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ASSOCIATION
MATHEMATICS
COUNCIL

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Volume XIV, Number 2, November 1974

Editorial

The 1974 annual meeting of MCATA was held in Jasper, October 25-26. The planned program was very interesting. We are unable to comment on the unscheduled impromptu portions since they did not meet publication deadlines, but a report will appear in the January *Delta-K*. The deadline for contributions is January 3. We invite your comments, contributions and/or suggestions for activities that MCATA could use as a service to all.

Our metric missionary workshops are being received with enthusiasm. They are intended to compliment the area meetings of Dr. Lindstedt by preparing teachers with advance information, or as a follow-up to provide further aid, in areas where Dr. Lindsted precedes our group. We had planned to terminate the program at the end of November - except for conventions and institutes - however, I am sure I can speak for all of us involved when I say that additional meetings could be scheduled, at later dates, where the service is requested.

Do you have a math club? If so, how did you organize it? Or, do you want assistance in forming a math club? We are interested in assisting new clubs and would therefore appreciate having this information. Although it is of interest primarily to secondary school groups, consideration of such a club in elementary schools might be feasible.

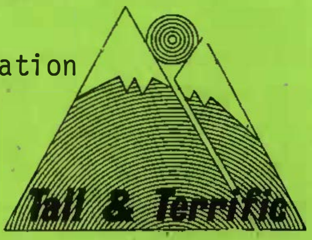
A new service to appear in *Delta-K* as soon as the questions start coming in, will be "The Question Box." Do you have a specific question? The editor will answer all queries in "The Question Box."

MEET YOUR 1974-75 EXECUTIVE — page 2.

THINK DENVER - APRIL 23-26, 1975

Plan now to attend the annual meeting of the National Council of Teachers of Mathematics, in Denver, April 23-26, 1975. A group flight is being arranged by your Math Council. For more details contact

Dr. George Cathcart
Dept. of Elementary Education
Faculty of Education
University of Alberta
Edmonton T6G 2G5



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Mathematics Council Executive – 1974-75

Res/Bus

President
Dr. W. George Cathcart 435-1949
Dept. of Elementary Education 432-4153
University of Alberta
Edmonton T6G 2G5

Vice-President
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428-36 Street SW 249-2449
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3716 - 107 Street 434-5472
Edmonton T6J 2L4

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2944 Lathom Crescent SW 281-3366
Calgary T3E 5W7

Treasurer
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Box 741 782-3812
Lacombe

DIRECTORS
Denis Baudin 693-2469
Box 861 723-3815
Edson

Brian Chapman 782-3551
Box 1525 782-3812
Lacombe

Dr. Joan Kirkpatrick 488-2634
Dept. of Elementary Education 432-4153
University of Alberta
Edmonton T6G 2G5

Doug McIntyre 281-3679
823 Cannell Road SW 281-3366
Calgary T2W 1T5

Res/Bus

George Stepney 453-1248
12414 - 125 Street 466-3161
Edmonton T5L 0T1

Marvin Wiedrick 332-4507
Box 825 332-4066
Grimshaw

REPRESENTATIVES
ATA
Dr. M.T. Sillito 459-4811
11010 - 142 Street 453-2411
Edmonton T5N 2R1 Ext. 269

Department of Education
J.H. Jeffrey 458-1511
Department of Education 426-0915
500, 11160 Jasper Ave
Edmonton T5K 0L1

Mathematics
Dr. H.I. Freedman 487-1238
Department of Mathematics 432-3530
University of Alberta
Edmonton T6G 2G5

NCTM
Denis Baudin

EDITORS
Delta-K
Ed. Carriger 843-6138
RR1, Site 2, Box 3 843-6528
Bluffton

Monograph No. 2
Dr. K. Allen Neufeld 436-0571
Dept. of Elementary Education 432-4188
University of Alberta
Edmonton T6G 2G5

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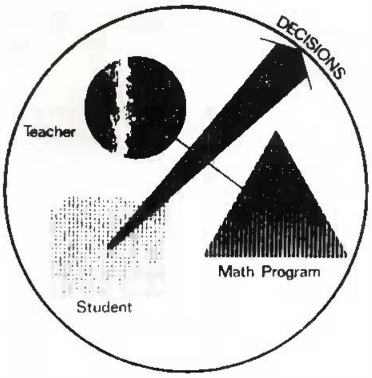
A Guide For Evaluating School Mathematics Programs and Textbooks



- *Irvin K. Burbank*

This guide is intended to assist school personnel in assessing and selecting elementary mathematics programs that will best meet their educational needs. It is designed to evaluate mathematics programs by rating desirable features within each of the following categories:

A. Content
B. Teacher's Edition
C. Manner of Presentation
D. Organization
E. Physical Characteristics

The evaluator rates the program from 0 to 5 as it meets the desired specifications of each item:

0 - missing
1 - poor
2 - fair
3 - good
4 - very good
5 - excellent

An importance factor, ranging from 1 to 4, is attached to each item. It merely evaluates the significance of the concept or idea being reviewed.

Example:

	Importance factor	Rating	Points
The teacher's edition provides suggestions for flexible use of the program to meet individual needs.	3	2	6

In the example, the item has an importance factor of 3. (Importance factor X rating = points.) The evaluator gave the program a rating of 2, resulting in 6 points.

NOTE -

1. The value of the importance factors is only a suggestion. If the evaluating

team feels the factor should be greater, or less, they may change it to satisfy their judgment.

2. The evaluating team may delete any item they feel does not apply or is not important. Space is left at the end of each category for the evaluators to add items considered to be important.

3. If the evaluating team has a minimal mathematics background and the period for evaluation and decision making is short, it may be more expedient to start the evaluation at Category B, "Teacher's Edition," and leave Category A, "Content," to the last.

______________________________ Text Being Evaluated

______________________________ Publisher

A. *CONTENT AND SCOPE OF THE PROGRAM*

I. Numbers and Operations

Goal: The learner will understand the structure of number systems and will be able to effectively use the four fundamental mathematical operations in the analysis and solutions of mathematical problems.

The program includes:	Importance Factor	Rating	Points
A-1. The development of number concepts, counting and order through investigation of one-to-one correspondences between sets of objects.	4		
A-2. The number line and plane to be used as model for developing understanding of numbers and operations on numbers.	4		
A-3. The properties of closure, commutativity, associativity, distributivity, inverse and identity elements as an integral part of the understanding and development of each number system. The concepts of "less than" and "greater than" as they relate to whole numbers and fractional numbers.	4		
A-4. Development of the four fundamental binary operations of addition, subtraction, multiplication, and division and their interrelation.	4		
A-5. Exposure of the multiplication structure of numbers such as factoring and prime numbers.	3		
A-6. Ratios, rates and percent as special use of rational numbers.	4		

		Importance Factor	Rating	Points
A-7.	The development and expansion of the number systems from the naturals to whole to the rationals to the reals.	3		
A-8.	A sound development of place value in the decimal numeration system, with a brief exposure to other numeration systems for further understanding of the decimal system.	4		
A-9.				
A-10.				
		Numbers and Operations Subtotal		

II. Geometry

The content includes:

A-11.	An informal intuitive development of geometric concepts of point, line, space, and shapes.	4		
A-12.	An introduction of geometry in the primary grades through the use of manipulative aids and physical objects and figures.	4		
A-13.	Classification of geometric shapes and configuration based upon a variety of attributes and the development of short chains of deductive reasoning.	4		
A-14.	Introduction of similarity and congruence.	3		
A-15.	Geometric contructions and drawings.	3		
A-16.	The development of coordinate geometry through the use of games and activities, growing into the graphing of simple mathematical relations.	3		
A-17.	Metric geometry relationships involving activities of measurement of length, area, volume, and angles.	3		

		Importance Factor	Rating	Points
A-18.	Concepts of inside, outside, or the boundary of a region of simple closed curves.	4		
A-19.				
A-20.				
		Geometry Subtotal		

III. Measurement

Goal: The learner will develop an understanding that measurement is a process of comparing a common attribute of two objects.

The content includes:

A-21.	The development of concepts of measurement through student activities involving measuring processes.	4		
A-22.	Activities of gathering, recording and manipulating data from our physical world.	3		
A-23.	The development of measurement as a function of comparing the attributes of two objects and assigning numbers to the objects which reflect the attribute.	4		
A-24.	The development of units of measurement from choice of units to the introduction of arbitrary units to the development of standard units of measurement.	4		
A-25.	Exposure to both English and metric system of measurement.	3		
A-26.	Experiences of estimating and understanding the approximate nature of measurement	2		
A-27.	Development and use of measurement formulas for determining volume, area, length.	3		
A-28.	Activities bridging the measurement and geometry strand.	2		
A-29.				

	Importance Factor	Rating	Points
A-30.			
		Measurement Subtotal	

IV. Application

Goal: The learner will be able to recognize (identify) and abstract the mathematical features in problems which arise in a context of some natural event, and fit these features into (a) mathematical model(s).

The content includes:

A-31. Application of mathematical principles and concepts to the real world, both physical and social.	4		
A-32. Open-ended application for the encouragement of divergent things.	3		
A-33. Application of real problems as seen by the student.	3		
A-34.			
A-35.			
		Application Subtotal	

V. Probability and Statictics

Goal: Given specific types of data, the learner will be able to make intelligent assessment of the information collected/derived therefrom.

The content should include:

A-36. Experiences in collecting, organizing and interpreting data.	4		
A-37. Development of the concepts of measures of central tendancy as models for interpreting data.	2		
A-38. A basic exposure to variance and deviation as aids to interpret data.	2		
A-39. Experiences of making predictions from data.	3		

	Importance Factor	Rating	Points
A-40. Development of concepts of elementary probability as they pertain to chance.	3		
A-41.			
A-42.			
Probability and Statistics Subtotal			

VI. Sets

Goal: The learner will be able to use sets and set notation to aid mathematical communication and to gain clarity, precision and conciseness.

The content includes:

A-43. An informal introduction and development of set concepts.	3		
A-44. Activities and situations where sets and set concepts are used as physical models as a basis for understanding number concepts.	4		
A-45. The terminology of sets, developed and used when appropriate in facilitating the learning of other mathematical concepts.	3		
A-46. Activities involving set operation of union, intersection, cross-production, and differences.	3		
A-47.			
A-48.			
Sets Subtotal			

VII. Functions and Graphs

Goal: The learner will be able to determine how a given data is related to another data.

The content includes:

	Importance Factor	Rating	Points
A-49. Activities and common situations which serve as models and illustrations of function and relation concepts, i.e., number patterns.	4		
A-50. Development of concepts of function through activities involving measurement.	4		
A-51. The various ways in which a function can be expressed, i.e. graphs, tables of value, ordered pairs and equations.	3		
A-52. Construction and interpreting information expressed in graphs.	4		
A-53.			
A-54.			
Functions and Graphs Subtotal			

VIII. Logical Thinking

Goal: The learner will be able to organize his thought processes in solving problems.

The content includes:

A-55. Development of informal logic concepts through the process of decision making such as in classification of objects according to attributes, i.e. using such words as and, or, some, all, none, etc.	4		
A-56. A development of logic from an informal decision making to arguments in the form of short chains of deductive reasoning to a semi-formal treatment at the upper elementary level.	3		
A-57. The meaning and power of the little words such as and, or, all, none, some, if, then, not, etc., as they are used in decision making and problem solving.	3		
A-58. Development of elementary deductive reasoning skills.	2		
A-59. Development of elementary deductive reasoning skills at the early grades by drawing generalizations based on study and observation of models, patterns and relations.	2		

	Importance Factor	Rating	Points
A-60.			
A-61.			

Logical Thinking Subtotal

IX. Problem Solving

Goals: The learner will be able to:

1. Identify problems
2. Select Pertinent information
3. Translate into mathematical language
4. Select an approach (or approaches)
5. Perform mathematical calculations
6. Interpret solution in terms of the conduct of the problem
7. Develop strategies (models) for future problems

The content includes:

A-62.	Practice exercises for continuous reinforcement of problem solving skills.	4		
A-63.	Development of a variety of problem solving strategies and tactics.	4		
A-64.	Problem solving situations that are meaningful and of interest to the student.	4		
A-65.	Situations which stress the process as well as the product of problem solving.	3		
A-66.	Open-ended problem which would challenge and encourage the student to carry on further investigation.	4		
A-67.				
A-68.				

Problem Solving Subtotal

B. *TEACHER'S EDITION*

Inasmuch as the elementary teacher is required to be knowledgeable in a number of subject areas, it is suggested that the mathematics program adopted be one which would be the best aid and helper to the teacher.

The teacher's edition contains:

		Importance Factor	Rating	Points
B-1.	Adequate information about the mathematical background underlying each mathematics lesson.	4		
B-2.	Lists of concepts and skills presented at each grade level and pages and lessons where they are taught.	3		
B-3.	A summary of the scope and sequence of the entire elementary mathematics program.	2		
B-4.	Glossaries, indices and answers in a format convenient for the teacher's use.	3		
B-5	Reproduction of pages of student text material.	2		

-it provides suggestions for:

B-6.	Flexible use of the program to meet individual needs.	3		
B-7.	Sources and use of instructional aids.	3		
B-8.	Ways teachers may utilize natural, everyday situations and data in motivating students' interest and making the mathematics more meaningful.	2		
B-9.	Avoidance of rigidity. This would help the teacher understand that mathematical symbols, notations and terminology sometimes have more than one interpretation, definition and use.	3		
B-10.	Variety of approaches in teaching or presenting a given concept or skill.	4		
B-11.	Evaluating pupil achievement at points throughout the mathematics program, i.e., review quizzes and cumulative review quizzes.	4		
B-12.				
B-13.				

Teacher's Edition Subtotal ☐

C. *MANNER OF PRESENTATION*

Pedagogy

		Importance Factor	Rating	Points
C-1.	The instructional materials should encourage and facilitate active involvement.	4		
C-2.	Problems which are task-oriented and commensurate with students' maturity, should be provided at all grade levels.	4		
C-3.	Self-checking devices, such as some answers or illustrations, should be provided to prevent reinforcement of errors.	3		
C-4.	Correct mathematical vocabulary appropriate to the grade level is developed and used with understanding, but it is not to be unduly stressed.	4		
C-5.	Exposition and vocabulary should be such that difficulty in language and reading skills does not extensively interfere with students' learning of mathematical concepts.	4		
C-6.	Adequate problems and exercises should be included. Introduction, reinforcement, diagnosis, and reviewing in each area.	4		
C-7.	Concept development generally moves from the concrete through semi-concrete to the abstract.	4		
C-8.				
C-9.				
	Manner of Presentation Subtotal			

D. *ORGANIZATION*

D-1.	The mathematical concepts should be presented in a spiral organization throughout the entire elementary mathematics program and within the text of each grade level.	4		
D-2.	Suggestions for introductory activities related to the Strands for initial learning, and reintroductory activities for review and re-teaching are included in both teacher and student texts.	4		

	Importance Factor	Rating	Points
D-3. Textbooks should provide learning situations whereby the Strands reinforce, complement and supplement each other.	4		
D-4. Practice activities should be appropriately spaced throughout the program to maintain skills and understanding of previous learning.	4		
D-5. Adequate practice activities (both written and oral) provided at each level, and related to prior learning.	3		
D-6. Vocabulary, symbolism and notation should be consistent throughout the program.	3		
D-7. Materials and activities should be provided and organized and presented in a way to meet individual differences.	2		
D-8. There should be a humanizing element in the program by making interesting historical references (where appropriate) to the development and uses of mathematical ideas.	2		
D-9. Student and teacher texts should include indices, tables of glossaries, tables of content and, where appropriate, cross-references.	2		
D-10.			
D-11.			

Organization of the Program Subtotal ☐

E. *PHYSICAL CHARACTERISTICS*

E-1. Art and color is functional as well as motivating.			
E-2. Type size is appropriate for each grade level.			
E-3. Each lesson is self-contained on one page.			
E-4. Directions for student exercises are clearly and simply written.			

	Importance Factor	Rating	Points
E-5. Format of each page is attractive and not unduly crowded.			
E-6. Illustrations are consistent with the content.			
E-7. The student text is a size and shape easily handled.			
E-8.			
E-9.			
		Physical Characteristics Subtotal	

SUMMARY

	Subtotals
A. Contents	
I. Numbers and Operations	
II. Geometry	
III. Measurement	
IV. Application	
V. Probability and Statistics	
VI. Sets	
VII. Functions and Graphs	
VIII. Logical Thinking	
IX. Problem Solving	
B. Teacher's Edition	
C. Manner of Presentation	
D. Organization	
E. Physical Characteristics	
TOTAL	

Text Title

NOTE:

The bulk of the information in this guide originated in the revision program of the California Elementary Mathematics Program, during which time the author was Mathematics Consultant for Los Angeles County Schools, and an advisor to the California State Curriculum Commission.

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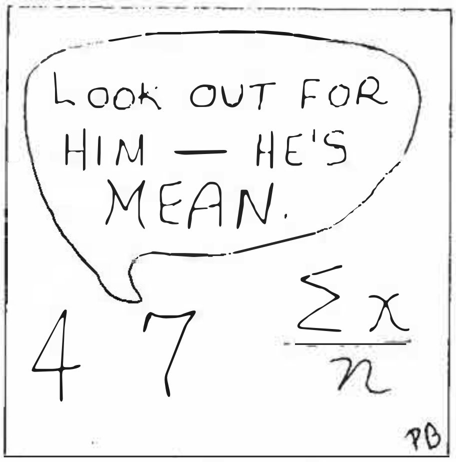
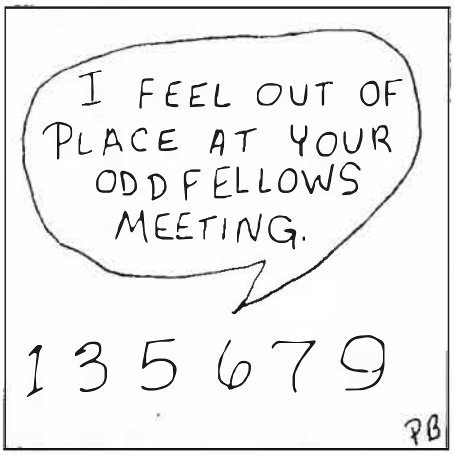


From VECTOR, B.C. Association of Mathematics Teachers Newsletter, Mar. '71



The "Inner Stars," "-Pictures" and "-Games,"

A Contribution to Reform in Mathematics and Art Teaching - Part 1

Reinhard Lehnert
Dillingen/Saar, Western Germany

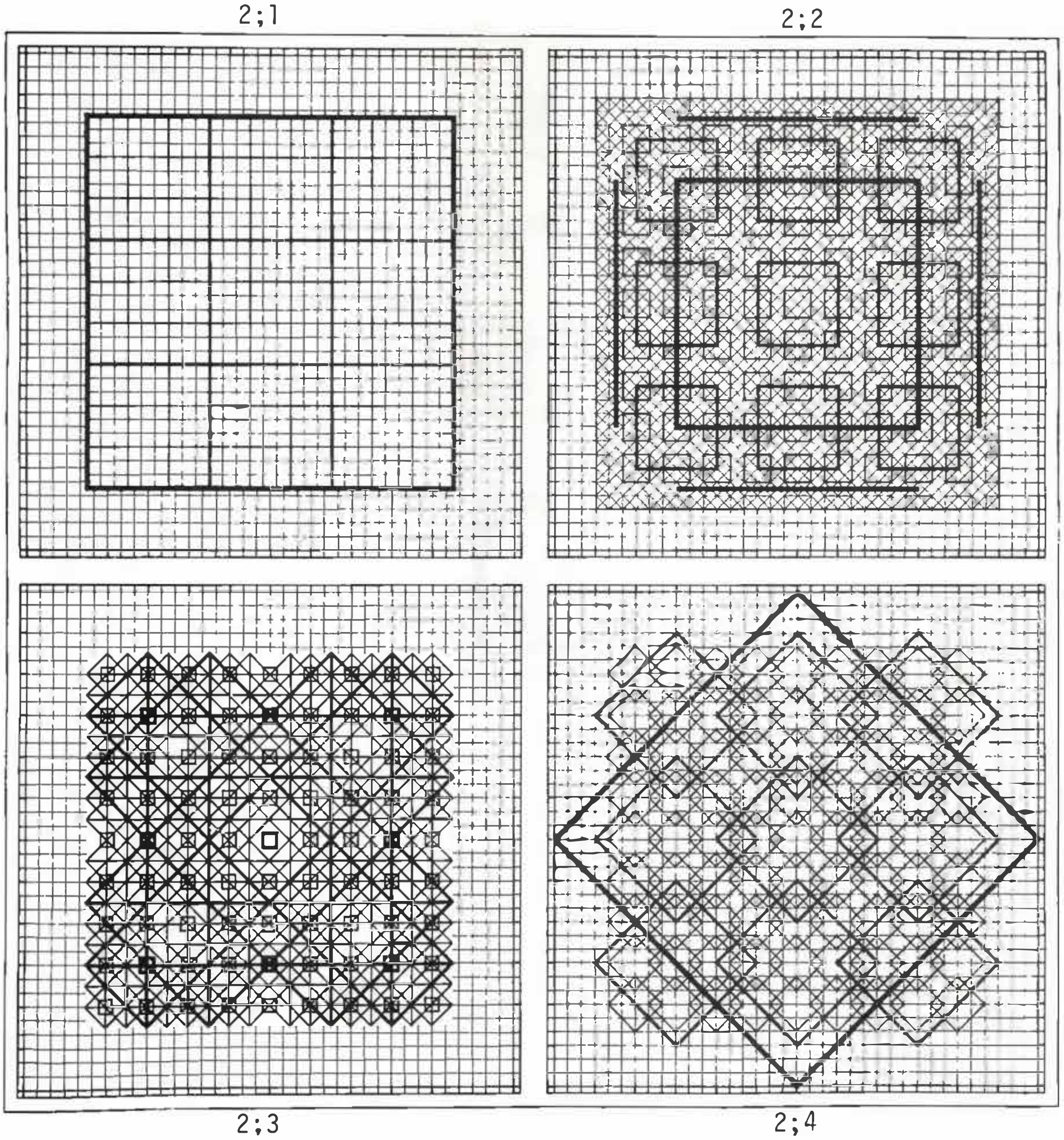
This article deals with modern and extensive geometrical figures discovered by the author. In his opinion, their appropriate treatment in lessons of geometry and/or art could contribute to an essential reform in the instruction of these subjects.

The figures are called "inner-stars," "-pictures" and "-games." The "inner-stars" are layered geometrical surface designs. They are well suited as screens for making esthetically attractive pictures, fixed or changing. These are the "inner-pictures" and the "inner-games." The simpler "inner-stars" and "-pictures" can be designed and examined with simpler means. They seem suited for improving and enlarging the introductory as well as the advanced instruction in mathematics and art.

The importance of the figures exceeds the interest of school instruction. For cogent reasons the "inner-stars," as they form scales of a future luminous music, are suited to achieve the same effects as the scales for music (including the twelve-tone scales). This visual music is not to be a tone music made visible, but an independent art, the works of which, as a rule, are films without special subjects. In the following, we examine square "inner-stars" and "-pictures" of the number of extension 3.

Picture 2;1 shows one large square (layer 0, to be conceived as an area), 9 smaller areas (layer 1), 81 still smaller areas (layer 2), and 729 smallest areas (layer 3). We introduce parallel coordinates. The center is the point (0;0), the center of the right side of the large square is (1/2;0), the center of the upper side is (0;1/2). In our thoughts, we add firstly the finer layers 4, 5 . . . and secondly we imagine the figure obtained thus continued beyond the borders of the large square over the whole plane. Thirdly, to the figure obtained in this way we add in our thoughts the coarser layers -1, -2 . . . The total figure which now exists is called the square layered "cell-star" of the number of extension 3, or C3. The squares are called its "cells."

For n = 0, ±1, ±2 . . . We call the centers of the "cells" of layer n the "strong-points" of layer n. Each "strong-point" of layer n is at the same time also a "strong-point" of all finer layers (n+1), (n+2). The center of the picture, and only it, is the "strong-point" of all the layers. The "strong-points" of layer 0 have coordinates which are whole numbers, those of layer 1 have coordinates with the denominator 2^1, and so on. We call a "strong-point" of layer n, which is not at the same time a "strong-point" of the next coarser layer (n-1), a "strong-point in a new place" of layer n; every other, a "strong-point in an old place." The total figure, consisting of all the "strong-points," is called the square "point-star" of the number of extension 3, or P3.



2;1 2;2

2;3 2;4

Picture 2

"M," 139 of layer 3 forming the stylized letters "LICHT-MUSIK," and 241 of layer 4 forming five rows of ornaments. The pictures are colored according to the following law: border lines are black; where "base-figures" in odd numbers cover the area the color is white; in even numbers it is black.

For n = 0, ±1, ±2 . . . A straight line passing through at least two, and therefore through infinitely numerous "strong-points" of layer n, is called a "strong line" of layer n. A "strong-line" of layer n which is not at the same time "strong-line" of the next coarser layer (n-1), is called a "strong-line in a new place" of layer n; every other, a "strong-line in an old place." Every segment of a "strong-line" is called a "strong-segment."

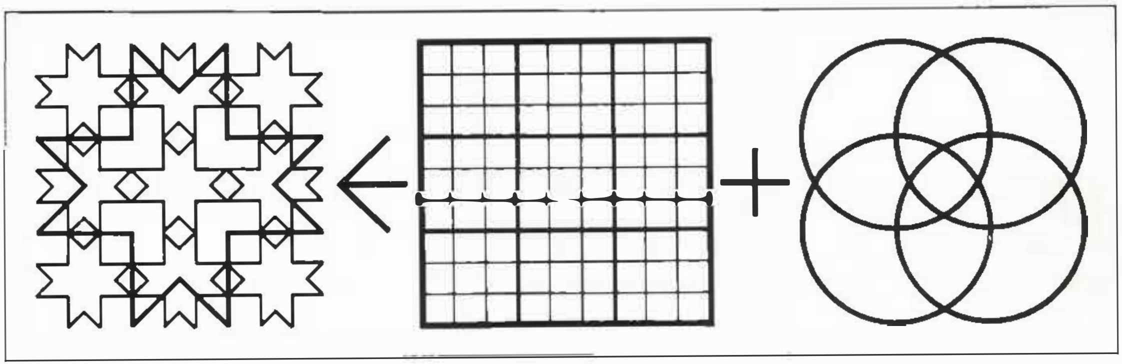
For n = 0, +1, +2 . . . The straight lines dividing the plane sector between two neighboring "strong-lines" of layer n into f equal parts, are called "field-lines" of layer n and of the number of division f. As such numbers of division f all natural numbers from 2 onward are possible so far as they have no common divisor with the number of extension e. In the present article e = 3. A "field-line" of layer n which is not at the same time "field-line" of the next coarser layer (n-1), is called a "field-line in a new place" of layer n; every other, a "field-line in an old place." Every segment of a "field-line" is called a "field-segment."

The whole of all "strong-lines" belonging to fixed gradients as well as of all appertaining "field-lines" to a fixed number of division is called a "general-star." The corresponding figure consisting of all lines "in a new place" is called a "complete-star." The "complete-stars" serve for the construction of the "inner-stars."

Picture 2;2 shows a modification of the "cell-star" C3. All "cells" have been reduced in the scale 1:(2/3). The new total figure is called the "screen-star" or S3, and the new squares its "base-figures." Let us compare C3 and S3. In C3 the boundary lines of "cells" of different layers are heaped one upon another in large numbers. In S3 boundary lines of "base-figures" of different layers have, at best, isolated points in common but never whole segments of straight lines. Therefore, we call the S3 "transparent."

For the central "cell" of layer 0 and for the gradients 0,∞, 1, -1, picture 2;3 shows the "strong-lines in a new place" and the "field-lines in a new place" of layers 1 and 2, and that, as far as the "field-lines" are concerned, to the number of division f = 2. It therefore shows a segment of a "complete-star" adjoined to C3 and P3. This "complete-star" contains also the "inner-stars" of pictures 1;3 and 2;4.

Picture 2;4 shows a further modification of the "cell-star" C3. The new "base-figures" are rhombuses (to be conceived as areas). The new total figure is an "inner-star." For this article we call it I(2;4). Let us compare S3 and I(2;4). The I(2;4) is also "transparent." In contrast to S3, neighboring "base-figures" (in the directions up and down, and from right to left) have some points in common. Therefore we call the I(2;4) "coherent."



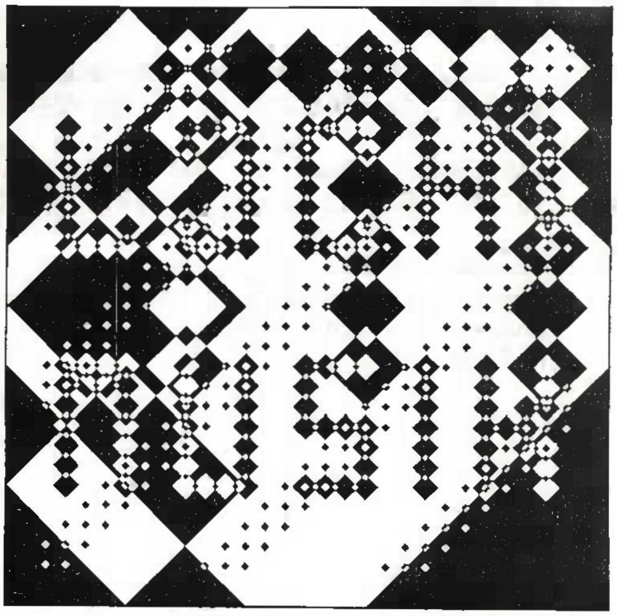
Picture 1

Picture 1 represents the basic idea of the "inner stars." It shows three partial pictures. The left figure represents the intersection law of seeing. Two or more areas of good form (here, circular areas) intersecting each other can, at the same time, be seen as intact forms. The middle figure shows layers 0, 1 and 2 of the "cell-star" C3 of the number of extension 3. The figure on the right shows layers 0 and 1 of an "inner-star" of the number of extension 3. We call this "inner-star" the I(1;3).

For every "inner-star" we call the whole figure consisting of the borderlines of all "base figures," the pertinent "line-inner-star." To every "inner-star" exactly one "line-inner-star" is coordinated. To every "line-inner-star" several "inner-stars" are coordinated, exactly even. The "inner-stars" are not an end in themselves. They serve as screens for the production of "inner-pictures" and "-games."

An "inner-picture" develops from an "inner-star" in the following way. Among the "base-figures" of the "inner-star" a limited number are chosen to appear or shine. The others are to remain invisible. The appearing "base-figures" are covered with colors.

Picture 3



Picture 4

Pictures 3 and 4 are 5-layered "inner-pictures" of the "inner-stars" I(1;3) and I(2;4). They show 1 "base-figure" of layer 0, 3 "base-figures" of layer 1 at the left side of the picture, 22 "base-figures" of layer 2 forming an "M", 139 of layer 3 forming the stylized letters "LICHT-MUSIK", and 241 of layer 4 forming five rows of ornaments. The pictures are colored according to the following law: boarder lines are black. Where "base-figures" in odd numbers cover the area, the color is white; in even numbers, it is black.

An "inner-game" is a changing "inner-picture." In it, "base-figures" can appear (rhythmically), change color and be extinguished. On a later stage of development they can also move (subject to certain laws) and change size and form. "Inner-games" are produced with the help of "luminous organs." These are electronic devices with a veiwing screen.

Artistically formed "inner-pictures" and "-games" are to be works of a new art, a static and dynamic visual music. Three-dimensional "inner-pictures" can be produced physically, but cannot be "looked-into."

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