A robot in Genoa's Royal Palace (but not only to be admired)

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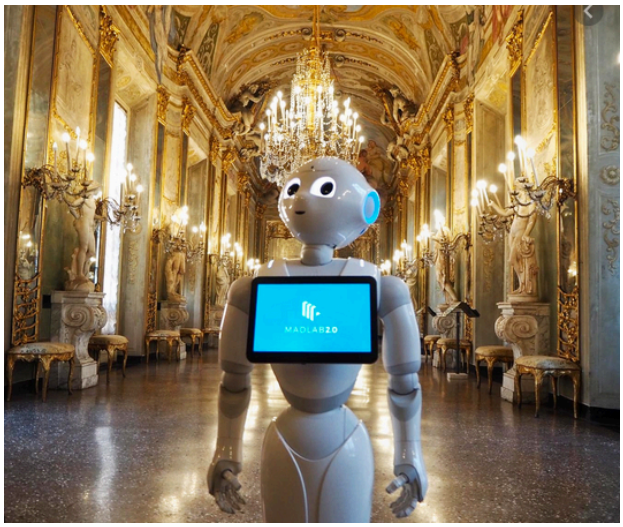
In 2019, Scuola di Robotica had coordinated a Regional Training Course in Liguria, which had taken place in Genoa, dedicated to training museum operators with a comprehensive training that also included the use of digital and robotics for edutainment activities in museums, archaeological sites, and so on.

On this occasion we met the then Director of the Royal Palace Museum, Serena Bertolucci, who is now Director of the Palazzo Ducale Foundation in Genoa, full of creativity and desire to innovate.

Together with the participants of the course for museum operators, we tried to plan some activities to be tested at the Royal Palace of Genoa, games, quizzes, other actions, until we came up with an idea that proved to be successful: we needed a narrative, a game that embraced many aspects of culture and had a story with characters.

We could count on the use of Pepper, a humanoid robot about 1.2 m tall and weighing about 38 kg, owned by Madlab 2.0, the innovative Genoese start-up with which Scuola di Robotica has a very close cooperation. Pepper is the most empathic humanoid robot on the market, originally designed by the French company Aldebaran and then acquired and produced by the Japanese company Softbank. It is a humanoid robot designed to collaborate with humans, a social robot capable of conversations, understanding and reacting to emotions, moving independently, and recognizing voices.



Pepper at the Royal Palace, Genoa

A storytelling robot

The winning idea came while discussing with Dr. Serena Bertolucci: a treasure hunt led by the Pepper robot. Pepper's programming for the treasure hunt took several months, and it was a collaboration between classical culture and robotics. The first treasure hunt took place, with great enthusiasm by all, at the Royal Palace Museum, on 18th May 2019, on the occasion of the International Museum Day.

Genoa's Royal Palace is a very beautiful museum, but often visited hastily. The museum operators told us that visitors were attentive to the first part of the Palace as far as the Throne Room, less to the other rooms which

include the rooms of the court's life, the Queen's bedroom, which are actually full of interesting details: among them, a nocturnal clock in which a candle was inserted that allowed to see the time even at night.

Treasure hunt with robot

Every visitor, or group of visitors, who entered the Museum was welcomed by Pepper who told the story we had imagined: a famous marquis, visiting the Royal Palace, had seen a beautiful hat with blue feathers and wanted to find it. So began the "feathered hat hunt". Each visitor received a qrcode that allowed the robot to recognize the name and to which data was associated, including the city of origin, or the number of participants in the group - if the visitor was accompanied. In total 42 qrcode were delivered and 108 people were involved. The age of the players ranged from 4 to 58 years.

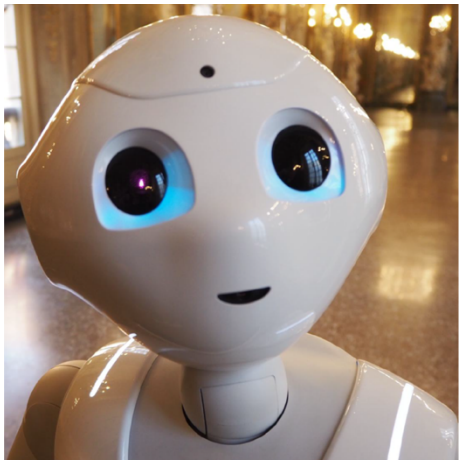
Through a series of riddles posed by Pepper, visitors were invited to carefully observe various rooms of the Museum, in search of the feathered hat, and other important details that would lead them to find the treasure, which is found in a painting in one of the rooms of the Palace. The details that helped the hunt for the feathered hat were details of the rooms, the doors, figures, drawings, statues that perhaps the visitor would not have noticed without the robot's requests.

On this occasion, the average time to complete the game was one and a half hours. This means that the treasure hunt favoured visitors staying inside the museum for an hour and a half, a much longer than average duration for that museum.

Pepper asked questions about details located in certain rooms of the Palace. For example: "How many snakes are hidden inside the hall of mirrors?" and he presented some possible answers. The question about the number of snakes was one of the most difficult, because these details are not very visible, and visitors had to observe the rooms with great attention, thus being able to notice many other details that would have escaped them from a less accurate observation.

Once they had found the object requested by Pepper, visitors would return to the robot, show their qr code and give the answer. The robot encouraged with a "Bravo, correct!", "It didn't take you long", and confirmed the answer by performing an animation inspired by the answer: in this case, the robot moved its arms flexibly like a snake. In fact, with every right answer Pepper mimicked movements inspired by the object found. After these staples, Pepper explained the room or the detail found.

There were six questions, and six times the visitors had to carefully observe the rooms of the Royal Palace: once they had guessed all six answers, the location of the hat was revealed - if it had not already been discovered. We had imagined 40 questions and each player received only 6, at random. Each visitor or group received a set of questions that were different from each other. The questions were not very easy, and favoured an accurate and prolonged visit to the Palace.



The whole game worked great. The operators of the Royal Palace have experience in treasure hunts for children. Certainly, using the robot made the game much more fascinating and engaging, and it was not only for children, but also for adults. Groups and families played together, discussing among themselves how to answer questions. The robot was positioned in a central area of the Museum, in the Throne Room, halfway between all the rooms, a bright and wide space so that the flow of visitors flowed smoothly: you could see the groups going to Pepper, going around the rooms and coming back to Pepper, in a forward or backward direction, along a stream of people who did not follow the typical circular path inside the Museum but wandered around the rooms of the Museum observing and discovering.

Some people told us that the game could be played using tablets, or stationary totems. Actually, Pepper involved everyone, also thanks to his dances and animations, on the notes of Vivaldi's *Primavera*, which were a reward for correct answers.

The robot functioned as a guide and a host: the visitor was greeted by a greeting from the robot which, as if it were a presentation at the Palazzo, struck the stick on the ground three times, beating the words: "We have the honour to welcome Mr, Mrs", and the name read by the qr code. Then he began to tell the story: "Some time ago my master saw inside this Palace a beautiful hat with blue feathers. Help us to find it because he is very interested".

When Pepper was not busy with a player, the other visitors could ask him other questions about the Royal Palace, the room where he was, and the robot could show the animations prepared for the answers of the game and if someone asked, "Balla" would answer "Sure there is a beautiful ballroom here" and he would start dancing to the notes of Vivaldi's *ouverture*.

Pepper's programming

It was a complex application that took six months of work.

In the first phase, we created, in collaboration with the Colleagues of the Royal Palace, the texts of the various questions and the setting stories underlying the narration of the game. We then had to develop a database that would collect all the players' data and their path through the questions asked and the time of the game.

The most difficult part was to create the Pepper animations associated with each topic of the various questions. It was necessary to program every single movement of the robot's 20 motors and synchronize them with the

chosen sounds. The animations had to be credible, fluid and natural because the robot had to move sometimes like a snake, sometimes it had to “flap its wings” - its arms - like a parrot, or dance to the notes of a melody, or even simulate the release of a prisoner from his chains. These are just some of the animations created.
We had to create the graphical interface for the content shown on Pepper’s tablet, so that it was essential, clear and ergonomic. In short, it was a lot of work, but the final rendering paid off. We invite you to watch the youtube video presentation of the activity, which only partially shows the complexity of this application: (https://www.youtube.com/watch?v=9HbOHDJ4INo)