

# Space to learn

In this first part, **Prof Emily Farran**, **Catherine Gripton**, **Sue Gifford** and **Alison Borthwick** consider the spatial possibilities of outdoor play

**A**re you good at finding your way around? Can you visualise how to turn a box so that it will fit through the doorway? How do you approach packing a bag, a lunch box or stacking the dishwasher?

All of these activities demonstrate spatial reasoning: the ability to understand how objects (including ourselves) move and interact in the physical space around us. Spatial abilities include noticing the size and location of objects and the ability to visualise objects and places in your head.

Spatial reasoning is happening all the time, in everyday activities in and outside the early years setting, often without us noticing. Children are using spatial reasoning when they hide objects in the sand, find a place to sit on the carpet and when they build a tower during block play.

### CURRICULUM LINKS

There is a robust body of research evidence which demonstrates that children and adults who have better spatial reasoning skills are better at maths. Children's spatial abilities also predict their expertise in wider STEM subjects (science, technology, engineering and mathematics) in adulthood.

While children need access to spatial toys (e.g. block construction and marble runs), research has shown that the quality of spatial play is also important. Children's spatial reasoning becomes much stronger when they receive practitioner guidance on how to think and learn

spatially, more so than playing with spatial toys without adult input. For example, practitioners can model key spatial language such as 'on', 'between' and 'narrow', use gestures (e.g. hands close together for narrow) and encourage children to think spatially when using jigsaws or construction sets ('Can you turn that in your head?').

Children from disadvantaged communities, whose spatial skills and language are more likely to be at an earlier stage of development, show a particular benefit from support.

Spatial reasoning is in the educational programme for mathematics in the EYFS framework, but many practitioners have told us that they would like to know more about how to support young children's development in this area. The Spatial Reasoning Toolkit was developed in consultation with practitioners (see box).

This defines the spatial learning



**Outdoor and Builder Copier activities at Corrie (see Case study)**

opportunities in the everyday activities that most practitioners already use in their settings so they can help enhance the spatial aspects involved for the children.

### ACTIVITIES

The outdoors environment is rich in spatial learning opportunities.

In the toolkit trajectory of spatial reasoning development, you can find many examples of how to 'spatialise' outdoor activities.

**Babies:** Strong body awareness is essential to the development of spatial reasoning because it helps babies understand the location of their body in space, so simply providing opportunities for babies to move freely will help them develop an awareness of space.

Younger babies are developing an awareness of their own body parts, for example, when they play with their feet. Older babies enjoy crawling to explore large-scale space. They will be experiencing different viewpoints and perspectives, and how the spatial relationships between themselves and objects in their environment change as they move around.

**Adult role:** Placing objects just





out of reach can support this embodied learning, and providing spatial words such as 'on', 'under' and 'in' supports the learning of spatial concepts.

**Toddlers:** Toddlers are learning to find their way around familiar environments and get good at spotting a familiar shop, knowing where their favourite slide is at the park or moving around the coffee table to get to where they want to go. It is important to value children's physical exploration, providing opportunities to explore spaces and move freely around.

**Adult role:** Comment on what can be seen from different

viewpoints and what is partially hidden. Point out how things that are near or far away appear large or smaller. Taking photos of the same place from different viewpoints or of the same object as you approach it and discussing them supports an understanding of perspective-taking and spatial scaling.

Take children for walks around the locality – a great opportunity for spatial language, where adults can comment on the route using spatial words like 'between', 'along' and 'over'. Using hand gestures to emphasise these words can be particularly helpful in supporting

## Take children for walks around the locality – a great opportunity for spatial language

children to remember them and use them when thinking spatially. Even getting ready to go out can be rich in spatial activities by discussing which boot goes on which foot, getting your coat the right way around, and pulling a zip up or down. Spatial language and gesture are an important bridge for learning new spatial concepts such as next to and in front and provide a way to communicate spatially.

**Three- to four-year-olds (see Case study):** Children are learning to respond to and use position and direction words.

**Adult role:** Provide outdoor

## the Spatial Reasoning Toolkit

**What:** A set of resources, including a learning trajectory of spatial reasoning development by age and stage from birth to seven years, developed from a review of international research.

**Who:** The Spatial Reasoning Toolkit was developed by Sue Gifford, Catherine Gripton, Helen Williams, Andrea Lancaster, Kathryn Bates, Ashley Williams, Katie Gilligan-Lee, Alison Borthwick and Emily Farran.

**Resources include:**

- A research summary that defines

spatial abilities, their importance and how they develop reasoning.

- A trajectory of spatial reasoning development that maps out the development of spatial abilities with suggestions of what the adult might provide and what the environment might include.
- Seven posters with activity ideas and key spatial language.
- Five videos explaining spatial reasoning development at different ages and in different contexts.
- Three children's book lists for three areas: shape, space and measures.

- Three sets of 'prompt' keyrings, which include developmental stages for three areas: Movement and navigation; Shape properties; and Shape composition and construction.

**Usage:** To date there have been more than 35,000 views of the Spatial Reasoning Toolkit resources online.

**Where:** The Spatial Reasoning Toolkit is available on the Early Childhood Mathematics Group (ECMG) website.



# spatial reasoning: part 1



materials to make an obstacle course. Encourage children to narrate their way around the obstacle course or direct a friend to go over, under, through, along and between. To encourage understanding of spatial scale, support children to draw a map of their obstacle course. To help them to understand the map as a representation of their obstacle course, encourage children to trace their route through the course on the map with their finger.

Use the outdoor materials to create a construction activity, which we call Builder Copier (see image on page 16). Ask one child to build a construction, and the other child to copy it. This helps develop an

understanding of object properties and encourages children to focus on the relationships between objects in space. Ask peers to compare the two builds from different viewpoints in order to develop an understanding of 3D space and perspective-taking.

**Reception:** Tidying up the outdoor space provides numerous opportunities for spatial reasoning. You can use tidying to promote discussion of what fits.

**Adult role:** Provide specific places for items to be fitted into,



perhaps using shape outlines/shadow silhouettes for children to match items to when tidying. Children can be asked to look for out-of-place items, or to reorder items by size, such as beakers in the water area. These activities support an understanding of shape properties and of spatial relationships.

Part 2 of this series on spatial reasoning will focus on how movement supports children's spatial development, considering how bodies and senses are key to mathematical development. ■

**The Spatial Reasoning Toolkit has been put to good use at Corrie**

## case study: Sharon Palfreyman, Corrie Primary and Nursery School, Tameside

Sharon had been interested in spatial learning with nursery children, for instance, creating 3D models of the local area. The Spatial Reasoning Toolkit led her to create a series of activities, which helped children to understand 2D maps.

She set up an obstacle course and encouraged children to use directional language as they went along it, saying, 'I'm going over, I'm going under, I'm going through.' Together the class drew a 'map' of the course on a long piece of paper, agreeing on symbols, and then traced their route along it with their

fingers. This is so challenging for young children, requiring them to translate their memory of whole body movement to their finger going round symbols. Some children could not describe what they were doing at the same time. Then children created their own obstacle courses and some drew maps of these.

Sharon also devised a construction activity, Builder Copier, where one child copied another's construction. This required them to focus on exact positions and to select particular blocks. To make this easier for younger children, they copied each other, one

move at a time. This was a very popular activity, especially outdoors with large blocks, involving a panel of onlookers in assessing the accuracy of what was copied. The children progressed to making a construction from a photo of another child's model and even to drawing constructions.

Using the toolkit has encouraged Sharon to develop a wide range of enjoyable and challenging spatial activities for very young children, but also to observe the fascinating ways in which they show spatial reasoning across the nursery setting.