

# An Autonomous Wheelchair at an Art Gallery

## Beurs van Berlage, Amsterdam, 16 December 2009 to 8 March 2010

Our robotic wheelchair has been exhibited at [Niet Normaal](#) in Amsterdam from December 2009 to March 2010. See a [Youtube video](#) or a local copy ([WMV](#)) (thanks to Aram Voermans for filming and editing).

## Institute of International Visual Arts (INIVA), London, 2008

The autonomous wheelchair "Psalms" commissioned by the late Donald Rodney in 1997 has been exhibited at the exhibition "[Donald Rodney In Retrospect](#)". Curated by Sebastian Lopez and Keith Piper. Produced by Iniva (Institute of International Visual Arts).



Psalms and Britannia Hospital 3 (Installation view of Donald Rodney in Retrospect)

Installation view of Donald Rodney in Retrospect Photograph © Thierry Bal, Courtesy of Iniva at Rivington Place

## South London Gallery 1997

An autonomous wheelchair has become a piece of art named "Psalms" as a part of an exhibition entitled "Nine Night in Eldorado" by Donald Rodney, held at the South London Gallery until the 12th October 1997 (Fig 1,2,3 and [wcl.mov](#)).

*"...Our fear of automata is again harnessed in Psalms, as the empty wheelchair courses through its various trajectories on a sad and lonely journey of life, a journey to nowhere. Its movements repeat like an ever recurring memory, a memory of another life and another journey, that of Donald Rodney's father..."*  
(Exhibition brochure, Jane Bilton.)



Fig.1. A part of the exhibition.  
(click on the images to see larger versions)



Fig.2. Waiting for a conversation to end before resuming its walk...  
...or taking part ?



Fig.3. A lonely presence after the closure.

The wheelchair was modified at the School of Computing of the University of Plymouth to perform a repeated sequence of circles, spirals and figures of eight, as specified by the artist Donald Rodney, himself disabled by sickle cell anaemia.

The wheelchair uses 8 sonar sensors (fig.4), shaft-encoders, a video camera and a rate gyroscope to determine its position. A neural network using normalised RBF nodes encodes the sequence of 25 semi-circular sequences of positions forming the trajectory (fig.5).

The control system comprises a laptop PC 586 running a control program written in CORTEX-PRO, and linked to a Rug Warrior board built around the 68000 microcontroller.

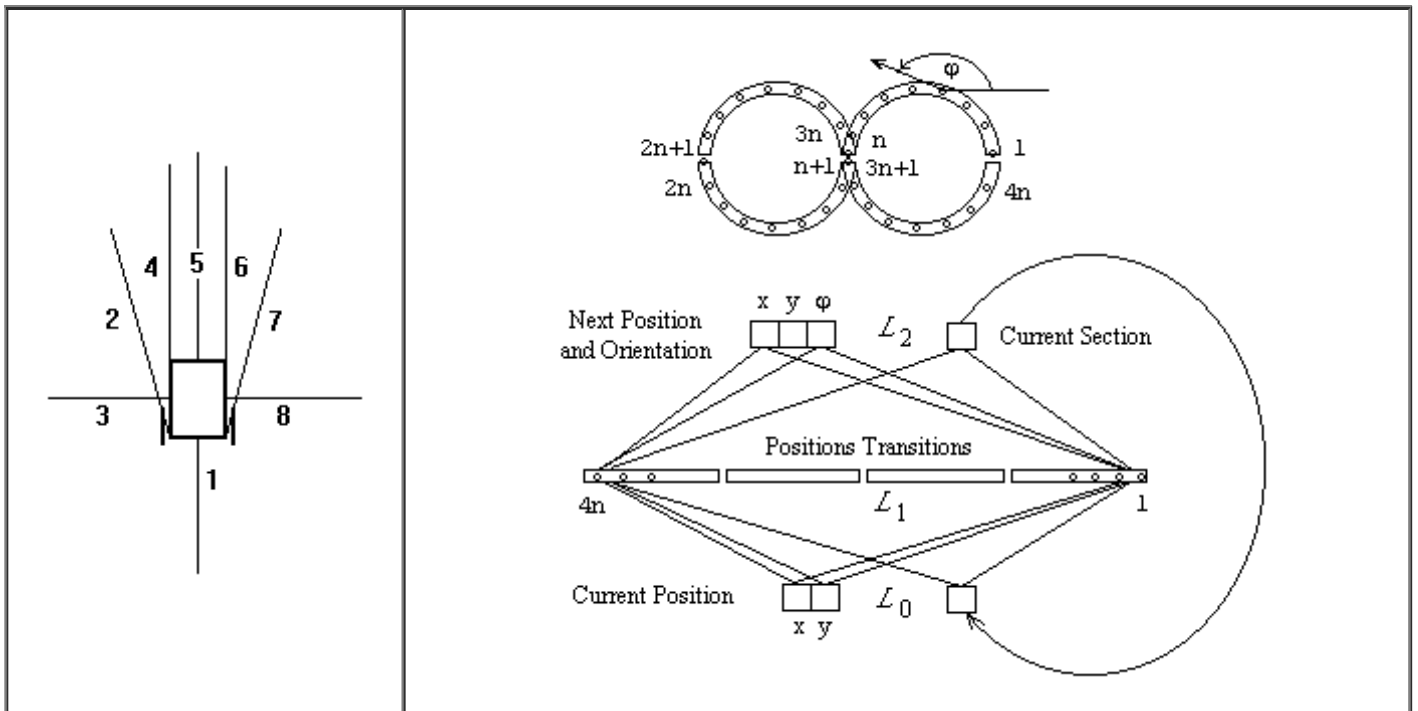


Fig.4. Orientation of the sonar sensors. The sensors are mainly oriented in front for safety reasons. Sensors 1,3,5 and 8 are also used

Fig.5. Neural network based on normalised RBF nodes encoding a sequence of sequences of positions (a figure of eight in this example). Layer  $L_1$  comprises input nodes representing the  $x,y$  position of the wheelchair. Layer  $L_2$  comprises usual RBF nodes centred on successive positions. Nodes in layer  $L_3$  perform the normalisation so that their outputs

for self-localisation purpose when the wheelchair is oriented parallel to a wall.

represent positions in the same form as nodes in layer L1. More details on normalised RBF nets can be found in Althofer and Bugmann (1995), Bugmann (1996), Bugmann et al. (1998).

## Contributors:

The control system of the wheelchair was built by:

- [Dr. Guido Bugmann](#) (School of Computing, University of Plymouth)
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- [Dr. Nigel Barlow](#) (School of Computing, University of Plymouth)

with the help of [Steve Hill](#) (SoC) and [Prof. Mike Denham](#) (SoC), and the support of *Technical Services of the University of Plymouth*.

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- [The Mobile Robotics Laboratory](#) in the Centre for Neural and Adaptive Systems (Prof. Mike Denham) of the School of Computing of the University of Plymouth (UoP).

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- Paul Robinson (School of Electronic, Communic. & Electrical Eng., UoP)

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- Peter Frere (Lucas Advanced Engineering Centre, Birmingham)
- [Dr. David Keating](#) (Dept. Cybernetic, University of Reading)

We are very grateful to [Mike Phillips](#) (School of Computing, University of Plymouth) for initiating this project by establishing the initial link between the artist and the builders.

Many technical solutions in the control system of the wheelchair are based on sub-systems developed during the projects realised by following **students**: Vincent Onillon, Priska Schönborn, Antonio Rodriguez Perez, Jose Dorado, Petr Bonus, Derrick Tapscott.

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*Guido Bugmann, Jan 2010*