

Discourse Processing - Anaphora Resolution

Haoyue Zhu

A spark, a flint: How fire leapt to life

To early man, fire was a divine gift randomly delivered in the form of lightning, forest fire or burning lava. Unable to make flame for **themselves(1)**, **the earliest peoples(1)** probably stored fire by keeping slow-burning logs alight or by carrying charcoal in pots.

How and where man learnt how to **produce flame(2)** at will is unknown. **It(2)** was probably a secondary invention, accidentally made during tool-making operations with wood or stone.

Studies of primitive societies suggest that the earliest method of making fire was through **friction(5)**. **European peasants(4)** would insert **a wooden drill(3)** in a round hole and rotate **it(3)** briskly between **their(4)** palms. **This process(5)** could be speeded up by wrapping a cord around **the drill(3)** and pulling on each end.

The Ancient Greeks used lenses or concave mirrors to concentrate the sun's rays and burning glasses were also used by Mexican Aztecs and the Chinese.

Percussion methods(6) of fire-lighting date back to Paleolithic times, when some Stone Age tool-makers discovered that chipping flints produced sparks. **The technique(6)** became more efficient after the discovery of iron, about 5000 years ago. In Arctic North America, the Eskimos produced a slow-burning spark by striking quartz against iron pyrites, a compound that contains sulphur. **The Chinese(7)** lit **their(7)** fires by striking porcelain with bamboo. In Europe, the combination of steel, flint and tinder remained the main method of fire-lighting until the mid-19th century.

Fire-lighting was revolutionised by the discovery of **phosphorus(8)**, isolated in 1669 by a German alchemist trying to transmute silver into gold. Impressed by the **element(8)**'s combustibility, several 17th century chemists used **it(8)** to manufacture fire-lighting devices, but the results were dangerously inflammable. With phosphorus costing the equivalent of several hundred pounds per ounce, the first matches were expensive.

The quest for a practical match really began after 1781 when a group of French chemists came up with the Phosphoric Candle or Ethereal Match, **a sealed glass tube(9)** containing a twist of paper tipped with phosphorus. When **the tube(9)** was broken, air rushed in, causing the phosphorus to self-combust. An even more hazardous device, popular in America, was the Instantaneous Light Box-**a bottle(10)** filled with sulphuric acid into **which(10)** splints treated with chemicals were dipped.

The first matches(11) resembling **those(refer to matches)** used today were made in **1827(15)** by **John Walker(12)**, **an English pharmacist(12)** **who(12)** borrowed the formula from a military rocket-maker called **Congreve(11)**. Costing a shilling a box, Congreves were splints coated with sulphur and tipped with potassium chlorate. To light **them(11)**, the user drew **them(11)** quickly through folded glass paper. **Walker(12)** never patented **his(12)** invention, and three years later **it(11)** was copied by a **Samuel Jones(13)**, **who(13)** marketed **his(13)** **product(14)** as **Lucifers(14)**.

About **the same time(15)**, a French chemistry student(16) called **Charles Sauria(16)** produced **the first 'strike-anywhere' match** by substituting white phosphorus for the potassium chlorate in the

Walker(12) formula. However, since white phosphorus(17) is a deadly poison, from 1845 match-makers exposed to its(17) fumes succumbed to necrosis(18), a disease that eats away jaw-bones(18). It wasn't until 1906 that the substance was eventually banned.

That was 62 years after a Swedish chemist(19) called Pasch(19) had discovered non-toxic red or amorphous phosphorus, a development exploited commercially by Pasch's compatriot J E Lundstrom in 1885. Lundstrom's safety matches were safe because the red phosphorus(20) was non-toxic; it(20) was painted on to the striking surface(21) instead of the match tip, which(21) contained potassium chlorate with a relatively high ignition temperature of 182 degrees centigrade.

America lagged behind Europe in match technology and safety standards. It wasn't until 1900 that the Diamond Match Company bought a French patent(22) for safety matches - but the formula did not work properly in the different climatic conditions prevailing in America and it was another 11 years before scientists finally adapted the French patent(22) for the US.

The Americans, however, can claim several 'firsts' in match technology and marketing. In 1892 the Diamond Match Company pioneered book matches. The innovation didn't catch on until after 1896, when a brewery(23) had the novel idea of advertising its(23) product in match books. Today book matches are the most widely used type in the US, with 90 percent handed out free by hotels, restaurants and others. Other American innovations include an anti-afterglow solution to prevent the match(24) from smouldering after it(24) has been blown out; and the waterproof match(25), which(25) lights after eight hours in water.

Notes: yellow expressions points to blue ones.