COMPUTERS AS METAPHOR, MINDS AS COMPUTERS; NOTES TOWARDS A DYSFUNCTIONAL ROBOTICS

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I am building a series of small robots that explore different approaches to thinking about cognition. Computational theories of mind are used by cognitive scientists as a model of how to build an electronic mind and by psychologists to understand the human mind. I want to complicate these cognitivist ambitions through the building of a nervous robotics that is situated in the everyday behavioural realities of contemporary dysfunctional life.

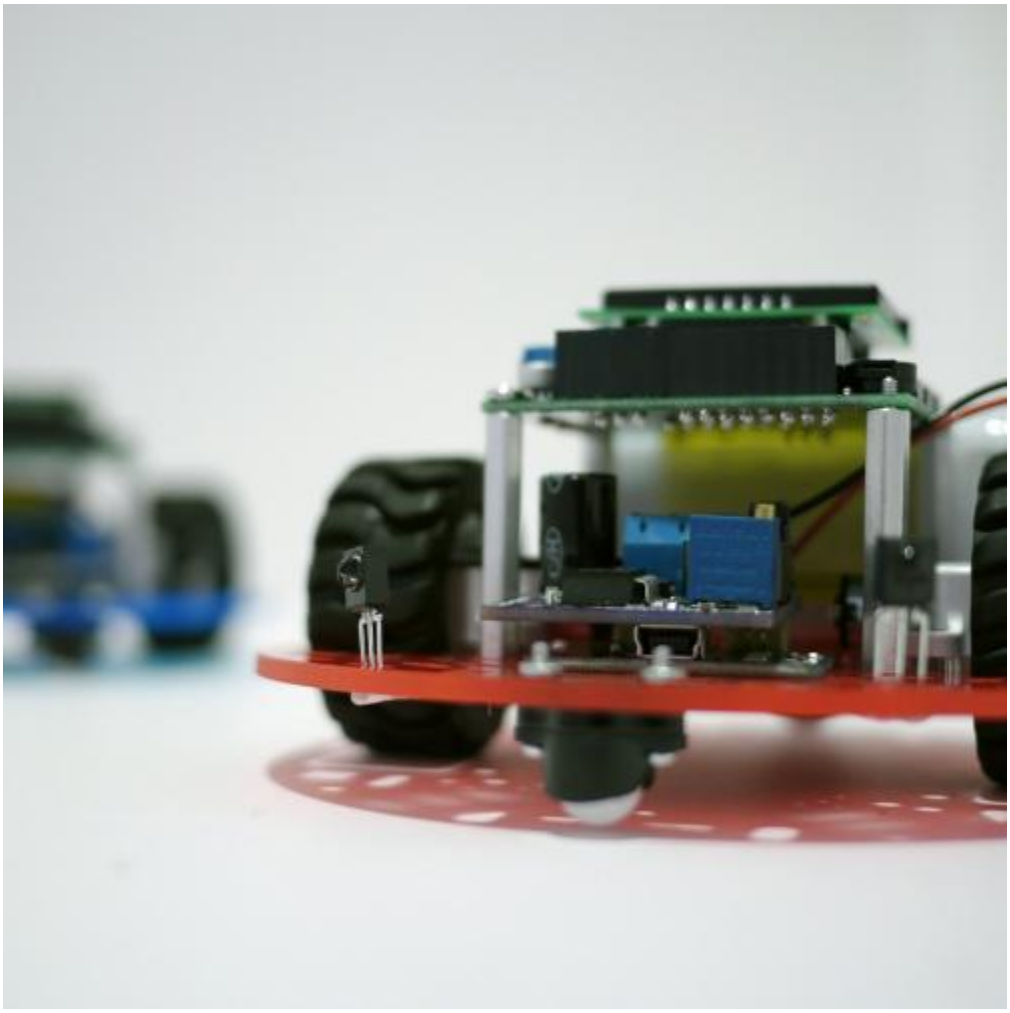

Fig 1. attached/detached : robot love for beginners, 2011, John Tonkin, custom hardware and software.

I am building a series of small robots that explore different approaches to thinking about cognition. This paper presents some background material in the development of this project.

Cybernetics was defined by Norbert Wiener in 1948 as the science of communication and control in the animal and the machine (Wiener 1948). It used ideas of circuits, feedback, and information flow to describe how systems, both organisms and machines, functioned. Many of the core group of early cyberneticians had backgrounds in psychology, psychiatry and psychoanalysis. Some practitioners in these fields have since adopted cybernetic models to conceptualise their research, using a language of feedback loops and homeostatic control systems to describe the (mis)workings of the human mind. For example; Gregory Bateson wrote a paper titled 'The cybernetics of "self": a theory of alcoholism' (Bateson 1972)

Jean-Pierre Dupuy suggests that the development of cybernetics represented not so much the anthropomorphisation of the machine as the mechanisation of the human (Dupuy 2000). This is perhaps most obviously made manifest in computational theories of mind which have been used by cognitive psychologists as a means of understanding the human mind and by cognitive scientists as models of how to build an electronic mind. They see the mind as an information-processing system and thought as a form of computation. These symbolic approaches to thinking about the mind have been challenged by more embodied and embedded approaches to cognition and perception. This has been reflected through the development of a number of bottom-up approaches to AI and robotics, such as neural networks (McCulloch, Pitts 1943) and behaviour based robots (Brooks 1986), that are based on ideas of reactivity and situatedness rather than higher level symbolic modelling.

AI researchers, regardless of their approach, are generally committed to building functional engineering tools that efficiently solve real world problems. If we are to take seriously the concept of a computational model of the mind; then does this not need to embrace the dysfunctional as well as the functional? I plan to investigate this question through the building of a nervous robotics; a robotics situated in the everyday behavioural realities of contemporary dysfunctional life. These robots are more likely to rock nervously in the corner than to lock you out of the spaceship (“Open the pod bay door, Hal. Sorry Dave, I'm afraid I can't do that” (2001: A Space Odyssey)) or attempt to enslave humanity.

The robots that I am building for this project draw from a number of different psychoanalytic theories as well as more generally from a folk psychology conception of the mind as being the home of internal mental processes such as motives, desires, phobias and neuroses. They use a range of computational approaches, for example Brooks' subsumption architecture (Brooks 1986), to create layered hierarchies of behaviours and stimulus/response reflexes. For ISEA 2011 I have built “*attached/detached: robot love for beginners*” which consists of two robots that go through an ever shifting interplay of insecurity and dismissiveness with occasional moments of mutual happiness. These robots are primarily focussed on seeking/avoiding each other and are oblivious to the audience. Their behaviours are based around attachment theory. Attachment theory grew out of research by psychoanalyst John Bowlby in the 1950s. It was further developed with developmental psychologist Mary Ainsworth in the 1960s and 70s. It concerns the relationship between infants and their primary caregiver. Bowlby was influenced by cybernetics. The young child's need for proximity to the attachment figure is balanced with a need for exploration in what he described as a homeostatic control system. It was extended in the 1980s to encompass attachment styles in adult romantic relationships. These different styles (secure, anxious-preoccupied, dismissive-avoidant and fearful-avoidant) corresponded to different combinations of a person’s atti-

tudes (positive or negative) towards themself and towards their partner. I further explore the development of attachment theory as an example of the use of cybernetics to model human behaviour in a paper that I will be presenting at Rewire 2011.

I am interested in how the audience will react to the robots' behaviour and am especially interested to explore the lower boundary of computational complexity that still evokes some sort of projection / anthropomorphism in the audience. Simon Penny has produced several robotic art projects including *Petit Mal* (1993-95). This low tech looking robot (it resembles a bicycle) reacts to the movement of people in its immediate vicinity. It follows them around curiously yet backs off if they get too close. Penny used a bottom up approach to create a system of layered behaviours similar to that proposed by Brooks.

People immediately ascribe vastly complex motivations and understandings to the Petit Mal. The robot does not possess these characteristics or capabilities, they are projected upon it by viewers. This is because viewers (necessarily) interpret the behavior of the robot in terms of their own life experience. In order to understand it, they bring to it their experience of dogs, cats, babies and other mobile interacting entities. The machine is ascribed complexities which it does not possess. This observation emphasises the culturally situated nature of the interaction. The vast amount of what is construed to be the `knowledge of the robot' is in fact located in the cultural environment, is projected upon the robot by the viewer and is in no way contained in the robot.(Penny 1997)

Australian artist Mari Velonaki has described something similar with regard to her Fish-Bird project. "The project has demonstrated that audiences are attracted to kinetic objects that represent 'characters' not because of the way they look but because of the way they behave." research statement (http://mvstudio.org/cms/wp-content/uploads/2009/08/ResearchStatement_VisualArt_Fish-Bird.pdf).

In his book titled "Vehicles, Experiments in Synthetic Psychology", Valentino Braitenburg describes a series of thought experiments that involve the building of a succession of simple robots that use a bottom up approach that is not unlike the approach that I am taking for my own robots.

"We will talk only about machines with very simple internal structures, too simple in fact to be interesting from the point of view of mechanical or electrical engineering. Interest arises, rather, when we look at these machines or vehicles as if they were animals, in a natural environment. We will be tempted, then, to use psychological language in describing their behavior. And yet we know very well that there is nothing in these vehicles that we have not put there ourselves." (Braitenberg 1984)

"It is actually impossible in theory to determine exactly what the hidden mechanism is without opening the box . . . A psychological consequence of this is the following: when we analyze a mechanism we tend to overestimate its complexity." (Braitenberg 1984)

This last statement of Braitenberg's is particularly interesting in terms of my broader project of thinking about cognition. Perhaps the "hard problem" of consciousness isn't actually so hard! This could lead us to a discussion around embodied cognition, but I shall save this for another time.

References and Notes:

Gregory Bateson, Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology (University Of Chicago Press 1972)

Valentino Braitenberg, Vehicles, Experiments in Synthetic Psychology (MIT Press, 1984)

Rodney Brooks, A robust layered control system for a mobile robot (IEEE Journal of Robotics and Automation 2(1): 14-23. 1986)

Jean-Pierre Dupuy, The mechanization of the mind; on the origins of cognitive sciencetrans. M B DeBevoise (Princeton University Press, 2000)

Simon Penny, Embodied Cultural Agents at the Intersection of Robotics, Cognitive Science and Interactive Art ed. K Dautenhahn, Working notes of the Socially Intelligent Agents Symposium (Menlo Park Calif.: AAAI Press. 1997)

Norbet Wiener, Cybernetics or Control and Communication in the Animal and the Machine (John Wiley & Sons 1948)