Epistemic Insight

CAN A ROBOT OWN ITS OWN IDEAS?

THEME TOPIC - **AI, ENGINEERING AND CREATIVITY**

FACULTY OF
EDUCATION

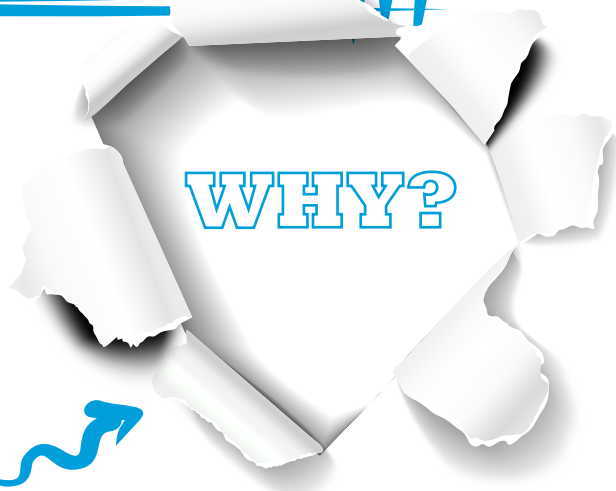
Canterbury Christ Church University

ep·i·ste·mic in·sight (ĕp′ĭ-stē′mĭk ĭn′sīt′)

Epistemic insight refers to 'knowledge about knowledge', and particularly knowledge about disciplines and how they interact.

Gaining epistemic insight is about developing an appreciation of the strengths and limitations of individual disciplines. One way to do this is to explore how two disciplines each investigate a cross-disciplinary question. Consider for example how science and history can each investigate *'Why did the Fire of London spread so quickly?'*

BIG QUESTIONS



Today's Big Questions include:

- **Can a robot be a good companion?**
- **Can and should genetic engineering be used to make better people?**
- **Why do life and the universe exist?**

Big questions are frequently squeezed out of school education. That's because they don't fit neatly into one subject, they are often religiously sensitive and they call for teachers to explain how science and other areas of knowledge interact.

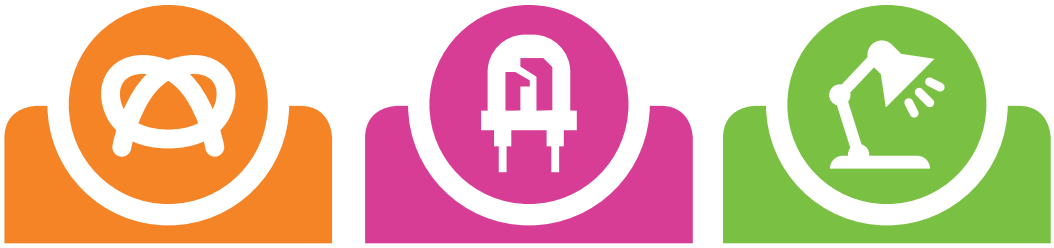
Big Questions are not currently covered in schools.

And yet these are questions where great advances are being made and where outputs affect the lives of individuals and society.

Look what happens when you include these objectives and students learn about the nature of knowledge...

THE EPISTEMIC INSIGHT CURRICULUM FRAMEWORK

The objectives below are from the Epistemic Insight Framework. They are statements about the nature of scholarship and knowledge that reflect the aims of the National Curriculum.



LEARNING OUTCOMES	Relationships between science and religion	The nature of science in real world contexts and multidisciplinary arenas	Ways of knowing and how they interact
UPPER PRIMARY	Science and religion are mostly concerned with different types of questions, including different types of why question.	Science begins with observations of the natural world and constructing ways to explain our observations. Some methods are more scientific than others.	Science has some similarities and some differences with other ways of knowing that we learn about in school.
LOWER SECONDARY	Today we ask big questions about human personhood and the nature of reality that bridge science and religion. Some people say that science and religion are compatible and some people say they are not.	Science informs our thinking about every aspect of our lives. Some questions are more amenable to science than others. There are some questions that science hasn't yet and may never be able to answer.	A school is a multidisciplinary arena. Different disciplines have different preferred questions, methods and norms of thought.
UPPER SECONDARY	Science and religion are not necessarily incompatible.	Scientism is not a necessary presupposition of science.	Some questions are more metaphysically sensitive than others.

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HOW DOES REALITY HANG TOGETHER – IS ANYTHING REALLY REAL?

There's a queue of aliens lining up to go through a customs archway – Fred, a human arrives at the checkpoint.

"What species are you?" asks the customs officer.

"Human"

"Human! We are trying to learn about humans. Where are you from?"

"Earth"

The alien reaches behind it and brings back a basket containing a rabbit.

"So do you belong with this?"

"I'm from the same planet. I share some biology with the rabbit. But the rabbit and the human are on different branches of Darwin's evolutionary tree. The rabbit evolved the ability to eat grass, poo and then eat its own poo in order to draw out the goodness from grass. Humans come from a branch of animals that evolved increasingly complex brains and as these brains became more complex they reached a point at which we became conscious of our own existence. Homo sapiens – that's us. With our impressive brains we have developed language, art, science and mathematics which help us to communicate and think in abstract ways. So the bottom line is – the rabbit eats grass and hops about and we humans have 3D printers and contact lenses and antibiotics and we live in houses with electric light-bulbs and central heating."

"You seem very pleased with yourself. Is that a trait of all humans?"

"Well – you did ask me to compare humans and rabbits. And let's put it another way, I'm here of my own accord. That rabbit got here in a basket."

The alien is satisfied that rabbits and humans are not the same thing. It waves over a humanoid robot which stands in front of Fred, smiling and blinking. The alien asks Fred,

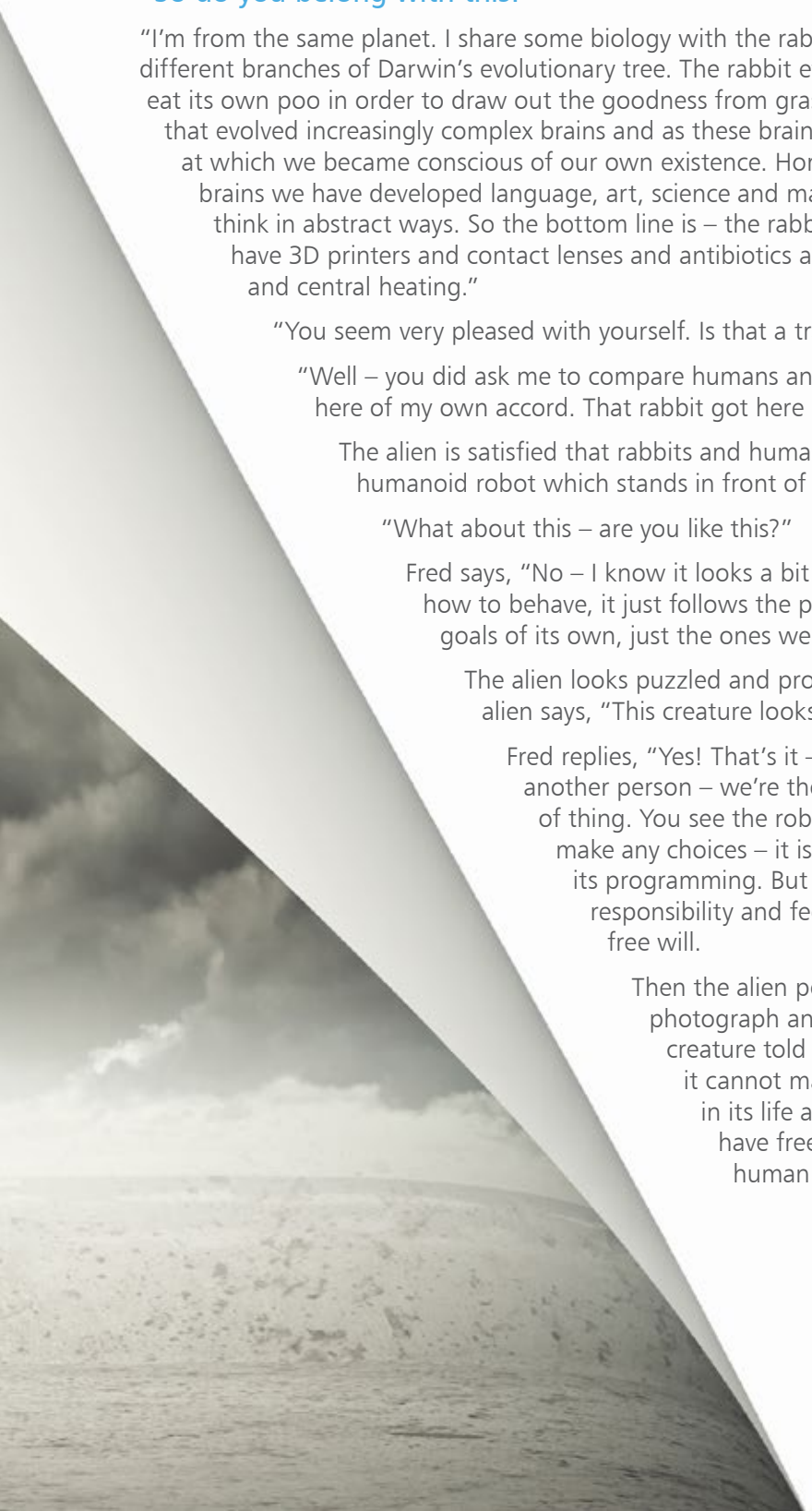
"What about this – are you like this?"

Fred says, "No – I know it looks a bit like me but that's a robot, it can't choose how to behave, it just follows the programming it is given. It has no ambitions or goals of its own, just the ones we give it."

The alien looks puzzled and produces a photograph of another human. The alien says, "This creature looks a bit like you. Are you one of these?"

Fred replies, "Yes! That's it – that's another person – we're the same kind of thing. You see the robot can't really make any choices – it is just following its programming. But a person has responsibility and feelings – and free will.

Then the alien points to the photograph and says "but this creature told us that it believes it cannot make choices in its life and it doesn't have free will so is this human a robot?"



CAN A ROBOT OWN ITS OWN IDEAS?

KEYNOTE
PROFESSOR BERRY BILLINGSLEY

Advances in science and technology are changing the world we live in. They are changing people and how we behave in the world.

Can a robot create a work of music? Can a robot own its own ideas? Can we ever see a painting the way the painter saw it?

We call these kind of questions 'Big Questions' because they rarely have simple, agreed-upon answers and are questions on which many disciplines have something to say. They are also questions that prompt us to wonder what it means to be a person and how much we really understand about the nature of reality.

Relationships between science and religion

Many of the questions that religion asks are Big Questions – and cannot 'automatically' be expressed or investigated scientifically.

The nature of science in real-world contexts and mulitdisciplinary arenas

At the same time, teachers need ways to work across curriculum boundaries to examine ideas from science and technology and explore questions that can sometimes be religiously sensitive.

Ways of knowing and how they interact

To engage wisely with Big Questions like whether robots can think for themselves young scholars need to build their understanding of the natures and interactions of disciplines like science, maths and the arts. The Discipline Wheel is designed to be a tool to explore Big Questions.

The chances are you like your own ideas. Most people do! But are you really generating your own ideas or are you really only picking up ideas from others and putting them into different words?

Until recently, we humans have been the only entities we know of that feel responsible and talk with words. How do we feel now that many of our everyday gadgets have started to talk to us? Did you know too that an application for a patent has been submitted with a robot's name as the inventor?

HERE'S THE RIDDLE...

Since we don't know how to replicate 'free will' we can't know if we have succeeded in giving a robot its own free will nor even be sure that we have free will ourselves...

Confused?
I'll try to explain ...

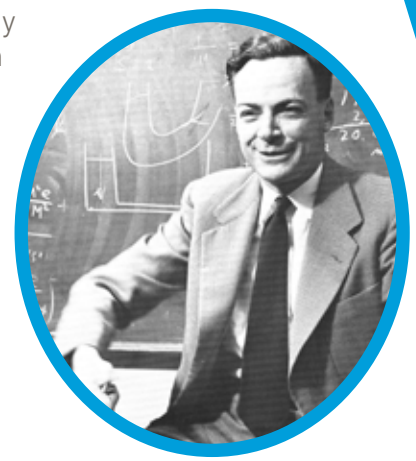
If I knock a box of cereal off the edge of the table – making a colossal mess on the floor - I know I can't blame gravity. Gravity is a mindless force that I must learn to live with and from an early age we all start to learn that lesson. I also can't blame the cereal box – it's 'just a box' and it topples when struck and then gravity pulls it to the ground. But if another person knocks into me just when I'm reaching for the cereal box – then it's a different story. This time there's another person to share the blame.

Now a robot is an interesting case – on the one hand it is a physical thing made by a person and in that sense, it is operating the way it has been instructed. But on the other hand, robots today can make simple decisions and some of them are creating new inventions.

Right now a robot's goals are still only the goals that it is given by a person but maybe one day robots will invent their own goals. If there are some robots that appear to be setting their own goals and appear to be making their own choices, then who are we to say they are not?

When did you first start to feel responsible for what you do? Did responsibility start within you or did you learn to feel responsible because those around you praised you for your ideas or told you to think again.

What's remarkable about our universe – in my view – is how beautifully it seems to balance being transparent and being mysterious. There's a physicist who is far more famous than I am called Richard Feynman. His delight in making connections meant that looking at a flower inspired him to think about the way that light produces different colours and then to wonder whether bees have an aesthetic sense and see 'beauty' when they look at a flower.



In other words he started with ideas we can test about relationships between physical objects and phenomena in the natural world and then moved to a question about how another species experiences the world – a question which many people would say we can never answer with scientific certainty.

LASAR (Learning about Science and Religion) was established in 2009 to investigate how Big Questions are managed in schools.

Based on the curriculum we have pulled out the 'knowledge about knowledge' that students in schools are expected to have. To give you an idea of what it might mean:

I am being epistemically insightful when...

- I appreciate that lots of good questions are not answerable today or possibly ever by designing an experiment.
- I compare the small questions we frame in science with the big questions we ask in religion.
- I explain that science informs our understanding about every aspect of life but some questions are more amenable to science than others.
- I explain that science and religion are mostly concerned with different types of questions, including different types of 'why' question.

PHYSICS AND BIG QUESTIONS

The connections we propose and test in physics are between non-living objects. For example I can imagine two surfaces rubbing together when they move past each other in order to understand why a book sliding across a table slows down and stops.

When you do a practical session at school, it has often been designed to teach you about one of these known connections. It's not really 'an experiment' - more like an interactive demonstration.

In the real world every physical thing of any significant size is a little bit rough and unique. Imagine a leaf falling in the autumn – every leaf is a little bit different and every leaf takes its own unique path to the ground.

Just take a moment to marvel at that thought – how many leaves would need to fall across the years to ever have two identical leaves that fall in the same way?

We tend to take our uniqueness for granted. You look around and you see lots of 'other' people and some of them have things in common with you – but none of them are you.

This amazingly complex universe is both beautiful and also exactly the kind of a universe that means it is difficult if not impossible to know with scientific certainty whether or not we have free will. As each one of us is unique, we expect to find differences in how we think and behave.

Now here's the critical question. When we look at what a person is doing, can we come up with physical equations or patterns to explain all the behaviour we see, just as we did for the (other) physical objects? Are the differences we see between you, me and everyone else on the planet really only due to differences that exist at a physical level – magnified up to give a kind of random uniqueness that effects everything you do?

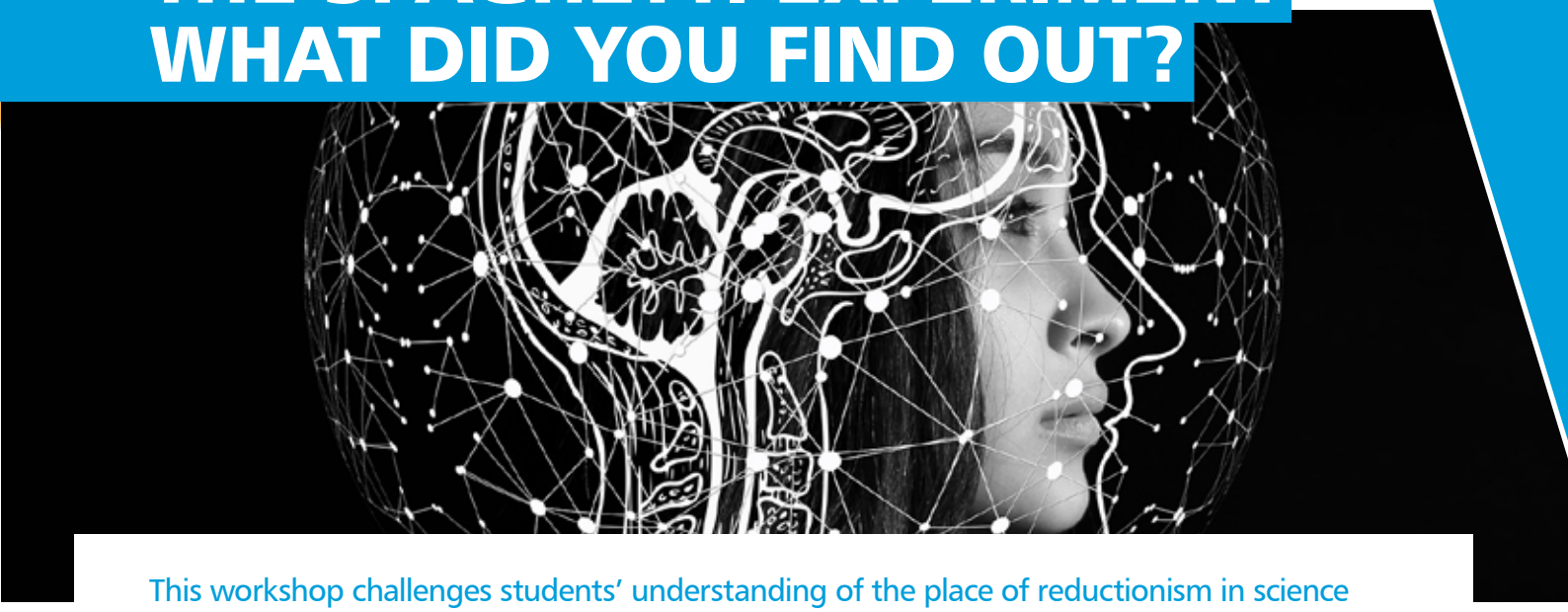
When you make a decision, is there more going on than we can explain at the level of your atoms and the electrical currents in your brain?

There are some people who have decided that the idea that humans have self-determination is no more than a fairy tale we tell ourselves because it makes our experiences in life seem more exciting and worthwhile. Some other people say that when you use your imagination and when you express ideas in language and other ways of thinking, you are doing something special that can't ever be expressed or explained in physical terms. In that case the truth about the real world is that we help to create our own personalities and futures by our own deliberate thoughts and actions – at least to some extent.

At the moment we can't say which view is right scientifically because both fit with what we see happening when we look at someone else. The evidence that might persuade you one way or the other is subjective. You can draw your own conclusion at least for the time being.

I suppose you could say that the dilemma of whether or not we really have a choice is part of what makes us human.

THE SPAGHETTI EXPERIMENT WHAT DID YOU FIND OUT?



This workshop challenges students' understanding of the place of reductionism in science and religion. Reductionism is a valuable tool in science - a way to zoom in on one small bit of reality at a time. But for some people it is also a metaphysical stance and has an impact on the meaning they give to personhood and human uniqueness. While examining their understanding of the nature of reductionism, students explore different ways to conceptualise its role in relation to big questions about life and nature.

Relationships between science and religion

Methodological reductionism helps us to frame small questions designed to be amenable to science. Many of the questions that religion asks are Big Questions – and cannot 'automatically' be expressed or investigated scientifically.

The nature of science in real-world contexts and mulitdisciplinary arenas

This workshop introduces students to the concept of reductionism as both a methodological tool and an ontological stance. Students meet the bubble tool and work together to develop their criticality around the power and limitations of science.

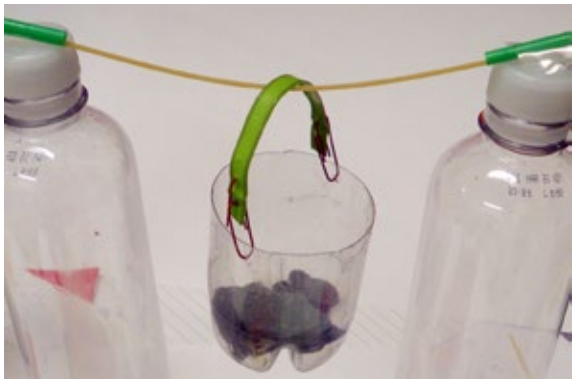
Ways of knowing and how they interact

Today's big questions about human personhood and the nature of reality bridge science, religion and many more ways of knowing. The Discipline Wheel is designed to be a tool to explore Big Questions.

HOW THIS HELPS STUDENTS UNDERSTAND THE RELATIONSHIPS BETWEEN SCIENCE AND A BIG QUESTION

Students begin by conducting experiments with spaghetti and formulating answers to different types of questions. They compare their answers to a question about the strength of spaghetti to their answers to a question about how people think when they are working together.

Students then consider a philosophical conundrum called the "Mary's Room" experiment. These activities raise questions about how we can and should use reductionism. We bring the insights we discover to bear by revisiting big questions about the nature of reality and human personhood.



HUMAN PERSONHOOD AND THE NATURE OF REALITY

Big Questions are questions about human personhood and the nature of reality. The skills and insight that we need to address these big questions include an understanding of how to create, judge and apply knowledge wisely.

In scholarship we have many different lenses or disciplines that we use to study our world. There's physics, biology, psychology, the social sciences, history and more. Scholars are in the habit of using one lens at a time but in reality these layers of explanation are all there together. A cereal box falls to the ground both because there is a person in a rush to get breakfast and because gravity is a force that pulls things down.

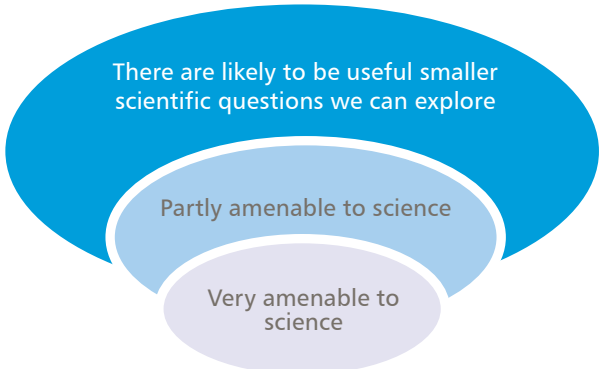
In schools, a fragmented approach to education – focused on knowledge rather than how knowledge is constructed, means there is a population of learners (future citizens) who rarely if ever have opportunities in school to examine the power and limitations of science when we consider a big question.

Today's big questions about human personhood and the nature of reality include 'How do we keep the planet safe?' 'How do we help people who are sick to get better?' and 'Can a robot ever own its own thoughts?'

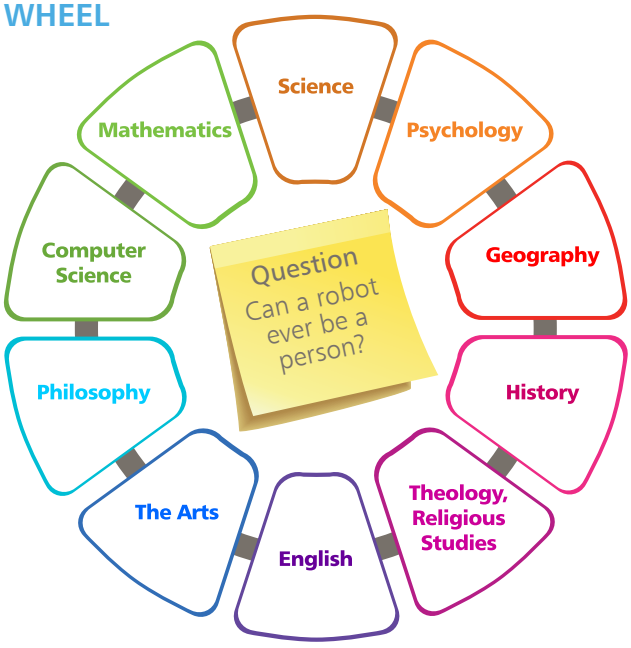
These big questions cannot automatically be reduced to the smaller types of questions that are particularly amenable to science.

THE BUBBLE TOOL

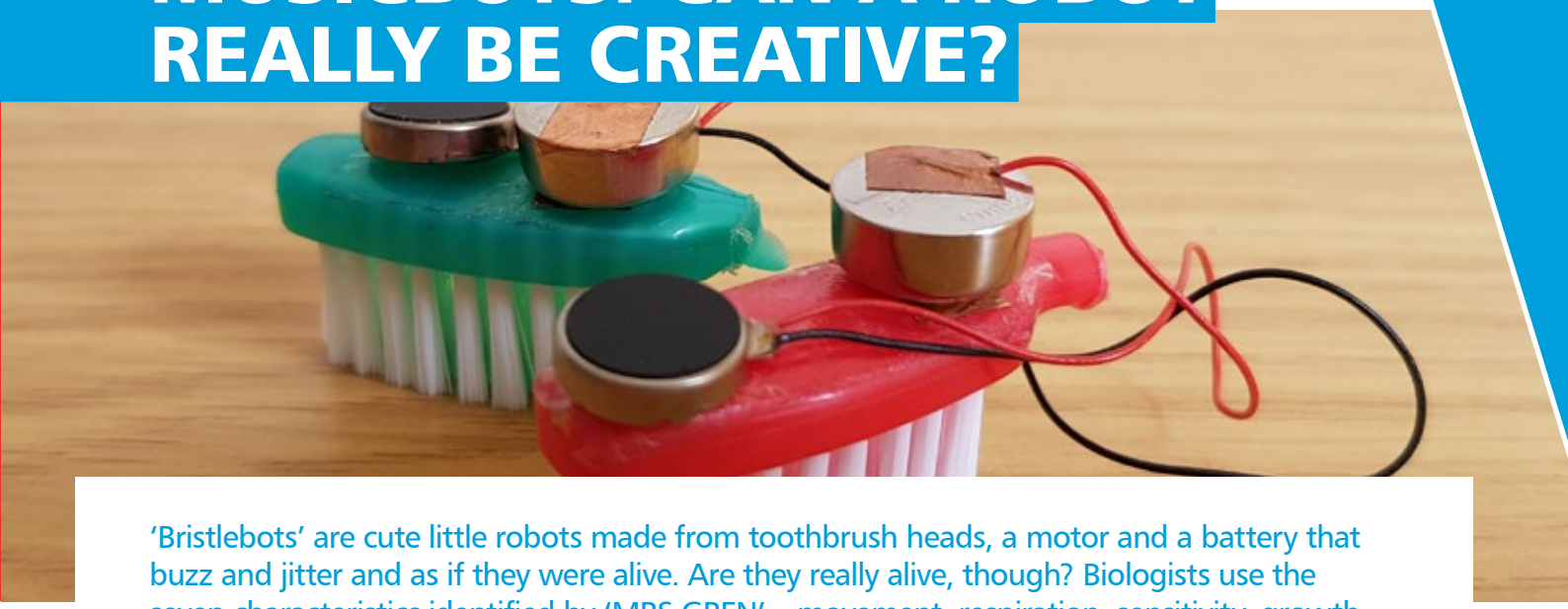
"Some questions are more amenable to science than others"



THE DISCIPLINE WHEEL



MUSICBOTS: CAN A ROBOT REALLY BE CREATIVE?



'Bristlebots' are cute little robots made from toothbrush heads, a motor and a battery that buzz and jitter and as if they were alive. Are they really alive, though? Biologists use the seven characteristics identified by 'MRS GREN' – movement, respiration, sensitivity, growth, reproduction, excretion and nutrition – to sort out things which are alive and things which are not. Bristlebots are clearly not 'alive' according to these criteria - but what about more advanced robots and AI? If a computer programme meets all of MRS GREN's characteristics, would that be enough to convince you that it really is alive?.

Relationships between science and religion

Students gain an insight into big questions about human personhood that bridge science, religion and many more ways of knowing. The target tool helps us to sort different types of evidence, methods and reasons into a picture of relevance when we explore – or compare – questions.

The nature of science in real-world contexts and mulitdisciplinary arenas

If a computer programme meets all of the criteria identified by MRS GREN, can science still tell us what is and isn't alive? Students gain an insight into the power and limitations of science in real-world contexts.

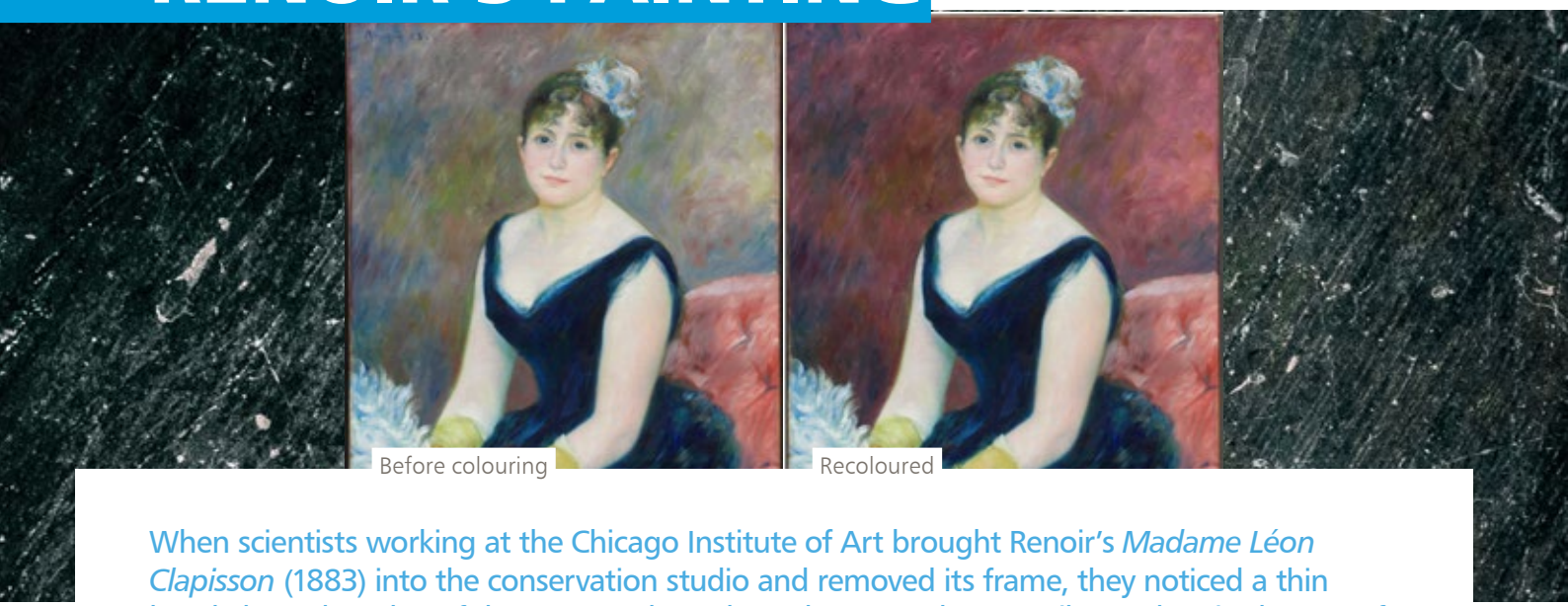
Ways of knowing and how they interact

By exploring how different disciplines understand 'being alive' differently, students gain an insight into how different disciplines have different preferred questions, methods and norms of thought. How is thinking like a scientist similar and different to thinking like an English scholar or a scholar of religion?

The category of 'alive' is important from a scientific perspective because living things share features with one another which non-living things typically do not. What about the fact there are cases MRS GREN struggles with? MRS GREN can still be used to explain why these cases are interesting and unusual. If some computer programmes have the typical characteristics of living things, maybe computer scientists might be able to learn something by talking with biologists. What if we ask a different question: not whether something is alive, but what does it mean to be alive? What is the value that we attach to life – and what disciplines can help us understand why life matters to us?

The first part of this workshop explores how different disciplines approach the question of something being alive differently – and why being this question matters. The second part of the workshop then explores what happens if the bristlebots are used to make music. Can a bristlebot – or any kind of robot – make a work of music, or does is the work always attributable to the robot's maker?

RENOIR'S PAINTING



Before colouring

Recoloured

When scientists working at the Chicago Institute of Art brought Renoir's *Madame Léon Clapisson* (1883) into the conservation studio and removed its frame, they noticed a thin band along the edge of the canvas where the red was much more vibrant than in the rest of the painting. Being exposed to daylight had faded one of the pigments used in the painting. Using a technique called spectroscopy, the conservationists identified the paint as cochineal red or carmine lake, which is made from crushed-up bugs. Using a computer, they created a recolourised visualisaton of the painting in its 'original' colours. Is that the end of the detective work – or what else can our disciplines reveal about this portrait?

The nature of science in real-world contexts and mulitdisciplinary arenas

Can science ever show us what makes a panting valuable? Students gain an understanding of how science informs our thinking about every aspect of our lives. Some questions are more amenable to science than others however. There are some questions that science hasn't yet and may never be able to answer.

Ways of knowing and how they interact

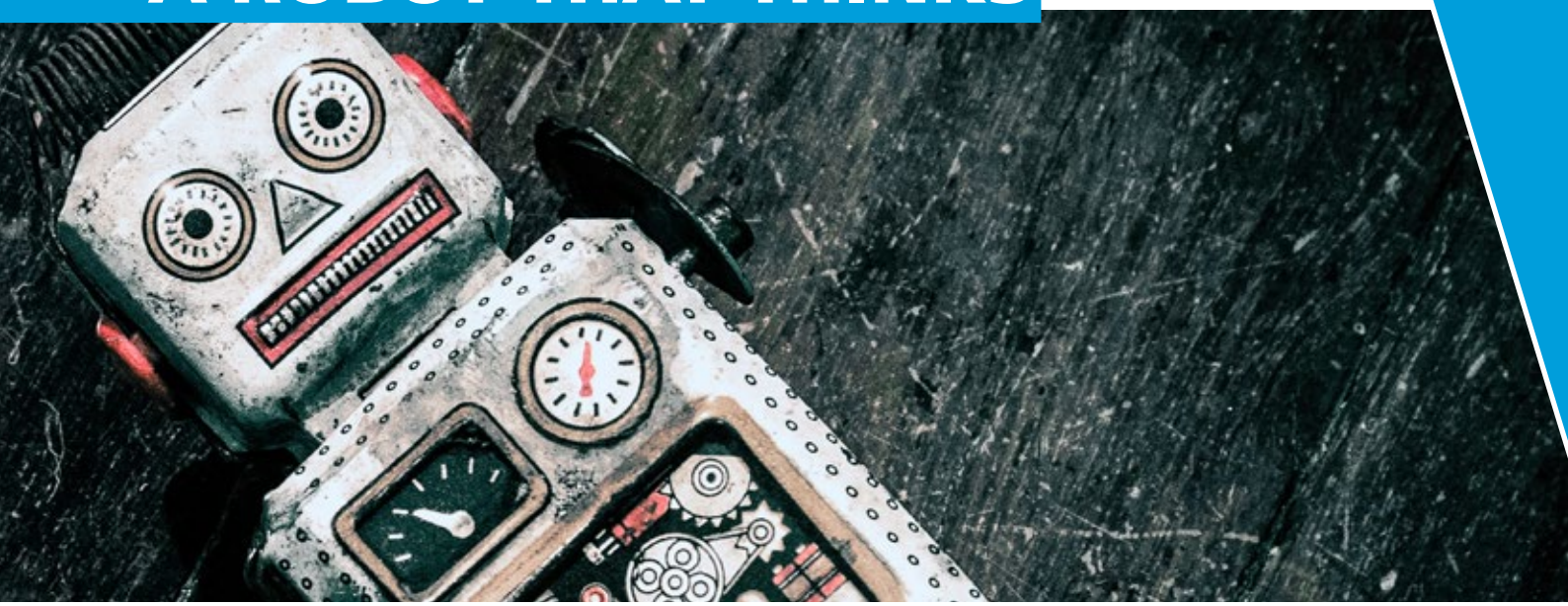
How did Renoir's audience see this portrait when it was first presented? Students build their understanding of how science, history and other disciplines interpret and add to our understanding of seeing.

Does authenticity really matter? Students discover the different metaphysical stances that people take when they examine the role of authenticity. What is its role in art? What is its role when we ask Big Questions about human personhood and the nature of reality?

Suppose you could go back in time and see Renoir's painting shortly after he had finished it – what would you see? Students discover that scientists have investigated the red paint that Renoir used – and changed how we see this portrait. The first part of the workshop reveals how science, history and other disciplines interpret and add to our understanding of seeing. Can we ever see a painting the way the painter saw it?

The second part of the workshop introduces a new question. Informed by this knowledge, how should the painting be restored and presented in the gallery? Authenticity matters in art – and even the knowledge that the painting has faded does not persuade conservationists to paint over Renoir's original brushstrokes to restore the colour. We share our views on the value we give to authenticity in art and in our areas of life – and ask – is it an irrational value that we should conquer or something to take seriously and respect? Is it anyway an impractical value since surely an idea, artefact or an invention is never really the product of a single mind?

A ROBOT THAT THINKS



Inventing a robot that thinks in some sense of the word seems to be possible. But can a robot be its own agent and can it own its own ideas?

It may seem as though science and technology are rapidly progressing to the point of answering all of our questions. But that's a controversial position to take. Epistemic insight reminds us to be humble. Each discipline is a lens through which to view reality and perhaps find something we have not yet considered.

In physics, we reduce the complexity of reality in the lab in order to carry out a systematic investigation of a connection we hypothesise exists. A view of reality that begins and ends with physics can hide from us the possibility that when we return to the real world, the whole is greater than the sum of the parts. Each person is complex and unique and that holds unanswered the question of how best to explain what we experience as human agency.

Our workshops revealed another way in which a scientific view on its own might inadvertently reduce our appreciation of the nature of reality. In the workshop on Renoir's painting we noticed that seeing an original work of art, a diamond, an ancient piece of Roman pottery or a rock that contains the footprint of a dinosaur conjures in us a strange emotional attachment to its story. We want to know if it's the real thing – is it authentic? A fake diamond may be physically and chemically 'just like the real thing' but its value to us emotionally and economically reflects that we care about its story and how it came to be.

What's wonderful about exploring the nature of personhood through many different disciplinary lenses is that we start to spot things we miss when we use one or two lenses alone. More than this, there is no perfect or sufficient language, model or metaphor that we have to fully sum up what it means to be a person. Even if you scoured the internet and scooped up every fact you could find, you still wouldn't have it covered.

Epistemic Insight

Here are a few more ways that we can express epistemic insight.

I am building my epistemic insight when I have a chance to observe in a science lesson how real things work naturally, where the investigation isn't the type that needs to be engineered or manipulated by a teacher to work 'successfully''.

I am building my epistemic insight by becoming familiar with key terms and ideas such as disciplines, amenable to science, preferred questions and methods and norms of thought, metaphysical sensitivity (metaphysical reductionism and methodological reductionism)

I am sharing my understanding of epistemic insight when I explain the issue of entrenched compartmentalisation to other people and the gaps it can mean exist in some students' appreciation of the power, relevance and limitations of different disciplines.

I am building awareness of epistemic insight when I ask and explore Big Questions that are about human personhood and the nature of reality and explain that they bridge science and religion and can also be explored through many more ways of knowing.

Principal Investigator: Berry Billingsley
For more information email: lasar@canterbury.ac.uk

Canterbury Christ Church University