

David Huffman

David Huffman was born on August 9 1925. He had a somewhat troubled childhood, and events during that time seemed to have instilled in him a striving for neatness and order. He is reported to have attributed his love of things mathematical to his tumultuous early years, and his need to cope with the uncertainties of that period. An apparent lack of ability in articulation during his childhood, viewed with some concern by his mother, actually masked considerable precociousness.

Huffman had his schooling and undergraduate college education in Ohio where he earned a bachelor's degree in Electrical Engineering at the age of 18. He then worked in the US Navy as a radar maintenance officer on a destroyer that was supposed to clear mines from Japanese and Chinese waters after World War II. He got his master's degree in Electrical Engineering in Ohio in 1944.

A few years later Huffman joined MIT for his doctoral studies. He is best known for his 'Huffman Codes' which were proposed in a term paper he wrote as a graduate student at MIT for a course in information theory with Robert Fano in 1951. Huffman codes are ubiquitous and are used in several devices, for example, modems, fax machines and high definition TVs. The problem Huffman addressed was that of coding the output of a symbolic-valued source in as few bits as possible, so that the original source output could be recovered without any loss of information. Huffman's algorithm was the first of its kind, and its beauty lies in its simplicity. As reported in the *Scientific American*¹ (September 1991), "That epiphany added Huffman to the legion of largely anonymous engineers, whose innovative thinking forms the technical underpinnings for the accoutrements of modern living – in his case, from facsimile machines to modems and a myriad of other devices." The article also reports Huffman to have said that he might never have tried his hand at the problem – much less solved it at the age of 25 – if he had known that Fano, his professor, and Claude E Shannon, the creator of information theory, had struggled with it. Although others have used Huffman codes to make enormous profits, Huffman never tried to patent his work. His main reward seems to have been a dispensation from the final examination for the course with Fano.

¹ Gary Stix, Profile: David A Huffman, *Scientific American*, September 1991.



Huffman joined the faculty at MIT in 1953 and became Chair of the Electrical Engineering Department in 1962. In 1967 he moved to the University of California, Santa Cruz to set up a Computer Science Department. This brought him closer to the western mountains where he loved to backpack and camp.

In the 1970's Huffman studied an interesting subject, inspired by the puzzling optical illusions in the work of the artist M C Escher, for example, triangles containing three right angles. A close inspection of Escher's creations led him to devise a set of rules which were designed to determine whether a two dimensional representation of a three dimensional scene was proper. He called his proof an image grammar, and his ideas were used in developing machine vision systems for robots. The work was presented in 1971 in a paper entitled "Impossible Objects as Nonsense Sentences."

At some point, Huffman is reported to have exchanged paper writing for paper folding. A browse on the Web brings up images of intriguing geometric patterns that Huffman formed using only paper folds. He developed a theory of such folds which he lectured on at Stanford, MIT and other institutions.

Among Huffman's many awards were the Louis E Levy Medal of the Franklin Institute for his doctoral thesis on sequential switching circuits, The Computer Pioneer Award from the Institute of Electrical and Electronics Engineers (IEEE) Computer Society, the Golden Jubilee Award for Technological Innovation from the IEEE Information Theory Society in 1998, and the 1999 Richard W Hamming Medal from the IEEE for "design procedures of minimum redundancy (Huffman) codes and asynchronous switching circuits" and for "contributions to analysis of visual imagery".

Huffman died on October 7, 1999 at the age of 74 after a 10 month battle with cancer.

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