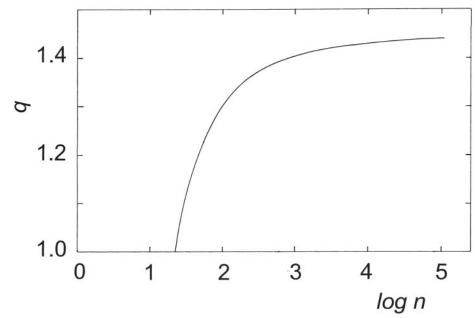

Fig. 3. Relation between two parameters of the inverse power distribution for which the golden condition, $r_F = 1/\phi$, is imposed. It is found numerically that, in the limit of $n \to \infty$, $q \to 1.4404$, i.e., the value of q approaches the fractal dimension of the golden tree. For illustrations of the tree, see Figs. 4 and 5 that follow.

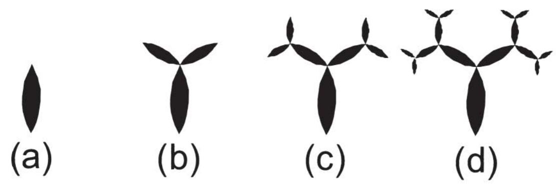

Fig. 4. Illustration of bifurcating *lunes* that will be evolving eventually to the golden tree (Walser, 1996). Here the term, lune, signifies a two-dimensional shape like a convex lens. Note that the ratio of the bifurcating lune-length over the preceding one coincides exactly with $1/\phi$. If the ratio exceeds $1/\phi$, neighboring branches on the tree overlap each other. (a) Unit lune (a trunk). (b) First generation. (c) Second generation. (d) Third generation.

which is valid for $q > 1$. An example of this distribution was initially found in linguistics. For corpora written in English, it was once demonstrated by Zipf (1949) that the relative frequencies, i.e., the statistical probabilities, of words obey Eq. (12) with $q = 1$. Later, this property, which is frequently called Zipf's law or a rank-frequency rule, has been ascertained in other diverse fields of sciences, such as demography, geography, biology, physics, and, more recently, informatics. Among them a case which might possibly be most unexpected was mentioned by Ma (1999) in the context of nuclear physics, where, for arbitrary q, Zipf's law was tested for the charge distribution of nuclear clusters in the liquid gas phase transition. In Fig. 3 the relation is shown between the two parameters of the inverse power distribution for which the golden condition, Eq. (2), is met. It is confirmed numerically that, in the limit of $n \to \infty$, $q \to 1.4404$. It seems to be much interesting and rather surprising to notice that this value of q does coincide with the fractal dimension of the golden tree (Walser, 1996):

$$D = \log 2/\log \phi = 1.4404 \cdots .$$

Here the golden tree is defined as the most significant self-similar tree depicted by using the upper boundary of the coefficient of reduction, above which branches of the tree collide each other; it was verified that the boundary value of the reduction coincides exactly with $1/\phi$ (Walser, 1996). Illustrations which explain the method for generating the golden tree are given in Figs. 4 and 5. To conclude, the results shown in Fig. 3 suggest that, in the limit of $n \to \infty$, the concept of the golden distribution would have relevance close to that of the self-similar golden tree and, possibly, the property of the zeta function.

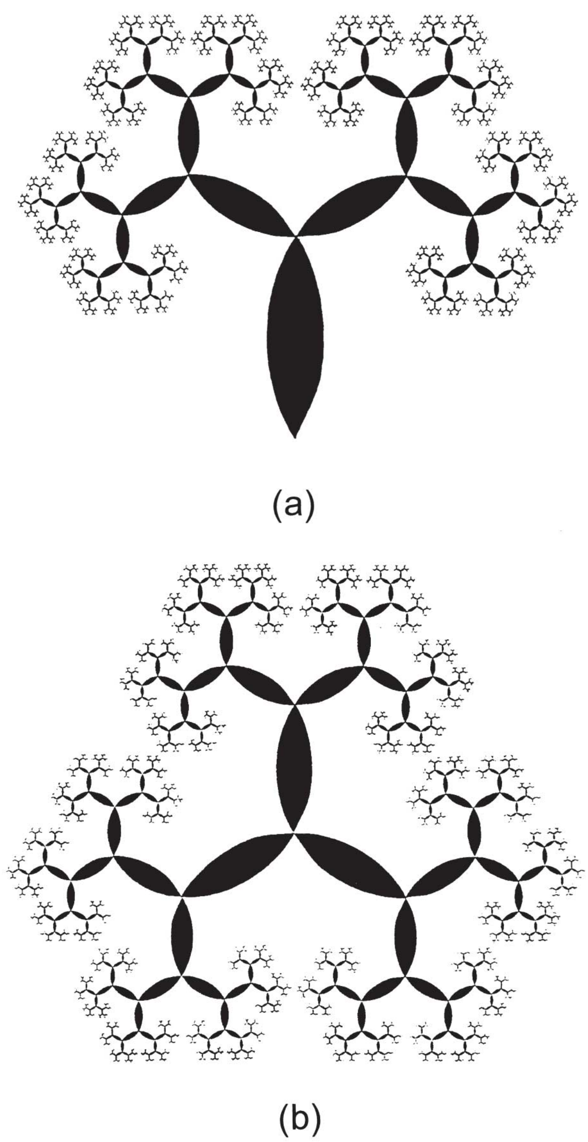

Fig. 5. The golden tree realized through the procedure of Fig. 4 (Walser, 1996). (a) Basic structure. (b) Composition of the three basic elements.

4. Examples in Word-Spectral Analysis

Examples of the golden distribution could be found in the word-spectrum analysis of texts in a corpus. Here the term *word spectrum*, which might be borrowed from the terminology of either physics or chemistry, can be defined by the frequency versus the length of words in a text. With these spectra being analyzed, one can obtain a stylistically important quality of texts, because their profile would depend on the writer's personality as well as the language. For all texts written by Shakespeare and by Bacon, Mendenhall (1901) analyzed their spectra and compared those of the two authors. The main conclusion was that the most