Artist Booklet – Feynman inspired art

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Fig.1: Coreen, 2012

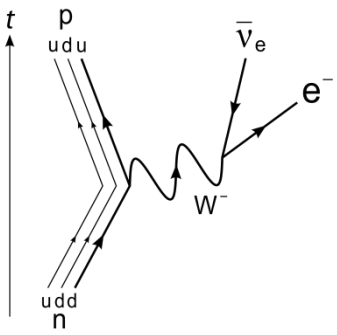
Introduction: artist statement

Physics can be a very difficult subject to master. Like most sciences, even when you have understood the broader concepts, you often need to work with involved mathematics and terminology to get into the subject.

Feynman diagrams are a very useful way of communicating in particle physics, and are used at all academic levels from school science to high level research. They provide a graphic language which defines complex particle processes in a visually simple way.

This visual language is not dependent on the spoken language of the user. It is therefore a very powerful tool in communicating these complex concepts to people from different countries. Being a visual artist I was impressed by the simplicity of the symbols used and saw beauty in the patterns and shapes formed in each diagram.

Background:



Early on when I was exploring Feynman diagrams and trying to understand the science behind them I found the beta decay diagram particularly interesting and memorable and especially liked its lack of symmetry. Watching television one evening I happened to see a music video where the dancers (for a brief moment) posed in a way which looked like the shape of this diagram. I decided to explore this further and started to photograph people in different positions. From these came the series of 4 photographs here, which are fundamentally about body shapes, but inspired by Feynman diagrams.

fig 2:Coreen

fig 3: *Claudia*

Fig 4: Elena

Fig 5: *The Boys*

What are you seeing?

Hopefully you will find these 'body shapes' interesting to look at. If you know about Feynman diagrams you may get an additional satisfaction from realising the source of these shapes. *Coreen* was the first image I made, and used a friend to pose in front of a wall in different positions in front of a plain white wall. I then used Photoshop (an image editing software) to cut and paste these images into the one you see. *Claudia* is not edited in any way. I see the shapes I want in her very gymnastic pose. *Coreen* and *Claudia* were based on the Beta Decay diagram. *Elena* and *The Boys* are based on other Feynman diagrams. A challenge for you later is to see if you come across these.

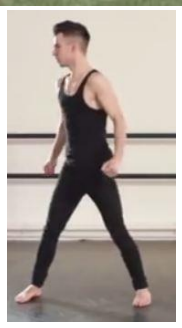
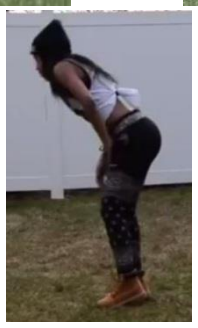
How can you make your own image?

To produce your own images I suggest you do the following:

1. Look through images of Feynman diagrams and become familiar with the shapes that are used to construct each one. Learn what the symbols mean. There is a brief guide in a later section, and also links to further information.






2. Choose a diagram you like.
3. Work with friends in a small group, exploring body positions and poses which look like the diagrams or bits of the diagrams. Be adventurous and see how different bodies or parts of the body can form shapes. Keep thinking of what might be useful to you later on.

4. Use cameras or mobile phones to take pictures of these poses. It is better to take lots and then reject the ones you don't want. Tip: Think about the background of your photos. A plain background will make it easier to do your editing later.
5. Combine images or parts of images together such that the shapes form your chosen Feynman diagram.
    a. You can use image editing programmes to do this. There are many available, like Photoshop or Gimp (which is an Open Source programme and free to use).
    b. Alternatively, print the images and cut out the bits you want. Glue them together to form a collage.
6. Once you start working on your image you might wish you had posed differently or think of a better pose. If you need to, go and take more pictures.
7. Keep a record of all you do, even when you are editing or sticking pictures down. Photographs are great for this, and fun to go through afterwards.
8. Remember that there are no rules to what you are doing. I did my work one way, and this guide is based on that. I am sure many of you can come up with more creative ideas. Use them and see what you can come up with!

Why does art and science work for me?

When I left school I went to work as a technician for the Physics and Astronomy department at a university in London. I trained as an engineer and spent many years designing and building equipment for the research groups there. My interest in science grew as I worked with these groups and got a better understanding of the science they were researching. I loved my job because it gave me so much insight into the science involved.

When I left that job and started as an artist I found that the excitement of science was something I didn't want to move away from. So, I decided to use science as the inspiration for my art. Most of the art I make comes from some bit of science that has seeded an idea. Science is a tool for letting us see our world more clearly, and for me it also inspires my work.

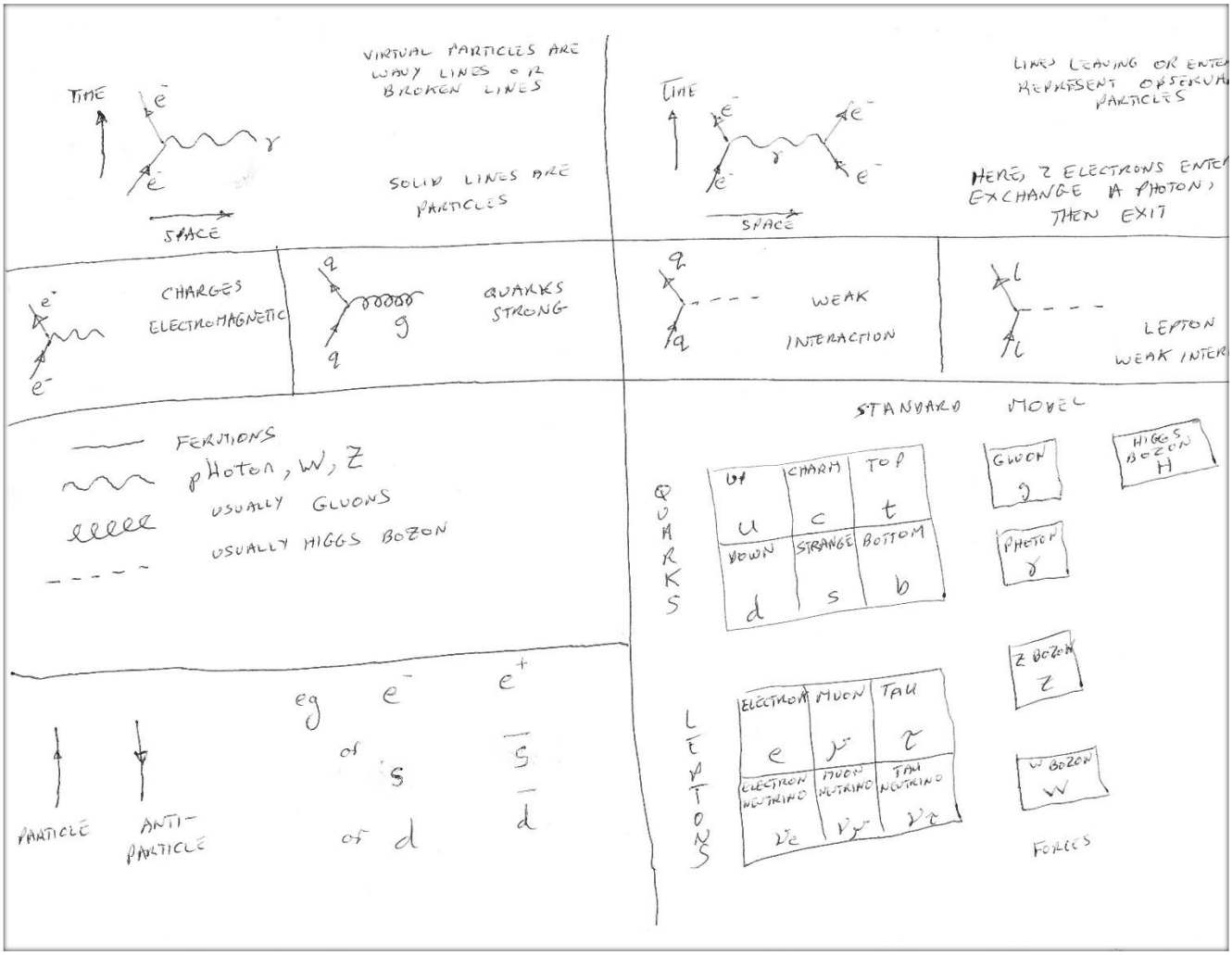
By the way, I have not moved very far from the university I worked at. I am Artist in Residence for the Astronomy group and the High Energy Physics groups there, as well as being part of the art@CMS project run by Michael Hoch at CERN.

More Information.

These are the types of symbols and rules that you will find with Feynman diagrams:

You can find a lot more information by looking on the web and in books. For lots more diagrams to see you can go to the Fermi Lab web site (1). There are also videos that guide you through an introduction (2), (3), (4), (5).

A really good video on Richard Feynman is also worth looking at (6).


TIME
SPACE
VIRTUAL PARTICLES ARE WAVY LINES OR BROKEN LINES
SOLID LINES ARE PARTICLES
TIME
SPACE
LINES LEAVING OR ENTER REPRESENT OBSERVA PARTICLES
HERE, 2 ELECTRONS ENTE EXCHANGE A PHOTON, THEN EXIT
CHARGES
ELECTROMAGNETIC
QUARKS
STRONG
WEAK
INTERACTION
LEPTON
WEAK INTER
FERMIONS
PHOTON, W, Z
USUALLY GLUONS
USUALLY HIGGS BOZON
STANDARD MODEL
QUARKS
UP
CHARM
TOP
DOWN
STRANGE
BOTTOM
GLUON
PHOTON
HIGGS BOZON
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LEPTONS
ELECTRON
MUON
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ELECTRON NEUTRINO
MUON NEUTRINO
TAU NEUTRINO
FORCES
PARTICLE
ANTI-PARTICLE
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5. Let's draw Feynman diagrams. *quantum diaries.* http://www.quantumdiaries.org/2010/02/14/lets-draw-feynman-diagams/

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7. *Andy Charalambous artist and ingenieur .*

8. *web pages for art@cms.* http://artcms.web.cern.ch/artcms/

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art@CMS_sciARTbooklet: web page : http://artcms.web.cern.ch/artcms/

A tool to support students with their research on various scientific topics, encourage an understanding of the relevance of expression through the arts, a manual to recreate the artwork and enable students to define and develop their own artistic inquiry in the creation of new artworks.

The **art@CMS sciART** booklet series directed by Dr. Michael Hoch, michael.hoch@cern.ch scientist and artist at CERN