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'If You Want to Be Green Hold Your Breath': Climate Change in British Theatre

With a rich mix of theatrical material to bring to the table, the climate-change debate playing out in the public domain would seem well adapted to the stage, and has often been presented in docu-dramatic form, as in Al Gore's well-known film *An Inconvenient Truth*. But until relatively recently climate change and the science relating to it have been conspicuous by their absence from the stage. Early movers on the climate-change theatre scene included Caryl Churchill's 2006 climate-change libretto for the London Proms, *We Turned on the Light*, and John Godber's 2007 play *Crown Prince*. Since then, interest has steadily increased. In 2009 came Steve Waters's double bill *The Contingency Plan (On the Beach and Resilience)*. This was quickly followed by *Earthquakes in London* by Mike Bartlett in 2010, and by three further plays in the spring of 2011: *Greenland*, the collaborative work of Moira Buffini, Matt Charman, Penelope Skinner, and Jack Thorne; *The Heretic* by Richard Bean; and *Wastwater* by Simon Stephens. In this article Julie Hudson focuses on three of these works to explore how the plays engage with the debate through the medium of climate-change science. As her article suggests, these British climate-change plays make an important and occasionally subversive contribution to the long-running discourse on the relationship between science, the ecosystem, and human beings. In performance, they succeed in turning a subject that has been overplayed for effect in the public domain into compelling theatre. Julie Hudson is currently a visiting fellow at the Smith School of Enterprise and the Environment, Oxford University.

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THE CLIMATE-CHANGE DEBATE playing out in the public domain is made for the stage. It brings a rich mix of inherently theatrical material to the table: human interest, ethical dilemmas, narrative tension, metaphor, special effects, and universal questions about the relationship between humanity and the environment. And this real-world debate and the science that underpins it have often been constructed as a series of docu-dramatic performances.¹ But in spite of its obvious dramatic appeal, climate-change science had, until relatively recently, been conspicuous by its absence on the stage. Hence, in the Appendix to her *Science on the Stage*, Kirsten Shepherd-Barr (2006, p. 219–30) lists no fewer than 82 science plays written between 1992 (the year of the Rio *Earth Summit*) and 2004 without directly discussing climate-change science.² This was no accidental omission:

the presence of climate change and its science on the stage was barely visible when Shepherd-Barr's book went to press just six years ago.

Hints of what was to come are found in works that appeared close to this time. Clare Pollard's *The Weather* (2004) depicts unpleasant family atmospherics generated by dysfunctional relationships,³ and climate change is woven into the fabric of the play as one of the problems for which no one (especially of the older generation) wants to take responsibility. Caryl Churchill's 2006 climate-change libretto for the London Proms, *We Turned on the Light*, takes hold of the vexed issue of intergenerational ethics in the context of resource profligacy and a disregard for the well-being of future generations.⁴ And John Godber's *Crown Prince* (2007)⁵ depicts the younger generation campaigning about

climate change while the older generation indulges in pointless power struggles on the bowling green. As Godber's protagonists age by two decades, the climate warms, rising sea-levels swallow up Leeds and Sheffield (p. 339),⁶ and the older generation still thinks global warming is 'nothing to do with them' (Introduction).

A rapid escalation of interest in climate change on the stage followed these beginnings. In 2009 Steve Waters's double bill *The Contingency Plan (On the Beach and Resilience)*⁷ arrived, closely followed by *Earthquakes in London* by Mike Bartlett (2010),⁸ and by three further plays in the spring of 2011: *Greenland* by Moira Buffini, Matt Charman, Penelope Skinner, and Jack Thorne;⁹ *The Heretic* by Richard Bean,¹⁰ and *Wastwater* by Simon Stephens.¹¹

The reactions of theatre critics to the most recent arrivals suggest that, from the perspective of the audience, these plays as a group constitute 'a fruitful intersection in the form of dramas that utilize scientific ideas or feature scientists at their centre' (Shepherd-Barr, p. 1). Waters's plays were acclaimed as an 'urgent wake-up call', also managing to present the issues in 'compelling human terms' (*Guardian*, 8 May 2009).¹² Charles Spencer (*Daily Telegraph*, 5 August 2010) opened his review of *Earthquakes in London* with a 'Whooooosh! And indeed wow,' going on to say that the 'show's mood of febrile anxiety about global warming at times succeeded in niggling even a crusty climate-change sceptic like myself'.¹³ The same reviewer later (*Daily Telegraph*, 20 February 2011) describes *The Heretic* as 'a corker'. His review concludes: 'It is great to see the Court putting on a play which will vastly offend a large section of its audience.' *Wastwater's* subtle approach meanwhile received praise from Andrew Dickson (*Guardian*, 9 April 2011) for successfully avoiding 'environmentalist agitprop'.

Given the signs of a lively environmental debate under way in the audience, on the evidence of these reviews, it becomes even more puzzling that climate-change science was so slow in coming to the stage. However, this is less surprising than it may seem: for

two significant challenges face the climate-change science playwright. First, if there is a universal truth in climate-change science it is drowned out by the noise of a sometimes vociferous science-laden discussion in which (contrary to the way science or the science play is generally done) unidirectional yes-or-no answers are demanded.¹⁴ Second, for environmentalists and eco-critics alike, science plays an ambivalent role (cf. Heise,¹⁵ 1997, and Garrard,¹⁶ 2004, p. 8).

Science, the Environment, and the Arts

The difficult mental block in the relationship between science and the environment as configured within the arts must somehow be reshaped for an environmental-science play (or a climate-change play) to work as a performance text.¹⁷ As Heise, commenting on the relationship between eco-criticism and science, says (p. 2): 'If the context out of which scientific research emerges is shaped by certain values, it does not naturally follow that the results of this research will lend support to these values.' Paraphrasing, if what climate-change science says about the environment (and indeed about science) is shaped by certain values, it does not necessarily follow that what happens on the stage, or how the audience reacts to what is on the stage, will support those values.

This article explores ambivalence in the context of climate-change science as evidenced for the stage in three plays, drawing initially on the performance-focused taxonomy provided by Shepherd-Barr (p. 4). For the climate-change plays at the time of writing, two of the four categories she lists are readily identifiable, both forms often occurring within the same play: docu-drama in which aspects of real-world climate-change science are depicted; and plays written by the non-scientist playwright seeking to exploit the subject matter of climate-change science for the performativity and theatricality it brings to the table, as briefly described in the opening lines above.

An aspect of the theatricality of climate-change science as debated in the public domain is found in the use of theatrical

props such as climate models, the infamous hockey-stick graph, and visual images such as polar bears, birds, and calving icebergs. Such climate-change iconography and the narrative that accompanies it, henceforth referred to as docu-science, also appear in the plays where docu-science performs several theatrical functions. Sometimes it is there to provide an authentic context within which otherwise fictional characters (who may or may not be scientists) play out aspects of human behaviour, as in *The Contingency Plan* and *The Heretic*. Sometimes it is there to describe the current state of play in climate-change science, with the aim of educating and informing, most obviously so in *Greenland*, and more subtly (as discussed below) in *The Contingency Plan* and *Earthquakes*. Sometimes docu-science drives the behaviour of some of the protagonists, as in *Earthquakes*.

Docu-science is also used in some of the plays to debunk the public-domain uses and abuses of science as agitprop by insisting on the non-unidirectional nature of climate change and its science. The climate is, after all, a system, and systems are multi-directional by definition. As scientist James Lovelock put it: 'Science tries to be global . . . but even those who take a systems-science approach would be the first to admit that our understanding of the Earth system is not much better than a nineteenth-century physician's understanding of a patient.'¹⁸ The scientists who do not accept Lovelock's metaphorical approach to science in the context of Gaia Theory may also object to the creative docu-science in plays such as *The Contingency Plan* and *The Heretic*. However, on the evidence of these plays fictionalized docu-science has a powerful role to play in dealing with climate-change ethics on the stage.

Together with imaginatively used climate-change docu-science, several of the plays (notably *The Contingency Plan*) take a leaf out of seminal works such as Michael Frayn's *Copenhagen*, throughout which the process of drafting and redrafting a scientific paper shapes plot and dialogue. Waters, too, leverages the procedures of scientific activity as

much for their theatricality as for the metaphorical depth they provide.

In the following sections, this article considers both strands – the docu-dramatic and the dramatic uses of climate-change science – focusing on three of the above-mentioned works: *The Contingency Plan*, *Earthquakes in London*, and *The Heretic*. Each of these plays has been selected specifically for its use of scientific ideas (including creative docu-science) in such a way as to address the different levels of scientific knowledge as well as the several points of view on science and the environment likely to be encountered in the audience.

The Contingency Plan

In the two two-act (three-scene) plays of Steve Waters's 2009 double bill *On the Beach* and *Resilience* a tight cast of five (playing five protagonists in each play, seven in the double bill) tells the apocalyptic tale of an extreme weather event that needlessly kills people because science-based warnings were not acted on. The two plays are similarly structured. Act One in each play takes place in April, with Act One in the second play picking up where Act One left off in the first; and Act Two in each play takes place in September, depicting events that took place in parallel in different locations.

The disaster depicted in the play is a fictional one but Waters makes sure that it accords with an actual, historical flood (in 1953). The story plays out in the context of a tightly knit family with scientist father and son (Robin and Will) at its core. As the first play opens, the audience finds the family in their isolated beach-front family home. The unusual presence of an egret warns of stormy weather.¹⁹ In the meantime Robin and his wife are waiting for Will as he returns home early from the Antarctic, girlfriend in tow. She, an ambitious environmental civil servant, pitches Will right back into the politically driven manipulation of science Robin had fled from in the 1970s.

The second play in the double bill picks up the story from Will and Sarika's departure to London (to deal with the first of the

two floods in the play) at the end of Act One of *On the Beach*. *Resilience* opens in a Whitehall bunker, a visual shock that separates all concerned (audience and protagonists) from any sense of connectivity to the outside world, with the external environment nevertheless still centre stage as the driver of events. Trapped in this pressure cooker with computers, phones, food smells, and one another for company, politicians and scientists fight over and eventually (in Act Two) mismanage the government's extreme-weather contingency plans, and so the flood wipes out several UK cities – and (as we know from the ending of *On the Beach*) Robin and the family home.

Depictions of natural disasters in the media are often accompanied by large-scale visual images, something that could at first sight make such scenarios challenging on stage; for science plays (unlike film and television) tend to combine 'visual minimization and textual abundance' (Shepherd-Barr, p. 2). Apocalyptic or not, visual frugality and dialogic abundance is a good description of Waters's double bill. One simple small-room setting for each play allows 'imaginary forces'²⁰ to do the work of bringing in the bigger picture.

As the first play opens, the idea of 'looking out to sea' (p. 9) is prompted by the sight of the 'wiry . . . weather-beaten' Robin peering through his powerful telescope (p. 9), combined with auditory cues (stage directions describe 'a wash of sound, the distant suck of surf, battling gulls, a dredger' (p. 10), leaving the audience to draw in the wide sweep of coastal wetland and sea. In the second play the UK-wide offstage scenes of natural disaster are linked to the bunker room through the medium of auditory fragments. Some of these are verbal descriptions: for instance, Will talks about the footage of huge waves off Spurn Head through the webcam on his computer (p. 161). Many auditory cues are received through electronic media (contrasting with the first play, in which telephones are ignored and BlackBerries often fail to connect). As *Resilience* progresses these connections steadily deteriorate, culminating in a power cut (p. 170). This device

produces a progressive narrowing of sensory perspective, causing the audience to share Will's sense of desolation more intimately, and also, on another scale, to appreciate how easily the elements can cut off the energy and other trappings of civilization on which so much hangs.

Much of the science in the play is at once recognizable as straight docu-drama. It is blatantly connected to identifiable contemporary publications widely discussed in the media, such as the reports of the Intergovernmental Panel on Climate Change (IPCC). Thus the intention to inform the science debate is clearly signalled. Climate science also appears as partially fictionalized docu-science, all the more powerful for having been carefully researched and purposefully tweaked.

The 'Stability Hypothesis'

The play's fictionalized glaciology-based 'Stability Hypothesis' is central to the narrative, core to the science as depicted in the plays, and integral to the leading theme in them. The twin ideas of stability and resilience run through every aspect of the plot, and are reinforced in scenes in which the scientist, in classic science-play fashion, puts on a performance. A practical joke is played by government scientist Jenks who sets off a rape alarm (p. 115), and describes the reactions of his colleagues (and perhaps the audience too) back to them: panic, shock, anger, learned passivity, resilience 'utterly depleted'. He immediately follows this by forcing the colleagues he has just depleted of resilience to act out a toe-curlingly artificial (thus, comical) resilience allegory under his direction (p. 115–19). The aim of all of this highly theatrical subversive behaviour is to focus the 'scientific community' (p. 120), government policymakers, and civil society – in microcosm both on the stage and in the audience – on 'the level of preparedness' for so-called one-hundred-year events. In this plot glaciological change is the force that might drive such events, should the worst happen.

The science of glaciology in the play is identifiably based on scientific papers pub-

lished from the 1970s onwards (when Robin was involved in the field), and the questions about the rate of ice-melt at Pine Island Glacier are urgent real-life science questions now as then. However, there appears to be no identifiable theory called the 'stability hypothesis', although reference to an 'instability hypothesis'²¹ is readily to be found in scientific publications.

It seems that the theory first Robin and now Will seek to tear down through scientific endeavour does not exist, and therefore neither does the cause of the violent verbal battles between Robin and Will, and between Will and Jenks. The play repeatedly questions how science should be used to engineer societal resilience in the face of climatic instability. So (echoing Fred Pearce's review of *The Heretic*, below) why semi-fictionalize the key piece of science? The answer to this question lies in what is happening in the audience.

As John Cage puts it, each person in the audience 'is structuring the experience differently from anybody [else]'.²² Thus, for the layman the question of scientific ethics raised in the play in the context of data fudges allegedly perpetrated by Jenks in the 1970s is clear enough.

Whether it is based in fact or fiction does not matter to the uninformed ear or eye from the perspective of the effectiveness of the play on the stage. For the scientist the references to the real-life Pine Island Glacier data on which the Stability Hypothesis 'rests heavily' (p. 27) are a theatrical signpost. For those sufficiently involved with the real-life science or politics of climate change to make the link to the real-world 'instability hypothesis', the message about the dangers of allowing politics to shape science is emphasized. For this trick casts doubt about where the truth lies, prompting a pointed question: does such data manipulation actually happen?

The Theatrical Metaphor

Beyond this innovative use of docu-science, the second scientific device of note connects to precedents such as Frayn's *Copenhagen*:

here, Waters transforms the scientific simulation into an extended theatrical metaphor. This works on several levels. In Scene Two of *On the Beach* we see a literal simulation with the scientist in performance as Robin, 'with great solemnity' (p. 52) use a (physical) scale model and a 'measuring vessel' to explain in several stages the weather dynamics that could wipe out glaciologist Will's childhood home. This is a key scene, for it points to the simulation as metaphor in the bigger picture, as well as being clever plotting that will allow the audience to visualize what is happening to Will's home from the bunker room at the end of the second play.

In this bunker in *Resilience* we hear Will running verbally through docu-scientific simulations drawn directly from the real-world 2007 *Assessment Report* of the Intergovernmental Panel on Climate Change (IPCC). In the IPCC's climate models an all-Antarctic ice melt would (as in the play) translate to about sixty metres of sea-level rise, giving Nelson in Trafalgar Square an extremely close-up view of the sea (p. 125). These docu-simulations prepare for yet another – Will's computer-driven verbal 'perfect storm' simulation in the bunker (p. 130).

Metaphorically speaking, the plot briefly described can also be viewed as a series of simulations in human behaviour, when the plays are seen as a double bill. First Robin then Will leave their Antarctic science work to mix with politics. First Robin then Will try to undo scientific and political damage done by scientist colleague Jenks. The sense of simulation and experiment is reinforced by the casting: Waters directs that the same actors double in the new roles in the second play while the same people play the roles that run through both plays. Robin is (ironically) paired with science cheat Jenks, Jenny the stalwart bedrock of stability for Robin with Tessa the frighteningly competent Minister of Resilience, while Will and Sarika remain themselves. Real-life scientific simulations must not be co-dependent to have any predictive value but, in this plot, strong characterization ensures that the two simulations running in different generations collide with full emotional force:

WILL: If your work had emerged in 1974 –

ROBIN: My work did emerge, boy. And they spat in my face. I made the mistake of thinking the truth was its own ambassador. And if you do this, now, you will make the exact same mistake again. These people, they use you, this girl will use you too, suck you dry, suck the good out of you, make you nothing but a pimp to power –

Will hits Robin in the face.

...

WILL: You were wrong back then, and now, you're absolutely wrong again.

ROBIN: Go and tell that to Colin. Go and tell that to your new paymasters. (p. 64)

Waters, working with a well-known scientific tool on a conventional theatrical canvas, transforms the simulation from scientific (and didactic) tool into powerful many-sided metaphor, a dramaturgical lens through which we contemplate the human condition.

Earthquakes in London

In terms of its theatricality this energetic, chaotic, carnivalesque five-act play is quite different to the (apparently) more traditionally structured plays, *The Contingency Plan* and *The Heretic*. As described by Aleks Sierz, the 'joy' of watching the play 'comes from not knowing what will happen next or where'.²³ As in *The Contingency Plan*, the family is the crucible within which the ethics of climate-change science are explored.

Robert, genius, climate-change scientist, Cassandra-figure and reluctant father, is the fulcrum on which the plot (which weaves together family breakdown, scientific integrity destroyed by money, reconciliation, and redemption) turns. His life story and those of his wife, children, and in-laws are woven around each other as the play jumps from one to the other. At least at first, *Earthquakes in London's* constantly shifting episodic structure comes across to the audience as chaotic, and this is quite deliberate. As instructed by the writer, scenes 'crash into each other impolitely, overflow, and overlap' (p. 5). The audience is constantly reminded, Brechtian fashion, that this is a play, and, while it is thoroughly entertained by the tumbling

sequence of events, it also has to work to see the scientific metaphor underpinning the whole. Moreover, depending on how individual audience members structure the experience (Cage), different people may recognize a different scientific theory behind the metaphor.

In contrast to Waters's plays (visual frugality and textual richness) Mike Bartlett's *Earthquakes* combines textual richness with visual excess. This is not simply spectacle for its own sake: the play is 'about excess, and we should feel that' (p. 5). In the opening stage directions Bartlett directs that as much set, props, costume, scenery, sound, backdrops, lighting, projection should be used as possible.

Excess is, indeed, everywhere. The entire play tropes excess; it is exaggeratedly theatrical. The actors perform characters who, in turn, constantly put on performances. So, we see Freya singing along to '2525 Venice Beat ft Tess Timothy' while she makes coffee (p. 11); Jasmine's eco-burlesque 'Don't leave the world naked' scene (p. 30); Freya's pupil Peter singing with backing from partying students in a contiguous scene (p. 39); a group of singing mothers with prams and exploding babies (p. 65–7); Sarah's unhappy husband Colin singing *Arcade Fire* (p. 99) and dancing with Jasmine; and swimmers by an open-air pool who 'stand in a line and act as backing singers' for Freya singing *Deep Water* by Portishead (p. 45). We also see the metamorphosis of Freya's former school pupil Peter into her daughter-to-be Emily as a young adult (p. 135) before her eyes, achieved, in the Oxford Playhouse production of November 2011, by a deft onstage doffing of swaggering male teenage body-language and hoodie.

Docu-science is far less evident than in Waters's two plays; nevertheless docu-science is the hook on which all the above hang. The all-important idea of system change is communicated by Robert the scientist, who informs the audience of the state of play in this key aspect of climate-change science, specifically the ill-understood risks of sudden system collapse in ecosystems that go wrong:

If we look at geological records of historical climate change, the onset of the last ice age for instance, we see there is no steady climb, no year-by-year increase. There is in fact a relatively stable climate system, and then something happens, the system is stretched and in a moment, it collapses and changes, in hundreds not thousands of years. You understand? (p. 95–6)

The idea of system collapse is structural to the play in several senses. From the perspective of theme, excess is what sends environmental systems off the rails. In the plot, Robert's belief that human systems will collapse under the pressure of climate change explains his nihilist perspective on life (as with Robin, who decided to die in the waves in *On the Beach*). Robert sees the end of humanity as an inevitable consequence of climate change, and this warrants extreme action: 'If you want to be green hold your breath' (p. 103). He means this literally. Not living – an idea he extends to the abortion of his grandchild – is Robert's proposed solution to the 'footprint' (p. 103) problem of the growing population, and the 'terrible world' (p. 104) to come.

System Collapse and Chaos Theory

System collapse connects to chaos, but this play turns out to be as much about chaos theory (the science of deterministic but unpredictable systems) and self-regulating ecosystem equilibrium (Gaia Theory) as it is about 'simple' chaos. The structure of the play is the means by which this is achieved. The writer quite needlessly instructs that 'The production should always seem at risk of descending into chaos but never actually do so' (p. 5). In fact there is no danger of the play losing its equilibrium for the audience. The structural skeleton underpinning the play's lively dynamism is made visible by two self-conscious devices, which have the second-order effect of weaving the theme of time through the fabric of the play in two dimensions.

In the first of these devices, Robert appears at key moments in his life in four of the five prologues, in a deliberate authorial act of punctuation that is carefully engineered to

add emphasis at the play's catharsis. The first three prologues, beyond acting as visual and textual punctuation, are primarily narrative. At the start of Act One Robert is on his first date in 1968 with his wife-to-be, Grace, and in the prologues to Acts Two and Three, set in 1973, we find out that he may have compromised scientific integrity for money through two dialogues with businessmen-in-caricature Roy and Daniel, who had sought out a 'boffin' to look at the potential impact of aircraft emissions on the environment (second prologue, p. 42), in exchange for a large fee – subsequently increased (third prologue, p. 70) as an incentive to make the report more 'meaningful' (p. 69).

In the fourth prologue, past and present, (and indeed much else) collide. The audience has just watched the pregnant Freya's 'foetus' (in magnified ultrasound) turn its head towards them and scream as blackout falls. Still perhaps wondering at the sound a screaming foetus makes, the audience next sees the newly widowed younger Robert, science-obsessed and out of love with human beings, in the act of abandoning his two younger children to the care of their older sister. As the scene closes (2010) we see him confronted by the present-day Freya (p. 111), who tells him she is pregnant with the grandchild we already know he will tell her to abort (p. 104). Bartlett thus contrives to put the outsize visual image of the unborn child at the play's focal point, confronting the audience with one of the most difficult ethical issues for those engaging with climate science (cf. Churchill's seminal 2006 libretto, noted above).

The second carefully engineered conceit is the birth of Robert's three children almost exactly a decade apart in age. As a consequence Sarah (in her very early forties in 2010 by extrapolation from Act Four, p. 110), Freya (aged thirty in 2010, p. 111) and Jasmine (aged nineteen, p. 17) march to the tune of different generational cohorts. This device allows the narrative threads running through the lives of Robert and his offspring to collide in a spectacular display of ordered chaos. In the all-important fourth prologue no fewer than six generational cohorts (the

older Robert, Sarah in her twenties, Freya as a child, Jasmine as a baby, Freya in the present day, and Emily the unborn child) are represented on stage.

Thus, just at the point where visceral content is at its height, the play is emphatically metatheatrical, forcing the audience to participate in 'the shaping of an artifice the better to perceive the imaginative consequences signified by the performance' (Shepherd-Barr, p. 23, citing Cave).²⁴ The circular structure of the play however allows the audience to move beyond Robert's pessimistically reductive view of life: 'We are simply earthquakes ourselves, wonderful irregularities in the evolving nature of the universe. We're a cycle. A system. We die and the earth uses us for something new' (p. 162).

Whether the culture of excess that is putting the environment under threat is resolved in this play depends on the point of view. The Gaian perspective expects the human race to end, while chaos theory leaves the question open – deterministic but unpredictable. How the scientific metaphor underpinning the play is interpreted will depend on the scientific and cultural perspectives individual audience members bring to the play. The very audience experience itself thus recalls chaos theory.

The Heretic

In Richard Bean's five-act play we return to visual minimization and textual abundance. The focal point of the action is a university Earth Sciences Department, and, within that, the person of Dr Diane Cassell. The small cast of six performs in two settings: Dr Diane Cassell's office (Acts One to Three) and her kitchen (Acts Four to Five). There are two threads to Diane's story – her relationships with the younger generation and her science career. In the first, she successfully keeps daughter Phoebe (anorexic climate protester) and student Ben (self-harming obsessive environmentalist) in balance despite the challenges. In her professional life as a scientist, she strives to adhere to sound science but is overridden by her Head of Department and former lover, Kevin, in the name of money.

These threads are woven round incidents borrowed from the real-life context of climate-change science and delivered as a classic comedy: the virtuous Diane is undone (in terms of her science career) by villainous cheats (scientist Kevin and eco-terrorist Geoff). Kevin gets his just desserts, repents, and is forgiven; Geoff redeems himself by saving Diane's daughter's life, and environmentalist boy (Ben) proves himself worthy of Greenpeace girl by seeing off her mother's Sacred Earth Militia kidnappers in fine style. All ends happily with a wedding, a baby on the way, and hints of another wedding.

As a climate-change science comedy (albeit one with serious strands) *The Heretic* is unusual in the field. Comic moments are evident in several of the climate-change plays, but this one takes the comic potential of the climate-change science debate to a new level. The play's title and reference to Galileo (p. 45), mentioned as Kevin escalates a bullying campaign against Diane, should warn an audience against taking things at face value, for Galileo the heretical scientist and *Galileo* the play are both associated with subversion.

Charles Spencer (self-described in print as a crusty climate-change sceptic) delighted in *The Heretic*, which he expected to annoy a large section of the audience. As discussed below, it does exactly this with a purpose, operating in practical-joke mode with the audience in its sights, so successfully that Fred Pearce, reviewing the play, was moved to ask why Bean did not take the trouble to get the science right.²⁵ The answer lies in what Bean is intending for his audience.

Bean brings the audience through the door in the expectation of seeing an anti-climate-change science play, only to discover it may be no such thing. The trap is set through a combination of unadulterated docu-science and fictionalized science. These are carefully selected and then presented in such a way as to 'vastly offend' (Spencer) any audience member not paying full attention to important details in dialogue and plot. As in the two preceding plays, how the audience reconstructs the mix of climate-change documentary, docu-science, and fictionalized science in the play is key to the message that is taken

away. In this play, this point is a key part of the message.

Some pieces of climate-change documentary are used to provide context, and to drive a plot that works in slapstick mode, in order to create an impression of anti-scientific content. The prospect of losing a lucrative funding contract puts Kevin's academic moral compass in a spin and Diane is disciplined for refusing to suppress her research in the name of money. She returns this metaphorical punch on the nose with a 'trenchant assessment' (p. 55) of her fellow scientists on TV, and is fired. Meanwhile the 'typo' Kevin had deliberately (p. 74) failed to put right in the draft of his IPCC paper (Himalayan glaciers projected to melt by 2035), even though Diane has pointed it out (p. 43), comes home to roost when he finds his reputation knocked to pieces in the press (p. 73). He redeems himself by helping Diane and Ben with the fraudulent data files and emails from the rival university that come to light on laptops in Diane's kitchen, and so the funding problem for his own university is resolved. In this plot, contemporary events dubbed by the media 'Glaciergate' and 'Climategate' are lampooned.

Polarizing the Audience

Taking such aspects of the play at face value, it is easy to see why some have concluded that this play is on the side of climate-change denial, thus using documentary and incorrect docu-science to debunk climate-change science. However, we recall Heise: '[If] the context out of which scientific research emerges is shaped by certain values, it does not naturally follow that the results of this research will lend support to these values' (2007, p. 2). This is a good description of the pseudo-science traps in the play.

The most important of these is an apparently straightforward piece of docu-science that appears in the context of tutorials between Diane and her student Ben.

BEN: Look, if we double CO₂, we double temperatures . . . and that is the end of the world. Common sense innit.

DIANE: If common sense trumped science my mother would be running a nuclear power station. The relationship between CO₂ and temperature is not linear, it's logarithmic. Think of an example, from your own life perhaps, where doubling a variable does not double the effect. (p. 39)

This innocuously didactic exchange is a direct reference to real-life climate models used to predict temperature change on the basis of the change in the concentration of CO₂ in the atmosphere. However, its function in the play is not purely documentary or didactic. It is the opening gambit of a set-up, in which the audience is the target, and to which different segments of the audience are bound to react in different ways.

Ben, responding to his teacher's request for an example of a logarithmic relationship, uses his imagination and comes up with the 'thermal chicken' theory (p. 51). This appears to be borrowed from the so-called 'saturation theory' of CO₂ in which (as described in the play) once CO₂ concentrations have reached 280 parts per million (ppm), subsequent increases in concentration cause no further warming (p. 51). The logarithmic relationship between CO₂ concentrations and warming is recognized in real-life science; but Ben fictionalizes the science by adding 280 ppm as the level where the warming effect of a rise in concentrations levels off. At this point, as Spencer hints, apoplexy is a possibility for audience members taking things at face value.

The first point to note is that Diane (p. 51) signals Ben's theory to be different to the (usual) logarithmic model (something that will reassure the observant scientist). The second is that any scientist concerned that the play appears to be giving the nod to this version of the 'saturation hypothesis' should be reassured by its ridiculous name – the 'thermal chicken' theory.

Another exchange also designed to polarize the audience on the basis of its members' climate-change views is the following:

BEN: You know that graph Al Gore has where the temperature is steady for ever then it, like, suddenly takes off in the twentieth century?

PHOEBE: The hockey stick?

BEN: Yeah.

KEVIN: In that film of his, Al Gore, he's got the Y-axis upside down.

DIANE: I told you that two years ago.

KEVIN: If you get really close to the telly, and freeze frame it, you can see. (p. 82–3)

By highlighting such a basic error (and relying for its theatrical effect on popular culture held in the memory of the audience) this piece of dialogue is designed to annoy some audience members by introducing doubts about the way science is used in the movie *An Inconvenient Truth*. Those who know the charts will know the error is less significant than it appears to be in the play: exactly thirty seconds later a correctly labelled version of the same chart appears in the film. This is a mischievous intervention but with a serious point – the playwright cherry-picking a fact and then presenting it in a manner that will cause vast offence to the climate-change apologist and enormous delight to the sceptic, thereby poking fun at the cherry-picking of data that those on both sides of the argument sometimes do to support their point of view (p. 43).

The third example escalates such mild authorial teasing of the audience to a new level, and Bean marks it out with a technological *deus ex machina*, putting Diane's blunt comments on climate-change science and scientists into a piece of fabricated *Newsnight* television,²⁶ drawing on (and partly fictionalizing) a widely watched real-life news item. The audience sees a magnified picture of the be-snorkelled President of the Maldives and his cabinet staging a meeting under water (a real event, widely broadcast). This is the backdrop to a three-way televised interview between Diane, the Maldives High Commissioner to London, and the real-life broadcaster Jeremy Paxman playing himself.

In the course of this interview (which was absolutely riveting in the Royal Court production of February 2011), Diane not only declares that the sea level in the Maldives is not rising, that the IPCC is a 'political body' (p. 54), that there is 'no evidence CO₂ is the cause of twentieth-century warming' (p. 55),

but also 'I'm a scientist, I don't "believe" in anything' (p. 55). These comments spoken in this carefully engineered context are political dynamite, for they directly attack ideas that have become climate-change sacred cows in the public domain.

Baiting the Theatrical Trap

The point, of course, is that no aspect of science should be sacred. Diane's extreme comments (which fit in with the verbal slugging match under way with Kevin) are theatrical bait in the trap. They are a carefully planted distraction from the serious point, found in a subtle but important detail in the main (fictional) science story. As the audience knows at this point in the play, Diane has discovered (p. 46) from two decades of data collection that 'the land is rising with the sea' in the Maldives because of 'new sand and sediment deposits'. What matters is that Diane is not denying sea-level rise in her paper. Thus, the coercive treatment meted out to Diane by her boss – suppression of the publication (p. 33), a formal warning (p. 53), and firing (p. 64) – was quite unnecessary. He could have used scientific fact to keep the funder happy.

In the play, Commissioner Waheed, asked by Paxman for scientific evidence in support of his fear that the sea level is rising, does the opposite of what Diane the scientist would do. He delivers up a list of NGOs²⁷ (p. 54). As Diane points out, these are 'not scientists [but] advocacy groups', and this is not evidence. Thus the message is that theatricality, no matter how brilliant or distracting, is no substitute for properly gathered evidence.

As the camera fades away, Paxman segues into a discussion of the falling population of bees, a hint that the point of this scene is not to deny the impact of human activity upon ecosystems, but to challenge the use of science to support specific belief systems. For Diane, rigorous scientific process (in which theories are tested to destruction and stand until – or if – they are knocked down) is the thing she '[holds] most dear' (p. 52), and it is this view of science that Bean reinforces time and time again in the play.

The reaction of individual audience members to the Paxman scene (some of whom may not agree with the above interpretation) will depend on the climate-science stance they bring into the theatre. Thus, overall, this play literally enacts the idea it engages, with 'a performativity that is provocative and innovative' (Shepherd-Barr, p. 6). The mischievously used mix of documentary, docu-science, and fictionalized science on which I have just focused are anchored (through Diane) to a darker theme – the unbalanced behaviour of human beings (Ben and Phoebe) caught up in a dysfunctional society.

The fact that it is Diane who is Kevin's moral compass, Diane who successfully helps both Ben and Phoebe find mutual equilibrium, and Diane who engineers the happy-ever-after ending affirms that right is on the side of science that accepts ambivalence and uncertainty (and the lack of unidirectional answers) as the norm. Bean, taking liberties with science, and Diane, ever the ethical scientist but not averse to doing a little computer hacking in the name of freedom of information, seem to be cast in the same mould.

Bean would not be expected to spend much time in the realm of metaphor. However, there is a change of tone in the wedding speech that ends the play:

DIANE: The stars know nothing of love. . . .
Which star invented air travel, the internal combustion engine? The stars are God's mistakes. . . . We are the miracle. Life. Human intelligence. Human innovation, creativity, invention. (p. 115)

Diane in this speech seems to represent classical science in which scientific knowledge confers power over nature – the material world which the sciences examine and technology transforms (Bate, 2001). In this speech she represents an aspect of human behaviour that can be seen as responsible for the environmental imbalances that characters like Ben and Phoebe worry about. It is left to the audience to decide whether to take Diane's words at face value or (following Heise, p. 2) to see science as the discipline that might

help humanity reach a better balanced relationship with the environment. Overall, the apparently lighthearted way in which this play deals with climate change belies the seriousness of the discourse visible just below the surface. Reflecting the state of the arguments in the climate-change debate, this play is likely to leave a divided audience in its wake.

Conclusion

The message of these plays in combination is that for the real-world climate-change debate to progress beyond vociferous polemic, the first step must be an acceptance in the public domain of scientific indeterminacy in the name of scientific rigour. Beyond this, much remains to be done in the field of climate-change science (and ecosystem science) on the stage. The ecologies of the theatre, the science play and science itself are ambivalent (cf. Kershaw, 2007),²⁸ ecosystems are chaotic and subject to sudden change, and science is unavoidably linked to the environment.²⁹ This complex set of conditions is only partly reflected in the climate-change plays as a group which, not unlike the science plays discussed by Shepherd-Barr 'are groundbreaking in their use of science but rather mainstream in their theatricality' (p. 199). The question is what comes next.

Notes and References

This article was developed from a 2011 essay written in the context of Tony Howard's British Dramatists MA module at Warwick University. An extract was presented at the conference of the Association for the Study of Literature and the Environment (ASLE) held in London in September 2011. My thanks to Dr Kirsten Shepherd-Barr, whose book *Science on the Stage* (2006) played an important part in shaping this version of the article, for several insightful comments.

1. Al Gore presented the climate-change story on stage as a live performance, with the support of props – pictures and charts, facts, figures, and mechanical devices, in effect rehearsing the eventual movie. See Al Gore (narrator), *An Inconvenient Truth*, directed by David Guggenheim (Paramount Classics and Participant Productions, 2006).

2. Kirsten Shepherd-Barr, *Science on the Stage from 'Doctor Faustus' to 'Copenhagen'* (Princeton, NJ: Princeton University Press, 2006). The play that comes closest to climate change is Steven Poliakoff's 1996 work *Blinded*

by *the Sun* (London: Samuel French, 1996), which Shepherd-Barr lists as a chemistry play (p. 221). It touches tangentially on climate change through the themes of peak oil, alternative energy, and science ethics.

3. Clare Pollard, *The Weather* (London: Faber, 2004).

4. 'My grand-daughter's grand-daughter says to my ghost "Didn't you love me?"', vocal score, *We Turned on the Light*, music by Orlando Gough (London: Boosey and Hawkes, 2006), p. 50–1. Text by Caryl Churchill. Reproduced by permission. The Ashden Directory contains a brief synopsis of Caryl Churchill's climate-change libretto. See <www.ashdendirectory.org.uk>.

5. John Godber, 'Crown Prince', in *Plays: 4* (London: Methuen Drama, 2009).

6. Godber (2009, Introduction) comments on the vulnerability of Hull and East Yorkshire to flooding 'should the ice-caps melt'.

7. Steve Waters, 'Resilience' and 'On the Beach', in *The Contingency Plan* (London: Nick Hern Books, 2009). All page references to the three main play texts discussed in this article refer to the editions cited here in full on the first mention of each play.

8. Mike Bartlett, *Earthquakes in London* (London: Methuen Drama, 2010).

9. Moira Buffini, Matt Charman, Penelope Skinner, and Jack Thorne, *Greenland* (London: Faber, 2011).

10. Richard Bean, *The Heretic* (London: Oberon, 2011).

11. Simon Stephens, 'Wastwater' in *Wastwater and T5* (London: Methuen Drama, 2011).

12. Michael Billington, Theatre Review, 'The Contingency Plan', *Guardian Online*, 8 May 2009.

13. Charles Spencer, 'Earthquakes in London, National Theatre, Review', *Telegraph Online*, 5 August 2010.

14. Within the science-play genre, it is well recognized that science itself is a two-edged sword, capable of good and bad outcomes. See, for example, Beer's 1996 discussion of the theatre piece *Square Rounds: 'Square Rounds and Other Awkward Fits: Chemistry as Theatre'*, in *Open Fields: Science in Cultural Encounter* (Oxford: Clarendon Press, 1996).

15. Ursula K. Heise, 'Science and Ecocriticism', *The American Book Review*, XVIII, No. 5 (July–August 2007), p. 4 ff. <www.asle.org/site/resources/ecocritical-library/intro/science/>.

16. Greg Garrard, *Ecocriticism: the New Critical Idiom* (London; New York: Routledge, 2004).

17. Jonathan Bate frames the much discussed separation between the arts and the sciences as problematic for the environment in particular: 'The values with which the humanities have taught us to regard mankind have rarely been extended to the material world which the sciences examine and technology transforms.' See Jonathan Bate, *The Song of the Earth* (Basingstoke; Oxford: Picador, 2001), p. 244.

18. James Lovelock, *The Revenge of Gaia* (London; New York: Allen Lane, 2006), p. 6.

19. Scientists read changes in the behaviour of birds as a harbinger of earth-systems changes in several of the climate-change plays. Cf. Robert's redwing in *Earthquakes*, p. 102.

20. Shakespeare, *Henry V*, Prologue I, line 18.

21. In this hypothesis, marine ice sheets resting on a sloping surface are unstable and could therefore hypothetically experience sudden large-scale changes.

22. Interview with John Cage by Kirby and Schecher, cited by Natalie Crohn Schmitt in *Actors and Onlookers: Theatre and Twentieth-Century Scientific Views of Nature* (Evanston: Northwestern University Press, 1990), p. 32.

23. Aleks Sierz, 'Review, Earthquakes in London, National Theatre Production', *The Arts Desk*, 4 Aug 2010 <www.theartsdesk.com/theatre/earthquakes-london-national-theatre>, accessed 20 May 2012.

24. Richard Allen Cave, *English Dramatists: Ben Jonson* (New York: St Martin's Press, 1991).

25. Fred Pearce, Review of *The Heretic*, 'Take Climate Scientists to Task but Avoid Formulaic Boffin-Bashing', *The Guardian*, 11 February 2011.

26. The footnote to the cast list in the 2011 play text, which also served as the programme in the Royal Court production, thanks Jeremy Paxman and the BBC *Newsnight* team for their help.

27. Non-Government Organizations.

28. Baz Kershaw, in *Theatre Ecology: Environments and Performance Events* (Cambridge: Cambridge University Press, 2007), asks how the 'uni-directional' nature of the environmental calamity awaiting humanity fits 'with a theatre and performance ecology that is frequently ambivalent' (p. 110).

29. Natalie Crohn-Schmitt, 'Theorizing about Performance: Why Now?', *New Theatre Quarterly*, VI, No. 23 (August 1990), p. 231–4. '[The] study of science is no longer nature itself but the interplay between nature and ourselves.'