

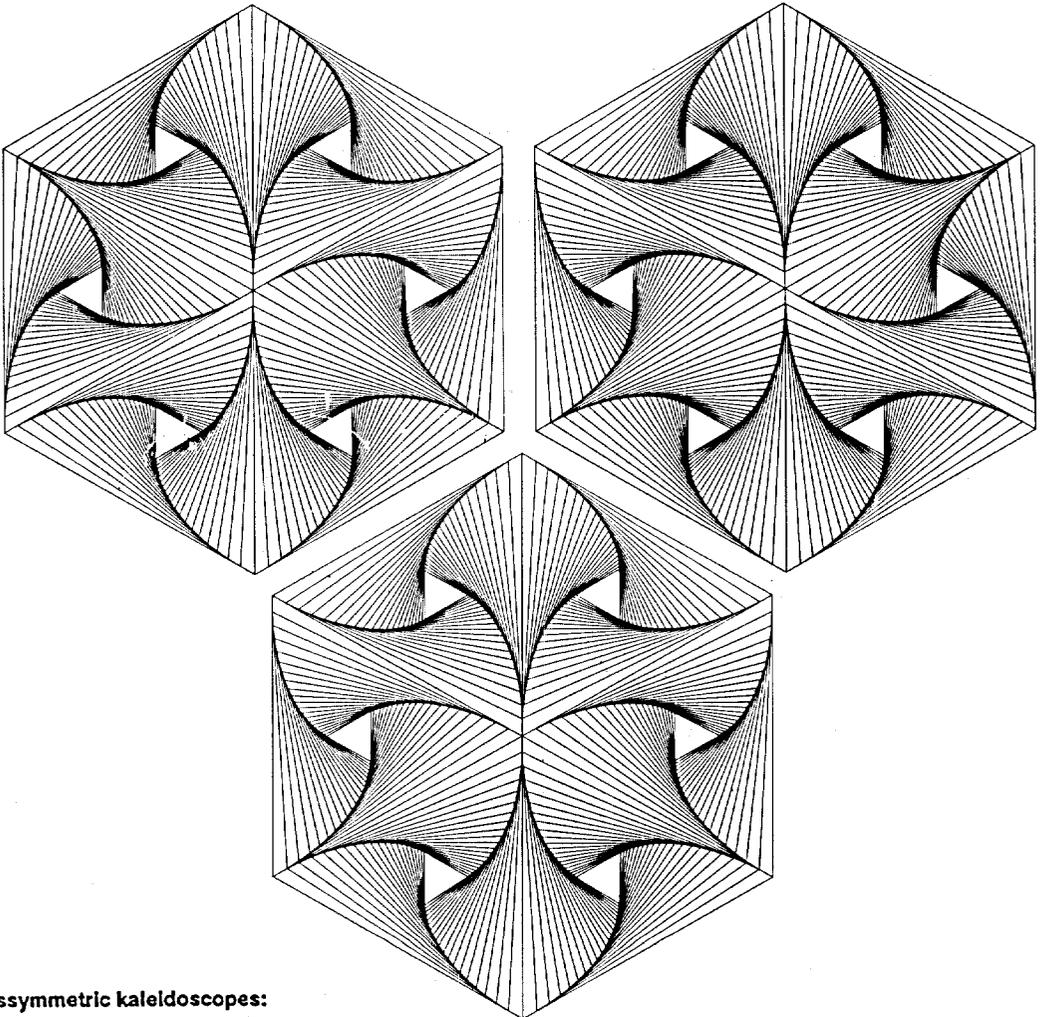
# Symmetry: Culture and Science

**SPECIAL ISSUE**  
Symmetry in a Kaleidoscope 1

The Quarterly of the  
International Society for the  
Interdisciplinary Study of Symmetry  
(ISIS-Symmetry)

Editors:  
György Darvas and Dénes Nagy

Volume 1, Number 1, 1990



Dissymmetric kaleidoscopes:  
Hommage à Pasteur

## **SYMMETRO-GRAPHY**

*Section Editor: Dénes Nagy, Department of Mathematics and Computing Science,  
University of the South Pacific, P.O. Box 1168, Suva, Fiji;  
Fax: +679 301-305; E-mail: d.nagy@usp.ac.nz*

*This section is devoted to bibliographies, reviews, and other short notes related to any kind of "-graphic" topics: bibliographic, discographic, software-graphic, ludographic (about toys and games), as well as biographic and historiographic. Some notes may have an informal character.*

*Some bibliographic articles may be related to the authors or papers in the same issue. Pioneers of the topic and their anniversaries are commemorated by biobibliographic articles (bibliographies with biographical notes). The reviews may be either detailed or brief. In the case of especially important works both forms can be used: to inform the readers about the publication briefly as soon as possible, then to present a comprehensive survey later.*

*The basic goal of this section is to keep a record of symmetry-related works appearing in diverse sources, including the non-English literature. Works for reviews and all correspondence should be directed to the section editor.*

### **BIBLIOGRAPHIES**

#### **The Bibliographic Project of ISIS-Symmetry**

Our authors and readers are invited to submit the lists of their symmetry-related publications, as well as any bibliographies, or other information, which are associated with the field. The goal of this project is to provide a computerized data bank of symmetry-related publications, symposia, exhibitions, sound disks, software programs, toys, games, and other items. Our desire is to build a world-wide network of reviewers who will collect and annotate the data at the broadest international level, including the non-English literature. The project has a special interest in those items which are not easily available and may remain unknown to a larger audience, including abstracts, exhibition catalogs, papers in proceedings, patents, preprints, problems, reviews, short notes, etc. It is useful to annotate the listed works (maximum of five lines for each item), especially in those cases where the title is not informative enough, or the publication has an important feature which should be emphasized. The use of abbreviated forms of journal titles and society names should be avoided because many of them are not known outside of a discipline. In the case of books, catalogs, and other individual publications, the length should be included (if there are two kinds of paginations, addition should be used, e.g., xi + 237 pp.). In connection with further technical details – including the treatment of non-English titles, and annotations – please refer to the note "Instructions for Contributors". Please submit items to this project by electronic mail or on diskette,

also sending a hard-copy. Please use red to mark the non-standard (non-ASCII) characters, if any, and to underline the words which should be italicized (it is crucial to distinguish journal articles from books and other individual publications). Of course typewritten texts will not be rejected, but the preparation of these items takes longer.

The cumulative bibliographies of this section will be available on diskette, so that the readers need not retype them. Furthermore, this section will publish various selections from it (general and topical bibliographies, lists of publications of individuals, etc.). All contributors to this section will be credited by listing their names and the descriptions of the submitted materials.

Briefly about plans: Simultaneously with the second part of the article "The kaleidoscope and symmetry" by Dénes Nagy, a related bibliography will be published which includes all of the cited historic and modern works on the kaleidoscope. In addition, a bibliography of interdisciplinary monographs, collections of essays, and symposia on symmetry is being prepared; it will appear in a later issue. There are very many books on symmetry: from Argentina to Poland, from Bulgaria to Mongolia, from Denmark to Armenia. Our readers are encouraged to inform us about any rare item which may have been missed.

### FunTiles, RepTiles and the Theory of Tilings

*The "marriage" of the theory of tilings with computing is mentioned in the article "Manifesto on (dis)symmetry", and the section SFS includes a brief description of the programs FunTiles and RepTiles. Daniel Huson kindly submitted a bibliography on this subject. Some of the works are very recent and available only in theses, or will appear in the near future. In connection with the theory of tilings in general, please refer to Grünbaum and Shephard's encyclopedic monograph.*

- Delaney, M.S. (1980) Quasi symmetries of space group orbits. *Match: Communications in Mathematical Chemistry*, 9, 73-80.
- Delgado Friedrichs, O. (1990) *Die automatische Konstruktion periodischer Pflasterungen*. [The Automatic Construction of Periodic Tilings, in German], [Thesis], Bielefeld: Universität Bielefeld
- Delgado, O., Huson, D. and Zamorzaeva, E. (to appear) The classification of 2-isohedral tilings of the plane. *Geometriae Dedicata*.
- Dress, A.W.M. (1986) Regular polytopes and equivariant tessellations from a combinatorial point of view. In: *Algebraic Topology: Göttingen 1984*, Berlin: Springer, 56-72.
- Dress, A.W.M. (1987) Presentations of discrete groups, acting on simply connected manifolds. *Advances in Mathematics*, 63, 196-212.
- Dress, A.W.M. and Huson, D. (1987) On tilings of the plane. *Geometriae Dedicata*, 24, 295-310.
- Dress, A.W.M. and Scharlau, R. (1984) Zur Klassifikation äquivarianter Pflasterungen. [On the classification of equivariant tilings, in German], *Mitteilungen aus dem Mathem. Seminar Giessen*, 164, 83-136.
- Franz, R. and Huson, D. (to appear) The classification of quasi-regular polyhedra of genus 2. *The Journal of Discrete and Computational Geometry*.
- Grünbaum, B. and Shephard, G.C. (1987) *Tilings and Patterns*. New York: Freeman, ix + 700 pp.
- Huson, D. (1986) *Die Klassifikation 2-isohedraler Pflasterungen der euklidischen Ebene*. [The Classification of 2-Isohedral Tilings of the Euclidean Plane, in German], [Thesis], Bielefeld: Universität Bielefeld.
- Huson, D. (1989) *Patches, Stripes and Net-Like Tilings*. [Dissertation], Bielefeld: Universität Bielefeld.

Daniel Huson  
 Fakultät für Mathematik, Universität Bielefeld  
 D-4800 Bielefeld 1, Postfach 8640, F.R. Germany

## BRIEF REVIEWS

### Vier Bücher von Symmetrie

Apologies to Dürer, the author of the work *Vier Bücher von menschlicher Proportion* (Nürnberg, 1528), Latin translation, *De simmetria partium in rectis formis humanorum corporum libri* (Nürnberg, 1532-34), Italian Translation, *Della Simmetria dei Corpi Humani* (Venice, 1591)

The scholarly literature is mostly in English, is not it? There are, however, exceptions. Very recently, four interdisciplinary monographs were released in German. Note that all the authors are founding members of ISIS-Symmetry: It is a small world after all...

**Burckhardt, J.J., *Die Symmetrie der Kristalle: Von René-Just Haüy zur kristallographischen Schule in Zürich*. [The Symmetry of Crystals: From René-Just Haüy to the Crystallographic School in Zürich, in German], Basel: Birkhäuser, 1988, 195 pp.**

Burckhardt, who was elected as an Honorary Member of ISIS-Symmetry at its first symposium, is a well-known personality in both mathematical crystallography and the history of science. His pioneering monograph on symmetry groups of crystallography (*Die Bewegungsgruppen der Kristallographie*, Basel, 1947; 2nd edition, 1966) even forced some American scholars to learn German. He also coauthored a paper in 1961 with van der Waerden about colored symmetry which became a milestone in that topic. Burckhardt's interest in the history of science can be demonstrated by his contribution to the editing of the collected works of Euler, articles written for the *Dictionary of Scientific Biography*, and some important papers about symmetry (Fedorov and Schoenflies's correspondence, Frankenheim's discovery of the 32 point groups, etc.). The present book is a masterpiece of historical survey of the sources: very many paragraphs and figures are quoted or reprinted from basic works. The book also includes a fine collection of portraits. A section about the discovery of the 230 crystallographic space groups by Fedorov and Schoenflies is written by Erhard Scholz, rather than by Burckhardt, thus making possible an additional "social symmetry" between two generations of historians of science.

**Caglioti, G., *Symmetriebrechung und Wahrnehmung: Beispiele aus der Erfahrungswelt*. [Symmetry-Breaking and Perception: Examples from the Empirical World, in German], Trans. from Italian by G.-A. Pogatschnigg, Braunschweig: Vieweg, 1990, x + 200 pp.**

This reviewer spent most of his very limited free time during the 1985 *Escher Symposium* in Rome with a "broken symmetry": to buy a copy of the original Italian edition of this book *Simmetrie infrante nella scienza e nell'arte* [Broken Symmetries in Science and Art], although it was published in Milan (CLUP, 1983). As a spontaneous symmetry (*sic*) he could buy a copy, maybe the only available one in the bookshops of Rome, in the last minute before departure. The conclusion was immediate: we should learn Italian. It is very fortunate that we now have the extended version of this book also in German with the new "synergetical" introduction by Hermann Haken (and there are rumors about a Japanese edition). The scope of the book is very broad: Caglioti, himself a physicist, guides us from natural structures to works of art, from information theory to dynamic instability. We may also meet Maxwell's demon as a doorman of the Café Chéz Maxwell, where the atoms are replaced by good looking girls. We have found a spontaneous broken

symmetry in the otherwise very useful bibliography: the editor of the book *La simmetria* (Bologna, 1973) is not Agassi, but Agazzi. This s-z symmetry (or dissymmetry) may represent an interesting coincidence: both names are well known in the history and philosophy of science.

**Hahn, W., *Symmetrie als Entwicklungsprinzip in Natur und Kunst*. [Symmetry as a Developmental Principle in Nature and Art, in German with English summary], Königstein: Langewiesche, 1989, 320 pp., 690 black-and-white and 121 color illustrations.**

Here we have a true Renaissance man talking about a Renaissance topic. This book by the biologist-artist or artist-biologist author is cited in the introductory survey of this issue. The richness of illustration by a single author is probably unparalleled in our age. The conventional bibliographic description of the number of illustrations is very misleading: the actual number would be astronomical, because many of the figures are composed of further ones (e.g., Figure 188 includes 88 individual shapes, Figure 189a presents 24 stamp-sized reproductions, etc.). Hahn's masterpiece is rich not only in illustrations and data, but also in ideas connecting various fields. The monograph will inspire further discussions and cooperations. We should learn the secret of the Hahn Research Institute (please do not misunderstand this name: it is a one-person institute operated probably, as the warm dedication suggests, with family help). The book has an interesting connection with ISIS-Symmetry: Hahn's English summary at the end of the book was written originally for the Society.

**Mainzer, K., *Symmetrien der Natur: Ein Handbuch zur Natur- und Wissenschaftsphilosophie*. [Symmetries of Nature: A Handbook on the Philosophy of Nature and Science, in German], Berlin: Gruyter, 1988, xii + 739 pp.**

The number of pages is not a misprint (and the price is, unfortunately, symmetrically proportional to this richness). This book will definitely become a significant handbook in the field. As a further symmetry, J.J. Burckhardt wrote about it in the *Mathematical Reviews* (1989, issue *i*, item 00033). We hope that this luxury edition will be followed by a cheaper paperback version. There are already some interdisciplinary courses on symmetry at some universities, and to assign or recommend appropriate reading material (we avoid using the conventional word "textbook") is usually a problem, in spite of the existence of a large number of books on symmetry. Some chapters of Mainzer's book certainly can be used for such a purpose. The author follows the main development in chronological order from the ornaments of early civilizations and ancient polyhedra to modern crystallography and physics. The last chapter is a *tour de force* of philosophy, the main field of the many-sided author, and also of modern arts. The book would obviously be a wonderful birthday present for scholars and students of almost any field.

We hope that all of these books will be translated into English to reach a broader audience. In that case we should speak not about *Vier Bücher...*, but about *Four (Exciting) Books on Symmetry*. Detailed reviews (in English) of some of these monographs will appear here.

Dénes Nagy

## About phyllotaxis in Chinese

Do you speak Chinese? If not, but you would like to follow the Chinese botanical-mathematical literature, you definitely should have access to a copy of Roger Jean's book in Chinese (Beijing: Academic Publisher, 1990, 18 + 224 pp.). Do not worry, it is available also in English: *Mathematical Approach to Pattern and Form in Plant Growth* (New York: Wiley, 1984, xxiv + 222 pp.). The focus of the monograph is the phyllotaxis or phyllotaxy which term was formed, in the 19th century, from the Greek words *phyllon* (leaf) and *taxis* (arrangement). Charles Darwin was among the first biologists who used the word in English, in a letter in 1863.

Why do we recommend this book for university collections, and not only for Chinese readers? Every scholar who tries to read a monograph in a foreign language realizes that the usual dictionaries do not give too much help in scientific terminology. It is also a typical problem for international students. Károly Simonyi, a Hungarian physicist-engineer, went as far as publishing a Chinese-Hungarian Electronical Dictionary, in addition to his textbooks and monographs in five languages. We should assure the reader that there already exists a very useful English-Chinese dictionary in the field of phyllotaxis and related mathematical and botanical expressions. The editors of the Chinese translation, instead of a usual subject index, also provided a dictionary (pp. 206-224). If someone needs such expressions in Chinese as "Adler's contact-pressure model" or "Jean's interpretative model", please see this dictionary. (Note that both of these terms are named after founding members of ISIS-Symmetry.) Although this bilingual index is organized according to English keywords, its visual arrangement makes it possible to use it for finding the English equivalent of a Chinese word. To be more specific, the English and Chinese expressions are ordered "symmetrically" in two columns.

The Chinese editors reprinted the whole bibliography of the English edition without change. It is an advantage to the English speaking reader, but it does not represent the Chinese literature in the field. This reviewer, who tries to follow the literature on phyllotaxis from China to Africa (with some difficulties), recalls that even the very first issue of the Chinese periodical *Journal of Biomathematics* included an article about the topic:

Li, Jing Gong (1986) On plant phyllotaxy.  
[Chinese, with English summary],  
*Journal of Biomathematics*, 1, 1-8.

The original bibliography by Jean is very detailed; it includes not only English and French, but also many German works and even a Hungarian one (Z. Szabó's article of 1930). On the



(加) R. V. Jean 著

## 植物生长模式与形态的数理研究方法



学术书刊出版社

other hand, the decision to reprint the bibliography, instead of translating and extending it, has an advantage: the number of misspelled foreign names is not increased further (cf., D'Arcy Thomason, Aodler, Schwendeunr, Van Iteson, etc.; even Snow became Show in one case in the "dictionary" we praised so much).

The author wrote a new foreword to the Chinese edition, (published only in Chinese), in which he emphasizes the interdisciplinary character of the topic and the need for dialogue between researchers, with various backgrounds, world-wide.

Dénes Nagy

## **INMAS, Ltd., PROVIDES**

***the best R + D results  
and top quality expertise  
— fast and efficiently —  
to the world market***

*The academies of sciences are the centres of the best scientific and technical developments and products in the East European countries. The academies of sciences of the USSR and the Republic of Hungary founded a joint venture, called INMAS Mechatronics, Ltd., for the first time, to build a bridge to the world market. Owing to its unique status, INMAS Mechatronics has the best brains and R + D results in the two countries.*

**We offer you an R + D result — you give us the market possibilities.**

INMAS Mechatronics has been authorized to engage on the basis of combined international scientific, technological and economic potentials, in the following spheres of activity:

- Guaranteeing the reliability and quality of machine building products.
- Mechanical systems with electronic components, e.g., diagnostic, adaptive, control and other systems.
- Machine building automation and computerization (hardware and software).
- Optimization of man-machine-medium systems, ergonomics and bio-medical engineering.
- Various deals in the field of industry and trade, finance and real estate and property.
- Participation in the realisation of the "Common European House" concept and other international and governmental programmes.
- Other spheres of activity  
We take the latest domestic and

foreign instruments, the most up-to-date scientific-technical methods, and the most famous domestic and foreign experts to where they are needed.

- You can choose the best —  
We make measurements and reports in Hungarian or any other language you wish.

*New instruments, new methods, new materials, new technologies: our partners are world-famous Hungarian and Soviet scientific-technical schools, operating in universities, colleges, R + D institutes, factories, firms, etc.*

*For more information, contact:*

**INMAS**  
MECHATRONIKA kft

H-1139 Budapest, Teve u. 1/b-c  
Tel. (36-1) 129-8036  
Tx: 22-3439 • Fax: (36-1) 129-0841

## RECREATIONAL SYMMETRY

*This is a non-regular section for symmetry-related problems and puzzles (symmetr-enigmas), as well as games, computer programs, descriptions of scientific toys, and other topics which are connected with both recreation and education. There is a Renaissance of problems concerning tilings and polyhedral toys, inspired by the Penrose tilings, the Rubik cube, and other inventions. The scientific dimensions of origami, the Japanese art of paper-folding, are discussed in some recent works by leading scholars and engineers (Husimi, Miura, and others). This section gives a forum for these developments, but it has no intention of competing with journals of recreational mathematics, since only short notes are published here.*

### Symmetr-enigmas

#### *Problem 1: Symmetric dates*

The "Manifesto on (dis)symmetry" (see the first paper in this issue) was signed on the centrosymmetric date 06 || 90 that is on June 11, 1990, according to the American style. It is, however, 6th of November 1990 following the British convention, and a non-existing date according to the International Standards Organization (ISO) which requires the year-month-day order.

For this problem, suppose that the zero is not crossed, contrary to the practice in computing; the one has no "flag", it is just a vertical line segment; the 6 and 9 are congruent; and the two circles in 8 are equal. It is also supposed that there are, as in many questionnaires, three times two boxes for the digits of the month, day, and year. That is we should write, for example, the sixth month or day as 06, and we are not using the first two digits of the year. This last convention may cause troubles for a computerized data bank in the case of the birthdays of the oldest people. (Once, a children's hospital invited a 105-year-old woman, who had absolutely no teeth for the last 30 years, to check her milk teeth.)

Our example, 06 || 90, is a centrosymmetric date (it possesses twofold rotational symmetry). There are, however, also mirror symmetric ones, for example, 08 || 80. A weaker requirement here is to request not the geometric mirror symmetry, but only the palindromic one. That is, the number should remain the same reading it in reverse (e.g., 03 22 30). Palindromic words and sentences gained some importance in experimental poetry; sometimes even magic meanings were attached to them.

The task is to determine the number of centrosymmetric, mirror symmetric, and palindromically symmetric dates, respectively, in this century according to both the American and the British conventions. It is not a difficult exercise, therefore it can be used to freshen the often monotonous problems in elementary combinatorics. A similar exercise can be performed with letters or words, requesting centrosymmetric, mirror-symmetric, and palindromic words or sentences, respectively. If you wish, feel free to send us your answers or comments.

György Darvas and Dénes Nagy

## REFLECTIONS: LETTERS TO THE EDITORS

*Comments on papers or letters of general interest should be addressed to the editors.*

### Symmetries of Ambigrams and Ambigrammatic "Symmetry"

*Before the symposium Symmetry of Structure (Budapest, August 13-19, 1990) we wrote to Douglas R. Hofstadter, using the "ambigrams" (texts readable symmetrically from different directions because of the ambiguity of the letters) of the word "symmetry" as well as of our names. The answer was, of course, also ambigrammatic (November 22, 1988), moreover, these ambigrams ("Hofstadterograms") became the symbol of the Budapest symposium. The cover of the Abstract-volumes includes three ambigrams: Symmetry, Budapest, Hungary. It is hard to imagine a better symbol for a symposium on symmetry in the (dis)symmetric Buda + Pest. The editors became both excited and ambigrammo-symmetrized...*

*The letter and some of the ambigrams of Hofstadter are reprinted here; see the back cover, and the "signature" of the editors at the end of the article "Manifesto on (dis)symmetry" (p.26). We plan also to have an exhibition of ambigrams for the next symposium.*

Instead of submitting an essay on symmetry, I am sending you herewith a set of ambigrams I have done on the following names and words:

- "Dénes Nagy" (two 180°-rotation ambigrams)
- "Darvas György" (one 180°-rotation ambigram)
- "György" (one 180°-rotation ambigram)
- "Budapest" (two 180°-rotation ambigrams)
- "Hungary" (two 180°-rotation ambigrams)
- "Magyarország" [Hungary] (four reflection ambigrams)
- "symmetry" (four 180°-rotation ambigrams)

I hope you enjoy them!

I noticed that in your letter to me, all the ambigrams you attempted were reflections. Certain words lend themselves more easily to reflection, others to rotation (and not always by 180°!) In particular, the word "Hungary" (or more precisely "hungary" with lowercase "h") lends itself very naturally to ambigrammetrization by rotation rather than by reflection. To a lesser extent, I found this true of the other words in the set, with the notable exception of "Magyarország" [Hungary, in Hungarian], which, when broken up into its two components, lends itself admirably to being ambigrammetrized via reflection.

What I find quite wonderful about ambigrams is the way in which, in a good one, the symmetry is almost completely hidden. Thus, for example, it is not at all obvious, when one looks at [the ambigram on p. 26] "Dénes Nagy", that it has any symmetry. It is therefore quite a surprise when one turns it around and reads the same thing again. Part of the surprise is due to the fact that "Dénes" turns into the different word "Nagy" rather than into itself, and another part is the fact that the two words have different numbers of letters, which - at least naïvely - seems almost impossible.

I find the concept of symmetry to be extremely subtle, because it contains implicitly in it the (seemingly exact) concept "sameness", but that concept implicitly means "sameness in certain respects", which is tantamount to the concept of "similarity", which is after all not exact at all, but highly dependent on human perception and categorization - which is, of course, what ambigrammetry depends so deeply on, and takes so much advantage of.

Douglas R. Hofstadter  
 Center for Research on Concepts and Cognition  
 Indiana University, Bloomington, Indiana

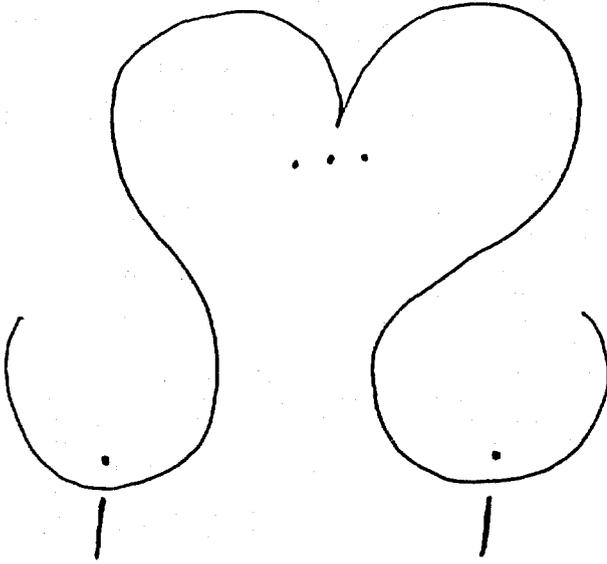
### Symmetry in Székely's art

*Pierre Székely, the well-known sculptor living in Paris, accepted membership on the Board of ISIS-Symmetry in a "symmetric" letter in two columns: the left side is written in French, while the right one is the English translation of the same text. As a "violation of symmetry" which often occurs in both nature and art, we quote here only from the right side (January 31, 1990). The "Isisological" drawings are from a later letter of him (March 7, 1990).*

Your letter brought one of the best announcements of this end-of-century: the birth of ISIS-Symmetry. I am of course delighted to be included in the Board of prominent persons! How could I not be thrilled to be a representative of symmetry of art-and-science? What a reward after long, unceasing efforts in the field of symmetry, asymmetry and dissymmetry. There is a film on the subject of symmetry showing in Paris at the moment. It is called *Symetierre*.

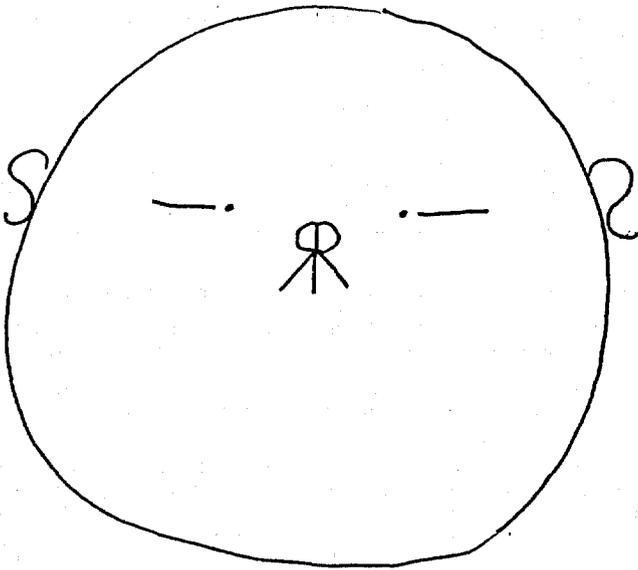
I very much look forward next year to a symmetric 1991. I send my warmest congratulations on your splendid work.

Pierre Székely  
 Paris



sze'kely

Preliminary draft of the bust of Lady Isis, Paris, 1990



sze'kely

Preliminary draft of the portrait of Sir Osiris, Paris, 1990

**Contributions** to *SYMMETRY: CULTURE AND SCIENCE* are welcomed from the broadest international circles and from representatives of all scholarly and artistic fields where symmetry considerations play an important role. The papers should have an interdisciplinary character, dealing with symmetry in a concrete (not only metaphorical!) sense, as discussed in "Aims and Scope" on p. 112. The quarterly has a special interest in how distant fields of art, science, and technology may influence each other in the framework of symmetry (symmetrology). The papers should be addressed to a broad non-specialist public in a form which would encourage the dialogue between disciplines.

Manuscripts may be submitted directly to the Editors, or through members of the Board of ISIS-Symmetry.

### Contributors should note the following:

- All papers and notes are published in English and they should be submitted in that language. The quarterly reviews and annotates, however, non-English publications.
- In the case of complicated scientific concepts or theories, the intuitive approach is recommended, thereby minimizing the technical details. New associations and speculative remarks can be included, but their tentative nature should be emphasized. The use of well-known quotations and illustrations should be limited, while rarely mentioned sources, new connections, and hidden dimensions are welcomed.
- The papers should be submitted either by electronic mail to both editors, or on computer diskettes (5.1/4" or 3.5") to György Darvas as text files (IBM PC compatible or Apple Macintosh); that is, conventional characters should be used (ASCII) without italics or other formatting commands. Of course typewritten texts will not be rejected, but the preparation of these items takes longer. For any method of submission (e-mail, diskette, or typescript), four hard-copies of the text are also required, where all the necessary editing is marked in red (inserting non-ASCII characters, underlining words to be italicized, etc.). Three hard-copies, including the master copy and the original illustrations, should be forwarded to György Darvas, while the fourth copy should be sent to Dénes Nagy. No manuscripts, diskettes, or figures will be returned, unless by special arrangement.
- The papers are accepted for publication on the understanding that the copyright is assigned to ISIS-Symmetry. The Society, however, aiming to encourage the cooperation, will allow all reasonable requests to photocopy articles or to reuse published materials. Each author will receive a complimentary copy of the issue where his/her article appeared. (Currently no reprints are provided; this option will be addressed later.)
- Papers should begin with the title, the proposed running head (abbreviated form of the title of less than 35 characters), the proposed section of the quarterly where the article should appear (see the list in the note "Aims and Scope"), the name of the author(s), the mailing address (office or home), the electronic mail address (if any), and an abstract of between 10 and 15 lines. A recent black-and-white photo, the biographic data, and the list of symmetry-related publications of (each) author should be enclosed; see the sample at the end.
- Only black-and-white, camera-ready illustrations (photos or drawings) can be used. The required (approximate) location of the figures and tables should be indicated in the main text by typing their numbers and captions (Figure 1. [text], Figure 2. [text], Table 1 [text], etc.), as new paragraphs. The figures, which will be slightly reduced in printing, should be enclosed on separate sheets. The tables may be given inside the text or enclosed separately.
- It is the author's responsibility to obtain written permission to reproduce copyright materials.
- Either the British or the American spelling may be used, but the same convention should be followed throughout the paper. The *Chicago Manual of Style* is recommended in case of any stylistic problem.
- Subtitles (numbered as 1, 2, 3, etc.) and subsidiary subtitles (1.1, 1.1.1, 1.1.2, 1.2, etc.) can be used, without over-organizing the text. Footnotes should be avoided; parenthetical inserts within the text are preferred.
- The use of references is recommended. The citations in the text should give the name, year, and, if necessary, page, chapter, or other number(s) in one of the following forms: ... Weyl (1952, pp. 10-12) has shown...; or ... as shown by some authors (Coxeter et al., 1986, p. 9; Shubnikov and Koptsik 1974, chap. 2; Smith, 1981a, chaps. 3-4; Smith, 1981b, sec. 2.12; Smith, forthcoming). The full bibliographic description of the references should be collected at the end of the paper in alphabetical order by authors' names; see the sample. This section should be entitled *References*.

**Sample of heading** (Apologies for the strange names and addresses)

SYMMETRY IN AFRICAN ORNAMENTAL ART  
 BLACK-AND-WHITE PATTERNS IN CENTRAL AFRICA

**Running head:** Symmetry in African Art

**Section:** Symmetry: Culture & Science

Susanne Z. Dissymmetrist and Warren M. Symmetrist  
 13 Phyllotaxis Street Department of Dissymmetry, University of Symmetry  
 Sunflower City, CA 12358, U.S.A. 69 Harmony Street, San Symmetrino, CA 69869, U.S.A.  
 E-mail: symmetrist@symmetry.edu

**Abstract**

The ornamental art of Africa is famous ...

**Sample of references**

In the following, note punctuation, capitalization, the use of square brackets (and the remarks in parentheses). There is always a period at the end of a title, and at the very end of a bibliographic entry (but never at other places, except in abbreviations). Brackets are used to enclose supplementary data. Those parts which should be italicized – titles of books, names of journals, etc. – should be underlined in red on the hard-copies. In the case of non-English publications both the original and the translated titles should be given (cf., Dissymmetrist, 1990).

Asymmetrist, A.Z. (or corporate author) (1981) *Book Title: Subtitle*. Series Title no. 27, 2nd ed., City (only the first one): Publisher, vii + 619 pp. (further data can be added, e.g.: 3rd ed., 2 vols., ibid., 1985, viii + 444 + 484 pp. with 2 computer diskettes; Reprint, ibid., 1988; German trans., *German Title*. 2 vols., City: Publisher, 1990, 986 pp.; Hungarian trans.).

Asymmetrist, A.Z., Dissymmetrist, S.Z., and Symmetrist, W.M. (1980-81) Article or e-mail article title: Subtitle. Parts 1-2, *Journal Name Without Abbreviation*, [E-Journal or Discussion Group address: journal@node (if applicable)], 22 (volume number), no. 6 (issue number if each one restarts pagination), 110-119 (page numbers); 23, no. 1, 117-132 and 133 (for e-journals any appropriate data).

Dissymmetrist, S.Z. (1989a) Chapter, article, symposium paper, or abstract title. [Abstract (if applicable)], in: Editorologist, A.B. and Editorologist, C.D., eds. *Book, Special Issue, Proceedings, or Abstract Volume Title*, [Special Issue (or) Symposium organized by the Dissymmetry Society, University of Symmetry, San Symmetrino, Calif., December 11-22, 1971 (those data which are not available from the title, if applicable)], vol. 2, City: Publisher, 19-20 (for special issues the data of the journal).

Dissymmetrist, S.Z. (1989b) *Dissertation Title*. [Ph.D. Dissertation], City: Institution, 248 pp. (Exhibition Catalogs, Manuscripts, Master's Theses, Mimeographs, Patents, Preprints, Working Papers, etc. in a similar way; Audiocassettes, Audiotapes, Compact Disks, Computer Diskettes, Computer Software, Films, Microfiches, Microfilms, Slides, Sound Disks, Videocassettes, etc. with necessary modifications, adding the appropriate technical data).

Dissymmetrist, S.Z., ed. (1990) *Dissymmetriya v nauke* (title in original, or transliterated, form). [Dissymmetry in Science, in Russian with German summary], Trans. from English by B.W. Antismmetrist, etc.

Phyllotaxist, F.B. (1899/1972) *Title of the 1972 Edition*. [Reprint, or Translation, of the 1899 ed.], etc.

[Symmetrist, W.M.] (1989) Review of *Title of the Reviewed Work*, by S.Z. Dissymmetrist, etc. (if the review has an additional title, then it should appear first; if the authorship of a work is not revealed in the publication, but known from other sources, the name should be enclosed in brackets).

In the case of lists of publications, or bibliographies submitted to *Symmetro-graphy*, the same convention should be used. The items may be annotated, beginning in a new paragraph. The annotation, a maximum of five lines, should emphasize those symmetry-related aspects and conclusions of the work which are not obvious from the title. For books, the list of (important) reviews, can also be added.

**Sample of bibliographic entry**

**Name:** Warren M. Symmetrist (b. Boston, Mass., U.S.A., 1938), Educator, mathematician

**Address:** Department of Dissymmetry, University of Symmetry, 69 Harmony Street, San Symmetrino, Calif. 69869, U.S.A. **E-mail:** symmetrist@symmetry.edu

**Fields of interest:** Geometry, mathematical crystallography (also ornamental arts, anthropology – non-professional interests in parentheses)

**Publications:** List all the symmetry-related publications – including abstracts, exhibition catalogs, papers in proceedings, patents, preprints, problems, reviews, short notes, – in chronological order, following the conventions of the references and annotations. Please mark the most important publications, not more than five items, by asterisks. This shorter list will be published together with the article, while the full list will be included in the computerized data bank of ISIS-Symmetry. Exhibitions, Films, Sound- and Videorecordings, Works of Art (in collections, museums, public areas) can also be listed.

There are many disciplinary periodicals and symposia in various fields of art, science, and technology, but broad interdisciplinary forums for the connections between distant fields are very rare. Consequently, the interdisciplinary papers are dispersed in very different journals and proceedings. This fact makes the cooperation of the authors difficult, and even affects the ability to locate their papers.

In our "split culture", there is an obvious need for interdisciplinary journals that have the basic goal of building bridges ("symmetries") between various fields of arts and science. Because of the variety of topics available, the concrete, but general, concept of symmetry was selected as the focus of the journal, since it has roots in both science and art.

**SYMMETRY: CULTURE AND SCIENCE** is the quarterly of the *INTERNATIONAL SOCIETY FOR THE INTERDISCIPLINARY STUDY OF SYMMETRY* (abbreviation: *ISIS-Symmetry*, shorter name: *Symmetry Society*). *ISIS-Symmetry* was founded during the symposium *Symmetry of Structure (First Interdisciplinary Symmetry Symposium and Exhibition)*, Budapest, August 13-19, 1989. The focus of *ISIS-Symmetry* is not only on the concept of symmetry, but also its associates (asymmetry, dissymmetry, antisymmetry, etc.) and related concepts (proportion, rhythm, invariance, etc.) in an interdisciplinary and intercultural context. We may refer to this broad approach to the concept as *symmetrology*. The suffix *-logy* can be associated not only with knowledge of concrete fields (cf., biology, geology, philology, psychology, sociology, etc.) and discourse or treatise (cf., methodology, chronology, etc.), but also with the Greek terminology of proportion (cf., *logos, analogia*, and their Latin translations *ratio, proportio*).

The basic goals of the *Society* are

- (1) to bring together artists, scientists, educators and students devoted to, or interested in, the research and understanding of the concept and application of symmetry (asymmetry, dissymmetry);
- (2) to provide regular information to the general public about events in symmetrology;
- (3) to ensure a regular forum (including the organization of symposia, and the publication of a periodical) for all those interested in symmetrology.

The Society organizes the triennial *Interdisciplinary Symmetry Symposium and Exhibition* (starting with the symposium of 1989) and other workshops, meetings and exhibitions. The forums of the Society are *informal* ones, which do not substitute for the disciplinary conferences, only supplement them with a broader perspective.

The **QUARTERLY** – a non-commercial scholarly journal, as well as the forum of *ISIS-Symmetry* – publishes original papers on symmetry and related questions which present new results or new connections between known results. The papers are addressed to a broad non-specialist public, without becoming too general, and have an interdisciplinary character in one of the following senses:

- (1) they describe concrete interdisciplinary "bridges" between different fields of art, science and technology using the concept of symmetry;
- (2) they survey the importance of symmetry in a concrete field with an emphasis on possible "bridges" to other fields.

The **QUARTERLY** also has a special interest in historic and educational questions, as well as in symmetry-related recreations, games, and computer programs.

The regular sections of the **QUARTERLY**:

- **Symmetry: Culture & Science** (papers classified as humanities, but also connected with scientific questions)
- **Symmetry: Science & Culture** (papers classified as science, but also connected with the humanities)
- **Symmetry in Education** (articles on the theory and practice of education, reports on interdisciplinary projects)
- **Mosaic of Symmetry** (short papers within a discipline, but appealing to broader interest)
- **SFS: Symmetric Forum of the Society** (calendar of events, announcements of *ISIS-Symmetry*, news from members, announcements of projects and publications)
- **Symmetro-graphy** (biblio/disco/software/ludo/historio-graphics, reviews of books and papers, notes on anniversaries)
- **Reflections: Letters to the Editors** (comments on papers, letters of general interest)

Additional non-regular sections:

- **Symmetrospective: A Historic View** (survey articles, recollections, reprints or English translations of basic papers)
- **Symmetry: A Special Focus on ...** (round table discussions or survey articles with comments on topics of special interest)
- **Symmetry: An Interview with ...** (discussions with scholars and artists, also introducing the Honorary Members of *ISIS-Symmetry*)
- **Symmetry: The Interface of Art & Science** (works of both artistic and scientific interest)
- **Recreational Symmetry** (problems, puzzles, games, computer programs, descriptions of scientific toys; for example, tilings, polyhedra, and origami)

Both the lack of seasonal references and the centrosymmetric spine design emphasize the international character of the Society; to accept one or another convention would be a "symmetry violation". In the first part of the abbreviation *ISIS-Symmetry* all the letters are capitalized, while the centrosymmetric image *ISIS!* on the spine is flanked by *Symmetry* from both directions. This convention emphasizes that *ISIS-Symmetry* and its quarterly have no direct connection with other organizations or journals which also use the word *Isis* or *ISIS*. There are more than twenty identical acronyms, and more than ten such periodicals, – many of which have already ceased to exist, – representing various fields, including the history of science, mythology, natural philosophy, and oriental studies. *ISIS-Symmetry* has, however, some interest in the symmetry-related questions of many of these fields.

continued from inside front cover

**Hungary:** György Darvas (see above, Executive Secretary)

**Italy:** Giuseppe Cagliari, Istituto di Ingegneria Nucleare - CESNEF, Politecnico di Milano, Via Ponzio 34/3, I-20133 Milano, Italy [Nuclear Physics, Visual Psychology]

**Poland:** Janusz Rębielak, Instytut Architektury i Urbanistyki, Politechnika Wrocławska (Institute of Architecture and Town Planning, Technical University of Wrocław), ul. B. Prusa 53-55, PL 50-317 Wrocław Poland [Architecture, Geometry, and Structural Engineering]

**Portugal:** José Lima-de-Faria, Centro de Cristalografia e Mineralogia, Instituto de Investigação Científica Tropical, Alameda D. Afonso Henriques 41, 4.º Esq., P-1000 Lisboa, Portugal [Crystallography, Mineralogy, History of Science]

**Romania:** Solomon Marcus, Faculty of Mathematics, Universitatea din București (University of Bucharest), Str. Academiei 14, R-70109 București (Bucharest), Romania [Mathematical Analysis, Mathematical Linguistics and Poetics, Mathematical Semiotics of Natural and Social Sciences]

**Scandinavia:** Ture Wester, Skivlaboratoriet, Bærende Konstruktioner, Kongelige Danske Kunstakademi - Arkitektsskole (Laboratory for Plate Structures, Department of Structural Science, Royal Danish Academy - School of Architecture), Peder Skramsgade 1, DK-1054 København K (Copenhagen), Denmark [Polyhedral Structures, Biomechanics]

**Switzerland:** Caspar Schwabe, Ars Geometrica Rämistrasse 5, CH-8024 Zürich, Switzerland [Ars Geometrica]

**U.K.:** Mary Harris, Maths in Work Project, Institute of Education University of London, 28 Woburn Square, London WC1H 0AA, England [Geometry, Ethnomathematics, Textile Design]  
Anthony Hill, 24 Charlotte Street, London W.1, England [Visual Arts, Mathematics and Art]

**U.S.S.R.:** Vladimir A. Koptsik, Fizicheskii fakul'tet, Moskovskii gosudarstvennyi universitet (Physical Faculty, Moscow State University), SU-117234 Moskva, U.S.S.R. [Crystalphysics]

Ivan S. Zheludev, Institut kristallografii AN SSSR (Institute of Crystallography, Academy of Sciences of the USSR), SU-117333 Moskva, Leninskii pr. 59, U.S.S.R. [Material Science, Theoretical Physics]

**Yugoslavia:** Slavik V. Jablan, Matematički institut (Mathematical Institute), Knez Mihailova 35, pp. 367, YU-11001 Beograd (Belgrade), Yugoslavia [Geometry, Ornamental Art, Anthropology]

*Chairpersons of*

**Art and Science Exhibitions:** László Beke, Magyar Nemzeti Galéria (Hungarian National Gallery), Budapest, Budavári Palota, H-1014 Hungary  
Itsumo Sakane, Faculty of Environmental Information, Keio University at Shonan Fujisawa Campus, 5322 Endoh, Fujisawa 252, Japan

**Cognitive Science:** Douglas R. Hofstadter, Center for Research on Concepts and Cognition, Indiana University, Bloomington, Indiana 47408, U.S.A.

**Computing and Applied Mathematics:** Sergei P. Kurdyumov, Institut prikladnoi matematiki im. M.V. Keldysha AN SSSR (M.V. Keldysh Institute of Applied Mathematics, Academy of Sciences of the USSR), SU-125047 Moskva, Miusskaya pl. 4, U.S.S.R.

**Education:** Peter Klein, FB Erziehungswissenschaft, Universität Hamburg, Von-Melle-Park 8, D-2000 Hamburg 13, F.R. Germany

**History and Philosophy of Science:** Klaus Mainzer, Lehrstuhl für Philosophie, Universität Augsburg, Universitätsstr. 10, D-8900 Augsburg, F.R. Germany

*Project Chairpersons:*

**Architecture and Music:** Emanuel Dimas de Melo Pimenta, Rua Tierno Galvan, Lote 5B - 2.º C, P-1200 Lisboa, Portugal

**Art and Biology:** Werner Hahn, Waldweg 8, D-3554 Gladenbach, F.R. Germany

**Dual and Other Modes of Classification in Anthropology:** Andrew Duff-Cooper, Department of Humanities, Seitoku University, 531 Sagamidai, Matsudo-shi, Chiba 271, Japan

**Evolution of the Universe:** Jan Mozrzymski, Instytut Fizyki, Uniwersytet Wrocławski (Institute of Theoretical Physics, University of Wrocław), ul. Cybulskiego 36, PL 50- 205 Wrocław, Poland

**Higher-Dimensional Graphics:** Koji Miyazaki, Department of Graphics, College of Liberal Arts, Kyoto University, Yoshida, Sakyo-ku, Kyoto 606, Japan

**Knowledge Representation by Metastructures:** Ted Goranson, Sirius Incorporated, 1976 Munden Point, Virginia Beach, VA 23457-1227, U.S.A.

**Pattern Mathematics:** Bert Zaslów, Department of Chemistry, Arizona State University, Tempe, AZ 85287-1604, U.S.A.

**Polyhedral Transformations:** Haresh Lalvani, School of Architecture, Pratt Institute, 200 Willoughby Avenue, Brooklyn, NY 11205, U.S.A.

**Proportion and Harmony in Arts:** S. K. Heninger, Jr. Department of English, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-3520, U.S.A.

**Shape Grammar:** George Stiny, Graduate School of Architecture and Urban Planning, University of California Los Angeles, Los Angeles, CA 90024-1467, U.S.A.

**Space Structures:** Koryo Miura, Spacecraft Engineering Research Division, Institute of Space and Astronautical Science, Yoshinodai, Sagami-hara, Kanagawa 229, Japan

Tibor Tarnai, Építéstudományi Intézet (Institute for Building Science), Budapest, Dávid Ferenc u. 6, H-1113, Hungary

*Liaison Persons*

Andra Akers and Nik Warren (International Synergy Institute)

Stephen G. Davies (Journal *Tetrahedron: Asymmetry*)  
Bruno Gruber (Symposia *Symmetries in Science*)

Alajos Kálmán (International Union of Crystallography)

Roger F. Malina (Journal *Leonardo* and International Society for the Arts, Sciences, and Technology)

Tohru Ogawa and Ryuji Takaki (Journal *Forma* and Society for Science on Form)

Dennis Sharp (Comité International des Critiques d'Architecture)

Erzsébet Tusa (INTART Society)