ПРОБЛЕМНАЯ СТАТЬЯ

THE SIGIL OF NUMBER TWELVE: A THOUGHT EXPERIMENT ON A SELF-LIMITED TWELVE SEGMENT HINGED COIL SEQUENCE FORMING THE GESTALT IMAGE

B. Momčilović

Institute for Research and Development of the Sustainable Eco Systems, Srebrnjak 59, 10000, Zagreb, Croatia

ABSTRACT. A kinetic diagram is shown where rectangles were expanding in a progressive linear sequence by hinged coil in 90° increment steps around the central core 1×1 square of a side a = 1; the width (base) of the rectangle varied with the length of the protruding tip of the hinged coil. The process was self-terminated after twelve steps when a unique (individual) 13×13 square Gestalt image mandala was formed comprising twelve distinctly different rectangles (segments). The growth and individualization of biological forms may be an inherently (structurally) pre-defined sequential non-linear auto-controlled dynamic process.

KEYWORDS: thought experiment, sigil twelve, number anthropology, Gestalt image, self-limited development, kinetic diagram, sequential hinge, sequence termination.

INTRODUCTION

Numbers function as a Supreme Court of science. Usually, we perceive any real number as an endless cumulation of the same quantitative units (1 = 1; 1 + 1 = 2; 1 + 1 + 1 = 3; ... etc.), but, anthropologically, every number may be also viewed as a distinct individual symbolic word presentation (One, Two, Three ... etc) (von Franz, 1985; Crump, 1990), a perennial dilemma of what was the first – the word or the number – In our contemporary technology-driven society, the anthropological approach to the symbolism of numbers is not in vogue. However, although the usual quantitative approach to the numbers is dominant in the physical world of cogs, levers, and wheels, it is not well suited for the study of complexity where a large number of the mutually interwoven data and other entangled factors are involved. Indeed, Godel in his incompleteness theorem has proved that we may not be able to prove everything with numbers (Freiberger, Thomas, 2016). Since physics needs numbers, there must be a considerable foible when using number in the life-science disciplines such as biology and physiology.

Since the dawn of human civilization, people have tried to visualize complex multifactorial relationships. Indeed, various mandalas were developed to visualize the phenomenon of multiple relationships, notably in their esoteric and spiritual context (Arguelles, Arguelles, 1985). Note that magical squares and cubes also belong to this category of symbolizing the internal unity of different components. Today's equivalent to visualizing and quantifying complex multifactorial relationships is network analysis, since the appropriate mathematical and statistical tools have matured enough and became available to scientists (Newman et al., 2006).

The study of patterns of growth and development in biology has occupied some of the best human minds like D'Arcy Thompson (1968), Allan Turing (1952), and Maynard Smith (1998). Indeed, the study of patterns is very much at the leading edge of science in numerous fields (Ball, 1999), including such diverse subjects as the study of life span and longevity. Indeed, mankind is still puzzled with the enigma of life (Schroedinger, 1965), and there is no plausible explanation why all the biological structures have a limited life span. Possible answers to such eternal question are beyond the current reductionistic paradigms based on linear analysis of data patterns and simple cause/effect response models.

The aim of the here presented thought experiment (*Gedanken experiment*) was to study the process of growth and development to an individual finite form through the development of a simple geometrical structure. Geometrical constructs have been used since the time of Pythagoras in order to prove

* Corresponding author:
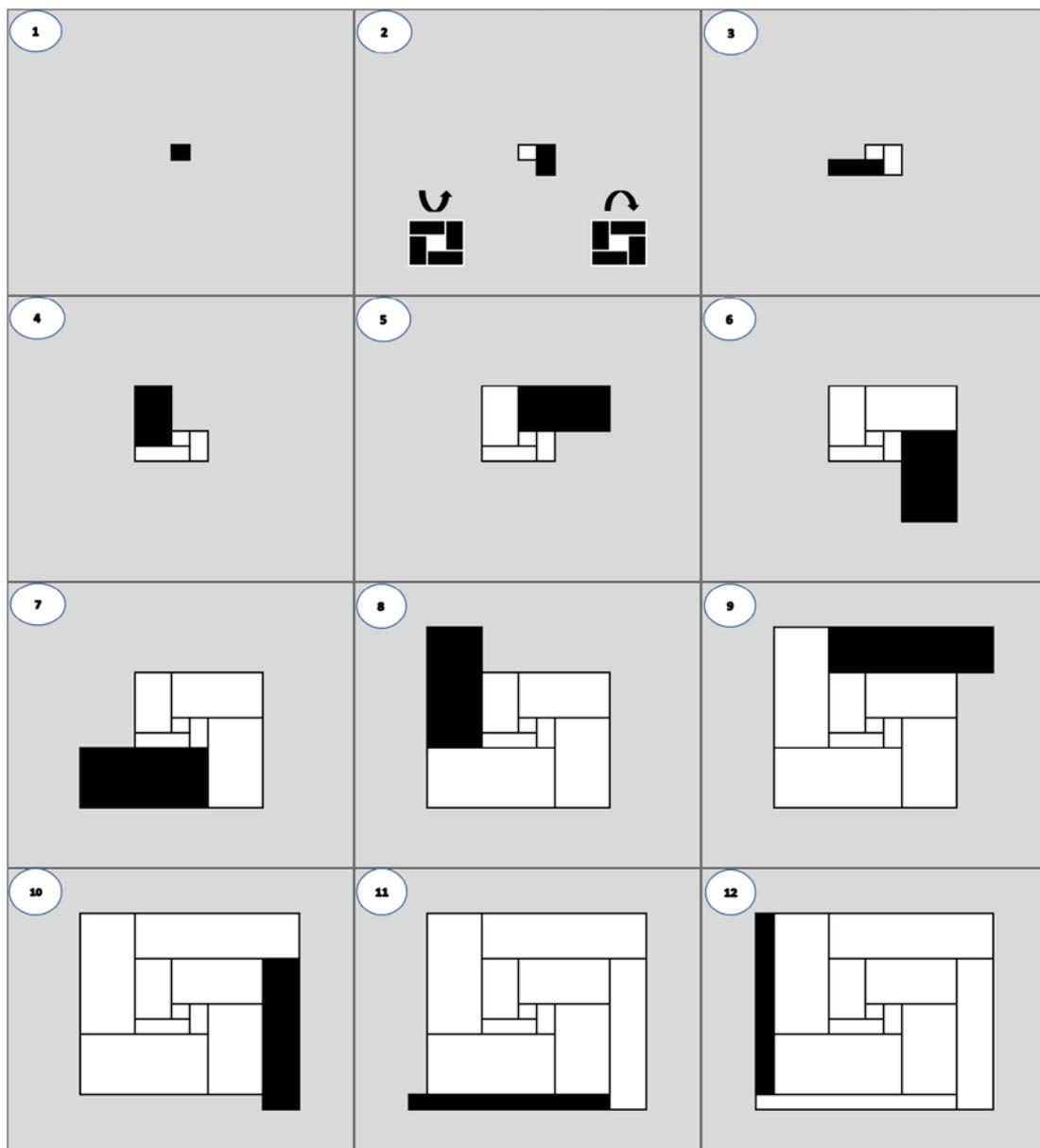**Momčilović Berislav**
E-mail: berislav.momcilovic@gmail.com

the mathematical truths (Maor, 2007). In this paper, we follow up the development of a linear sequence of a set of length expanding rectangles (independent parameter). The rectangles (segments) were coiling sequentially one after the other like a chain around the central 1×1 core square in a 90° steps. The width of the rectangles was also simultaneously changing, depending upon the change of the coiled leading rectangle end length (dependent variable). It took 12 rotations of such a constantly expanding sequence of rectangles of different lengths and widths until the coiling process was self-terminated. The final geometric structure of this chain-like coiling sequence was the 13×13 square Gestalt image. Gestalt is defined as a structure or configuration of physical, biological, or psychologi-cal phenomena integrated to constitute a functional unit with properties non-derivable from its component parts (Momčilović et al., 1997). This thought experiment model is in difference to the other well-known open end linear rotatory sequences based on the Fibonacci log expanding series (Cook, 1979; Dozi, 1981; Colman, 1912). Indeed, these rotatory sequences are the open (unlimited) expanding geometric series, whereas the one presented here is, thus far an unreported self-limited one («apoptotic» series of forms).

FORMATION OF THE GESTALT IMAGE

The development of the entire geometric structure has twelve distinct steps (Steps 1 – 12), which are shown in Fig. 1.

Fig. 1. *The kinematic diagram of Sigil number twelve development and termination*

Step 1 represents the starting point, the nidus or seed around which the dynamic, chain-like, rotational structure is formed, and the end Step 12 is the fully developed and self-limited Gestalt image form. The initial Step 1 started with one equal-sided square having the sizes 1×1 or $a \cdot a = a^2$. This central core square has four sides of equal length, i.e., AB, BC, CD and DA. Further on, the length of adjunct rectangles is formed by its expanding in constant increments of 1 a unit. Next, Step 2 in the sequence of linear expansion shows the position of the rectangle having the length (L) of two a's ($2a_L$) and the width (W) of one a ($1a_W$). Thus, the entire rectangle has a form of $2a_L \cdot 1a_W$, i.e., the total planar area equals 2a. This rectangle is sided to the central a^2 square. Evidently, this $2a_L \cdot 1a_W$ rectangle can be sided either clock-wise (right hand) or anti clock-wise (left hand) to the central square. That allows for a total of 8 distinct positions of this rectangle to coil the entire chain around the central core, as depicted in the insert to the Step 2. We chose to side the $2a_L \cdot 1a_W$ rectangle clockwise with extension pointing downward to a central a^2 square. And to place it on the AB side, and to rotate it for 90° for every consecutive step in a clockwise direction. Thereafter, the elongation of any further rectangle would occur by expanding the length of rectangle in a linear fashion such that it would grow step by step in single unit increments (a) at a time. At the same time, the width (base W) of the rectangle would accommodate to cover for the protruding linear increments of every such a unit. It is evident from Step 2 further on that the extension in the length of the rectangle would coil around the central core until Step 12. As long as the rectangle coils and extends around the central core, these increments in the protrusion of the length of the rectangles would allow for the change of the width of the rectangle. Thus, the stepwise revolving of the length expanding rectangles (L) around the central core will be followed by the change of the width (W) of any further rectangle. The base W of the rectangle is changing, depending upon the elongation L of the linear sequence growth.

This dependency of growth in length and the base accommodation to the length of the elongated part over the central core is demonstrated further in Step 3, where the rectangle $3a_L \cdot 1a_W$ is based ($1a_W$) on the leading edge of the previous rectangle $2a_L \bullet 1a_W$ of the sequential growth pattern. The next rotational sequence of Step 4 would be the rectangular segment $4a_L \cdot 2a_W$, followed further by the segment $5a_L \cdot 3a_W$ of Step 5. The process will be continued for the revolving Steps 6 to12 by following the same pattern, i.e., the respective rectangles (segments) would be ($6a_L \cdot 3a_W$), ($7a_L \cdot 4a_W$), ($8a_L \cdot 3a_W$), ($9a_L \cdot 3a_W$), ($10a_L \cdot 2a_W$), ($11a_L \cdot 1a_W$), and ($12a_L \cdot 1a_W$). This presented growth sequence will develop regularly until the rectangular segment $12a_L \cdot 1a_W$ of the Step 12. After Step 12, the process of revolving elongation is halted (terminated) since there is no necessary edge extension available for the next hypothetical rectangle segment «13 a_L». Step 12 acts as an inbuilt «stop codon» for the proposed algorithm, which appears to be an individual (final) Gestalt image of a $13a \cdot 13a$ square. Note the difference between the number of Steps (12) and the expansion of the planar area of the entire image which is $13a \cdot 13a = 169a^2$.
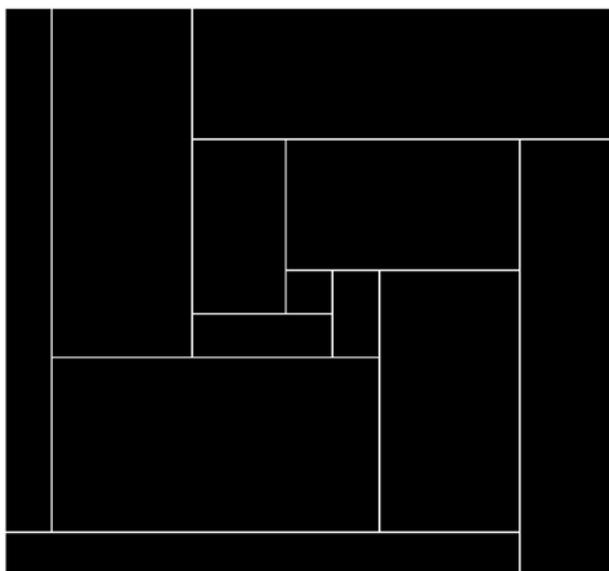
We can overcome this discontinuity and attempt to restore the revolving sequence in two possible ways. The first would be to consider the end of a self-limited planar square image of $13a \cdot 13a = 13a^2$ as a new growth seed central square of $1A \cdot 1A = A^2$ (where A = 13a). If we now repeat the revolving sequence in the next 12 Steps with A as a unit, we will get a new and much larger construct, i.e., the same pattern Gestalt end-image pattern ($13A \cdot 13A - 169A^2$). Then again, we may use this "super-square" as a new seed square, and so we may go on and on expanding it in an infinite series. Alternatively, if we may expand the sequence by siding the rectangle $14a_L \cdot 1a_W$ next to the core $13 \cdot 13$ square to generate a new cycle. However, such $14a_L \cdot 1a_W$ addition to a sequence would generate an infinite open onion shape repetitive pattern; there would be four 90° rotations per every «onion» shaped layer.

DISCUSSION AND CONCLUSION

The presented results of our thought experiment have shown how growth and development have led to the birth of a new form, i.e., to the individualization. And in difference to the other open-end linear expanding geometric models (Cook, 1979; Dozi, 1981; Colman, 1912), this one was self-terminating. This termination of growth and development by individualization is the inbuilt quality of the governing principle of the revolving sequence of the expanding rectangles in length (independent parameter) and width (dependent variable). We may describe the entire process as a novel way to generate a partition of a plane from within (Andrews, 1984), and in difference to the classical methods of partitioning when the plane is partitioned by imposing the partition pattern of the plane from the outside.

In this model, the partition has started from within and expands to a given limit inherent to the initial (inbuilt) information contained in the algorithm contemplated in this thought experiment. Evidently, this initial information may be quite simple, so that the similar self-limiting forms, shapes, and structures may be presented in all the living beings. If such or similar structures of inbuilt «stop codon» indeed exist, they may be at the core of the rate of production of the finite functional biochemical units such as, for example, hormones or any other dynamic biochemical parameter of the body leading to some identifiable individual end product or byproduct intermediary metabolite. This is a thought provoking conclusion since, if such a biological mechanism exists, there is no need for some independent controller from the outside – the growth and development of the structure is self-limited from the beginning. Such a self-limited dynamic structure is already the integral part of the process itself where the effect permeates the cause (Cleary, 1986).

The other aspect of this 12 step self-limited revolving pattern is the formation of a distinct final Gestalt image. Gestalt is the description of a situation where the whole has different characteristics that may not be derived from the individual property of any of its parts (Momčilović et al., 1997). Indeed, if you do not know the sequence, by simply studying the different rectangles it is not possible to deduce what would be the shape of the next one or a previous member of the sequence, respectively. Since rectangles are simultaneously changing their shape in both length and width, we have encountered the

problem of circulatory thinking logic in quite a novel prospective. This thought experiment is the first evidence that number 12 may have some internal structure and that the anthropological approach to this number may be a conceptual tool for the study of complex, non-linear phenomena. In other words, some numbers indeed may have distinct qualities which depend on their inner structure and beyond the quantitative arithmetic property of the number one. Hence, the Sigil of twelve is the title of this paper (*sigil* is an individual symbolic stamp) (Fig. 2).

In conclusion, the here reported Gestalt image, like Rorschach images of psychiatry (Exner, 2002a,b), may be interpreted in many other possible ways associated with the anthropology of the number 12. It's hard to believe that thus far nobody else has come up with the so simple Gestalt image mandala like the one demonstrated herein. Perhaps, like enneagrams of Ouspernsky (1949) and Gurdjieff (1973), such a geometric construct may have been lost or kept guarded, within the realm of some secret esoteric society, to be revealed only to the initiated. Evidently, complex multifactorial patterns may be visualized in many different ways.

ACKNOWLEDGEMENT

Fig. 2*. The Sigil number twelve –
The unity in diversity*

REFERENCES

Andrews G.E. The theory of partitions. Cambridge University Press, Cambridge. 1984.

Arguelles J., Arguelles M. Mandala. Shambaala Pobl. Inc., Boston and London. 1985.

Ball P. The self-made tapestry. Pattern formation in nature. Oxford University Press, Oxford. 1999.

Cleary T. (Transkator). I Ching Manadalas. Shamballa Pibl. Inc., Boston and London. 1989.

Cleary T. (Translator). Taoist I Ching. Shamballa Publ. Inc., Boston and London. 1986.

Colman S. Natures harmonic unity; A tretise on its relations to proportional form. G.P. Putnam and Sons, New York. 1912.

Cook T.A. The curves of life. Dover Publications Inc., New York. 1979.

Crump T. The anthropology of numbers. Cambridge University Press, Cambridge. 1990.

D'Arcy W. Thompson. On growth and form: abridged ed. Cambridge University Prress, Cambridge. 1968.

Doczi G. The power if limits. Shambala, Boulder and London. 1981.

B. Momčilović. THE SIGIL OF NUMBER TWELVE: A THOUGHT EXPERIEMENT
ON A SELF-LIMITED TWELVE SEGMENT HINDGED COIL SEQUENCE FORMING …

23

Exner J.F. The Rorschach , basic foundations and principles of interpretation. Vol.1., Wiley-VCH, Weinheim. 2002a.

Exner J.F. The Rorschach , basic foundations and principles of interpretation. Vol.2., Wiley-VCH, Weinheim. 2002b.

Freiberger M., Thomas R. Maths squaared. Apple Press, London. 2016.

Gurdjieff G.I. Belzebub's tales to his grandson. E.P. Dutton and Co Inc., USA. 1973.

Maor E. The Pythagorean theorem. Princeton University Press,Princeton. 2007.

Maynard Smith J. Shaping life. Genes, Embryous, and Evolution. Yale University Press, New Haaven, CT. 1998.

Momčilović B., Prejac J., Momčilović R., Ivičić N., Veber D., Lykken G.I. On the same element isotope mass number(Pleiad) and the cluste3rs of elements bearing the samer amass numbers in the Periodic system – the „chesshya" (fish skin) model. Trace Elements in Medicine (Moscow). 9 (3-4):5-20. 2008.

Momčilović B., Reeves P.G., Blake M.J. Idiorrhythmic dose-rate variability in dietary zinc intake generates a different response pattern of zinc metabolism than conventional dose-response feeding. British Journal of Nutrition. 78:173-191. 1997.

Newman M., Barabasi A-.L., Watts D.J. (Eds.). The structure and dynamics of networks. Princeton University Press, Princeton and Oxford. 2006.

Ouspensky P.D. In search of the miraculous. Harcourt, Brace and World Inc., Nrw York, NY. 1949.

Schroedeinger E. My view of the world. Cambridge University Press, Cambridge. 1964.

Turing A.M. The chemical basis of morphogenesis. Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences. 237:37-72. 1952.

von Franz M.-L. Number and time. Northwestern University Press, Evanston. 1974.

APPENDIX 1.
ON THE UNITY IN DIVERSITY

The conjectures of number twelve in human anthropology are numerous (Crump, 1999); it is a harbinger to the number mysticism of Pythagorean lore. The author of this article was always intrigued by the fact that the Last supper of Christian religious tradition is showing Christ and 12 Apostles. Why are there twelve Apostles and not some other number? At a glance, it is evident that the here shown chain-like hinged revolving self-limited Gestalt image mandala is a geometric key to the answer to this question. Indeed, there are 12 different rectangles, like 12 different Apostles, and only when they are combined into its final Gestalt image, the mystic body of Christ emerges. Did you notice that there are twelve windows at the dome of the Isakievsky Sabor in St Petersburg? It is reasonable to assume that the image of Christ in the Last supper is the metaphorical Gestalt image of the mystical unity of all the 12 Apostles in the body of Christ – Christ is the Apostles, and Apostles are Christ.

APPENDIX 2.
URANIUM IS AN INCOMPLETE SELF LIMITED GESTALT IMAGE

To illustrate the point of view expressed in this article, I should refer to Uranium (^{92}U) the last and the heaviest natural element of the Periodic system. Uranium has seven electron orbits (shells), each one having a different number of electrons $k = 2$, $l = 8$, $m = 18$, $n = 32$, $o = 21$, $p = 9$, and $q = 2$ (Fig. 3). Evidently, the number of electrons per shell is growing until inclusive the orbit n, and thereafter decreases. Apparently, the system of electronicshells is non-linear. Whereas the growth sequence (k–n) may appear to reassemble some regularity of the increase in the number of electrons, the further and more distant orbits (n–q) show no regularity except for the successive decrease of electrons from shell after shell. The pattern of growth and development is followed by decay and termination. Essentially, the process appears to be very similar to the pattern we have observed in the Number 12 Gestalt Mandala. The ^{92}U mandala has seven shells with 92 electrons unequally distributed; again, we are dealing with a self-limited structure. It should be noted that the entire Periodic system of 92 natural elements includes some 1500 isotopes (Momčilović et al 2008). Each of them may be considered as a finite complex self-limited system whose inner structure needs to be elucidated in apparently a non-linear function.
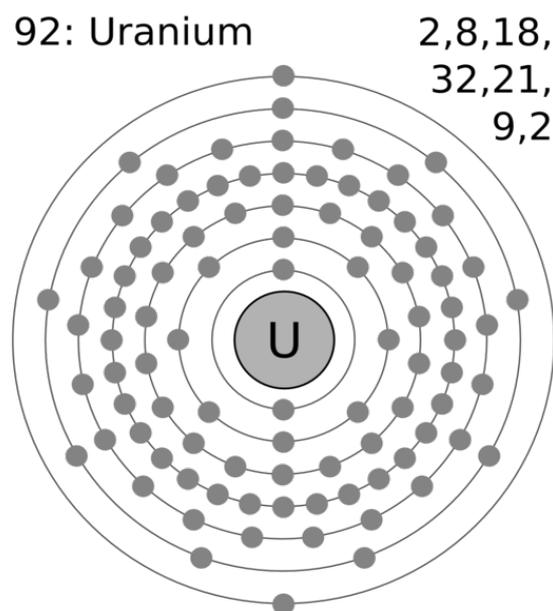

Fig. 3. *Uranium electronic shells structure*

СИГИЛ ДВЕНАДЦАТИ СЕГМЕНТОВ: МЫСЛЕННЫЙ ЭКСПЕРИМЕНТ ПО ФОРМИРОВАНИЮ САМООГРАНИЧИВАЮЩЕЙСЯ 12-СЕГМЕНТНОЙ СПИРАЛЬНОЙ ПОСЛЕДОВАТЕЛЬНОСТИ, СОЗДАЮЩЕЙ ЦЕЛОСТНЫЙ ОБРАЗ

Б. Момчилович

Институт изучения и развития устойчивых экосистем, Загреб, Хорватия

РЕЗЮМЕ. Автором предпринята попытка перевести систематизацию природных структур и процессов из области чисел в область формализованных образов. В работе предложен способ визуального отображения процесса формирования и развития природных структур. Визуализация представляет собой кинетическую диаграмму в форме спирали из прямоугольников, увеличивающихся в линейной последовательности с приращением под углом 90° и расхождением от центрального ядра размером 1×1. Ширина (основание) прямоугольников варьируется в зависимости от длины выступающего сегмента предшествующего прямоугольника. Приращение самопроизвольно завершается по достижении размера 13×13 с формированием уникального (индивидуального) целостного образа («мандалы»), содержащего 12 совершенно разных прямоугольников (сегментов). Предполагается, что рост и индивидуализация биологических форм может по своей природе представлять собой исходно (структурно) предопределенный самоконтролируемый последовательный нелинейный динамический процесс.

КЛЮЧЕВЫЕ СЛОВА: мысленный эксперимент, самоограничивающееся развитие, кинетическая диаграмма, шаговая спираль, целостный образ, сигил двенадцати сегментов.