A Solution to the Mind-Body Problem

Grand Challenge 5

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Caveat

- Every claim made in this workshop presentation is backed up by my documented research.
- However, some of that research is currently under review for publication and may not be disclosed in writing here.
- The potential publishers state that submitted research may be discussed in workshops without prejudicing publication so I will deal with any question of detail orally.
- My software may properly be disclosed on the world wide web once publication of the research is agreed.

Introduction

- A theory of mind and body obtained by unifying the Turing Machine and Projective Geometry.
  - Perspex Machines as excessively powerful super-Turing Machines operating on a subspace.
  - Perspex Machines as super-Turing parallel and serial machines operating on real-numbered points.
  - Perspex Machines as Turing Machines operating on rational-numbered points.
  - The Perspex Neuron.
  - Paradigm shifts explained.

Introduction

- Perspex Space - the world's first anisotropic geometry.
  - Newtonian time reversal is impossible.
  - Irreversible perception of arbitrary time flow.
  - A resolution of the time traveller's paradox.
  - Embodiment of mind in physical spacetime.
  - The emergence of neural structures - fibres and functional blocks.

Introduction

- The geometrical structure of mental faculties.
  - Consciousness, feeling, free will.
  - A common basis of intelligence and morality.
  - A programmable definition of intelligence.
  - A solution to the problem of evil.

Introduction

- The Perspex Machine fulfils many of our expectations of a theory of mind.
  - It explains the irreversible perception of time flow.
  - It gives a programmable basis for consciousness, feeling, free will, intelligence, and morality.
  - It explains why paradigm shifts occur and gives numerical bounds on the minimum speed at which they occur.
  - It solves the problem of evil by limiting the responsibility of a potentially universal class of creators of minds.

Introduction

- Why does the Perspex Machine explain so much?
  - The theory claims that any physically possible mind can be embodied in a Perspex Machine, but explanations are properties of mind, so either all physically possible explanations are supported by the Perspex Machine or else the theory is wrong. (Hence, the theory is supremely testable.)
  - The theory is the first practical solution to the mind-body problem, but the paradigm shift formula guarantees that many significant advances can be made with little effort if a new theory is accurate. If my solutions are accepted, this is consistent with the view that my theory *is* accurate.

Perspex Machines

- If the *Strong Thesis of AI* is correct then the Turing Machine is a mind.
- Any geometry is a theory of geometrical bodies.
- Projective Geometry describes both how objects look in perspective and how they are in Euclidean space. It is an ideal model of the geometry of human perception.
- Projective Geometry can describe projection along the time dimension. Thus, it is a geometry of spacetime that can model the process of perception and, more generally, any Perspex computable function, such as physical theories of the universe.

Perspex Machine

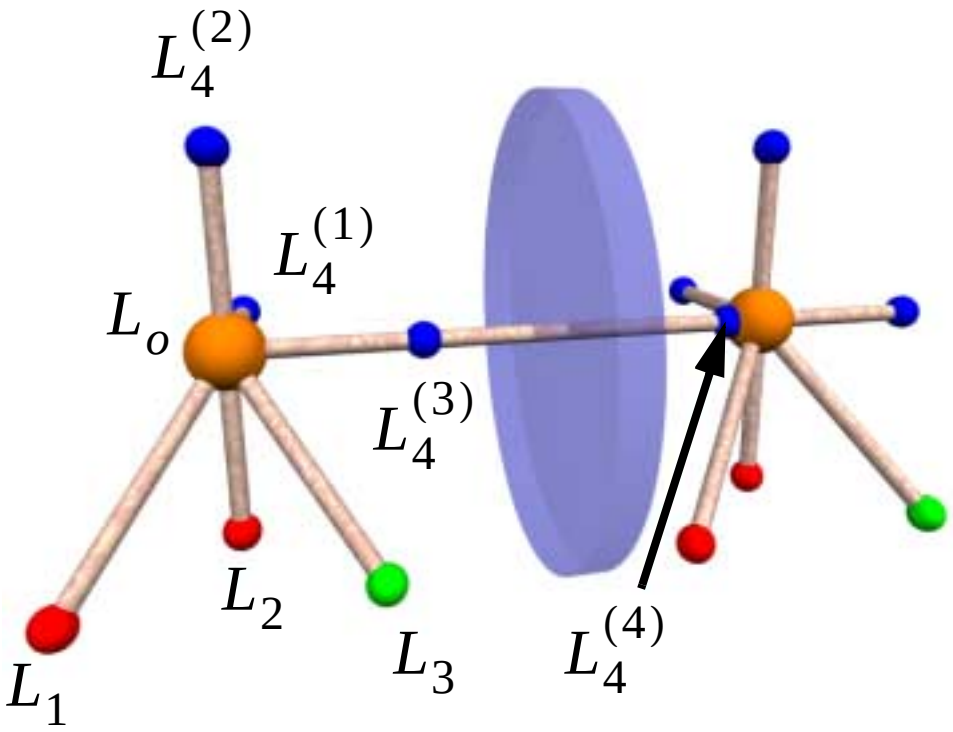
- The Perspex Machine arose from the unification of the the Turing Machine and Projective Geometry.
  - J.A.D.W. Anderson, "Perspex Machine," in *Vision Geometry XI* Longin Jan Latecki, David M. Mount, Angela Y. Wu, Editors, Proceedings of the SPIE Vol. 4794, 10-21 (2002).
- The Perspex Machine is super-Turing because it operates in a continuous, not a discrete, space.

Perspex Machine

- The Perspex Machine operates in a 4D homogeneous spacetime at a location L_o (coloured orange).
- It reads data into L_o from two locations L_1 and L_2 (coloured red).
- The data is combined at L_o and the result is written to one location L_3 (coloured green).
- Control then jumps from L_0 to one of four locations (coloured blue) $L_4^{(1)}$, $L_4^{(2)}$, $L_4^{(3)}$, or $L_4^{(4)}$ depending on the result written into L_3 and the time vector t.

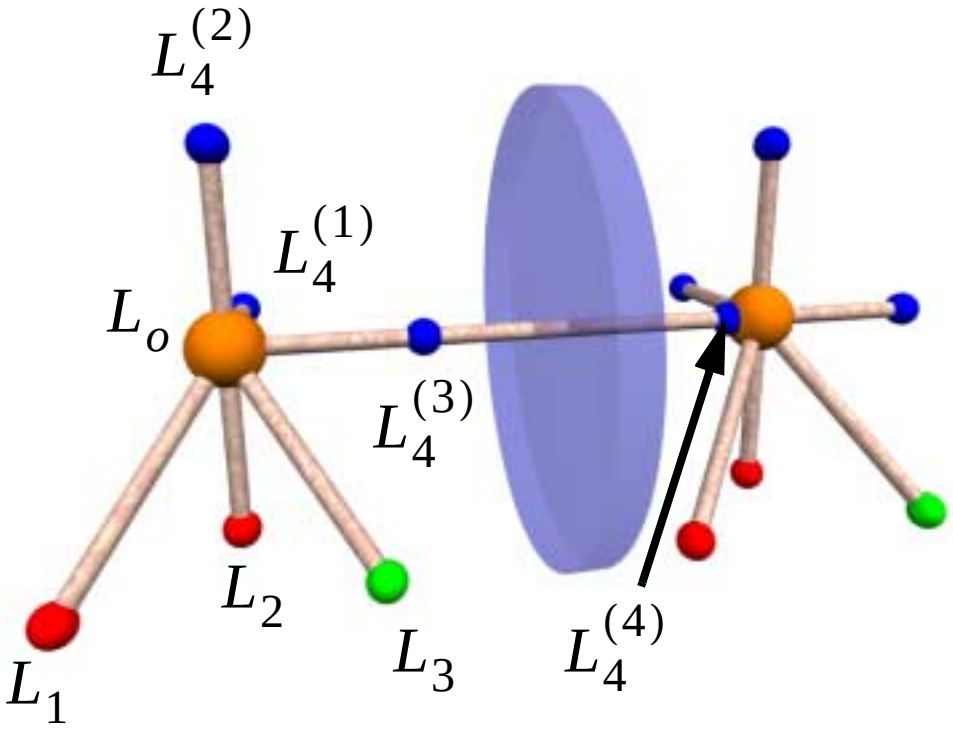
Perspex Machine

- If the location is a subspace of dimension at least one then the Perspex Machine is super-Turing and can, for example, compute infinite series in a single operation.



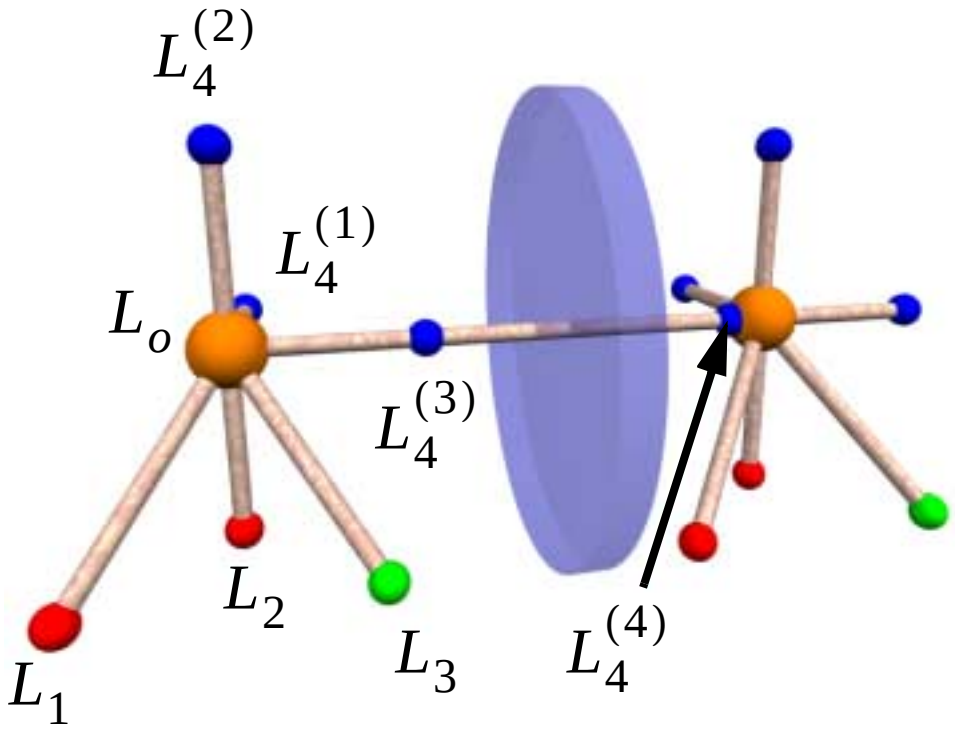
Perspex Machine

- If the location is an arbitrary real-numbered point then the Perspex Machine is a super-Turing serial or parallel machine and can, for example, test an arbitrary real number for equality with zero.



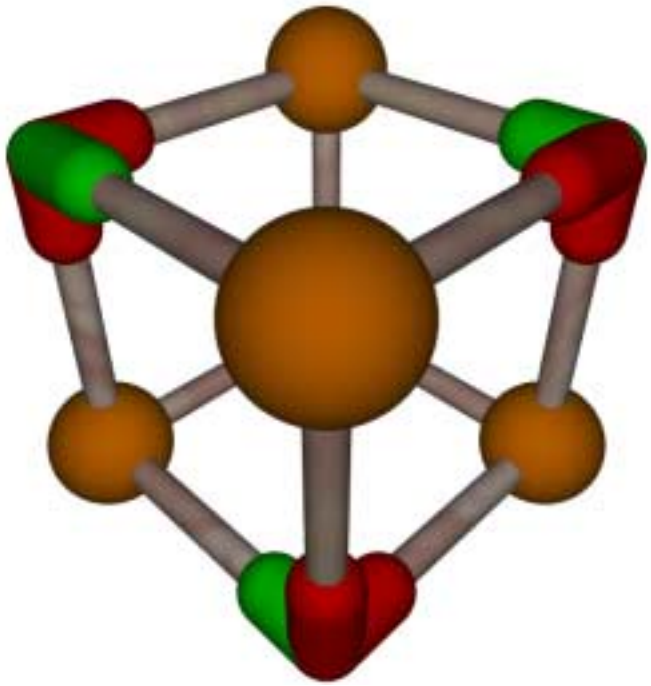
Perspex Machine

- If the location is a rational-numbered point then the Perspex Machine is a serial or parallel machine that is Turing computable.



Perspex Neuron

- A network of Perspex Neurons can compute anything that a Turing Machine can compute.
- For example, it can describe a cube and carry out a rotation of it.



Perspex Neuron

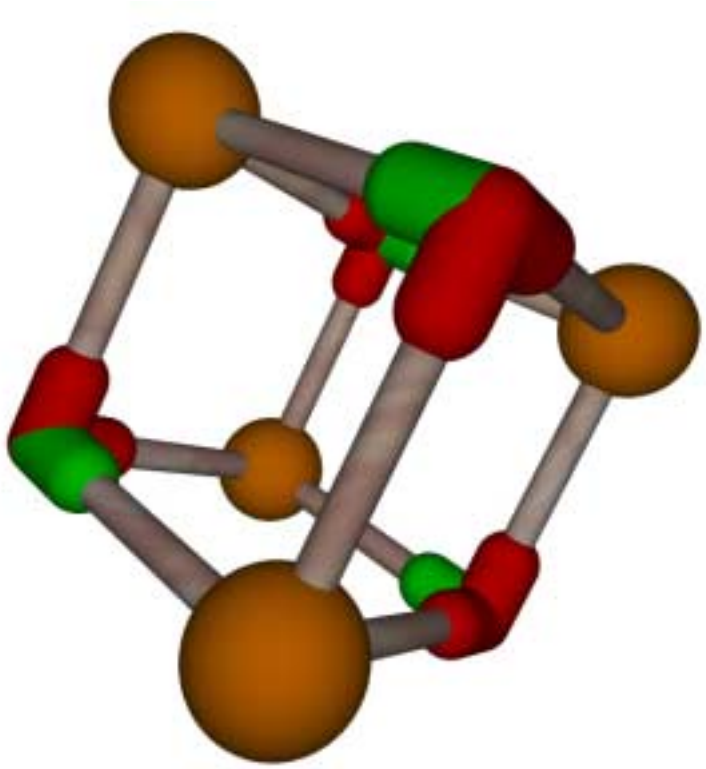
- Embryonic animation program.

Perspex Neuron

- Mature animation program.

Perspex Neuron

- Rotated cube in the mature animation program.



Perspex Neuron

- Perspex Neurons can be laid out isomorphically with the shape and motion of the things they describe so they can support a very direct form of visual reasoning.
- Visual reasoning over arbitrary real numbers is super-Turing, whereas symbolic reasoning is Turing computable. Hence visual reasoning can be more powerful than symbolic reasoning. For example, it is not necessarily subject to paradigm shifts.
- A perverse programmer can lay out Perspex Neurons in very complex ways, subject to certain constraints on how complexity is introduced to a Perspex Network. Representations arise where the local complexity of the network exceeds the complexity of a neuron.

Paradigm Shifts

- All rational functions do the following:
  - Arrive at an exact value on one step or
  - Iterate without converging or
  - Iterate through paradigm shifts whilst a norm of the error converges.
- All Turing Machines compute rational functions (of a Turing computable number) so they all go through paradigm shifts as above.
- All written theories are symbolic so they are Turing computable and go through paradigm shifts as above.

Paradigm Shifts

- Formulae are known for the minimum speed of paradigm shifts in precision and accuracy consistent with convergence.
- Thus, the occurrence of paradigm shifts in science and all linguistic endeavours is explained both qualitatively and quantitatively.
- The numerical predictions of the formulae are subject to empirical testing wherever there is an independent method of recognising paradigm shifts.
- The formulae lead to physical measurement techniques that are more precise than conventional applications of the Chinese Remainder Theorem.

Paradigm Shifts

- Continuous Perspex Machines:
  - May go through the above paradigm shifts, but are not universally subject to them.
  - Are universally subject to paradigm shifts at turning points - if any.

Perspex Space

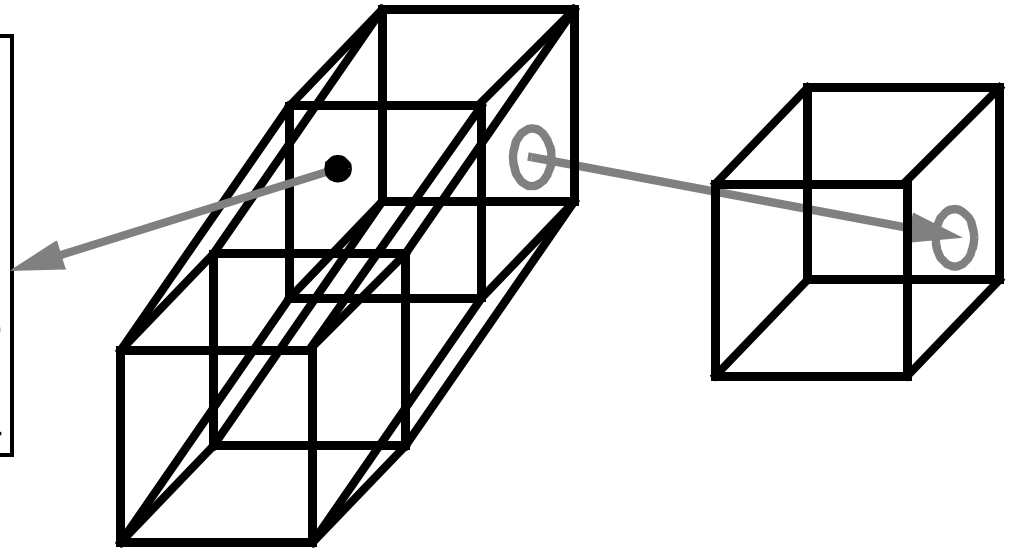
- Perspex Space is a 20D homogeneous matrix space that can support various projective geometries.

16D Matrix (Perspex)

4D Projective Spacetime

3D Euclidean Space

$$\begin{bmatrix} x_1 & y_1 & z_1 & t_1 \\ x_2 & y_2 & z_2 & t_2 \\ x_3 & y_3 & z_3 & t_3 \\ x_4 & y_4 & z_4 & t_4 \end{bmatrix}$$



Causality

- There is just one operation in Perspex Space so it is the entire causality of the space:

$$\vec{x}\vec{y} \rightarrow \vec{z}$$

$$\text{jump}(\vec{z}_{11}, t)$$

- The projection used here is never behind the projection point, consequently time cannot jump backwards.
- Time can jump either simultaneously or else forwards.
- A Perspex can read and write into any time, but control jumps either simultaneously or else forward in time. (This is a temporal least commitment.)

Causality

- Newtonian time reversals are impossible because the projection inherent in causality prevents time from jumping backwards.

- Similarly, physical time is always perceived by a Perspex Machine as flowing forwards regardless of how it actually flows. For example, physical time might flow backwards, oscillate, or flow in unorientable ways, but it will always be perceived as flowing forwards, if it flows at all, because control in the Perspex perceiver is either simultaneous or else forward.

Causality

- It is impossible to use a Perspex to construct the *Time Traveller's Paradox* in Perspex Spacetime, despite the fact that signals can be read and written across time.
  - On the materialistic assumption everything is physical, therefore counterfactuals do not exist.
  - If a time machine and traveller exist then a counterfactual temporal paradox does not exist.
  - This dissolves the time traveller's paradox.
  - Similarly, time travel is Perspex computable, but the paradoxes are incomputable so they never manifest in Perspex Spacetime.

Causality

- It is *extremely* unlikely that the universe obeys Perspex Causality.
- But now that one anisotropic spacetime has been produced it should be easier for physicists to develop further, realistic anisotropic spacetimes.
- The anisotropy ratchets Perspex Neurons into forward time so that they form into temporally ordered neural fibres and functional blocks of neural tissue. This explains the emergence of Perspex Neuroanatomy and Neurophysiology from Perspex Causality.
- Mind is the functioning of Perspex Neurons.

Mental Faculties

- Specific mental faculties have been identified with the structure and functioning of Perspex Neural Tissue. This serves as a hypothesis to be tested in programmed robots.
  - A *selection* is the *jump* part of a Perspex.
  - *Visual consciousness* is a partial, bi-directional mapping between Perspexes.
  - Any kind of *consciousness* can be obtained by synaesthesia to visual consciousness.

Mental Faculties

- *Feeling* is the physical content of consciousness.
- An *action* is an *instruction* being the *product* and *jump* parts of a Perspex.
- *Will* is the conscious selection of action.
- *Free will* is will by an agent itself and no other agent.
- Free will can be implemented by executing a perceived Perspex.

Mental Faculties

- The geometrical development of the above mental faculties is recorded in:
  - J.A.D.W. Anderson "Robot Free Will" *ECAI 2002 Proceedings of the 15th European Conference on Artificial Intelligence* Lyon, France, ed. F. van Harmelan, pp. 559-563, 2002.

Intelligence and Morality

- Intelligence is intimately related to Perspex Symmetry.
- Symmetry is also the basis of some moralities:
  - Do unto others as you would have them do unto you.
  - Love thy neighbour as thy self.
  - Treat others equally without fear or favour.
  - Justice moderated with mercy.
- These kinds of intelligence and morality arise from Perspex Causality via the emergence of symmetry.

The Problem of Evil

- The theological *Problem of Evil* is easily summarized:
  - If an omniscient and omnipotent God created the universe and we do evil then God is responsible for our evil.
- But its solution is also easily summarized:
  - If an omniscient and omnipotent God selected a set of several potential universes that were equally and supremely good and brought one of these into existence at random then God is responsible for holding a cosmic lottery with a supremely good outcome, but He is not responsible for our actions. In other words, He gave us free will.

The Problem of Evil

- If an omniscient and omnipotent God is not necessarily responsible for our evil then we are not necessarily responsible for the evil done by any robots that we might create.
- In other words, we can give robots free will.

Conclusion

- The Perspex Machine:
  - Explains the irreversible perception of time flow.
  - Gives a programmable basis for consciousness, feeling, free will, intelligence, and morality.
  - Explains why paradigm shifts occur and gives numerical bounds on the minimum speed at which they occur.
  - Solves the problem of evil by limiting the responsibility of a potentially universal class of creators of minds.

Little Challenge

- I claim that I solved the mind-body problem in 2001 and published the solution in 2002.
- I now offer you this challenge:
  - Either show that I am mistaken or
  - Publicise the solution as a result of this workshop.

Acknowledgement

- I acknowledge that this research was:
  - Unfunded.
  - Undertaken whilst UK university staff were excluded from the economic growth of their country.

    See: www.aut.org.uk