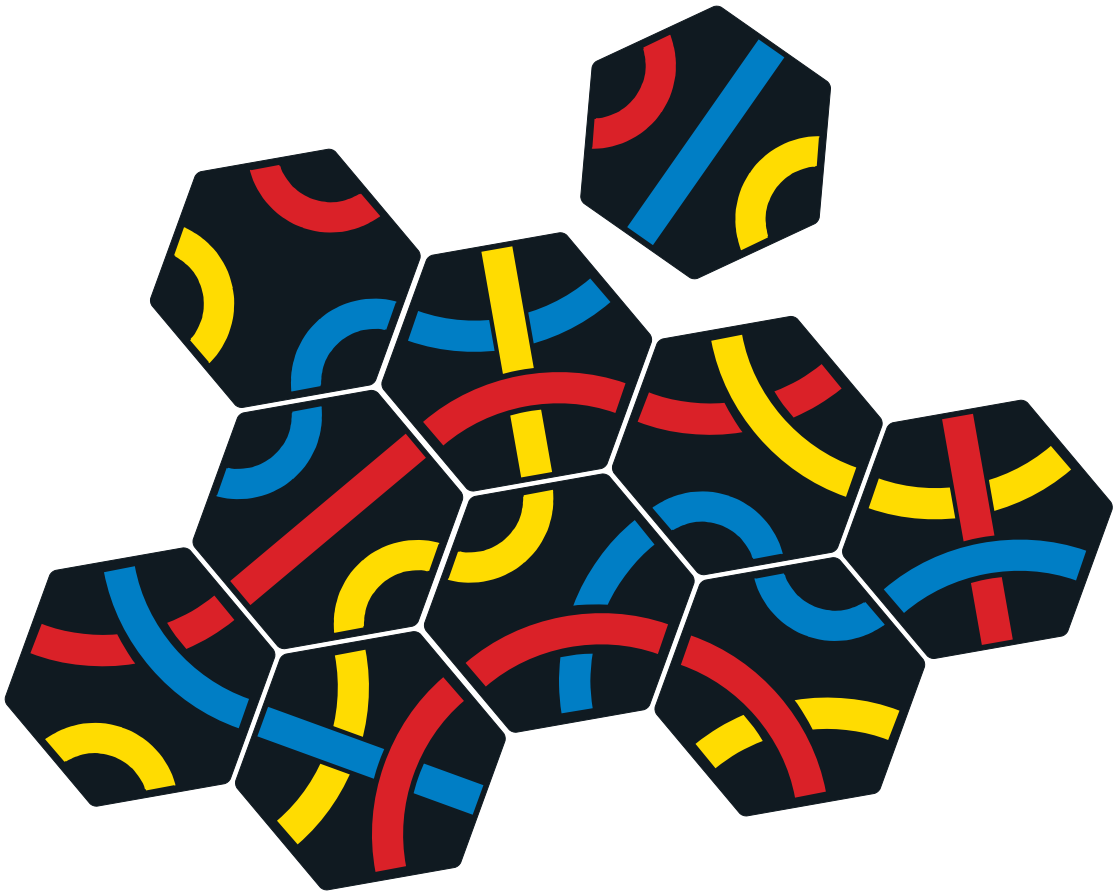
TANTRIX®



Teacher / Parent Guide

for the use of Tantrix tiles with children of all ages

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Full contact details can be found on p. 18.

Contents

Introduction

What is Tantrix?

Tantrix is a collection of activities for 1-4 players using hexagonal tiles each criss-crossed with three lines of different colours.

The Tantrix range in the UK includes the Discovery, Xtreme and Tantrix Match! solitaire puzzle sets, the Tantrix Game Pack for 1-4 players and a couple of travel versions - Magnetic Tantrix and Pocket Tantrix.

Although most Tantrix activites are suitable for children from the age of six, this guide attempts to put Tantrix into a more educational context in line with the goals set out by the National Curriculum.

How to make the best use of this guide

We recommend you use this guide with standard 10-tile Tantrix Discovery sets. Alternatively, you can also use the first ten tiles of a Tantrix Game Pack.

Activities

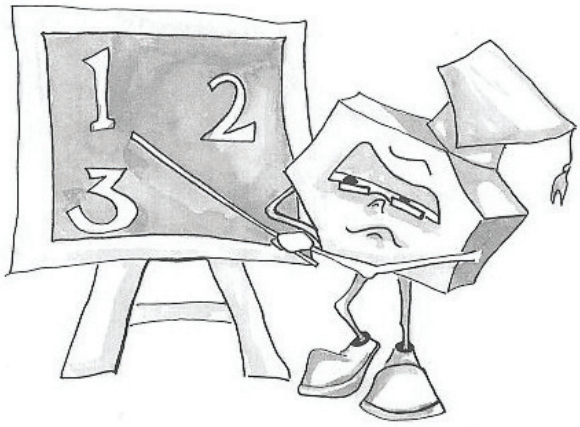
Notes for teachers

The activities in this guide are loosely divided into the main key stages of the National Curriculum. However, activites in an adjacent higher or lower age group may be appropriate for some children.

There is no need to strictly follow the order in which the tasks are set out in this guide - feel free to pick out the tasks you consider most suitable, rearrange them, or even invent your own tasks.

There are example solutions to most of the tasks on pages 12-17.

Before you start, please read the section on How to make the best use of this guide above if you haven't done so already.



Notes for teachers continued

Reception (age 4)

Once presented with the tiles, even very young children will spontaneously turn them all line-side up and try to join them together, usually instinctively trying to match the colours. However, children will soon reach a stage where they need help to develop their initial ideas further.

The tasks in this section try to connect the way children intuitively play with the tiles to the goals set out by the National Curriculum, such as using the numbers up to 20, using words like 'more' or 'less', as well as talking about, recognising and recreating simple patterns.

Key stage 1 (ages 5-7)

The tasks in this section build on what was learned in Reception and some of the activities from Reception may still be appropriate. New to this stage is the introduction of symmetry and the ability to tessellate large numbers of tiles.

Key stage 2 (ages 7-11)

At this stage we continue to build on the concept of symmetry as well as introducing some basic principles of geometry such as the properties of a Tantrix tile and measuring the angles of sectors in a circle.

Key stage 3 and above (ages 11 and above)

At this stage the children will be able to complete most of the more difficult activities contained in a standard Tantrix Game Pack (see p. 11). This guide looks in more detail at the properties of hexagons, loops and circles.

Reception

REC-1) Line building

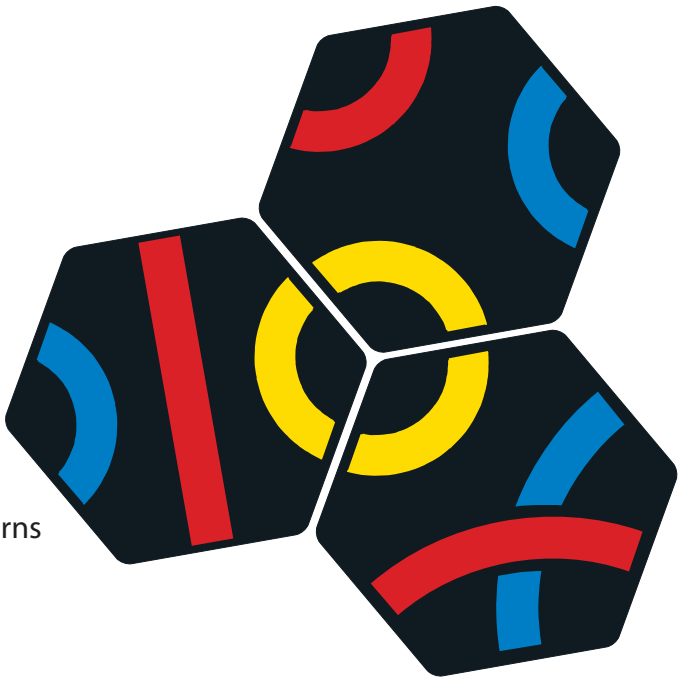
a) Pick up a handful of tiles and join them together to form a path in one colour.

b) How many tiles does your path run through?

c) Find a friend whose path has the same colour. How many tiles does your friend's path run through? Whose path is longer?

d) See if you can join your paths together. How long is the new path? Maybe you can make a really long line if you join up with several friends.

REC-2) Sorting tiles



Look at a set of 10 tiles.

a) The lines on the tiles are arranged in four different patterns. Find them.

b) How many tiles of each type are there?

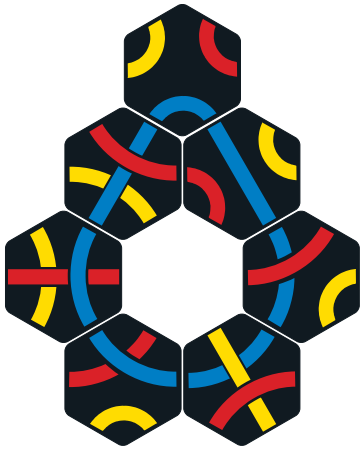
c) Ask your teacher or a friend to describe a tile and see if you can find it among your tiles.

d) Working in groups, give the different patterns names.

REC-3) Simple shapes

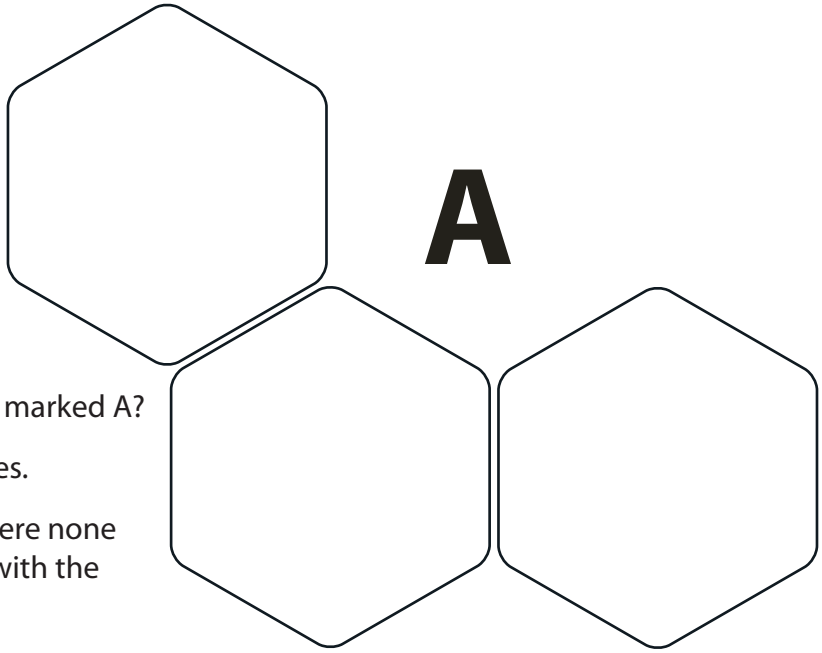
a) Make a small circle in one colour like the one shown above. How many circles can you make with a set of 10 tiles?

b) Try to recreate and name some of the shapes below.



Key stage 1

KS 1-1) Tiling



a) Put any three tiles together in the shape shown on the right so that *all touching links match in colour.*

b) Can you find a tile to fit the space marked A?

c) Try again with a different set of tiles.

d) Is it possible to find three tiles where none of the remaining tiles will fit at A with the colours matching?

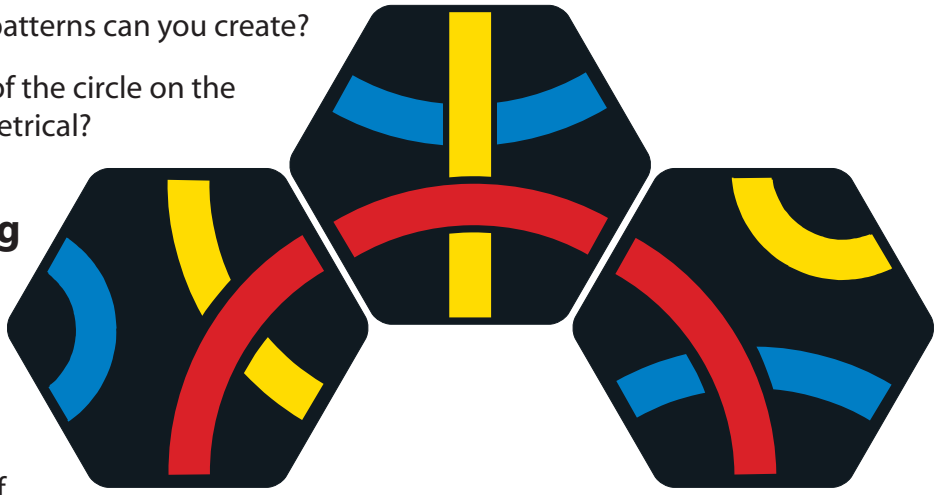
KS 1-2) Symmetry

a) Recreate the pattern on the left. Is the line which runs through all of the tiles symmetrical?

b) Is it possible to remove a tile and end up with the line being symmetrical?

c) What other symmetrical patterns can you create?

d) Complete the other half of the circle on the right. Are all circles symmetrical?



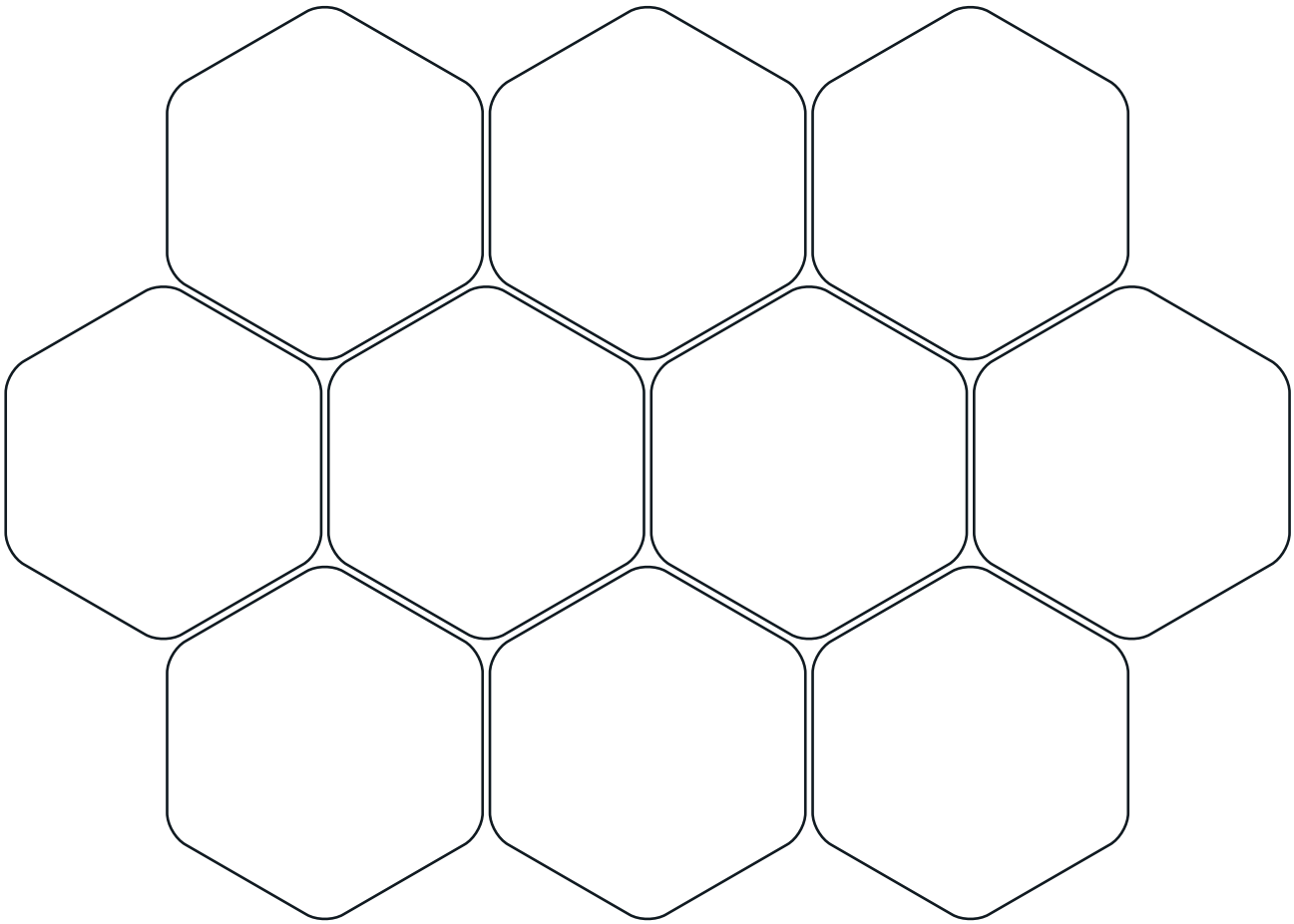
KS 1-3) Line building

a) Take all 10 tiles and put them together in the shape shown on page 6.

b) Arrange the tiles so all touching colours match. If necessary, swap two or more tiles.

c) Count how many tiles the longest line of each colour runs through. Which one is the longest overall?

d) Can you make your longest line even longer by taking a tile away from one place in your layout and adding it to your longest line? (There is no need to stick to the original layout for this.) What happens to the other lines if you do that?



KS 1-4) Tantrix Discovery

Tantrix Discovery covers everything learned so far - tiling, line building and symmetry. Note that not all loops (ie. lines that form a closed circuit) are perfect circles. Try the puzzles below. After each one, discuss whether the loop is a circle and whether it is symmetrical.
NB: Make sure that all links that touch match in colour.

a) Take tiles 1, 2 and 3 and make a yellow loop. Discuss.

b) Break up the first three tiles, add tile 4 and make a new loop with all four tiles. The colour of the number on the tile just added tells you what colour loop to make, so the 4-tile loop is red.

c) Continue as above with five (red) and then six tiles (blue).

d) For a really tough challenge try the puzzle with seven tiles. Remember that a loop can be any closed shape.

Key stage 2

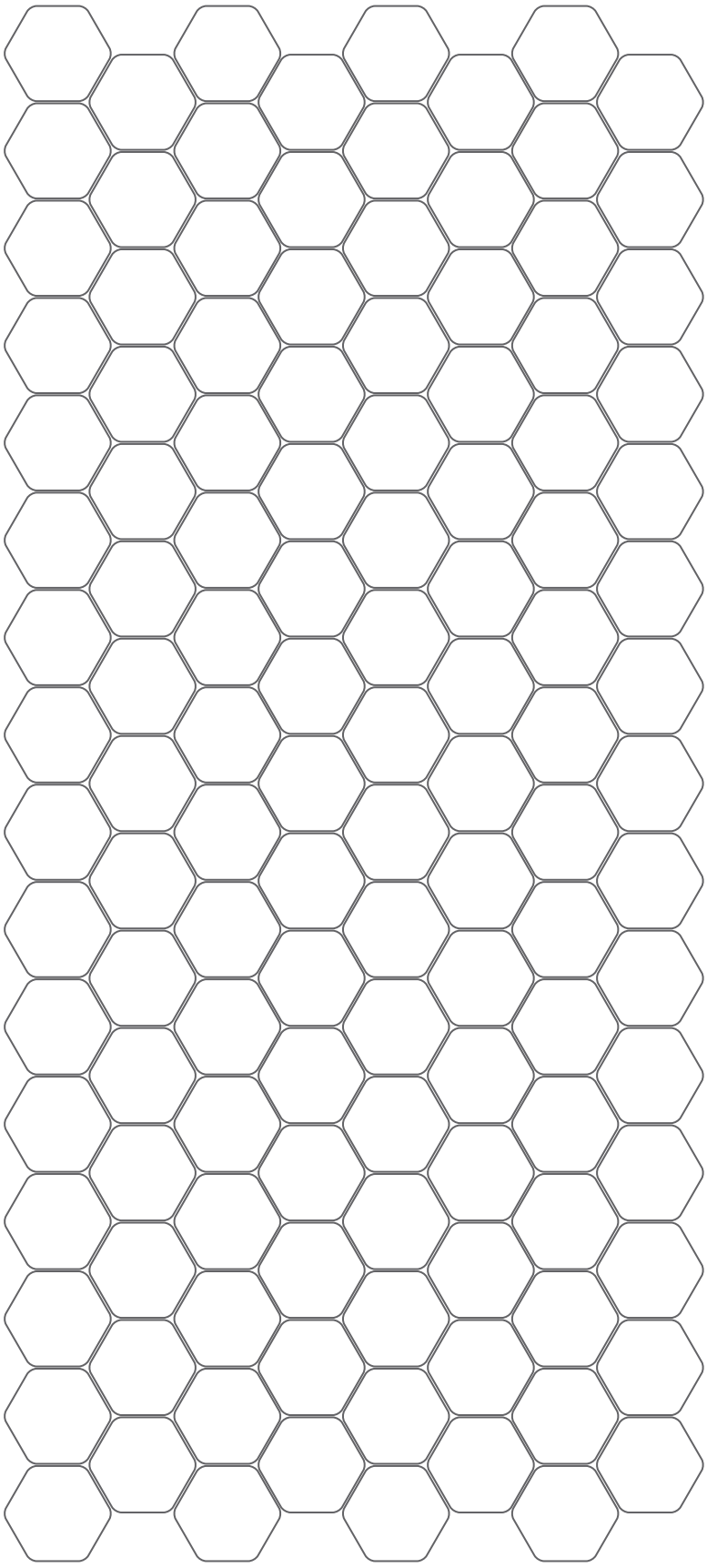
KS2-1) Tantrix Discovery continued

Following on from the Discovery puzzles under key stage 1, continue to make loops with seven (red) and eight tiles (blue).

a) Draw your solution to the eight-tile puzzle. You can use the grid on the right to help you with this.

b) There are four different solutions to the eight-tile puzzle. Find as many as you can and draw each one.

c) Which of the solutions are symmetrical and which ones are not?



KS 2-2) Tantrix tiles

a) What is the mathematical name for the shape of a Tantrix tile?

b) How many lines of symmetry does this shape have?

c) As you know, Tantrix tiles can be tiled (or tessellated) perfectly. Are there any other shapes that fit together without any gaps?

d) What would it be like to play with those other shapes?

KS 2-3) Angles

a) Build a perfect circle using six tiles.

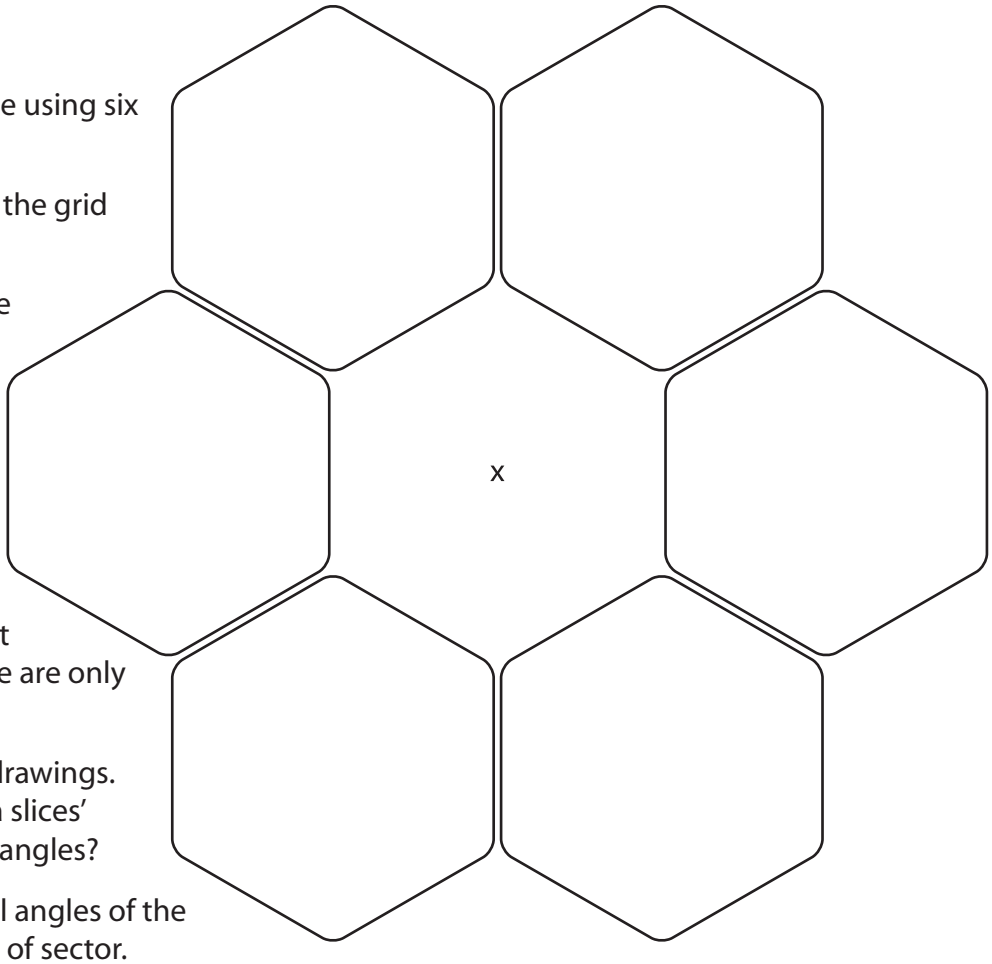
b) Draw your circle in the grid on the right.

c) The six tiles split the circle into six sectors. Draw these sectors on your drawing like slices of a pizza.

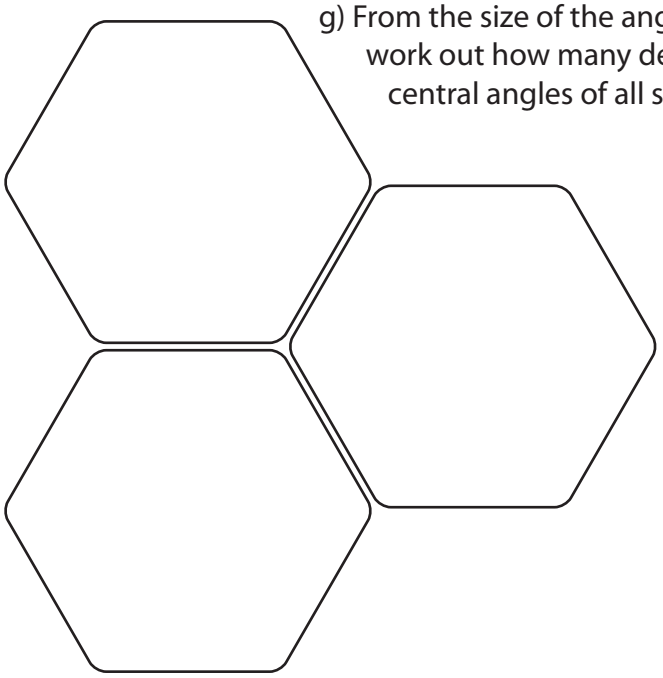
d) Do the same with a three-tile circle (below), except that now of course there are only three sectors.

e) Compare the two drawings. Which circle's 'pizza slices' have wider central angles?

f) Measure the central angles of the two different types of sector.

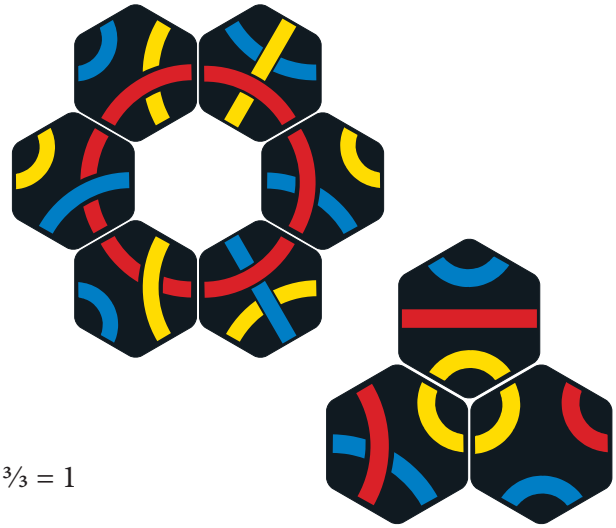


g) From the size of the angles and the number of sectors in the circles, work out how many degrees each circle has. Are the sums of the central angles of all sectors in any circle the same?



Key stage 3 and above

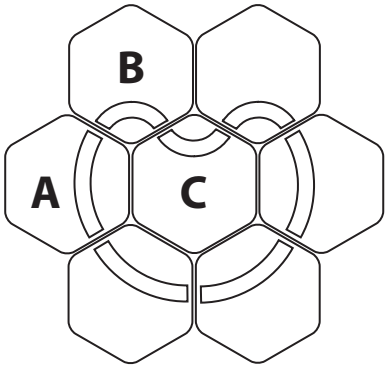
KS 3-1) Simple loop theory



A circle made up of shallow bends contains six Tantrix tiles. One bend therefore makes up ⅙ of a circle. Similarly, a narrow curve is ⅓ of a circle. The straight does not contribute to a circle - its value is 0.

Solve the Discovery puzzles with 3, 4, 5 and 6 tiles (see KS1-4). For each puzzle count the number of straights, bends and narrow curves that form part of the loop. Show how adding up their values will always give you a total of 1. For example, the 3-tile loop contains ⅓ + ⅓ + ⅓ = ⅗ = 1

KS 3-2) Complex loop theory



The curves and bends used for the Discovery puzzles up to six tiles all curve inwards as at A and B on the left. They are *supporting links*. The narrow curve played at C is a *non-supporting link*, ie. the link on the tile faces outwards.

a) In the solution to the 7-tile Discovery puzzle, count the number of straights, bends and narrow curves that form part of the loop. What do you need to do in order to arrive at a total of no more than 1 for all parts of the loop combined?

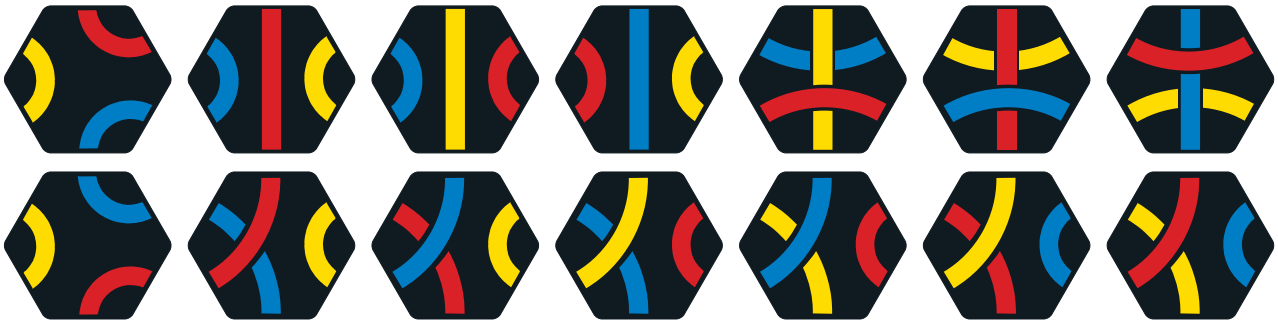
b) Write a general rule which can be applied to the total sum of all bends and curves that form part of any loop, if this total is greater than 1.

c) Imagine you are asked to create a yellow loop using the tiles below. Using the rule you wrote under b) above, work out whether this is possible or not.

d) In what way can loop theory help you predict the shape of a Tantrix loop? Test your theory by first predicting and then solving the 10-tile Discovery puzzle in red.

KS 3-3) Tantrix tiles

The Tantrix Game Pack uses the colours red, blue, green and yellow. It contains four sets of 14 tiles with three colours on each set. This is the set with no green lines:



a) One possible pattern with each of the three line colours ending on two edges of the tile is missing. Which one is it and how many different tiles with that pattern could you add to the set to complete it?

b) Why do you think the additional tiles have been left out of the game?

Other Activites

Older students can try to solve the advanced puzzles which are contained in the Tantrix Game Pack, which includes 40 puzzles of many types and varying difficulty, from the basic Tantrix Discovery puzzles covered in this guide right up to two near-impossible puzzles.

Tantrix Strategy

Depending on the age of your students, you may like to introduce them to the Tantrix strategy game included in the Tantrix Game Pack. We have found that from the age of eight, children are quite capable of playing and enjoying the game. In fact, some of the best players in the world are children.

At the time of writing, the youngest ever tournament player was seven years old (the oldest was 74). The youngest World Junior Champion was just 9 years old and the youngest ever winner of an adult tournament was a 12-year old from Australia.

Tantrix online

If you have a PC with Internet access then you can meet, chat with and play against other players from around the world by connecting to www.tantrix.co.uk. This opens up all sorts of possibilites such as interschool competitions - maybe even against schools on the other side of the world!

Background

Tantrix was invented by Mike McManaway of New Zealand in 1991. Since then, it has won major awards around the world.

In 1994, Tantrix underwent a detailed testing programme using groups of school children in France. The study found Tantrix a useful, versatile and fun tool for the development of logic and reasoning, visual discrimination and observation skills.

In 1996, Tantrix won the National Parenting Association Award in the USA and in 2003 it won the gold award in the UK Good Toy Guide, another publication using rigorous play-testing by adults and children to determine its award winners.

Example solutions

Reception (age 4)

REC-1) Line Building

There are no right or wrong answers to this task. It is simply designed to let the pupils learn to add up, join colours and create patterns while having lots of fun.

REC-2) Sorting tiles

a & b) In a set of 10 Tantrix Discovery tiles, there are:

- 4 tiles with 1 narrow curve and 2 bends 
- 1 tile with 3 narrow curves 
- 2 tiles with 2 narrow curves and 1 straight line 
- 3 tiles with 1 straight line and 2 bends 

c) Obviously, there are no limits to the children's imagination in this task. We have, for example, had several reports of children calling the tile on the right 'angry face'. Do let us know of any other original names your students come up with!

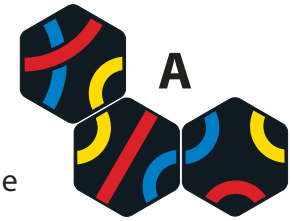
REC-3) Simple shapes

a) As there are only two red narrow curves, you cannot make any small red circles. You can make one yellow circle and one blue circle.

b) Possible names are 'circle' or 'wheel', 'waves' and 'raindrop'. The children are free to invent their own names.

Key stage 1 (ages 5-7)

KS 1-1) Tiling



b) The best way to find a tile that fits a space like 'A' is to 'read' the coloured links ending in the space in a clockwise direction. The space on the right, for example, is a blue-red-yellow space. Then read the coloured links around the edges of the remaining tiles in the same way.

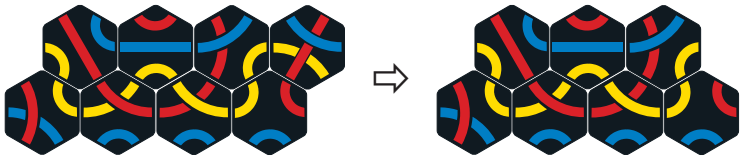
NB: Empty spaces which are surrounded by three tiles such as 'A' above are known as 'forced spaces' in the Tantrix game. Identifying the tiles that can fit a forced space and hence being able to put together large numbers of tiles is a key skill in most Tantrix activities.

d) If the coloured links ending in space A are all the same colour, it is not possible to fill the space, as a link in any colour can only ever end on two sides of a Tantrix tile.

KS 1-2) Symmetry

a) No, it is not symmetrical.

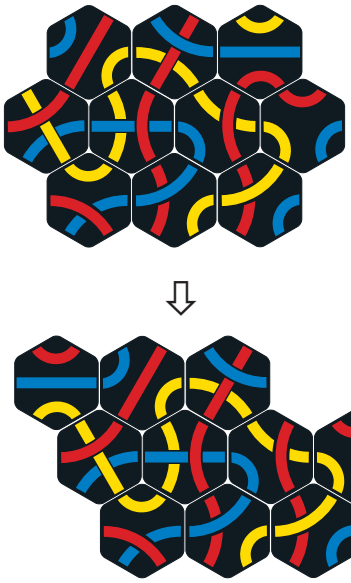
b) Yes, if you remove the tile on the top right as shown.



c) For inspiration, please see the patterns on p.4. There are plenty of other patterns too.

d) All circles are symmetrical.

KS 1-3) Line building

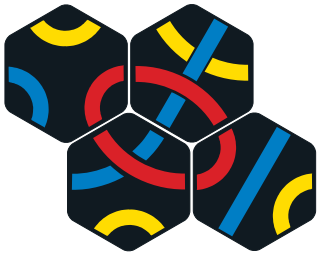


a-c) Again, there are no right or wrong answers. In the example on the left, the longest red line runs through 4, blue through 5 and the longest yellow line through 9 tiles.

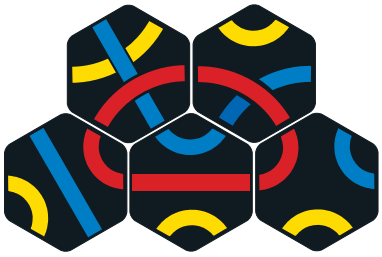
d) Adding the separate yellow link to the end of the yellow line will reduce the longest red line to 2, thereby making the red line which runs through three tiles in the middle the longest red line.

KS 1-4) Tantrix Discovery

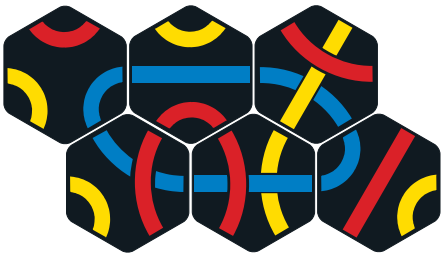
circle: yes
symmetrical: yes



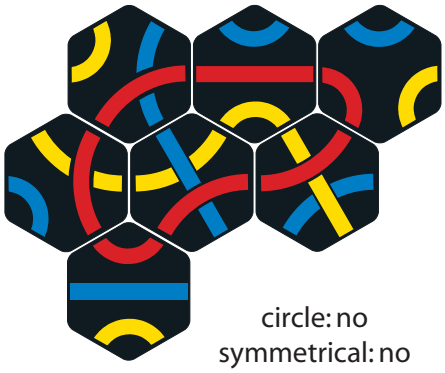
circle: no
symmetrical: yes
(2 lines of symmetry)



circle: no
symmetrical: yes
(1 line of symmetry)

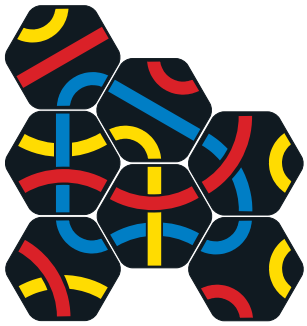


circle: no
symmetrical: yes,
but only rotational, ie.
no lines of symmetry



circle: no
symmetrical: no

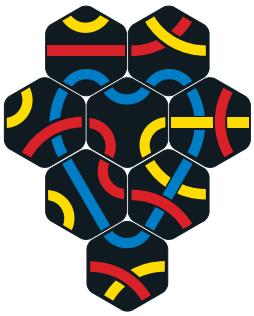
NB: If you are using the tiles from a Tantrix Game Pack (instead of Discovery tiles), please note that number 7 is blue. In fact, the 7-tile loop can be solved both in red and in blue. The blue solution is pictured below:



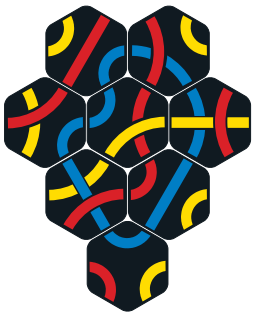
Key stage 2 (ages 7-11)

KS 2-1) Tantrix Discovery

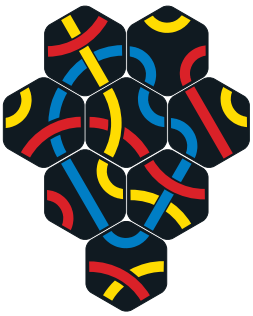
a-c) The different solutions to the 8-tile puzzle are:



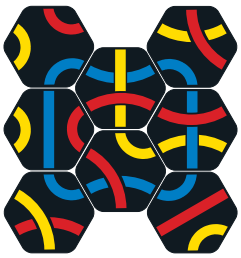
symmetrical (1 line of symmetry)



not symmetrical



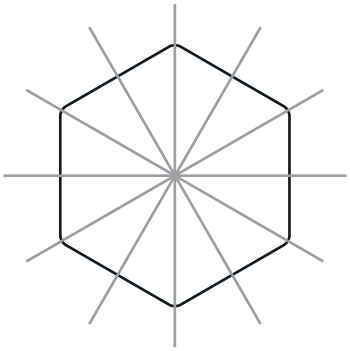
not symmetrical



symmetrical (2 lines of symmetry)

The two loops in the middle are not symmetrical. They are, however, mirror images of each other.

KS2-2) Tantrix tiles



a) Hexagon

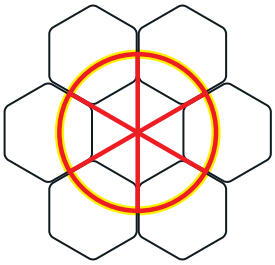
b) Six (see right). The number of lines of symmetry in a regular polygon is equal to the number of its sides.

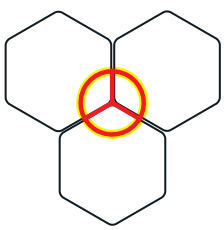
c) Rectangles and triangles also tessellate perfectly.

d) For the coloured links to end on two different sides, the shape must have an equal number of sides, else one side would be unused. Hence, triangles are not suitable. Squares would have only two lines per tile instead of three and only two different types of tiles.

KS 2-3) Angles

b-d)





e-f) With 120˚, the sectors in the smaller circle are wider than the 60˚ sectors in the larger circle.

g) The larger circle has 6 x 60˚ = 360˚
The smaller circle has 3 x 120˚ = 360˚
The central angles of all sectors in any circle add up to 360˚

Key stage 3 and above (ages 11 and above)

KS 3-1) Simple loop theory

3 tiles: $3 \times \frac{1}{3} = \frac{3}{3} = 1$

4 tiles: $2 \times \frac{1}{6} + 2 \times \frac{1}{3} = \frac{2}{6} + \frac{2}{3} = \frac{2}{6} + \frac{4}{6} = \frac{6}{6} = 1$

5 tiles: $2 \times \frac{1}{6} + 2 \times \frac{1}{3} + 0 = \frac{2}{6} + \frac{4}{6} = \frac{6}{6} = 1$

6 tiles: $2 \times \frac{1}{6} + 2 \times \frac{1}{3} + 2 \times 0 = \frac{2}{6} + \frac{4}{6} = \frac{6}{6} = 1$

KS 3-2) Complex loop theory

a) The red 7-tile loop consists of: $2 \times \frac{1}{3} + 4 \times \frac{1}{6} + 0 = 1\frac{1}{3}$
In order to achieve the sum of 1, the angle of the non-supporting link must not be added to but subtracted from the total: $2 \times \frac{1}{3} + 3 \times \frac{1}{6} + 0 - \frac{1}{6} = 1$

NB: If you are using the tiles from a Tantrix Game Pack (instead of Discovery tiles), number 7 is blue and a slightly different shape. Therefore, the calculation differs too: $3 \times \frac{1}{3} + \frac{1}{6} + 0 - \frac{1}{6} = 1$

b) If you simply added up the values of all parts of a loop, this would suggest that all of them are supporting links. If the total is greater than 1, however, it is impossible for all links to be supporting. As we saw under a) the extra amount must be halved to arrive at the total value that makes up the non-supporting link(s):

$$\text{total of all non-supporting link(s)} = \frac{(\text{overall total} - 1)}{2}$$

(If you wonder why you cannot simply subtract the total over 1, remember that tiles cannot just be removed. Instead, each non-supporting link cancels out a supporting link of the same value.)

c) The tiles include 2 narrow curves (⅓ each), 3 bends (⅙ each) and 1 straight (0).
⇨ ⅔ + ⅜ + 0 = ⁴⁄₆ + ⅜ = ⁷⁄₆ = 1⅙ This means that a tile with a value of ¹⁄₁₂ (half of ⅙) would need to face outwards. As such a tile does not exist, tile sets with an uneven number of bends cannot be made into loops. (If a set of tiles is one curve over 1 on the other hand, the tile that needs to face outwards must have a value of ⅙, ie. it must be a bend.)

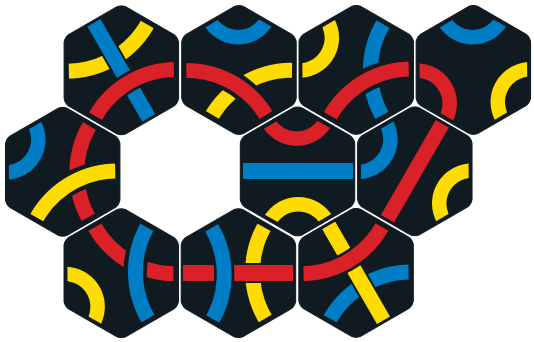
d) See b) above for the formula to calculate the total value of all curves and bends in the loop that must face outwards.

The red no 10 Discovery puzzle consists of 2 curves, 6 bends and 2 straights, ie.
2 x ⅓ + 6 x ⅙ + 2 x 0 = ⅔ + ⁶⁄₆ = 1⅔

Applying the formula under b) means: $x = \frac{(1⅔ - 1)}{2} = \frac{⅔}{2} = ⅙$

⇨ Either two bends (2 x ⅙) or one curve (⅓) must face outwards.

In fact, both solutions are possible, though solutions without a hole in the middle are generally preferred in Tantrix.



One curve facing outwards

Two bends facing outwards

NB: The 10-tile Discovery puzzle can also be solved in blue and yellow.

KS 3-3) Tantrix tiles

a) The two tiles called 'triple intersection' are missing:

b) All other tiles each fit six types of 3-sided space. The triple intersections only fit three types of 3-sided space each, as the sequence of colours around the edge of the tiles repeats itself (e.g. yrb, rby, byr, then again yrb, rby, byr for the tile on the left). Therefore, the triple intersections (which were included in early versions of Tantrix) tended to stay in players' hands longer than the other tiles and considerably handicapped the players who were unlucky enough to pick them up.

Final note

You will no doubt discover many other ways to use Tantrix in your teaching environment. Please send us your ideas - we may include them in future revisions of this activity guide.

Please feel free to contact Tantrix UK Ltd if you have any queries or comments:

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This guide can be downloaded for free from the Tantrix website at:
ww.tantrix.co.uk/download.html

If you lose a tile, please go to www.tantrix.co.uk/replacement.html for a replacement.

What others say

"Tantrix not only helps the player develop strategic thinking, but also spatial ability, non-verbal problem solving, planning ability, and memory skills... Simple enough to learn, yet with the possibility to be infinitely complex!"

Linda Palmer, Department of Behavioural Sciences,
Louisiana University, USA

"A good progression of difficulty levels means this game will be loved by adults and can be introduced to children as young as 6. The series of games are great for teaching children problem solving and logic skills [...], concentration and observation, hand-eye coordination and small movements, creativity and imagination."

The Good Toy Guide, UK