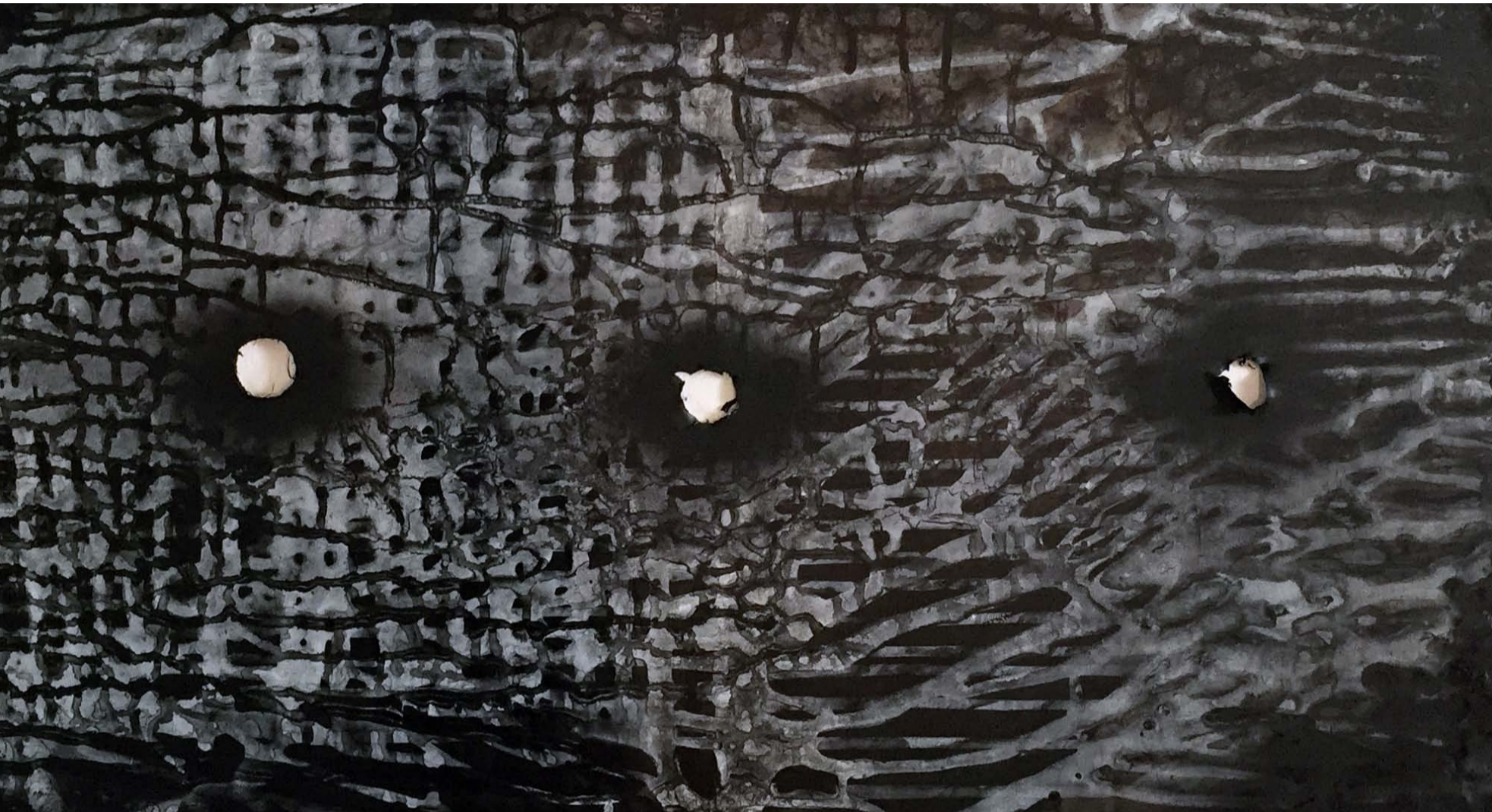


# Quantum brushstrokes



Malcolm  
Koch

Malcolm Koch

# Quantum brushstrokes Malcolm Koch

## Artist statement

Particle physics has been a long-term interest of mine. And I could see a way of expressing ideas developed in theoretical physics in a visual form—based on ideas developed in my previous works. Until now my work has mainly focussed on the play of surface geometry and conditions that lead to certain kinds of events being created on it, rather than relating it to the fundamental workings of the natural universe.

However, in a recent exhibition entitled, *Visual entanglement*<sup>1</sup>, held at The Royal Institution of Australia's (RiAus) FutureSpace Gallery, in Adelaide, South Australia, I tried to bring all of my ideas together. Creating what I think is a happy synergy between science and art. Furthermore, a piece created for the exhibition has now been 'Highly Commended' at the prestigious Waterhouse Natural Science Art Prize 2016<sup>2</sup>.

My current work is an attempt to express a classical interpretation of how fundamental particles may have evolved. I recognise that this aesthetic interpretation could be described as 'fruitloopery' interpretations from a fringe dweller, nevertheless, it is an invitation to consider what fundamentally cannot be, at this point in time, directly observed - a quantum particle. However, I trust that with further understandings this aesthetic practice will evolve and be enhanced.

<sup>1</sup> Short video produced by RiAus TV about the exhibition:  
[www.malcolmkoch.com/wp/archives/1654](http://www.malcolmkoch.com/wp/archives/1654)

<sup>2</sup> [www.waterhouse.samuseum.sa.gov.au/gallery](http://www.waterhouse.samuseum.sa.gov.au/gallery)

# Quantum brushstrokes



An interpretation of the  
science of particle physics.

## Building brushstroke expressions

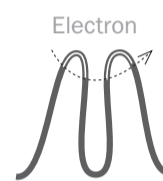
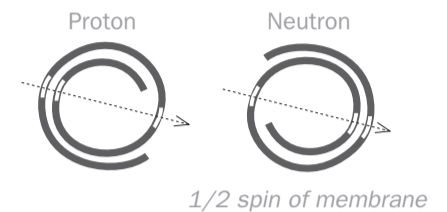
Brushstroke expressions (building blocks of matter) are created from two kinds of curvature constructs:

- **Curls (creates quark brushstrokes)**

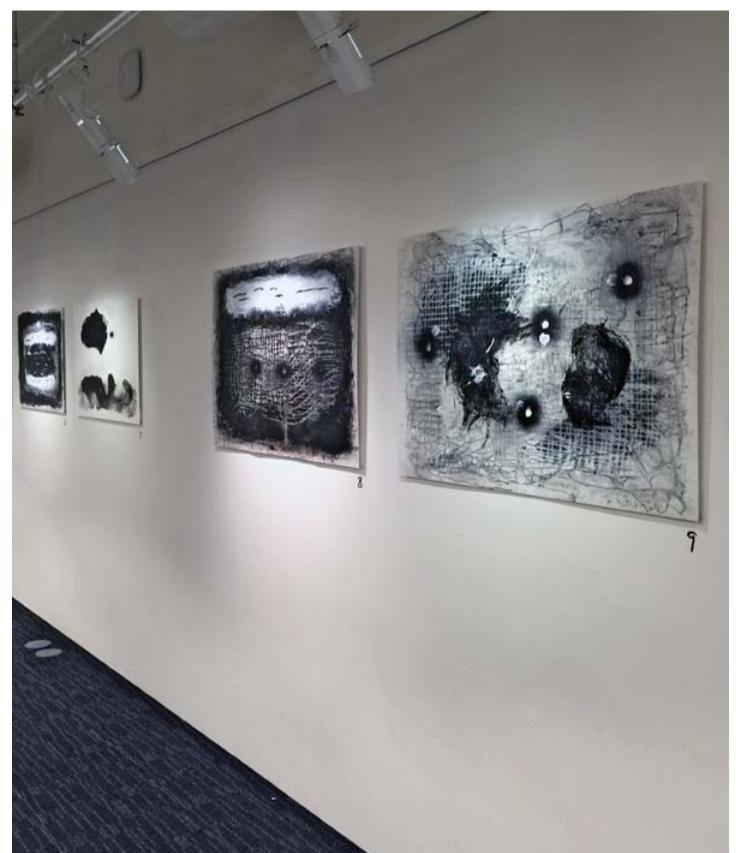
Quarks are represented by drill holes created on a particular kind of curl (strong interactions) ...

- **Waves (creates lepton brushstrokes)**

Electrons (leptons) are represented by saw cuts created on a wavy surface (electromagnetic interactions). Also paint pourings may be applied over the space to allow gravity to play a role ...

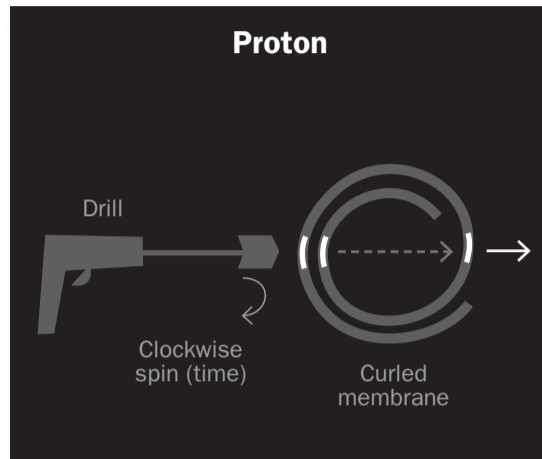
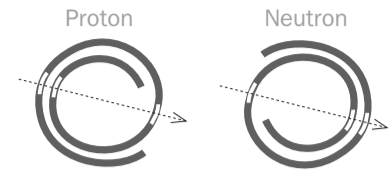


Whichever brushstroke expression is used the similarities to the way a brushstroke mark is made on a flat plane remains the same — there is initial contact, movement across and then an exit off the surface.

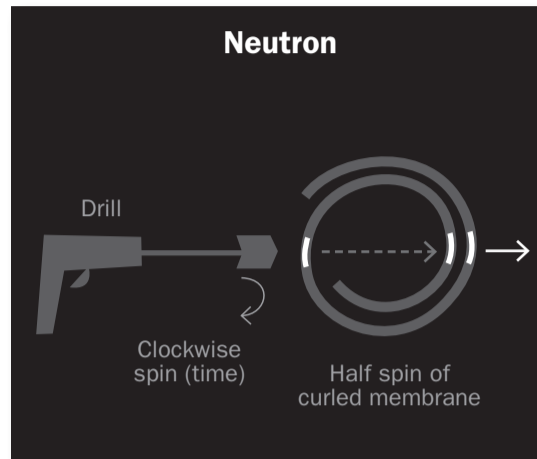


*The Visual entanglement exhibition showing the aesthetic idea. The left images show the curls and waves (preliminary work) as it then progresses to the final flattened out pieces on display (above).*

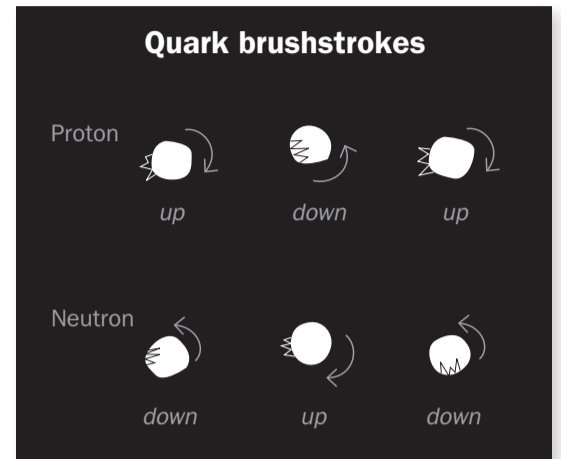
## Curls: Quark brushstrokes



This side view of a curled membrane represents how strong interactions are created. One drill hole can express a multiple flavours of quarks. When entry occurs at the point where two convex surfaces are close together and the exited point is a concave structure - a proton is created (two up / one down).



If the curl is spun 180° (half spin) then a different set of events occur. When entry occurs at one convex structure and the exit point is at two concave structures that are close together - a neutron is created (two down / one up).



*Flat view:* The aesthetic is realised when the membrane is opened out and the depth is compressed. Nothing disappears, it just changes form. This generates the human visual experience, a metaphor for how we perceive. *Note:* The observed surface is made on the inside. Spin would be in reserve if we observe the outside.

## Favourable curled structures

The curled membrane represents the geometry of the strong field needed to create the particles that interact with it. However, the curled structure has to be right for either a proton or neutron with three drill holes occur. Slightly off it doesn't work.

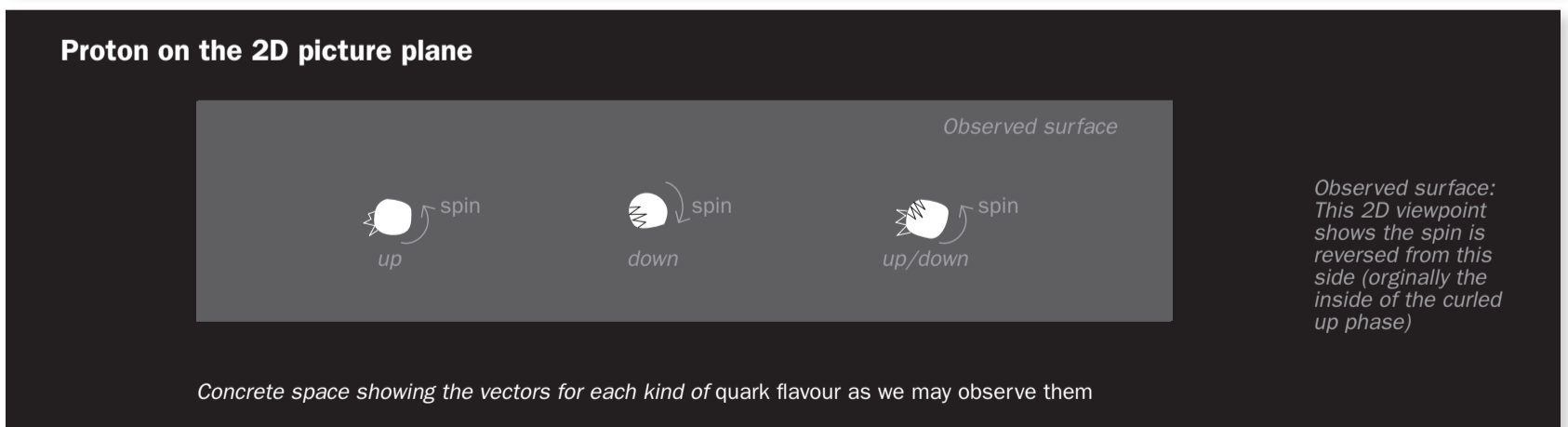
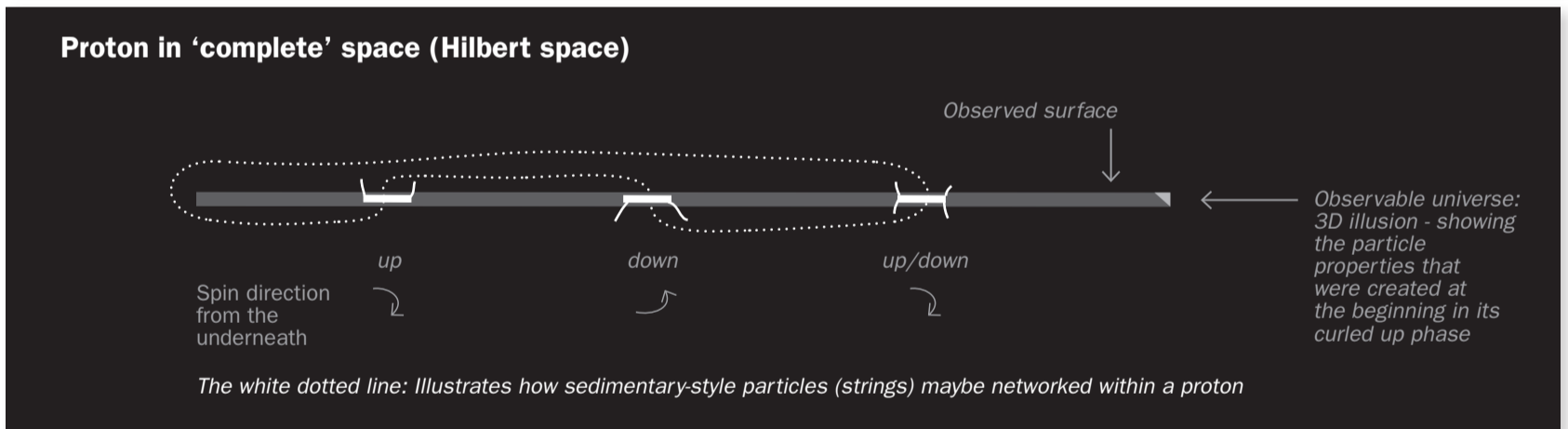
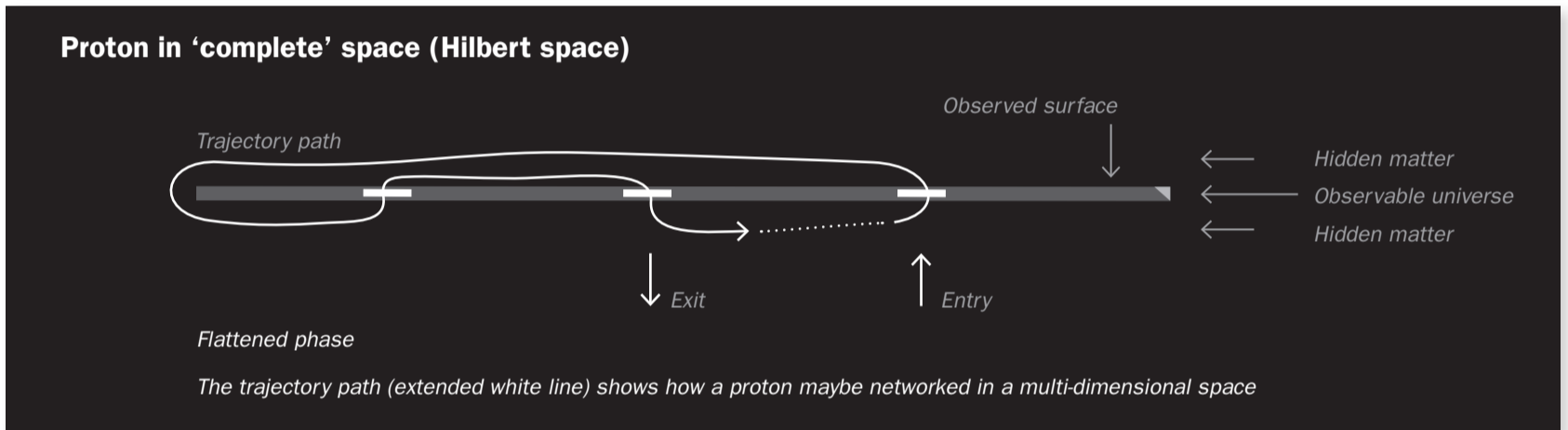
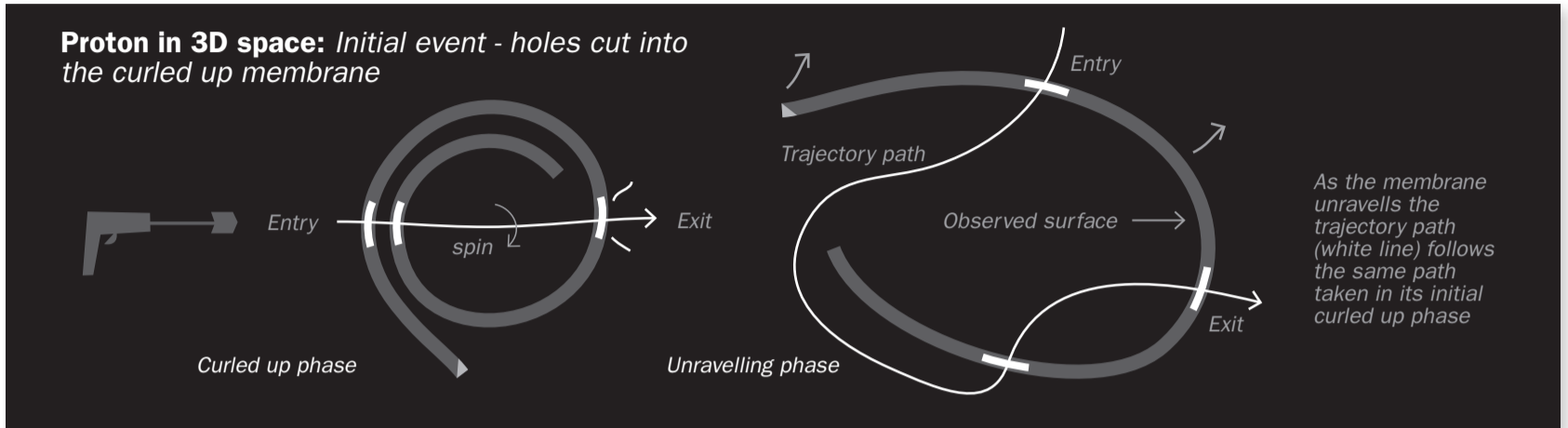
The drill holes produced on this curvature structure is similar to the way a brushstroke mark is made on a flat plane – there is initial contact, movement across and then an exit off the surface.



*Curled membranes:* This is a classical mechanics interpretation of how a fundamental particle with strong interactions may have evolved and be entangled. The drill hole will go through many layers (including hidden curls inside it) to create one expression.

# Quantum brushstrokes Malcolm Koch

## Diagram of a 'proton' brushstroke: from curvature to flat

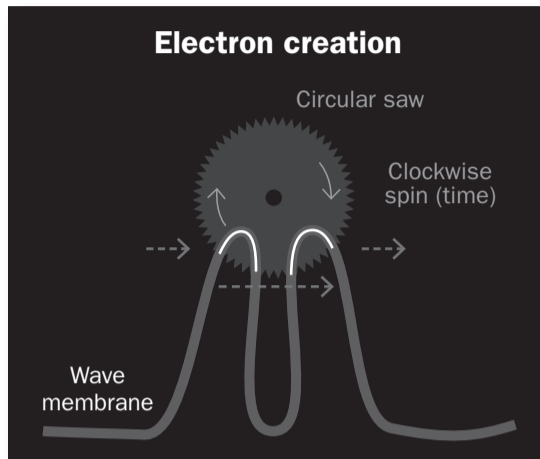
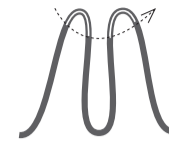


'I'm inclined to think that...the 3D world is an illusion. The ultimate precise reality is the 2D reality on the surface of the universe', Leonard Susskin\*

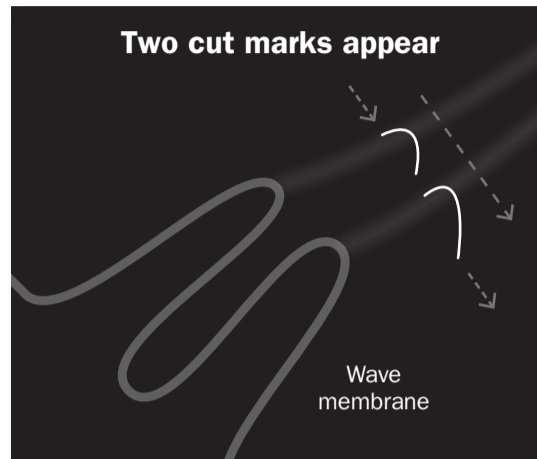
\*Source: What is space? 48:30s, 2015 www.youtube.com

Note: A second phase dimension has been neglected from this diagram.

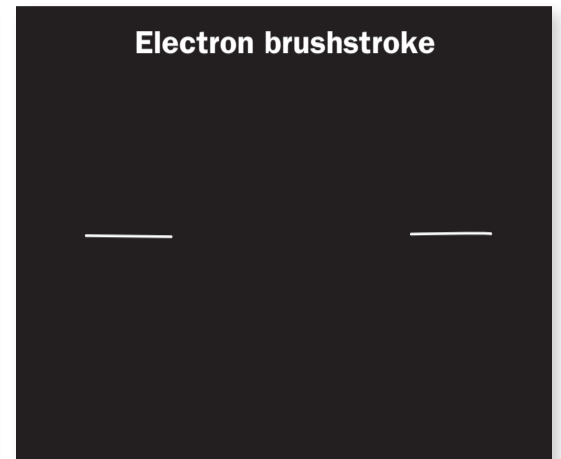
## Waves: Electron brushstrokes



This side view of the wave membrane represents the geometry of the electromagnetic field. It creates a 'hidden' structure for the work.



This shows how one expression (a cut made by the circular saw) can appear to be in two places at the same time, like a brushstroke - there is initial contact, movement across and then off the surface.



*Flat view:* The aesthetic is realised when the membrane is opened out and the depth is compressed. Nothing disappears, it just changes form. This generates the human visual experience, a metaphor for how we perceive.

## Favourable wavy structures

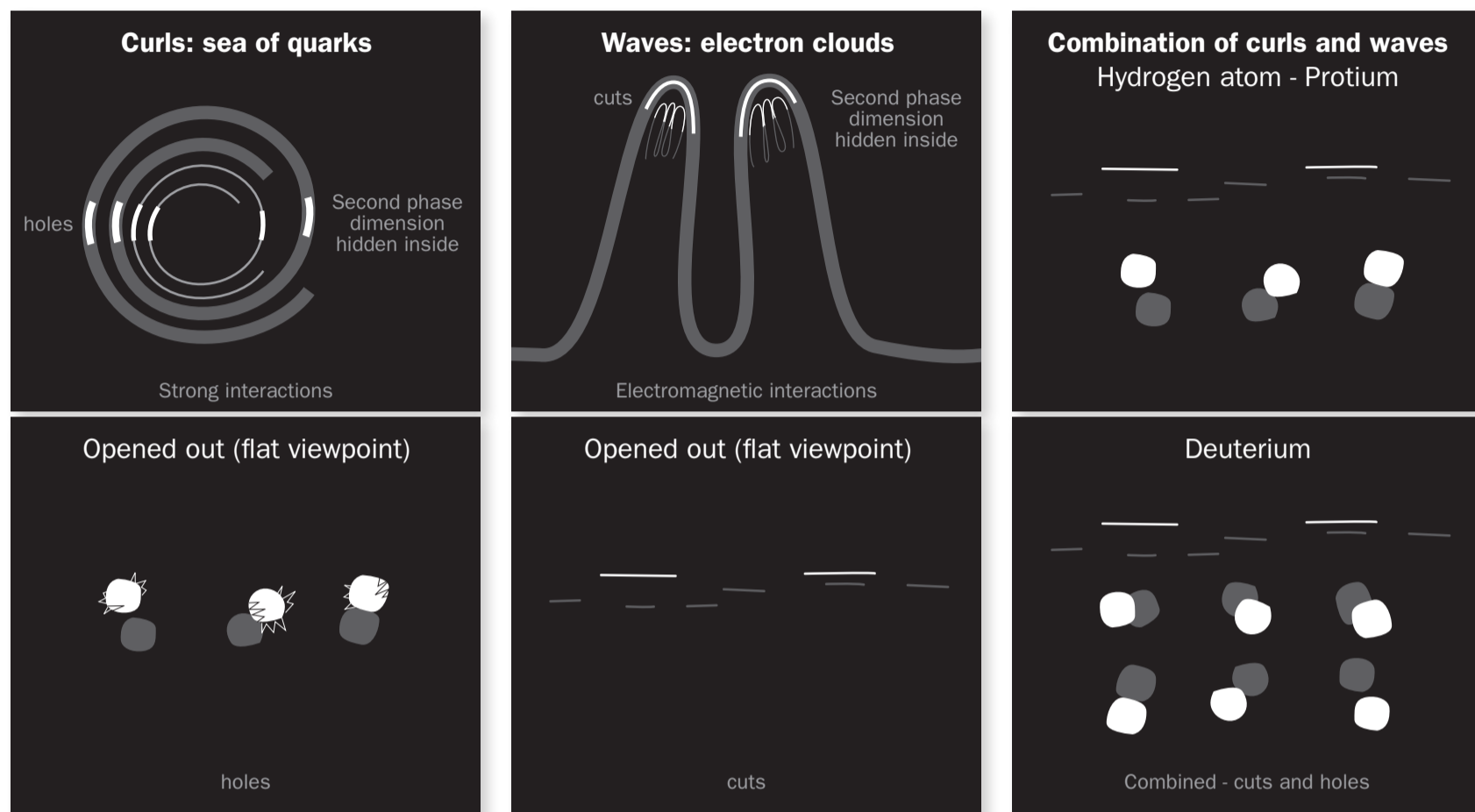
The wavy membrane represents the geometry of the electromagnetic field needed to create the particles that interact with it. The cut is spread over the various folds.

The saw cuts on this curvature structure is similar to the way a brushstroke mark is made on a flat plane – there is initial contact, movement across and then an exit off the surface.



*Wave membrane:* This is a classical mechanics interpreting how fundamental particles with electromagnetic interactions may have evolved and be entangled. Note the bottom fold could be seen as part of the structure.

## Creating atoms with second phase dimensions



Multiple quarks can be created with additional hidden structures (phase dimension) to express a 'sea of quarks' that are entangled (networked) as one expression as shown on the opened out perspective.

This electron was created with additional hidden structures (phase dimension) to express a 'cloud of electrons' that are entangled as one expression as seen on the opened out perspective.

*Flat viewpoint* - all sorts of expressive combinations can be created with 'quantum brushstrokes' that relate to fundamental particle formations. Yet the flat picture plane is necessary to help us analyse and contemplate what has happened.

## Favourable particles

We can now use both drill holes and saw cuts to create vectors and other interactions on the surface of the membranes. To create entangled (networks) a second phase dimension is hidden within the geometry of the curvature constructs at the time of creation. In practice, this second phase dimension must be large enough so that it can be held in place by the outer dimension at the time of creation — too small, it misses, rolls around inside and remains unconnected.

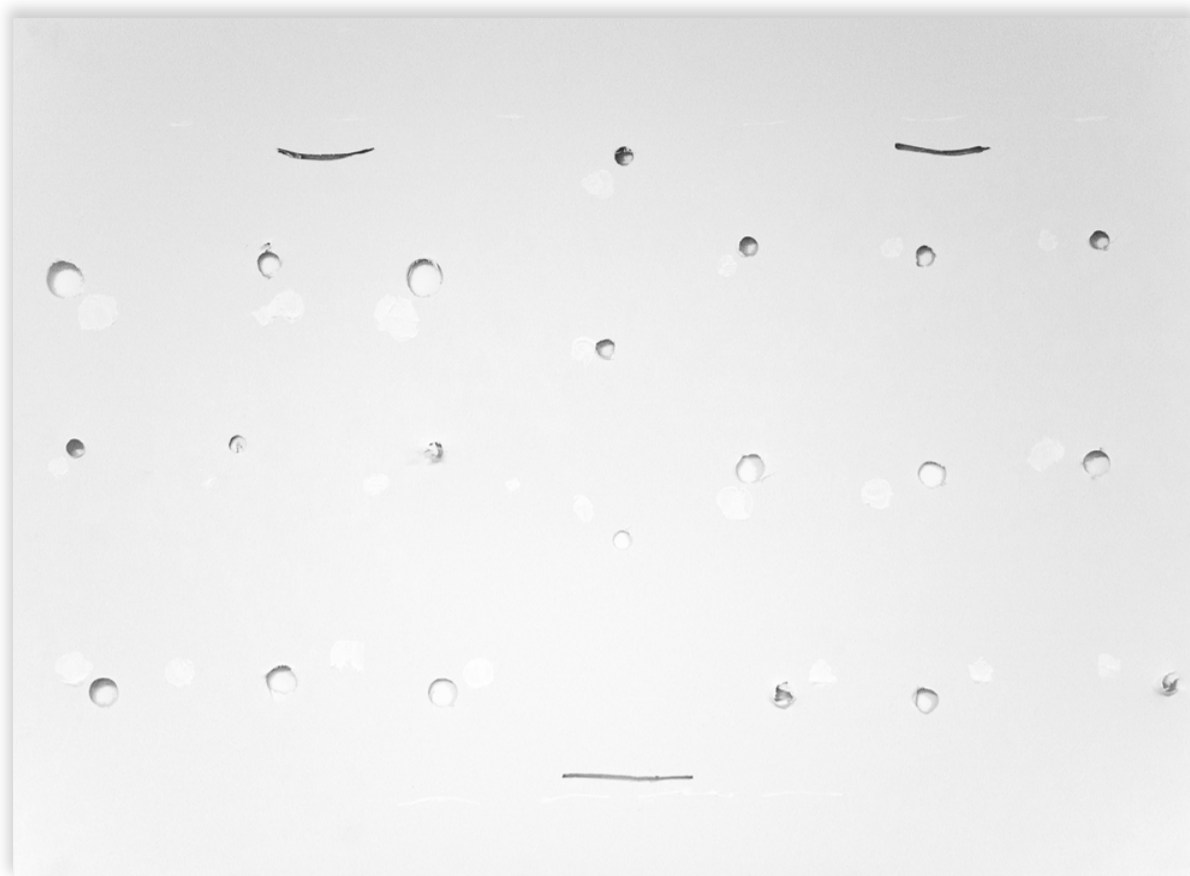


*Hydrogen atom (Protium):*  
A classical mechanics interpretation of how fundamental particles maybe entangled. This was created with one saw cut and one drill hole expression. Yet on the opened out perspective there are multiple (entangled) events that are observe.

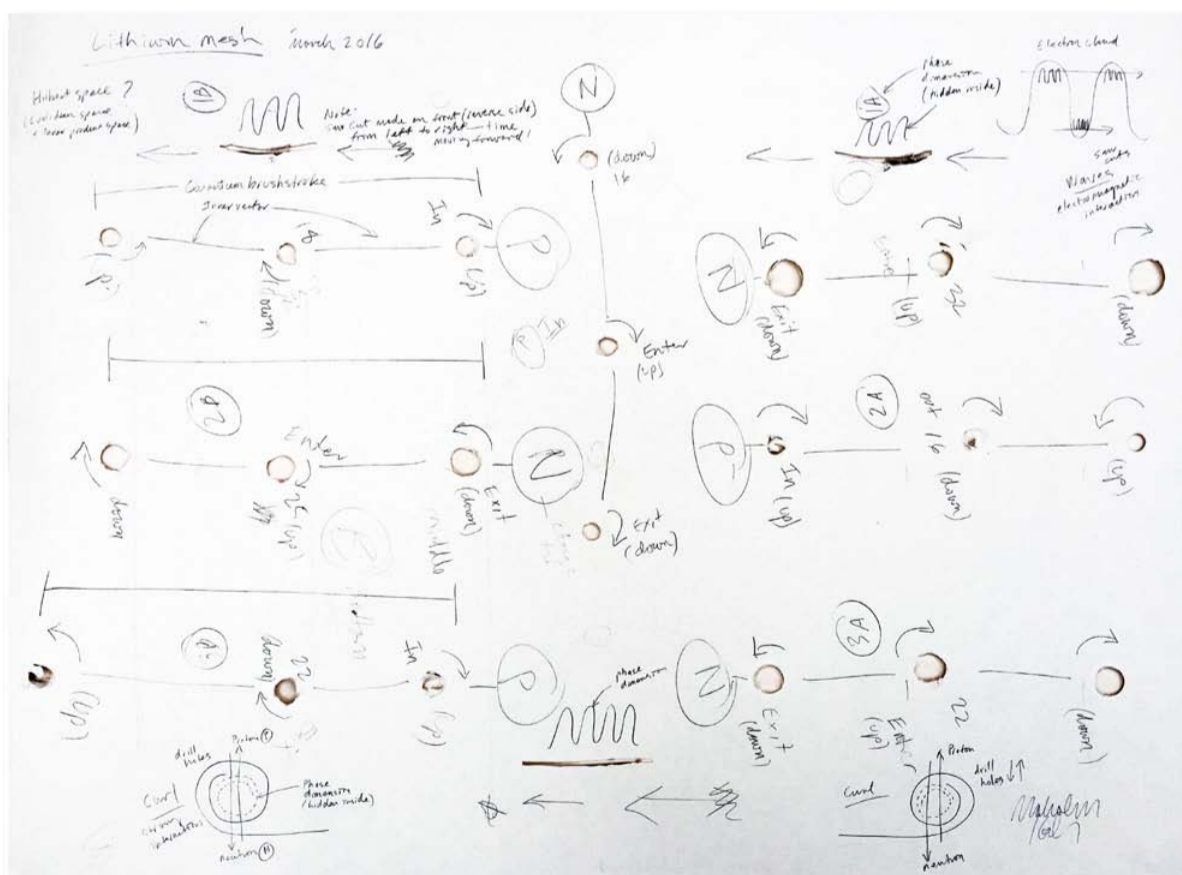


# Quantum brushstrokes Malcolm Koch

## Artwork



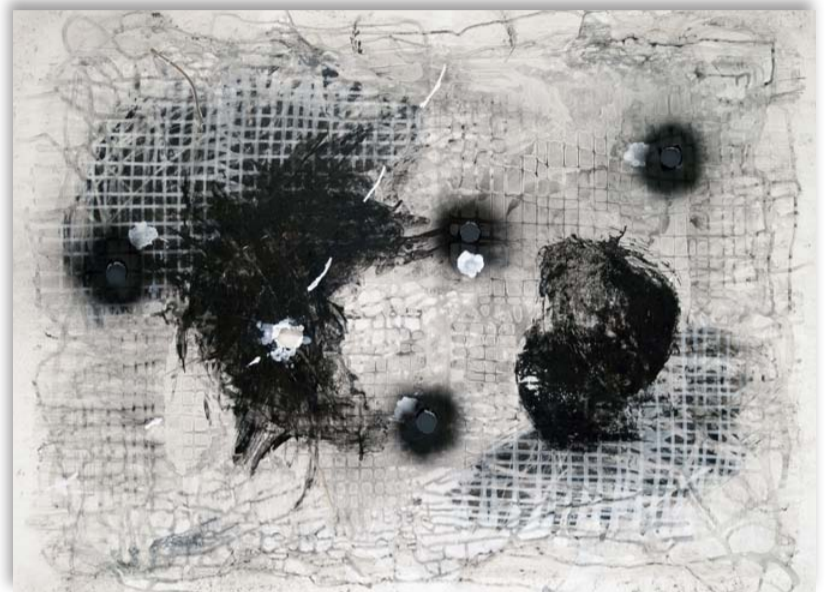
Lithium mesh:  
Highly Commended  
at the prestigious  
Waterhouse Natural  
Science Art Prize  
2016



These are my  
working notes and  
thoughts as seen on  
the reverse side. This  
illustrates entry and  
exit points, and the  
spin (direction) of the  
cuts and drill holes  
made on the various  
curls and waves used  
to create the above.

# Quantum brushstrokes Malcolm Koch

## Artwork



### **Atomic face**

Synthetic polymer on  
JPP Synthetic,  
1020 x 760 mm

### **Annihilation point**

Synthetic polymer on  
JPP Synthetic,  
1020 x 760 mm

### **Short and sweet**

Synthetic polymer on  
JPP Synthetic,  
910 x 650mm

### **Deuterium brushstroke**

Synthetic polymer on  
JPP Synthetic,  
1020 x 760 mm

### **Visual entanglement exhibition**

21 March - 9 June 2016  
FutureSpace Gallery  
RiAus, 55 Exchange Place  
Adelaide, South Australia, 5000

Top: Atomic face – The proton (3 quark holes) are surrounded by a network of gluons. This was created with many different directional waves (undulations) to represent the electromagnetic force holding it in place.

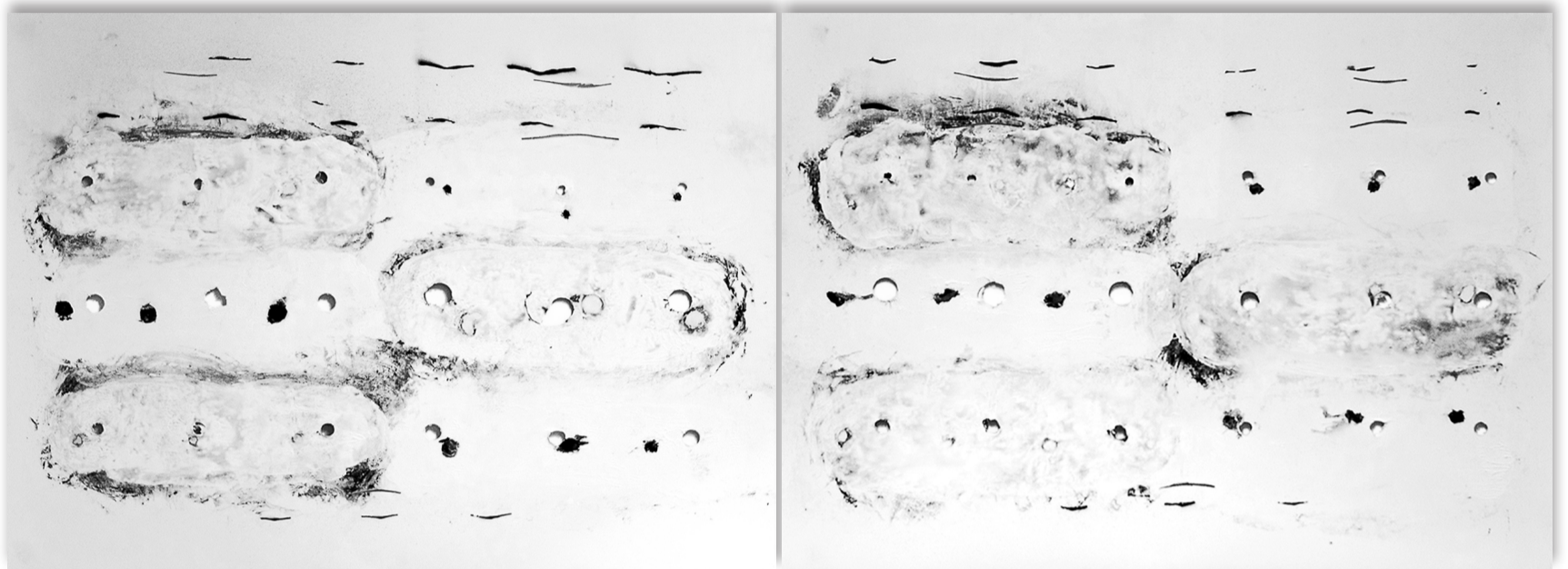
Top right: Annihilation point – A proton and an anti-proton collide (anti-proton is created the same way but in reverse). Electrons, positrons, gluons (glueball) break away from the 'scene'. The electromagnetic field sits between them.

Bottom: Short & sweet – Two mesons (quark and anti-quark) breaking apart - unstable.

Bottom right: Deuterium brushstroke – A proton, neutron and electron, with many different directional waves (undulations) to represent the electromagnetic force / gravity holding it in place.

# Quantum brushstrokes Malcolm Koch

## Artwork



Top: Carbon 12 - The efficiency of creating this diptych seems to be a clue as to why all life forms are carbon-based. This was completed with only 6 drill holes and 3 saw cuts as one entangled expression, yet we can observe — a sea of 72 quarks (holes) and a cloud of 39 electrons (cuts).

Bottom: Quantum kiss - This is an interpretation of the hydrogen isotope Deuterium. Note that the proton is slightly smaller in mass than the neutron. This diptych was completed with one drill hole and one saw cut as one entangled expression that spans over both images.

**Carbon 12 (diptych)**  
Synthetic polymer on  
JPP Synthetic,  
2040 x 760 mm (unframed)

**Quantum kiss (diptych)**  
Synthetic polymer on  
JPP Synthetic  
1820 x 650 mm (unframed)

**Visual entanglement exhibition**  
21 March - 9 June 2016  
FutureSpace Gallery  
RiAus, 55 Exchange Place  
Adelaide, South Australia, 5000

# Malcolm Koch

## Curriculum Vitae, 2016

### Background

Malcolm grew up and was educated in South Australia. He had five years of formal art training prior to entering University. He graduated from UniSA in 1989, and began work in 1990 as a sole trader in the graphic design industry. Malcolm's views of painting have led him to coining the phrase, 'Membrane Art'.

### Solo exhibitions

- 2016 *RiAus: FutureSpace Gallery*
- 2015 *Energy Travels (Angas Travel)*
- 2015 *Brick + Mortar Creative*
- 2014 *Adelaide Convention Centre*
- 2013 *Tidswell Wines*
- 2012 *Barossa Living Gallery*
- 2012 *Dare Hair (Hyde Park)*
- 2011 *Clarion Hotel SOHO*
- 2011 *Red Opus Art Space*

### Group exhibitions

- 2016 *South Australian Museum*
- 2014 *National Archives of Australia*
- 2014 *RiAus: FutureSpace Gallery*
- 2014 *South Australian Museum*
- 2013 *Prospect Gallery*
- 2011 *Botanic Gardens Restaurant*
- 2009 *Stephen Sinclair Gallery*
- 2007 *Aptos Cruz Galleries*

### Bibliography

- Barossa Living Magazine*  
Spring 2012
- Biological Membranes –  
Surface, Undulation And Interface*  
[ow.ly/zLZlb](http://ow.ly/zLZlb)
- RiAus – Under the Surface*  
[ow.ly/AI7oo](http://ow.ly/AI7oo)
- RiAus TV –*  
[riaus.tv/videos/visual-entanglement](http://riaus.tv/videos/visual-entanglement)

### Collections

- City Square Rei, Hong Kong*
- Private residence, Hong Kong*
- Numerous private and corporate  
collections in Australia.*

### Awards

- Waterhouse Natural Science Art Prize, 2016  
Finalist and Highly Commended
- Waterhouse Natural Science Art Prize, 2014  
Finalist and Highly Commended
- SALA Finalist - Emerging Artist Award, 2011

### Academic achievement

- 1986-89: Bachelor of Design (Visual  
Communication), University of South Australia.
- 1981-85: The Heights School, South Australia.

### Personal data

- Born: Adelaide, South Australia, 1968
- Languages: English, Sign language (Auslan)

### Skills, interest and activities

Malcolm enjoys problem solving, oil painting, designing type characters, gardening, cycling and playing team sports. He has played football (aka soccer) for over 40 years, including several years in the South Australian State league. He's an active member for Trees For Life and enjoys spending time with his young family.

### Referees

- *Jacqueline Mitchell*  
Art Logic  
[jm@artlogic.com.au](mailto:jm@artlogic.com.au)  
+61 432 924 305
- *Keith McEwan*  
MA (Royal College of Art) London  
Creative Director, Motiv Design  
+61 8 8363 3833
- *Dr Lisa Bailey*  
The Royal Institution of Australia  
Programs Manager  
[LBailey@riaus.org.au](mailto:LBailey@riaus.org.au)  
+61 8 7120 8605



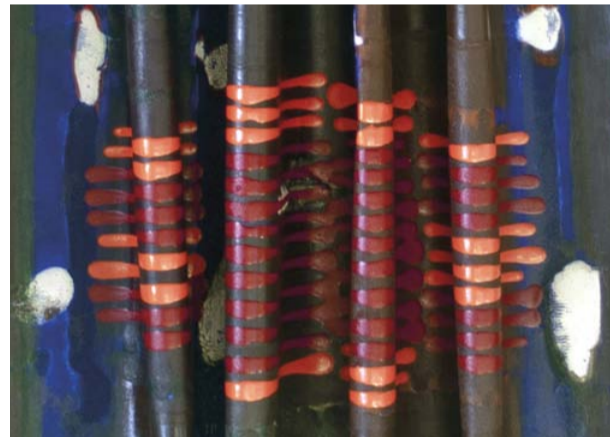
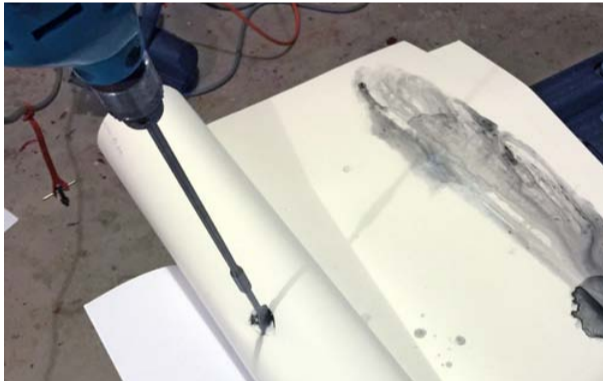
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[www.malcolmkoch.com](http://www.malcolmkoch.com)

# Malcolm Koch

## About Membrane Art

Curve the surface and create an event – ultimately returning to the flat picture plane. A metaphor for how we view the world.

Membrane Art holds true — regardless of whether the events made on the surface are painted, sprayed, poured, drilled, sawed, stamped, cracked or any other kind of mark making. As it is the curved nature of the membrane that creates the structural expressions for the work — and provided the work is presented in a flattened 2D form for observation — it is a consequence of the aesthetic thought.



**Example of events made on a wavy surface: Paint pourings.**

**Example of events made on a curled surface: The making of Quantum kiss (11) - proton/neutron style quarks.**