

Narrative Science

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Objectives

- **To investigate the potential for using the narrative approach to facilitate deep learning of scientific concepts through the medium of playwriting and playacting**
 - ***Purely Narrative Approach: 2nd Law***
 - ***Student Centred Approach: When Boyle met Pepys***



Outcomes

- ***Holey Terror*** - a play about the 2nd Law of Thermodynamics
- ***When Boyle met Pepys*** - student worksheets on Boyle's Law, Restoration England and writing a play



Holey Terror

a narrative approach to the Second Law of Thermodynamics

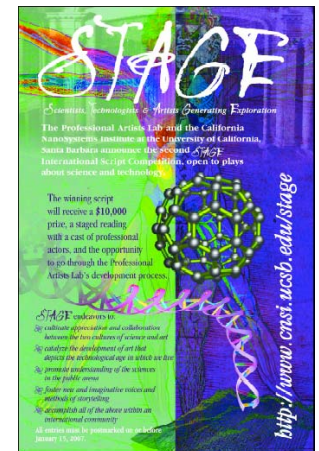
Everyone loves a story...





Holey Terror (2nd Law)

- Reading of *Holey Terror* at Barbican Theatre SciBAR
- Stage play submitted for 'Stage' an international science theatre competition
- Radio play submitted to BBC



When Boyle met Pepys

- **Student worksheets**
 - **Science and arts students**
 - **Aids to learning**
 - **Re-awaken interest in science or art students**



When Boyle met Pepys

- **Biographical sketch**
 - Robert Boyle
 - Samuel Pepys
- **Boyle's Law**
 - Original data from the 1662 publication
 - Exercises
- **Historical timeline**
- **Playwriting workshop**
 - What is a play
 - Restoration comedy
 - When Boyle met Pepys



Robert Boyle (1627-1691)

Robert Boyle (Plate 1) was one of the most significant scientists of his time. He put into practise, through experiment and observation, the process of inductive reasoning advocated by Francis Bacon in the early part of the 17th century. He was one of the founding members of the Royal Society, which became the focus for the burgeoning of British science during the enlightenment in the following century.

Born into a wealthy protestant family at Lismore Castle on 25th January, Robert was the seventh (and youngest) son of Richard and Catherine Boyle. His father was the Earl of Cork and Lord High Treasurer of Ireland, making him one of the richest and most influential men in the country. He was educated at home by private tutors and, from 1635-1638, at Eton College England, subsequently travelling abroad to France, Switzerland and Italy. While in Florence in 1642 Galileo died at his villa in Arcetri nearby. On his eventual return to England in 1644 Boyle would have found the country in a chaotic state as a result of the outbreak of the civil war in 1642. His father had died in 1643 and left him an estate at Stalbridge in Dorset where he lived for the next decade, setting up a laboratory in 1649 to pursue his scientific interests.

In 1654-6 Boyle moved to Oxford encouraged by John Wilkins, the leader of a group of natural philosophers who, in 1660, were instrumental in establishing the Royal Society. It was here that Boyle's experimental work took off, and coincides with the publication of the work which became known as Boyle's Law (sometimes called Mariotte's Law), describing an ideal gas. His experimental results were described in detail an appendix (1662) to his work entitled *New Experiments Physio-Mechanicall, Touching the Spring of the Air and its Effects* (1660) shown in Figure 1. This work was undertaken using an air-pump (Figure 2) which he designed with the aid of Robert Hooke, who was working as his assistant at the time. The publication demonstrates Boyle's attention to experimental detail and comprehensive descriptions of the experiments themselves, which was intended so that others could repeat them. In this way he was important in establishing experimental science as a means of acquiring knowledge. Boyle also advanced a corpuscular theory of matter (substances are composed of particles) in defiance of the widely held Aristotelean belief that matter was comprised of four elements, earth, air, fire and water.

In 1668 Boyle went to live with his sister, Lady Ranelagh, in London. In 1670 he suffered a stroke which left him temporarily paralysed, however, he gradually recovered his health and continued to work.

Religion was an important part of Boyle's scientific philosophy.



Plate 1 Robert Boyle by Johann Kerseboom (1708).

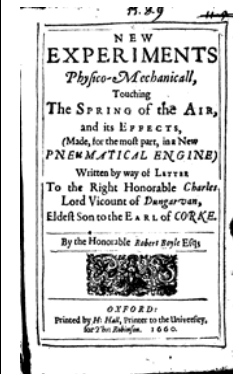


Figure 1 Title page of Boyle's *New Experiments Physio-Mechanicall, Touching the Spring of the Air and its Effects* (1660).



Figure 2 The air-pump designed by Boyle and Robert Hooke.

Samuel Pepys (1633-1703)

Samuel Pepys (Plate 1) was an important civil servant during the latter part of the 17th century. Perhaps more importantly, during the period 1660-1669 he kept a diary in which he recorded several major events of the age, including the Restoration of the Monarchy (1660), the Second Dutch War (1665-1667), the Great Plague of London (1665), the Great Fire of London (1666), as well as daily events.

Samuel Pepys was born on 23 February, 1633 in Salisbury Court, off Fleet Street, London. His father, John Pepys, was a tailor so, although relatively well off for the time the family were not particularly wealthy; but they did have influential relatives which would aid Pepys in his later career. After a spell at the 'Free Grammar School' in Huntingdon he was educated at St Paul's School, beside the Cathedral, in London. It was while at St Paul's that he witnessed the execution of Charles I in 1649, at the culmination of the English Civil War. At this point Pepys was a staunch Republican, but in common with many contemporaries he was a faithful subject after the restoration of Charles II in 1660. Between 1651-1654 he studied for a degree at Magdalene College, Cambridge and subsequently entered the employ of a relative, Sir Edward Montagu in 1655, the year in which he married Elisabeth Marchant de St Michel.

The period between his marriage and the start of his Diary in 1660 saw Pepys establish himself as a clerk in the service of Montagu, then eventually appointed to Clerk of Acts to the Navy Board in 1660. The most significant event during this time was his decision to undergo a lithotomy, an operation to remove a bladder stone, which was by 1658 causing him extreme pain. This was no trivial decision on the part of Pepys: the operation involved insertion of a thin metal tube through the penis to locate the stone then, bound and trussed, he was held down while an incision was made between the scrotum and anus and a stone the size of a 'tennis ball' extracted. This was endured without the benefit of anaesthetic or antiseptic and the fatality rate was between 20-40%. Pepys survived the operation and made a full recovery; he even mounted the stone in a special case and resolved to celebrate the anniversary thereafter.



Plate 1 Portrait of Samuel Pepys painted by John Hayls in 1666, when he was 33.



Plate 2 Pepys' library at Magdalene College Cambridge.

On January 1, 1660, Pepys started his famous Diary with this entry:

Blessed be God, at the end of the last year I was in very good health, without any sense of my old pain, but upon taking of cold.

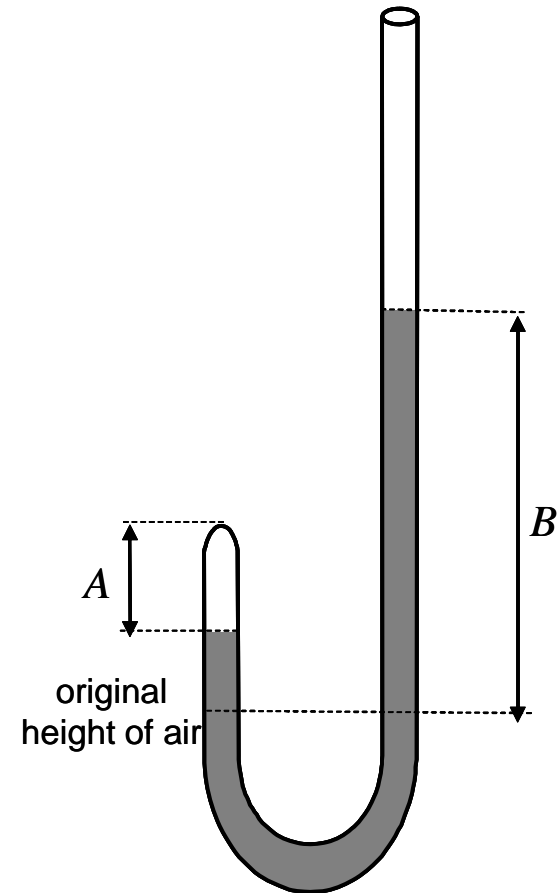
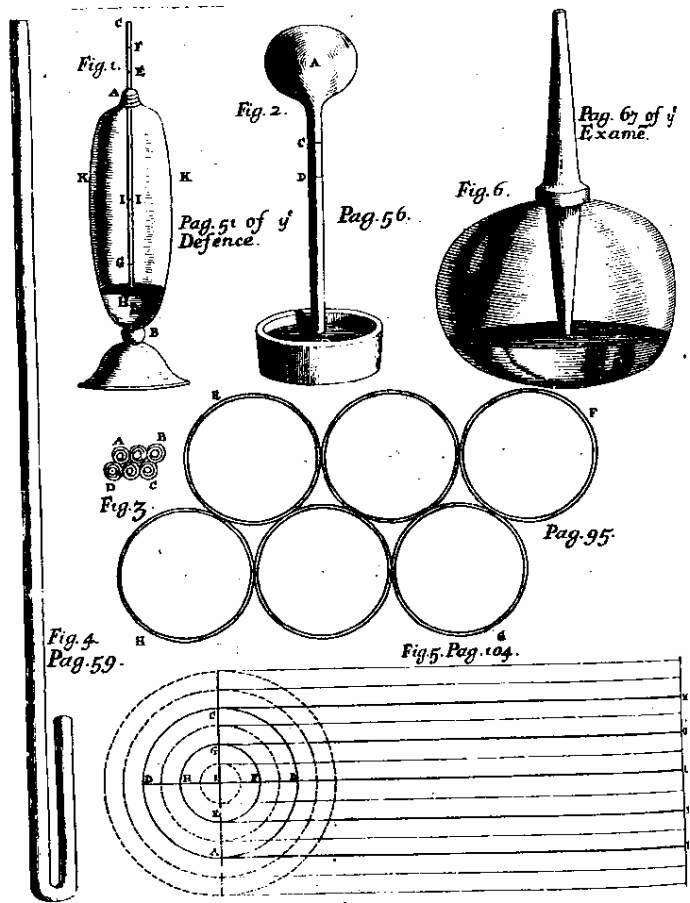
I lived in Axe Yard, having my wife, and servant Jane, and no more in family than us three.

My wife, after the absence of her terms for seven weeks, gave me hopes of her being with child, but on the last day of the year she hath them again. The condition of the State was thus; viz. the Rump [*the so-called Rump Parliament*], after being disturbed by my Lord Lambert, was lately returned to sit again. The officers of the Army all forced to yield. Lawson lies still in the river, and Monk is with his army in Scotland. Only my Lord Lambert is not yet come into the Parliament, nor is it expected that he will without being forced to it.



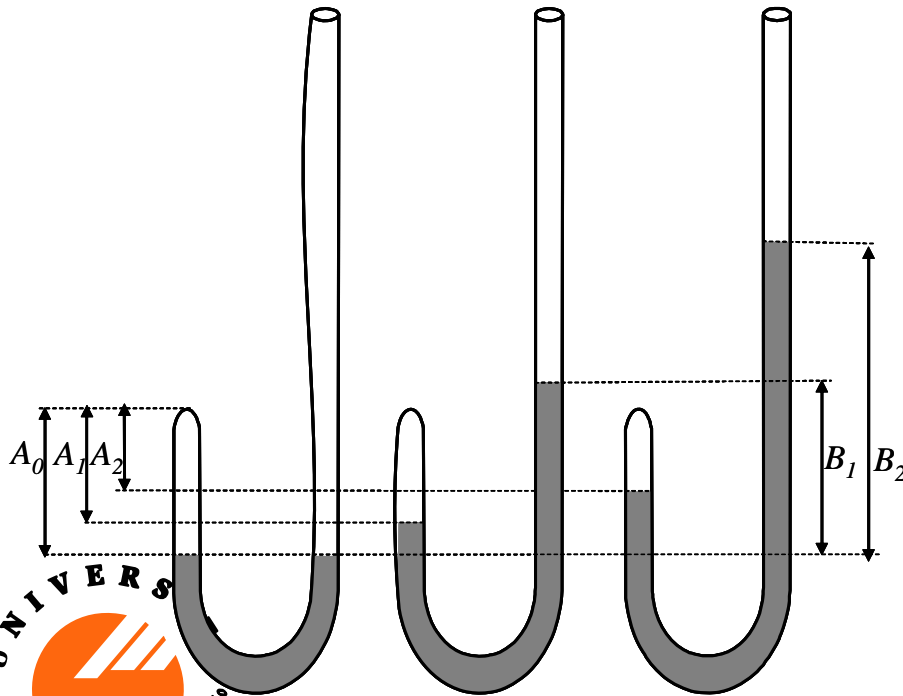
‘We took then a long Glass-Tube, which by a dexterous hand and the help of a Lamp was in such a manner crooked at the bottom, that the part turned up was almost parallel to the rest of the Tube....’ ().

‘...then Quicksilver being poured in to fill up the bended part of the Glass...’



‘...then Quicksilver being poured in to fill up the bended part of the Glass, that the surface of it in either leg might rest in the same Horizontal line, as we lately taught, there was more and more Quicksilver poured into the longer Tube; and notice being watchfully taken how far the Mercury was risen in that longer Tube, when it appeared to have ascended to any of the divisions in the shorter Tube, the several Observations that were thus successively made, and as they were made set down, afforded us the ensuing Table.’

A Table of the Condensation of the Air



	A	B	C	D	E
48	12	00		29 $\frac{1}{2}$	29 $\frac{1}{2}$
46	11 $\frac{1}{2}$	01 $\frac{1}{2}$		30 $\frac{1}{2}$	30 $\frac{1}{2}$
44	11	02 $\frac{1}{2}$		31 $\frac{1}{2}$	31 $\frac{1}{2}$
42	10 $\frac{1}{2}$	04 $\frac{1}{2}$		33 $\frac{1}{2}$	33 $\frac{1}{2}$
40	10	06 $\frac{1}{2}$		35 $\frac{1}{2}$	35 $\frac{1}{2}$
38	9 $\frac{1}{2}$	07 $\frac{1}{2}$		37 $\frac{1}{2}$	36 $\frac{1}{2}$
36	9	10 $\frac{1}{2}$		39 $\frac{1}{2}$	38 $\frac{1}{2}$
34	8 $\frac{1}{2}$	12 $\frac{1}{2}$		41 $\frac{1}{2}$	41 $\frac{1}{2}$
32	8	15 $\frac{1}{2}$		44 $\frac{1}{2}$	43 $\frac{1}{2}$
30	7 $\frac{1}{2}$	17 $\frac{1}{2}$		47 $\frac{1}{2}$	46 $\frac{1}{2}$
28	7	21 $\frac{1}{2}$		50 $\frac{1}{2}$	50 $\frac{1}{2}$
26	6 $\frac{1}{2}$	25 $\frac{1}{2}$		54 $\frac{1}{2}$	53 $\frac{1}{2}$
24	6	29 $\frac{1}{2}$		58 $\frac{1}{2}$	58 $\frac{1}{2}$
23	5 $\frac{3}{4}$	32 $\frac{1}{2}$		61 $\frac{1}{2}$	60 $\frac{1}{2}$
22	5 $\frac{1}{2}$	34 $\frac{1}{2}$		64 $\frac{1}{2}$	63 $\frac{1}{2}$
21	5 $\frac{1}{4}$	37 $\frac{1}{2}$		67 $\frac{1}{2}$	66 $\frac{1}{2}$
20	5	41 $\frac{1}{2}$		70 $\frac{1}{2}$	70 $\frac{1}{2}$
19	4 $\frac{3}{4}$	45 $\frac{1}{2}$		74 $\frac{1}{2}$	73 $\frac{1}{2}$
18	4 $\frac{1}{2}$	48 $\frac{1}{2}$		77 $\frac{1}{2}$	77 $\frac{1}{2}$
17	4 $\frac{1}{4}$	53 $\frac{1}{2}$		82 $\frac{1}{2}$	82 $\frac{1}{2}$
16	4	58 $\frac{1}{2}$		87 $\frac{1}{2}$	87 $\frac{1}{2}$
15	3 $\frac{3}{4}$	63 $\frac{1}{2}$		93 $\frac{1}{2}$	93 $\frac{1}{2}$
14	3 $\frac{1}{2}$	71 $\frac{1}{2}$		100 $\frac{1}{2}$	99 $\frac{1}{2}$
13	3 $\frac{1}{4}$	78 $\frac{1}{2}$		107 $\frac{1}{2}$	107 $\frac{1}{2}$
12	3	88 $\frac{1}{2}$		117 $\frac{1}{2}$	116 $\frac{1}{2}$

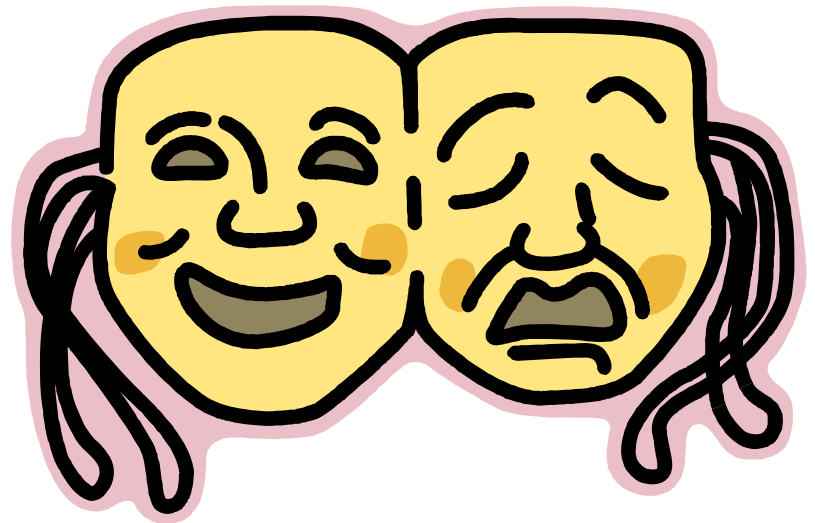
Added to 29 $\frac{1}{2}$ makes

- A.A. The number of equal spaces in the shorter leg, that contained the same parcel of Air diversly extended.
- B. The height of the Mercurial Cylinder in the longer leg, that compress'd the Air into those dimensions.
- C. The height of a Mercurial Cylinder that counterbalanc'd the pressure of the Atmosphere.
- D. The Aggregate of the two last Columns B and C, exhibiting the pressure sustained by the included Air.
- E. What that pressure should be according to the *Hypothesis*, that supposes the pressures and expansions to be in reciprocal proportion.



What is a Play

- **Haupttext**
 - The written text
- **Nebentext**
 - Non-verbal signs
- **Making meaning**
 - Lexical meaning
 - Characterisation
 - Structure of dialogue



What is a Play?

- **Creation of a dialectic**
 - **Subtext**
 - the situation as it has developed from the chain of previous situations
 - the words that are spoken
 - the underlying unspoken thoughts and emotions of the characters



Restoration Comedy

- **The Country Wife**
 - Playsheet 1
 - Playsheet 2
 - Playsheet 3



ACT IV, SCENE III.—HORNER'S Lodging

Re-enter Mrs. Squeamish.

Mrs. Squeam. I can't find 'em.—Oh, are you here, grandmother? I followed, you must know, my Lady Fidget hither; 'tis the prettiest lodging, and I have been staring on the prettiest pictures—

Re-enter Lady Fidget with a piece of china in her hand, and Horner following.

Lady Fid. And I have been toiling and moiling for the prettiest piece of china, my dear.

Horn. Nay, she has been too hard for me, do what I could.

Mrs. Squeam. Oh, lord, I'll have some china too. Good Mr. Horner, don't think to give other people china, and me none; come in with me too.

Horn. Upon my honour, I have none left now.

Mrs. Squeam. Nay, nay, I have known you deny your china before now, but you shan't put me off so. Come.

Horn. This lady had the last there.

Lady Fid. Yes indeed, madam, to my certain knowledge, he has no more left.

Mrs. Squeam. O, but it may be he may have some you could not find.

Lady Fid. What, d'ye think if he had had any left, I would not have had it too? for we women of quality never think we have china enough.

Horn. Do not take it ill, I cannot make china for you all, but I will have a roll-waggon for you too, another time.

Mrs. Squeam. Thank you, dear toad.

Lady Fid. [*Aside to Horner*] What do you mean by that promise?

Horn. [*Aside to Lady Fidget*] Alas, she has an innocent, literal understanding.

Lady Squeam. Poor Mr. Horner! he has enough to do to please you all, I see.

Horn. Ay, madam, you see how they use me.

Lady Squeam. Poor gentleman, I pity you.

Horn. I thank you, madam: I could never find pity, but from such reverend ladies as you are; the young ones will never spare a man.

Mrs. Squeam. Come, come, beast, and go dine with us; for we shall want a man at ombre after dinner.

Horn. That's all their use of me, madam, you see.



Restoration Comedy

- **The Country Wife**

Click on the picture the clips on YouTube

The Country Wife



Writing Workshop

- **Non-stop writing**
- **Starting points for two characters**
- **The Nebentext**
- **The dialectic**
- **Boyle and Pepys**
- **Time-line**
- **Further development**



Performance

- **Restoration comedy**
- **Props**
 - Wigs
 - Quill
 - J-tube



Future Directions

- **UoP Teaching Fellowship - Affective Learning in Science**
 - *Development of a cross faculty SciArt Module*
 - *New Learning Materials*
 - *Rediscovering Science*
 - *When Boyle met Pepys: a play*



Some Questions

- **Is there a place for a cross-disciplinary syllabus in the way we train our arts and science students?**
- **Do you think we can explore scientific ideas within the context of historical and/or contemporary issues?**
 - **Theatre & writing**
 - **Art and design**
 - **Multi-media**
 - **Social and moral issues**
 - **Other**



The Process

- **Understanding each other's discipline**
- **Neither discipline compromised**
- **Open minded**
 - **no preconceptions**
 - **accept criticism**
 - **honest appraisal of ideas**
- **Flexibility**
- **Ownership of outcomes**
- **Get on well together**



The Process

- **Choose the science**
- **Discuss a number of possible ideas**
- **End up with a single idea**
- **Criticise**
- **Redraft**
- **Criticise...redraft...criticise...redraft....**
- **Go for a drink!**

