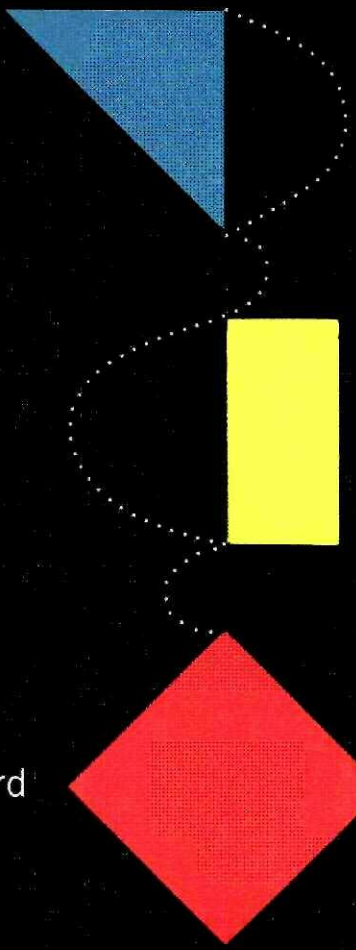
a
guide to

DANCE SQUARED



the national film board canada

16mm colour — running time: 4 minutes

"If the teaching of mathematics is to be in harmony with its recent developments and with its continually widening applications in science and in our social life, our pupils must explore for themselves and rejoice not only in the discovery of solutions but even more in the discovery of problems."

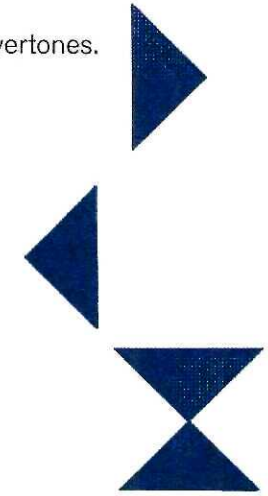
Trevor Fletcher, Ph.D

It is in this spirit that the film animator has designed **DANCE SQUARED,** a film which employs movement, colour and music to explore the symmetries of the square.

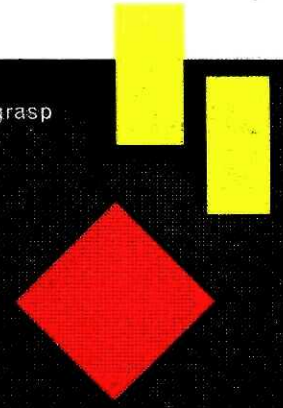
a film by rené jodoin, maurice blackburn and trevor fletcher, ph.d.

produced by **the national film board of canada**—1961

DANCE SQUARED is an experience with mathematics for the very young—a gay, colourful encounter with geometrical shapes. To small children seeking relationships and grasping tentative meanings, DANCE SQUARED brings an intriguing mathematical design. The familiar assumes strange overtones.

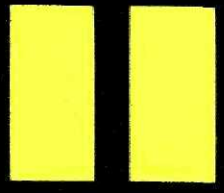


this is something that every child can grasp

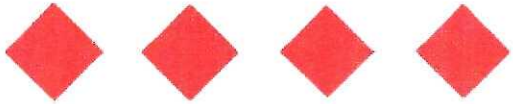


Yet for the mature mind, and even for
many skilled professional mathematicians,
DANCE SQUARED poses problems
too difficult to solve.

DANCE SQUARED is a challenge to all enquiring minds...



Needless to say, what is done with the challenge
of DANCE SQUARED depends upon the
learning environment. Most small children will
be eager to probe beneath the dance of
gyrating shapes which suddenly divide to form
new patterns. They will want to discover and
create for themselves the "laws" which rule
over every movement, every fresh design.



In creative mathematics, it is not always
possible to put check marks beside every answer.
In mathematics, answers are usually
stepping stones to new problems.

Answers can be drilled.

But thinking, problem-solving, is a lively activity.
DANCE SQUARED will be most rewarding
when it is used as a magic carpet to thought.

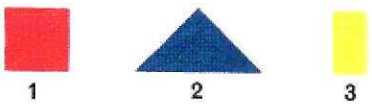
on a first screening in primary grades the objective
might be simple appreciation of a novel experience—

On a second screening, perhaps the class will look for as many shapes and colours as they can. After that ideas will come thick and fast:

- Children trace shapes in the air or on their desk with a finger.
- Draw them on the board.
- Make them with coloured paper.
- How many of the shapes can be made from one square?
- Which shapes show half a square?

Note
In the film, all the shapes and combinations in the sequences invariably add up to the same square. The square chosen by the artist was 7" x 7".

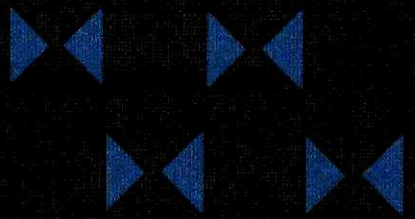
- Give numbers to the shapes:



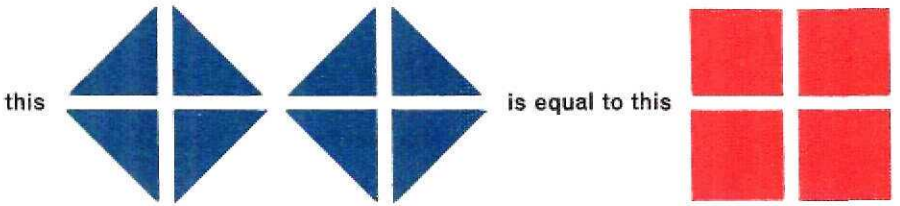
What number could two triangles and a square stand for?

Many number stories and interesting combinations can be worked out.

the feltboard would be useful here

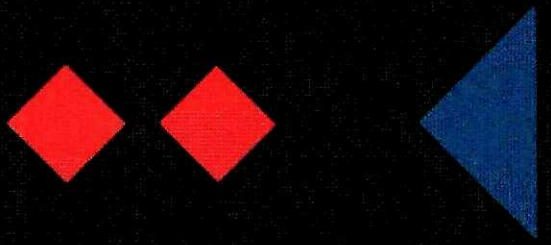


This search for patterns, equality and symmetry may be extended and varied in many enticing ways. Whether the lesson is called Art or Arithmetic doesn't matter. In either case, fundamental understandings are being developed. The algebra of symmetry groups is pretty advanced for grade ones. Yet symmetry is a mathematical concept which they recognize and utilize spontaneously in their own drawings. It can therefore be studied at *their* level, providing a strong foundation which will engender confidence in advanced studies later on.



Can you make a rectangle equal to a square?

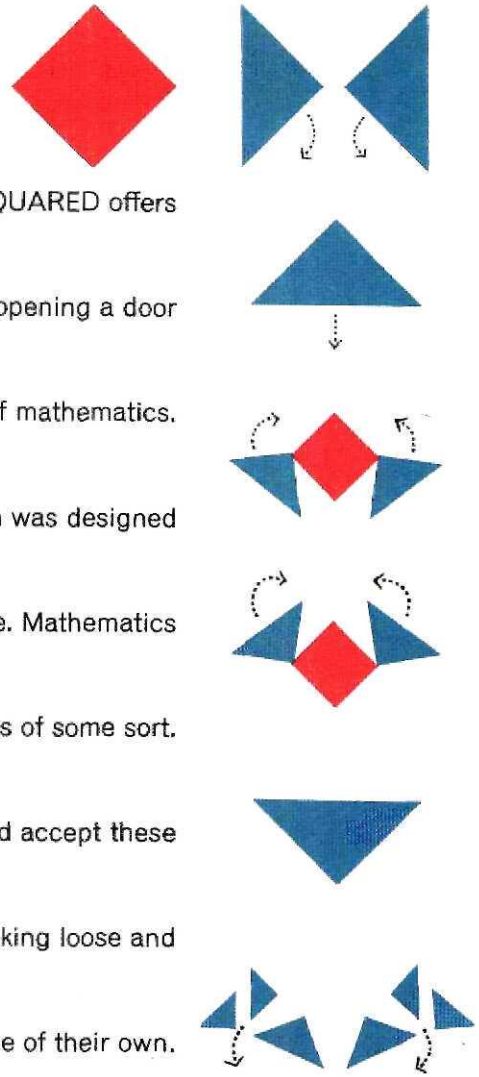
. . . or a triangle equal to two squares?



A good idea might be to dramatize short sequences from the film. The children will take the place of "shapes". If the sound track can be put on tape, so much the better. One value of this activity (apart from the fact that it is fun) is that symmetry in movement is a more sophisticated notion than static symmetry. It is said that Egyptian symmetric patterns are the first recorded examples of higher mathematics in human history; but it is certainly possible that the dance may have developed such ideas even earlier than graphic arts.

You will have noticed that colour, too, provides further areas for exploration in the film.

for convenience, each shape is identified throughout by one of the primary colours

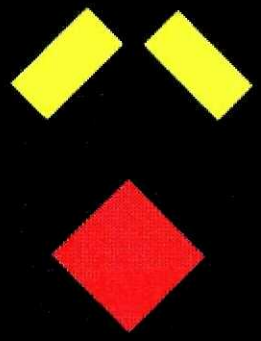


Without doubt, DANCE SQUARED offers countless possibilities, each one opening a door on the wider horizons of mathematics.

It is important to note that the film was designed within a strict, inflexible discipline. Mathematics always operates within limitations of some sort.

Students should recognize and accept these conventions before breaking loose and creating a discipline of their own.

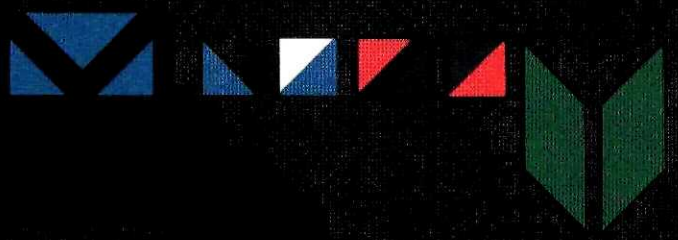
the alternative is confusion, and a desk littered with meaningless scraps of coloured paper



Opportunities for originality among older students may be of particular interest to the mathematically inclined. After some initial experiment, they may decide on another set of shapes and colours to be used in another arrangement of patterns and sequences.

This leads very quickly to some pretty advanced mathematics, included here for those

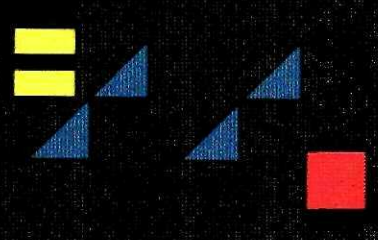
to whom such things are an endless delight.



Following along the lines laid down in DANCE SQUARED, what can be done with the equilateral triangle, the rhombus and the golden rectangle?

Symmetrical properties of the square, rectangle, isosceles and right-angled triangle may be studied in connection with the film. Then too, what symmetries are evident in the music of the film? In one of the tunes the musician regularly misses a beat. What is the effect of this? What are the areas of the different shapes in the film?

what theorem on area may be demonstrated by manipulating diagrams like the ones in the film?



In how many different ways can the square be cut

into three equal pieces, four, five? . . .

Given some particular set of pieces,

in how many ways can they be fitted together

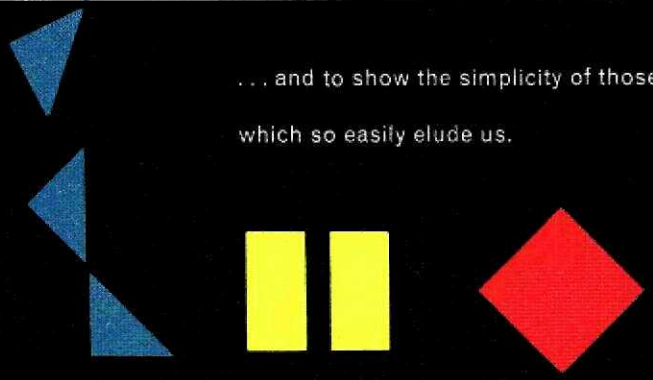
to form the square?

It is only a step or two now into higher mathematics

—into the same intricate problems which

faced the film-makers as they worked to unravel

the complexity of familiar things...



. . . and to show the simplicity of those characteristics

which so easily elude us.

For example, advanced students may like to

construct a graph or flow chart to show the

possible transitions between some of the

decompositions of the square. In effect, they will

show the transformation of one configuration

or arrangement to another by splitting some

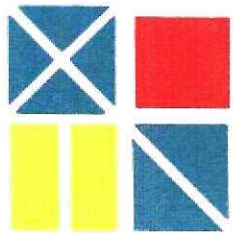
or all of its components.

Working on the graph, they then try to define

a greatest upper bound or a least upper bound.

Is the resulting structure a lattice? If so,

is it a distributive lattice?



You are now into twentieth century mathematics.

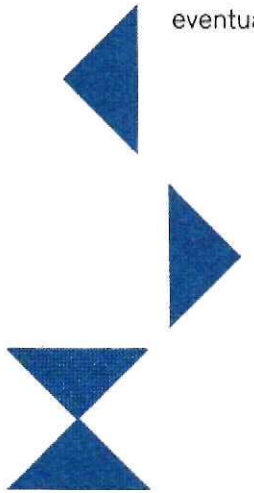
Mathematicians today do not expect to solve

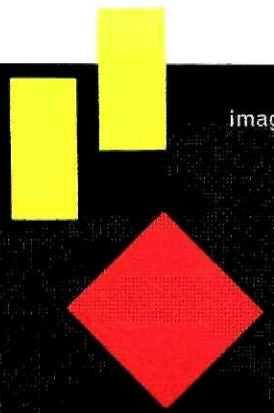
all their problems.

some may have to wait for solution until

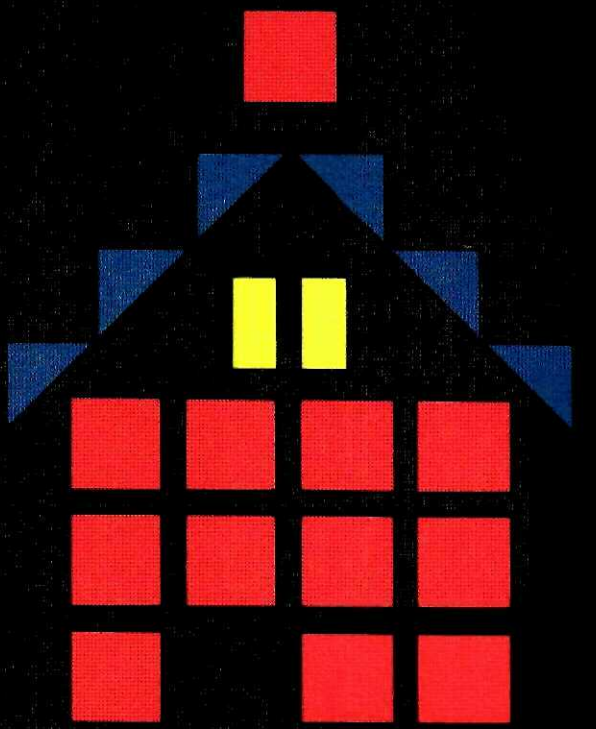
today's children grow up

To conclude, then, DANCE SQUARED shows how simple structures, which children readily understand and enjoy, can lead very quickly to some of the most sophisticated concepts in our technological era. And it is this world of rapid change and development that the child must eventually learn to understand, serve and enjoy.





imaginative teaching will help him



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