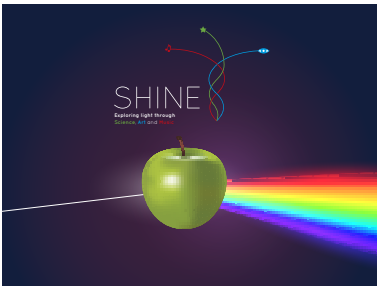
St Andrews Voices

University of St Andrews

byreopera

Science & Technology Facilities Council

In partnership with the School of Physics and Astronomy



John Eccles (composer) and William Congreve (librettist)

The Judgment of Paris (1701)

"O're whelm'd with a Torrent of Light"

Thursday 25 October, 2018

Byre Theatre

5.30pm

Cast List

Paris:	**Kat Gunya** (2nd year, MA Psychology)
Juno:	**Alice Gold** (4th year, MA Art History)
Pallas:	**Georgia Curwen** (2nd year, MA Classical Studies)
Venus:	**Seonaid Eadie** (4th year, MA Ancient History & Latin)
Mercury:	**Alexander Hayes** (Staff, Development Office)
Chorus:	**Holly Scrivener** (3rd year, MA English)
	Thea Moe Bjoeranger (4th year MA Art History)
	Parker Gordon (2nd year, PhD English)
	Ross McArthur (2nd year, MA Biblical Studies)

Orchestra

Strings coach:	**Feargus Hetherington** (Associate Teacher, University Music Centre)
Violins:	**Joanna Phillips** (1st year, MA History)
	Charlotte Perkins (2nd year, MA IR)
Viola:	**Feargus Hetherington** (Associate Teacher, University Music Centre)
Cello:	**Lucy Hellawell** (2nd year, MA History)
Flute:	**Iona Baillie** (3rd year, MGeol Earth Sciences)
Recorders:	**Dr Alexander Scholz** (Director, University Observatory);
	Dr Antonia Wilmot-Smith (Senior Lecturer, Maths & Stats)
Oboe:	**Laoise Rogers** (1st year, MA Geog. & IR)
Trumpets:	**Alex Robinson** (1st year, MA Economics)
	William McCartney-Moore (3rd year, MA Ancient Hist.)
Timpani:	**Michael Medina** (1st year, MA IR)
Harpsichord:	**Claire Innes-Hopkins** (Acting University Organist and Director of Chapel Choirs)
Lighting Designer:	**Tim Fitzpatrick** (The Red Field)
Director:	**Dr Jane Pettegree** (Director of Teaching: Music as Part of Your Degree)
Stage Manager:	**Amy Addinall** (4th year, BSc Medicine)
Byre Technical Support:	**David Venters, Pieter MacMillan, Lewis Allan, Daniel Hippisley, Scott McKeen**

SHINE Project Leader: Dr Anne-Marie Weijmans (Reader - School of Physics & Astronomy). Anne-Marie joined the School of Physics and Astronomy at the University of St Andrews in 2013, after obtaining her PhD in Leiden (the Netherlands) and a research fellowship in Toronto (Canada). Her research concentrates on galaxies, using spectra of galaxies to map the stars, gas and dark matter in these systems, and to study how galaxies form and evolve over cosmic time. She is the initiator and project lead of Shine: a collaboration between science, music and art, to explore light and its use in astronomy. She has been awarded a Leadership Fellowship in Public Engagement from the UK Science & Technology Facilities Council (STFC) for her work on Shine. In her spare time, Anne-Marie plays the oboe at the University of St Andrews Music Centre.

Stage and Musical Director: Dr Jane Pettegree (Director of Teaching, Music as Part of Your Degree, Music Centre). Jane's doctoral research and first monograph was on early modern theatre in England (Foreign and Native on the English Stage, 1588-1611 (2011). Previous directing projects with the University of St Andrews' in-house opera company, Byre Opera, include Purcell's Dido and Aeneas (2009); Eccles' The Judgment of Paris (2011); Handel's Acis and Galatea (2013) and Gluck's Iphigenia in Tauride (2015).

Lighting Designer: Tim Fitzpatrick. Tim Fitzpatrick is an installation artist based in North East Fife and a founder member of the Fife-based community arts project The Red Field. Much of his work has combined light, sound and film and is often collaborative and across multiple disciplines. For the past three years Tim has been collaborating with Anne-Marie Weijmans of the School of Physics and Astronomy at the University of St Andrews on the Shine project and he is currently Artist in Residence for the Sloan Digital Sky Survey - an international astronomical survey based at the Apache Point Observatory, New Mexico, USA.

Education Officer: Ellen Thomson. Ellen graduated with a degree in music performance from Royal Birmingham Conservatoire in 1997. Her career began in London running workshops, teaching and developing as an arts administrator before becoming the first-ever Education Manager at the Royal Albert Hall in 2003. Following a move to Scotland, Ellen spent seven years as the Director of Education and Community Partnerships for the Royal Scottish National Orchestra before turning freelance in 2014 to combine work and bringing up her three children. She now devises projects and develops strategy for a variety of clients including sound in Aberdeen, St Andrews Voices Festival and the University of St Andrews Music Centre.

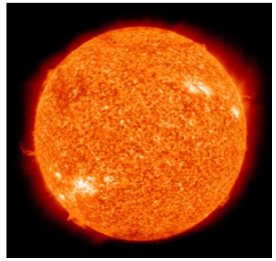
Shine at the opera

When we started Shine in 2015 to celebrate the International Year of Light, we had one goal: combining science, art and music to explore the properties of light, and how these properties play a role in modern astronomical research. Now, more than three years later, Shine still has that same goal. Light is fascinating, and can be studied from so many different angles. An astronomer will tell you that light is essential to understand the Universe that we live in: we cannot travel to the stars, but we can still study their light through our telescopes. An artist will tell you that light can be both an inspiration and an ingredient for art, and is vital for experiencing art: without light, we would not be able to see any artwork. And a musician relies on light to play their music, and can find many similarities between the behavior of sound waves and light waves. So what would be a better way to celebrate light than an opera, with a light show and a stellar backdrop? Shine is very proud to present their very first opera production, in collaboration with Byre Opera and the St Andrews Voices Festival, and we hope that you will enjoy this latest addition to our Shine adventure!

Dr Anne-Marie Weijmans

Stars and Goddesses

Composer John Eccles had a strict scheme linking harmony, colour and character when he composed *The Judgment of Paris*. Pallas is associated with the highly energetic blue colour; Juno with the opposing red colour; and Venus persuades Paris to part with his apple in-between these extremes, using the colour green. But how would an astronomer assign colours? And how would an astronomer judge which is the most beautiful? To find the answer, we have to look at the sky.



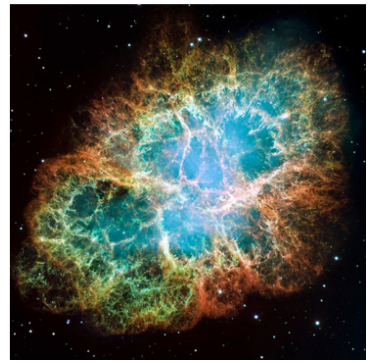
[right] The Sun, observed by NASA's Solar Dynamics Observatory. Note the solar flares! [credit: NASA/SDO].

The nearest star to Earth is the Sun. The Sun is a big sphere of gas, fuelled by the hydrogen gas in her core. The yellow surface of the Sun is 5500 degrees Celsius, so it is a good thing that we on Earth are a comfortable 150 million kilometers away. The Sun gives us light and energy, and makes life possible on Earth. She has been around for a good 4.5 billion years, and will keep us warm for another 4.5 billion years.

[left] Star field observed by the Hubble Space Telescope [credit: ESA/Hubble].

The Sun is just one of the over 100 billion stars that make up the Milky Way. A look at the night sky, especially on a very clear, dark night, will show you that not all of these stars are yellow like the Sun; some of them are blue, while others are red. What causes these stars to have such different colours?

Blue stars are the rarest stars, but because these stars are so big and bright (over 10,000 times as bright as our Sun), we can see them over large distances. Blue giant stars appear blue, because of their high temperature: they can be as hot as 30,000 degrees Celsius at their surface. Although blue is usually associated with cold, in actual physics, blue tells you that something has a high temperature. A very hot star therefore emits most of its light as blue light (look up "Wien's law" if you want to know more about this). The blue colour of the flame of a Bunsen burner or camping gas cooker will give you the same warning – 'blue hot'. Unfortunately for these blue giant stars, being so bright means that they also very quickly run out of hydrogen gas: they die after just 10 million years of stellar life. And although 10 million seems like a respectable age, life on Earth has taken a lot longer than that to develop. But although blue giants may not make the best Suns for planets that host life, they do give one final show at the end of their life: these heavy stars are the ones that will explode in a supernova, leaving behind a black hole.



[right] The Crab Nebula: a remnant of a super nova, observed by the Hubble Space Telescope [credit: NASA, ESA, J. Hester and A. Loll, Arizona State University].

What about the red stars? Most of the stars in the Milky Way are red dwarf stars: they are only half the size of the Sun or smaller. The nearest star to the Sun, Proxima Centauri, is an example of a red dwarf star. These stars are also the coldest stars around: they 'only' have a temperature of up to 4000 degrees, and can be as cold as 3000 degrees Celsius. This is still hot enough to fuse hydrogen in their cores and shine, but a visit to a red dwarf must be a cold breeze compared to a hot blue giant star! However, red dwarfs have a good survival rate: in fact no red dwarf star has ever died yet. Because they are so 'cold', they can shine for 100 billion years, much longer than the age of the Universe (13.7 billion years). So would red dwarfs make good Suns for planets that harbour life? For life, a planet needs liquid water, and since red dwarfs are cooler stars, a planet would have to be pretty close to its Sun. And then those nasty, big solar flares could become an issue…

Finally, what about green? This colour is not the most obvious colour we see in deep space. Perhaps to find the best and richest examples of the colour green, we need to look not at just the stars, but at our own planet – beautiful earth, seen from space. Green is evidence of photosynthesis – the colour of life.

So, which star is best? An astronomer interested in life on other planets will have a clear answer for you. But is that the best way to judge the beauty of a colour? How would you judge?

The Judgment of Paris (synopsis)

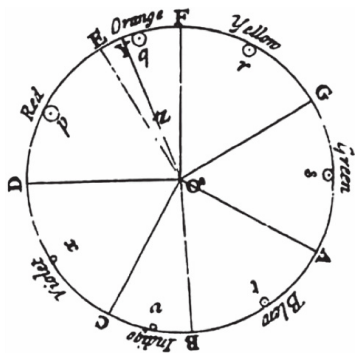
The three senior goddesses of the Greek pantheon - Juno, wife of Jove; Pallas Athena; and Venus, goddess of love – all want a fabulous apple, and Mercury is sent to Earth to find an impartial judge. The task falls to Paris, a simple shepherd. The opera gives each goddess two attempts to persuade Paris that what she has to offer merits the prize. In the classical story, this was simply a beauty contest. But in the libretto and our production, the goddesses are also offering Paris a wider set of attributes and life choices. Juno offers power and luxury. Pallas offers a life of strenuous martial bravery and physical endeavour. And Venus offers a life away from the spotlight, dedicated to "one true love". In our production, this includes the passions of the mind: both Venus and Paris are literally star-struck.

[right] Title page to the first published edition of the opera. London: Walsh and Hare, 1702]

Background to the opera: Isaac Newton, Opticks, and Opera

In March 1700, readers of the London Gazette were intrigued by an advert for a prize of 100 guineas offered for a newly composed English opera to be titled *The Judgment of Paris*, with a libretto written by leading playwright William Congreve. The prize was the idea of Charles Montagu, soon to be Lord Halifax, a recent president of the Royal Society of London and former student of, and lifelong friend and patron of, Isaac Newton. The agenda was to re-launch opera on the English stage, with a story that had impeccable classical credentials. Aspects of the libretto, however, and the resulting music, suggest connections with contemporary theories on the possible connections between sound and light. Four operas were composed for first performances in 1701, by John Weldon (the winner of the prize), John Eccles, Daniel Purcell (son of Henry), and Gottfried Finger, of which all but Eccles's work have sunk into obscurity.

Our 2018 production explores the way in which Eccles's opera uses the sounds of words, voice types, and even musical keys to associate plot and character with the colour spectrum. The foremost English scientist of the age was Isaac Newton, known today for his experiment-based scientific work on such fundamental ideas as gravity, motion and light. Some of Newton's earliest papers had been on optics i.e. light, delivered first as lectures to Cambridge undergraduates in the 1670s, and then circulated to the Royal Society (e.g. *Philosophical Transactions* Feb 1672, 'A New Theory about Light and Colours'). By 1701, his experimental demonstration that sunlight can be broken down into the colours of the spectrum using a prism was well-known in scientific circles. Even more amazing, to Newton, was that having 'decomposed' white light, the various colours could be re-combined by prismatic refraction into the original beam of pure white. Having demonstrated the phenomenon, Newton continued to ponder on the reasons behind this scientific marvel. Encouraged by his election in 1703 to the post of President of the Royal Society, achieved with the backing of his friend the opera-lover Charles Montagu, Newton finally published his research on light for a wider public under the name of *Opticks* (1704), including an appendix speculating on the possible connections between light spectra and sound spectra: in other words, mapping colours to note pitches.



[left] Colour Wheel from Opticks (1704), mapping colours to diatonic scale notes. 7 colours, 7 diatonic notes. [credit: Newton shows the light: a commentary on Newton (1672) 'A letter … containing his new theory about light and colours…' Patricia Fara, Phil. Transactions of the Royal Society March 2015].

Although there is no (known) evidence of direct collaboration between Newton and the opera team, and indeed, some evidence that Newton didn't much like opera, Newton's speculations are suggestive for the characterization and plotting of Eccles and Congreve's opera. We now know that many of Newton's ideas about light and sound were rather wild, but his colour wheel does, surprisingly, map exactly to the same tonal regions associated with the three goddesses in the opera. Modern science shows us that red light is less energetic than blue light (red light has a longer wavelength and a lower frequency than blue light), which factors explain the different degrees of refraction. Our opera has mapped this to an 'energetics' schema that associates Juno with slow movements, Pallas with rapid change, and Venus with a middle way. When the three goddesses sing together in a trio at the centre of the work, Paris complains that he is overwhelmed by a 'torrent of light', suggesting the re-combination of the three primary spectral colours into white light noted by Newton (look out for the white light in the performing space when green, red and blue combine).

Look out for the colour shifts on stage when different goddesses sing, and the music changes key. Juno is, on average, more associated with reds and oranges: the tonal centres of d minor and E major. Pallas has a particular affinity to the blue tonal areas of A major and b minor (although her second aria, which doesn't 'move' Paris', is expressed with trumpets playing in the 'red' key of D major). The most notably individual pitch/colour cluster is associated with persuasive Venus. In her second set of arias, which win her the apple, Venus sings uses the mid-spectrum green-yellow range of g minor for the first and only time in the opera. To underline the distinctive difference, Eccles brings into the orchestral "colour palette" the distinctive sounds of the recorder.

William Congreve, who wrote the libretto for the opera, was also sensitive to the affective 'coloration' of words. The libretto pushes Juno and Pallas into polarized sound worlds, with Venus inhabiting a middle ground. Contralto Juno, the queen of the gods, sings with a concentration of heavy, long, open vowels; soprano Pallas, a warrior goddess, issues her call to arms using lots of fizzing consonants reinforced by loud wind, brass and timpani. Venus's text blends consonants and vowels in a more moderate way, with patterns of voiced consonants, and her music reinforces this by blending strings with the gentler winds.

One last piece of curious backstory might be relevant. Charles Montagu, the sponsor of this opera, was to become the lifetime lover of Isaac Newton's beautiful niece, Catherine Barton, leaving her £20,000 on his death in 1715 'for her excellent conversation'. She was first mentioned in his will from 1706, with a greater amendment in 1712. Verses about her survive from the notes of the Kit-Kat club, a society of Whig-leaning gentlemen, attributed to Montagu and written around 1703, which cast Catherine Barton as a kind of Venus:

> Beauty and Wit strove each, in vain,
> To vanquish Bacchus and his Train;
> But Barton with successful Charms
> From both their Quivers drew her Arms;

And in another poem we find a metaphor that suggests Barton is a drinking glass which acts, like a prism, to focuses love's flames on the lover's heart:

> Stampt with her reigning Charms, this Standard Glass
> Shall current through the Realms of Bacchus pass;
> Full fraught with beauty shall new Flames impart,
> And mint her shining Image on the Heart.

Jane Pettegree

Join us again in 2019

We hope you'll join us again for St Andrews Voices next year and encourage your friends and family to come along too.

Dates for your diary: 17-20 October 2019

We have lots of exciting plans in the pipeline which we can't wait to share with you. To receive the latest festival news, sign up to our newsletter at **www.standrewsvoices.com/contact** or fill in one of our keeping in touch postcards.

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