

THE HISTORY OF PROJECTION AND LIGHTING IN THE THEATRE

We begin here the publication of the texts of five lectures which the late Hermann Hecht delivered under this general title to theatre students at Croydon College of Art in 1985. We hope that these will be helpful in setting developments in the lantern field in the wider context of the evolving technology of the theatre – just as Hermann's edition of *Dates and Sources*, on which he worked at the same time, succeeded in setting them in the context of the technical evolution of the cinema.

Lecture 1

HISTORY OF LIGHTING IN THE THEATRE

HERMANN HECHT

THE BEGINNING

The open-air performances in Greece and Rome, in medieval Europe and Elizabethan England, took place by daylight, with torches used in the final scenes. It was only in the enclosed playhouses, which began in Renaissance Italy and from there spread across Europe, that artificial light was needed – at least for evening performances.

As early as 1545, Sebastiano Serlio in his book on architecture, which dealt with perspective illusions in the theatre, advised placing candles and lamps behind coloured glass or behind bottles filled with coloured liquid. He also suggested using barbers' basins (really concave reflectors) behind the lamps to increase the light.

The auditorium was at first brightly lit by candelabra or lamps, and in 1566 Leonardo di Somi was the first to suggest reducing the amount of light in the auditorium in order to intensify the effect of stage lighting. Somi was chief arranger of theatrical entertainment to the ducal court at Mantua in Spain, and was the first to use mirror reflectors behind the lamps fixed to the backs of the side wings. He also arranged for many of the stage lights to be extinguished at one critical moment in the play as a special effect. Others tried to darken the auditorium entirely, but this was not achieved for a long time because a fashionable audience wanted to be seen as well as to see. To this day the conflict has not really been resolved!

Candelabra hung over the stage and the auditorium, with concealed lights behind the wings and below the backcloth, were used throughout the seventeenth and eighteenth centuries. Samuel Pepys described in his diary in 1669 how the unconcealed chandeliers over the stage threw a painful glare into the eyes of the spectators. It was Garrick at Drury Lane in 1765 who first removed the overhead lighting from the stage, relying entirely on lamps concealed behind the wings in addition to the footlights.

Garrick has been quite wrongly credited with the first use of footlights; they were first mentioned

as early as 1628 and might even have been in use before then. Their first use in England can be dated at about 1672.

Changes made by Garrick were soon adopted at Covent Garden, but many of the wax candles were replaced with rather smelly oil-lamps – that was before the invention of the Argand lamp. From then on, and prior to the introduction of gas lighting, either candles or oil-lamps, or a mixture of both, were used in the theatre. Oil-lamps were of two kinds, the usual rope-wick lamp and the Argand lamp (1) which had a column of air drawn up by the chimney round its circular wick and gave a much brighter light. At Drury Lane in 1810, 270 wax candles were used every night, with 300 Argand lamps to light the stage and scenery and as many again to light the corridors, dressing rooms and staircases. A small army of so-called *lamp-men* were employed to look after the lamps, replace the oil, snuff the wicks, and clean the glass chimneys.

GAS LAMPS

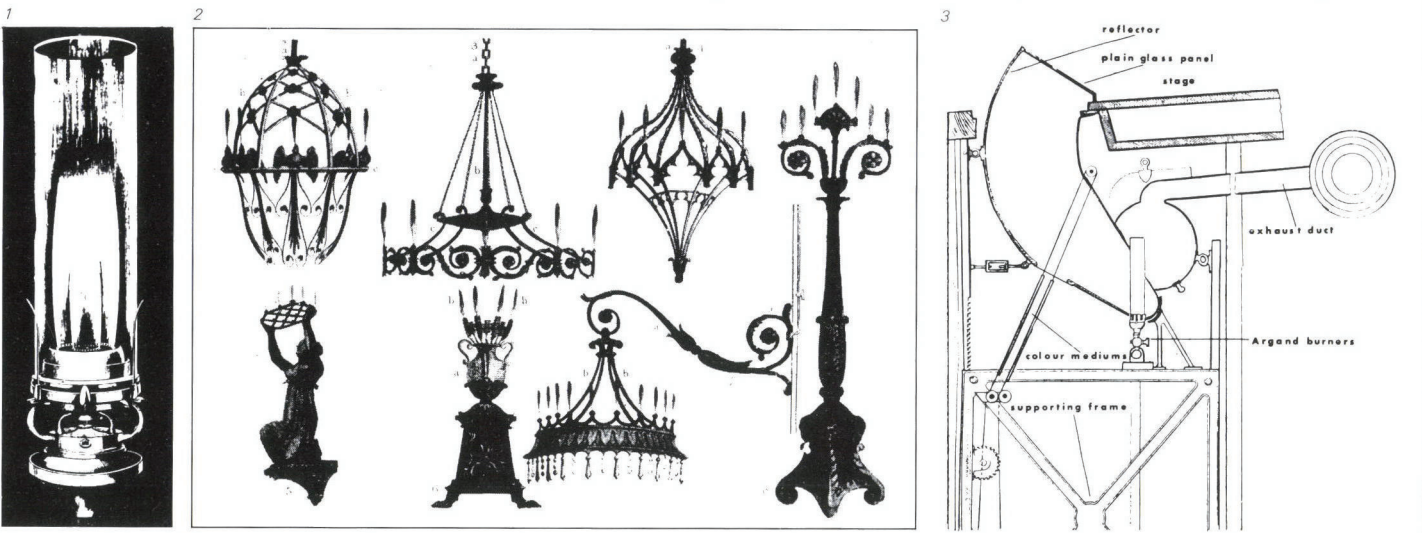
On 11 September 1815, when Covent Garden opened for the first night of the season, the exterior, the grand hall, and the staircase were illuminated by gas. This is the first recorded instance of gas being used anywhere in the theatre. The Olympic in Shoreditch, which later became a Salvation Army Hostel for many years, followed suit on 30 October. The first time gas light was actually used on stage was on 6 August 1817 at the Lyceum Theatre. When Drury Lane opened on 6 September it was equipped with a gas float and gas wing lights. Again, the Olympic quickly made use of the publicity generated by the new-fangled light and installed it for their Christmas show.

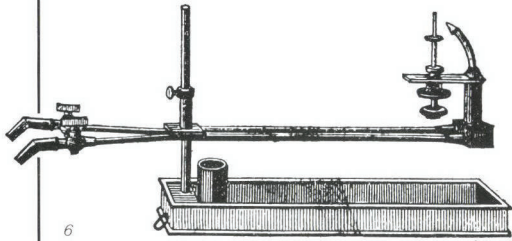
They were all simple gas flames – the kind of flame produced depending on the kind of holes made in the pipe. The pipes were then fitted in fanciful chandeliers and lamp standards (2) but the light wasn't really much stronger than that of one or

two candles, so in a sense, until lamps were improved, it was a fashion rather than a necessity; but it was cheaper than oil and it was certainly a novelty which theatre-goers could talk about and the papers write about, even if they had little to say about the play or the performance.

There was, of course, no central supply station or gas works and each theatre had to construct its own – usually under the stage (4). In 1828 at Covent Garden this private gas works blew up and two men lost their lives. By the re-opening in December the management decided that no more gas would be manufactured within the theatre and they reverted to candle and oil-lamps for stage lighting and used candles only for the auditorium.

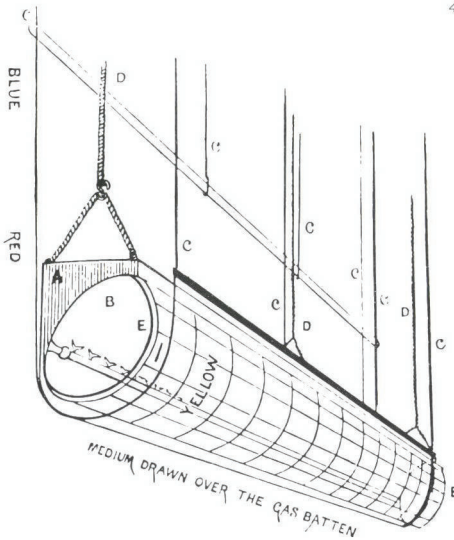
One problem all along was to arrange the footlights, technically called the *float*, in such a way that it could be raised or lowered for the purpose of turning the lamps on or off for darkening the stage when required. Naked, unprotected gas jets were not only dangerous but the bad smell, the smoke, and currents of heated air were very much disliked by the actors. In time the jets were covered with glass cylinders which also allowed coloured glass to be used. This could be changed to achieve different lighting effects when the float was lowered. By the early 1860s new sunken footlights were installed – first in July 1861 at the Théâtre Impérial de l'Opéra in Paris. The row of Argand gas burners, which gave a very much stronger light, were sunk beneath the stage and the chimney glasses inserted into a horizontal flu/chimney which carried off the smoke and smell (3). A curved metal reflector ran the full width of the stage and the light reflected upwards and out. Gas lights – mostly Argand lamps – were also used as wing lights and in what were called *gas battens*. This linear arrangement of gas lighting from above the stage was first installed in the late 1840s – comparatively late as things go. In 1849 the Olympic was fitted with five battens, each with seven gas lights, each extending the full width of the proscenium. In the same year the Prince Theatre in Glasgow was





6

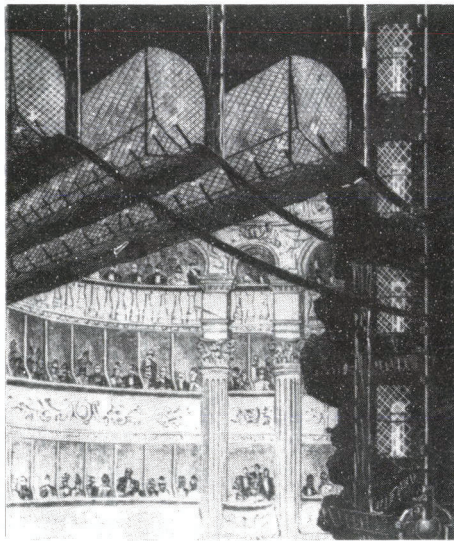
also fitted with gas batten. The new Covent Garden of 1858 was equipped with six gas batten (4), each 71 feet in length and fitted with metal guards so that coloured material could be pulled



4

across the batten to give different lighting effects. The system involved painting the gauze in colours gradating from yellow to red to orange to blue and green, but this allowed only a primitive colour change which was just good enough for the scene to pass from sunset to night or, in reverse, from night to sunrise. Later, metal replaced the wooden batten, wires replaced the ropes, and wire-mesh screws were introduced, making the batten considerably safer to use (5). A smaller version of the gas batten, called a *length*, could be installed in any position on the stage, usually suspended to light a specific part of the scenery from in front or from behind. They could also be laid flat on the stage after the manner of a float for special effects.

5



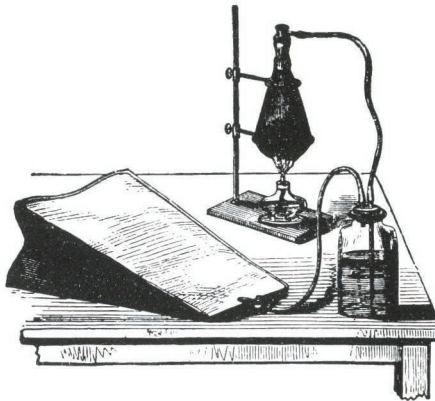
LIMELIGHT

While the gas light was still being developed, a new light source, the so-called limelight, began to come into use. The system required a stream of oxygen and hydrogen to mix and the flame to impinge on

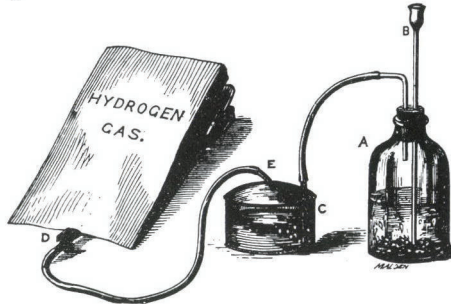
a cylinder of compressed quicklime. Hence the term *limelight*! This system was first suggested by Hare in 1801 and was used by Lieutenant Drummond for the geodesic survey in Ireland in 1825. Although he was not the inventor, to this day it is still called the Drummond light. Illustration (6) shows what it looked like in the 1840s, although the first limelight jets, as they were called, were a great deal clumsier.

The first use of limelight on stage was by William Charles Macready at Covent Garden during the 1837/38 pantomime *Peeping Tom of Coventry*. Macready hired Frederick Gye, a magic lantern showman, for the then very considerable sum of 30 shillings a night (£1.50 to those of you who have already forgotten!). The production of both oxygen and hydrogen was such a dangerous occupation that Gye really deserved every penny: a mixture of potassium chlorate and manganese dioxide (7) was roasted in a cast-iron retort and the evolved oxygen, after being purified by bubbling it through water, was collected in a gas bag – and that is where that expression originated! Hydrogen was made (8) by the action of sulphuric acid on granulated

7

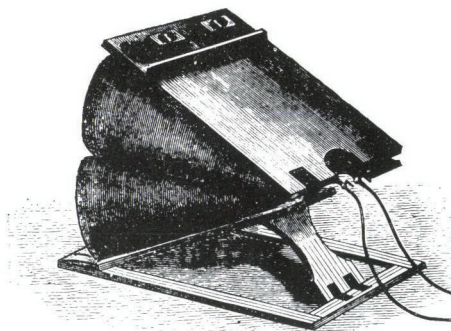


8

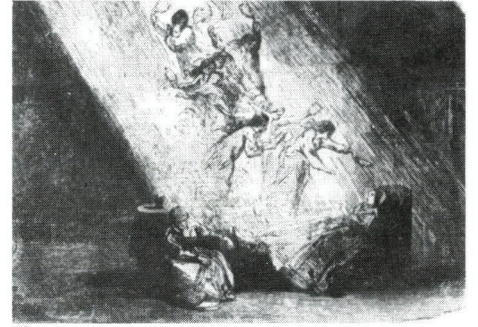


zinc; the resultant gas was similarly purified and collected in a second gas bag. If you survived all this, you put the two bags between two pressure boards (9), placed heavy weights on top of the boards (or, if no weights were available, the boy who swept the stage – one unfortunate boy was blown up!) and you were then ready to use the limelight. It was only with the introduction of compressed gas in cylinders in the early 1860s that some of the dangers of explosions could be overcome.

9



To begin with, limelight was simply used in a box with a very large hole in the front: this gave a strong beam of light to illuminate either an actor or a small part of the scene – a form of flood-light. The credit for introducing the lens into the limelight box to turn it into a proper spot (as we now understand the term) is usually given to Charles Kean, who used it on the occasion of his production of *Henry VIII*

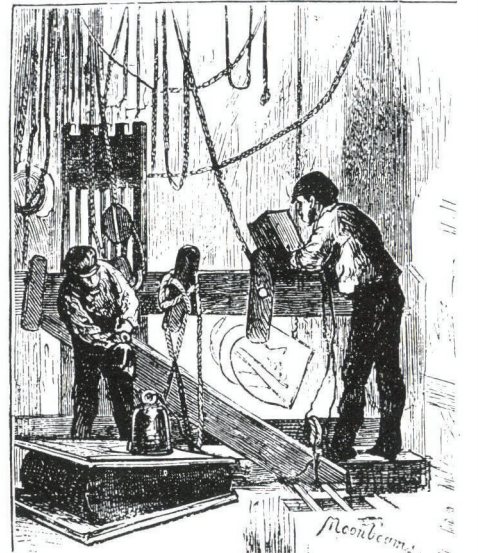


10

at the Princess Theatre in 1855 (10). Here the focused rays of light fell on the sleeping form of Queen Catharine.

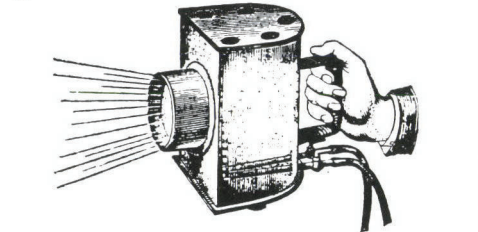
The growing popularity of limelight led to the evolution of the expert consultant, the so-called *lime-light man*, who might have two or more theatres and a large number of operators under his control. Apart from using it in the wings, (11) the

11



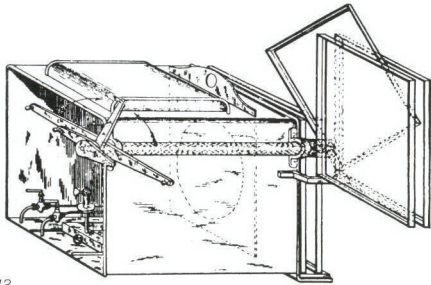
most common vantage point for the focused limelight was the fly-gallery. Before 1877, Duboscq, the great French stage-lighting engineer of the nineteenth century, produced a small, entirely hand-held limelight lamp (12) which allowed the

12



operator a considerable amount of freedom and, instead of the light being fixed, it could follow an actor or produce very specific lighting effects (to be discussed in another lecture). Eventually it became necessary to have a reliable and instantly available supply of oxygen and hydrogen, and in 1871, in the Alexandra Theatre in Liverpool, a cellar below the stage was converted and gas storage tanks for oxygen and hydrogen were permanently installed and connected to the stage. In the 1880s these so-called *limelight rooms* were to be found in a number of theatres.

Meanwhile, the outer form of the lamp was undergoing considerable changes. The simple wooden limelight box, with and without lens, was first replaced by an all metal one composed of two cylinders one inside the other, with sufficient space between them to allow the passage of a cooling current of air. In 1870, a circular plate with different coloured glasses which, when rotated, put any colour in front of the limelight box, was patented. Prior to this, flat sheets of tinted glass were used in front of the box and colour changes were managed by hand. But this produced some terrible mistakes: in a desolate snow scene at the Old Royal Theatre in Bristol during a performance of *The Sea of Ice*, the snow was suddenly flooded with green limelight and ruined the performance just at the crucial moment!



13

In 1893, E. C. Cooper invented a new colour lime-light box (13) where each colour was set in a metal frame and mounted at the end of a series of metal tubes inside one another, running the length of the box. Each tube was equipped with its own handle, allowing any chosen colour to be revolved at will in front of the light. After the advent of electric light, the limelight eventually came to an end.

ELECTRIC CARBON ARC LIGHT

As with gas light and limelight, the electric carbon arc at first ran side by side with the limelight. It appears to have been first used at the Princess's Theatre in 1848, in the pantomime *Harlequin and the Enchanted Arrow*, where it illuminated *The Haven of Happiness*. It was certainly used by Duboscq at the Paris Opera to create the sunrise effect in Meyerbeer's opera *Le Prophète*. In 1855 the carbon arc light was exhibited over the portico of the Lyceum, and later that year for the same purpose at Covent Garden.

Davenport's
NEW SMALL ELECTRIC

ARC LAMP

FOCUS KEEPING SIMPLE AND CERTAIN.

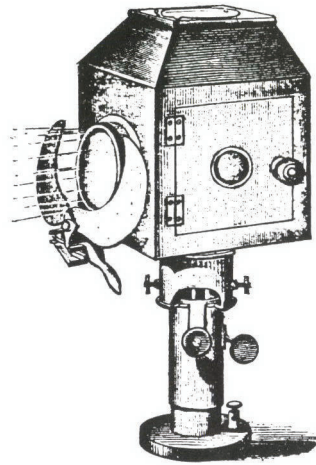
Patent. Price £4 4s.

J. H. STEWARD,

14

In its simplest form the carbon arc (14) consists of two carbon rods positioned with the points nearly touching. When an electric current is fed through the two rods an electric arc is formed between them, and brilliant light comes from the glow at the tip of the positive carbon. On this, a little 'crater' is burned out and gradually the carbon is worn away. The problem is to keep the distance between the two carbons constant, and until the invention of automatic carbon regulators this had to be done by the arc light operator.

In the absence of a commercial supply of electricity, it was necessary to generate the electric current within the theatre and this was done by using a series of what we now call *batteries*. As with the limelight, a large number of batteries had to be made to yield electricity on the spot and as many as 360 so-called Bunsen cells were installed at the Paris Opera. This illustration dates from 1875 and also shows the oxygen and hydrogen tanks, proving that both light-sources were used at the same time. Just as the limelight man had to give constant attention to the lime cylinders and gases, the operators of the electric arc needed to watch and exchange the carbon rods until a way was found to move them automatically by a clockwork mechanism. A lens in front of the arc light to focus the beam probably did not come into use until about 1855 or 1856. Hans Christian Andersen, the teller of fairy tales, had been to see a performance of *The Tempest* at the Princess's Theatre in 1857 and mentioned in his diary how the electric light 'shed a meteoric splendour over the scene' when Ariel appeared floating over the water. It was used the



15

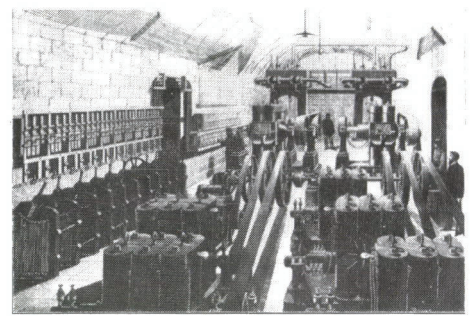
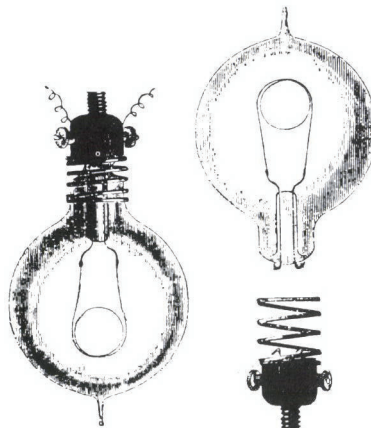
next year as a follow-spot (15) in *A Midsummer Night's Dream*, and at Covent Garden in 1859 to imitate a brilliant beam of sunshine. You will find references to the *electric limelight*, which of course is a contradiction in terms and simply meant that both limelight and arc light were used for different lighting effects in the same production.

INCANDESCENT LAMP

While the electric arc and the limelight demanded constant attention from the operator, the convenience of the filament incandescent lamp was immediately obvious, but it still took a long time to establish itself in the theatre.

The electric filament lamp was independently and almost simultaneously invented by Thomas Alva Edison in America and by Joseph Wilson Swan in Britain in 1878 and 1879. The early lamps had no bayonet or screw fitting attaching them to the holder and looked like the ones shown here (16). At

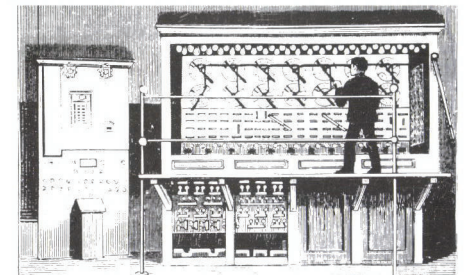
16



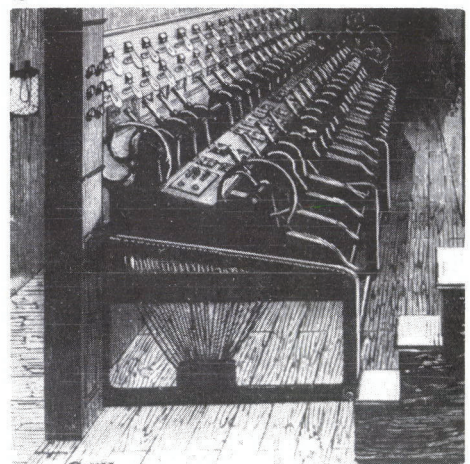
17

the opening of the Savoy Theatre, specially built to stage the works of Gilbert and Sullivan, all the latest advances in stage lighting were incorporated. (17) The current for the lamps was supplied direct from generators driven by steam engines below the stage, and because the speed of the engines was difficult to regulate there were occasional sudden fluctuations from light to darkness, which didn't help to popularise the lamps. Another drawback was that they gave a yellow tinge to the ladies in the audience and, worse, to the ladies on the stage. So *Patience* was completely re-dressed, the make-up adapted to the new light, and the scenery completely repainted. Altogether 824 lamps were used, 600 in 6 battens, each with 100 lamps, above the stage. This was more light than had ever been used before – or perhaps since – but as the auditorium lights were left undimmed during the performance, this tremendous output was needed on stage. Even if the heat was less than that produced by gas (between 87°C and 105°C has been recorded) it was still about 30°C on the stage in the 1870s. The illustrations below, from the New York Metropolitan Opera (18) and the Paris Opera (19) show what lighting boards looked like at that time, and for that matter still did until a few decades ago.

18



19



I have attempted to give an overview of the early history of stage lighting, but must apologise for having to leave out a great deal of detailed information. Terence Rees has collected most of it together in his book on stage lighting (*Theatre in the Age of Gas*, The Society for Theatre Research, London 1978), from which I have taken the majority of my illustrations – don't be put off by the title, the book deals with all forms of lighting.

Our thanks to Ann Hechte for making the text of this lecture available to us.