# THE MAKING OF DIAMANDINI: PERCEPTION, IDENTIFICATION, EMOTIONAL ACTIVATION DURING HUMAN-ROBOT INTERACTION

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This paper presents Mari Velonaki's new project, the humanoid robot 'Diamandini'. Diamandini is a five-year collaborative research project conducted by Mari and robotics scientists at the Centre for Social Robotics, ACFR, the University of Sydney. The project aims to investigate intimate human-robot interactions in order to develop an understanding of the physicality that is possible and acceptable between a human and a robot.

*Diamandini, 2010-2013, Mari Velonaki, Interactive robotic installation, 155cm high.*

In this paper I will discuss what led me to the creation of my new robot Diamandini – the road to Diamandini.

I am a media artist/researcher who has created interactive installations over the last 15 years. I have always been interested in creating 'characters' – either projected, or as three-dimensional kinetic objects

that inhabit an installation space. Since 2003 I have been working as a senior investigator in collaboration with robotics scientists at the Centre for Social Robotics / Australian Centre for Field Robotics (ACFR) at the University of Sydney, Australia.

## THE "FISH-BIRD" PROJECT

In 2003 I started working at ACFR, leading a research team to develop the "Fish-Bird" project. This was an interdisciplinary project that involved the creation of novel interfaces for human-robot interaction, experimentation in distributed sensory systems and robot 'perception'. "Fish-Bird" is an interactive autokinetic artwork that investigates the dialogical possibilities between two robots, in the form of wheelchairs, that can communicate with each other and with their audience through the modalities of movement and written text. The chairs write intimate letters on the floor, impersonating two characters (Fish and Bird) who fall in love but cannot be together due to "technical" difficulties.

The most important thing that we learned from the Fish-Bird project in relation to human-robot interaction, after 35,000 recorded encounters in five countries is that Behaviour is more important than Appearance. Although Fish and Bird have the utilitarian appearance of an assistive device, participants were drawn to them because of the way they move and interact physically with them, and because of the handwritten style 'personal' messages that they print for their audience.

## DIAMANDINI

With Diamandini, I wanted to make a new robot that would take this experimentation further, adding the element of interaction via touch. It was important that the interaction be one-to-one: one human, one robot.

The Greek word for interactive transliterates as amphi-dromos (amphi: around on both sides of, dromos: street or road). Thus it is defined as a middle point where two roads meet. In English, the preposition 'inter' means 'between' or 'among'. Inter-action, therefore, signifies between or among actions. A meeting point beyond action and reaction and prior to discourse, a brief moment of recognition between two parties. In this meeting point of recognition and identification I intend to use the moment as a stage to test if intimate human-to-human interactions can serve as an analogue for human-to-robot interactions.

The original intent of the Diamandini project was to create a robot that was non-representational and non-anthropomorphic. As I started experimenting with a variety of abstract sculptural forms, although interesting in shape and structure, as the artist/creator I found it extremely difficult to assign behaviours to them that could lead to emotional activation of the spectator/participant.

With Fish and Bird, although the wheel chair robots are certainly not anthropomorphic, it was inevitable for the participants to assign personalities to what was not there, since a wheel chair is a socially charged object that signifies the absence or the presence of a person. The dialogues expressed in written text between the two characters in Fish-Bird and the storyline further assisted the participants to feel a momentary connection to the Fish and Bird characters.

These considerations influenced my decision to create a humanoid robot. This was a challenging decision, especially when I had to decide how the robot should look. I didn't want Diamandini to have a typical humanoid robot aesthetic. After a long period of reflection I began to think of Diamandini as a female sculpture. In my mind Diamandini had a diachronic face that spans between centuries, a style that could be reminiscent of post-World War II fashion influences, and at the same time with futuristic undertones.

Diamandini is small - only 155 cm high. I wanted her figure to be small and slender so that people didn't feel threatened by her when she 'floats' in the installation space. I wanted her to look youthful, but not like a child, and for her age not to be easily identifiable. Interestingly, in my mind she is between 20 to 35 years old. Because I am a woman I feel more comfortable working with a female rather than a male representation.

Diamandini's construction was a multi-stage process, involving a sculptured prototype terracotta head, a custom-tailored fabric dress made over a wooden armature, high precision 3-dimensional laser scanning and manipulation of the scanned data, followed by computer-aided design (DAC) modelling. Diamandini's external shell was made using stereolithography – an additive manufacturing process that uses computer-controlled UV lasers to polymerise a resin. Of course, the skeleton, muscles, blood and organs were designed by my roboticist collaborator David Rye together with Mark Calleija and Cedric Wohlleber.

I imagine spectators entering the installation space to see Diamandini moving in a smooth, choreographed manner. How Diamandini behaves towards her visitors depends on factors such as time spent with her, proximity to her, and Diamandini's perception of the body language of the participants.

The dialogical approach taken in this project both requires and fosters notions of trust and shared intimacy. It is intended that the technology created for the project is invisible to the audience. Going further than a willing suspension of disbelief, a lack of audience perception of the underlying technological apparatus focuses attention on the poetics and aesthetics of the artwork and promotes a deeper psychological and/or experimental involvement of the participant/viewer. For me as an artist, the challenge is to create a female humanoid robot that simply does not resemble a female humanoid robot. When people first meet Diamandini I want them to experience a new aesthetic approach to what a robot can be. I want to intrigue them as to how a robot can behave. I strive to create a robot that doesn't look or behave like a 'robot'.

We live in a technology-driven world. I didn't create Diamandini to proselytise for robots in one's living room, yet as robots rapidly emerge from laboratories into society, my role as an artist (I am tempted to say) is to question, to provoke and hopefully to inspire.

This paper has described Diamandini in the first stage of the project. The next stage will involve articulation and actuation of her arms, kinetic autonomy of motion including tilting of her body, interaction and reaction via touch and generated text. In the next version, Diamandini will be covered in a light blue porcelain-like material, giving her the appearance of a floating porcelain figurine in the installation space.