

initially been the focal point for the study. However, the move into an historical study enabled us to develop our cross-curricular approach and, of course, meet the requirements of another curriculum area.

At the outset of the project we knew little about the Merchant's House in Yarmouth, but an essential preliminary visit provided us with many ideas, from which our planning took place. The building itself was far from the imposing cathedral or castle that one associates with ancient buildings. Indeed, the building was tucked away in an alley that led from the industrial quayside of Great Yarmouth. The seventeenth century house, which is one of the few survivors of the Second World War, proved to us to be an excellent resource in helping our children gain a better understanding of the past and of how life may have been.

As we toured the house, with rooms either empty, or full of artefacts from the rows of houses which had long since disappeared, we 'bubbled' with ideas. However, reality soon took over as we agreed it would be futile to attempt to absorb everything viewed. As a consequence, we decided that our objectives should be narrowed down. Since it is the normal practice in the school to plan and work in teams, and to involve as many experts and outside agencies as possible, we organised a collection of artefacts from the Suffolk Museum Service, and invited English Heritage to offer further support in helping us prepare our children to make comparisons of how different life was in the seventeenth century to the life which we lead today.

For the actual main site visit, we decided not to arm our children with clipboards, question sheets and tape measures, but to make this an opportunity for observing, touching and recording all that we saw, using a wide range of tactile materials. We also had to decide which rooms would provoke the greatest thoughts and discussion and, as a consequence, the following three areas were chosen:

The Panel Room

This room was empty. The wooden floor and blue carved panelled walls were all bare. The mystery and motivation lies behind the secret panels which, when opened, revealed intricate and colourful storage shelves, or staircases that led to other parts of the house.

The Fireplace Room

This room was situated high up the winding narrow staircase of the house, in the attic. Here, amongst the wealth of roof beams, an assortment of fireplace surrounds were displayed, all having been gathered from the other Merchants' Houses.

The Door Room

This room comprised a selection of doors, mounted in a row, and freely swinging as if part of a poster collection. The children were able to move through these doors, studying differences, and selecting a favourite.

The Courtyard also had to be explored, since the flint and cobbled stones were fascinating, together with the intricate brickwork patterns of the building's walls.

Having decided upon our focus points, we began to share our plans and ideas with the children, and prepare them for the visit. Preparation also had to take place for the filming. The children were warned of the bright lights, the cameras, the sound equipment and 'that fluffy caterpillar on the pole'! Everything was explained in detail, and the filming commenced.

As the children began to prepare for their visit, they were asked to make comparisons of old and new buildings in which sequencing exercises, slides and jigsaws were used. The children looked at building styles and designs, and looked for signs which would indicate the age of the building. The observation and handling of domestic objects taken from a kitchen of today, and those of a seventeenth century kitchen, led to further comparisons and thoughts of 'what you would use it for'.

The study of costumes and 'what went underneath' caused interest, and with the use of textiles and fabric, costume collages were developed. The school computers were equipped with concept keyboards and the 'House Journey' program enabled the children to 'move around' an ancient house and put in appropriate fireplaces, furniture and lighting.

Following detailed discussions and the standard preparation procedures for any school visit, the day of the trip came. Armed with our teaching resource packs, lunch, and with our ever valued parent helpers, we set off. On arrival, the children had an opportunity to tour the house, and look at the location in which it stands. The children were then divided into groups and despatched to the chosen rooms.

In the Panel Room, the children studied the panels and guessed that some may open. 'But what will you find behind them?' we asked. As imaginations began to flow, thoughts were written down into stories. Colour matches were also made for work on returning to school.

In the Fireplace Room, the children were on the floor looking up into the roof, studying the beams. To assist them, large mirrors were laid upon the floor, and the children drew the reflections on equally large paper. The fireplaces were subjected to the children's fingers tracing the intricate patterns and shapes, and then rubbings were taken. These rubbings were collected together by the children and used in a later collage of a fireplace of their own design.

Finally, in the Door Room, the children, having selected their favourite door, set about recording their observations in clay. A special sparkle was added to the day when the custodian of the house shared with the children the story of 'Montegue Mouse', a former resident of the building.

BELOW LEFT: Suffolk Museum Service provided a range of interesting objects for the children to study and handle.

BELOW RIGHT: The Door Room provided the stimulus for creative work.



Studying the roof beams in the house led to follow-up work in design and technology.

As we left the building we knew that we had achieved our aims and that not only did the children have a better understanding of life 300 years ago, but that they had all enjoyed their experiences.

The follow up work was easy to develop since the children's interest had been stimulated and they were keen to transfer observations into model and design work. Displays began to appear, books were written, roofs reproduced, and merchant

signs painted on glass. The return of the camera team tested the children's knowledge and understanding, and brought the project to a close as we shared our stories and thoughts of Montegue Mouse. Further evaluation took place in the nerve racking interview, which was subsequently used for much of the dialogue of the film.

The final conclusion was, without a doubt, that the experience was both

valuable and well worthwhile. The History Key Stage 1 Attainment Targets had been developed and were understood and meaningful to the children. Many cross-curricular links had been used, making the visit and ideal way of meeting the requirements of other curricular areas. The staff of Gunton County Primary School have decided that they should continue to use historic sites to enhance their teaching, and to share the value and easy access of these historic buildings with our children.

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The Key Stage 1 Curriculum is the second video in our Teaching on Site series, and is available on free loan, or for sale, price £10.95. See our Resources Update on p.13 for full details. Two further titles on Maths, Science and Technology, and English, Art, Drama and Music will be available during the Summer term, and announced in future issues of Remnants. The Old Merchant's House, Row 111 Houses and Greyfriars' Cloisters are in Great Yarmouth, Norfolk, 1/2m inland from the beach. To book a free educational group visit and to check opening hours please ring 0223-455520.

Your School Building as an Historic Resource

Planning a local study project? Look no further than your own school building. It's full of opportunities and there's no need to wait for an anniversary to happen!

In 1990 a number of schools responded to an appeal in **Remnants** for information about projects which used the school and its building as a resource. As expected, most replies were from teachers organising anniversary celebrations. They were preparing displays about the school's history to commemorate some significant date in the history of the school, usually twenty-five or fifty years since it opened. Others were marking the move from old to new buildings by an exhibition and in one case, at Reydon in Suffolk, the school was closing altogether. The librarian, Julie Jordan, had been asked to compile a booklet about the life of the school, something she tackled with a will but confessed that she had never done anything similar before. Reydon was an interesting example of a site which had adapted to every change in the history of education for over 150 years. It had started as a tiny rural school attached to the church in 1806. The first building can still be seen near the present school, now converted into a cottage. Over the years the name of the school alone had been



Buckminster County Primary School, Leicestershire. Built in 1899 for the Earl of Dysart as 'The Buckminster Unsectarian School'.

changed four times this century from 'Council' to 'County', from 'Modern' to 'High', words which themselves are clues about changes in educational policy and management. On one site different architectural school building styles can be seen: science labs, sports facilities, a canteen and a ROSLA block had been added. ROSLA was shorthand in 1959 for Raising of the School Leaving Age. While many of the people at school today do not remember this, the name of the block

remained. In cupboards in the school there were logbooks and some photographs; sports trophies from the 1920s remained in the school and a preliminary request to former pupils in the neighbourhood had produced some personal memorabilia, including a school exercise book started in 1912.

Hatchford Brook Junior and Infant School in Solihull was another interesting case study. They let us know that they were celebrating their Golden Jubilee in



English Heritage



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1990. This information was intriguing. A new school opening at the beginning of the Second World War? Why should such an initiative be funded in 1940 and what sort of buildings had been put up in the middle of a period of national emergency? Research into a reference book about educational funding and policy at the time, revealed that government funding was released for nursery provision in 1940 to enable mothers to make their contribution to the war effort. Solihull had developed as a result of the growth of the motor industry in the late 1930s. In wartime, factory production had been switched to build aircraft and armaments, and former employees had been 'called', hence the need for a female workforce and a nursery school for their children. This factor also helped explain why the first buildings on the site were wooden ones and why the brick built school which went up in 1947 was built in the modernist style of the late 1930s. The site had been designated for a school before the war, the plans had been drawn, but construction of the whole building, apart from the nursery school had been delayed. With the postwar reorganisation of local government, Solihull had become a metropolitan borough and Hatchford Brook School a flagship of its newly-found civic pride.

In their project work both these schools and many others, mentioned in a forthcoming English Heritage publication **A Teacher's Guide to Using School Buildings** largely focussed their classroom work on the human and personal stories associated with the building, recovered from log books, old photographs and the reminiscences of former teachers, governors and students. Their findings, their displays and booklets were semi-private, of great interest to the local community and great fun to do. **Using School Buildings**, however, aims to persuade many more teachers firstly that they don't need to wait for an anniversary for a school-focussed project, and secondly, that close observation of school buildings themselves can be a stimulus and resource for developing skills which can be applied to other investigation in the historic environment.

School buildings fall into both the private and the public domain. To the

BELOW: *The Convent School, Park Road, Loughborough, built in 1848-50. This was the first Catholic day school in England supervised by nuns.*



Jill McPherson



Jill McPherson

Mountfields County Junior School, Loughborough, Leicestershire, 1949-51 by T.A. Collins, the county architect.

people who work or have worked there, to past and present pupils and to members of the local community, the building is a personal and private space. However they are public institutions, designed in the main by architects employed by the Local Authority, subject to rules about public health and safety and having to meet the requirements of democratically-determined educational policy and curriculum change. The architectural style of school buildings also reflects certain values and expectations held within society at a particular time in history about the purpose of education. When Arthur Conan Doyle drew attention to the Board Schools of the 1870s as 'isolated clumps of buildings rising up above the slates like brick islands in a lead coloured sea' he went on to interpret their function as 'lighthouses', 'beacons of the future' and 'capsules, with hundreds of bright little seeds out of which will spring the wiser, better Britain of our future'. This was a commonly-held view of education at the time when it had become available to all. Similar sentiments about opportunity and social reconstruction can be deduced by thinking about the design, decoration and location of school buildings at different points in the twentieth century. Think about the design of old and more modern

schools known to you. Which aspects of the design reflect ideas about access to light and fresh air? health and hygiene? an instructional or activity model of teaching? Why are schools always designed with halls? Why were the first schools surrounded by high walls, but later schools provided with playing fields? Just as we understand the purpose and function of castles and cathedrals within the historical context of the Middle Ages, so school buildings belong to the history of the nineteenth and twentieth centuries and society's ideas about the education of the young.

Every school building is a series of clues to be unravelled to provide us with information about:

- the history of education and national educational policy
- the history of art and design
- the history of technology and the use of building materials
- public standards of health and safety
- community values and civic pride

Each school is part of the history of the particular neighbourhood where it is located and part of the history of individual lives and there is plenty of historical evidence about if you search for it. The investigation can begin as historical detective work. The students can raise their own historical questions which will lead them to local archives, old newspapers and oral history tape recordings. The findings can be developed as drama, as broadcast material, as living history experiences such as the Victorian school day or as a booklet for people to buy. Sources of information can be accessed as a catalogue or database, so that in twenty years time, a new generation of pupils and teachers won't have to start from scratch all over again. There is no reason why schools should not share 'their' building with another neighbouring school as a topic to study, particularly in the light of the National Curriculum Programmes of Study for History and Geography. Local studies appear in both.

In History at Key Stage 2, there are specific recommendations for the local study. All can be applied to work on school buildings. We include some suggestions in

An investigation of an important historic issue

Relate local developments to national trends.

An aspect of the local community over a long period of time.

An aspect of the local community in a short period illustrating developments taught in other Study Units.

What happened in our area as a result of the Act of 1870 which said schools had to be built for all children?

Growth of suburbs between the wars.

Timeline display, with photographs, of school buildings in our area.

How schooling has changed since 1930, using oral history reminiscences.

the table above, but there are many other approaches to take.

There are many opportunities with school building projects for work right across the curriculum, from mathematics

to technology. We suggest some in the forthcoming publication. The book also lists old school buildings open to the public, museums with education displays and a number of venues providing

opportunities to take part in a Victorian School day. These will raise discussion about the interpretation of history (Attainment Target 2) and help the pupils to think about school in the past from different points of view, the child's and the teacher's.

Sallie Purkis,
Formerly Senior Lecturer in History at Homerton College, Cambridge.

A Teacher's Guide to Using School Buildings will be published during the summer term, as part of our Education on Site series, price £4.75.

Shaping up to the National Curriculum

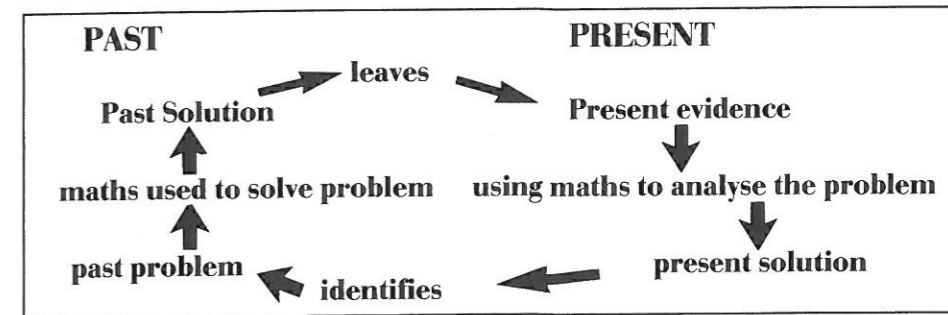
Maths is not just for the classroom. It is all around us, both in the natural world and in the structures people have built.

Wherever you are when you read this article you can be sure of several things:

- you are surrounded by aspects of the historic environment: structures or artefacts for the past;
- you would need some sort of mathematics system to locate how far back in the past the structures and artefacts originated, that is to date them;
- you could use some aspect of mathematics to describe those structures and artefacts, for example counting, measuring, using the language of shape, drawing a plan or making a graph;
- mathematics could help you interpret and explain how the structures or artefacts were used;
- since mathematics was used in building the structures or in creating the artefacts, you might use the same mathematics to discover how they were made and what was in the designer's mind.

The diagram shows how we use the present surviving evidence to discover the maths used in the past and find explanations for the use of the site or objects.

Mathematicians might call the statements above 'generalisations' and they would ask for some 'specialisations' to show exactly how maths and the historic environment relate to each other, what you and I might call 'for instance'. The number of examples that could be related are huge so it is best to find an aspect of the historic environment that might be frequently used in the curriculum and examine the implications of mathematics for it. Places of worship are all around us in the shape of cathedrals, churches, chapels, mosques and synagogues, as well as the remains of medieval abbeys and ruined churches. Places of worship feature at many points of the history orders. In KS1 they might be part of the 'historical sources' or as background to stories from the past. In



ABOVE: *Problem solving to show how people in the past lived*



Castle Acre Priory, Norfolk.

KS2 'Houses and places of worship' form a supplementary study unit and in KS3 'Castles and Cathedrals' form another supplementary study unit. Geography and RE also have places of worship, Christian and of other religions, featuring strongly. Here we have a subject that could be a focus for much work in mathematics, and indeed help to satisfy many Statements of Attainment in the Mathematics Orders.

There are many questions we could ask

about a place of worship that maths could help us answer: Where is it? How old is it? How was it built? What size is it? The questions we are asking are: What shapes can we find? How are they related? Why were they used?

Shape

Churches tend to use the rectangle as a basic building 'block', probably because it was structurally the easiest: each of the walls support each other, though there are many examples of round churches, particularly in recent times when the altar is set at the centre of the congregation (this may also be cheaper to build as a circle is the most efficient way of getting maximum space for minimum perimeter). However, triangles, that very efficient taker of weight, are found holding up roofs, and cuboids are seen in towers, and cones are the basic shape of spires. Fonts are often hexagonal or circular and some towers and the bases of spires are octagonal. Shape is frequently used in symbolism. The triangle is often present to represent the Holy Trinity, and the circle, a line with no end often depicts the Godhead or eternity. Identifying shapes and their practical, as well as decorative, use is a basic mathematical skill and churches are a major resource for developing such skills. Making shape trails for children to follow, or shape collecting games, improve observational skills enormously.

Symmetry

Symmetry has been used in places of worship for a number of reasons. Human beings seem to have an in-built need to make things symmetrical because it is pleasing on the eye. There are however, structural reasons why symmetry was used in churches: it enables equal numbers of people to be placed either side of the aisle and therefore gives equal vision to and from the altar, particularly by making equal spaces either side of the main aisle. The most pervasive use of symmetry in the plans of churches is the form of the cross, also a powerful Christian symbol. In the vertical plane the rows of arches that we see lining a nave have to be symmetrical to spread the weight of the roof evenly otherwise the structure would collapse. Buttresses fixed to the external walls of the church, also to take weight, are placed symmetrically for the same reason.

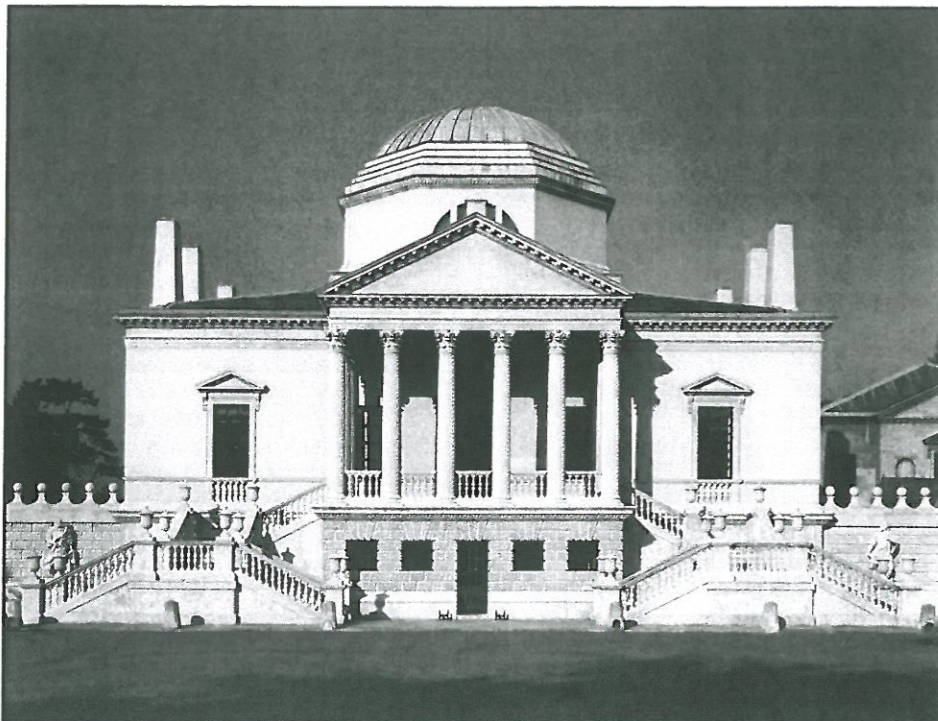
The structural aspects of the building might be the best place to find line symmetry, but it is in the decorative parts of the church that both line and rotational symmetry can be recognised. Windows, doors, arches and much of the ceremonial furniture are covered with designs that have many orders of rotational symmetry from which the axis of symmetry, and their number, can be analysed.

Identifying the types of symmetry in a church, both the horizontal, in the plan, and the vertical, in the walls and decorations, can lead children to an appreciation of both the structural and decorative need for the form.

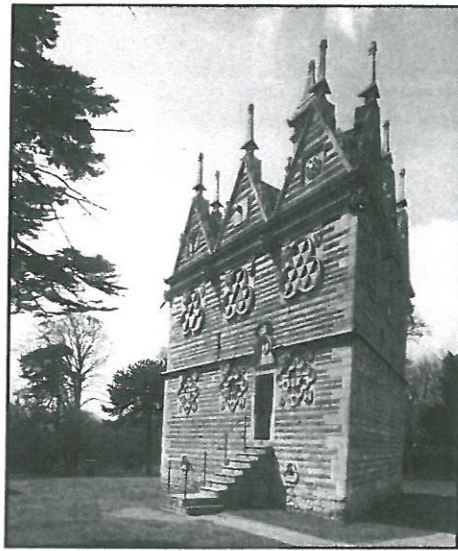
Transformations

Within symmetrical shapes we find particular designs repeat themselves but in a variety of positions. These are known as transformations. Many features, a window, for example, may have the same shape repeated on opposite sides as a reflection, or it may be turned and become a rotation, or made bigger and become an

BELOW: Chiswick House, London. Transformations can be identified in places and facades of Classical and Palladian country and town houses.



English Heritage Photo Library



The Triangular Lodge at Rushton in Northamptonshire, where everything is symmetrical and based on the triangle.

English Heritage Photo Library

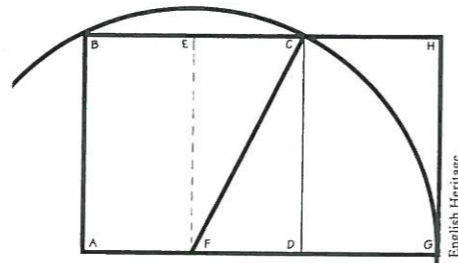
enlargement. It is surprising how few shapes are actually used but in a large number of translation formats. Look at the tracery of a window, or the columns of arches, the decoration around a font, or the face of a screen. Children can design their own windows and try to use as few shapes as possible but transformed as many times as they possibly can.

Tessellation

Shapes, particularly those found in the floors of the aisles and in the windows will fit together without leaving any space between them — they tessellate. What sort of regular shapes, triangles, squares, rectangles, and other polygons, are used by the markers to achieve tessellation? Which shapes would they not have used and why? The windows will have shapes that are likely to tessellate. What sort of shapes are these? Do they have straight or curved lines as their edges?

The Golden Rectangle

So now we have looked at shape, symmetry, transformations and tessellation. There is one question left: why did the architects and craftsmen use the particular measurements that we have found? In very old buildings the dimensions of the church might be related to the structural skills of the masons or the availability of materials. The measurements of windows and doors might have been determined by a major consideration: how big a door or window could be without causing the wall to collapse. In later churches the dimensions might be deliberately designed to fit the Golden Rectangle. This shape was thought to be the most pleasing to the eye of all possible shapes. Its dimensions are the result of using the Fibonacci series of numbers and finding the ratio between them. These numbers are produced by starting with 1 and adding the last two numbers to arrive at the next: 1,1,2,3,5,8,13,21,34, etc. The ratio between any two Fibonacci numbers after 3 is about 1:1.6. This is known as the Golden



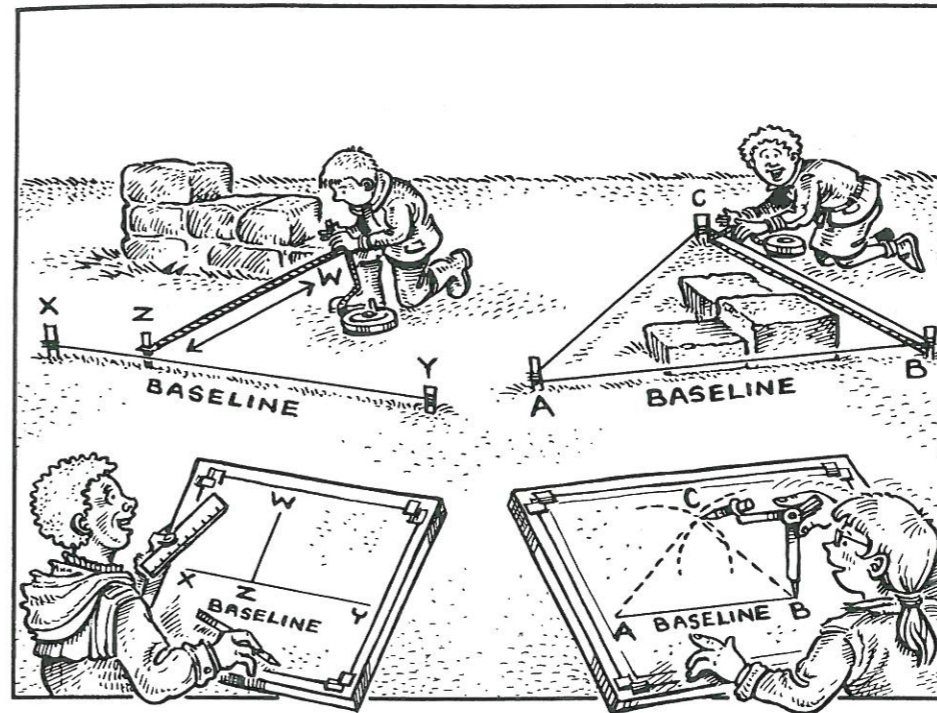
English Heritage

The Golden Rectangle

Section or Golden Rectangle. The diagram shows how to make a Golden Rectangle. Begin with a square ABCD, which you divide up into two equal parts with a line EF. Point F is used as the centre of a circle whose radius is the diagonal FC. An arc is drawn, CG, and the base line AD is extended to intersect it. This becomes the base of the rectangle. A new side HG is drawn at right angles to the new base, with line BH brought out to meet it. You might get your class to make Golden Rectangle detectors by cutting a rectangle of the required dimensions out of a piece of card. This can be held at the required distance from the eyes to locate the Golden Rectangle in church plans, elevations, windows and doors.

Planning

Because churches are designed on a rectangular basis there are many right angles to identify. This simplicity has its benefits in other ways: churches are generally easy to plan because of the right angles and errors are readily identifiable because of this, although sometimes the shape is not as regular as might be thought at first sight due to masons' errors. A set of string baselines in a rectangle around the church will enable simple planning using offsets, again the right angle, to be undertaken. The measurements of the building will almost certainly be in the system set up by Edward I in 1305 which formed the basis of imperial measurement: inches feet and yards. Here is a useful exercise in the equivalence of metric and



Using triangulation to plan parts of buildings

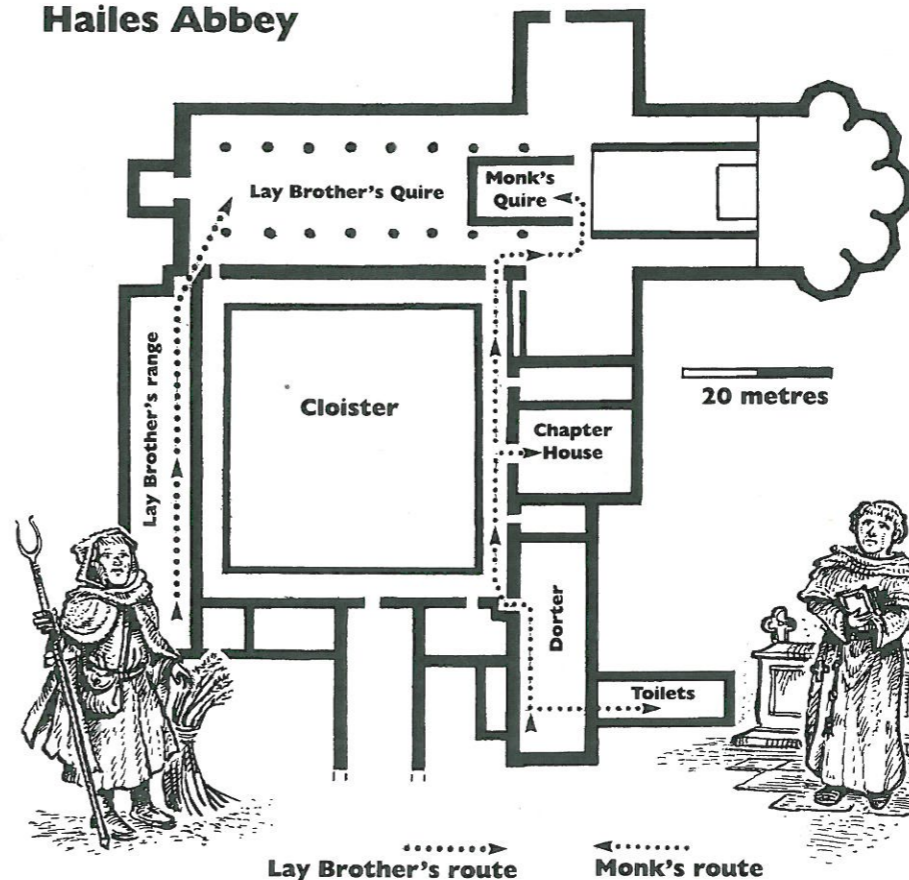
imperial units. It may be thought that the measurements are not always accurate to the nearest whole unit. Perhaps the system being used was the personal measurements, paces, of some long dead architect! Younger children might even measure using their own paces: in the footsteps of the past!

Sequencing

Many churches have altered their shapes during the past. Unless the structure was built all at one time, such as some of the Victorian churches in industrial suburbs of

BELOW: The monks and lay brothers followed different routes

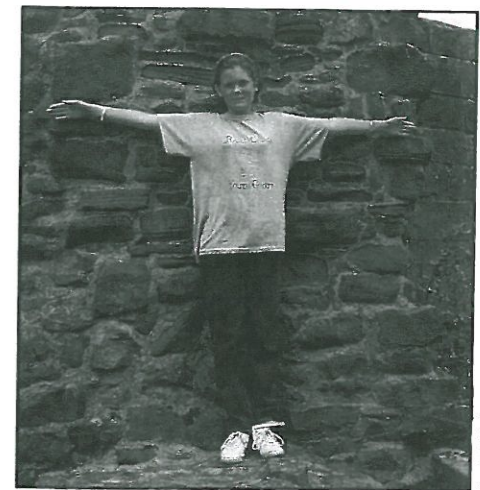
Hailes Abbey



English Heritage

towns, the building tended to be added to or parts were demolished as the numbers of people grew or shrank. This population growth or decrease can be related to periods of growing and shrinking wealth in the area.

The guide book will probably have a plan with the building phases and dates included and this provides a good opportunity for discovering the shape of a church at a particular time, and, perhaps, to see whether there was always an attempt to achieve symmetry. The individual phase plans might be put in a



Using a span to measure the width of a wall.

flowchart or a made into a time-line, both powerful means of representation to aid understanding.

As the horizontal shape of the structure altered so did the vertical shape. It is possible to detect, by looking at the shape, colour and type of stone used, and finding the breaks in between, how the shape of the walls has altered through time. Windows of different shapes also give clues to the date of a particular piece of wall. It is possible to build up a flowchart of the shape of the walls throughout history by determining which part of the wall came first.

Networks

Finally, what shapes did the people make when they used the church? In the churches of medieval monasteries it is possible to plot the routes taken by the choir and lay brothers because we know the Rule that they lived under. In other churches plotting wear marks in the floor might indicate the most favoured routes. Some experimental archaeology might also be in order, watching how the present congregation use the building. Asking the clergy in a cathedral about the processional routes taken on feast days might also be another method of research. The information gained can be plotted on a network, with one colour or type of line used for the congregation and another for the clergy and their attendants.

Churches as part of the historic environment are full of mathematics. We can use maths to describe a structure or artefact, we can use maths to give us an insight into the thoughts of the people who designed and made the buildings around us. The children whom we teach benefit doubly in their further understanding of the past and its people and in their more purposeful use of mathematics.

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A Teacher's Guide to Maths and the Historic Environment by Tim Copeland is now available, price £4.75, from English Heritage, PO Box 229, Northampton, NN6 9RY.