LoveTechnology!

Kevan Shaw

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Lighting has the potential to feed the Geek in all of us. Of course some of us are geeky to begin with! Lighting technology has never settled down since it really got off the ground at the beginning of the 19th century. Before then lighting consisted of a wick dipped in some combustible material; whether it was a candle made from tallow, or a very basic oil lamp burning olive oil in the Mediterranean or whale oil in Scotland. The developments started with the Argrand burner (fig. 1) in 1784 that provided a much better air to fuel mixture. From there we went from oils extracted from plants and animals to paraffin or kerosene derived from minerals, then gas derived from coal and finally electricity. Each step brought us more light without much consideration for anything else. Since the application of electricity to light we have found many different ways of changing the electrical energy to light energy, with each step providing more and more light. The speed of change has been incredibly rapid compared to most other technologies in the building sector; what has really changed in plumbing in the last century and a half?

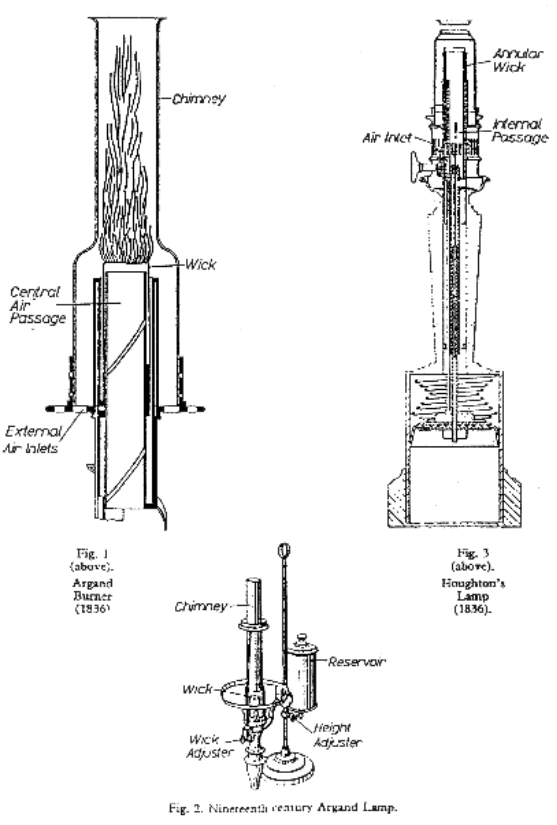

Fig. 1 (above). Argand Burner (1836)

Fig. 3 (above). Houghton's Lamp (1836).

Fig. 2. Nineteenth century Argand Lamp.

Figure 1: the Argrand Burner

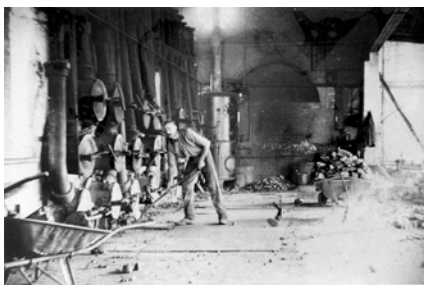

Figure 2: 19th century gas-works

Lighting does tend to piggy-back on other technological developments, or certainly has done over the last 50 years or so. If we come right up to date everyone is talking about LEDs as a light source for the future. Where did this come from? The electronics industry. Even though LEDs have been in the lighting market for 12 or 13 years there are still some pretty massive disconnects between LED manufacture and fitting design, with a lot of companies still too happy to believe in the hype rather than face the realities of designing fittings a whole different way!

Over the century or so that we have been predominantly using electric light we can see each wave of technology setting off design ideas that were just not possible before. Frequently these ideas have started in theatre and filtered out into architecture. Artificial and controlled lighting has been integral and necessary in theatre since the buildings became enclosed auditoria. The control provided by a dark space allows the presentation of different scenes depicting different environments and the passing of time, essential elements in the storytelling of a play. Naturally theatre buildings adopted the latest lighting technology first not just for the stage but for the auditorium as well. We can see developments of gas lighting, such as the Sun burner, a devilishly simple combined lighting and ventilating device, created for theatres. Theatres also saw the rapid adoption of electric light as an attraction in its own right.

By the end of the 1920s film had become a major attraction and the amazing super cinemas made all possible use of the latest lighting technology from coloured neon over the entrances to fantastic interiors with colour changing lights depicting everything from spanish villages to underwater fantasies. These involved coloured lighting multiple circuits and lighting control based on the technologies of the cinema organ!

Figure 3: the Rainbow Theatre (formerly the Finsbury Park Astoria), London, an example of a typical 1930s cinema

In the 1930s light really became an essential architectural element spreading from the facades of theatres and cinemas to iconic towers and tube stations. Light for advertising was also gaining ground.

Coming right up to date we have a similar technology migration visible in the last 30 years. Much of this has been fed by the general technological change of this era, the pervasive adoption of computers. These also entered the lighting market through theatre lighting control. Today all lighting control but the simplest dimmer switch contains a computer usually more powerful than the ones fitted to the Apollo moon landing craft. This level of technology is now helping us deliver energy efficient lighting schemes by switching or dimming down lighting when it is not required.

What else have we adopted from theatrical lighting control? Well, the DMX protocol invented to control moving lights in the 1980s is now a standard for driving very complex dynamic lighting in architecture. As we have adopted the LED it has allowed us to create colour and dynamics on a scale only dreamt of by the designers of the 1930s. We can relatively easily create lighting facades that provide information or respond to environmental stimuli. We can bring story telling to architecture and the urban environment

in a wide variety of new and exciting ways. We do however need to show restraint in design and not get carried away with the toys lest we end up in Ridley Scott's vision of the future in Blade Runner!

Figures 4 a, b, c: Al-Tijaria Tower, Kuwait. A recently completed KSLD project demonstrating use of DMX controlled colour changing LEDs; one scene is linked to wind-speed, with windier conditions causing lit bands to extend further down the facade.

Figures 5: still from the Ridley Scott directed film Blade Runner (Warner Bros. Pictures, 1982)

The other technology that has overwhelmed us is that of the mobile phone. Originally a mere means of communication it has now become a computer with communications and media abilities that can be the control centre to many activities. Manufacturers are now using it as an interface to lighting controls. This should make people more responsive and make it easier for people to interact better with more complex lighting.

As a communication device it also permits people to interact with larger lighting installations. Ultimately we will have systems that detect your presence and set lights according to behaviour patterns the system has learned from you; this was science fiction but a few short years ago and I am prepared to bet that

this will be available in control systems within the next 5 years.

We are getting close to the end of development in one area of technology and that is the sheer efficiency of converting electricity to light. Here we are about to hit some of the immutable laws of physics. These relate to our visual system and the fact that it has a specific response to different frequencies of light that we experience as colours. White light efficiency is limited to around 251 lumens per watt: that is not electrical watts but light power. By the time we subtract electrical efficiencies and limitations of materials to convert electricity to light we are going to hit a maximum practical efficiency probably around 145 lumens per watt. That isn't too bad when you consider that the sun's efficiency is only around 93 to 96 lumens per watt. Currently the best available fluorescent lamps are achieving around 113lm/W and in laboratories LEDs are approaching 200lm/W (refer to fig. 7) - though not under operating conditions that can ever be matched in practice.

Figure 6: Martin Cooper; conceived of and demonstrated the first cellphone in 1973, for Motorola

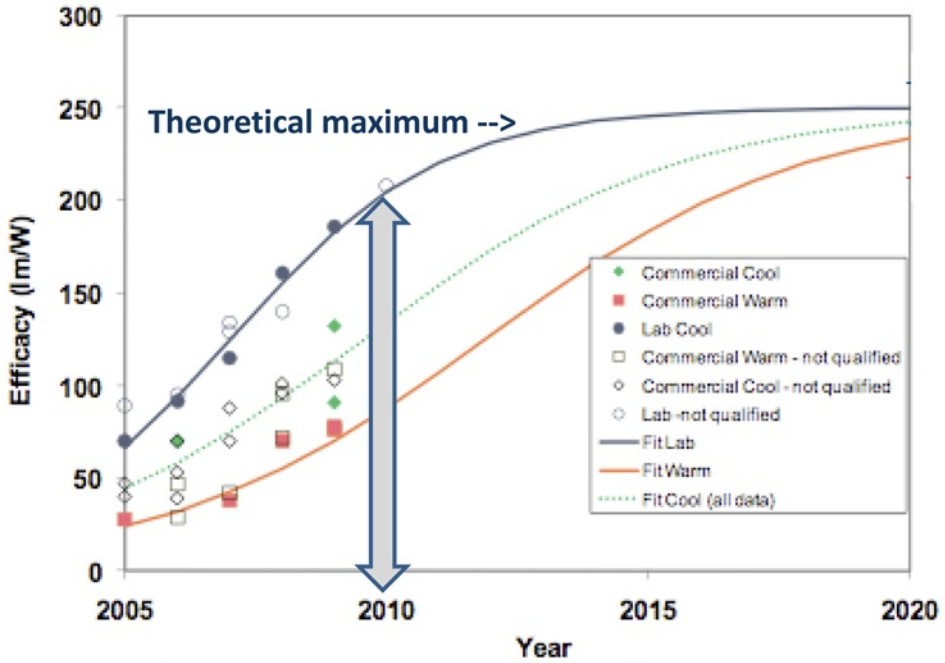

Figure 4.11: White-Light LED Package Efficacy Targets[64], Laboratory and Commercial

Figure 7: LED efficiency graph (US Department of the Environment)

So what next? We probably need to wait for a flying saucer to bring us some new technology for light that breaks our dependence on electricity, though maybe the geneticists will dispense with our need for light by just making us all glow!

Figure 8: Mouse genetically modified to express green fluorescent protein (GFP), a protein originally isolated from jellyfish.