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# Joseph Lovibond & His Tintometer

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The Scottish physicist James Clerk Maxwell is well known in the scientific community for his elegant equations that define the fundamentals of electromagnetism. Combined with the Lorentz force law, these equations govern all basic aspects of the subject. Maxwell's great achievement was to obtain a modified form of Ampère's law that predicted radio waves, later transmitted and detected by Hertz. But before Maxwell succeeded in bringing about the mathematical marriage of electric and magnetic phenomena, he had pondered deeply on the subject of colour, famously an area of study by Isaac Newton. Maxwell's untimely death in 1879 at the age of 48 no doubt robbed us of further early developments in this field<sup>1</sup>. Twenty-six years later, brewer Joseph Lovibond formed The Tintometer Ltd to manufacture his patented measuring instrument, originally inspired by the need to quantify the colour of beer.

## Introducing Joseph Lovibond

During a presentation given to the Colour Group of the Physical Society in 1943, Gerald Sidney Fawcett spoke about a man '...to whom science and industry are, in no small measure, indebted.' Fawcett could speak with some authority<sup>2</sup> since he was the grandson of Lovibond and a director of The Tintometer Ltd since 1930. His talk, on 'Sixty Years of Colorimetry', gave details of Lovibond's life.



Joseph W. Lovibond at work with his coloured glass slides

Joseph Williams Lovibond<sup>3</sup>, born 17 November 1833 at Long Sutton, Somerset, was the third son of John Locke Lovibond. At the age of 13 he joined the Merchant Navy and went to sea under a Captain Aitken. Conditions on board were unpleasant enough for him to jump ship by diving overboard in an Australian harbour, apparently preferring to brave shark-infested waters rather than another voyage with Aitken.

He then turned his hand to gold prospecting at Ballarat, in Australia, before moving

on to the gold fields of California around 1849. He might have returned to England with a decent reward for his efforts, except for an unfortunate incident. Whilst saying his farewells to friends ashore a cache of gold dust fell from his hat into the sea.

Meanwhile, Joseph's father and two brothers had been running a brewery in Greenwich. John Locke Lovibond had started a brewery at Frome, Somerset in 1834<sup>4</sup> and acquired the Nag's Head Brewery on Bridge Street in Greenwich during (or shortly after) 1847. Joseph joined the family business around 1854. The enterprise subsequently expanded. In 1865 a



Joseph W. Lovibond at rest

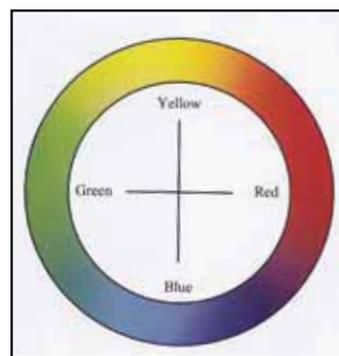
new brewery was built on Greenwich High Road and Joseph moved to Salisbury in 1869 to acquire another facility, the St Anne's Street Brewery<sup>5</sup>.

## Colour Perception

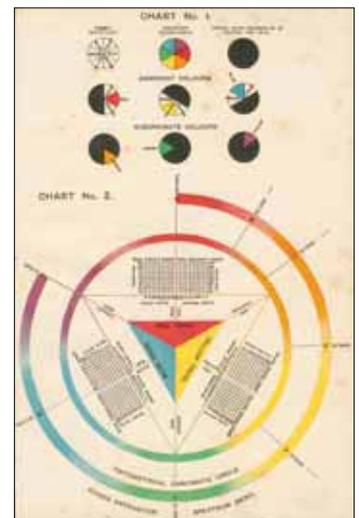
Out of the huge span of wavelengths in the electromagnetic spectrum, there is an extremely narrow range of values that represents all the colours visible to the human eye. Ranging from about 0.39 micrometres at the blue end to 0.70 micrometres at the red end, they are interpreted by the brain via receptors in the retina. It was in 1777 that the dye chemist George Palmer proposed what eventually re-appeared

in refined form as the Young-Helmholtz theory of colour perception. In this later theory, three types of receptors were proposed, each sensitive to a particular colour: blue, green and red (Palmer's were blue, yellow and red). Experiments show that the receptors (cones) are stimulated to about the same degree by red and green but respond weakly to blue. This explains why hot stars observed in the night sky appear less blue than they do when photographed, because colour film has a better sensitivity to blue.

Colours are generally described with regard to three key attributes:

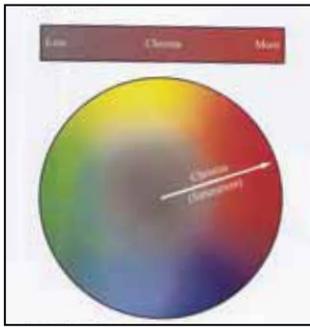


Hue



Illustrations from the Journal of The Society of Dyers and Colourists, February 1908, in an article called 'On a method of Identifying and Valuing Dyestuffs'

hue, chroma and value. Hue gives the name that we have learnt to associate with the sensation called colour as seen in rainbows: red, orange, yellow, green, blue, violet, and their combinations on the 'hue circle' such as green-blue. Chroma, or saturation, is a value that increases as the colour tends to a



Chromaticity

pure hue and decreases as the colour becomes greyish. The two extremes of the third variable, value, are black and white, so value gives the 'lightness' of a colour. The development of methods for assigning numerical values to any given perceived colour is a fascinating subject, but beyond the intended scope of this paper.

## The Colour of Beer

When J.W.Lovibond joined the family brewery he found that there was no simple method available for measuring the colour of beer and wort (malt solution). Not a major worry for brewers of the time but nonetheless a subject that appealed to Lovibond's inventive nature.<sup>6</sup>

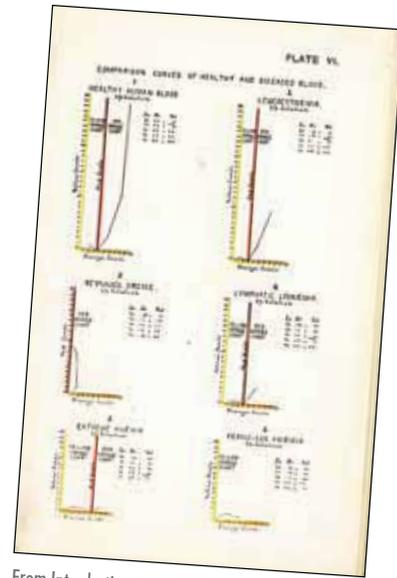
According to G.S. Fawcett, Joseph purloined a tea caddy from his wife's kitchen and cut observation slots in front and back. By this means, two glasses of beer could be compared with each other. This led on to thoughts of how to prepare standards so that comparisons could be made and the results recorded numerically. Chemical solutions approximating to the various shades of brown were tried and found unsatisfactory because of long-term stability. Then came the answer: '...after extensive searches through the bins of several glass merchants, Lovibond was successful in finding a few samples of amber-coloured glass which very closely resembled the colour of malt worts and beer.' To control the conditions under which determinations were made, he devised an instrument with an eyepiece that allowed the simultaneous observation of the



Advertising home deliveries – this was registered as a trade mark in 1925

sample and one of a series of coloured glass slides numbered 1 to 20. Extending the idea for use in other industries resulted in a multitude of arbitrary colour scales and before long he adopted the idea of using combinations

of red, yellow and blue glasses, of various intensities, to make the matches. The numbering system formed an arithmetical progression so that (for example) number one and two in red, when combined, gave the same intensity as a number three.



From Introduction to the Study of Colour Phenomenon (1905)

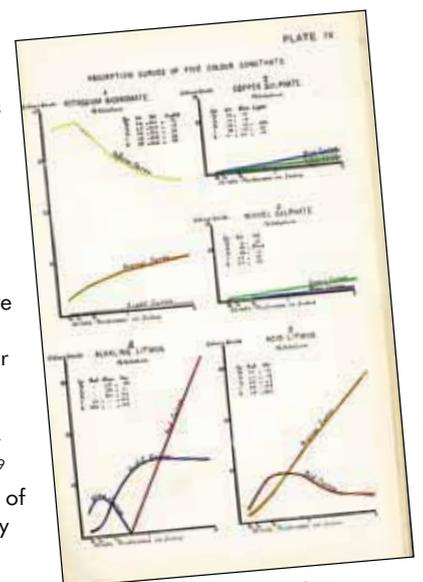
## The Tintometer Ltd

Joseph lived next door to the St Anne's Street Brewery and the early work on colour measurement was done in the summerhouse at the rear of his home. With (or around the time of) the incorporation of The Tintometer Ltd on 23 August 1895, he ceased to play an active role in the management of the Salisbury brewery<sup>7</sup>, which continued to run as John Lovibond & Sons, under the management of his nephew Joseph.

Tintometer's premises stood behind the brewery, at No 1, The Friary, home for the next 35 years. Joseph's wife, Charlotte, died in 1896 and shortly after this he bought the Lake House estate, some six miles from the centre of Salisbury, where he lived for a time with a retinue of servants. His occupation of Lake House was not continuous. For part of the time Joseph used a smaller house called 'The Pleasance'<sup>8</sup>. He leased Lake House to a Liberal MP, Percy Illingworth, in April 1912 and within days the place was almost totally destroyed by fire. Today, the musician and actor called Sting (Gordon Matthew Thomas Sumner) lives in the rebuilt mansion.

Lake House is situated at the village of Lake, close to the River Avon. Joseph provided work for the locals by setting up a cottage weaving industry. These activities were later moved to the Tintometer factory in Waterloo Road where three large looms were installed. After WWI, the weaving gave employment to disabled ex-servicemen, operating under the name of Stonehenge Woollen Industry Ltd. The cloth produced had a ready outlet – via Arthur Fawcett's<sup>9</sup> three shops in the West End of London and one in Salisbury High Street.

Tintometer's Articles of Association in 1895 included provision for publishing books and these were forthcoming from J.W.Lovibond, such as: *Measurement of Light and Colour Sensations* (1893), *An Introduction to the Study of Colour Phenomena* (1905) and



From Introduction to the Study of Colour Phenomenon (1905)

*Light and Colour Theories and their Relation to Light and Colour Standardization* (1915). He also wrote extensively for various professional bodies, like the Society of Dyers and Colourists, the Institute of Brewing and the International Society of Leather Trades Chemists.

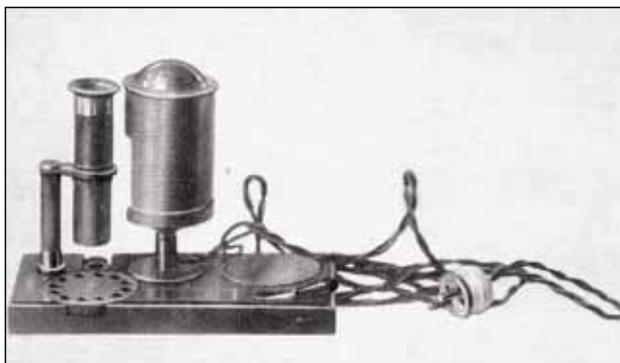
In a paper on 'Measurement of Fog Densities', presented at a meeting of the Royal Meteorological Society in 1907, Joseph described his 'Tintometric Light Units', a luminous intensity scale running from 1 to 32. Defining 32 as visibility under broad daylight conditions, 1 represented the darkness that reduced vision to the point at which the 'sky line at 1500 yards [is] just distinguishable'. To the criterion 'cannot read The Times newspaper' he gave a value of 29.

It was in 1930 that Tintometer moved to a former flour mill that had been unused for a number of years. This stood at the end of Waterloo Road, Salisbury where adjacent land provided room for expansion. After refurbishing the buildings, furnaces were installed for the manufacture of glass colour standards. A second factory was opened in 1969 at Wadebridge, Cornwall.

## Some Tintometer Products

Soon after establishing the utility of the comparator in brewing, the extension of the principle to other industries followed. Paint, sugar, edible oil, flour, wine, malt, tanning solutions, all of these products and more have colour measurement as a useful parameter.

An interesting instrument featured in an old brochure (undated) is the No.4 set, used for estimating the colour and turbidity of water. The instructions include the advice: 'The Tintometer must be set up facing a North Window over which a sheet of the special diffusing paper screen has been placed.' A platinum coated needle, devised by Dr J.C.Thresh, was offered as an optional extra for the turbidity measurements.

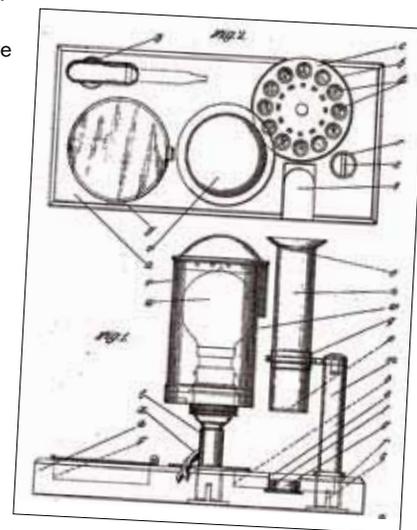


Dr Oliver's Haemoglobinometer (note the two-pin mains plug, then in use)

By moving the needle through the sample (contained in a long glass cell) until it was just visible, the turbidity could be expressed in terms of a distance scale. John Clough Thresh, Medical Officer of Health to the Essex County Council around the turn of the last century, had other devices to his credit. His incubator and condenser could be bought from A.Gallenkamp & Company (1902 catalogue) and he held patents on apparatus relating to disinfection and water purification. He was even a director of the Manchester firm Stelfox Ltd<sup>10</sup> that specialised in the construction of scientific equipment from sheet metal and supplied the University of Manchester.

Another device on offer was an improved form of Dr Oliver's Haemoglobinometer<sup>11</sup>, the subject of a patent by Frances Elizabeth Baker in 1922. The sales literature boasted certain advantages of the modified instrument such as: 'Electric light is used instead of a candle'. Frances Baker married Joseph Locke Lovibond, the son of Joseph Williams Lovibond's

brother Edward, in 1922. She had been a director of Tintometer since before WWI and very active in technical development. Other members of the board (as of 1919) included the daughters of Joseph Williams Lovibond. It seems that the Salisbury brewing industry provided a happy hunting ground for spouses. Amy Lovibond married John Follitt (of the firm John Follitt, Old George Steam Brewery) and Charlotte married Sidney Fawcett (of W.Fawcett & Sons, Endless Street Brewery), all in 1887.



Patent 189375 for Dr Oliver's Haemoglobinometer (1922)

G.W.G.Kaye, in his *The Practical Applications of X-Rays* (1922), notes that there are several ways to measure the degree of exposure a patient receives from X-rays: 'Of all the various intensity measurers, the pastille<sup>12</sup> finds most favour with medical men in this country. '...but the colour matching cannot satisfactorily be carried out without a tintometer, for example, of the Lovibond type.'

This method stemmed from the investigations that Joseph had conducted in collaboration with doctors at the Salisbury Infirmary.

British Drug Houses Ltd<sup>13</sup> and Tintometer Ltd established a financially beneficial relationship that greatly assisted Tintometer's sales during the trade depression of the late '20s and early '30s. BDH's interests in analytical testing led to the development of 'The BDH pattern Lovibond Tintometer'



The British Drug Houses pattern Lovibond Tintometer from the 1965 BDH catalogue

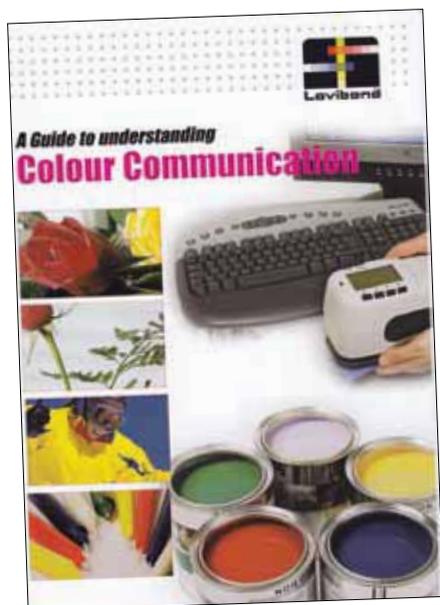


Modern version of the Tintometer, model AF710-3

in their own research laboratories, largely under the direction of Thomas Tusting Cocking who was working on Vitamin A estimations. The BDH catalogue of 1965 shows the device (pictured) and recommends the additional use of a white light cabinet. The Tintometer, being a subtractive colorimeter<sup>14</sup> requires a standardised light source to be most effective.

## Exit Joseph Lovibond

In addition to his professional duties, Joseph was Mayor of Salisbury in 1878 and 1890 and variously acted as a Magistrate and County Councillor. He experimented with military camouflage, which the Admiralty encouraged to some extent by providing facilities to carry out tests around Portsmouth in 1915. Other interests were reinforced concrete and scientific trout breeding. On his 80th birthday he was still able to ride a horse to the local foxhounds meeting. He died on 21 April 1918, leaving a personal estate with a gross value of £33,392.



## Postscript

John Lovibond & Sons Ltd, brewers of Greenwich, made its last batch of beer in 1959. It continued to trade with a chain of off-licences until acquired by Wine Ways Supermarkets Ltd in 1968. In 2005, Jeff Rosenmeier resurrected the old name when he formed Lovibonds Brewery Ltd in Henley-on-Thames.

The Tintometer Ltd continues to be a leader in the field of colour measurement, now based at Solstice Park, in Amesbury<sup>15</sup>.

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## Acknowledgements

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Jeff Rosenmeier of Lovibonds Brewery Ltd.



## Notes

<sup>1</sup> Maxwell had produced the first colour photograph in 1861.

<sup>2</sup> G.S.Fawcett's article contains some dates that are slightly in error. The date of Tintometer's incorporation is 1895 (1896 given) and the death of Joseph Williams Lovibond is 1918 (1917 given).

<sup>3</sup> Joseph Williams Lovibond is referred to simply as 'Joseph' in most of this article.

<sup>4</sup> Early details of the brewery's foundation are open to question and require verification.

<sup>5</sup> On more modern maps it is marked as St Ann Street.

<sup>6</sup> For example, in addition to several patents related to colour measurement he patented 'An Improved Combined Forcing Frame and Light for use more particularly in Intensive Cultivation' in 1908.

<sup>7</sup> He then became Chairman of John Lovibond & Sons Ltd, serving in that capacity until his death.

<sup>8</sup> Gordon Chamberlin's article records that this was built by Joseph using reinforced concrete, incorporating broken railings and iron bedsteads.

<sup>9</sup> Arthur Joseph Fawcett, son of Sidney who married Charlotte Lovibond.

<sup>10</sup> It is likely that Stelfox Ltd constructed in part, or in full, some of the equipment used by Ernest Rutherford at the University of Manchester. Stelfox Ltd went into liquidation during 1928.

<sup>11</sup> Developed by George Oliver (1841-1915) to measure the haemoglobin content of the blood.

<sup>12</sup> In this particular application, a pastille is a small disc of barium platinumocyanide. Initially green, it turns orange with exposure to X-rays.

<sup>13</sup> Became BDH Ltd, then taken over by Merck of Germany in 1973. After further transitions it is now a component part of VWR International Ltd.

<sup>14</sup> Starting with a beam of white light, colours are produced by removing certain wavelengths as the beam passes through coloured transparencies.

<sup>15</sup> The Tintometer Ltd moved from Waterloo Road to the present site in December 2005.