

Spatial Reasoning

IN EARLY CHILDHOOD

Stages of development
trajectory



EARLY  CHILDHOOD
MATHS GROUP

<https://doi.org/10.31234/osf.io/jnwpu>

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TRAJECTORY OF EARLY LEARNING EXPERIENCES TO DEVELOP SPATIAL REASONING



The ECMG spatial reasoning trajectory provides a developmental progression (first column), how adults might sensitively support children in this phase of spatial reasoning development (second column) and how the environment might support spatial reasoning development (third column).

The trajectory is organised into approximate developmental stages but individual children may well develop spatial reasoning in an order or way that differs from the typical pathway. Statements are colour coded as broadly relating to spatial relations (**in blue text**) or spatial features of objects and images ('shape', **in black text**) to make the document easier to work with. In reality, these overlap as well as including other areas of mathematics such as measures and pattern.

doi.org/10.17605/OSF.IO/BX87U

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Stage 1	Children are learning to...	Adults might...	The environment might include...
	<p>Explore space when they are free to move, roll and stretch.</p> <p>Develop an awareness of their own bodies, that their body has different parts and where these are in relation to each other.</p> <p>Show an interest in emptying containers.</p> <p>Explore differently shaped objects and their properties through seeing and feeling/mouthing.</p> <p>Respond to size, reacting to very big or very small items that they see or try to pick up.</p>	<p>Support babies' developing awareness of their own bodies e.g. through baby massage and singing songs like <i>This Little Piggy Went to Market</i>.</p> <p>During floor play sometimes place objects that are just in or just out of reach, including small objects on cloths that babies can pull towards themselves.</p> <p>During water play and bathing routines, show filling and emptying different shapes and sizes of container.</p> <p>Encourage babies' explorations of the characteristics of objects, e.g. by rolling a ball to them.</p>	<p>Opportunities for babies to move freely in space (e.g. on carpets, grass etc.) being on the floor without objects and being free to play with their hands and feet.</p> <p>Sensitive support for babies' play and give them long stretches of uninterrupted time to explore.</p> <p>Interestingly shaped objects e.g. vegetables, spoons, corks, pinecones, balls.</p> <p>A range of objects of various lengths and weights in treasure baskets to excite and encourage babies' interests including larger and smaller items, e.g. a larger and a smaller soft toy.</p>

Stage 2	Children are learning to...	Adults might...	The environment might include...
	<p>Engage with positions and directions, using gestures and concepts like ‘<i>in</i>’, ‘<i>on</i>’, ‘<i>under</i>’, ‘<i>up</i>’, ‘<i>down</i>’ sometimes moving objects or pointing to where they would like to go.</p> <p>Enjoy hiding and finding with themselves and objects.</p> <p>Begin to put objects inside others and take them out again.</p> <p>Explore space by crawling and walking.</p> <p>Show an interest in objects which are the same in contrasting sizes e.g. selecting a big spade or a small spade.</p>	<p>Use spatial words during everyday play and routines, e.g. when sweeping leaves <i>off</i> a path or water <i>down</i> the drain.</p> <p>Demonstrate rolling a ball or moving objects over shorter and longer distances.</p> <p>Play peekaboo games.</p> <p>Support babies’ embodied understanding of position, e.g. singing songs using positional language such as <i>The Grand Old Duke</i> of York or taking them on a laundry basket ride and saying ‘<i>Up, up, up!</i>’ as you sweep them up into the air, and ‘<i>Down, down, down!</i>’ as you come down, maybe making your voice go up and down too.</p> <p>Play games that involve curling and stretching, popping <i>up</i> and bobbing <i>down</i>.</p> <p>When sharing picture books, take opportunities to point out differences in size, e.g. a big truck and a little truck, or a big cat and a small kitten.</p> <p>Talk about the properties of shapes, e.g. <i>flat, round, curvy, bumpy</i>.</p>	<p>Books with opportunities for using spatial language, e.g. <i>Where’s Spot?</i> by Eric Hill and <i>Peepo</i> by Janet and Allan Ahlberg and use opportunities in all other books to use spatial words.</p> <p>Resources on different levels and at differing heights and talk about these, e.g. ‘<i>There’s your teddy up on the shelf</i>’.</p> <p>Bags, boxes and cloths for items to be stored, hidden and transported.</p> <p>Nested boxes, cups or toys, i.e. boxes/cups/ toys of different sizes that fit inside each other.</p> <p>Books about bodily awareness and movement, e.g. <i>More, More, More said the Baby</i> by Vera B Williams.</p> <p>Low mirrors to support babies to develop bodily awareness.</p> <p>Objects demonstrating marked differences in size e.g. dolls and adult chairs, tiny and big bears, blocks and containers and talk about <i>big</i> and <i>small</i>.</p> <p>Blocks and boxes to build with objects that stack e.g. wooden blocks, stacking cups.</p>

Stage 2	Children are learning to...	Adults might...	The environment might include...
	<p>Respond to changes of shape, e.g. flattening mud pies.</p> <p>Attempt to fit shapes into spaces on inset boards, sometimes successfully.</p>	<p>Talk about simple properties of objects such as <i>big</i> and <i>small</i>, <i>long</i> and <i>short</i>, <i>high</i> and <i>low</i>, etc. during play and everyday contexts, e.g. when out and about, on swings/see-saw/slides, toy play, chopping food.</p> <p>Talk about and show the shape of objects can be changed, e.g. a sponge can be squeezed or stretched into a different shape.</p> <p>Demonstrate putting a smaller item inside a similarly shaped larger item (e.g. smaller bowl inside a larger bowl).</p>	<p>Malleable materials where children can change the shape and size e.g. mud, playdough, enlarging a puddle, chop an apple.</p> <p>Shape sorters, posting toys and inset board puzzles for children to explore independently as well as co-operatively with adults (e.g. posting pompoms through a cardboard tube or hole in a plastic lid).</p> <p>Bags/boxes to fit things inside and to transport around the environment.</p> <p>A range of containers for water play.</p>
Stage 3	Children are learning to...	Adults might...	The environment might include...
	<p>Begin to use gestures and perhaps words for <i>in</i>, <i>on</i>, <i>under</i>, <i>up</i>, <i>down</i> as instructions.</p> <p>Enjoy filling and emptying containers.</p> <p>Investigate fitting themselves inside and moving through spaces.</p> <p>Push objects through holes, moving them around to find the hole.</p>	<p>Use ‘tidy up time’ to promote logic and reasoning about where things fit in or are kept.</p> <p>Regularly use gestures in familiar contexts alongside spatial language e.g. pat the cushion when asking a child to sit beside you.</p> <p>Support children’s interest in body-sized spaces by providing suitable boxes etc and</p>	<p>Specific places or spaces for items to be stored and fitted into for tidying.</p> <p>Children’s books about fitting inside boxes.</p> <p>Boxes, outside spaces and furniture to get inside and move through.</p> <p>Shape sorters and other toys where items can be hidden, enclosed or posted through holes.</p>

Stage 3	Children are learning to...	Adults might...	The environment might include...
	<p>Begin to explore stacking objects with flat surfaces together, e.g. stacking blocks and cups.</p> <p>Explore familiar environments, moving freely around and enjoying finding out about the world from the new viewpoints they experience.</p> <p>Show an interest in shape and size, sometimes responding to words or gestures for <i>big</i> and <i>small</i>, <i>round</i> or <i>flat</i>.</p> <p>Attempt to fit shapes into spaces on inset boards or puzzles, beginning to select a shape for a specific space and put objects of similar shape inside each other.</p> <p>Use blocks to create their own simple structures and arrangements including lines of identical shape.</p>	<p>provide commentary on going '<i>inside</i>', '<i>through</i>', '<i>under</i>', '<i>over</i>' and '<i>between</i>'.</p> <p>Build towers '<i>up</i>' for the child to knock '<i>down</i>'.</p> <p>Hide a favourite toy '<i>under</i>' a container or cloths.</p> <p>Value children exploration of their environment indoors and outdoors.</p> <p>Talk about the properties and size of shapes (e.g. flat, round, bumpy, big, small) when selecting them to fit into spaces, e.g. "<i>Oh dear, the one with corners won't fit, we need a round one.</i>"</p> <p>Play alongside children building their own structures, building your own structures and providing a commentary or building together.</p> <p>Talk about size in everyday play and routines, extending the range of vocabulary heard e.g. <i>bigger/smaller than</i>, <i>little bit bigger than</i>, <i>further</i>, <i>nearer</i>.</p> <p>Comment on children's selection of big objects and attempts to move them.</p>	<p>Access to small spaces where children like to hide, squeeze into to fit through.</p> <p>Larger spaces with a variety of levels to give a range of viewpoints.</p> <p>A range of inset board and puzzles with pieces.</p> <p>A range of construction materials, e.g. wooden blocks, packaging.</p> <p>Storage with photos to show where things are kept.</p> <p>Objects of similar shapes that can nest inside each other, e.g. pots, boxes, baskets.</p> <p>A range of objects, including big, heavy and awkward ones that can be transported, both indoors and outdoors.</p>

Stage 4	Children are learning to...	Adults might...	The environment might include...
	<p>Respond to position and direction words to identify location, e.g. <i>in, out, on, up, down, over there, long way away</i>.</p> <p>Use position and distance to identify the location of objects in an enclosed space.</p> <p>Manoeuvre toys and themselves around objects and the environment.</p> <p>Place objects with both hands, creating patterns and constructions with two sides which match.</p> <p>Explore what can be seen and how things look from different viewpoints, e.g. partially hidden, looking between your legs or hanging upside down from a sofa.</p> <p>Order objects by size.</p> <p>Find their way around familiar environments, e.g. the way to the toilet, sand tray or to park the ride-on toy outdoors.</p> <p>Respond to differences between shapes and sizes, and associated informal language and gesture (e.g. <i>flat, round, curvy, corner, giant, teeny</i>).</p>	<p>Demonstrate arranging things, emphasising position and direction language, e.g. setting the table in the home corner or lining up cars to roll down the slope.</p> <p>Play games involving jumping, running and hiding and model making very simple obstacle courses.</p> <p>Model making things with matching components on two sides, sometimes reflected.</p> <p>Play hide-and-reveal games with objects in boxes and under cups.</p> <p>Look for opportunities to fit objects according to their size, e.g. whether a teddy will fit in a bed.</p> <p>Support children to order things e.g. stacking all the cups in a stacking-cup set, all the nesting dolls.</p> <p>Help children to create simple roads and rail tracks and talk about position, e.g. "<i>Shall we put this piece next to the bridge or the river?</i>"</p> <p>Talk about size and shape properties using informal language and gesture, e.g. <i>flat, round, curvy, corner, pointy</i>.</p>	<p>Spaces for children to hide, travel <i>through, over, down and around</i>.</p> <p>Books that include fitting into spaces, e.g. lift the flap and <i>What will Fit?</i> by Grace Lin.</p> <p>Sand trays with sufficient sand and objects which can be buried.</p> <p>Similar items and toys of different sizes such as dolls, trucks, bottles, cups, boxes or spoons.</p> <p>Large floor level mirrors.</p> <p>Small world play provides an opportunity to look 'down' on a world and to think about different perspectives.</p> <p>Wheelbarrows, bags, baskets and flexi tubs to enable children's fascination with transporting.</p> <p>Inset board and jigsaw puzzles of increasing complexity.</p>

Stage 4	Children are learning to...	Adults might...	The environment might include...
	<p>Recognise that two objects have the same shape, e.g. chooses two circles for eyes.</p> <p>Predict and fit pieces into inset puzzles.</p> <p>Make simple constructions with blocks, combining identical shapes to make walls, towers, etc.</p>	<p>Demonstrate the language of size and distance to describe everyday items and contexts, e.g. <i>huge, much smaller, longer, taller, shorter, long way away.</i></p> <p>Demonstrate choosing a particular shaped item for a purpose, e.g. a <i>pointy</i> carrot for a nose.</p> <p>Demonstrate comparing two objects to see if they have the same shape, e.g. two blocks or collage pieces/stickers.</p> <p>Talk about the shape of the pieces and the holes when fitting pieces into inset puzzles.</p> <p>When building, talk about the shape of the blocks you are selecting and why.</p>	<p>A variety of construction materials for indoor and outdoor play.</p>
Stage 5	Children are learning to...	Adults might...	The environment might include...
	<p>Respond to and use position and direction words, e.g. <i>inside, under, next to, over, through, along, upside down.</i></p> <p>Use relative position and distance to identify the location of objects.</p> <p>Move and rotate objects to fit the space or create the shape they would like.</p> <p>Make patterns with some symmetrical elements, often by placing objects on the other side to 'match' and perhaps some that grow from the middle outwards (radiating patterns).</p>	<p>Demonstrate the language for position and direction in everyday interactions, accompanying these with gestures. Find out and use equivalent terms for these in children's home languages and Makaton.</p> <p>When tidying, encourage children to look for and retrieve out of place items.</p> <p>Play together with small world toys for children to create their own environments, discussing where they want to position items and the reasons for these. Make a small world model the same as theirs, copying each move they make with a commentary.</p>	<p>Games involving children positioning themselves <i>inside, on top, underneath.</i></p> <p>Trails and treasure hunts, e.g. using recordings of verbal instructions (using talking pegs, tins, microphones, postcards etc), e.g. '<i>Look under the bench</i>'.</p> <p>Obstacle courses and materials to create these, so children <i>go over, through</i> and <i>between.</i></p> <p>Books such as <i>Up and Down</i> by Britta Teckentrup and <i>Inside, Outside, Upside Down</i> by Jan and Stan Berenstain to stimulate discussion about position and direction.</p>

Stage 5	Children are learning to...	Adults might...	The environment might include...
	<p>Perspective-take, recognise objects that are near or far away.</p> <p>Recognise things represented by scaled toys and small world environments (such as dinosaurs, cars, figures, dolls house, farms).</p> <p>Find their way around familiar environment.</p> <p>Recognise and predict familiar routes e.g. says <i>garage</i> before they see it.</p> <p>Show awareness of similarities and differences between shapes, including selecting items by their shape and size so they are appropriate (e.g. chooses a puzzle piece by its shape, chooses a triangular block for a roof and the wedge shaped block for a ramp).</p> <p>Respond to informal shape language (e.g. <i>straight, round, slanting, pointy</i>).</p>	<p>Demonstrate moving and turning jigsaw pieces to check if they will fit.</p> <p>Discuss how reflections in mirrors and ponds etc. are the other way round, or upside down.</p> <p>Discuss patterns and natural objects with reflective or rotational symmetry.</p> <p>When looking out of the window, in pictures or on walks, point out things or people that are near or a long way away and how they appear larger or smaller.</p> <p>Create walkways together, e.g. stepping stones, hollow blocks, planks, chalk lines, log slices.</p> <p>Draw children's attention to shapes in the environment and describe them using informal language, common shape names and gestures. Discuss 'nearly' shapes (e.g. <i>This is almost a square but it's got curvy corners</i>).</p> <p>Find out and use equivalent terms for shapes in home languages and Makaton.</p>	<p>Materials to explore small world play and freely create rail tracks and road layouts</p> <p>Mirrors to explore and play with.</p> <p>Outings to look at reflections in puddles, ponds or rivers, taking photographs.</p> <p>Shadow silhouettes or specific places and containers for children to tidy up items by fitting them into the designated space.</p> <p>Photographs of things and familiar places from different positions and perspectives.</p> <p>Indoor and outdoor spaces, stimulating children make their own choices and create routes, e.g. with wheeled toys.</p> <p>Resources with different shape properties to handle, move around and explore e.g. packaging for box modelling, pattern blocks.</p> <p>Food items cut into different shapes, e.g. sandwiches, carrots cut into sticks or circles.</p> <p>Freely explore playdough with knives, paper with scissors.</p>

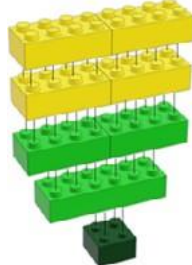
<p>Stage 5</p>	<p>Children are learning to...</p> <p>and common shape names (e.g. <i>circle, triangle</i>).</p> <p>Partition and combine shapes to make new shapes with 2D and 3D shapes (e.g. cutting 'square' sandwiches into different shapes, putting blocks together to make a 'floor').</p> <p>Create arches and enclosures when building, using trial and improvement to select blocks.</p>	<p>Adults might...</p> <p>Encourage children to select blocks for specific purposes when building, e.g. "<i>What will we use for the elephants trunk?</i>"</p> <p>Offer an appropriate or inappropriate shape for what you think the child's purpose might be (to investigate their thinking).</p> <p>Value children's constructions (e.g. helping to display them or taking photos of them) and talk about how the shapes have combined to make new shapes.</p> <p>Sensitively support and challenge experienced builders to make specific structures e.g. bridges and rooms. Offer choices "<i>Would you like one of these or one of these next?</i>".</p>	<p>The environment might include...</p> <p>Lightboxes for silhouette play.</p> <p>Books and props for traditional tales involving ordering and size, e.g. <i>The Three Billy Goats Gruff, Goldilocks</i> and <i>The Enormous Turnip</i>.</p> <p>Large and small blocks and boxes available for construction both indoors and outdoors, e.g. for making entrances, bridges, walls and dens.</p>
<p>Stage 6</p>	<p>Children are learning to...</p> <p>Understand relative position, such as <i>between, in front of, behind, before</i> and <i>after</i> (where the position is in relation to other things, e.g. <i>in front of</i> the house or <i>behind</i> the wall).</p> <p>Follow and give directions, e.g. <i>forwards, backwards, sideways</i>, and <i>left</i> and <i>right</i> turns when accompanied by gestures.</p>	<p>Adult interactions</p> <p>In everyday play and routines, encourage children to describe position and give directions, e.g. in small world play, when following pathways or creating obstacle courses.</p> <p>Play 'barrier games' where you give instructions to a partner to 'make it the same', with an identical set of objects. Begin without a barrier (copying) then introduce one when they become proficient.</p>	<p>Provision</p> <p>Controllable and programmable toys, with simple routes and obstacles to negotiate.</p> <p>Small mirrors for exploring reflection. Provide toys, pictures and pen/paper for experimentation.</p> <p>Toys or packaging to create marble runs, predicting the path of the marble/ball and solving problems in the marble run design.</p>

Stage 6	Children are learning to...	Adults might...	The environment might include...
	<p>Solve problems (e.g. <i>Will it fit?</i>) involving comparisons and predictions about length/distance, volume/capacity; paying attention to fairness and accuracy e.g. matching ends and ‘fullness’.</p> <p>Turn and flip objects in order to create models and make shapes fit, visualising and predicting how they will look, including to create a mirror image (sometimes doing it the wrong way).</p> <p>Create reflections with a vertical axis (top to bottom), or with four lines of symmetry (sometimes repeating rather than reflecting).</p> <p>Making radiating patterns (grown from the centre) with reflective and rotational symmetry.</p> <p>Explore what can be seen from different viewpoints, e.g. knows how to hide effectively from a ‘seeker’; compares what they can see e.g. from the top and bottom of the climbing frame.</p> <p>Engage with 3D models & 2D map-making of familiar environments, sequencing landmarks and designing small worlds, e.g. a playground in a builder’s tray and rail tracks that join up.</p>	<p>Look out for everyday opportunities to make comparisons, e.g. predicting if the tray will fit in the role-play oven then trying it. Engage in solving problems such as: Which car will roll furthest? (predict where the car will stop), find a stick exactly as long as your arm/little finger/leg or which jug will hold enough water for everyone to have a cupful?</p> <p>Challenge children to make as many different shapes as they can from 4 or 5 multilink cubes. Discuss whether any are the same but <i>the other way around</i> (mirror images).</p> <p>Encourage children to turn and flip objects to solve problems such as selecting the correct pieces so that a train track joins up or to make a marble run that works (and is stable).</p> <p>Model strategies for solving shape puzzles, e.g. hovering a piece over a gap and turning shapes to see if they will fit, then doing this in their head.</p> <p>Model flipping shapes to match a mirror image.</p> <p>Children’s face drawings cut in half: complete the whole face- compare with a mirror and discuss.</p>	<p>Crates, tyres, planks, canes/sticks, string and logs for children to create their own obstacle courses and dens. Include clipboards for children to record and make alternative designs.</p> <p>Mirrors, including hinged mirrors.</p> <p>Books involving symmetry such as ‘<i>Make a bigger puddle, make a smaller worm</i>’ by Marion Walter.</p> <p>Pattern outlines with reflective symmetry to fill with pattern blocks and shapes</p> <p>‘Half patterns’, to complete with pattern blocks or pegboards, large squared paper and tiles. Provide mirrors to check symmetry.</p> <p>Free play and outline puzzles with a range of shapes, including pattern blocks, mosaic tiles and Numicon baseboards or tray surrounds.</p> <p>Photographs of the children’s models taken from different viewpoints, e.g. aerial and side view of the same block model.</p> <p>Engage families in taking photos of familiar things from different viewpoints.</p> <p>Small world play, train and road layouts, miniature gardens in trays, for children to create, arrange and describe.</p>

Stage 6	Children are learning to...	Adults might...	The environment might include...
	<p>Notices landmarks and uses these to find their way around familiar places.</p>	<p>Play partner mirrors: one child makes a shape or movement and the other mirrors it.</p> <p>Discuss what might be seen using small world scenarios or asking '<i>What might this be?</i>' with silhouettes and photos from different viewpoints and including partial views.</p> <p>Encourage children to create scaled down versions of familiar places, e.g. their bedroom in a shoebox or a small world version of the local park.</p> <p>In addition to free play, challenge children to make a model from a 2D picture. Encourage children to focus closely. Discuss <i>what is the same and what is different</i> between their model and the original.</p> <p>Make simple line-maps on a blank piece of paper, drawing arrows to show direction and modelling the language as you draw it.</p> <p>Discuss the local environment and visit local places, examining photographs and simple maps. Encourage children to recall the order of landmarks on familiar routes around their local environment.</p>	<p>Photos of familiar places to inspire model making, painting/drawing, block play and small world play.</p> <p>Online maps with the children to look at routes, landmarks and homes on 'street view' and discuss what can be seen next to, in front of, behind, opposite, etc.</p> <p>Story books about journeys e.g. <i>Rosie's Walk</i> and <i>Changes, Changes</i> by Pat Hutchins.</p> <p>Rolls of wallpaper on the floor for children to freely draw their own road layouts and maps, with toy cars and people or maps related to familiar stories.</p> <p>Photo books and videos of familiar routes and landmarks to stimulate conversation using relative language, e.g. '<i>in front of</i>', '<i>behind</i>', and '<i>next</i>'.</p>

Stage 6	Children are learning to...	Adults might...	The environment might include...
	<p>Understand and use mathematical terms to describe shapes (e.g. <i>cylinder, cone, square</i>) and properties (e.g. <i>straight, curved, edges, corners</i>) as well as informal language and analogies (e.g. <i>slanty, wiggly, box or roof-shaped</i>).</p> <p>Identify several examples of the same shape (e.g. different kinds of triangles) and recognise that a shape is the same even in different orientations (e.g. turned round).</p> <p>Solve shape puzzles of increasing complexity, selecting shapes according to their properties.</p> <p>Compose and decompose shapes, knowing how shapes combine to make other shapes, (e.g. triangles making a rectangle) and identifying shapes within shapes (decomposing).</p> <p>Build complex compositions including repeated units, (such as arches made of three blocks), corners (pieces at right angles) and ramps. Selects shapes to solve a problem.</p> <p>Plan mentally by visualising what they will build and selecting blocks needed.</p>	<p>Play games focusing on the properties of shapes, e.g. hiding and partially revealing a shape, asking children to say what different shapes it could be or could not be and why, or using a feely-bag to identify familiar items as well as 3D shapes.</p> <p>Discuss different examples of shapes (e.g. different types of triangle such as equilateral and right-angled) in a variety of orientations (e.g. squares positioned on a corner).</p> <p>Discuss the shapes that emerge when children paint, draw and collage or that they notice in the environment. Discuss which shapes make other shapes, e.g. triangles making rectangles and hexagons with pattern blocks or mosaic tiles.</p> <p>Teach strategies for solving shape and jigsaw puzzles, e.g. describing shape properties and modelling the mathematical vocabulary, such as <i>straight, corner, edges</i>.</p> <p>Challenge children to make more complex constructions (perhaps in story contexts), e.g. with towers or arches, a window or a staircase.</p>	<p>Books e.g. <i>The Smartest Giant in Town</i> by Julia Donaldson, <i>Big Blue Whale</i> by Nicola Davies and Nick Malan. <i>Is it larger, Is it smaller?</i> by Tala Hoban, as well as adapting familiar stories to have a shape theme (e.g. We're going on a <i>square</i> hunt).</p> <p>A wide range of materials for construction indoors and outdoors including unit blocks and a range of recycled materials which provide real life examples of shapes e.g. kitchen roll tubes, cube tissue boxes, party hats, tyres, drainpipes, planks, canes and connectors etc.</p> <p>A wide range of resources for shape play including pattern blocks and mosaic tiles.</p> <p>Shape and jigsaw puzzles with different levels of challenge. Old greeting cards to be cut up for children to make into jigsaws.</p> <p>Photos of shapes in nature and manufactured items as well as buildings from around the world and local landmarks for children to construct and draw the shapes they see. Books that include shapes in the environment.</p> <p>Printing using a variety of 3D items. Discussing the 2D printed shapes they make.</p> <p>Measuring cylinders/beakers in the water area and shadow these so children are ordering by size at tidy up time.</p>

Stage 7	Children are learning to...	Adults might...	The environment might include...
	<p>Understand spatial concepts and use the language of:</p> <p>Position e.g. <i>before, after, between, opposite, overlapping.</i></p> <p>Direction e.g. <i>left and right (describing turns that are more/less than 90 degrees), diagonally, across.</i></p> <p>Orientation e.g. <i>upside down, back to front, slanting.</i></p> <p>Predict the path of travelling objects, in terms of distance and direction.</p> <p>Solve shape puzzles of increasing complexity, predicting which shapes will fit and how; create own puzzles.</p> <p>Build complex constructions including repeated units, staircases and ceilings.</p> <p>Visualise transformations by sliding and reflecting objects, rotating half and quarter turns; predicting how they will look. Reflect images or patterns over a horizontal axis (and sometimes diagonal).</p>	<p>Use a range of language to describe the location of objects and relevant landmarks when exploring familiar or unfamiliar environments.</p> <p>Briefly show children a simple multilink or Lego model and ask them to build it from memory. Reveal and discuss similarities and differences using spatial language.</p> <p>Build children’s physical and spatial co-ordination by playing ball games, rolling games and experimenting with vehicles and ramps.</p> <p>Using pentominoes, find different shapes with 5 squares (whole sides touching), prompting children to discuss which are mirror images or rotations of others.</p> <p>Encourage children to predict the shape of the hole when folding and cutting paper. Cut a bit out of a folded piece of paper and ask children to justify their prediction before unfolding.</p> <p>Describe a simple model that is out of sight. Imagine turning it upside down or</p>	<p>‘Barrier games’ with increasingly sophisticated pieces; e.g. blocks of the same colour, pattern blocks, paper-tangrams.</p> <p>Materials for creating interesting small world routes for cars and trains, recreating routes and journeys from stories and obstacle courses outdoors.</p> <p>Designing plans and maps for these.</p> <p>Programmable toys to direct through obstacle courses or to follow routes. Children can play robots and direct each other to follow routes with landmarks.</p> <p>Photographs of familiar items or their own models, taken from a range of perspectives.</p> <p>Mirrors and half images to complete (drawing). Play symmetry games with a partner (see barrier games in our Firm Foundations guidance for 5-7s).</p> <p>Sheets of paper quartered, for children to draw patterns reflected vertically and horizontally. Provide long strips of paper</p>

Stage 7	Children are learning to...	Adults might...	The environment might include...
	<p>Interpret and predict what and how things will appear from different viewpoints (perspective-taking), including when partially obscured or from above (plan view).</p> <p>Interpret and make 3D models and simple 2D maps of familiar environments, identifying the representation of the real world feature.</p> <p>When drawing maps of familiar routes, place things at approximately correct relative distances e.g. near my home</p> <p>Begin to use proportional language e.g. <i>halfway, middle</i>.</p> <p>Navigate simple routes. Plan a simple route in a familiar environment using landmarks.</p>	<p>what it might look from the back or top. Show the actual model, view it from different perspectives and discuss how it looked the same or different in their head.</p> <p>Support children to build more complex constructions, using exploded model diagrams, e.g.</p>  <p>Encourage them to notice smaller units of combined shapes within models. Encourage children to create diagrammatic instructions, with drawing or writing, for others to make a model.</p> <p>Construct Lego marble mazes / roadways together, discuss left and right, forwards and backwards. Encourage problem solving.</p> <p>Create a classroom, school or playground map and give directions (referencing landmarks along the way) to find specific places or hidden items.</p>	<p>to make zig-zag folds and cut out people shapes holding hands (paper dolls).</p> <p>Mirror puzzle books such as '<i>The magic mirror book</i>' by Marion Walter.</p> <p>Resources and examples for making paper snowflakes: paper folded in half, then in three, to cut out designs on the fold.</p> <p>Images of constructions made with blocks (including exploded models) for children to discuss, compare and improve upon. Consider a 'Lego club' with family members or older children.</p> <p>Clipboards and pens for children to draw their models and design new ones.</p> <p>Plan views (or oblique views which are not quite above) of environments (e.g. classroom). Perhaps, use paper maps for role-play (e.g. travel agents) and Google maps for aerial photographs to identify familiar routes viewing them from above e.g. from school to the park or shops, from home to school.</p> <p>Plenty of opportunities to practise and develop confidence in playing bat and ball, over varying distances.</p> <p>Play at rolling balls down ramps and catching it, encourage children to invent their own anticipatory games.</p>

Stage 7	Children are learning to...	Adults might...	The environment might include...
	<p>Use mathematical terms to describe regular and irregular shapes (e.g. <i>cuboid, prism, pyramid, hexagon, octagon</i>). Describe shapes using mathematical terms for properties (e.g. <i>faces, diagonals, right angles, wide, narrow</i>). Use informal language, gesture and analogies (e.g. <i>zigzag, bumpy, wedge-shaped</i>).</p> <p>Identify extreme and non-examples of the same shape, e.g. plastic 'rectangles' as cuboids, but not rectangular-ish shapes with rounded corners (e.g. mobile phone); mathematically similar shapes of different sizes.</p> <p>Decompose shapes in different ways e.g. predicting folds, nets and cross –sections.</p> <p>Relate 2D and 3D in making models from photos and plans (2D-3D) and do drawings of 3D models and arrangements (3D-2D).</p>	<p>Encourage children to problem solve involving scale, making a model skeleton that is half your size (in proportion) or work out how large a giant would be from their footprint, for example. Compare different approaches.</p> <p>Draw maps of familiar places and routes and discuss the relative distances between landmarks. Encourage children to make maps for other children (e.g. to find hidden objects).</p> <p>Briefly show children a simple model and ask them to build it from memory (given a selection of shapes). Reveal and discuss similarities and differences.</p> <p>Model folding a sheet of paper in half and making one straight cut, unfolding to see how many sides the shape has when unfolded.</p> <p>Place a collection of 3D shapes into a feely-bag to identify and match with some they can see.</p> <p>Predict what cross-sections, e.g. of fruit, will look like, including when cut horizontally and vertically. Predict 3D shapes from nets and vice versa (e.g. Polydron). Solve problems such as identifying nets which will make a cube.</p> <p>Use a construction resource such as Geostrips to make shapes, discuss different angles and the properties of shapes when transformed (e.g. squashed).</p>	<p>Small world play to re-create familiar routes and discuss the relative positions of landmarks and distances between landmarks.</p> <p>A range of boxes and cartons to de-construct (into nets) and re-construct or turn inside out. Provide 3D shape-making resources, like Polydron or Clix, or large scale outdoor materials.</p> <p>Paper and card to fold and cut shapes, e.g. snowflakes.</p> <p>A range of jigsaws of different complexity; consider a 'jigsaw club' with family members or older children.</p>

This document is part of the Spatial Reasoning Toolkit series. To view the full series, see: earlymaths.org/spatial-reasoning

Feedback form: tinyurl.com/ToolkitFeedbackForm

Funding: The Spatial Reasoning Toolkit is funded by the Economic and Social Research Council Impact Acceleration Account and the Centre for Educational Neuroscience.

To cite this document: Gifford, S., Gripton, C., Williams, H., Dr, Lancaster, A., Bates, K. E., Williams, A. Y., Miss, ... Farran, E. K. (2022). Spatial Reasoning in early childhood. <https://doi.org/10.31234/osf.io/jnwpu>

Author contributions statement: Gifford, S.: Conceptualisation, Writing – Original draft, Dissemination; Gripton, C.: Conceptualisation, Writing – Original draft, Dissemination; Williams, H.J.: Conceptualisation, Writing – Original draft, Dissemination; Lancaster, A.: Conceptualisation, Writing – Original draft, Dissemination; Bates, K.E.: Project administration, Practitioner feedback methodology and acquisition; Williams, A.Y.: Project administration, Writing – Review & Editing, Practitioner feedback acquisition; Gilligan-Lee, K.A.: Advisory capacity, Dissemination, Borthwick, A.: Advisory capacity, Dissemination; Farran, E.K.: Funding acquisition, Project administration, Conceptualisation, Writing – Original draft, Dissemination.

Acknowledgements:

Thank you to the practitioners who took part in evaluation focus groups. Your suggestions on the first version of this document were invaluable. Thank you to Becky Watt for proof reading.

Thank you to everyone who contributed images: Oli and Jenni Back, Max and Ruth Edwards, Amanda Belbin, Janine Davenall and Netley Primary School, Victoria Graham, William Gray, Simon Gregg, Julie Herlihy, Long Melford Primary School, Wells-Next-the-Sea Primary and Nursery School, Julia Norman, Sharon Palfreyman, Community Playthings, Amelie and Maz Usher, Niamh, Orla and Aidan Willoughby.



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