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Fairthorne R A. Empirical hyperbolic distributions (Bradford-Zipf-Mandelbrot) for bibliometric description and prediction. *J. Documentation* 25:319-43, 1969.
[Farnborough, Hampshire, England]

After about 1960, many papers appeared discussing bibliometric manifestations of these distributions. For over a century, they had been observed in many other contexts and had been studied mathematically. This paper attempts to survey these so as to show their common formal basis and to explain this clearly enough to lie within the tolerance of a generally educated reader. [The *Science Citation Index*® (*SCI*®) and the *Social Sciences Citation Index*® (*SSCI*®) indicate that this paper has been cited in over 65 publications, making it the most-cited article published in this journal.]

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The most obvious feature of this paper is its unwieldy title. It was stuffed with keywords in the hope of reaching a wide range of potential readers who might find it useful. Its unpublished working title was *Zipf Unfastened*, an immodest claim. Neither then nor, I think, since has anyone done or undone this completely.

The survey was suggested to me, with considerable vigour, by the late, and great, Herbert Coblans, then managing editor of the *Journal of Documentation*. My qualifications were that I had been around for a long time, had known Bradford personally, had acquaintance with a wide range of documentary topics, experience of many mathematical ones, and was recently retired. In particular, on the one hand I had been, and still am, a fascinated onlooker of Mandelbrot's work since hearing him in 1952.[1] On the other hand, some decades of experimental work (in aeronautics) had taught me the perils that beset those who apply mathematics, or computers, to unexplained phenomena.

So the survey attempted not only to describe the general kind of behaviour concerned, its widespread occurrence in quite distinct fields, and its particular manifestation as Bradford's Law but also to warn of the vulnerabilities of empirical mathematics. All this was to be reasonably clear to a nonspecialist reader without offending the specialist. Obviously, it could not, and did not, do all this, let alone solve the problem as well, but it did try.

Bradford's Law, whatever its exact formulation, is attractive to theoreticians because its formal aspects are distinct from its social and subjective ones. It deals with the properties of ranked data. Once ranked, the principles of the ranking can be ignored, but they must not be forgotten. The ranking depends on judgments of relevance, and neither these nor the documentary units—journals, books, articles—can be subdivided indefinitely or consistently. This does not rule out the use of continuous functions for general, statistical description or for approximation, but it does rule them out for explanation. The Bradford behaviour is of and by discrete units and discrete processes, mostly random ones.

As suggested in the title and text of this paper, an obvious approach, more obvious now than in 1969, is through Mandelbrot's "fractals," though he did not coin this term till later.[2] He has discussed Zipf behaviour (whose ranking is objective) extensively but never, so far as I know, Bradford. However, in his summary of scaling and power laws[3] lies the solution of the formal problem. The documentary problem is another matter.

1. Mandelbrot B B. An information theory of the statistical structure of language. (Jackson W, ed.) *Communication theory: papers read at a symposium on applications of communication theory, held at the Institute of Electrical Engineers, London, September 22nd-26th, 1952.* London: Butterworths Scientific Publications, 1953. p. 486-500.
2. ————. *Les objets fractals: forme, hasard et dimension.* Paris: Flammarion, 1975. 190 p.
3. ————. Scaling and power laws without geometry. *The fractal geometry of nature.* San Francisco: Freeman, 1982. p. 341-8.

