



THE SKETCHBOOK AND THE COLLIDER

DRAWING LINKS BETWEEN FINE ART AND PARTICLE PHYSICS

IAN ANDREWS & PROF. KOSTAS NIKOLOPOULOS

AN EDUCATIONAL & ARTISTIC COLLABORATION

MAIN PROJECT WEBSITE

<http://thesketchbookandthecollider.com/>

SHORT FILM DISCUSSING THE PROJECT

<https://www.youtube.com/watch?v=nPxSHBn1R34&t=146s>

EDUCATIONAL WORKSHOPS

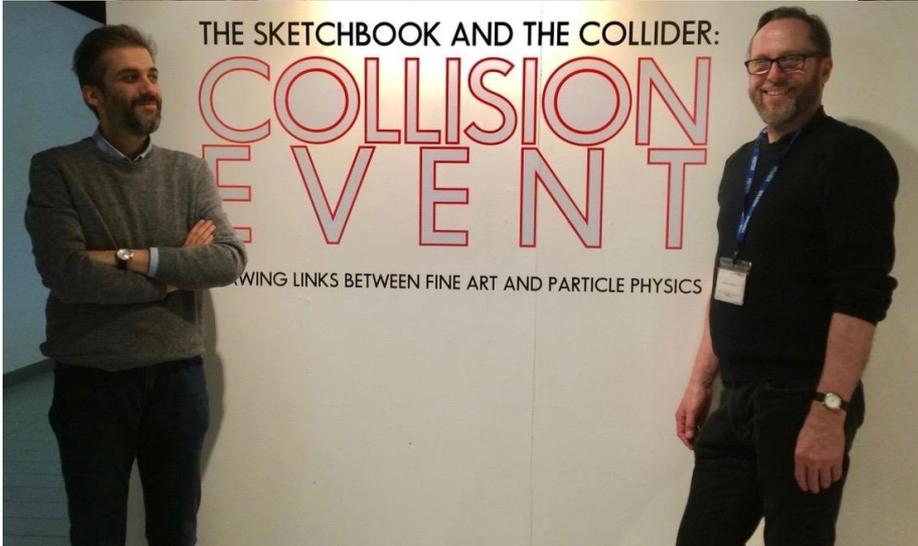
<https://www.youtube.com/watch?v=D2H8xFoqELA&t=229s>

[?](#)

IOP ARTICLE

[?](#)

http://epweb2.ph.bham.ac.uk/user/nikolopoulos/Andrews_2018_Phys._Educ._53_054001.pdf[?](#)



“ it became apparent that despite obvious differences both specialisms are concerned with **making the invisible, visible**. Scientific developments have seen the ‘everyday’ dissolve into sub-atomic interactions only accessible by examining traces left in an enabling medium. **A process mirrored by the artist** expressing thoughts, emotions and insights through mark made and materials manipulated.”

Started in **2015** and has grown organically delivering over **35 workshops** and **12 exhibition / events**.

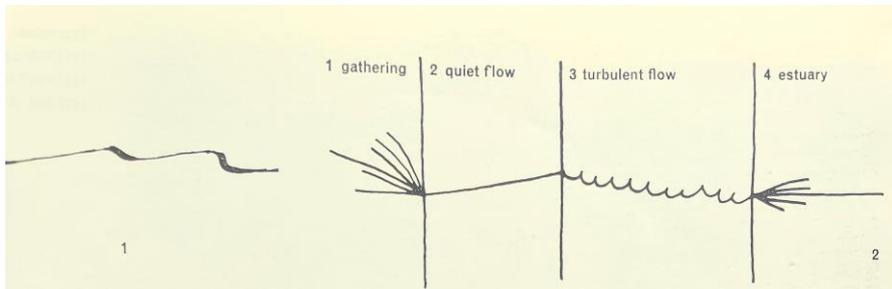


The search for equivalents

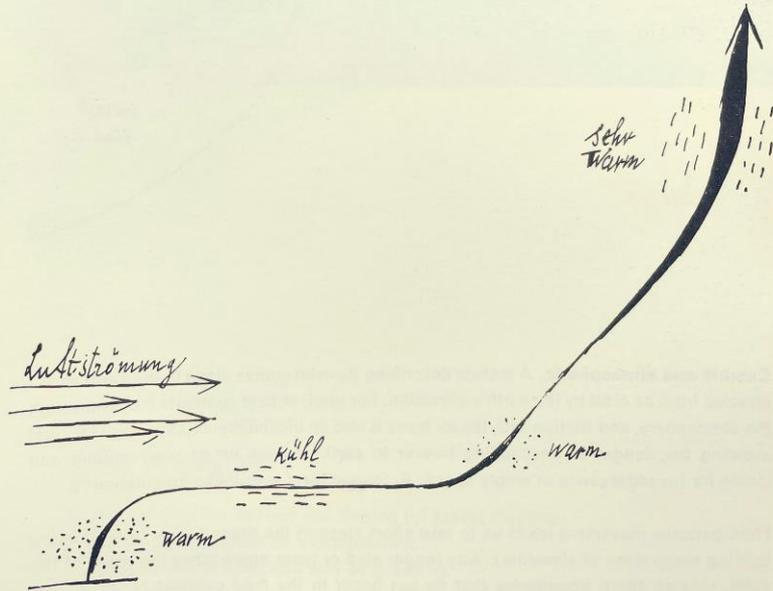
Equivalents between the **visual elements of drawing**: point, line & shape and the visual forces of tone, texture and colour and the **interaction of elemental particles** via the strong, weak and EM forces.

Use of templates

The pen interacts with the **different shaped templates** to reference different particle interactions



Water. The leg thrusts of a swimmer, a rhythm with loose articulation [1]. The watercourse. If I broaden my field of vision,¹ I create a perceptible whole at a higher level [2]. I give the drawing new, wider limits, or within the old limits I reduce the content.



Air. In rising, a free balloon passes from a warm to a cool layer of air, then enters another warm layer, and finally a very warm one. A rhythm with loose articulation.

Paul Klee

Bauhaus lecture notes

$\pi^- + p \rightarrow K^- + p + K^0$
 \downarrow
 $\pi^- + \pi^+$

$K^- \rightarrow \pi^- \pi^+ \pi^-$

$\pi^+ \rightarrow \mu^+ + \nu^+$
 \downarrow
 $e^+ + \bar{\nu}$

$\pi^- \rightarrow \Lambda + \pi^-$
 \downarrow
 e^-
 $e^+ + \gamma$

$K^- + p \rightarrow \Xi^0 + K^0$
 \downarrow
 $\Lambda + \pi^0$
 \downarrow
 $e^+ + e^- + \gamma$
 \downarrow
 $\pi^- + \pi^+$

The drawings rest on the.

Figure 5.21 Exemplary tracks (1968). These “cleaned up” tracks (with their interpretations) were reproduced in the training memoranda to instruct initiates into the art of classification. Trainees would learn to find not only these particular processes but also classes of related processes in which elements of these interactions were found. Given the complexity of these interactions, along with the variety of optical perspectives and distortions,

Enrico Fermi

particle recognition training



IAN ANDREWS

THE SKETCHBOOK AND THE COLLIDER
REALITY IS NOT WHAT IT SEEMS

DRAWING LINKS BETWEEN FINE ART AND PARTICLE PHYSICS

A COLLABORATION WITH **PROF. KOSTAS NIKOLOPOULOS**

IN ASSOCIATION WITH **CLAIRE ADAM** AND THE LABORATOIRE D'ANNECY DE
PHYSIQUE DES PARTICULES







Matter, Media and Energy



Ian Andrews

30th July - 21st August 2021
Wed - Sat 12:00pm - 5:30pm



Supported using public funding by
**ARTS COUNCIL
ENGLAND**

KIND.









IAN ANDREWS

THE SKETCHBOOK AND THE COLLIDER
POINT TO LINE TO PARTICLE
DRAWING LINKS BETWEEN FINE ART AND PARTICLE PHYSICS

IN COLLABORATION WITH PROF. KOSTAS NIKOLOPOULOS

5 FEBRUARY-24 APRIL 2022
The Beacon Museum Whitehaven
CA28 7LY

The Sketchbook and the Collider is a collaboration with award-winning physicist **Professor Nikolopoulos** from the University of Birmingham exploring links between the language of drawing and sub atomic Interactions. The show includes a 17 metre long drawing made especially for the Beacon Museum inspired by the linear accelerators used in particle detection



Open Tues-Sat 10- 4.30pm Sun 10- 4pm

www.thesketchbookandthecollider.com

Artist Talk - 15 March 2-4pm with tour, slideshow, drawing demonstration and Q&A. £5

Free family workshops (details from the venue) are available on April 5 & 6. 10-12pm or 1-3pm

Booking by phone required for both with the Beacon Museum **01946 592302**

thebeacon@copeland.gov.uk



Supported using public funding by
**ARTS COUNCIL
ENGLAND**













Resource material: both **curated** and **informal** arrangements are included in the exhibitions



Picturing the invisible

Making sense of particle physics through art

Papers: Mercury, Pendulums Frontline: Kahoot!

IOP Publishing



PAPER

Phys. Educ. 53 (2018) 054001 (8pp)

iopscience.org/ped

Introducing particle physics concepts through visual art

I Andrews¹ and K Nikolopoulos² 

¹ In-Public, Community arts group, Birmingham, United Kingdom

² School of Physics and Astronomy, University of Birmingham, B15 2TT, United Kingdom

E-mail: k.nikolopoulos@bham.ac.uk



Abstract

The development of a workshop using the language, techniques, and processes of visual art to introduce particle physics concepts is described. Innovative delivery methods committed to the interaction and collaboration of different specialist areas are utilised, which—in curriculum terms—encourages connections to be made between separate subjects to the benefit of both. Beyond enhancing the understanding of the nature of the microcosm, this approach aims to stimulate a ‘creative curiosity’ about the world.

Workshop 1: Secondary schools

originally designed for 15 year olds.

Focus on Interaction



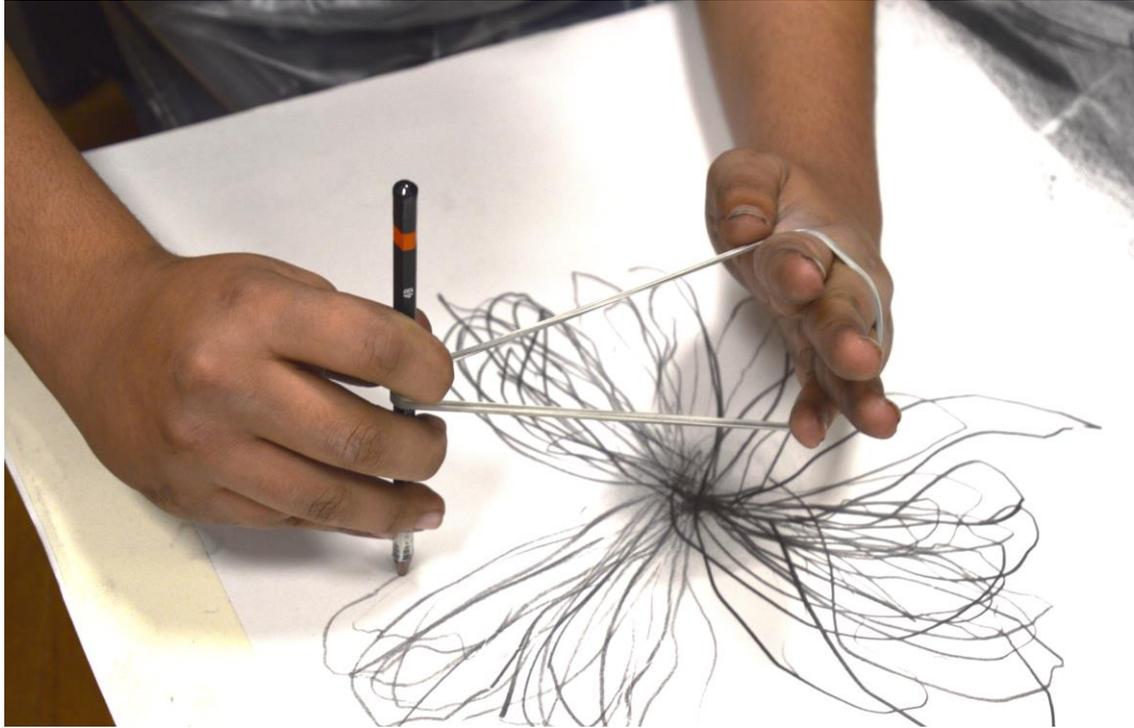
A charcoal **ground** is laid across the surface of the paper rubbers are then used to remove the charcoal creating white marks on the dark surface. In this context it represents the particle interaction with the **substance of the detector**.

This technique encourages consideration of the whole **visual field**. Students then consider overlapping the trails to understanding that particles interact in all three spatial dimensions.

The charcoal ground can also be used as a reference to the **Higgs field** that is present everywhere in the universe, even in empty space: the zero of white paper replaced with a surface of grey charcoal.



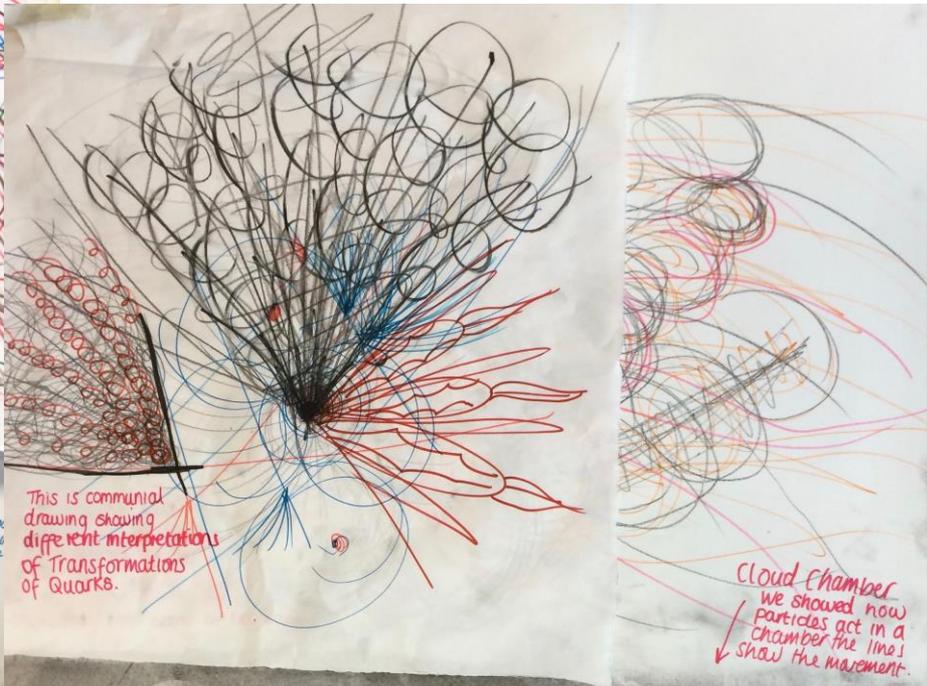
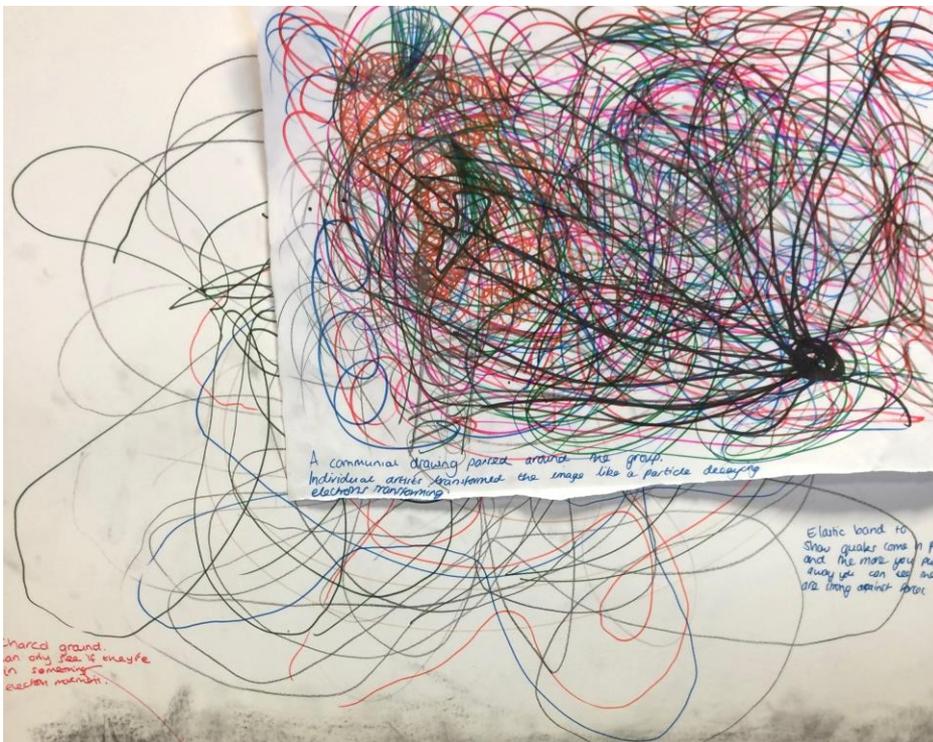
Traditional drawing: the ground or field



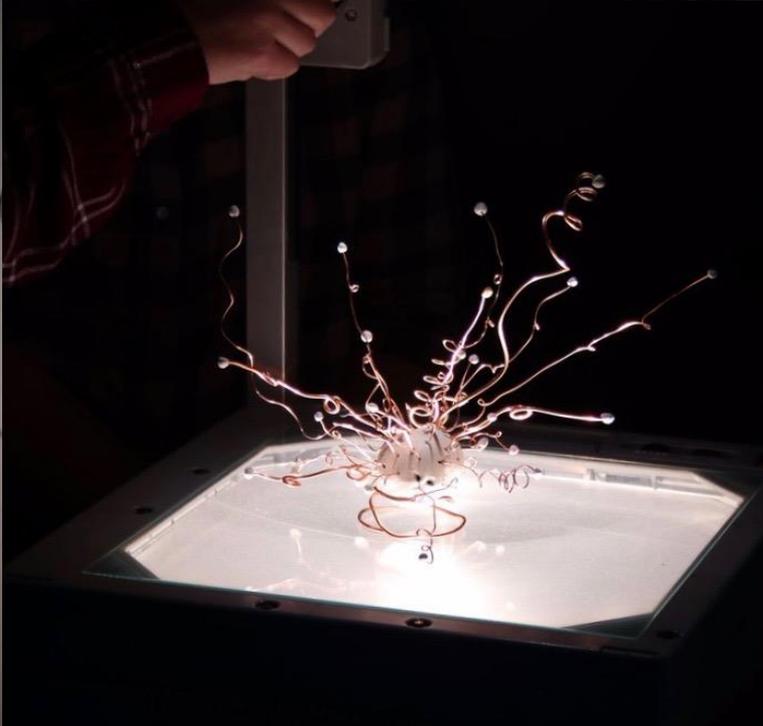
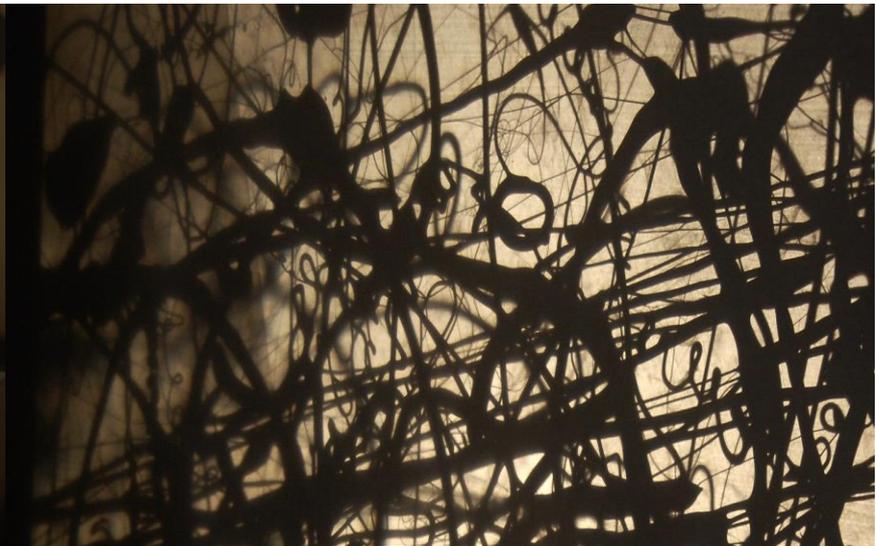
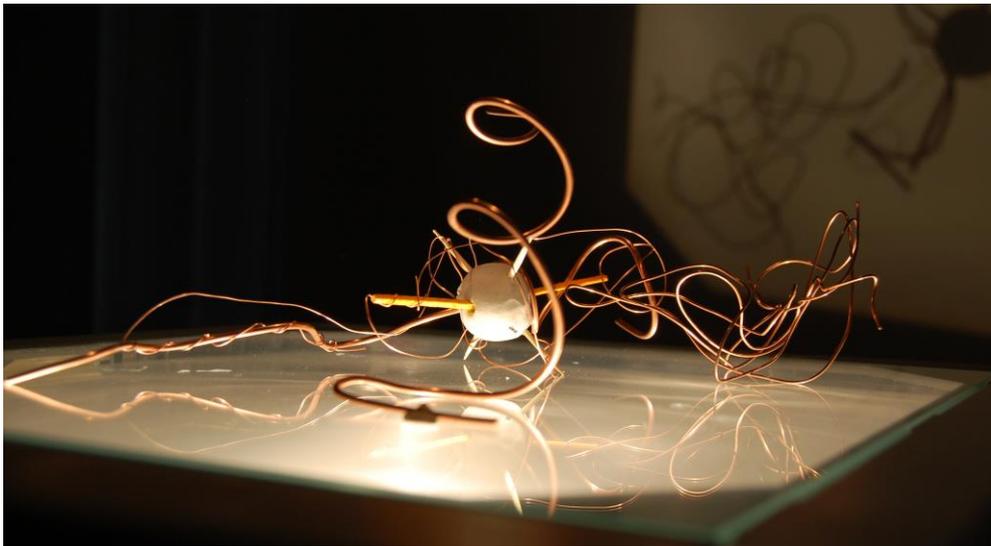
Experimental drawing: drawing against **the restrictions of an elastic band** referencing **the strong force confining quarks**.



Collaborative drawing: **transforming the drawing** you receive. Referencing the Surrealists' "exquisite corpse" exercises and **particles transforming** their nature.



Students develop an annotated **ideas sheet** of particle interaction visualisation exercises

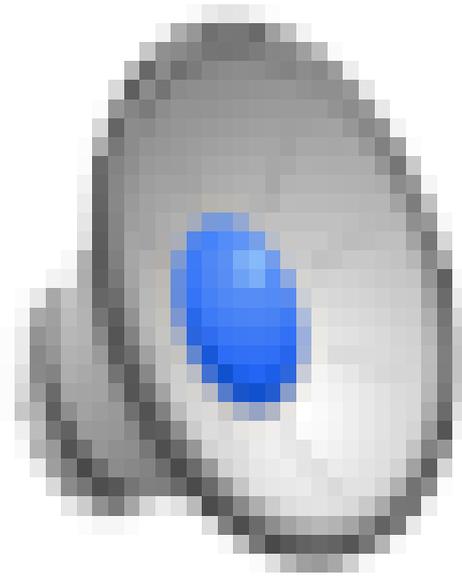


Experimental Drawing: Glue gun as drawing tool expanding into 3D and photography

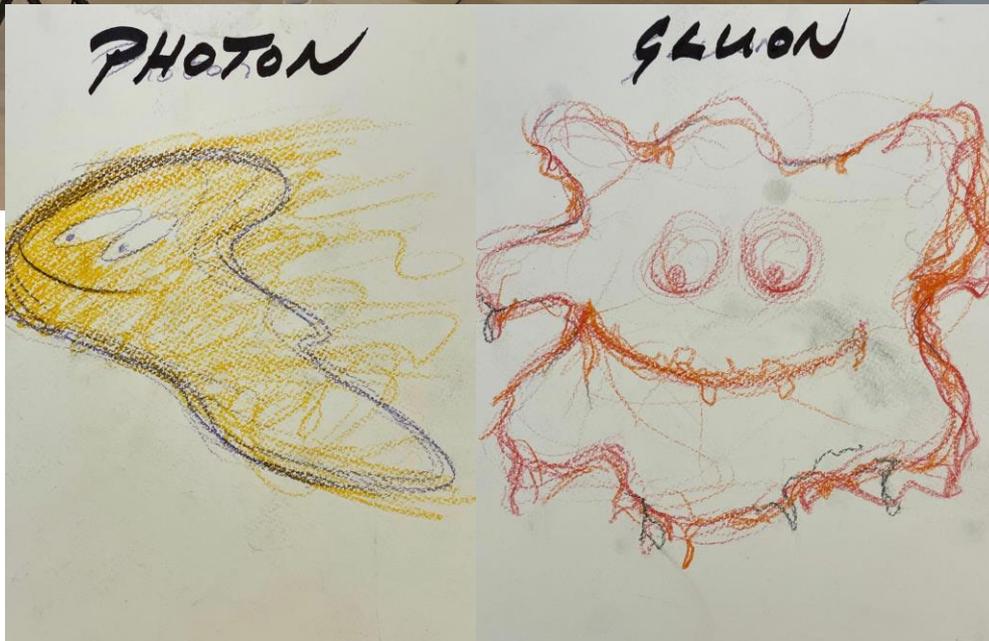


Shadow screen performance art: expressing **particle interactions** through **the movement of the body**. Working collaboratively to create a short film.





Shadow screen performance art: The Higgs field giving mass



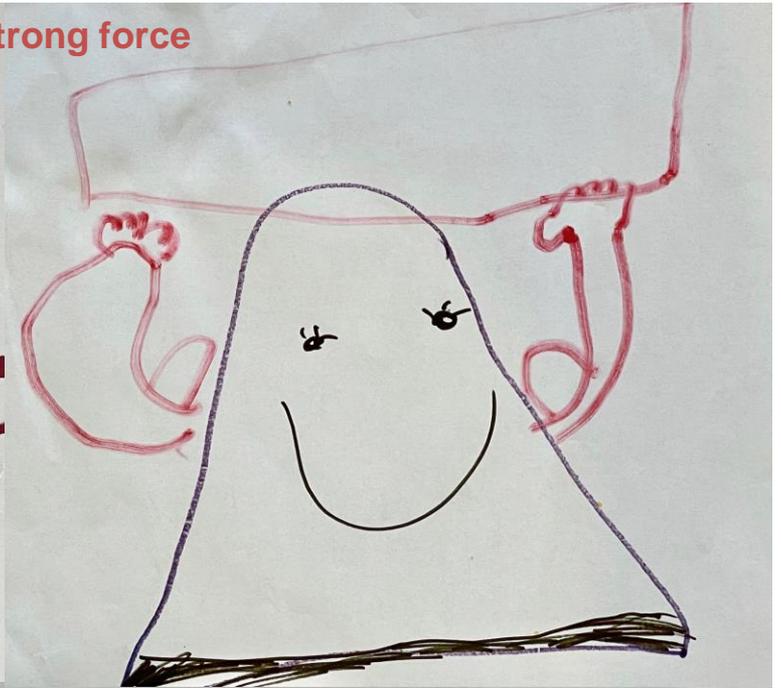
Workshop 2: Primary Schools originally designed for final year 11ys old

Focus on characteristics

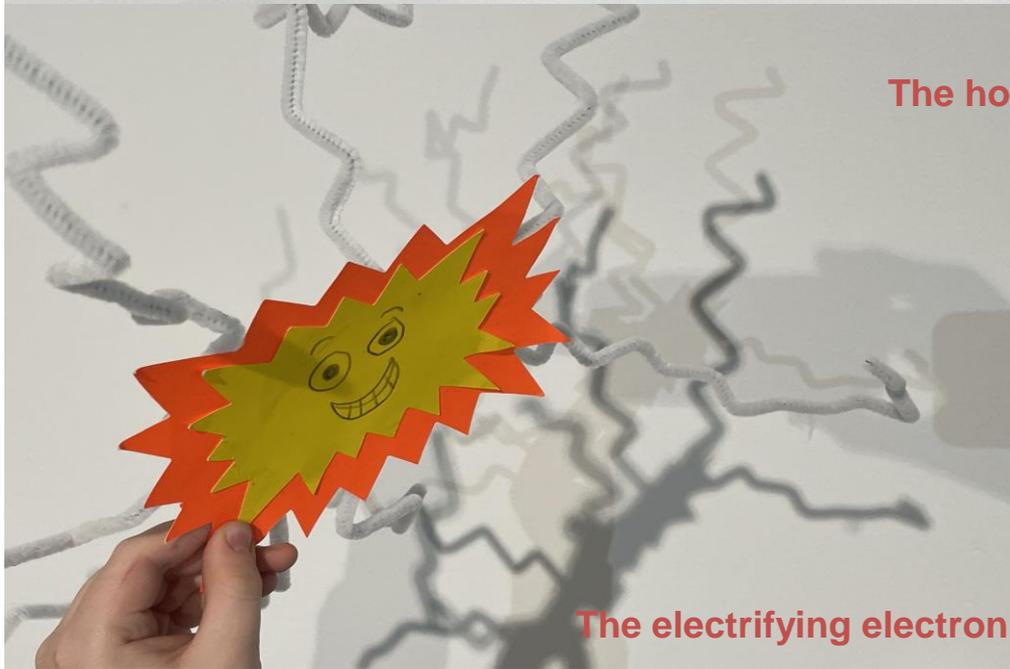
The Gluon carrying the strong force



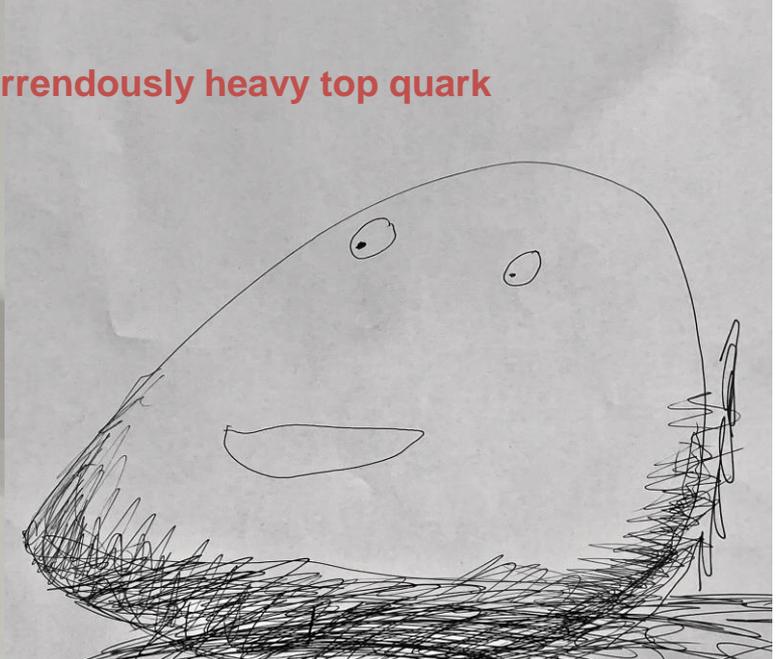
The fabulously fast photon

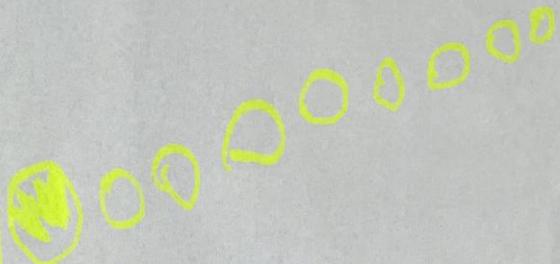


The horrendously heavy top quark



The electrifying electron

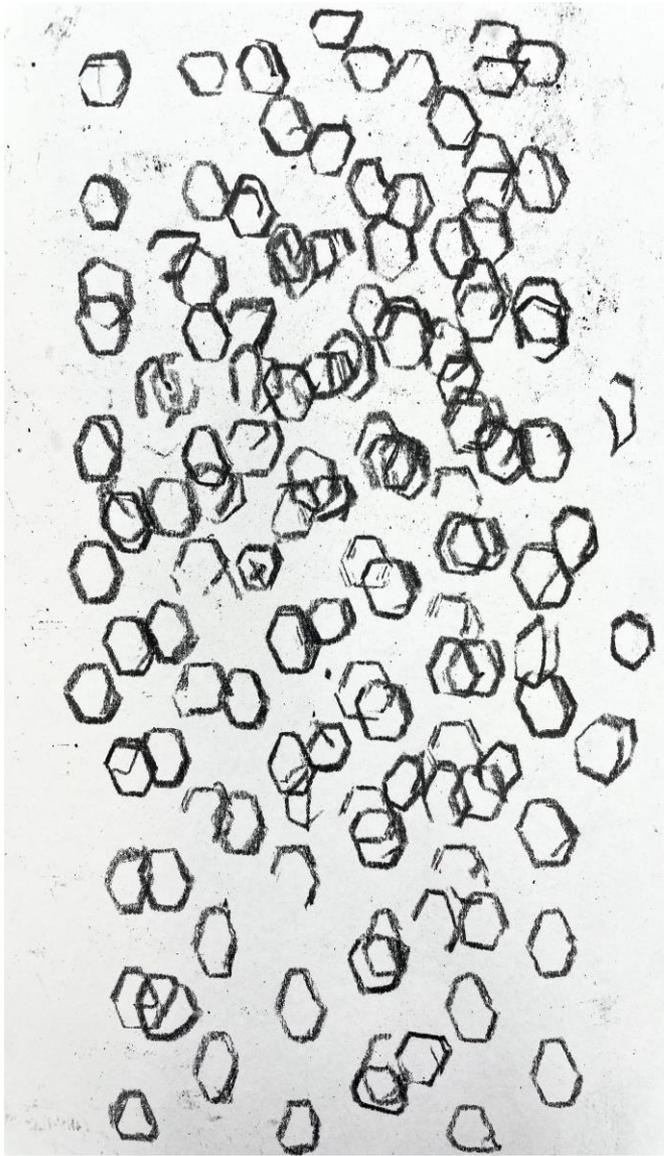




LOLA
4



LOLA
4 X

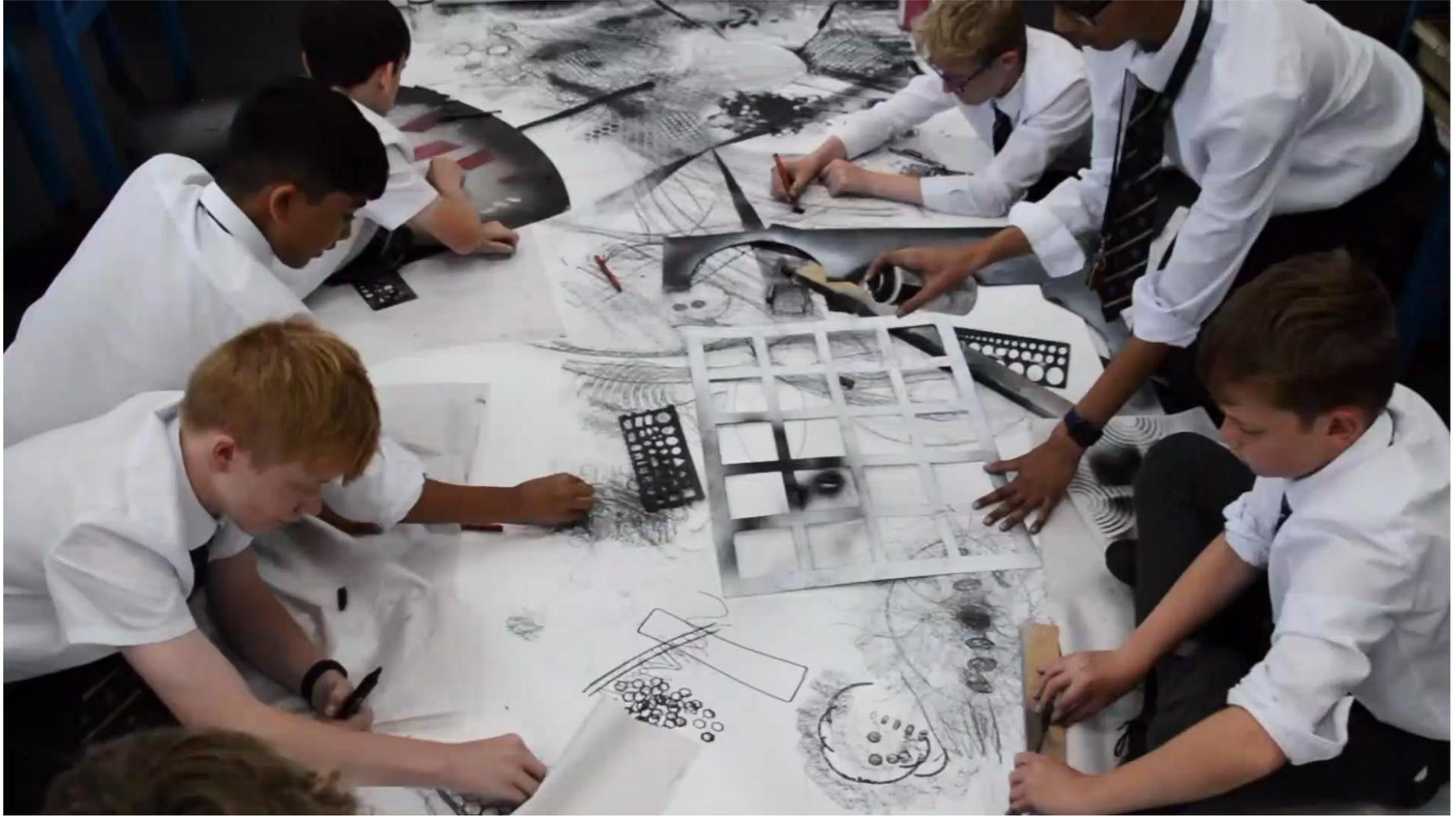


Workshop 3: individual experiments into collaborative drawing

pilot with 12yr olds









Women In Cancer Network
@WiCN_Manchester

Mind blowing exhibition on a recent trip to Whitehaven DRAWING LINKS BETWEEN FINE ART AND PARTICLE PHYSICS - Congrats @TheBeaconMuseum @IanAndrewsArt Worth a trip @marianneaznar Imagine this in the new Paterson? @MCRNews thesketchbookandthecollider.com



Ane Appelt
@cancerphysicist

Replying to @IanAndrewsArt @marianneaznar and 3 others

I sometimes have a hard time with art inspired by science - it can feel superficial and superfluous. But your work had a synergy which both engaged and enriched, in a way that I haven't experienced before. Highly recommended!

FEEDBACK FROM "COLLISION EVENT" WORKSHOP

Dear Ian & Kostas,

The workshop was so good! Everyone came away with a real buzz. From conversations afterwards and watching them during the day, they all really enjoyed taking part and it was lovely to see them so engrossed!

What I learned was a) **the power of getting pupils to visualise new and complex ideas in different ways** and b) **not to stereotype our students who proved they can cope with, and enjoy being presented with, very challenging ideas** away from the exam system.

Nicky Thomas

CPhys MInstP FRSA

IOP Coach (IGB)

Physics Network Coordinator: Herefordshire and Worcestershire

Chloe:

Ian and Patrick were amazing at delivering the **fantastic workshop**. They combined art and physics very well and put it in a way that we can understand, I really enjoyed the workshop and helped me express other subjects such as physics in art form. He offered great advice!

Year 9 Student:

Ian and Dr Patrick both made the experience fun and enjoyable. It was **a unique and different to any other workshops** I've done.

Primary School feedback from Montréal primary school and Monkway primary school

Ian was lovely everything was explained so well.

I want to come back and do more.

It was amazing!

I liked everything about the day and would not change anything.

Do not change anything!

It inspired me a lot I learned so much!

Analysis of questionnaires requesting “Marks out of ten”

Of the 60 participants -

50% scored it 10 out of 10.

78% scored it 9/10 or higher.

92% scored it 8/10 or above.

97% scored it 7/10 or above.

2

The importance of 3 elements in particular have become clear during the recent workshops-

Environment

Having educational activities take place within the art exhibition greatly enhances the participants experience and increases the opportunity for them to make the links between disparate disciplines and ideas. It reinforces the collaborative “ideas sharing” involved in developing a creative curiosity.

Group critiques

Having critiques throughout the session where pupils present their work or discuss the work of others is a crucial aspect and even works with much younger children than originally planned. It was recently trialled with primary school pupils aged 7 and 8 year olds to good effect.

With primary school pupils the critiques become a game of “Guess the particle” when students present their artwork to the group.

With secondary school pupils 2 approaches were used. Firstly pupils presented their own work and justify their artistic choices and its scientific validity. Secondly pupils select a particular favourite from other students work and then justify their choice by outlining its merits.

Shadow screen performances

This aspect has continued to be extremely engaging for participants and although originally designed as part of the package of “Art school in a day” activities for students making their GCSE choices we have now successfully rolled it out to students in their first year of secondary school, pupils aged 12.

It remains to be seen if it can be used with primary school pupils, as so far the distinction has been that the primary school pupils look at the particle characteristics whilst the secondary school pupils are introduced to the idea of the interaction via the fundamental forces.



Environment

Educational activities within the art exhibition enhances the participants experience

Increases opportunity for **links between disparate disciplines** and ideas

Reinforces **collaborative ideas** sharing involved in developing **creative curiosity**



Group critiques

Throughout the session pupils present/discuss work and the work of others **reinforces learning**.

Works also with younger children (7-8 yr old): Becomes a game of **"Guess the particle"**

Both artistic choices and scientific context discussed: Further **reinforce key concepts and dispel any misconceptions**.

Parallels to the scientific seminar:^[SEP]Progress relies on scientists presenting, discussing, and improving their results



“Just seen an **incredible exhibition** at the Beacon in Whitehaven.

The artist is Ian Andrews who is working with particle physicist Professor Kostas Nikolopoulos of Birmingham University to bring the ephemeral world of high-energy physics to life through drawing. **I loved the references to Paul Klee and David Bohm, who between them reconceptualised the philosophy of drawing and perception.**

The drawings are MASSIVE and extremely detailed, acting as mysterious metaphors for the unseen processes they interpret. Prepare to be intrigued and challenged as well as perhaps getting a little closer to the boundaries of human knowledge!”

Professor John Sidney, PhD

Institute of Business, Industry and Leadership.

University of Cumbria, Learning Gateway West.



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