divina Commedia*.

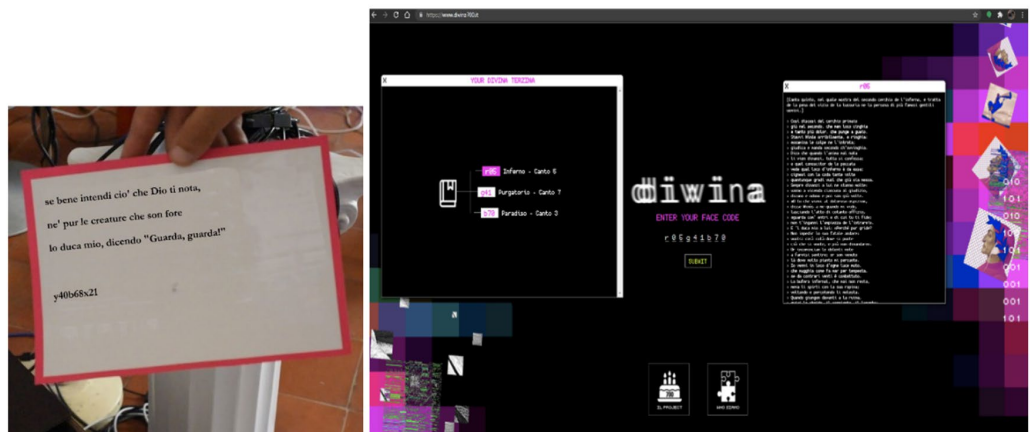


Fig. 6. Printing of the tercet and code for entering dedicated website.

### Conclusions

The 700th anniversary of Dante's death will be celebrated and lived in the complicated context of the pandemic that has brought with it not only uncertainty, fear and suffering, but also an extraordinary impulse towards the digital transition. In the hardest moments of the lockdowns, the massive recourse to ICT-based solutions, from remote working to distance learning, e-commerce, etc., has shown us how digital technologies permeate almost every field of our lives in a pervasive way. The new technologies have supported the authors in the effort to recover a new condition of normality.

The project “Divina!” is placed in this context to celebrate the Great Poet and his immortal work by transposing the technological and digital reality in the Poem.

The *Divina Commedia* was written more than 700 years ago and has come down to our days without intermediaries other than those related to transcriptions or reprints of the text as it was.

Unlike the written text, technology needs many more processes of linguistic intermediation to ensure that the content created and usable on a given device remains so over time but offers the possibility to communicate and project the Poem into the digital future.

In conclusion, we owe a great deal of thanks to Dante, for writing a book seven hundred years ago, without which none of this would have been conceived.

Last but not least, a special thanks to culture and education, for still being able to excel today, as they surely will be tomorrow.

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