Coy-B
an Art Robot for Exploring the Ontology of Artificial Creatures

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'As participants in a block of becoming composed of both natural and artificial life forms and traits, human subjects do not thereby become more machinelike; nor do artificial life-forms become more human. Instead, as new relays and networks of transversal communications begin to cohere, boundaries rupture and are newly articulated, energy and image are redistributed, and new assemblages form in which human being is redefined.'

John Johnston, *The Allure of Machinic Life*

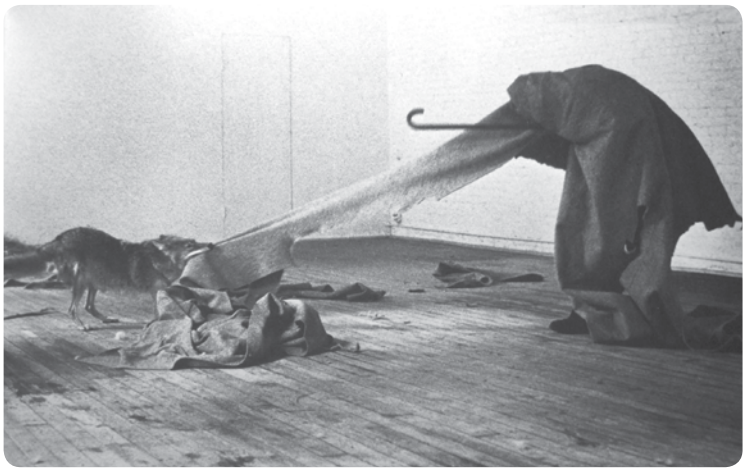

Fig 1, Joseph Beuys and coyote, photo by Caroline Tisdall

The author is a performance and visual artist whose interest lies in the co-evolution of humans and machines, a subject he explores with self-made machines. The paper describes the aims, method, and context of *Coy-B*, a robot designed for a performance art experiment in human-robot interaction loosely based on Joseph Beuys' *I Like America and America Likes Me* (1974) where the German artist shared a gallery space in New York for several days with a wild coyote (Fig 1). *Coy-B* will feature in a series of durational performances for an autonomous mobile robot and a human, where the robot will take the role occupied by the coyote in Beuys' piece. Diametrically opposed to the coyote who symbolised a natural instinctual dimension, the *Coy-B* robot is a representative of contemporary techno-scientific achievements, a fully artificial creature.

In *The Allure of Machinic Life* John Johnston originates in the work of W. Grey Walter and other early British cyberneticians the emergence of a 'machinic life' where the development of A-life, AI, robotics and digitisation reaches a critical complexity that strongly undermines the differentiation between living and non-living things, enabling the emergence of complex and adaptive 'liminal machines' [1]. In Johnston view the new 'sciences of the artificial' (artificial intelligence, artificial life, robotics) 'have been able to produce [...] a completely new kind of entity'. The new machines require a new ontology which the *Coy-B* performance proposes to empirically explore. At the core of the project is the construction of an intrinsically motivated learning robot capable of interacting with its environment and with a human in a life-like manner.

Robotic creatures have roamed in art galleries since the 1960s, generating a great variety of responses from audiences and art critics. In the article *Robot and Cyborg Art*, art critic Jack Burnham envisions that the 'cultural tradition with the art object is slowly disappearing and being replaced by what might be called "systems consciousness"'. Based on scientific-technological evolution, 'these new systems prompt us not to look at the skins of objects but at those meaningful relationships within and beyond their visible boundaries' [2]. In many ways, the *Coy-B* performance is an experiment in relationships and exploration of boundaries, with two main aims:

– To generate an experiment in human-robot interaction with a metaphorical dimension that will provide material for reflection, dialogue and analysis on the ontology of artificial creatures.

– To truly experience the unfolding of a relation between an intelligent mobile machine and a human sharing a common territory over a set duration.

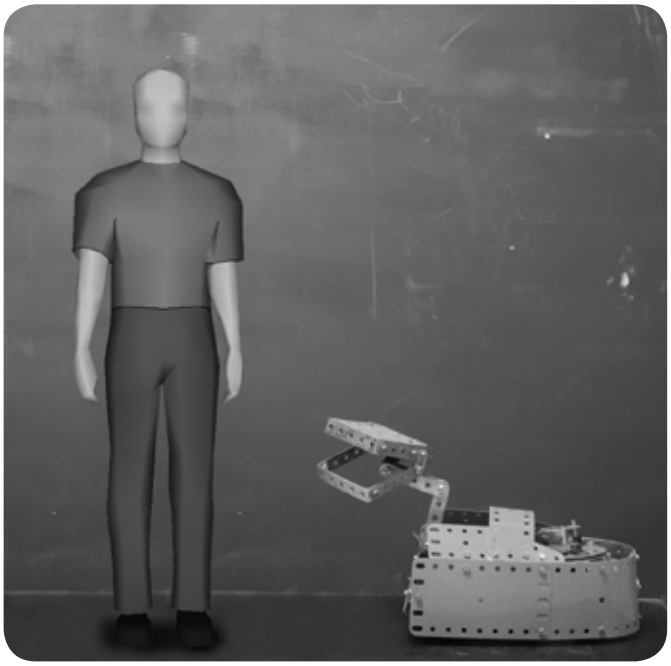

Fig 2, visualisation of possible Coy-B body design

An abundant documentation was recorded during Beuys' performance, including black and white cine footage which I used to identify aspects of the interaction between the artist and the animal. The overall volume and weight of the final robot will be similar to those of a coyote, but the body, motor system and appearance will be structurally different. The design will favour functionality and avoid gratuitous zoomorphic aspects such as fur, tail, eyes or ears. The body will likely be based on a wheeled platform equipped with an extending, rotating neck/arm (fig 2) . A set of jaws mounted on the neck will be fitted with pointed teeth strong enough to pull at things and to provide a bite of adjustable power.

One of the most prominent aspects of the coyote's behaviour is his determined avoidance of physical touch with the human. The machine will implement the basic avoidance drive at the hardware level, through implemention of a hard-wired behavioral layer. The other prominent, instinctual or physiological aspects of the coyote's behaviour are constant awareness and monitoring of the animal's environment, resting and feeding. These will not be hard-wired, but operate at a very high priority level within the software of the machine.

The machine will extract information from its environment with a comprehensive array of sensors. A vision and depth sensor will be used to navigate the space, differentiate the human from other features, and locate objects. An array of microphones will allow acoustic source localisation, sound processing and recognition. The robot will detect touch on key parts of its body with contact sensors. It will also feature an olfactory organ and will be able to mark the territory in a similar way to a mammal, Finally the machine might be given the ability to detect some of the human's cerebral activity with a brainwave sensor system, enabling it to react to variations in mood or peaks in cerebral activity triggered by fear or surprise.

Coy-B will be an intrinsically motivated learning robot, able to develop and adjust idiosyncratic behaviours according to its interactions with the environment, including the human. Its behavioral design draws from several examples in cybernetics and robotics sciences. Bottom-up approaches such as the non-representational, hard-wired navigation of W.G. Walter's cybernetic turtles, the adaptive capabilities of R. Brook's behavior-based robots and the emerging fitness aspect of evolutionary robotics are complemented with more computing-heavy functions inspired by MIT's Kismet's synthetic nervous system [3], the curiosity function of Frédéric Kaplan's Aibos [4] and the use of adaptive resonance theory (ART) neural networks for implementing associative memory predictors as seen in the motivated reflex agents developed by Rob Saunders [5].

Fig 3, *Biting Machine*

Fig 4, Alex May with *Toothless* sensor testing prototype platform

The starting point of the project was the *Biting Machine*, a simple automaton built by the author in 2008 [6] (fig 3). A more complex prototype platform was built in August 2012 in collaboration with artist programmer Alex May in order to test the suitability of a Microsoft Kinect three-dimensional vision sensor for differentiating a human figure from other objects. An on-board Linux machine and an Arduino board were used for processing the data and interfacing with the hardware.

The prototype robot called *Toothless* (fig 4), is able to locate and approach a (slow-moving) human in its environment. The experiment demonstrated that the Kinect was not sufficiently effective for human detection when mounted on a mobile platform and too power-hungry for the application. A simpler solution involving a combination of IR beacon, 2d video camera and distance sensors is now considered. A fully functional machine is not expected before 2015 and the author is open to suggestions and collaborations.

As well as philosophers and sociologists who are engaged in understanding the changes brought upon by technical evolution, visual artists investigate the field of techno-scientific progress and its dynamic interaction with humanity and the world, using tools and methods derived from science. Aspects of the *Coy-B* performance can be compared to a scientific experiment in human-robot interaction. A key difference is that the experiment's main aim is not to test a novel techno-scientific development but to produce a strong metaphor for the relationship between humans and artificial creatures in the 21st century. Electronic arts specialist Stephen Wilson states that 'In a techno-scientific culture, artistic probing of the world of research is a critical, desperate need. We need people looking at these fields of inquiry from many frames of reference, not just those sanctioned by academia or commerce' [7]. At a time when machinic life becomes a tangible possibility it is my ambition that the *Coy-B* project will generate an empirical ground for reflection and insight relevant for both artistic and scientific contexts.

References

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