

Epistemic Insight

EPISTEMIC INSIGHT AND BIG QUESTIONS

22-23 JUNE 2020

PROGRAMME

LASAR CONFERENCE

FACULTY OF
EDUCATION

 Canterbury
Christ Church
University

CONFERENCE THEMES

Artificial intelligence and humanlike machines

Strategies to care for the planet

Communication in a multicultural world

Physics and the nature of reality

Biology, health and wellbeing

Ways for individuals and our global society to tackle
and overcome the challenges of COVID 19

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KEYNOTE PRESENTERS

PROFESSOR BERRY BILLINGSLEY

Professor Berry Billingsley is Professor of Science Education and Director of the LASAR (Learning about Science and Religion) research centre at Canterbury Christ Church University. Berry is principal investigator of the Epistemic Insight Initiative. This research and innovation initiative is developing and testing ways to develop students' epistemic insight - which means their understanding of the ways that science and other disciplines and ways of knowing can interact to help us to address different types of questions. There is a particular interest in Big Questions and real-world problems and how to give students opportunities to explore these types of questions and issues in a holistic way across their curriculum subjects. By doing so, our hypothesis is that students can build both their substantive knowledge (knowledge produced by disciplines) and also their disciplinary knowledge (or epistemic insight) - i.e. knowledge about disciplines - such as their distinctive strengths and limitations and their preferred questions, methods and norms of thought.



PROFESSOR JOHN BRYANT

Professor John Bryant is Professor Emeritus of Cell and Molecular Biology at Exeter University. His research was mainly focussed on various aspects of DNA and genes. He also has a keen interest in bioethics – the ethical issues arising from modern science and medicine – and in the relationship between religion and science. John is a past-President of the Society for Experimental Biology and a former Chair of Christians in Science. He was a Visiting Research Associate at the Brookhaven National Laboratory, USA and Visiting Professor of Molecular Biology at West Virginia State University, USA. Since 2002 he has been, with Dr Chris Willmott (University of Leicester), advisor on bioethics to the Higher Education Academy. John loves mountains, moors, marshes and other wild places; he enjoys bird-watching. He also loves sport, especially running, cricket and football (he supports Crystal Palace FC) and enjoys several different types of music. His latest book (Graham Swinerd and John Bryant: From the Big Bang to Biology, Where is God?) is due to be published later this year.



PROFESSOR JERRY KAPUS

Professor Jerry Kapus is Professor of Philosophy in the Department of English and Philosophy at the University of Wisconsin-Stout. His research interests are in the philosophy of language and metaphysics with a focus on theories of truth and realism/anti-realism. His most recent publication is "Rationality and Free Will," Proceedings of the Twenty Third World Congress of Philosophy (2018). He teaches courses in epistemology, logic, metaphysics, and philosophy of religion. In 2007, he received a National Endowment for the Humanities Faculty Workshop grant to work with secondary school teachers on addressing philosophical issues in their classes.



DR SHOAIB MALIK

Dr Shoaib Malik is a Chemical Engineer by qualification (BEng and PhD) and recently finished an MSc of Philosophy of Science and Religion at the University of Edinburgh. He currently holds the position of an Assistant Professor of the Natural Sciences at Zayed University in Dubai and is also an Associate Fellow at the Asia e University where he remotely supervises MSc and PhD students. His research focus is in Islam and Science (with a current focus on Islam and Evolution), Islamic Theology, and Atheism. He has publications with Zygon and Cambridge University Press, and is currently finishing a monograph on Islam and Evolution which will be coming out in 2021 with Routledge.



DR ANDREW SERAZIN

Dr Andrew Serazin is a President of Templeton World Charity foundation. As a researcher, entrepreneur, and executive, Dr. Serazin has worked to bring science, technology, and the humanities to address some of humanity's greatest challenges. He is also a Trustee and past Chair of the Development Committee of the Jesuit Refugee Service/USA. From 2006 to 2012, Dr. Serazin served as Program Lead in Global Health Discovery & Translational Science at the Bill & Melinda Gates Foundation. Dr. Serazin is also an entrepreneur, Founder and Chairman of Matatu, Inc., a venture-backed biotechnology company, and has also worked as a key scientific advisor to Mars, Inc. Earlier in his career, Dr. Serazin was Departmental Lecturer in Zoology at the University of Oxford, where he conducted infectious disease research and taught courses on the biology of disease. As a Rhodes Scholar, he received his doctorate from the University of Oxford and has also been a member of the College of Science Advisory Council of the University of Notre Dame, where he received his undergraduate degree. In 2019, he was named a Young Global Leader by the World Economic Forum.



SCHEDULE

Links to the online conference rooms are provided throughout the schedule and the URLs are provided below should you have any difficulty using the button links:

Room 1 (*main conference room*)

<https://eu.bbcollab.com/guest/2d185782d35c40b98625509b4eb9328a>

Room 2

<https://eu.bbcollab.com/guest/6d0478d55415406caec91057cfba3b4b>

Room 3

<https://eu.bbcollab.com/guest/f55e4da3a5c74b89bbdef04f29fe3ebe>

SYMPOSIUM DAY

22 JUNE 2020

SESSION 1. KEYNOTES

10:15 – 12:30

Moderator: Lee Hazeldine

Chair: Finley Lawson

10:15-10:30 Welcome - Finley Lawson

10:30-11:00 **Keynote**

Professor Berry Billingsley, Big Questions in challenging times.

11:00-11:15 Q&A

11:15-11:45 **Keynote**

Shoaib Malik, Islam and Evolution – Islam and Evolution
– Mapping the Interdisciplinary Dimensions.

11:45-12:15 **Keynote**

John Bryant, Conversations between science and religion in framing
ethical responses to developments in biology and medicine.

12:15-12:30 Q&A

12:30-13:15 Lunch break

SYMPOSIUM DAY

22 JUNE 2020

SESSION 2. DISCUSSIONS GROUPS

13:15 – 15:00 – Theme discussions

Room 1 - Solving World Problems

Moderator: Sherry Simpson

Facilitator: Mark Windsor

Room 2 - Early Years, Church groups and Non-formal education

Moderator: Dani Shalet

Facilitator: Mehdi Nassaji

Room 3 - ITE and School teaching - Incorporating EI into Teacher education programmes internationally.

Moderator: Aga Gordon

Facilitator: Berry Billingsley

15:00-15:15 Coffee break

SYMPOSIUM DAY

22 JUNE 2020

SESSION 3. PANEL PRESENTATION

15:15-16.30

Moderator: Mark Windsor

Chair: Matthew Sossick

15:15-16:15 Panel Presentation

Alexis Stones, Emma Newall, prof. Michael Reiss, Tamjid Mujtaba and Jo Pearce, Science, Religion and Other Animals.

UCL Institute of Education colleagues in Science Education and Religious Education will share insights and recommendations from recent and continuing research on their projects in schools and teacher education.

16:30 Q&A

CONFERENCE DAY

23 JUNE 2020

SESSION 4. MAIN CONFERENCE – MORNING SESSION

Room 1

10:30-11:30

Moderator: Sherry Simpson

Chair: Finley Lawson

10:30-10:45 Siew Yap, Developing epistemic insights - Influence of NOS and hermeneutics' teaching on high school students' perception of science and religion.

10:45-10:50 Q&A

10:50-11:05 Ravi Gomatam, On the Necessity of God to Science

11:05-11:10 Q&A

11:10-11:25 Sibel Erduran, Liam Guilfoyle & Wonyong Park, Research on Argumentation in Secondary Science and Religious Education: Reflections from the OARS Project.

11:25-11:30 Q&A

Room 2

10:30 – 11:30

Moderator: Mehdi Nassaji

Chair: Jennifer Brown

10:30-10:45 Christiane Konneman, Science unlimited? Differential effects of epistemic insight on scientific and non-scientific students.

10:45-10:50 Q&A

10:50-11:05 Ben Trubody, Easy, but not simple: The explicit vs the tacit.

11:05-11:10 Q&A

11:10-11:25 Simon Hoult Student, Teachers' disciplinary informed thinking about 'Big Questions': Study Abroad and the implications for Epistemic Insight in Schools.

11:25-11:30 Q&A

Room 3
10:30-11:30

Moderator: Lee Hazeldine

Chair: Paul Hopkins

10:30-10:45 Flora Wang, A Religious Dialogue with Human-like AI and Robots on the Foundation of Personhood.

10:45-10:50 Q&A

10:50-11:05 Jostein Sæther, Fact-value discourses in research on genetics in biology textbooks.

11:05-11:10 Q&A

11:10-11:25 Aya Nakama, Multi-layered Image as Virtue in Medieval Christian Art: For Understanding Diversity in Multicultural Communication of the Modern World.

11:25-11:30 Q&A

11:30-11:35 Coffee/comfort break

SESSION 5. MAIN CONFERENCE – MID-MORNING SESSION

Room 1

11:35-12:35

Moderator: Dani Shalet

Chair: Robert Campbell

11:35-11:50	Elisabetta Canetta, Transhumanism: How will AI change humankind?
11:50-11:55	Q&A
11:55-12:10	David Hutchings, The Multiverse in Our Heads.
12:10-12:15	Q&A
12:15-12:30	Laurent Dessberg, A cosmopolitan viewpoint on epistemic responsibility.
12:30-12:35	Q&A

Room 2

11:35-12:35

Moderator: Aga Gordon

Chair: Finley Lawson

11:35-11:50	Mehdi Nassaji and Agnieszka Gordon, Epistemic insight: A systematic problem and an Eco-systemic solution.
11:50-1:55	Q&A
11:55-12:10	Jennifer Brown, Science, Religion and Humanity's Response to Environmental Issues.
12:10-12:15	Q&A
12:15-12:30	Zoubeida Dagher, Negotiating Perceived Conflict between Scientific and Religious Claims.
12:30-12:35	Q&A

Room 3
11:35-12:35

Moderator: Sherry Simpson
Chair: Jacqueline Perrin

11:35-11:50	Karl Bentley, Teaching and Learning about Epistemic Insight – workshop.
11:50-11:55	Q&A
11:55-12:10	Nathan Bossoh Why does it persist? A historical and cognitive perspective on science-religion narratives.
12:10-12:15	Q&A
12:15-12:30	Saulo Quintana, Religion and science teaching in the school context.
12:30-12:35	Q&A
12:35-13:05	Lunch break

SESSION 6. MAIN CONFERENCE – AFTERNOON SESSION

Room 1

13:05-13:50

Moderator: Aga Gordon

Chair: João Paiva

- 13:05-13:20 Anthony Nairn, The Grand Cosmic Perspective: The Presentation of Science in Popular Culture as a Post-Theological Secular Means of Re-Enchantment.
- 13:20-13:25 Q&A
- 13:25-13:30 Stephen Thompson, Surveying the landscape of epistemic insight.
- 13:30-13:35 Sherry Simpson, "Why did the Titanic sink?" – bridging two disciplines to teach epistemic insight.
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- 13:35-13:50 Q&A to flash presentations
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Room 2

13:05 – 13.50

Moderator: Mehdi Nassaji

Chair: Liam Guilfoyle

- 13:05-13:20 Zaheeda Alibhai, De-Orientalizing Discourses: Co-operation and Connections in the History of Science.
- 13:20-3:25 Q&A
- 13:25-13:30 Caroline Thomas, Investigation of 'You are what you eat' with Key Stage 2 pupils.
- 13:30-13:35 Jacqueline Perrin, Encountering and finding purpose in the lives of high-functioning autistic students: a participatory study.
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- 13:35-13:50 Q&A to flash presentations
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Room 3
13:05- 13:50

Moderator: Dani Shalet
Chair: Jerry Kapus

13:05-13:20	David Jackson, Enlightenment Now? Or are Contingency, Irony, and Solidarity the best we can hope for?
13:20-13:25	Q&A
13:25-13:30	Miriam Rosa, Joao Paiva, Luciano Moreira and Carla Morais, Science, religion and teaching: perceptions from a Roman-Catholic context.
13:30-3:35	Paula Stone, Seeking Epistemic Insight: Student teachers as associate researchers.
13:35-13:50	Q&A to flash presentations
13:50-14:05	COMFORT/COFFEE BREAK

SESSION 7. MAIN CONFERENCE – AFTERNOON SESSION
Room 1.
14:05-16:15

Moderator: Finley Lawson
Chair: David Jackson

14:05-15:00	Q&A Expert Panel: Berry Billingsley, Robert Campbell, Tom McLeish, Marianne Cutler
15:00-15:25	Keynote, Dr Andrew Serazin, To Lead Out: Education in A Time of Uncertainty.
15:25-15:30	Q&A
15:30-15:55	Keynote, Jerry Kapus , Kalam Cosmological Argument. An Intertwining of Philosophy, Religion and Science.
15:55-16:00	Q&A
16:00-16:15	Closing remarks: Berry Billingsley

LIST OF KEYNOTES, ABSTRACTS AND PANEL PRESENTATIONS

KEYNOTES

Berry Billingsley
Canterbury Christ Church University

Big Questions in Challenging Times

This conference comes at a particularly relevant moment in the unfolding story of our research. We find ourselves in a world of education that for now at least has lost some of the assumptions and certainties that used to shape the format and content of the school timetable.

This prompts us to ask two questions – how is this crisis influencing the ways that students, parents and educators view the purpose of education and – how can education help young people to thrive in the current coronavirus crisis?

To respond to these questions my colleagues and I will begin with some examples of workshops and research underway in the Epistemic Insight Initiative. I will explain that the workshops bridge science and other disciplines– to teach epistemic or ‘disciplinary knowledge’ and give us (for example) a richer and more meaningful account of what a Renoir painting looked like to its original audience. I will explain why developing ‘epistemic insight’ about the distinctive nature of science and its power and limitations can prepare children for a fruitful exploration of ways to relate science and religion.

I will then talk about current events and the way we have adapted our planned activities to focus on emerging opportunities and areas of need in schools and teacher education.

This will lead me to my two central questions – Thus, ‘what is education for’ and ‘how can education help young people to navigate the current crisis?’ Drawing on the EI framework and the research so far, I will propose five principles and invite feedback on them as a way to answer both of our questions.

I hope via this session or what you now already know you are open to joining a national co-creation research initiative – the Epistemic Insight Initiative.

Taking part can be as simple as filling in a 15-minute survey or as much as designing your own action research with your class.

We will start the session with the findings of a survey – of what are the preferred problems to solve with research. Please help us by filling it in now.

Find out more at

www.epistemicinsight.com/research-and-coronavirus/

John Bryant
University of Exeter

Conversations between science and religion in framing ethical responses to developments in biology and medicine

Advances in biomedical science are giving us unprecedented opportunities to intervene in major ways in the lives of individual humans, from the start of life to the end of life. Many of these newer developments raise ethical questions which we may regard either as new or as old problems in new guises. Whichever view is taken, it is regarded as important that 'faith groups' are consulted about or actually participate in discussions aimed at framing ethical best practice in respect of the new developments. Thus, the Nuffield Council on Bioethics aims to arrive at conclusions which ensure that 'benefits to society are realised in a way that is consistent with public values'.

So, what do religion and science have to say to each other in these debates? The talk will address that question in consideration of beginning-of-life issues, especially genetic selection, genetic modification and genome editing. From a scientific perspective, the 'right' decision is usually the one that gives the best (genetic) outcome. It is an essentially consequentialist perspective, albeit that it may be tempered by consideration of risks. The religious perspective will certainly include an added dimension which even at its most basic will ask whether factors other than genetic outcomes should be considered in the discussion. However, a shared awareness of for example, the spiritual dimension of human existence, does not necessarily mean agreement among representatives of faith groups. Some fall back on traditional teaching, often based on traditional interpretations of holy texts. This usually leads to a deontological position in which all or nearly current developments are regarded in a negative light. On the other hand, other members of faith groups hold that modern scientific understanding of, for example, human fertility and human development means that we cannot base our views on texts that date back to a pre-scientific age. Our ethics must be informed by science as well as by our religious understanding of humankind. People holding this view are thus more likely to support, with appropriate provisos, modern developments in medical genetics.

Jerry Kapus

Department of English and Philosophy University of Wisconsin – Stout

Kalam Cosmological Argument: An Intertwining of Philosophy, Religion, and Science.

Where did it all come from? Why is there something rather than nothing? These big questions of origins, or cosmological questions, are the focus of philosophy, religion, and science and provide an intricate interplay between these approaches to answering our cosmological yearnings. Aristotle's classic formulation of the cosmological argument relies on the idea that a series of cause and effect relationships extending infinitely into the past is not comprehensible. Given this, there must have been a first uncaused cause that originated our universe. However, work on infinite series within mathematics has shown that infinite series are quite understandable. The Kalam Cosmological Argument presents an alternative approach. Developed first during the Middle Ages by the Islamic theologian/philosopher al-Ghazali and most recently by William Lane Craig and J.P. Moreland, the Kalam Cosmological Argument claims that the universe had a beginning, the beginning of the universe was caused, and this cause was the result of a creative choice. Craig and Moreland support the first step in this argument by drawing on work in physics, the Big Bang and the second law of thermodynamics, and by arguing that the mathematical work on infinity shows that there are no actual infinities as applied to our universe. They support the second step in the argument based on empirical observations of the ubiquity of cause and effect relationships and the conceptual truth that something cannot come from nothing. This conceptual truth is defended against interpretations of quantum mechanics suggesting that some things may come into existence from nothing. The last step in the argument draws on considerations of what counts as an explanation: explanation in terms of physical laws or in terms of intentional action. Since the origin of the Big Bang cannot be explained in terms of physical laws, the only explanation left is in terms of an intentional, creative choice. Thus, contemporary versions of the Kalam Cosmological Argument weave together ideas from math, physics, and the philosophy of science and religion to argue that there is a God who created our universe.

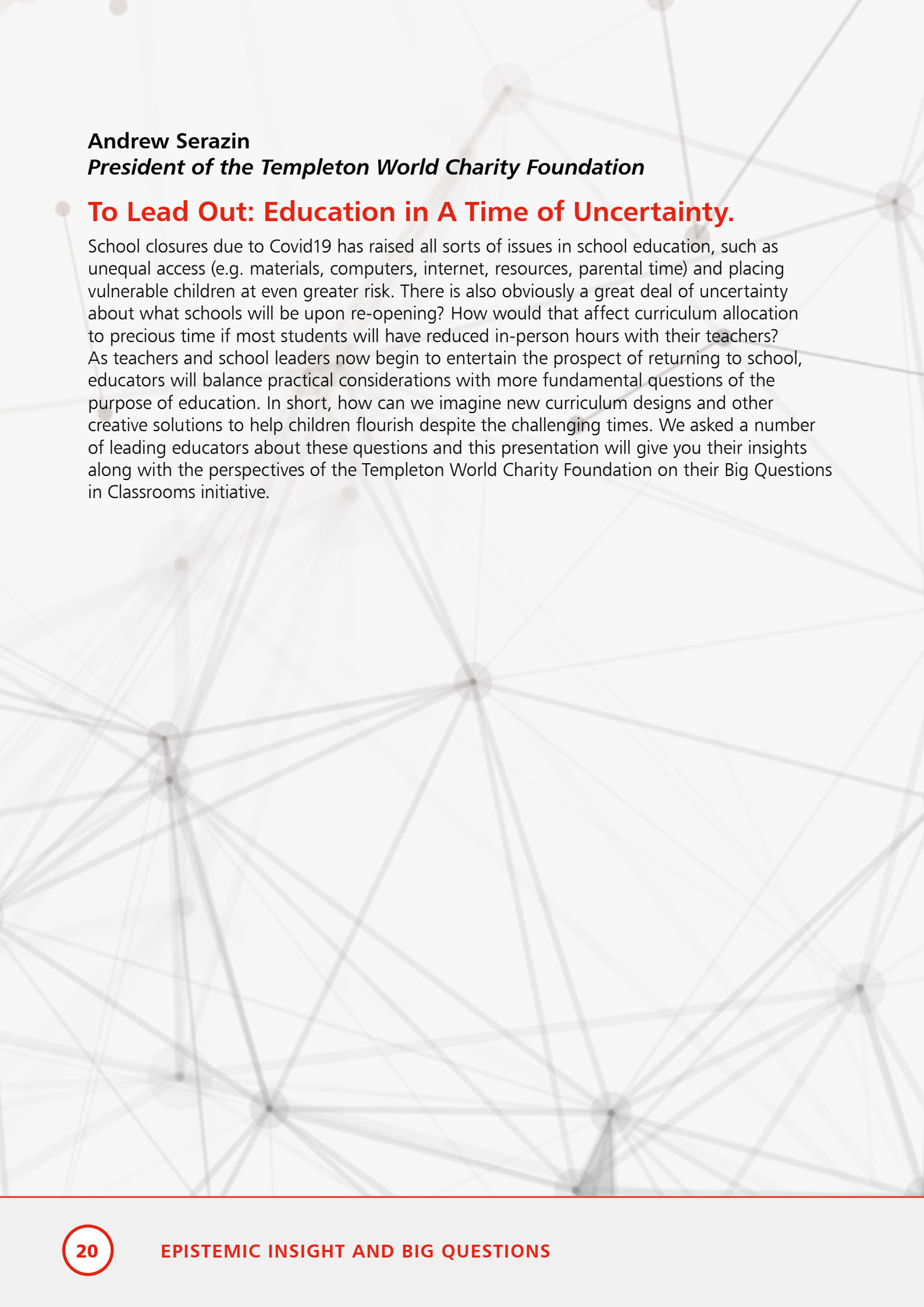
The purpose of my paper is to show how the Kalam Cosmological argument brings together mathematics, philosophy, religion, and science to understand the question of the origins of our universe and to draw out points of disagreement for further research in addressing issues of cosmology. These points of disagreement include the applicability of mathematical conceptions of infinity to physical systems, the reasonableness of seeking an explanation for the Big Bang beyond what physics can tell us, shifts in what might count as understanding how something can come from nothing, and the need to understand what counts as an adequate explanation in differing contexts such as philosophical/theological contexts, scientific contexts, and the intersection of these contexts. These points of disagreement will also indicate language to assist educators to clearly conceptualize and analyze cosmological issues in terms of potential and actual infinities, theoretical and applied mathematics, physical laws, necessity and contingency, sufficient reason, and inference to the best explanation.

Shoaib Malik
Zayed University

Islam and Evolution – Mapping the Interdisciplinary Dimensions.

Islam and evolution is a very sensitive subject for most Muslims and surveys indicate that many see the two as being irreconcilable. Accordingly, such individuals see this discourse as a binary choice: either leave Islam or reject evolution. The underlying problem with this approach is that it neglects the various sub-discussions that require further deliberation to make an educated opinion. The interdisciplinary nature of the conversation creates a major obstacle for many young Muslims, particularly laypeople. Additionally, due to the hyper-specialisation of education, it is not surprising to see educated philosophers, theologians, and scientists to sometimes speak past one another. This article intends to alleviate this problem by creating a heuristic map within which the conversation is compartmentalised into three knowledge domains. These include 1) science, 2) metaphysics and 3) hermeneutics. After introducing this division, I then intend to illustrate the kind of issues that are specific to each knowledge domain for the topic of evolution in relation to Islam, i.e. intradisciplinary. I will then illustrate how one can manage this triangular, interdisciplinary relationship by summarising the thoughts of three thinkers, two who argue for human creationism and one for evolution. These include Rana Dajani, a molecular biologist who accepts human and non-human evolution; Nuh Keller, a Muslim theologian who accepts non-human evolution but rejects human evolution; and Seyyed Hossein Nasr, a professor of Islamic studies who rejects human and non-human evolution. These particular thinkers are chosen because they each stress on a particular domain without carefully reviewing nor appreciating the nuances from the others. This makes them perfect case studies for when explaining how the conversation cannot be needlessly simplified. Finally, this article doesn't intend to provide a normative framework on how to manage the relationship between the three domains but instead provides educators with tools and ideas that they can use to develop students' understanding without resorting to simplistic binaries given the nuances of each discipline.

Islam and Evolution: Al-Ghazali and the Modern Evolutionary Paradigm contracted by Routledge (2021).



Andrew Serazin

President of the Templeton World Charity Foundation

To Lead Out: Education in A Time of Uncertainty.

School closures due to Covid19 has raised all sorts of issues in school education, such as unequal access (e.g. materials, computers, internet, resources, parental time) and placing vulnerable children at even greater risk. There is also obviously a great deal of uncertainty about what schools will be upon re-opening? How would that affect curriculum allocation to precious time if most students will have reduced in-person hours with their teachers? As teachers and school leaders now begin to entertain the prospect of returning to school, educators will balance practical considerations with more fundamental questions of the purpose of education. In short, how can we imagine new curriculum designs and other creative solutions to help children flourish despite the challenging times. We asked a number of leading educators about these questions and this presentation will give you their insights along with the perspectives of the Templeton World Charity Foundation on their Big Questions in Classrooms initiative.

PANEL PRESENTATION

Tamjid Mujtaba, Emma Newell, Jo Pearce, Alexis Stones, Michael Reiss
University College London

Science, Religion and Other Animals.

UCL Institute of Education colleagues in Science Education and Religious Education share insights and recommendations from recent and continuing research on their projects in schools and teacher education.

Tamjid Mujtaba and Michael J. Reiss
University College London

Broadening Secondary School Science: Emerging findings from the BRaSSS Project.

The place of science in the school curriculum, certainly in the secondary phase, is secure but has contributed to an unwelcome degree of insularity. It is all too easy for school science to make little effort to help students explore the ways in which science engages with other subjects. In the 'Broadening Secondary School Science' (BRaSSS) project we are providing materials to help teachers of 11-16 year-old students develop a broader understanding of secondary school science. In phase 1 of the project (September 2018 – August 2019), an extensive bank of trial materials was developed for use in science lessons. In phase 2 (September 2019 – August 2020), we have recruited six schools to trial these and associated pedagogical approaches. Data gathered at the start of phase 2 suggest that more young people may be open to see the synergies between science and other subjects than is sometimes appreciated. For example, in one of our interviews, a 15-year-old, in response to the question "Do you believe science and religion have anything in common?", replied "Yeah I do. They link to each other in different ways; they are both needed. Obviously, lots of Christians do believe in science and religion; they can go together perfectly".

Emma Newall
University College London

An Examination of Affective Responses to Evolution.

The teaching of evolution has been consistently associated with controversy and has been the source of a great deal of debate and research in the science education community across the world. Much of the relevant research scholarship has highlighted the significance of religious belief in this debate. However, little research has looked at non-faith-based reasons for rejection of the scientific explanation. I propose that the concepts presented by evolution can be perceived as potentially disturbing to all; ideas about change, uncertainty, absence of purpose or plan, extinction and struggle, as well as challenges to identity arising from the emphasis on our place in the natural world alongside other animals, could provoke anxiety. Using a psychoanalytical theoretical framework, I have used Free Association Narrative Interviewing to examine novice educators' conscious emotional responses to evolutionary concepts. My findings suggest that, for many, the ideas inherent in evolution reveal disturbing existential questions, irrespective of whether they have a religious faith or not. I propose that the affective dimension of teaching and learning about evolution needs to be considered in our approach to teaching this vital biological topic and that this research highlights the importance of dialogue and trust in the classroom.

Jo Pearce and Alexis Stones
University College London

RE, Big Questions and Knowledge: Interim findings.

Religious Education (RE) is an interdisciplinary subject with parent disciplines in theology, religious studies, sociology, history, psychology, literature, philosophy and anthropology. This list is not exhaustive and must also take into account the educational aims for the subject that reflect understandings of the academic, philosophical, social, spiritual and moral purposes of RE. We posit that RE has a distinctive contribution to make to the development of epistemic literacy in students, due to this interdisciplinary nature. Epistemic literacy refers to capabilities that allow people to appreciate distinct frameworks and systems of knowledge, methods, language, and data pertaining to particular disciplines. If students and teachers are to avoid misconceptions about how knowledge works in response to big questions and develop insights into specific knowledge forms present in RE, they must be able to develop epistemic literacy.

Little research exists to support the epistemic literacy of RE teachers and students as they tackle big questions influenced by scientific and religious knowledge. We will share interim findings from our literature review and recent interviews in secondary schools where we are starting to collaborate in the development of strategies to promote epistemic literacy.

Emma Newall and Alexis Stones
University College London

Dialogue and Discovery: Reflections on a joint study day for Science and RE student teachers.

As part of a commitment to engaging with interdisciplinary encounters with big question in their own research, Emma Newall and Alexis Stones, lecturers on PGCE Science and RE respectively, developed a joint study day for their students. In its second year, Emma and Alexis 'swapped' student groups to address sensitive and controversial aspects of their specialisms where religion and science co-exist. The day concluded with mixed groups of RE and Science student teachers identifying topics found in the science and RE curricula and beginning to think about how these might be planned and taught in tandem.

Student teachers' responses to the day reflected the need to address reductive assumptions of 'other' subjects. Through dealing with the complex questions that both subjects provoke, student teachers were asked what they could learn from each other and how this could support their own students when teaching in the future. Through an awareness of the significant roles of philosophy, history, sociology and anthropology in each other's undergraduate education, students found that they had more in common than anticipated and were encouraged to continue interdisciplinary approaches in their NQT years.

PRESENTATIONS

Zaheeda Alibhai
University of Ottawa

De-Orientalizing Discourses: Co-operation and Connections in the History of Science.

Samuel Huntington (1996) has argued, that a new phase in world politics will be the advent of “cultural conflicts” along the lines of civilizational difference, what Huntington refers to as “civilization identity,” between seven or eight major civilizations. Therein, according to Huntington, lies the new battle lines—the fault lines between civilizations. Particularly troubling, Huntington concludes with a warning that the “clash” will be between primarily two—Islam and the West. Critiquing Huntington’s simplistic theory Edward Said (2001) countered that the danger does not lie in clashes between civilizations but in the assumption that civilizations and identities are “shut-down, sealed-off entities” that have been purged of their “internal dynamics and plurality” and “the myriad currents and countercurrents that animate human history.” For Said (2001), the clash lies in ignorance of the “less visible history” between “Islam” and “the West,” one of “exchange, cross-fertilization and sharing.” The rejection of the “clash of civilizations” and in favour of the “clash of ignorance” is argued by the Aga Khan (2002) who furthered that the fault line between Islam and the West is not characterized by fortified boundaries or civilizational enmity but by gaps of knowledge from both sides that neglect the “long history of respect and cooperation” between both civilizations (2006). Nowhere does this relationship of exchange and co-operation become more visible than in the history of science. For instance, the 9th century Graeco-Arabic translation movement in Baghdad provides a very early example of the “dialogue of civilizations” (Bala 2008) where diverse ideas from different languages, epistemologies, religions, cultures and worldviews were made compatible with one another. This paper explores the cross-cultural history of science to illustrate the “less visible” relationship between “Islam” and the “West.” I argue that, a re-examination of these relationships in the co-creation of science can become a site where we can observe a deeper cosmopolitan pluralism and see more clearly the way that clashes between civilizations can be transgressed, destabilized, and bridged to imagine a new social, cultural and political world ‘in the making.’ I conclude that in this way, the history of science can provide the pathway towards fostering deeper insights and understanding of the past that can offer new opportunities in the present to tell a new but old story of cultural engagement, relationships and connections between civilizations that transforms “old ideas” into “big ideas” towards new revolutionary pathways of knowledge production.

Karl Bentley
Canterbury Christ Church University

Teaching and Learning about Epistemic Insight – workshop.

This workshop is an example and insight into a part of one of several workshops run for Primary and Secondary students and Student Teachers as part of the Canterbury Christ Church University (CCCU) Epistemic Insight Initiative (CCCU, 2019). This initiative was launched on Thursday 16th May 2019 with over 500 students, with 200 from Primary and Secondary schools, who came on to the CCCU campus for a day of asking and exploring big questions. The workshop explores the insights we expect young people to call upon when they address the big questions of life and the universe. Epistemic Insight refers to 'knowledge about knowledge' and particularly knowledge about subject disciplines and how they interact.

It asks what strategies can schools use to develop young people's expressed curiosity about the nature of reality and human personhood and how we can give future great minds of science and other disciplines the inspiration and stimulus that they need.

Research has highlighted that as children move into Secondary education schools typically provide few opportunities for asking cross-discipline and multi-disciplinary questions or ask students to explore and critique the distinctive approaches that different subject disciplines take. Further, there is a basis to say that the impact of pedagogies, like entrenched compartmentalisation, are largely hidden – because assessment tends to focus only on a narrowly definition of student progress within each subject and not the full intent or extent of the curriculum (Billingsley et al, 2018).

Teaching Epistemic Insight goes hand in hand with teaching of a broad and balanced curriculum (OECD 2018). It includes building students understanding of the ways that different types of subject disciplinary knowledge can help us to address questions that bridge subjects and disciplines.

This workshop also allows participants to explore how such workshops challenges problems around entrenched Scientism in the curriculum. Scientism is a belief and attitude that science is the only way to construct knowledge and that nothing exists beyond the material universe (Stenmark 2013). These workshops help to address what has long been a blind spot in the school curriculum – by drawing students' attention to scholarly and political about the power and limitations of science (Kötter and Hammann, 2017). By doing so students can appreciate that there is a range of stances – and avoid the misperception that a scientist has to commit to scientism (Billingsley et al, 2016).

Bristlebots are cute little robots made from toothbrush heads, a motor (or buzzer) and a battery the buzz and jitter as though they were alive. Are they really alive though? Biologists often use the seven characterises identified by the acronym 'MRS GREN' – movement, respiration, sensitivity, growth, reproduction, excretion and nutrition – to sort out things that are alive and things that are not. Bristlebots are clearly not 'alive' according these criteria – but what about more advanced robots and AI?

The framing of such questions can affect how deeply we need to engage with contentious issues around personhood in order to respond. If a computer programme meets all of MRS GREN's characteristics, would that be enough to convince you that it really is alive?

The workshop also models and explores how, via a spiral curriculum, epistemic insight can build up as students move through school, college, university and beyond.

Workshop structure

Can we explore big ideas with small things?

Students build small robots – bristlebots. As the bristlebots move and jostle around their terrain – they seem to be alive, are they, alive? Via a dialogic space, created and guided by the workshop lead, students consider definitions of 'life' and what happens when Biologists and Robot designers ask the same questions.

The first part of this workshop explores, using as a starting point present practices taken from science education, it then invites the participants to explore how different subject disciplines approach the question of something being alive differently – and why this question matters. The second part of this 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 is the work always attributable to the robot's maker and are we any different?

References

- Billingsley, B., Brock, R., Taber, K. S. & Riga, F. (2016) *How Students View the Boundaries Between Their Science and Religious Education Concerning the Origins of Life and the Universe*, Science Education, 100(3), 459–482.
- Billingley, B., Nassaji, M., Fraser, S., and Lawson, F. (2018) A Framework for Teaching Epistemic Insight in Schools. Research into Science Education. <https://link.springer.com/article/10.1007/s11165-018-9788-6> (Open Access)
- Canterbury Christ Church University, Epistemic Insight webpage available at: <https://www.canterbury.ac.uk/education/our-work/epistemic-insight/epistemic-insight.aspx>
- Kötter, M., & Hammann, M. (2017). *Controversy as a blind spot in teaching nature of science*. Science & Education, 26(5): 451–482.
- OECD (2018) *The Future of Education and Skills: Education 2030*, Paris: Organisation for Economic Co-operation and Development
- Stenmark, M. (2013) *Scientism*, Encyclopedia of Sciences and Religion (pp. 2103-2105) Springer.

Nathan Bossoh
University College London

Why does it persist? A historical and cognitive perspective on science-religion narratives.

In his infamous 1874 Belfast address to British Association for the Advancement of Science, John Tyndall asserted that "Scientists claim, and we shall wrest from theology the entire domain of cosmological theory." Claims as such have led historians to trace the origins of the conflict thesis to the late Victorian period. Yet it was Tyndall who elsewhere stated that "religion is not a persuasion; it is a life...it finds a root in human nature which is deeper than all sensuous experience and lies below our modern science of logic." When historians reinvestigate the language of late 19th century Victorian polemicists such as Tyndall, it becomes clear that it was never the case that "religion" was in conflict in science, rather the conflict, in their eyes, lay between "theology" and science. Recent scholarship has shown that the Victorian progenitors of the - now misplaced - conflict narrative themselves overwhelmingly did not in fact perceive an inherent conflict between science and religion, rather the conflict was between science and specific theological claims. The transition from the focus of 'science and theology' to 'science and religion' therefore took hold strongly during the 20th century shaped largely by the very creator of the discipline of history of science George Sarton. Steeped in the positivist thought of August Comte, Sarton set the tone for the "real" conflict between science and religion and although scholars today usually point to the (not so) New Atheists such as Richard Dawkins and Daniel Dennett as the modern advocates of conflict, it is becoming clear that there is a newer emerging group of much younger sceptics who we might consider to be the "New New Atheists". Over the last few years YouTube channels such as 'Cosmic Skeptic', 'Rationality Rules' and 'Genetically Modified Skeptic' have achieved substantial followings whilst continuing to endorse the supposed rationality of science against the irrationality of religion. Interestingly against the claims of these vocal New New atheists a novel emerging field of science, the 'Cognitive Science of Religion' (CSR) has begun to explore in detail why religion persists throughout the world despite its history of criticism. In this talk I will draw from scholarly research into human cognition which suggests, in contrast to the commonly perpetrated misconception that humans are born with no religious beliefs, that it rather seems we are born with cognitive tendencies which lean towards agency, purpose and design from a young age - traits all common to religion. In our modern age where truth is seen as synonymous with science, at the expense of the value religion, CSR has the potential to aid in redressing public understandings about the place of science and religion in society by showing fundamentally how the persistence of religion might not be due to cultural reasons but cognitive ones. Finally, applied to history, CSR can help us to better understand why Tyndall could claim such a fierce clash between science and theology yet claim such a peaceful harmony between science and religion.

Jennifer Brown
Ripon College Cuddesdon

Science, Religion and Humanity's Response to Environmental Issues.

Climate change, species extinction and other instances of environmental degradation raise big questions about humanity's place within and relationship to the wider natural world. Science and religion both offer ways of exploring and, perhaps, answering these questions. The scriptures of the Judeo-Christian tradition and their interpretation have led some to assume that human beings have a right to use the resources of the natural world and other species to our own ends. Science and technology have, particularly through the 20th century, enabled large-scale exploitation of the natural world. But science has also provided evidence of the damage that such exploitation causes, and a growing scientific understanding of environmental problems demonstrates humanity's connection with and dependence on the natural world. In addition, science and technology may provide possible solutions to environmental problems. Within Christianity and other religious traditions, a growing emphasis on creation care has led to a re-evaluation of traditional teaching about humanity's place in the world and is raising new questions about the way human beings do and should relate to other animal species. Bringing together scientific understanding and religious teaching can enlarge and enrich our thinking about how human beings interact with the natural world and respond to global environmental challenges.

Elisabetta Canetta
St. Mary's University, London

Transhumanism: How will AI change humankind?

The near future looks like an exciting space and time to be, with humans probably living in "smart" houses capable of monitoring the dwellers' wellbeing through "smart" furniture made of sensors that can detect our vital functions, body posture, etc. The work environment will also be completely different with humans working from home and being in the office only as a virtual 3D image. As exciting as it may sound, what can be foreseen about the future of sentient beings? What about our human consciousness? What about personhood?

One of the most popular predictions is that humans will become transhumans and achieve "digital immortality" by uploading their consciousness in a quantum computer. Quantum computing is still in its infancy but the prospect of storing a human being's memories and personality in a quantum computer is not so far-fetched. Scientists are already working to make transhumanism become a reality, and there are ongoing projects whose main goal is to build avatars containing a person's consciousness. The creation of such an avatar would permit humans to live eternally as a human-machine hybrid.

As fascinating, exciting and intriguing as this prediction and vision of our world in the near future may be, there are Big Questions that need to be asked: are we running the risk of dehumanising the human race? What type of role is Artificial Intelligence (AI) going to play in the development of personhood?

If transhumanism becomes a reality, would we still be made in God's image? Would this mean that AI becomes the new God? Would God be transformed into a Universal Programmer of a virtual matrix that encompasses the whole creation? This would probably be the end of humanity and the beginning of a dystopian reality.

In this paper, the current dialogue between neuroscience, computer science, engineering and the theology of the human person and of creation, in the context of transhumanism and digital immortality, will be presented. The potential shift from the current concept of personhood that AI may produce will also be discussed.

Zoubeida Dagher
University of Delaware

Negotiating Perceived Conflict between Scientific and Religious Claims.

Studying science provides students with opportunities for exploration and wonderment. It also provides opportunities to appreciate how scientific knowledge enables us to learn a lot about ourselves and the world around us. Some would argue that religion provides us with similar opportunities along a different pathway. Teachers act as social brokers in the sense that they are tasked with enabling children to make sense of the natural and social worlds, pursue questions that matter to them, and develop healthy values and perspectives and that will help them mature into responsible adults and informed citizens. Teachers are often unsure how to help children assimilate and accommodate scientific theories that might conflict with their religious beliefs. In many cases, they struggle themselves with these very questions (see Glaze & Goldston, 2015). Students dilemmas that lie at the intersection of science and religion have been well documented in the context of theories of evolution and the big bang (e.g. Dagher & BouJaoude, 1997, Shipman, Brickhouse, Dagher, & Letts, 2002). Evidently, many resources have been developed to aide educators in helping students resolve perceived conflicts by appealing to basic understandings about the nature of science (e.g. NRC, 2009, Shane, Meadows, Hermann & Binns, 2019). Building on these efforts, I propose using a teaching approach that is grounded in the cognitive-epistemic components of the Family Resemblance Approach to the nature of science (Erduran & Dagher, 2014, Dagher & Erduran, 2016). This strategy provides teachers with rich referents that can help them frame classroom conversations about how science and religion compare with respect to their aims and values, practices, methods, and knowledge structure. Discussing attributes of scientific and religious claims along these referents promotes respectful dialog and discussion. It also provides anchor points that can be used to distinguish ways of knowing in the sciences from other fields. The presentation will illustrate the potential fruitfulness of this approach for navigating perceived tensions between science and religion, point out potential limitations, and propose productive directions for more culturally responsive science curriculum and instruction.

References:

- Dagher, Z. R. & BouJaoude, S. (1997). Scientific views and religious beliefs of college students: The case of biological evolution. *Journal of Research in Science Teaching*, 34, 429-445.
- Dagher, Z. R. & Erduran, S. (2016). Reconceptualizing the nature of science for science education: Why does it matter? *Science & Education*, 25(1), 147-164. doi 10.1007/s11191-015-9800-8.
- Erduran, S. & Dagher, Z. R. (2014). Reconceptualizing the nature of science for science education: Scientific knowledge, practices and other family categories. Dordrecht, The Netherlands: Springer.
- Glaze, A., & Goldston, M. J. (2015) U.S. Science teaching and learning of evolution: A critical review of the literature 2000-2014. *Science Education*, 99(3), 500-518.
- National Research Council. (1998). Teaching about evolution and the nature of science. Washington, DC: The National Academies Press.
- Shane, J., Meadows, L., Hermann, R., & Binns, I. (2019). Making sense of science and religion: Strategies for the classroom and beyond. Washington, DC: NSTA Press.
- Shipman, H., Brickhouse, N., Dagher, Z. R., & Letts, W. (2002). Changes in student views of religion and science in a college astronomy course. *Science Education*, 86, 526-54.

Laurent Dessberg
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A cosmopolitan viewpoint on epistemic responsibility.

In the face of globalization associated with “unstoppable (...) mechanisms of trade, artistic and scientific exchange, migration, and communications technology” (Hansen, 2011, p. 11), cosmopolitanism illustrates an attempt to take control of our own future with a strong reminder of the bounds and opportunities individuals have to interact with others and the world. It is based on the long-lasting idea of belonging to a ‘world community’ that maintains its cohesion and integrity despite the vagaries of human condition. From this perspective, the paper explores a cosmopolitan vision of the scientific community as an example of ‘good practice’ supportive of knowledge seen as the result of a collective endeavour rather than a solo enterprise. Pragmatism provides an alternative to the correspondence theory of truth by focusing on the way scientific knowledge is produced on a global scale, within and across communities of scholars. In this regard, Dewey’s theory of inquiry outlines the way we attain knowledge in its different scientific forms and levels of sophistication. However, such an approach is anchored in a subject-world transactional process. To grasp a cosmopolitan outlook of our current epistemic responsibility, I therefore focus on the conditions under which this community reaches and sustains a ‘disciplinary matrix’ (paradigm) with standardized practices recognised as ‘normal’ by the vast majority of researchers (Kuhn, 2012). Here, the sociological and psychological factors that underpin the emergence, acquisition and transmission of knowledge hold greater interest than the recognition of a particular method of inquiry. But how do we become collectively responsible for our moral and epistemic stances? According to Rorty the scientist has to be praised for “knowing in advance what would count as disconfirming his hypothesis and prepared to abandon that hypothesis as a result of the unfavourable outcome of a single experiment” (2011, p. 36).

In that second part, I insist on the character traits that define the 'responsible knower' (thoroughness, intellectual curiosity and endeavour) and advocate for a pragmatist version of cosmopolitanism that supports a good epistemic attitude or disposition to knowledge. As a result, the epistemic virtues become more inclusive with qualities such as "open-mindedness and conversability" (Rorty, 1999, p. XXI) that resonate with the idea of cosmopolitanism as a "willingness to engage with the Other" (Hannerz, 2015, p. 487). It offers the opportunity to draw some final remarks on the possible expansion of our epistemic responsibility in diverse research areas. Laurent Dessberg Canterbury Christ Church University

Sibel Erduran, Liam Guilfoyle & Wonyong Park
University of Oxford

Research on Argumentation in Secondary Science and Religious Education: Reflections from the OARS Project.

In recent years, argumentation, or the justification of knowledge claims with evidence and reasons, has emerged as a significant educational goal, advocated in international curricula and investigated through school-based research. Research on argumentation has made connections to other areas such as indigenous knowledge and ethics in science. Surprisingly, however, the contrast of argumentation in science and religious education has been under-investigated although some educators have been concerned with the manifestation of science-religion debates in schools, particularly in relation to topics such as evolution and intelligent design. The purpose of this paper is to outline a research project with secondary science and religious education teachers in order to infuse argumentation in their teaching. In particular, the focus is on how science and religious education teachers perceive argumentation in their subject and the other subject. The context is a funded 3-year research and development project in England. Twenty-nine teachers were presented with an online survey in order to collect data on various aspects of their perceptions about argumentation. The empirical study used qualitative and quantitative methodology. Findings suggest that teachers of both subjects consider argumentation as a significant aspect of their subject although differences exist in how the teachers interpret argumentation in their discipline. Data suggest that there are statistically significant differences in terms of the frequency of use of pedagogical strategies that support argumentation in lessons. Contributions to broader research in science education are discussed.

Siew Fong Yap

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Developing epistemic insights - Influence of NOS and hermeneutics' teaching on high school students' perception of science and religion.

Understanding the nature of science (NOS) is one of the key objectives of science education, and is challenging due, in part, to the complex relationship between science and religion. Research has shown that the complexity also arises due to the concepts of absolute truth, theory and belief. This study examines how NOS and hermeneutics teachings affect high school students' perceptions of the relationship between science and religion in an evangelical Christian school. The participants included 180 high school students. The experimental group of participated in a scientific content course, which utilised historical narrative and ethical dilemma story pedagogy that explicitly addresses the NOS and biblical hermeneutics on human origins. The course content refers to evidence from physical anthropology, genetics and genomic studies which constitute part of the Year 12 Australian Tertiary Admission Rank (ATAR) Human Biology curriculum. Science as a Human Endeavour strand states that developments in the fields of comparative genomics, comparative biochemistry and bioinformatics have enabled identification of further evidence for evolutionary relationships which help refine existing models and theories of science understanding. Case study methodology and semi-structured interviews were used to generate thick descriptions of their views. Both control and experimental groups completed a closed questionnaire that examined various aspects of NOS perceptions and hermeneutics, prior to, and following the course. 18 students participated in case study and semi-structured interviews. A paired t-test was performed; and the interviews were recorded, transcribed and analysed. The findings show that the course influenced some aspects of the students' perceptions of the relationship between science and religion. The interviews brought to light key aspects of the students' understanding of relationship between science and religion, and the educational implications of the findings are discussed.

Ravi Gomatam

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On the Necessity of God to Science.

The issue of the relevance of God to science, it might be argued, presupposes the existence of God, which itself needs to be first justified. However, the methodology of modern science does not have to make 'existence' claims when entities are posited. Only the practical usefulness of any posited entity and its properties to discover order amidst our experience is the primary criterion. Thus, Hawking noted that it has not been necessary to invoke God to explain the origin of the universe.

However, the origin of the universe is not the only realm in science where the issue of God is relevant. The program of science in general, and physics in particular, is to treat material systems as closed systems. To that extent, it might be expected that God will not be found necessary, i.e. not practically useful to be invoked, in the study of matter in general. Thus, in raising the issue of the necessity of God to science, we mean to raise and discuss the following specific question: Is there a notion of a God together with posited qualities that can be seen to be practically relevant to solving some outstanding problem in studying matter as closed system in physics? This is a big question.

It is well-known that an atom or a sub-atomic particle in quantum theory is an 'open' system in the sense that the atom cannot be predicated definite physical properties independent of the context in which it is observed. I shall discuss how this known problem of 'inseparability' of a quantum system from its environment occasions a failure of realism in quantum theory along pre-quantum or classical lines. What is the nature of quantum physical reality in and of itself? It is also a big question, concerning the nature of matter in physics. It is relatable to the big question posed in the previous paragraph.

I shall introduce a notion of personal God and a particular property of God from a relatively less known monotheistic tradition of Hinduism called Gaudiya Vaishnavism (GV). The issue of the part-whole relation is ubiquitous in quantum mechanics. Quantum inseparability is only one instance where the relation between the parts (the observed system) and whole (the macroscopic observing agency) crops up. I shall discuss, in nontechnical language, other instances. Thus far, the approach has been to treat the parts as primary and the identity of the whole as derived. GV inverts the treatment, treating the whole (God) as primary and parts (the categories) as deriving their identity from the whole. It provides an alternative framework for relating the above two big questions and shows promise to throw useful light on scientifically addressing the problem of the nature of matter within contemporary quantum physics.

Mehdi Nassaji and Agnieszka J. Gordon
Canterbury Christ Church University.

Epistemic insight: A systematic problem and an Eco-systemic solution.

Epistemic Insight: A Systemic Problem and an Ecosystemic Solution. Dr. Mehdi Nassaji and Dr Agnieszka Gordon (Canterbury Christ Church University) Prior research points to systemic challenges to the development of epistemic insight within the education system (Billingsley et al., 2018). 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. There is a basis to say that education is locked into particular ways of working which means that schools are failing to stimulate and promote epistemic insight across curriculum areas of study and in relation to Big Questions in particular. In our view, it requires a complex portfolio of activities and interactions at multiple points within the educational ecosystem in order to break a cycle that flows causally through systems at multiple different stages. Given the way that pressures on the development of epistemic insight are applied at each stage of the educational process, we argue for the necessity of interacting with multiple systems concurrently including at the level of teacher training. We hypothesise, trainee teachers find themselves with little knowledge of issues surrounding epistemic insight, its importance or how to effectively promote it. They then enter schools, which individual students pass through successively (from primary to secondary) facing distinctive pressures within each of these systems on the way. In this presentation we will report on a survey study conducted among more than 500 trainee teacher in two Higher Education institutions in order to assess trainee teachers' level of epistemic insight. The baseline study indicated that there is a lack of epistemic insight among trainee teachers. Only about 10% of respondents in the study were familiar with the term 'epistemology' while more than 90% said that they are familiar with the term pedagogy. More than 80% of respondents stated that they would like to know more about how to teach Big Questions, which suggests that the barrier today is not a lack of interest. More data analyses on the assessment of the trainee teachers will be presented in the talk. Billingsley B, Nassaji M, Fraser S, et al. (2018) A Framework for Epistemic Insight. *Research in Science Education* 48: 1115-1131.

Simon Hoult
Canterbury Christ Church University

Student Teachers' disciplinary informed thinking about 'Big Questions': Study Abroad and the implications for Epistemic Insight in Schools.

In this paper, I draw on empirical research to consider the ways that postgraduate student teachers' disciplines informed their thinking about 'big questions' related to their professional and personal Self provoked by a short period of 'Study Abroad'. I then consider the implications for such disciplinary influences on ideas of teaching Epistemic Insight in schools. The Study Abroad specifically refers to a two-week study visit to South India that I lead with 14 student teachers which formed the basis of an elective module for primary and secondary-phase specialists undertaking a programme in Initial Teacher Education in England. During their time in India, the student teachers reflected on self-chosen critical moments through their engagement with a learning journal. In addition, the student teachers wrote an academic essay after their return to the UK about the process of their intercultural learning, and the ways (if any) it influenced them personally and/or professionally. The journals and essays constituted my empirical research when added to individual interviews conducted upon return to the UK and the end of the module. The first phase of my analysis focused on the intercultural dimensions of the study visit and has been discussed elsewhere (e.g. Hoult, 2017, 2019). Additionally, this analysis revealed an apparently mostly unconscious disciplinary influence on the ways that the student teachers constructed meaning in the complex and shifting nature of knowledge construction in an intercultural setting. It is this focus to which my analysis has now turned. The student teachers' responses were idiosyncratic and unpredictable in their detail and yet a disciplinary dimension was evident and influential to their responses. Their discipline seemed to influence: the ways that, and the degree to which, the student teachers were comfortable with uncertainty; their approach to learning and acknowledging the challenge to their personal and professional identity. This, I argue, has significant implications for the ways that we teach student teachers to engage beyond their disciplinary boundaries and to see the limits to thinking that such approaches and boundaries instil; in short to give them greater Epistemic Insight in their own teaching.

David Hutchings
Pocklington School

The Multiverse in Our Heads.

This paper seeks to investigate how it is that Professors Stephen Hawking and Don Page – cosmologists, friends, and collaborators on many papers – could end up disagreeing about whether or not the Universe has a Creator. After all, they broadly agreed on the initial premises, the observations, and the methodology of their subject. Yet Hawking says ‘the multiverse concept can explain the fine-tuning of physical law without the need for a benevolent creator who made the universe’ⁱ, and Page ‘Given our present knowledge, to me it currently seems simpler to hypothesize that God created a multiverse.’ⁱⁱ

This is strange, since both thinkers are operating on the same playing field. They are provided with the same data by experimentalists. They are applying the same laws of physics. Page even wrote a lengthy paper with no fewer than eight separate defences of Hawking’s favourite cosmological model – his (in)famous no-boundary proposal.

To the non-scientist – and even to some within the profession – this can appear confusing: does the evidence point to God, or away from Him? If two of the most foremost spokespeople on the matter, who are united on the science, can part ways on this, then what hope for the rest of us?

This paper proposes a tentative solution to such a quandary: it is that there is indeed a multiverse, but one we never speak of – the multiverse in our heads. Page believes, for instance, that Jesus did rise from the dead; Hawking doesn’t. This means that Page’s Universe has within it a risen Saviour, whilst Hawking’s doesn’t. Their Universes, therefore, are different. Hawking and Page are not looking to explain the same reality.

Perhaps, then, there is virtue in ensuring that these other factors are explicitly mentioned in discussions about ultimate explanation or about meaning. When a cosmologist declares their conclusion about these, and apparently only bases this on the cosmological data, are they not misleading people? Should they not also have to declare the rest of the ‘data’ that is in ‘their Universe?’ If they did so, then surely the public – and other scientists – would be better informed; would they not?

David F. Jackson

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Enlightenment Now? Or are Contingency, Irony, and Solidarity the best we can hope for?

This presentation questions how intellectual assertions about external reality, based in an entirely secular scientific perspective, square with real challenges to the implications of those “truths” posed almost daily by the emotional and social reality of personal life. The American jurist Oliver Wendell Holmes framed the issue well when he said, “All the pleasure in life is in general ideas. But all the use of life is in specific solutions.” Or, as summarized by the source of these words, “Even people who think that their thinking is guided by general principles... actually think the way everyone else does – by the seat of their pants.” (Menand, p. 342). Professional implications are then drawn as they relate to the specific context of practice in science teacher education in the Southeastern USA, updating the point of view introduced in an earlier publication (author, 2007), which I will briefly summarize.

The primary framework for the argument in this presentation is a critical commentary on the works of two authors who have recently become highly influential on my thought – Steven Pinker (2018) and Richard Rorty (1989). The immediate context in which I found their ideas helpful was the challenge to defend a rather traditional, empirically-based pragmatism, rooted in a neo-positivist epistemology, in the face of strong critiques from points of view such as radical constructivism, critical theory, and poststructuralism (author and others, 2018). Pinker argues, and to my mind highly convincingly, that the ideal of the power of human reason is as relevant today as it historically was over a more than 200-year period beginning with the Enlightenment, and baldly states his belief that true human progress has fairly simply represented the ongoing triumph of science, and the technology facilitated by it, over increasingly outdated values primarily originating in religious traditions. Rorty’s (1989) “fundamental premise...is that a belief can still regulate action, can still be thought worth dying for, among people who are quite aware that this belief is caused by nothing deeper than contingent historical circumstances.” (p. 189). He labels such a person a “liberal ironist... someone for whom this sense [of human solidarity] was a matter of imaginative identification with the details of others’ lives, rather than a recognition of something antecedently shared.” (p. 190). His normative conclusion is that we should “try to extend our sense of ‘we’ to people whom we have previously thought of as ‘they.’” (p. 192). He fundamentally challenges the core assumption that Pinker makes of the ongoing relevance of Enlightenment thinking: “... although the idea of a central and universal human component called ‘reason,’...was very useful in creating modern democratic societies...it can now be dispensed with...democracies are now in a position to throw away some of the ladders used in their own construction.” (Rorty, p. 194)

At the risk (for an academic audience) of appearing to trivialize the issues, they may well best be summed up by reference to a popular culture source: Why does it seem nearly inescapable that in order “...to be human...to be the place where the falling angel meets the rising ape,... people have got to believe...[in] justice, mercy, duty, that sort of thing...some ideal order in the world...some rightness in the world by which it may be judged.” (Pratchett, 1998).

References

- author (2007). The personal and the professional in the teaching of evolution. In L. S. Jones & M. J. Reiss (Eds.), *Teaching about scientific origins: Taking account of creationism* (pp. 159-178). New York: Peter Lang.
- author and others (2018, March). Creating a polyphonic and dialogic process to address the issue of science mistrust and misunderstanding. Symposium presented at the Annual Meeting of the National Association for Research in Science Teaching, Atlanta.
- Menand, L. (2001). *The metaphysical club: A story of ideas in America*. New York: Farrar, Straus, and Giroux.
- Pratchett, T. (1998) *Hogfather*. New York: HarperCollins.
- Pinker, S. (2018). *Enlightenment now: The case for reason, science, humanism, and progress*. New York: Viking.
- Rorty, R. S. (1989). *Contingency, irony, and solidarity*. New York: Cambridge University Press.

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Science unlimited? Differential effects of epistemic insight on scientific and non-scientific students.

Discussing Big Questions within the science classroom is thought to develop student epistemic insight and - amongst others - prevent students from scientism. In this paper we present two studies in which we first describe different groups of secondary school students in terms of their scientific beliefs and second investigate differential effects of an introductory university course on the epistemology of the biosciences - integrating discussions of selected Big Questions - on scientific beliefs among groups of scientific and non-scientific university students.

It is not easy to answer the question of which persons are to be labelled as scientific. Within philosophy, scientism is generally understood as "a matter of putting too high a value on science in comparison with other branches of learning or culture" (Sorell, 1991, p. X). In his scholarly work, the philosopher M. Stenmark distinguishes eight categories of scientific beliefs, two of them referring to scientism within academia (1. academic-internal scientism, 2. methodological scientism) and six of them referring to scientific beliefs within the broader society (3. epistemic scientism, 4. rationalistic scientism, 5. ontological scientism, 6. axiological scientism, 7. existential scientism, 8. comprehensive scientism). According to Stenmark (2001, p. 134) agreement to one of the categories 3, 5, 6 or 7 is sufficient to characterize someone as adherent to scientism.

Previous studies investigating scientific beliefs among young people in different European countries have shown that secondary school students - on average - do not show strong agreement with scientific statements (Astley & Francis 2010; Konnemann et al., 2012; Korte, 2015). Furthermore, there is evidence that students' ideas of scientist agreement with scientific statements is considerably higher than the students' personal agreement (Hansson & Lindahl 2010; Korte, 2015). In a recent study, Billingsley and Nassaji (2019) explored scientific stances on the topic of human personhood distinguished between three groups of students: 1) a group of students with a strongly scientific stance on this topic

(20%), 2) a group of non-scientistic students (30%), and 3) a group of students characterized as neither scientific nor non-scientistic (50%). The study also found that in their comments at different points in the survey, the majority of students expressed ideas and everyday phrases associated with scientism.

In the first study we explore proportions of scientific and non-scientistic students among German secondary school students ($n=152$) comparing three different approaches. Adapting Korte's (2015) operationalization of Stenmark's categories of scientific beliefs with a total of 63 Likert-type items, we compare a characterization of students based on a) mean agreement to one scientism category, b) mean agreement based on all items, and c) KMeansCluster on scale means three cluster solution. The proportions of students characterized as scientific range from a) 86%, b) 23% to c) 10%. Strength and limitations of the approaches will be discussed.

In the second study we report differential effects of an introductory course on the epistemology of the biosciences (integrating discussions of selected Big Questions e.g. the question if science can explain and replace religion) on scientific beliefs among groups of scientific and non-scientistic university students applying approaches b) and c). A pre-post-one-group comparison (rmANOVA) of student responses to 10-item short version of Korte's scientism scale (Korte et al. 2016) revealed a significant decrease of scientific beliefs from pre- to post-test in the group of scientific students, but not in non-scientistic students.

Anthony Nairn
York University, Canada

The Grand Cosmic Perspective: The Presentation of Science in Popular Culture as a Post-Theological Secular Means of Re-Enchantment.

Modern science can now reveal in reliable detail nearly all the relevant processes which have allowed for the creation and evolution of the cosmos and life. Science popularizers and Hollywood teams have, I will argue, used such knowledge, from the Big Bang to the 'awakening' of life, to emulate the creation of biblical canon with a cohesive and seamless narrative based on scientific findings. Critically, in presenting science as a cohesive narrative whole, such presentations are ripe with endowing meaning and purpose to life, something that has been missing in much science communication. I argue that this is a "reoccupation" of theology but throughs secular means.

This narrative type is what I call, borrowing from Carl Sagan, the grand cosmic perspective. Such a narrative form has inspired many creative teams to embark on creative projects that are the source of my study. I argue that modern Hollywood films like *Interstellar*, *The Tree of Life*, and *Noah*, and especially the science communication program, *Cosmos*, use religious narrative strategies, themes, and symbolism to purposefully present secular understandings of life and cosmos via the affect made possible by sensory experience. I use a novel experiential presentation style to present samples of the above mentioned while simultaneously explaining that Max Weber's disenchantment theory was correct, revealed by the secularization thesis outlined by Charles Taylor and Norbert Elias. I then offer that by reconstituting religious symbolism and theological notions of love, compassion and togetherness, into popular secular presentations of scientific content, the mediums of popular culture that utilize this grand cosmic perspective are doing so in an attempt to re-enchant against common feelings of meaninglessness and purposelessness, which John Haught refers to as "cosmic pessimism."

Aya Nakama
Tokyo University of the Arts

Multi-layered Image as Virtue in Medieval Christian Art: For Understanding Diversity in Multicultural Communication of the Modern World.

The Christian faith is based on the Bible, which contains explanations of imaginary images and visions. Throughout Christianity's history, most prominently in the Middle Ages, biblical images were expressed in various ways through artwork. For example, sculptures, stained glass, and liturgical books at cathedrals and churches were used to educate people in grasping doctrinal issues.

Medieval Christians valued the ideas of St. Augustine, who argued that invisible truths are hidden multi-layered as symbols in biblical words and natural images. Visible images, especially those of art, gave birth to great many symbols which often had their own spiritual meanings and were complex enough to significantly contribute to the whole image program of the artwork.

Miracles, such as the Immaculate Conception, and medieval art, such as gothic sculptures, are to be appreciated in the same way: in harmony with the forefront of natural science. During medieval times, the influences of optics, mathematics, and natural philosophy were direct and unshakable. In the thirteenth century, God was thought to have created the universe as scientist (as represented in *Biblia pauperum*) and sculptor (as interpreted by St. Bonaventura) at the same time, which gave creation of art higher value.

In the veneration of the Virgin Mary, visible and invisible beauty were thought to be equaled to virtues of the Virgin Mary. Her beauty would spread as mercy above things in church and above believers, as confirmed by contemporary theology of mystic love based on the Song of Songs (for example, as shown in Spanish liturgical books). The Virgin Mary intercedes for the redemption of the souls of all humankind, and her mercy, acquired by appreciating images as religious practice, was also to be shared among members of the community.

In this presentation, I will explore medieval art works and theological thinking in historical sources, specifically around thirteenth century, in which the connection of art and science is especially evident. This presentation will address one of the Big Questions between science and religion posed by Keith Ward: "Can science provide a wholly naturalistic explanation for moral and religious beliefs?" (The Big Questions in Science and Religion, 2008).

The idea of finding multi-layered invisible truths in visible symbols by appreciating images of art is also suggestive for today's world of increasing multicultural communication. From the age of the veneration of the Virgin Mary, we learn respect for diversity in thoughts and truths of the world, and we have hope of accepting these differences even during difficulties faced with regard to social and individual issues.

We could effectively apply these learnings to the education of young people. Understanding the history of connecting art and science, and the important ways to appreciate images in the Middle Ages, would contribute to ensuring sensibility in the educational process. It would encourage them to obtain wide and profound insights for the truth of world through art and science, which would show them the importance of diversity via education by acquiring the creativity, critical thinking, and problem-solving abilities necessary for global citizens.

Jaqueline Perrin
Oxford Brookes University

Encountering and finding purpose in the lives of high-functioning autistic students: a participatory study.

One of the truly Big questions in life perhaps, is 'what is my purpose?' UK advice to schools on the teaching of spiritual, moral, social and cultural education (SMSC) no longer makes reference to encouraging students to find 'meaning and purpose' in their lives. Yet literature indicates that there are important benefits to be gained from exploring and developing these concepts. Following key authors in the field, William Damon and Kendall Bronk (from the US), this study is a focus specifically on 'purpose' and the rationale for this is to be explained. Purpose has been associated with a range of life benefits, such as a longer life span and greater satisfaction in life. It is recognised to be an important predictive variable of physical and mental health. It is widely acknowledged now, that children and adolescents with autistic spectrum disorders (ASD) are at increased risk of anxiety and anxiety disorders. A driving question behind this research has been whether this population suffer even more than those without autism, in the struggle to contend with life. Viktor Frankl (1946) famously stated: 'Life is never made unbearable by circumstances, but only by lack of meaning and purpose.' This inquiry seeks to discover how consideration of ones' purpose in life may have been encountered by high-functioning autistic young people. The investigation addresses those aged 16 and above – both within and outside of the school setting, in Southern England. Where individuals have encountered and engaged with purpose, this is to be analysed and its importance to them, considered. Questions are to be put to the young people themselves in their schools. There will be the opportunity for those interested, to be involved in the research process as co-researchers. Research has been found most widely in the US on 'purpose,' situated within positive youth development and this study aims to add to the nascent area of exploring purpose with autistic adolescents. Use of questionnaires and semi-structured interviews are anticipated, so that young peoples' thoughts can be found. Such qualitative methods will be decided, after an initial consultation phase with autistic participants. Views encountered may reveal whether there could be an advantage to accommodating work on purpose into the curriculum for this diverse group. If this were the outcome, other ideas to promote purpose may be explored. The author, encouraged by the work of Dr Liz Pellicano, at the Institute of Education, University of London, seeks to avoid a traditionally positivist and cognitive approach, commonly used in the field of research into autism in the past. Formally, research agendas have been predominantly led by non-autistic individuals and participants are inactive subjects. It is anticipated that a participatory approach may yield relevant, non-hierarchical and ethical research.

Saulo Quintana
Universidade Estadual de Campinas / Brazil

Religion and science teaching in the school context.

The interactions between science and religion have been studied by several researchers. Barbour's (1997) typology of four theses is one possibility, among many, to summarize the positions in this field: conflict, independence, integration and dialogue. The opposition between creationism and evolutionism has been the central theme of this debate, especially when considering the interactions between religion and science teaching. However, several other topics may also be included in this discussion. The most common approach has been to look at the science teacher, his religiosity, and his practices, in both qualitative and quantitative research. Our project, which also focuses on the relationships between religion and science teaching, aim attention at the worldviews of high school students, from schools in the city of Campinas - São Paulo, Brazil and in the city of Freiburg - Baden-Württemberg, Germany, and the possible influences of school characteristics on the construction of these worldviews, as well as the cultural context of the country where they live. The universe of students is distributed among three types of schools - namely secular, confessional or Waldorf - and between two countries in order to make comparisons. As data collection tools we chose Likert questionnaires and semi-structured interviews. So far it has been possible to apply the questionnaires in Brazil and analyze the data obtained through Exploratory Factor Analysis and show, still preliminary, that: 1. within the studied sample, regardless of religion, practically all individuals have a point of view that can be called evolutionist, as well as considers that science seeks the truth; 2. A small number of individuals studied appears to have very religious and unscientific worldviews or the opposite, but most individuals have intermediate worldviews; 3. There are no significant differences between school contexts within the studied sample. Keywords: Science teaching; Science and religion; Multiculturalism

Miriam Rosa, João Paiva, Luciano Moreira, Carla Morais
Instituto Universitario de Lisboa

Science, religion and teaching: perceptions from a Roman-Catholic context.

Research on ways to relate Science and religion in classrooms has focused mostly on the reality of Protestant, Jewish or Muslim communities/countries. Our research aims at complementing those findings by examining views on science and religion in the education system of the Roman-Catholic (Portuguese) society, knowing that adherence to religious worldviews are stronger or at least less diverse than in traditionally Protestant countries (Fernandes, 20003; Vilaça, 2001). Given that Portuguese religious education curricula allow for intersecting science contents but not the other way around, we analysed religious education teachers' perceptions of science and religion based on existing and new instruments, adapted to the Roman-Catholic context. Additionally, we analysed the extent to which those perceptions are associated with religious practice (e.g. personal prayer) and/or exposure to science contents (e.g. visiting science museums). Data from 198 Portuguese religious education teachers ((Male = 88; Female = 111; Missing = 4, aged 31-66 years old (M = 47, SD = 6.80)) showed that they are highly involved in both religious practice and exposure to science, suggesting they want to be involved in both worlds. In addition, signalling the particularities of Roman-Catholic contexts, participants showed a strong refusal to read the Bible literally. In light of Barbour's (1997) typology, these teachers showed perceptions of compatibility (rather than conflict or independence/separation) between religion and science. Although recognizing the limits of science, they fully endorsed scientific-based knowledge and showed openness to dialogue between both science and religion. Thus, their perceptions can be framed in terms of dialogue or integration between science and religion. These findings are discussed in terms of opportunities for multidisciplinary devised by legal educational diplomas such as in the Portuguese case, stimulating curricular flexibility through interdisciplinary projects. If given opportunities for science-religion dialogue in pedagogical activities, teaching approaches that compartmentalise science, religion and other subjects, can be successfully reduced (Billingsley & Fraser, 2018).

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Jostein Sæther
NLA University College, Bergen, Norway

Fact-value discourses in research on genetics in biology textbooks.

This review has grown out of an interest to integrate academic achievement and value(s) education in science education. More specifically, we want to identify “big questions” in the field of “genetics and human beings” by using existing textbook research as our point of departure. We ask: what do recent analyses of genetics in textbooks express about fact-value discourses? By disclosing (more or less) hidden discourses in research reports, which are also supposed to represent possible strategies in teaching, our aim is to contribute to background knowledge in textbook writing and teaching in this area.

Genetics discourses involve not only the natural sciences but also the social sciences and the humanities (e.g., religion, philosophy), encountering questions such as ‘what is a human being?’, ‘what ethical principles should guide genetics technology applied to human beings (and other creatures)?’ and what is a worthy human life in this context?’ From the perspectives of four fact-value and ideology-related discourses, we have conducted a qualitative interpretative content analysis of 17 research articles on genetics in biology textbooks.

This paper builds on three studies (Sæther, Reindal, Skrunes & Toft, 2018ab; Toft, Reindal, Skrunes, & Sæther, 2018). Our previous work was based on 14 research articles on genetics in biology textbooks. This paper adds three articles and a new quantitative part that tests the validity of our analysis. We have identified discourses on a continuum, from a narrow single academic (scientific) discourse to a values-based interdisciplinary discourse. By comparing the results based on qualitative and quantitative methodology, we obtained a Spearman’s rank order coefficient of $R=.90$.

It is important to be aware that identifying discourses is not the same as describing researchers’ intentions. Researchers must always limit the scope of their research project, for example, as in this context, by focusing on scientific correctness or analysing what subject matter is given the most weight. In this paper, we have maintained our focus on the texts and the underlying discourses that can be identified from an external perspective. At the same time, we suggest that a researcher has a responsibility, at least in an introductory or implications part of a study, to reflect on the value, ideological, political or educational contexts to which one might connect. During the analysis, we have identified possible “big questions” in the teaching of this issue, for example: Should interdisciplinarity be the guiding principle in science education? In what terms are human beings not only a species in the animal kingdom? Do human beings have (equal) value regardless of their genetic equipment? Should science education reflect on the possible limitations of its own scope, for example, raising ethical questions about the use of genetics technology by suggesting perspectives rooted in the humanities or social sciences? Should the idea of “genetic equipment” be understood in the context of “genetic determinism” isolated from the individual’s societal-cultural context and their freedom (within limitations) to be a free agent?

Sherry Simpson
Canterbury Christ Church University

“Why did the Titanic sink?” – bridging two disciplines to teach epistemic insight.

Through the bridging question ‘Why did the Titanic sink?’, this paper describes a Key stage 2 epistemic insight driven workshop to encourage development of scholarly inquiry. Exploring the notion that a big question is better informed when a multi-disciplinary investigation is adopted within the classroom. Investigated through two distinct disciplines; that of science and history, which respond through their different disciplinary perspectives. Students are introduced to the objectives within the Epistemic Insight Curriculum Framework (Billingsley et al, 2018), to consider ‘the nature of science in real world contexts and multidisciplinary arenas.’ Two separate class activities intend to inspire and challenge Key stage 2 students to investigate the question through different lenses. Initially through scientific inquiry, reflecting the aims within the National curriculum (DfE, 2014, p.168), “...developing a sense of excitement and curiosity...”. Testing out hypothesis’ and making observations of how the titanic model sinks when variables are adjusted; to appreciate the powers and limitations of science. Students are then transported back in time, becoming historians to investigate the human story of the disaster. Addressing the question of ‘who was to blame’ for the titanic sinking, students explore a variety of past sources offering contrasting interpretations of this past event. Examining the big question through two separate disciplines highlights how the framing of a question demands specific methods, language and norms of thought which are distinct to the discipline. Finally, students are encouraged to consider how the question could be further informed by other perspectives presented through the discipline wheel (Epistemic Insight pedagogical tool) to facilitate a deeper and fuller answer. School engagement with the intervention so far, has been very encouraging. It is intended to support teachers to enable a shift in their current pedagogy whilst developing scholarly thinking amongst primary students.

Paula Stone
Canterbury Christ Church University

Seeking Epistemic Insight: Student teachers as associate researchers.

In this presentation I will share how we enabled student teachers to carry out their own small epistemic enquiry projects so that they were able to contribute to the wider project. This meant introducing them to the notion of Epistemic Insight and inducting them into the research process so they could carry out research engaged teaching. I will share with the some of the students’ projects and their findings.

Caroline Thomas

Senior Lecturer in Education at Canterbury Christ Church University

Investigation of 'You are what you eat' with Key Stage 2 pupils.

I explore from a multi-disciplinary perspective how pupils, aged 8 to 11, can investigate the Big Question 'You are what you eat'. Pupils' responses to our workshop reveal their varying conceptions of human personhood and scientific enquiry.

Stephen Thompson

Fulston Manor School

Surveying the landscape of epistemic insight

Epistemic insight includes understanding how knowledge is developed and tested within each subject discipline. So what epistemic insight can each subject discipline theoretically contribute to a student's overall understanding of how scholarship and knowledge work? A response informed by an exploration of the types of questions posed across the curriculum.

Ben Trubody

University of Gloucester

Easy, but not simple: The explicit vs the tacit.

Moravec's paradox (Moravec, 1988) is the problem in artificial intelligence systems (AIS), that what humans and AIS find hard or easy exist on opposite ends of the computational scale. Humans struggle with things like reasoning, maths and statistics, whereas tasks a child can do a supercomputer cannot. Why is this?

Firstly, the differences between 'easy/ hard' and 'simple/ complex'. As humans what we find easy is not simple. Our existence is made-up of complex systems from motor functions to social interactions, all of which, generally, we experience as easy. However, things that are simple we struggle with and arguably are the hardest things we have to do. In reasoning, maths and statistics we struggle to represent a world of geometrical shapes, numbers and logical operators, even though they are basic objects which obey simple determine rules. A famous example might be Fermat's last theorem, which a child can understand, but it took centuries of mathematicians to solve. Moving away from simple objects and their relationships, what about simple ideas? An experience familiar to anyone who has done philosophy – What is 'good'? What is 'mind'? What is existence? Everyone knows what it's like to have a mind or exist, but can we articulate it without descending into an abyss of strained metaphors, mysticism or pseudo-science?

Putting aside that there might be issues with a question like 'what is x' another distinction I would like draw upon is the explicit-tacit divide (Polanyi, 1958). Explicit knowledge is any 'data' that can be represented and passed on without loss of information, e.g., propositional knowledge, instruction-rule following. This is the domain AIS works in. They follow rule bound algorithms which means reasoning, mathematical and statistical work are easy, because the objects and information they encode are simple (e.g., 1,0's). Tacit knowledge is the idea that 'we know more than we can tell'. The extent to which tacit knowledge exists is debated (Collins, 2010), some arguing that all knowledge is potentially explicit, others that the tacit is forever beyond the realm of explicit representation and even that it makes the explicit relationship possible. However, it is skills and knowledge that we might label 'tacit' AIS routinely fails at not only due to its complexity, but possibly because it cannot be coded. It's the stuff I cannot directly communicate, yet we are aware of or given enough practice become good at. A test for 'tacitness' is the inability to describe something that you do regularly, even if you are amazing at it. The Nobel Prize winning physicist Richard Feynman (1966) when asked to explain what science was to a room full of science teachers said he could not, rather he could show them.

However, the sorts of knowledge that not just formal education, but most socio-economic activities privilege is of the explicit kind - quantifiable, assessable, measurable. However, due to tacit knowledge being beyond formal representation it is regarded as secondary or even illusory. The over-representation of explicit knowledge in education and generally as our conceptual model for 'knowledge' is not only a hindrance to AIS development, but human well-being. Since the Enlightenment it has been a goal to get human knowledge and even morality into explicit form be it laws, rules or principles that can be written down, calculated or taught/ followed by rote, however, it has been the work of some to counter this by drawing a line under what it is possible to make explicit and the possible harmful misapplication of this to the human condition i.e., treating humans like machines. Here things like rule creating-breaking, imagination, play, insight-intuition, embodied knowledge, craftsmanship/ connoisseurship, ineffability, the transcendent, indirect communication and existential angst, are all tacitly human, addressed (though not exclusively) by the arts and humanities. The import of this is that whilst many of the achievements of the Enlightenment and formal education would not be possible without explication (e.g., recording, documenting, quantifying) it is also vital to understand that there are limits to what this can do and even harmful consequences to its over-representation. I would like to argue that the development of a person is in-part a transcending of the explicit-representational elements of our existence. Here we are invited into realms of poetry, art, literature, philosophy, music, ethics, religion, mysticism and so on, as ways of understanding the limits of what can be explicitly represented.

Flora Wang
University of Edinburgh

A Religious Dialogue with Human-like AI and Robots on the Foundation of Personhood.

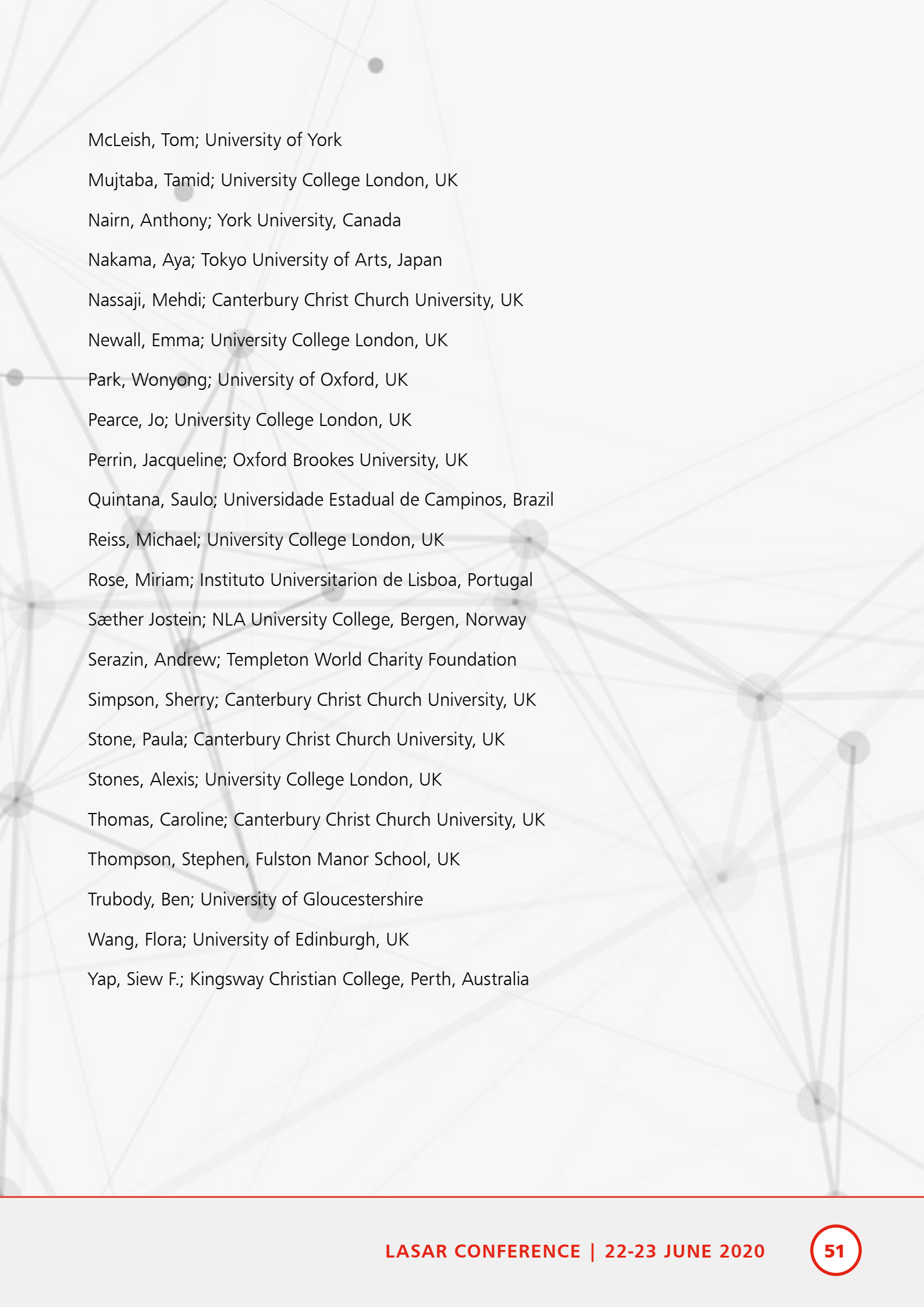
In this paper, I wish to address the following question: What fundamentally constitutes our human personhood, from a theological perspective? The question is especially pressing as AI and robots are declared to be more human-like, thereby threatening our human uniqueness. To address this question and its subsidiary questions, my approach is a phenomenological reflection on the existence of human-like robots with its ontological assumptions, scientific limitations and possible ethical problems in the future.

The key idea starts from a term “Heideggerian AI”, which can be seen as a theoretical form of human-like AI and robots since it bears the ontological structure of human beings, Dasein, in a Heideggerian context. It is a critical problem in cognitive science to help scientists understand how to make AI and robots exist in the real world like human beings. However, the idea of “Heideggerian AI” has the two following problems relevant to artificial intelligence and robots. First, Dasein means not only being-in-the-world but also the innermost relationship with Being which constitutes the selfhood or personhood of human beings. If AI and robots can have Dasein, it means that they can also have human personhood. Secondly, the will of transplanting Dasein to AI and robots displays the fact that the ontological boundary is blurred between human beings and artificial life. In this sense, Heideggerian AI cannot fully present Heidegger’s philosophy, and, to some extent, even contradicts it.

On the other hand, Karl Rahner’s understanding of the personhood of the human in a Christian and Heideggerian context can be a source of theological reflections on the practical form of Heideggerian AI, namely human-like AI and robots, like Sophia from Hanson Robotics, in respect to a contrast with the personhood of human-like artificial life (AI and robots). Compared with a Heideggerian notion of a human person and its relation to Being, a Rahnerian notion of human personhood includes the possibility of being grounded by God as the mystery and the orientation to the infinite horizon as the foundation of meaningful presence. Nevertheless, social psychology research shows that our interaction with machines, especially robots, has a tendency towards anthropomorphism and dehumanization. Following a Rahnerian understanding of human personhood, I argue that human personhood and the personhood of AI and robots have an ontological difference in the aspect of transcendence. We should not take human-like AI and robots as the full “image of us”, or as a copy of the “image of God”, since our belongingness to God as the ground of our personhood cannot be copied or mastered by modern technology, from Rahner’s theocentric perspective. I suggest that we can grant AI and robots a quasi-human-personhood as they are a new category which is close to human beings. However, we should always keep in mind the existence of the ontological boundary and our incapacity to eliminate it. In a broader scale, I hope to present how the mystical and apophatic traditions can help in terms of our relationship with human-like machines, which is free from the confusing imaging-imaged interaction, as our hope in the co-existence with human-like machines in the future.

LIST OF PRESENTERS

Alibhai, Zaheeda; University of Ottawa, Canada
Bentley, Karl; Canterbury Christ Church University, UK
Billingsley, Berry; Canterbury Christ Church University, UK
Bossoh, Natan; University College London, UK
Brown, Jennifer; Rippon College, Cuddesdon, UK
Bryant, John; University of Exeter, UK
Canetta, Elisabetta; St. Mary's University, UK
Campbell, Robert; St. Mary's University, London
Cutler, Marianne; The Association for Science Education
Dagher, Zoubeida; University of Delaware, USA
Dessberg, Laurent; Canterbury Christ Church University, UK
Erduran, Sibel; University of Oxford, UK
Gomatam, Ravi; Institute of Semantic Information Science and Technology, Mumbai, India
Gordon, Agnieszka; Canterbury Christ Church University, UK
Guilfoyle, Liam; University of Oxford, UK
Hoult, Simon; Canterbury Christ Church University, UK
Hutchings, David; Pocklington School, UK
Jackson, David; University of Georgia, USA
Kapus, Jerry; University of Wisconsin-Stout, USA
Konneman, Christiane; University of Muenster, Germany
Malik, Shoaib; Natural Sciences at Zayed University in Dubai



McLeish, Tom; University of York
Mujtaba, Tamid; University College London, UK
Nairn, Anthony; York University, Canada
Nakama, Aya; Tokyo University of Arts, Japan
Nassaji, Mehdi; Canterbury Christ Church University, UK
Newall, Emma; University College London, UK
Park, Wonyong; University of Oxford, UK
Pearce, Jo; University College London, UK
Perrin, Jacqueline; Oxford Brookes University, UK
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Epistemic Insight

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