Science on the stage

Recent plays on scientific topics show that science and theatre have more in common than it appears

The separation between science and art is not only objectively erroneous, but also dangerous, if taken seriously... it prevents the real world from being an object of fantasy; this way we favour a lack of culture that we are bound to face when we prefer a specific competence to the exploitation of all the possible means to reach knowledge of nature and of the world... let us then forget all deceiving distinctions and let us exploit all man's capabilities, his wit, his feelings and his fantasy. Let us accompany a well-mastered objectivity with a colourful speech, in order to create not only an objectively better knowledge than the one we possessed before, but also a more pleasant one.

Paul Feyerabend, scientist and philosopher (1924–1994)

Art and science are often considered to be two disciplines that are diametrically opposed. Art is entertainment—often provocative—and is seen as a mysterious form of creativity based on personal idiosyncrasies. It is not able to offer a reason, nor solve a misunderstanding, but instead poses questions and sometimes challenges well-established views. Science, in contrast, is regarded as pure, methodical rationality that explains observations and validates theories on the basis of factual affirmation. Such deep stereotypes, held by laypersons, artists and scientists alike, drive a strong wedge between the two activities. But such disciplinary boundaries are contingent and largely arbitrary, and history contains many figures who have successfully transgressed them. We are all familiar with the fascinating combination of science and art in the technical, anatomical and biological drawings of Leonardo da Vinci. Later during the Enlightenment, figures such as Francois Marie Arouet, better known as Voltaire, Gottfried Wilhelm von Leibniz and Benjamin Franklin discussed scientific questions with the same ease as philosophy, politics or the latest novel. And Johann Wolfgang von Goethe, the famous author of numerous theatre plays and novels, was equally interested in science.

Nevertheless, the theatrical representation of science has been relatively rare. The few notable exceptions have often portrayed scientists who led particularly dramatic lives or whose work had significant implications for society. Galileo Galilei's confrontation with the Holy Inquisition is the subject of Bertold Brecht's *Life of Galilei*, written between 1938 and 1939. The play centres on his decision whether to defend his discovery that the Earth revolves around the Sun and be condemned as a heretic, or whether to withdraw his claim and thus save his life. Friedrich Dürrenmatt's *Physicists*, first performed in 1962, and Heiner Kipphardt's *The Case of J. Robert Oppenheimer*, first performed in 1964, both explore the political and moral dilemmas of the scientists who developed the atom bomb. And Tom Stoppard's *Arcadia*, written in 1993,

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is an elaborate comedy of not only literary history but also mathematics and physics, with a fugitive description of Fermat's last theorem appearing within the first five minutes of the play and iterated algorithms and chaos theory occupying a significant part of the remainder.

A more sensational and resonant encounter between science and the theatre is Michael Frayn's *Copenhagen*, first previewed in London at the Cottesloe Theatre in 1998 and then performed in London and New York City for the subsequent two years. The play is based on the uncertainties surrounding the 1941 meeting of the physicists Niels Bohr and Werner Heisenberg in German-occupied Copenhagen. The two were long-standing collaborators on the development of quantum theory and their work had opened the way into the atom. But they then found themselves on opposite sides

of a world war: Bohr was half-Jewish and a citizen of occupied Denmark, Heisenberg was a professor at Leipzig, and, unknown to Bohr, also head of the Nazi's project to develop nuclear weapons.

The events surrounding, and the possible motives for, Heisenberg's visit are explored by the 'spirits' of Heisenberg, Bohr and his wife. They replay the events in three different permutations in search of alternative outcomes, including whether World War II would have taken a different course if Heisenberg had managed to solve the problem of nuclear fission. In addition to elucidating the historical and political importance of Heisenberg's visit, *Copenhagen* is vividly impregnated with the theories of quantum mechanics that the two scientists had developed together. This is apparent in memorable scenes, in which Frayn spins poetic metaphors between principles of physics, notably Heisenberg's uncertainty principle and Bohr's complementarity principle, and when Frayn lets Bohr define nuclear fission: 'What happens in fission? You fire a neutron at a uranium nucleus, it splits, and it releases energy.'

Recently, scientists themselves have discovered theatre as a means not only to abandon their institutional and disciplinary trenches, but also to bridge the chasm between the two seemingly different cultures. Carl Djerassi, the father of steroid oral contraception, is not only an eminent scientist, but also a novelist and playwright. In *An Immaculate Misconception*, which premiered in 1999, the American chemist explores the new advances in contraception and assisted reproduction—notably intracytoplasmic sperm injection—together with the ethical and societal issues associated with this new era of reproductive technology.

His second play, *Oxygen*, hit the stage in 2001 and was written with Roald Hoffmann, also a famous scientist, poet and a Nobel laureate in chemistry. It portrays the decision to award the first post-mortem Nobel Prize in chemistry for the discovery of oxygen, which took place before the establishment of the Prize in

Jacque Bablet

Scenes from Alain Prochiantz's and Jean François Peyret's *La Génisse et le Pythagoricien*

1901. At around the same time in the early 18th Century, the Frenchman Antoine Lavoisier, the Swede Carl Wilhelm Scheele and the Englishman Joseph Priestley all claimed to have isolated the element, which overthrew the phlogiston theory and revolutionised chemistry. The action alternates between 18th Century laboratories and the Nobel committee, who are faced with a difficult choice as to who deserves the most credit for the discovery. With an intentional nod to women, the work of the chemists is introduced through the voices of their wives during their imaginary meeting in a sauna. Within this original plot, the play wittily deals with the meaning of scientific discovery and with the ethical issues related to meritocracy and priority in the backstage politics of scientific production.

Alain Prochiantz, Director of the Department of Biology at the École Normale Supérieure in Paris, is another eclectic scientist who has brought science to the stage. His *Biology in the Bedroom*—named after Sade's *Philosophy in the Bedroom*—explains, through didactic dialogue, notions of embryology and neurobiology and thus the concept of individuality to a young girl. Describing why he writes plays in addition to his scientific work, Prochiantz said, 'Taking our time to create a theatrical experience is an occasion to do science differently, to show its hidden side, the one that never appears in the official discourse. What scientific discovery owes to imagination is often hidden and neglected and the organisation of scientific work does not leave space for games of reflection.'

Together with the stage director Jean François Peyret, he has now written another play, *La Génisse et le Pythagoricien* (*The Cow and the Pythagoric*), which premièred on April 17 this year at the Théâtre Nationale de Strasbourg, one of the five national theatres in France. Its subject is the form and its changes, represented on stage through the *Metamorphoses* of Ovid, the poet who sings about the change of the form and who is obsessed by the fragile separation between animality and humanity—a border

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that modern biology is increasingly questioning. As an example, the playwrights explain Creutzfeldt–Jacob disease as a transformation of the brain, which in turn is a result of the change in an endogenous protein, a 'molecular metamorphosis'. In parallel they describe the myth of Io, a young mistress transformed into a cow by Jupiter to protect her from Juno. The structure of the play does not conform to convention: the stage is divided into two separate scenes, there are no fixed characters featuring from beginning to end and the plot is replaced with individual sentences, poems and dense, quick dialogues, at times accompanied by live piano music.

'On the stage the main aim is to find a link between the speech and the body,' said Peyret. 'In our case, it has been a

challenging and incredibly interesting task to link the scientific discourse, epitome of clarity and integrity, to a corporeality, which belongs to the stage,' he explained. 'We wanted the scientific discourse to exit its own domain and enter the world of fantasy, of literary imagination.' The two Frenchmen are already preparing another play about chimeras in literature and science to be staged later this year in Germany.

In addition to chemistry, physics and biology, mathematics has also become a subject of theatre through the work of the Cambridge mathematician John Barrow. He has written a text on the infinite, a concept that 'corrupts and devastates all the others' as Jorge Luis Borges, the Argentinian poet and author, said. The play, called *Infinites*, consists of five paradoxical scenarios, each representing a different aspect of the infinite. The first refers to David Hilbert's imaginary hotel with an infinite number of occupied rooms, where an infinite number of guests need to be accommodated. The second imagines that human beings have an infinite, immortal existence, with all the consequences that this privilege entails, a clear parallel to the myth of Eos and Thitonius. A third scenario deals with Borges' *Infinite Library*: in an infinite universe there should be infinite copies of each of us and of our world. In a fourth, we witness the fight between the ideas of mathematician Georg Cantor and his mentor Leopold Kronecker about the mathematics of infinity. The last scenario—with literary influences from H.G. Wells' *The Time Machine* to Douglas

Adams' *Hitchhiker's Guide to the Galaxy*—deals with an infinite journey back in time. The structure of this play is also quite unique. The concept of infinity is transferred to the stage without the mediation of any characters or even a specific plot, and the scenarios are set in five different rooms that the audience must visit in succession. The play was translated into Italian and staged and directed by Luca Ronconi, one of the most prominent and innovative theatre directors in Italy. He has welcomed the text by John Barrow and is eager to discover whether and how scientific themes and the use of scientific language can modify and interact with conventional dramaturgy.

Both scientists and artists have illustrated that the fusion of their disciplines is not only possible but also rewarding. Clearly, the huge success of *Copenhagen* and also the increasing number of plays dealing with the moral, political and

philosophical aspects of science are paving the way for a permanent change in the perception of science as a part of our culture and, as such, a legitimate topic for theatre. And theatre, which is often a means of entertainment or a stimulus for

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moral, political and personal reflection, is becoming a vehicle for scientific didacticism. It can convey concepts and stimulate elaborate reflections about them—here, pedagogy and drama are not antithetical.

It is pertinent to note that 'theatre' has the same etymological root as 'theory'. The two words derive from the Greek *thea*, which means 'a view'. Scientific

theory in the western tradition is strongly connected to observation and vision. According to the Greek philosopher Plato, we see with our eyes only the essences or ideas observed through our intuitive mind. This is a powerful metaphor for the scientific enterprise. Similarly on stage, we observe a representation of what we know or have experimented with elsewhere. On the other hand, the theatrical and the visual can also be part of scientific seminars or demonstrations of experiments, as proven by Alessandro Volta's memorable demonstrations of the mechanism of the battery at the Italian University of Pavia. The amalgamation of scientific and artistic activities can thus be seen as an auspicious goal, linking two cultures that, in reality, are not so very far apart.

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