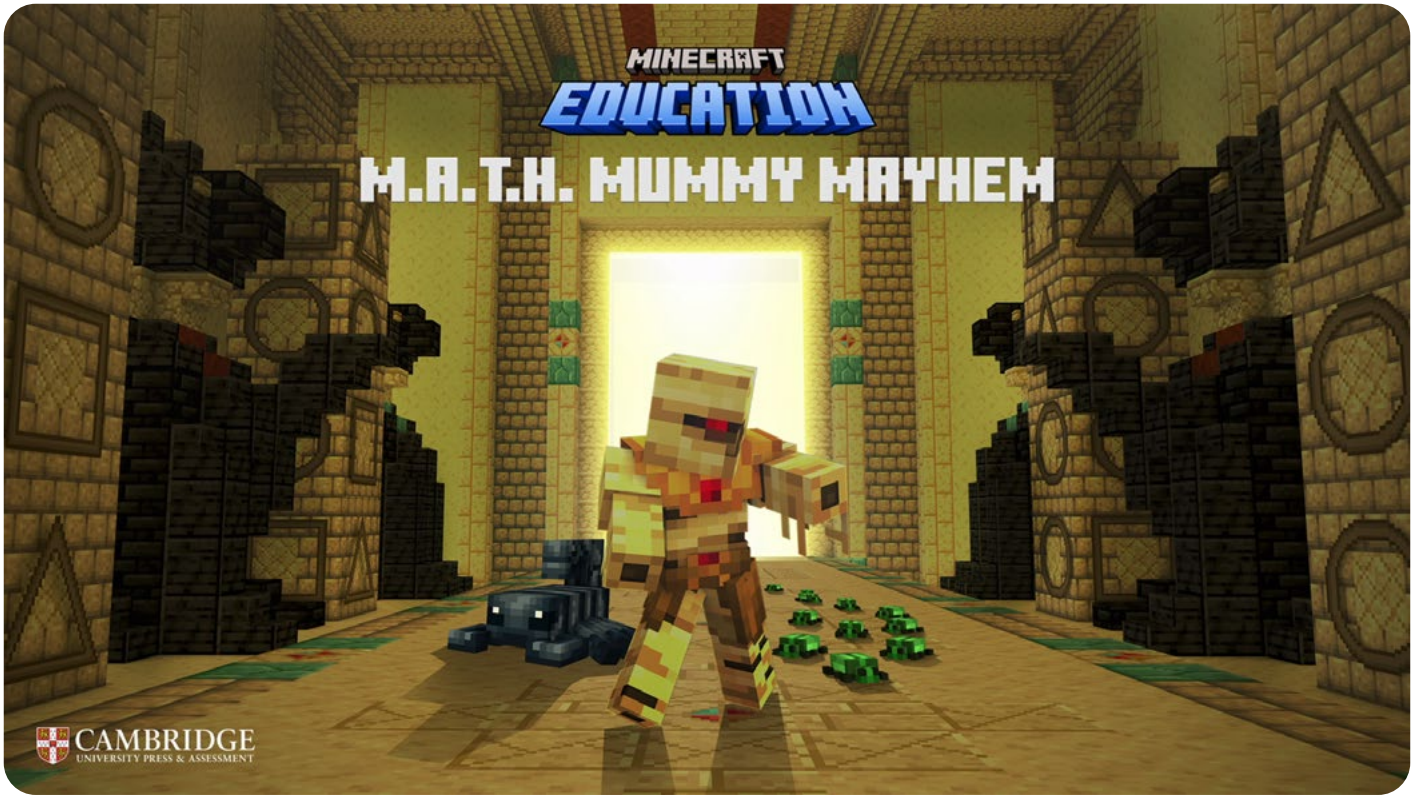


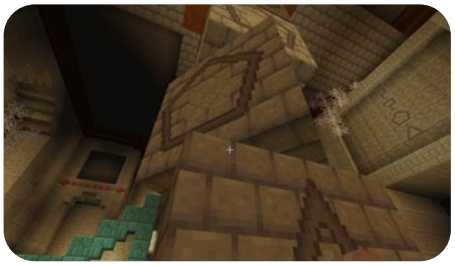
Teacher support materials

Concept focus: Spatial reasoning

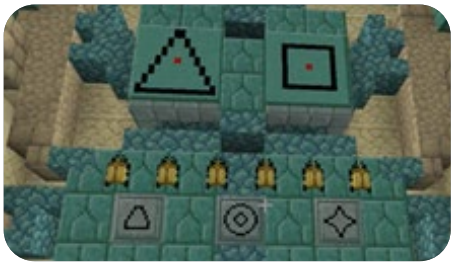
CAMBRIDGE Mathematics

Children's spatial reasoning evolves from their lived experiences of building, moving and imagining moving themselves and shapes (both 2D and 3D), as well as considering the relationships between these objects in space. So from their earliest experiences, learners need to be encouraged to explore where bodies are in relation to each other, supported to use language to describe this and given the opportunity to develop their spatial reasoning and mental manipulation skills.

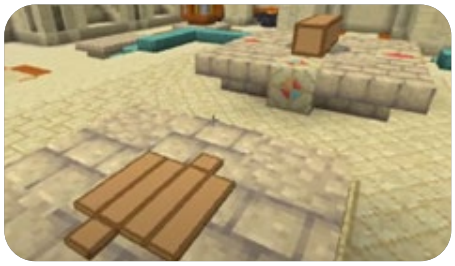
Some of the M.A.T.H. Mummy Mayhem game content which is linked to the concept of spatial reasoning can be found in parts of the game illustrated below.



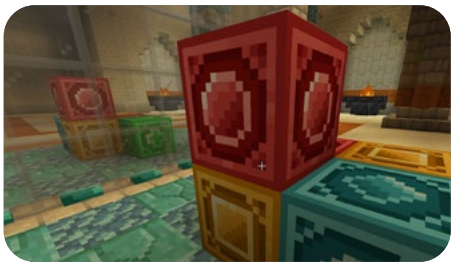
Puzzle 3 – Cryptex



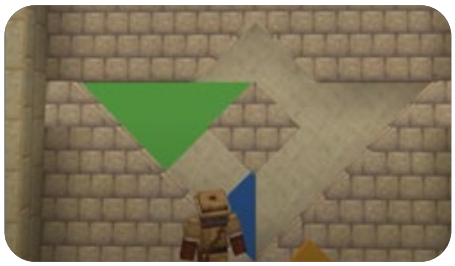
Puzzle 4 – Overlapping shapes



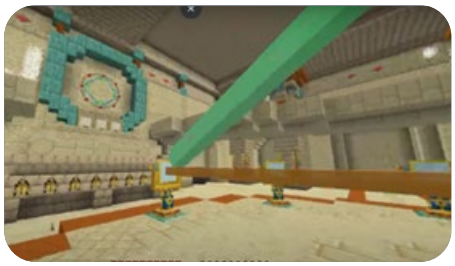
Puzzle 7 – Nets and 3D shapes



Puzzle 8 – Reflecting build

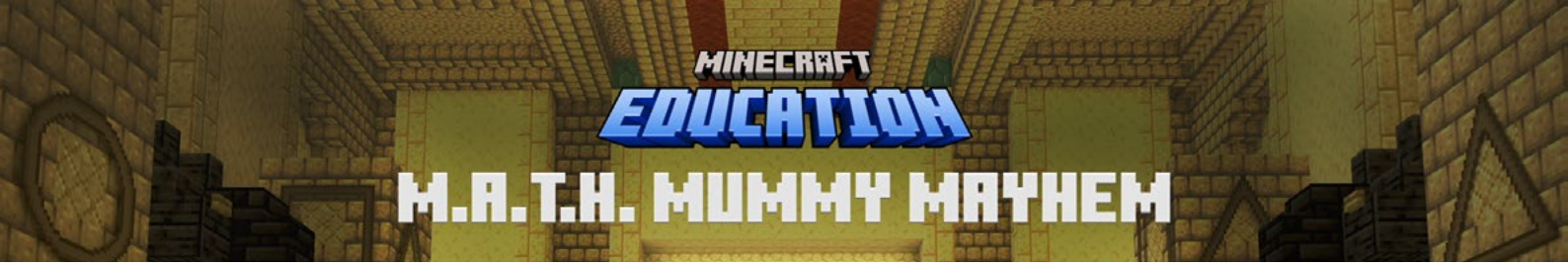


Puzzle 9 – Tangram



Puzzle 10 – Quadrilaterals

These parts of the game form the basis for the following ideas and jumping-off points, which you are invited to adopt and/or adapt according to your context.



After/before/in between playing M.A.T.H. Mummy Mayhem, you might like to:

- Display the illustrations of the game shown above and ask students to write down as many words describing the mathematical challenge as possible.
- Share examples of these with the class (e.g., using post-it notes or a visualiser, etc.) and invite students to talk about the words with a partner. Pairs can then share their explorations as part of a class discussion. Conversations might arise about specific mathematical vocabulary and other more generic words. These categories should be recorded, and time allowed to consider connections and for consolidation of understanding.
- Encourage students to pick three mathematical words to describe and three more that they are unsure about (either they don't know them or would find it challenging to explain them).
- Set up 'musical chairs' (half the class remain seated, and the other half move around to find someone new to talk to) in order to try out their explanations on someone else (e.g., can their partner guess the word if only told what it means?) and to talk about the meanings of the words that they are less sure about. Play for multiple rounds.
- Take feedback about what was learned from their exchanges. Particular words might arise as being challenging to explain, as might feelings about why it is important to try and be as clear as possible, and how helpful the right word is in order to communicate what you notice/think/wonder.

The vocabulary generated by your students will be wide-ranging (particularly given the range of ages who might play the game), but some examples are given in the table below of words that students might generate having considered these puzzles (this is not an exhaustive list nor intended as a checklist).

Example spatial reasoning vocabulary

2D shape | intersection | parallelogram | reflection | symmetry | 3D shape | kite

pattern | reversed | tangram | border | line of symmetry | pentagon | right angle

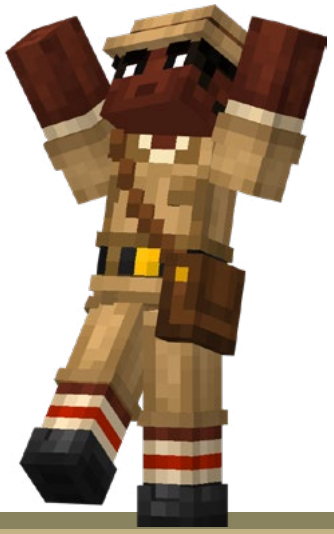
trapezium | circle | mirror line | pentagonal prism | right-angled isosceles triangle

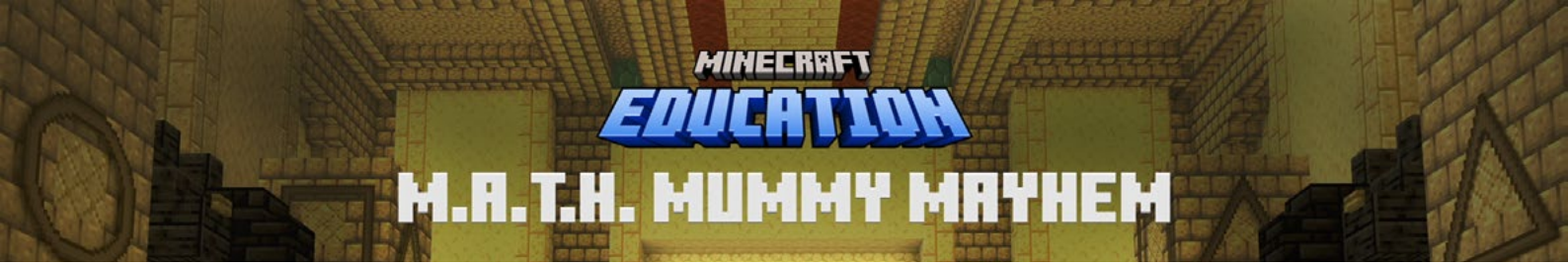
triangle | cube | net | perimeter | rotation | cuboid | opposite | perspective

shape | unfolding | equidistant | orientation | position | square

unknown | folding | overlap | quadrilateral | symbol | imagine

hexagon | overlay | rectangle | symmetrical





To provide an opportunity to explore students' understanding further and uncover misconceptions within the concept of spatial reasoning, you could share the following statements and ask students to think about whether the statements are always true, sometimes true or never true.

1. The shadow of a 3D shape must be the same shape as one of its faces.
2. A 2D shape folded in half is the same shape as the original.
3. A cube can fit through a circular hole.
4. The best shape for a box to hold oranges is a cuboid.
5. The perimeters of two shapes each made from the same number of square tiles will be equal.
6. Triangles tessellate.

Allow time for:

- developing reasoning
- asking questions to test ideas and to think about different interpretations
- generating examples and non-examples to support/disprove conjectures

When they have thought about where they want to place each statement, and just as importantly why, students could compare, explain and justify their findings to others.

Students might be interested in rewriting the "never true" ones, to make them true and/or creating statements about this topic for other students to think about.

Acknowledgements

Cambridge Mathematics thanks the Blockception and Minecraft Edu teams for their expertise in co-designing the Minecraft Education learning activities and for their creative development of the game world.

Credits

Pedagogical design lead: Frances Watson
Graphic design: Ray Knight
Editing and proofreading: Lynn Fortin