The first 30 SMILE programs FOR THE BBC MICRO MODEL 'B'

Microelectronics Education Programme

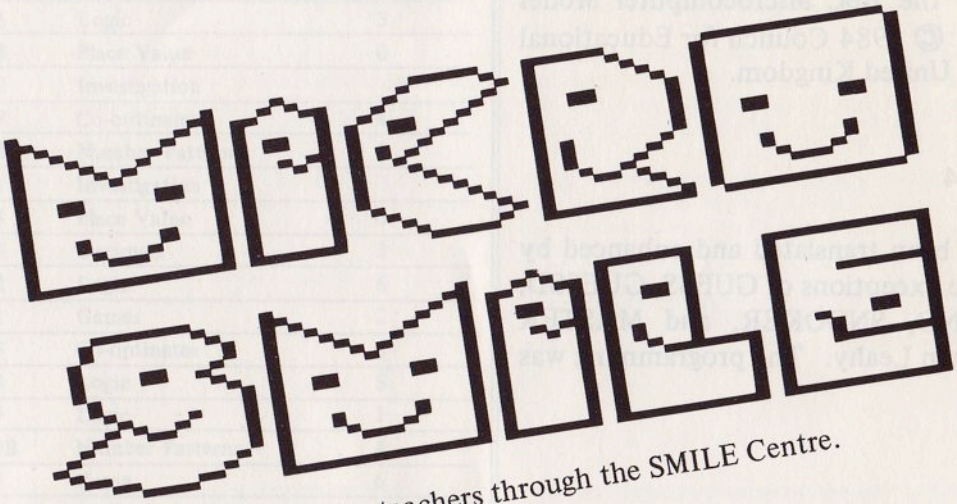
MESU
Microelectronics Education Support Unit
INFORMATION UNIT

The programs described in this booklet are written for the BBC Microcomputer Model 'B' and are supplied on three single-sided 40 track discs.

To run any of the programs place the disc in the disc drive. Then holding down [SHIFT] press and release [BREAK] The menu for that disc will then load and be displayed. The desired program is chosen by pressing the appropriate number.

Sometimes you may wish to escape from a program. Many of the programs offer this facility explicitly. It is, however, always possible to return to the menu by pressing [BREAK]

Versions of the programs for use on the RML 380Z and the RML 480Z (Network and standalone) are also available. Please write for further details to: **Loan Services Administration (4th Floor), ILEA Learning Resources Branch, Centre for Learning Resources, 275 Kennington Lane, London SE11 5QZ**



Devised by teachers through the SMILE Centre.

First published 1984

The programs have been translated and enhanced by Pete Smith with the exceptions of GUESS, GUESSD, ELEPHANT, RHINO, SNOOKER, and MASTER which are by Siobhan Leahy. The programming was funded by MEP.

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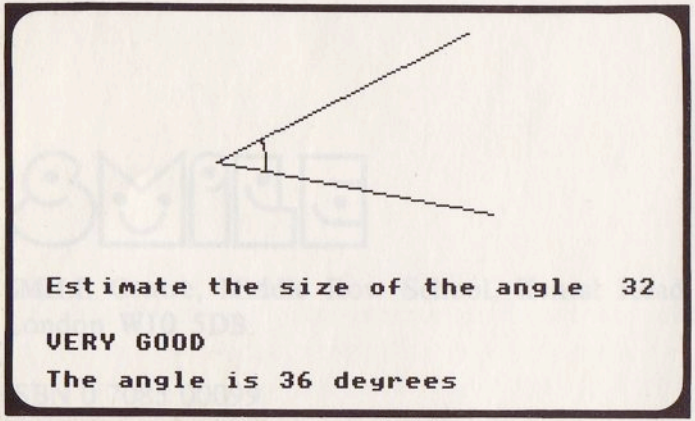
ANGLE 90

This program is designed to help children learn to estimate the size of acute angles. There is an exercise first where the children are asked to estimate randomly chosen angles which are drawn on the screen. The exercise is followed by a game where the angle on the screen opens and the user has to press the space bar to stop the movement at the specified size.

After each estimate the computer responds according to the size of the error.

In the exercise an error of 16^{o} or more is followed by a remedial routine. A simplified protractor (0^{o}, 30^{o}, 60^{o}, and 90^{o} lines only) is superimposed on the angle and the user is invited to try again. If four responses of 'Very Good' are accumulated the user is invited to move on directly to the game, though the exercise may be returned to at any time.



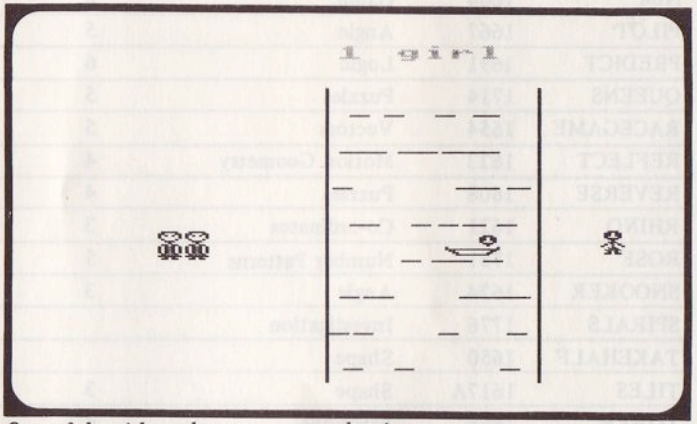
The user has estimated 32 degrees – only 4 degrees out.

BOAT

This is a puzzle to ferry 2 women and 2 girls across a river. There is no bridge and the small boat only holds 1 woman or 2 girls (or 1 girl).

It is not possible to get 'stuck' since the user can always 'undo' a move by repeating it. The challenge is to reduce the number of crossings or moves which is required. The minimum number is 9 and if this is exceeded the user is invited to improve her score. If the minimum number is achieved the user can opt for a harder (?) puzzle in which the same boat has to ferry 4 women and 2 girls across the river.

At the end it is suggested that the user might investigate the minimum number of crossings required for different combinations of women and girls. But this cannot be done with the computer.

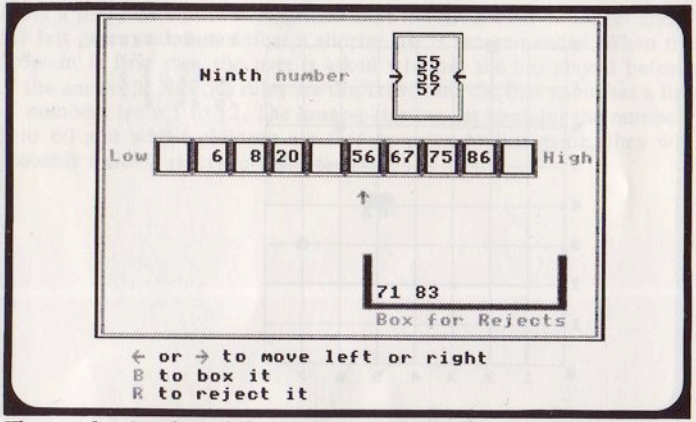


One of the girls on her way across the river.

BOXES

This is a game which involves a certain element of chance. Ten boxes appear across the screen with a rejects box beneath them. Ten random numbers between 1 and 99 are generated one at a time and the aim is to place as many of them as possible in the boxes. Only one number can be fitted in each box and numbers may not be placed in the wrong order.

The main purpose of the game is to give children more confidence about the size and order of numbers.



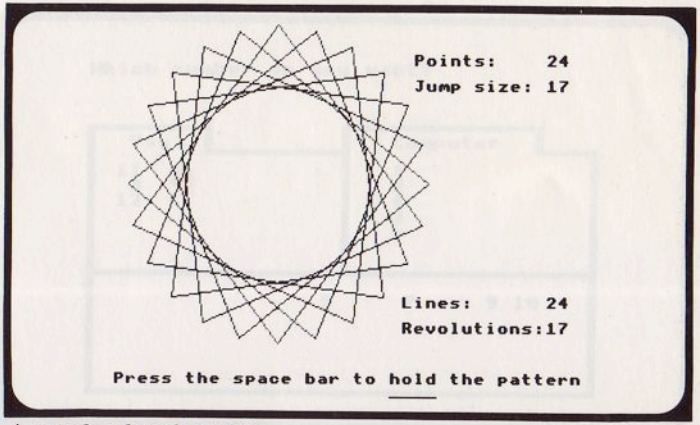
The user has just boxed the ninth number.

CIRCLE

CIRCLE is a resource program which displays patterns made from straight lines drawn inside a circle. The user specifies the number of points around the circle and the size of each jump.

After the pattern has been drawn the computer prints the number of lines and also the number of revolutions.

To investigate the various patterns children will need to record them and tabulate the numerical information. This could work with a group of mature children at the keyboard. Alternatively the program might be used for a whole class, to introduce the investigation, to explain the rules and to stimulate further work with circle worksheets. At a later stage the micro might be used again to test any rules which have been discovered.



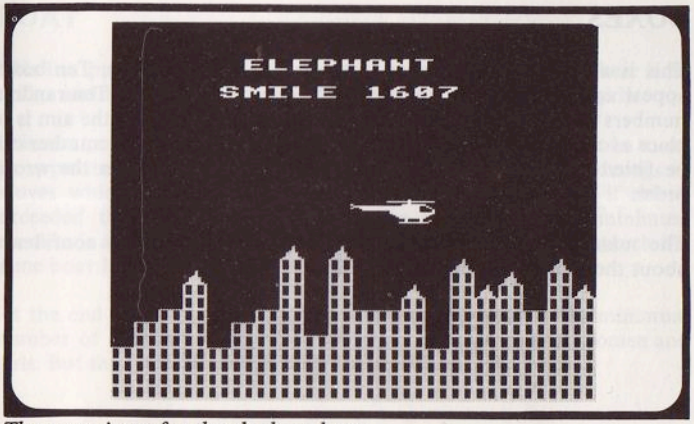
A completed circle pattern.

ELEPHANT

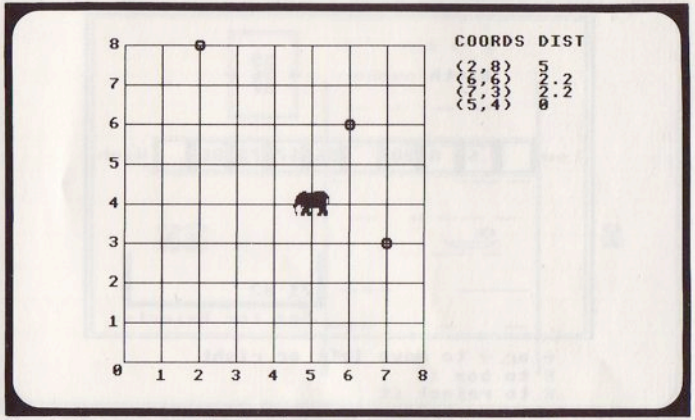
An elephant is lost in New York! Can you find it? In this program New York is an 8 x 8 grid and the user enters co-ordinates to guess the position of the elephant. The computer responds by recording the *direct distance* (to 1 decimal place) between the elephant and the position of the guess.

The aim is to try to minimize the number of guesses and this involves some strategic thinking, which often will be enhanced when children are working in a small group.

To solve the problem more quickly, Pythagoras' Theorem could be used, but this is certainly not necessary for the program to be used successfully.



The scene is set for the elephant hunt.



A winning guess at the fourth attempt. Could the user be sure of this guess by examining her other three tries?

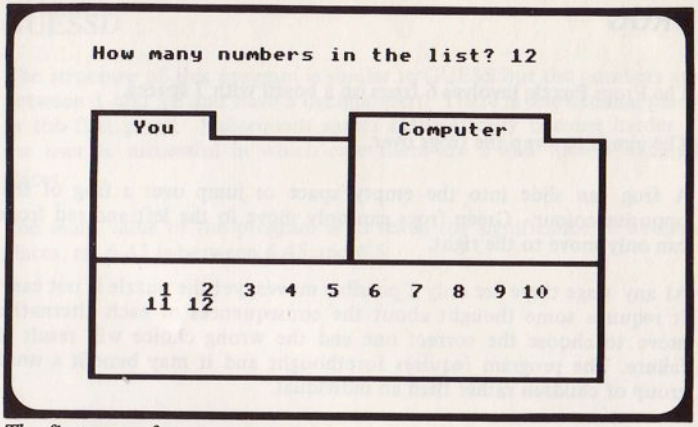
FACTOR

Although this is described as 'a game against the computer' the user is really competing with herself.

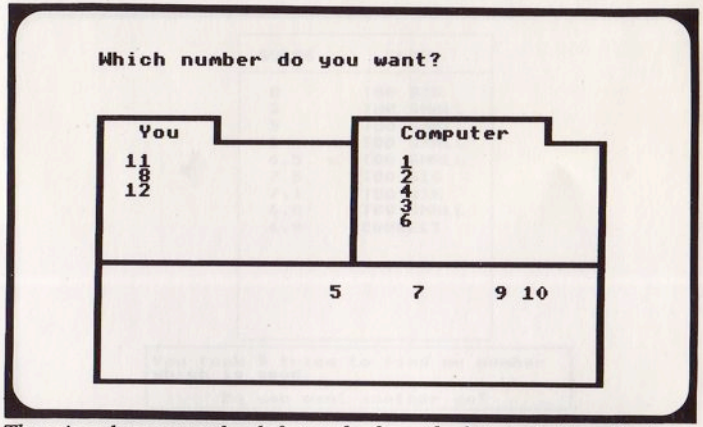
The computer displays a list of numbers and the user is invited to choose one. The choice is limited to those numbers in the list which have factors also in the list. Once the choice is made the computer acquires all of these factors. The user continues to choose one number at a time until no further choice is possible. Any remaining numbers are automatically credited to the computer's score. To win, the user's sum total must be greater than the computer's.

The game can be played at many levels: for some children there will be a challenge involving a great deal of forward planning whilst for others the greatest benefit will be to gain familiarity with numbers and their factors. For the program to succeed it will often be very helpful for a group of children to be involved. They will soon start to discuss and argue about which number to choose and so they may be able to feed off one another's ideas.

At the start of each game the user can determine the length of the list. After a previous win it is suggested that the list should be longer and if the last game ended in defeat a shorter list is recommended. When the program is first run, the user is asked whether she has played before. If the answer is NO the rules are displayed and the first game has a list of numbers from 1 to 12. The longest starting list contains the numbers 1 to 60 and whilst children are free to attempt this game, they will probably quickly revert to a shorter list! . . . .



The first game for a new user.



There is only one number left to take from the list, but who will win?

FROG

The Frogs Puzzle involves 6 frogs on a board with 7 spaces.

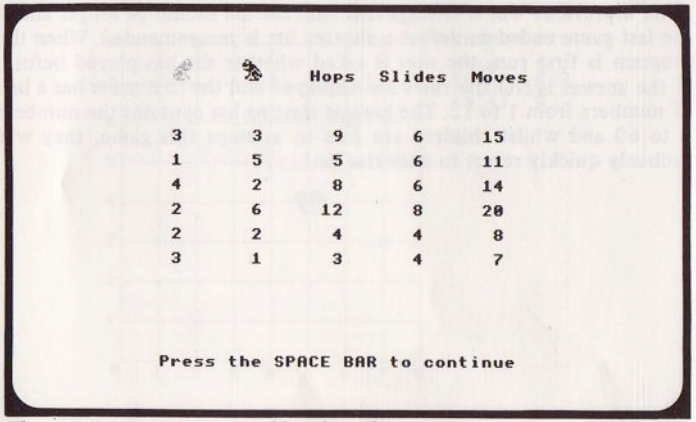
The aim is to swap the frogs over.

A frog can slide into the empty space or jump over a frog of the opposite colour. Green frogs can only move to the left and red frogs can only move to the right.

At any stage there are only 2 possible moves, yet the puzzle is not easy. It requires some thought about the consequences of each alternative move to choose the correct one and the wrong choice will result in failure. The program requires forethought and it may benefit a small group of children rather than an individual.

The facility to choose the number of frogs means that children who can cope with the puzzles might generalize the number of moves required. The user may opt to see a table of results. Also, children who find the puzzles difficult can work with fewer frogs.

Nearly there! Can you work out the remaining moves to complete the swap?

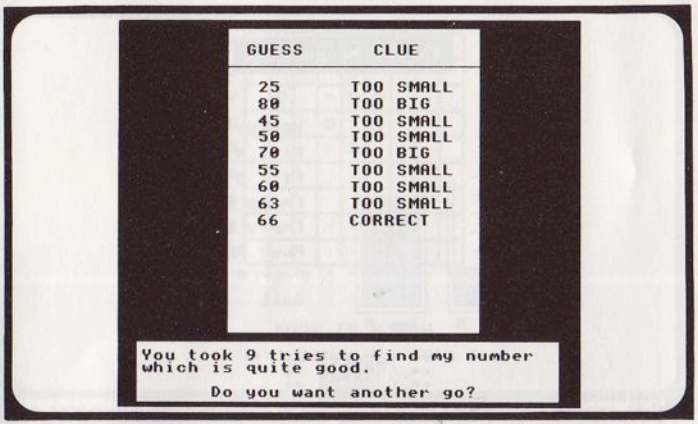


The user can opt to see a table of results.

GUESS

The computer chooses a (random) number between 0 and 100. The user has to guess what it is. After each guess the computer will give a clue which will usually be 'Too small' or 'Too large'. If the user enters 33 but has already been told that 40 is too small the computer responds 'Think!' and the number 40 flashes. At the end the computer records how many guesses were required.

The program is valuable for children who need to practise the ordering of two-digit numbers. It may also be useful at a much higher level when it is appropriate to discuss the minimum number of guesses which might be required.

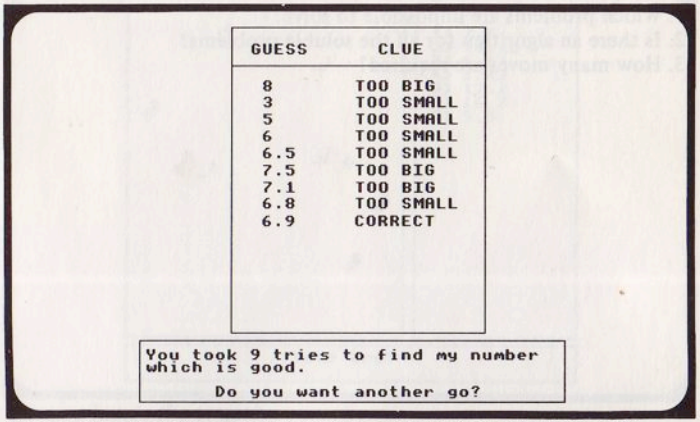


A completed game which took the user 9 tries. Was 25 a good first guess?

GUESSD

The structure of this program is similar to GUESS but the numbers are between 1 and 10 and have a decimal part. There is one decimal place in the first game. Subsequent games automatically become harder if the user is successful in which case there are 2 and then 3 decimal places.

The main value of the program is to teach the significance of decimal places, eg. 6.47 is between 6.45 and 6.5



The user has just discovered that the computer's number was 6.9.

JUGS

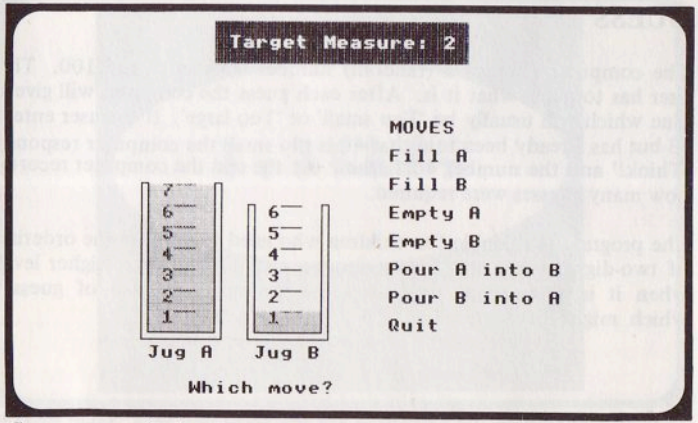
This program produces problems of the following form:

Jug A contains 4 litres and jug B contains 5 litres. You have to obtain 2 litres in either of the jugs.

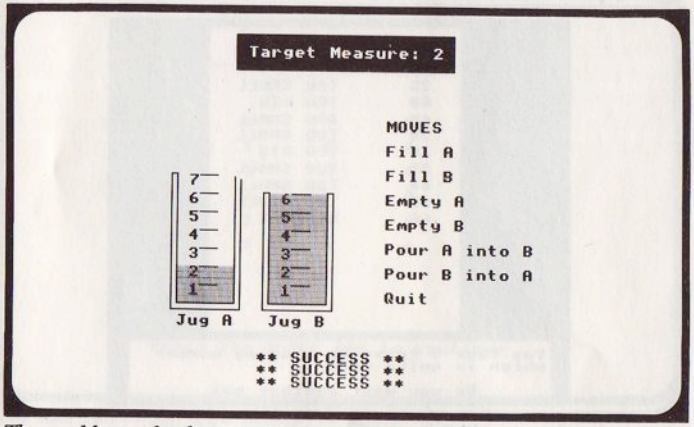
Without the micro these standard problems are inaccessible to many children. Using actual jugs with water is impractical. Even if there is a sink in the class-room water will be spilled and wrong quantities will be poured. With pencil and paper there is a major difficulty over the recording of moves. The micro allows children to proceed immediately. At any time the user can simply empty both jugs and start again but there is always a strong incentive to keep the number of moves to a minimum and so the user is encouraged to look for general algorithms.

If the child has not used the program before a short explanation is given with reference to a simple problem which the user then tries to solve. After this the user can choose the capacity of each jug and also the target measure, or let the computer choose.

Some questions which might arise:
1. Which problems are impossible to solve?
2. Is there an algorithm for all the soluble problems?
3. How many moves are required?



Can you see which move to win?

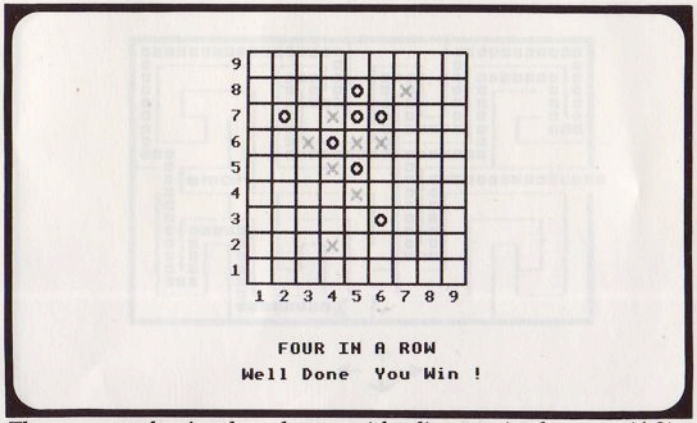


The problem solved.

LINES

This is a game against the computer. The game is a more complex version of noughts and crosses. It is played on a 9x9 board and the winner is the first to get 4 in a line. Any straight and unbroken line is required, horizontal, vertical, diagonal. In the game below the computer has been beaten by a line of 4 crosses which run between (4,2) and (7,8).

The computer is programmed to play at one level only and many children will learn to succeed. It may be appropriate for 4 children who have succeeded against the machine to continue to play in pairs with pegboard and pegs. Playing two against two will allow a continuation of the discussion of strategies which is stimulated by the micro, and using pegs enables children to extend the game to 5 in a line. . . .



The computer has just been beaten with a line running between (4,2) and (7,8).

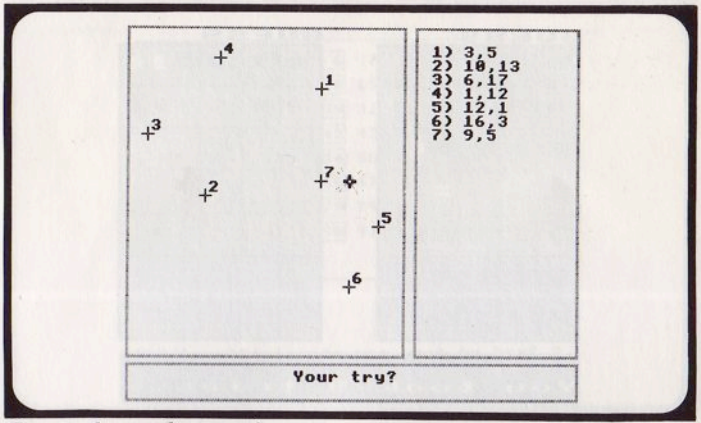
LOCATE

A small cross appears within a large square and the aim of the activity is to locate the cross by typing in 2 numbers. The numbers are co-ordinates but they are unconventional ones, i.e. the origin might be near any of the corners of the squares and the first number might represent the distance up (or down) rather than the horizontal distance.

The aim is to minimize the number of 'guesses' which are required and each guess gives the user further information.

The essence of the activity is problem solving but there is also a clear message about the need for 2 numbers to locate a point in the plane, whatever the co-ordinate system. Children will benefit from working in a small group and discussing the next sensible guess.

There are 3 levels of difficulty. The level is not displayed but it increases automatically if the user is successful i.e. she does not take more than a certain number of guesses.

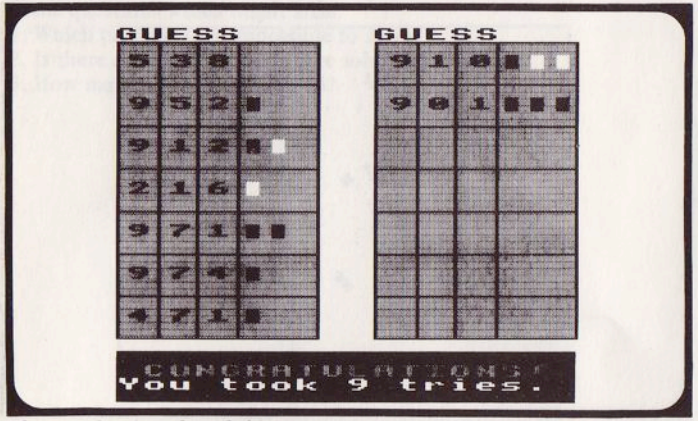


Can you locate the target?

MASTER

The standard game of mastermind is presented on the screen. The computer has randomly chosen a three digit number in which all 3 digits are different. The user has to determine this number as soon as possible. After each attempt she is informed how many of her digits are correct and in the correct position and how many are correct but in the wrong position.

Since the micro adopts the role of the passive player in the conventional game, all the user's time may be spent thinking strategically. A small group of children will be eager to minimise the number of attempts which are required and will hotly debate which number would be a sensible guess.

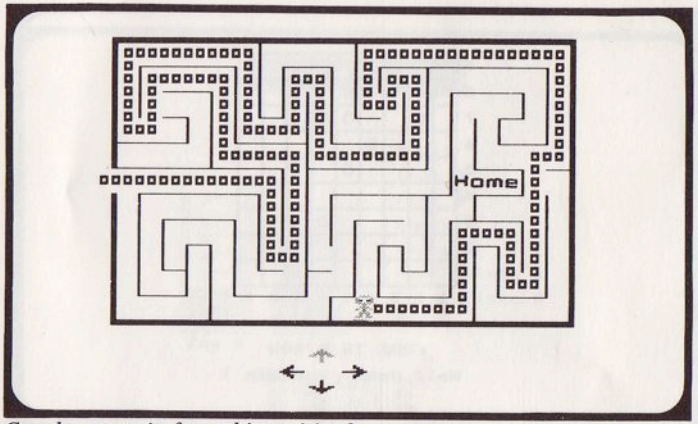


The user has just found the computer's combination in nine moves.

MAZE

A simple maze is drawn on the screen and the user is invited to choose a direction using the arrow keys (up, down, left or right). After each input the path is traced until there is a choice of direction.

Some thought is required to reach 'HOME' safely because the user is *not* permitted to retrace her steps. There are usually two alternative directions (there may be three) and so the user can choose sensibly without having to solve the entire maze mentally. If one path can be seen to be a dead end the user must choose the other.



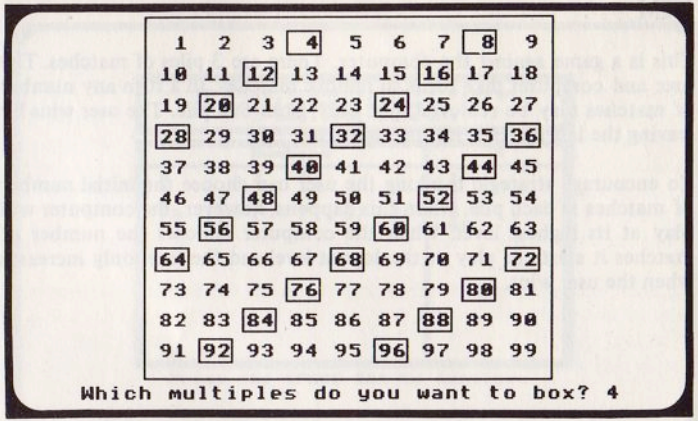
Can the user win from this position?

MULTIPLE

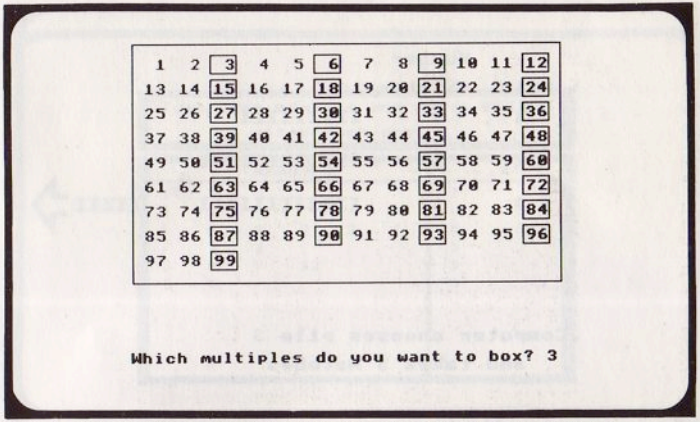
This is a resource program which simply draws a grid of numbers and boxes certain multiples. Two examples are illustrated.

* Which other multiples give diagonal patterns on a grid with 9 columns?
* What about other grids?
* When do the diagonals run from top right to bottom left and when do they run from top left to bottom right?
* When do you get column patterns–complete columns without gaps?
* When do you get column patterns with gaps?
* What other patterns are there? Can you classify them?

The computer does not record results and so it is only more mature children who will be able to investigate the patterns whilst working with the micro. Most children will need to start working with pencil and paper. It would be useful to have hundred squares available and worksheets can be produced for other grids. The micro can be used to start a lesson with the whole class and again, at a later stage, to check any theories which children have developed.



Can you think of another set of multiples which will give a diagonal pattern with 9 columns?

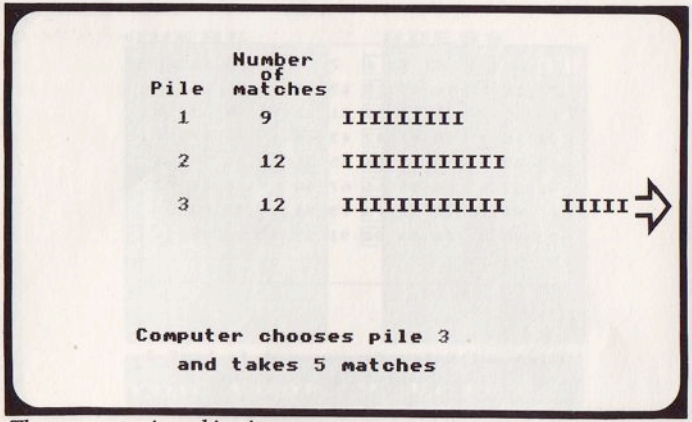


Which other multiples give a column pattern with 12 columns?

NIM

This is a game against the computer. There are 3 piles of matches. The user and computer take turns to remove matches. In a turn any number of matches may be removed, but only from one pile. The user wins by leaving the last match with the computer.

To encourage strategic thinking the user can choose the initial number of matches in each pile. When this happens, however, the computer will play at its highest level. When the computer chooses the number of matches it starts to play at the lowest level and the level only increases when the user wins.



The computer is making its move.

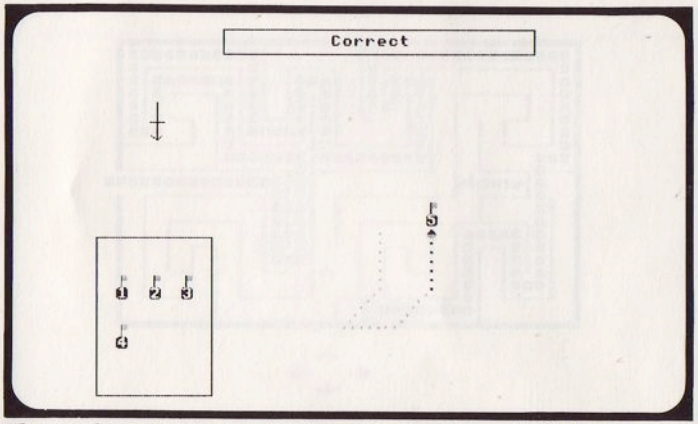
PILOT

The user is taken on a six stage journey and at each stage she has to give the correct direction to reach the next stage. To do this she must type one of the main eight compass points. There are four levels of difficulty to be overcome before the user is eventually awarded her pilot's "ticket".

At the first level the map is orientated so that North is not 'up' but towards the bottom right of the screen and this orientation remains for the six stages of this level. In subsequent levels, the map is rotated after each stage, the clues given at the higher levels needing more thought to enable the correct direction to be analysed.

There is an introduction to remind the user about the eight compass points. This is partly interactive and can be jumped if the user enters that she has used the program before.

(This program is equivalent to GOLDHUNT which runs on RML machines.)



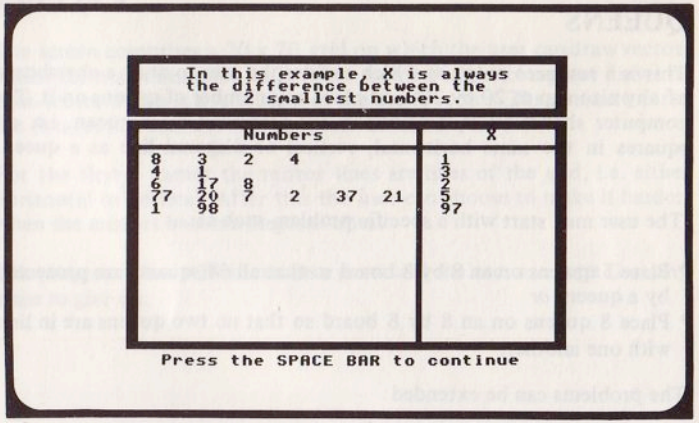
The user has correctly selected South to move towards the buoy.

PREDICT

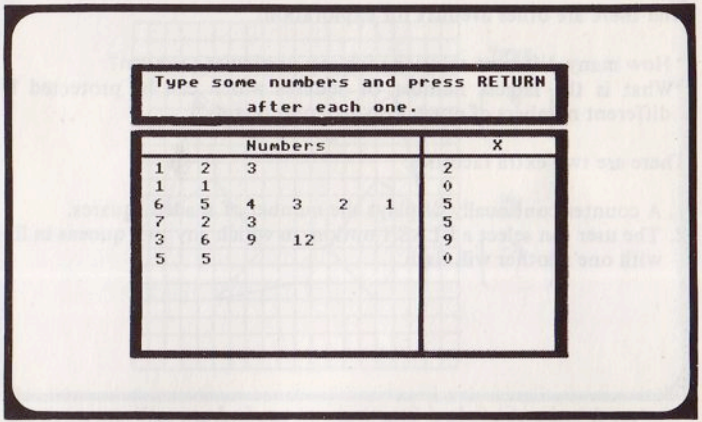
The user can enter sets of numbers and the computer then calculates X by some rule. The object of the exercise is to spot the rule and hence predict the value of X. The rule which is randomly chosen from a list of twelve, may not be easy to spot even though the calculations are simple. For instance X may be the smallest difference between any 2 numbers.

After a correct prediction the user can opt to be tested. In the test it is the computer which chooses the numbers. If both test questions are answered correctly it is assumed that the user has the correct rule; otherwise the program offers another test or the opportunity to type in some more numbers.

This is a problem solving activity and is most successful when a group of children is working together and the various possibilities are being debated. If one child does spot the rule, perhaps she should be encouraged not to give it away! Rather she should choose sensible numbers which will help the rest of the group to make a correct prediction.



The new user is given an example with the rule for X displayed.



Can you guess the rule for X?

QUEENS

This is a resource program which enables the user to draw a chessboard of any size (up to 20 by 20) and place any number of queens on it. The computer shades all squares which are protected by a queen. i.e. all squares in the same horizontal, vertical or diagonal line as a queen.

The user may start with a specific problem such as:

* Place 5 queens on an 8 by 8 board so that all 64 squares are protected by a queen *or*
* Place 8 queens on an 8 by 8 board so that no two queens are in line with one another.

The problems can be extended:

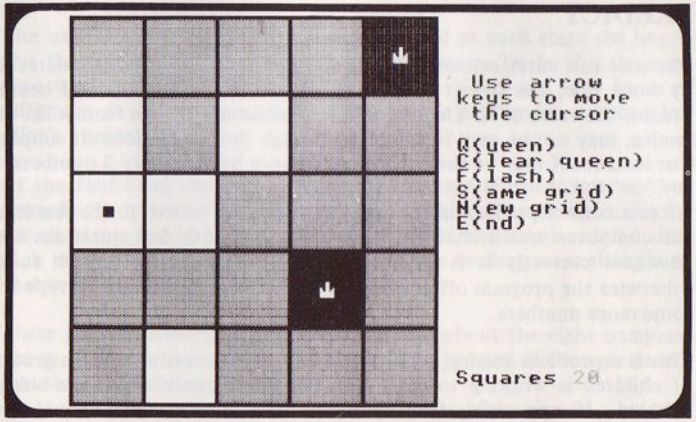
* What is the smallest number of queens that can be placed on any board so that they protect the whole board?
* What is the largest number of queens that can be placed on any board so that no two queens are in line?

And there are other avenues for exploration:

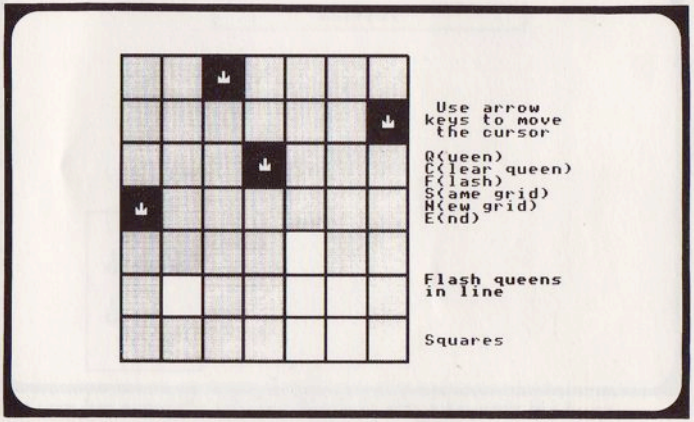
* How many different solutions for any particular problem?
*What is the largest number of squares which can be protected by different numbers of queens on different boards?

There are two extra facilities:

1. A counter continually displays the number of shaded squares.
2. The user can select a FLASH option, in which any two queens in line with one another will flash.



Only 5 squares remain unprotected. Can you place one more Queen to protect them all?



Can you place three more queens so that no two are in line?

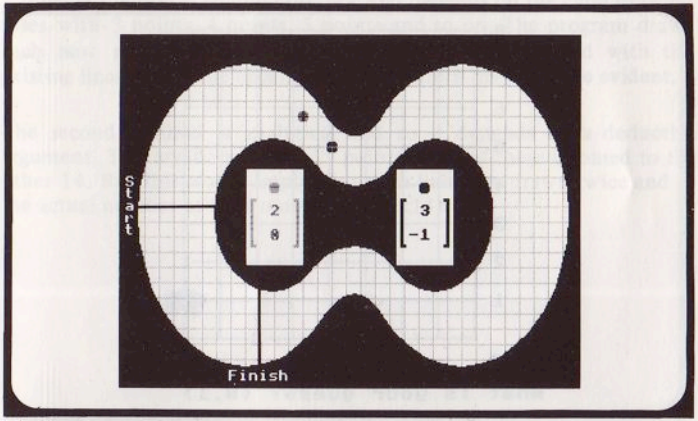
RACEGAME

This is a game where 2 players compete against one another and so they need to be of compatible ability.

A racetrack is drawn on a square grid and the two cars move when vectors are typed in. Both vectors start at $\begin{bmatrix}0\\0\end{bmatrix}$ and each component of a player's vector may only be changed by 1 each time. Thus the computer will only accept –1, 0 or 1 for the first move (for both components).

The first player to cross the finish line is the winner. If one player crashes then the other may opt to continue alone but only wins if she crosses the finish line.

There are 3 different tracks. The first one is relatively smooth and if either of the players finishes they may opt to have the subsequent race on a track with more bends to negotiate. The third track is even more difficult!



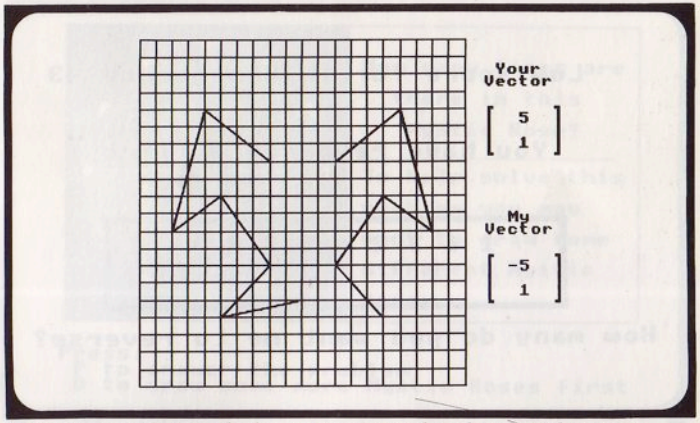
The hardest of the three tracks with both players negotiating one of the tight bends.

REFLECT

The screen comprises a 20 x 20 grid on which the user can draw vectors which form a continuous path. After each input the computer draws its own vector which is a reflection of the user's vector. The aim is to force the two vectors to meet (i.e. to locate the mirror line).

For the first 4 games the mirror lines are lines of the grid, i.e. either horizontal or vertical. After this the user can choose to make it harder, when the mirrors become diagonal lines.

The program allows 20 moves in a game and the user can type G at any stage to give up.



The computer has worked out its move and is about to place it on the screen. Can you see what will happen when it does so?

REVERSE

This is a puzzle which would be quite tedious without the micro. The digits 1 to 9 are given in random order and the user has to arrange them in the correct order. This must be done by reversing strings of numbers. The strings can be of any length but they must be from the start of the list, so

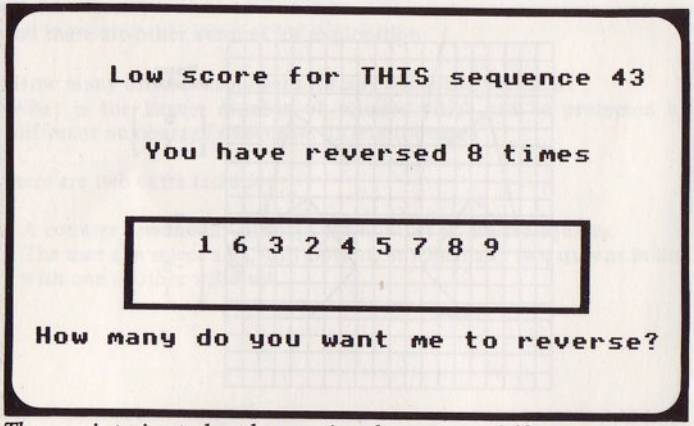
1 2 7 9 4 6 5 8 3

could be changed to

9 7 2 1 4 6 5 8 3

by reversing the first 4 numbers.

Although the puzzle is not easy, when children are debating the different possible moves a solution is always likely.

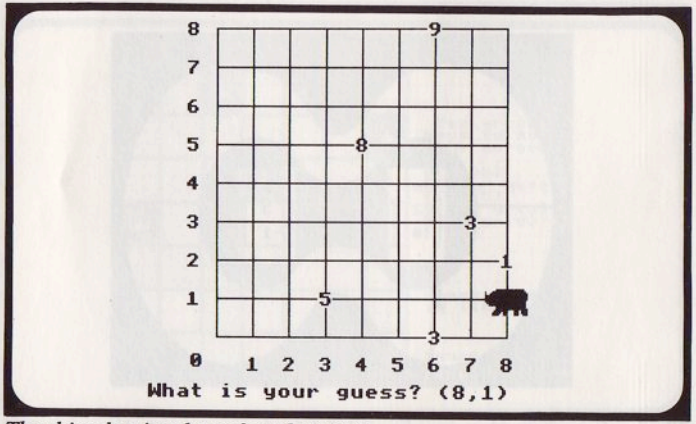


The user is trying to beat her previous best score of 43 moves, and has already correctly positioned some of the numbers.

RHINO

A rhino is lost in New York. Can you find it? In this program New York is an 8 x 8 grid and the user enters co-ordinates to guess the position of the rhino. The computer responds by saying how far the user has to walk (along the grid lines) to find the rhino. This distance is recorded on the grid.

The aim is to try to minimise the number of guesses and this involves some strategic thinking, which will often be enhanced when children are working in a small group.



The rhino has just been found at (8,1).

ROSE

A mystic rose is made entirely from straight lines. Points are equally spaced around a circle and each pair of points is joined with a line. If the mystic rose has 15 points, how many lines are there?

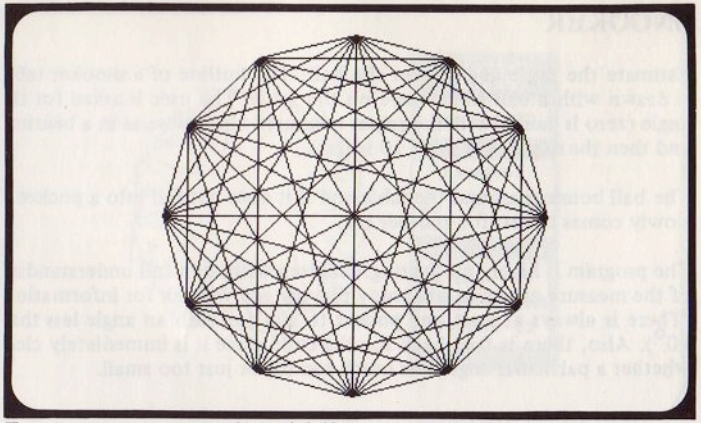
In order to solve this problem, the child will almost certainly need to draw several simpler mystic roses (i.e. roses with less points).

The program starts with a short film in which different mystic roses are drawn in a variety of ways. The film lasts for 2 minutes and the user can opt to jump straight to the problem. If the problem is answered correctly the program ends, otherwise the user has the choice of drawing her own roses, trying the problem again, or giving up.

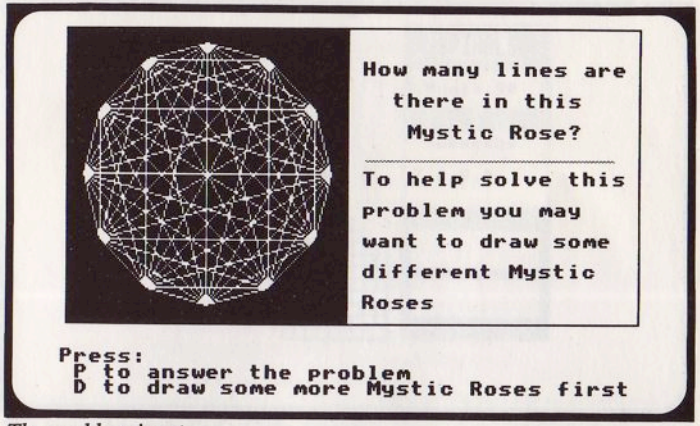
When drawing roses the user may also change the method of drawing. In method 1 the first set of lines joins one point to each of the others. The second set of lines joins a neighbouring point to all the others (except the first point which is already joined). In method 2 the sequence is reversed.

There are two methods of approach which could be adopted. The more accessible method is an inductive one and depends on the child drawing roses with 3 points, 4 points, 5 points and so on. The program draws each new set of lines in white before they are merged with the existing lines and so the ensuing number pattern may become evident.

The second method is analytical and so it depends on a deductive argument. The mystic rose has 15 points. Each of these is joined to the other 14. But this would imply that each line were drawn twice and so the actual number of lines must be ½ (15x14).



For the new user a number of different roses are drawn at the beginning of the program.



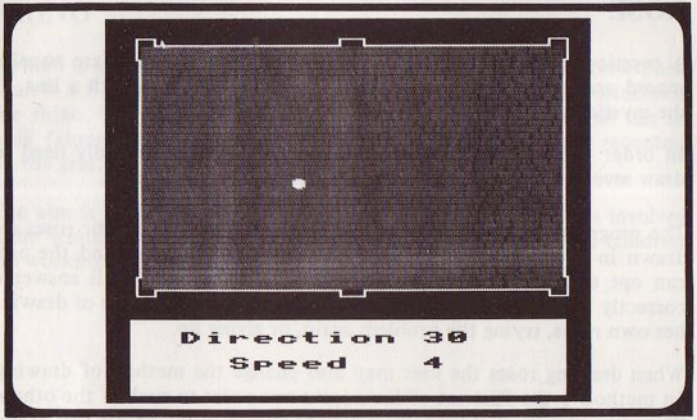
The problem is set.

SNOOKER

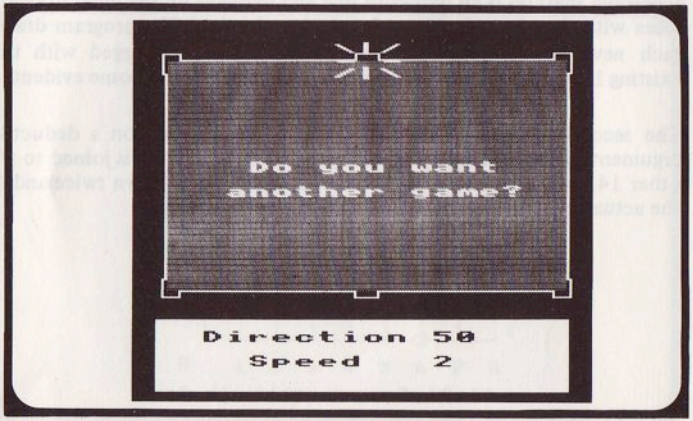
Estimate the angle and pocket the ball! The outline of a snooker table is drawn with a ball somewhere on the table. The user is asked for the angle (zero is 'north' with the angles measured clock-wise as in a bearing) and then the speed (1 is slow, 10 is fast).

The ball bounces around the table and if it does not fall into a pocket it slowly comes to rest for another try.

The program is highly motivating. Children without a full understanding of the measure of angles will enjoy playing and will ask for information. (There is always at least one pocket to aim for with an angle less than 90^{o}). Also, there is feed-back for the child since it is immediately clear whether a particular angle was much too big or just too small.



Can you say which pocket the user is aiming for?



The user has successfully potted the ball into the top centre pocket and has the option of another game.

SPIRALS

SPIRALS is a resource program which draws patterns on the screen to the specification of the user.

Patterns are either closed or infinite. Cyclic patterns are terminated by the computer when completed, and are always scaled to be drawn on the screen. Infinite patterns will continue off the edge of the screen and must be interrupted by the user.

The children may benefit from beginning their investigation on squared paper or isometric paper to examine angles of 90 degrees and 120 degrees.

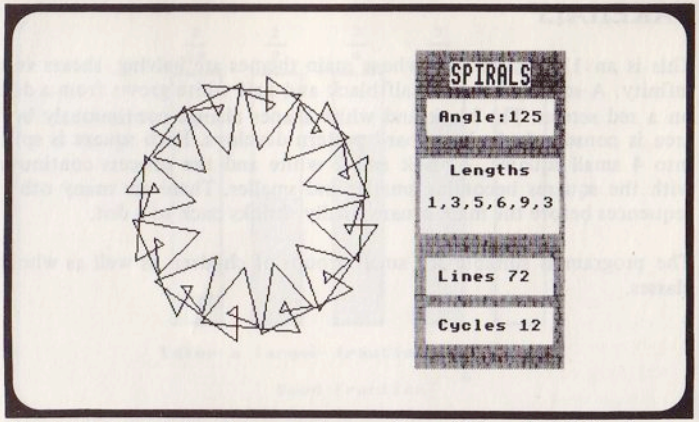
The computer facilitates the exploration of other angles and records for each pattern the lengths entered, the number of lines drawn, and the number of cycles completed. The results from previously drawn patterns can be recalled at any time.

Many investigations are possible:

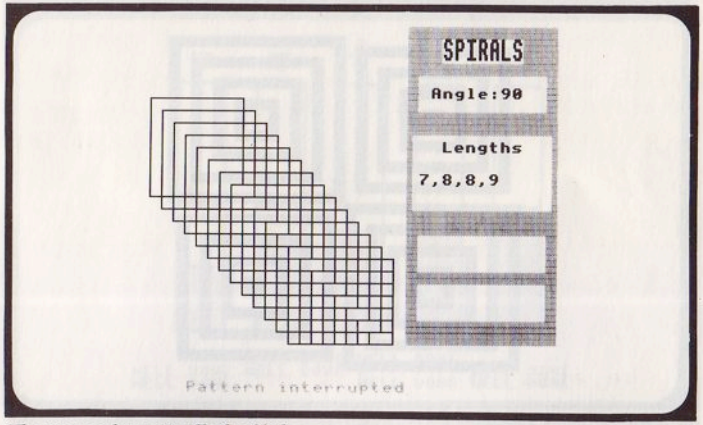
* Which patterns are closed and which ones cycle off to infinity?
* For closed patterns, how many lines are drawn?
* How many revolutions are made?
* For 90 degree patterns with 3 numbers, when is there a square 'hole' at the centre?

The program can be used with benefit in the following ways:

* As an introduction for the whole class, to stimulate work with pencil and paper.
* To test any rules the children might find.
* For a small group of children to investigate further with angles other than 90^{o} and 60^{o}.



Can you see a relation between the numbers of 'Lengths', 'Lines' and 'Cycles' in this pattern? Does this relation hold for other patterns?

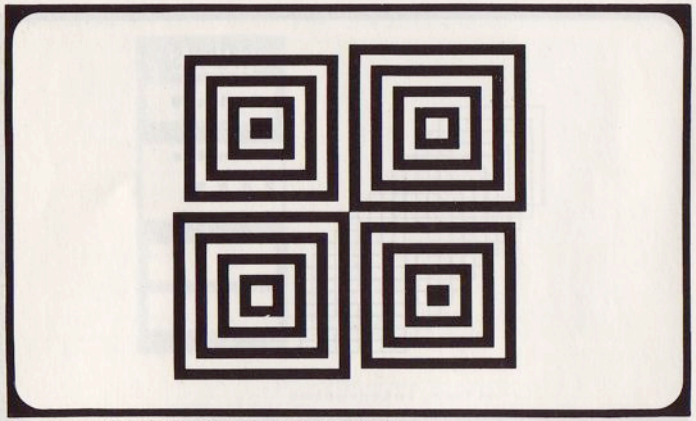


The image has spiralled off the screen.

TAKEHALF

This is an 11 minute film whose main themes are halving, shears and infinity. A square which is half black and half white grows from a dot on a red screen. The black and white shapes change continuously but area is conserved. A chess-board pattern develops. Each square is split into 4 small squares, 2 black and 2 white and the process continues with the squares becoming smaller and smaller. There are many other sequences before the main square finally shrinks back to a dot.

The program is suitable for small groups of children as well as whole classes.



An image from the microfilm Take Half.

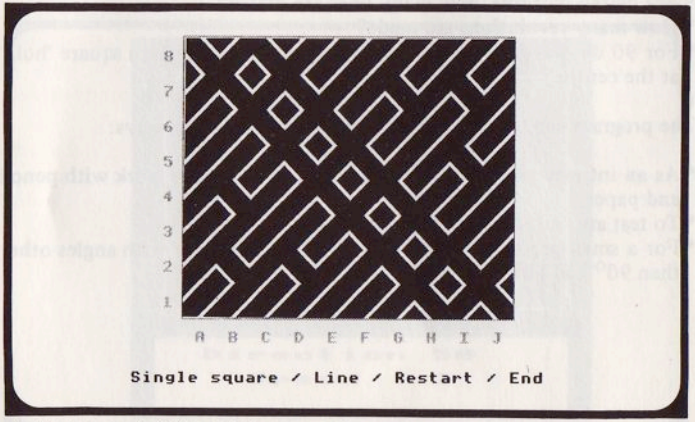
TILES

The 'board' comprises a 10 x 8 array of square tiles. The tiles may be rotated 90^{o} individually or in lines (horizontal, vertical or diagonal) to make interesting patterns.

If the user does not create her own challenge there are some ideas at the start of the program:

There are many different patterns which you could make:

You could ..... fill the screen with squares
..... or rectangles
..... or zig-zag lines
..... or squares within squares
..... or you could try something of your own



A design created from this program.

TOWER

The aim of this program is to build a 'tower' of fractions with each one larger than the previous one. All fractions must be less than 1. The fractions are displayed visually as partially filled rectangles.

In each game there are 5 rectangles. The first fraction is given and so there are four for the user to enter.

If, in any game, the user makes 3 errors or less the next game will have a larger starting fraction. After 5 games the starting fractions are smaller again, but each fraction entered must be less than $\frac{1}{2}$.

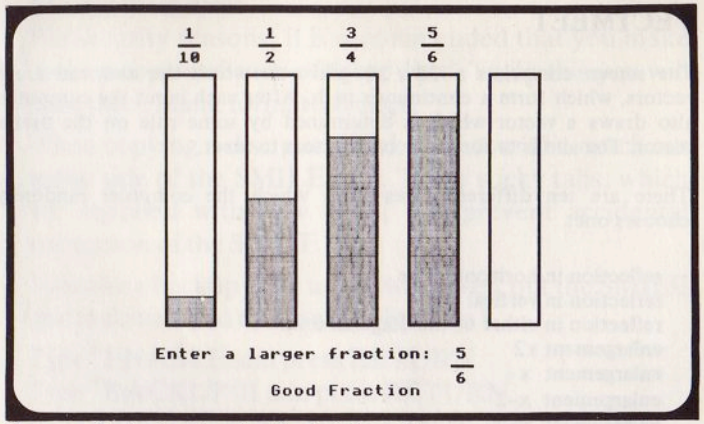
	Starting fraction	Limit
game 1	$\frac{1}{10}$	1
game 2	$\frac{1}{4}$	1
game 3	$\frac{1}{2}$	1
game 4	$\frac{3}{4}$	1
game 5	$\frac{7}{8}$	1
game 6	$\frac{1}{10}$	$\frac{1}{2}$
game 7	$\frac{1}{4}$	$\frac{1}{2}$

The program encourages intuitive ideas about equivalent fractions and children readily form algorithms for finding larger fractions. These algorithms often have to be abandoned in subsequent games. For instance in the first game a child may enter

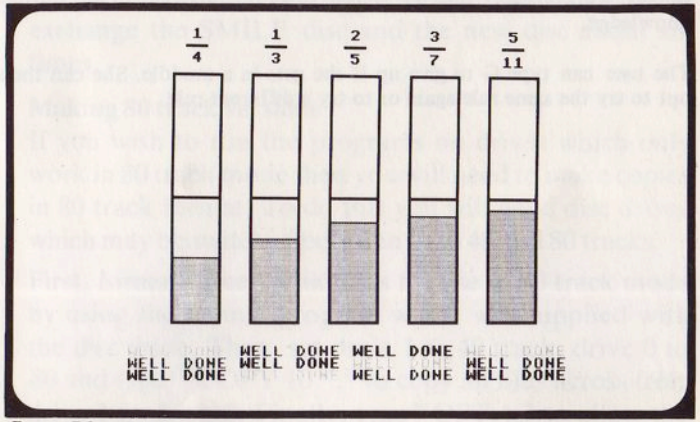
$\frac{1}{10}$. $\frac{1}{9}$. $\frac{1}{8}$. $\frac{1}{7}$. $\frac{1}{6}$

but a similar approach fails in game 2. Another common strategy which breaks down in game 7 is exemplified by the following sequence:

$\frac{3}{4}$ $\frac{4}{5}$. $\frac{5}{6}$. $\frac{6}{7}$. $\frac{7}{8}$



Can you find a fraction for the last tower?



Game 7 has been completed.

VECTMEET

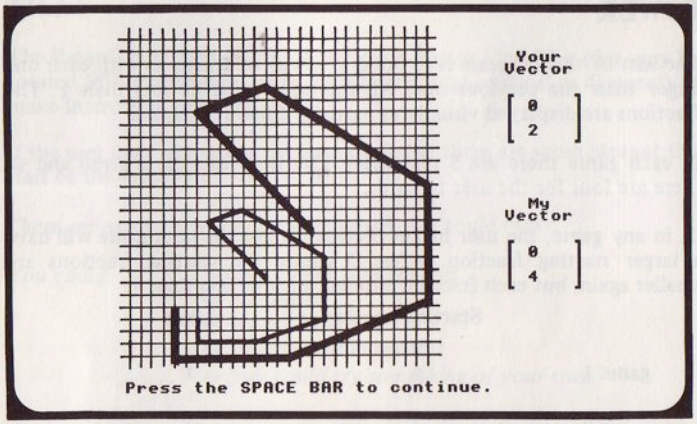
The screen comprises a 28 x 28 grid over which the user can draw vectors, which form a continuous path. After each input the computer also draws a vector which is determined by some rule on the user's vector. The aim is to force the two vectors to meet.

There are ten different rules from which the computer randomly chooses one:

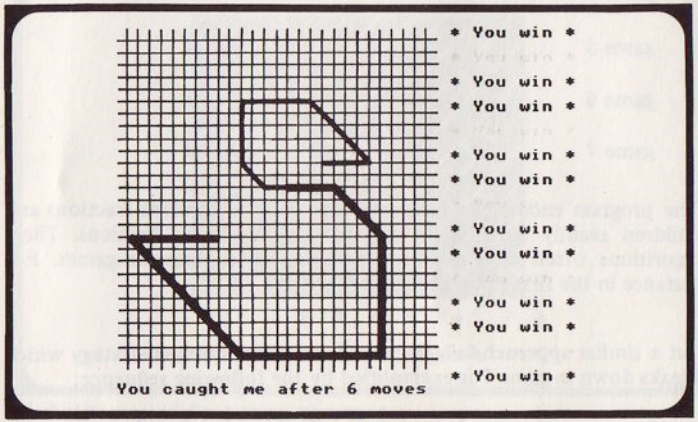
reflection in horizontal line
reflection in vertical line
reflection in either of the diagonal lines
enlargement x2
enlargement x $\frac{1}{2}$
enlargement x–2
enlargement x– $\frac{1}{2}$
90 degree rotation
180 degree rotation

The computer's vector is always printed on the screen but children will usually work visually and so success does not depend on any formal knowledge.

The user can type G to give up if she gets in a muddle. She can then opt to try the same rule again or to try a different rule.



Can you work out the relation between the user's vector & the computer's vector? Where will they finally meet?



The user has forced a meeting after 6 moves.

To copy these discs

For security reasons, it is recommended that you make backup copies of each of these discs. To do this you will need three blank formatted discs.

When copying a disc put a sticky tab over the notch cut in the side of the SMILE disc. These sticky tabs, which are supplied with new discs, will prevent accidental corruption of the SMILE disc.

To make a backup copy using two drives, put the SMILE disc in drive 0 and the new disc in drive 1.

Type*ENABLE and press RETURN
Type*BACKUP 01 and press RETURN

If you have a single drive, put the SMILE disc in it.

Type*ENABLE and press RETURN
Type*BACKUP 00 and press RETURN

Follow the instructions on the screen. You will need to exchange the SMILE disc and the new disc about six times.

Making 80 track versions

If you wish to run the programs on drives which only work in 80 track mode then you will need to make copies in 80 track format. To do this you will need disc drives which may be switched between both 40 and 80 tracks.

First, format three blank discs for use in 80 track mode by using the format program which was supplied with the disc drive. Then, set drive 1 to 40 track, drive 0 to 80 and type *COPY 10*.*to copy all files across from drive 1 to drive 0. Finally, type*OPT 4,3 to allow the disc to be 'auto booted'.

SMILE

SMILE is an ILEA mathematics project which produces learning resources for children of all abilities in the 11-16 age range.

Most of the thousand items currently on the SMILE network have been written by practising teachers and this includes the design of the 30 computer programs. The content of these MICROSMILE programs ranges across the whole spectrum of mathematics and they all aim to encourage children to think mathematically. The programs are designed to be used by children working independently. Many of the activities are most successful when two or three children are working together.

For further information about SMILE contact the SMILE Centre, Middle Row School, Kensal Road, London W10 5DB.

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