THE
GEORGIAN
GROUP

James Campbell, 'The carpentry trade in seventeenth-century England', *The Georgian Group Journal*, Vol. XII, 2002, pp. 215–237

THE CARPENTRY TRADE IN SEVENTEENTH-CENTURY ENGLAND

JAMES W.P. CAMPBELL[1]

Carpenters were key players in the seventeenth-century building world. John Summerson has shown how they were involved in speculative development,[2] David Yeomans has described in detail how the structures that they worked on changed during the period[3] and, more recently, Elizabeth McKellar has suggested that carpenters and other craftsmen were more commercially sophisticated than has hitherto been supposed.[4] Yet several matters concerning the life of the building craftsman have gone unexamined and recent studies have made sweeping statements about the role of the carpenter in this period that are not true. So a reassessment and summary may be useful.

This article starts by looking at the definition of carpentry in the period, leading naturally to a discussion of the guilds and their role, which is more complicated than is often suggested. The next section looks at the role of apprenticeship in training. Tools are then briefly discussed, followed by timber supply, pay and working hours, before finishing with a examination of the idea of the carpenter's firm in the period.

CARPENTRY: A SEVENTEENTH-CENTURY DEFINITION

It has been suggested that joiners frequently worked as carpenters or vice versa.[5] This notion, that the two trades were interchangeable, seems to derive primarily from R.Campbell's *The London Tradesman*, a mid-eighteenth century source,[6] but care should be exercised in using Campbell as evidence for seventeenth-century practice. *The London Tradesman* was not a book on the building trades; it was a manual aimed at helping parents guide their children into suitable careers. As such, it covered a broad spectrum of occupations, some of which Campbell presumably knew better than others. Guild records show that there were disputes between the trades which are evidence of a wish to maintain a division between carpentry and joinery, even where there were obvious areas of overlap.[7] Moreover the most reliable sources of building practice for the period are building accounts and contracts, and they suggest that a rigid distinction was maintained between the two trades on site.[8]

In rural areas it is true that a single village 'carpenter' might be expected to act as a carpenter, joiner, wheelwright, and cooper,[9] much as the nineteenth-century village carpenter Walter Rose described.[10] But in towns and cities in seventeenth-century England it seems to be likely that few joiners and carpenters practised both crafts at once.

Yet the areas of overlap were grey and the two trades were frequently in dispute.[11] In London a particularly severe argument arose in 1621, forcing representatives of the two companies to meet to solve differences, and they continued to do so fairly regularly for a number of years.[12] In 1628 the talks finally fell apart over the problem of shop-windows, and the Court of Alderman of the City set up a special committee to arbitrate. The resulting Court proclamation of 1632 provides the clearest description of the two trades in the seventeenth

century. The following are the work of joiners:

1. All bedsteads 'except boarded Beadsteads and nayled togeather'
2. All chairs, and stools, made with mortise or tenon joints
3. All tables of wainscot, walnut, or other wood, glued with frames 'mortesses or tennants'
4. All forms, framed, made of boards with the sides pinned or glued.
5. Chests framed, 'dustalled [dovetailed], pinned or glued'
6. Cabinets or boxes dustalled, pinned, glued, or joined
7. Cupboards framed, dustalled, pinned or glued 'for wearing apparel Mercers Silkemen Millenors, or Napkinpressers'
8. All sorts of wainscotting, 'sealing' of houses, and 'setling' made by 'the use of two Jages'[13]
9. Shop windows 'made for ornament or beauty which Cannot be made without glue'
10. Doors framed, panelled or glued
11. Hatches 'Jaged, framed or glued
12. Pews, pulpits, and seats with desks, framed panelled or glued
13. All sorts of frames upon stalls, framed or glued
14. Picture frames, 'latesses for Scrivenors, or the like'
15. All signboards of wainscot or carved
16. All work made by one or two 'Jages' with the use of any kind of nails
17. All carved works, using carving tools and not planes
18. All coffins of wainscot; but if of other wood, can be made by either company.

And the following are the work of carpenters:

1. All tables for drapers, taverns, victuallers, chandlers, countinghouses, all tables of deal, elm, oak, beech, or other wood nailed together without glue, but not moveable tables [i.e. trestles]
2. 'Cesternstooles, washing stooles, bucking stooles' and all other stools headed with oak, elm, beech, or deal and footed with square or round feet, except framed stools which are glued or pinned.
3. All sorts of frames made of elm, oak, beech, or deal heads as long as the feet are not lathe-turned
4. Laying of floors made of elm, oak (except 'grooved' floors which are Joiners' work). Deal floors can be laid by either company
5. 'Deviding' warehouses and rooms, unwainscoted and unpanelled, with split or whole deals or other materials, except wainscot, and 'except all particions grooved glued battened or framed'
6. Shelving all rooms unwainscoted and unpanelled with seats and brackets, 'except worke in studies which wee conceive fitt to be left Indifferent to both Company'
7. All signboards not made of wainscot or carved
8. All pillars or ballasters for lights in a partition are to be made by whichever company made the partition itself
9. All galleries in churches and elsewhere unless wainscot or panelled or carved
10. Shelving in kitchens with racks
11. Floors for pews in churches, if of oak or elm; if of deal, then either company
12. All frames for screens not made of wainscot, glued, carved or panelled

Also the 'Jage' to be used by the Carpenters only for the work listed above.[14]

The carpenters mostly worked on site and contributed to the heavy work of building, while the joiners worked on more delicate pieces in the safety and cleanliness of a shop. Carpenters had an

important part to play in all aspects of building. Even when the building was to be constructed in brick or stone, they were often the first tradesmen on site. They were responsible for scaffolding, shoring up existing walls, and making battering rams to destroy old ones.[15] When the site was cleared, it was carpenters who provided walkways across the mud and shoring to the trenches for the foundations.[16] If the ground was unsound the carpenter would lay a timber raft beneath the building or drive timber piles down to firmer soil.[17] Beyond that point the method of construction varied according to the material.

For timber buildings the carpenter remained in absolute control, the mode of construction being much the same as it had been in the Middle Ages. A brick foundation would be laid, on which the sill plates would be fitted.[18] The whole frame was constructed before erection, each section being tried and measured against the adjacent pieces on the framing floor and marked with Roman numerals to identify their location.[19] The location of the framing floor might be adjacent to, or in the middle of the site, but this was not necessarily the case and a wily carpenter might even frame his building outside the city limits to avoid guild regulation.[20] Once the frame was complete it had to be raised using ropes and props. Although few carpenters were needed for the often lengthy framing process, the raising of large structures required considerable labour for a relatively short period. The floor joists and wall studs were often integral to the frames. After the raising, the floors could then be boarded.

For stone or brick buildings the sequence of works was different, and it has not been clearly described elsewhere. After clearance of the site and construction of the foundations, the carpenters' first task was to provide scaffolding for the bricklayers and masons. They might provide it themselves (as was the case at most of the City Churches), but more commonly it was constructed for them by the carpenter, who also produced and maintained the ladders, trestles, barrows, and the troughs for mixing the mortar.[21] On larger jobs it was the carpenters' task to erect storage sheds and lodges for other craftsmen.[22]

For taller buildings cranes,[23] gibbets,[24] capstans,[25] and other lifting devices were required.[26] These could be quite elaborate, as the great 'engines' at St Paul's appear to have been.[27] At St Paul's it was the carpenters' job to cover exposed masonry with shed roofs to keep off the rain. Elsewhere it sufficed to cover the top of the walls with boards or sacking to prevent water penetration over the winter months when no bricklaying or masonry could be carried out.

Centering was one of the most important aspects of carpenters' work. All masonry vaults (whether stone or brickwork), domes and arches required form-work during their construction. Centering was time-consuming and expensive, requiring structures as large as the roofs themselves, frequently at great heights above the floor. At St Paul's in April 1693 forty-one men worked under Woodstock and Longland making centres and carrying out general scaffolding works, whereas in December of the previous year only seven men were required to frame and raise part of the roof of the choir.[28] Although scaffolding and centering timber was softwood and partly reusable, it represented the largest part of the overall timber used on site. Few buildings in the seventeenth century used masonry vaults, but centering was still required for curved arches in windows and for flat arches. At present it is impossible to reconstruct seventeenth-century centering from documentary sources, because building accounts provide only the barest descriptions, and no surviving pictorial evidence has been found.[29]

During construction floor girders would have been put in as the work progressed, the ends built into the masonry unless the wall diminished in width, in which case the girder could rest upon a sill or plate on the resulting ledge. In most cases the joists were probably put in at this stage, but the floor covering would not have been nailed down to avoid it

getting damaged by weather and building work. Instead, where necessary, loose boards would be laid across the joists to make a working platform.

When the walls had reached the appropriate height, the carpenter could assemble the roof. This was framed on a framing floor, numbered, dismantled, and lifted into position, piece by piece, to be re-assembled. The roof would immediately be boarded or battened so that the roof covering could be added. Once the roof was on, the floors could be laid, plastering and joinery could begin, and the windows, doors, partitions and stairs installed. The carpenter played an important part in this work and provided timber cornices both inside and out and supporting frameworks known as 'bracketting' or 'bargetting' for the plasterer.[30] The laths, however, were the responsibility of the plasterer himself because the strength of the plaster depended on them.

CARPENTERS' GUILDS

It is tempting to account for the continuing separation of crafts by the power of the trade guilds. Yet it is generally accepted that there was a steady decline in guild power in this period. Guilds of building workers were in existence as early as the thirteenth century.[31] They ostensibly played a major part in the control of their respective crafts and provided an important welfare function in medieval urban society. In major cities like London, Norwich, and Bristol each building trade usually had its own guild or company. In smaller towns there might be no guilds or several different trades might be gathered into a single company. Thus, for instance, Cambridge never boasted a separate guild of carpenters, while Canterbury had a joint guild of Carpenters, Joiners, Bowyers, Fletchers, Cappers, Glaziers, Pewterers, Plumbers, Painters, Bricklayers & Tilers.[32] It is worth noting that the inclusion of a number of trades within the same guild did not mean that distinctions between these crafts were not preserved within the guild itself.

Building guilds probably did not have the monopoly or control that their records would suggest. Most of these are ordinances and regulations which reflect the senior members' desires rather than actual practice. Many building craftsmen lived in rural areas outside the jurisdiction of the guilds, and even in the cities, where guilds did manage to exercise a degree of control, 'peculiars' and suburbs still lay outside their influence.[33]

The situation was even more complicated in London. It has been shown that the number of carpenters enrolled in the Company only represented a small percentage of the carpenters who might be expected to be operating within the City.[34] However, existing figures fail to take note of the so-called 'custom of London', in force throughout the seventeenth century, which allowed freemen of the City to practise any trade, regardless of the one they had been apprenticed to.[35] This curious exemption has two results: first, it makes it difficult to trace individual tradesmen, and, secondly, a tradesman is often recorded with two trades. It is easy to presume, for instance, that, because William Edge is described as a Fletcher and a Bricklayer, he practised both trades; whereas it is likely that, although a member of the Fletchers' Company, he only worked as a bricklayer. The true meaning can only be surmised from the context.

A number of the most prominent carpenters in seventeenth-century London were members of other guilds. The most striking example is John Longland, who started his career as a haberdasher. He served an apprenticeship in this trade under Thomas Bates from February 1658,[36] gaining the freedom of the Company on 27 March 1666.[37] Thus up until the Great Fire he does not seem to have had any experience of carpentry. Yet after the Fire he worked on many of the City churches, and was for 35 years master carpenter at St Paul's. He remained a member of the Haberdasher's Company throughout his

Table 1. Carpenters' Companies in the late seventeenth century.

City	Guild	Source of Information
Abingdon	Carpenters	Berkshire County Record Office.
Berwick-upon-Tweed	All Building Crafts	Berwick upon Tweed Record Office
Bristol	Carpenters†	Bristol City Archives
Canterbury	Carpenters, Joiners, Bowyers, Fletchers, Cappers, Glaziers, Pewterers, Plumbers, Painters, Bricklayers & Tilers	Louw, 'Demarcation Disputes', *cit.*, 4
Chester	Wrights, Sawyers and Slaters	Chester City Record Office
Coventry	Carpenters, Tilers, Pinners	Coventry City Record Office
Exeter	Carpenters, Joiners, Masons, Painters, Glaziers	Louw, 'Demarcation Disputes,' *cit.,* 4
Gateshead	Carpenters, Joiners, Dyers, Fullers, Blacksmiths, Locksmiths, Cutlers	Tyne and Wear Archives
Hull	Carpenters	Woodward, *Men at Work*, *cit.*, 18
King's Lynn	Carpenters, Joiners & Tilers	Louw, 'Demarcation Disputes,' *cit.,* 4
Lincoln	All Building Crafts	Louw, 'Demarcation Disputes,' *cit.,* 4
London	Carpenters	Guildhall Record Office
Newcastle-upon-Tyne	House Carpenters, Mill Wrights, Trunkmakers	Tyne and Wear Archives
Norwich	Carpenters	Norwich City Archives
Oxford	Carpenters, Masons & Slaters	Louw, 'Demarcation Disputes,' *cit.,* 4
Salisbury	Carpenters and Joiners (f.1615/22)	Louw, 'Demarcation Disputes,' *cit.,* 4
Shrewsbury	Carpenters, Bricklayers and Brickmakers	Shropshire County Record Office
Stratford-upon-Avon	Carpenters	Stratford-upon-Avon Record Office
Worcester	Joiners and Carpenters (f. 1692)	Louw, 'Demarcation Disputes,' *cit.,* 4
York	Carpenters, Joiners, Carvers, Wheelwrights, Sawyers	York City Archives and York Minster Archives

† Hentie Louw lists the Bristol Company as a joint company of Joiners, Cofferers, Inlayers, and Carpenters [Louw, 'Demarcation Disputes', *cit.,* 4]. This is incorrect. Original ordinances for the separate carpenters' company are preserved in the Bristol City Archives [MS. 04369/1, fols. 167–78, 178–82, 277–80].

career, becoming a warden in 1693, again in 1700, and Master in 1701.[38] We know of Longland's case only by chance; in most cases guild records do not record the trade which the individual actually carried out. In turn this makes quantification of practising carpenters very imprecise.

The building guilds survived not so much because they ran a restrictive monopoly, but because they were beneficial to three groups in society: the craftsmen, their clients, and the city administration. For the craftsmen the company provided a limited form of welfare insurance, an opportunity to take part in the regulation of the city and the craft, and the benefit of its legal protection. For the client the guild

provided an assurance that transactions would be carried out honestly and that work would be of an acceptable standard. For the city, the guild provided a way of controlling the building process and a support to members and families who might otherwise become a burden on the city coffers. These principles remained the dominant factors in influencing guild membership in the seventeenth century.

The charitable work of carpentry guilds was exercised in a number of ways. The guild undertook to look after members who fell on hard times.[39] That was rarely necessary unless a carpenter was injured, because most regulations dictated that members of the companies should be employed in preference to others.[40] If a craftsman died his widow had the option of carrying on his trade as a full member of the guild[41] or of collecting a pension.[42] If he survived to old age the carpenter might retire to a company almshouse.[43]

Senior members of the guild were appointed as searchers.[44] In this capacity they were responsible for examining buildings and goods, and dealing with complaints from patrons. When faulty workmanship or short measure was encountered searchers could fine defaulters[45] and require them to make good.[46] The power of examination applied equally to structures, timber for sale and furniture. Many guild ordinances specified the frequency with which periodic random searches had to be carried out,[47] and the officers were empowered to enter any premises they saw fit.[48] The searchers themselves were liable to be fined if they failed to carry out their duties.[49] The guild thus played a crucial role in building regulation, particularly when there was little by way of statute. Even at its best, however, such regulation was difficult. New building in London, for instance, was mainly in the suburbs, over which the carpenters' guild had no jurisdiction, giving the potential for unlicensed craftsmen to proliferate beyond its control.

The Great Fire of 1666 finally rendered the London Carpenters' Company obsolete by removing its monopoly.[50] The rebuilding required all the labour that was available.[51] The Acts for Rebuilding, recognising this, allowed anybody to practise building crafts within the City limits.[52] Although it was meant to be a temporary relaxation of the rules, the building guilds in London never recovered.[53] New building regulations replaced the guild regulations and were strictly enforced by a system of City Surveyors, making the Company's searchers effectively redundant.[54] Men from different occupations acted as builders with a freedom unknown before. New houses could no longer be timber-framed, making carpentry a subservient trade. The resulting loss of power was never regained and the Carpenters' Company of London became progressively less important.[55]

Outside London, craft guilds seem to have retained power slightly longer, albeit with increasing difficulty. Many rural towns still used predominantly timber construction and guild regulations suggest a continuation of monopoly well into the eighteenth century, but it is difficult from the surviving documentation to determine the exact degree of control exercised in any individual case.[56]

EDUCATION AND TRAINING

Although the guilds may have played a lesser role in regulating carpentry in the seventeenth century, this probably had little effect on the way carpenters were trained. It seems likely that the typical carpenter in the late seventeenth century learnt his trade by apprenticeship in much the same way as his medieval counterpart. Unfortunately it was possible for the apprenticeship to be informal (ie. without written indenture) so this is impossible to prove.[57]

Apprenticeship followed a recognised path. When a young man was apprenticed (carpenters and their apprentices were almost invariably male in the seventeenth century),[58] he was *bound* to his master by a contract known as an *indenture* for between

seven and eight years.[59] The average age of apprenticeship for carpenters in London was much higher than is generally assumed, most being bound between eighteen and twenty years old.[60] No such figures are available for carpenters working outside the capital, but it was probably in much the same range. The relatively high age of apprenticeship presumably reflected the heavy nature of the work.

The contractual relationship between the carpenter and his apprentice was strict. The carpenter undertook to feed, clothe, and train the apprentice in return for free labour.[61] The apprentice, for his part, was forbidden to marry, drink, gamble or attend alehouses, and was required to be in constant attendance on his master.[62] Although theoretically the master could beat an apprentice for even minor infringements and misdemeanours, in practice eighteen to twenty-six year-old apprentices were notoriously difficult to discipline, and reports of apprentices being continually drunken and causing riots in cities abound in the literature of the late seventeenth century.[63] The training that the individual received was equally questionable. Just as it was difficult to dismiss an absent or unruly apprentice, so it was not easy to prevent an insubordinate and incompetent student who had served his term from gaining his freedom, especially if a master might be glad to see the back of him. In continental Europe, carpenters were required to create a 'masterpiece' before graduating,[64] but normally no such test was required to complete an apprenticeship in seventeenth-century England.[65]

At the end of his apprenticeship the carpenter was eligible to take his *freedom*. To do so he would have to join a company, pay a one-off fee to the city and then further regular amounts to the company in question (*quarterage*).[66] In doing so, he became a *free* carpenter. Most guilds required their members to have served a full apprenticeship within the city in question. In practice not all of the members of a guild, or freemen for that matter, would necessarily have entered into any such agreement. A son of an existing member of the guild was entitled to join simply by paying a fee (by *patrimony*)[67] and frequently anyone could join by making a sizeable donation to the coffers (by *redemption*). Gentlemen or minor nobility might join by redemption, but these methods was more commonly reserved for carpenters who had trained outside the city and now wished to work within it, or for others who simply had the wherewithal to jump the queue.

For poorer carpenters, entering by the traditional route, there was usually a gap of one or two years between completing apprenticeship and taking up freedom, during which the newly qualified carpenter worked as a *journeyman* to earn enough to pay the fees.[68] Many apprentices never went on to take their freedom, remaining journeymen for the rest of their lives.[69] Journeymen are the least understood group. Because they were not members of the guild, journeymen do not appear in guild records, and they are rarely distinguished in building accounts.[70] The title 'journeyman' implies an element of travelling. A tour of the country was an important part of the training for continental carpenters and remains so to this day,[71] but there is no evidence to suggest that this was the case in England. Indeed English guild regulations were openly hostile towards the employment of any worker in any capacity who had not been trained and registered locally. It was thus difficult for carpenters in one area to learn techniques used elsewhere.

London was an important exception to this rule. Guild records show that many rural carpenters in the seventeenth century chose to serve their apprenticeships in the City.[72] It is perhaps these apprentices, returning to their place of origin after serving their apprenticeships,[73] who played an important part in disseminating the techniques they had learned. London may thus have acted as an important focal point in the development of English carpentry in the period.

Journeymen could be men who had failed to

complete apprenticeships; men who had been apprenticed elsewhere, but had not yet sought freedom in the City; or simply local carpenters who had finished their apprenticeships, but had not taken up their freedom for other reasons. The first sort was regulated against in most cities, but Woodward has provided evidence to suggest that they probably represented a larger portion than the guilds wished to admit.[74] The second and third groups of journeymen tended to be tolerated, but were encouraged to join the company, sometimes on proof of ability.[75] In general journeymen worked for lower wages than free-carpenters,[76] and were banned from employing others[77] or carrying out work on their own account.[78] Outside London their master might have to provide an assurance of continuing employment and might also have to provide board and lodgings. It has been suggested that most journeymen did not go on to take their freedom.[79]

In theory all seventeenth-century carpenters would join the local carpenters' company on becoming free, and gradually become involved in regulating and administering their craft. If they did so in London, the next stage was to *take livery*. The time between gaining freedom and taking livery varied, the usual period being about a decade, but some carpenters took much longer or never made the transition at all. In a list of the Carpenters' Company of London in 1666, the Company consisted of forty-nine freemen, thirty-six liverymen and twelve senior members on the Court of Assistants (including the Master).[80] The livery was the right to wear robes. With it went an increase in fees to the company and a rise in commitment. Though it was expected that a successful carpenter would take an active part in running the guild, and would progress steadily up its ranks, in practice the busier carpenter often wished to avoid this sort of distraction. Successful carpenters could pay fines to postpone taking livery and other higher posts, and these fines were an important source of income for the company.[81]

All the guilds were ruled by two or three *wardens*, sometimes known as *searchers*. The process of election varied.[82] In some cities all the members of the guild had an equal vote, while in others only past-masters could vote. The wardens or searchers were usually ranked into *senior* and *junior* or *renter* warden. In London only a carpenter who had served as a warden, in one or both posts, could be elected *Master* of the Company. Having been Master or at least a senior member, the London carpenter could then sit on the *court of assistants*, the ruling committee of the guild.

Being a senior member of a guild was a prerequisite to holding office in the town council. A young and ambitious carpenter might theoretically ascend a simple ladder to the summit of his profession and political power in the city. In practice the carpenters' guilds did not attract the sort of wealthy and powerful men who tended to become aldermen and mayors,[83] and guild administration took up valuable time and money without offering much in return. By the end of the seventeenth century many of the leading London carpenters working under Wren had little or no connection with the guild.[84]

The method of training in carpentry was thus by no means as straightforward as it might at first seem. Although apprenticeship probably remained the normal way to train as a carpenter, there were many ways to avoid apprenticeship and few real measures to prevent any individuals who could wield the tools from setting themselves up in the craft. Furthermore, there were few regulations to follow, and except in the capital and a few large provincial towns, there was little danger of being caught. On the other hand, outside apprenticeship there were few opportunities for learning the trade. The literacy rate was surprisingly high in the late seventeenth century and many carpenters could read,[85] but until the publication of Joseph Moxon's *Mechanick Exercises* in 1680, there were no books in English from which to learn even the basic rudiments of the craft.

TOOLS

In some areas it was traditional for carpenters to give tools to their apprentices at the end of their training. W.L.Goodman carried out a study of tools mentioned in apprenticeship indentures between 1535 and 1650 in Bristol, Norwich, Great Yarmouth and Southampton.[86] From this study and the large number of tools surviving in museums and private collections, combined with the descriptions contained within Joseph Moxon's *Mechanick Exercises*,[87] it is possible to form a reasonable picture of the contents of the typical carpenters' tool-chest and their various uses. Advances in technology can be measured by comparing them with medieval tools, either surviving or reconstructed from pictorial or textual sources.

Moxon lists axe, pit-saw, whip-saw, hand-saw, tenant (tenon) saw,[88] compass-saw, bow-saw (also termed frame-saw), chisel,[89] augers, crow bar, single-handed mallet, commander (a wooden sledgehammer), claw hammer, plumb-line, level, ten-foot rule, two-foot rule and square.[90] The most basic tool used by the seventeenth-century carpenter, and the oldest, was the axe.[91] Moxon distinguished the carpenter's axe, which was two-handed, from the joiner's hatchet, which was used in one hand.[92] He also related that carpenters used the axe standing on the timber which they were cutting.[93] The long-handled axe, swung with two hands, was a fairly rough tool. The smaller hand-axe had been used in the Middle Ages.[94] It had an edge bevelled on only one side and was used as a smoothing tool. In many areas it seems to have been used instead of the adze.[95]

The adze had a long and distinguished history in carpentry, examples surviving from the Bronze Age.[96] Used to smooth timber, the carpenter again stood astride his work and used both hands. Impressive effects could be obtained by the skilled craftsmen and an adzed face can sometimes only be determined by looking obliquely along a piece of wood while shining a light in the opposite direction.

Most timber used in carpentry in the late seventeenth century was cut with the saw rather than the axe, and one of the most important distinguishing features of carpentry of the period was that, having been sawn, the timber was frequently planed rather than smoothed with the adze. The plane was virtually reinvented in the late seventeenth century,[97] but types of plane had been used in Roman times[98] and huge medieval planes are illustrated in manuscripts and mentioned in building accounts.[99] The plane is often described as a joiner's tool.[100] It is true that joiners had a greater variety of planes and used them in a larger number of ways, but the plane did play an important part in seventeenth-century carpentry. Its most important role was in fine finished work such as flooring and stairs, but the plane was also used on concealed carpentry; Sir Christopher Wren even specified planed timber in contracts for roofing.[101] Timber was also smoothed using a draw-knife, but this delicate two-handed scraping knife was unsuited to the building site and Moxon points out that it was mainly used for the manufacture of 'household-stuff'.[102]

The late seventeenth-century carpenter worked with tools which were slightly improved upon those available to his medieval predecessor, mainly through advances in their manufacture. Some tools seem to have gone out of use altogether,[103] although they may have seen continued use in rural areas. Others, like the adze, were in decline. But most of the seventeenth-century carpenter's tools would be recognisable today, and all of them had a longer history. In producing buildings, tools were only half the story, however, and carpenters were dependent on the material on which they worked. In this area too changes were under way.

TIMBER

Shortage of timber was a perennial problem for the government of England throughout the seventeenth century. Timber was an indispensable raw material

for many things beside building, yet woodland had been decimated by a combination of greed and bad management.[104] The felling of timbers for agricultural clearance and for iron smelting had been going on for centuries, and to these the later seventeenth century added the requirements of the Navy. Much of the timber in Royal Forests had been sold off for quick profit in the Civil War. A third-rate ship of the line might require up to 3,800 trees (some 78 acres of woodland)[105] and seventeenth-century ships needed continual repair and replacement. The history of the Navy was thus inextricably bound up with that of timber supply. By the late seventeenth century procuring adequate naval timber was becoming extremely difficult.[106] Timber prices were rising accordingly, and the problem was exacerbated by the destruction of the City's buildings in the Fire of London.[107]

Timber for building in rural areas was often available locally, but where this was not the case, and in cities, the carpenter, architect or building owner might have to travel widely to secure adequate supplies. Carpenters' guilds sometimes traded in timber or exercised buying privileges in cities.[108] The Carpenters' Company of London ran their own timber yard and the accounts from the first half of the seventeenth century show that before the Civil War timber was available to members of the company on credit.[109] This was probably still the case after the Restoration, but no documents survive from that period. Carpenters and landowners often sold timber when they had a surplus and large timbers might be transported hundreds of miles for use in particularly prestigious buildings.[110] The London carpenter could also acquire raw materials from independent commercial timber merchants. Sir William Warren was one of the most prominent merchants of the age. He seems to have concentrated on supplying timber to the Navy[111] and Pepys records in his Diary being taken around his extensive yards in Deptford.[112] Similar less prestigious merchants probably operated elsewhere. No research has hitherto been carried out on these important individuals. This may be due to the absence of a timber merchant's guild;[113] the Company of Woodmongers were suppliers of fuel rather than building materials.[114] It is thus probable that any regulation of the timber trade that existed came through the Carpenters' Company, but this is not likely to have been great. Few of the London timber merchants seem to have been members of the Carpenters' Company. Carpenters and architects were left to strike bargains and examine timber measures as their means allowed; dishonesty and fraud were real concerns.

Oak was the timber of choice for building construction.[115] English oak was particularly valued.[116] Wren advocated its use in preference to all other timber in his report on Westminster Abbey,[117] The Act for Rebuilding London specified that all structural timber for roofs, windows, lintels, and cellar floors must be oak,[118] and a ready supply was vital to shipbuilding.[119] Pepys's diaries reveal his preoccupation with procuring oak for the Navy.[120] Officially the Navy was meant to have had the choice of oak grown in Britain, and under an Act of Parliament crooked timber, especially valuable for ship-building, was reserved for naval use in 1653.[121] Purveyors were appointed to seek out and reserve oak and elm for government use. In practice these ordinances were ineffectual, and the navy had to compete with the building industry in acquiring oak on the open market.[122] Here it was at a disadvantage, being, like other crown departments, continually in arrears and unable to pay its debts until years after purchase.[123] Building work was more flexible. Oak was no less scarce, but private clients could pay cash and architects and carpenters were often prepared to search far and wide to procure the longest timbers. Still it was preferable to use timbers locally produced. Carriage of wood across land was difficult. Logs were transported on *tugs*, sets of cartwheels attached to each end of the logs and pulled by oxen or horses.[124] These were slow, costly, and easily became bogged down in mud in damp weather.

Timber could be transported much greater distances by barge or ship.[125] Oak from Nottinghamshire and York was used at St Paul's, and by the 1670s an increasing quantity of oak was being imported from the Baltic states. The patriotic bias in favour of English oak probably disguises the extent to which continental oak was actually employed, but by 1677 the Navy had accepted the use of Baltic oak in shipbuilding[126] and it probably also had a more widespread use in building than is generally acknowledged.

Besides oak, carpenters used elm, chestnut, spruce, pine and fir. Other woods, such as larch, may have been employed in individual cases, but they were less common.[127] Elm had been used in medieval carpentry.[128] In the seventeenth century it seems mainly to have been used for stair treads and more expensive floor boards, where its curving grain could better be appreciated.[129] Evelyn also suggested its use for ships, below the water-line, and for pipes and water-wheels because of its apparent resistance to rot when immersed in water.[130] Chestnut was also used in structural carpentry. Evelyn claimed that, next to oak, it was 'one of the most sought after by the Carpenter and Joyner', and that it was widely used in London.[131] Wren, by contrast, was scathing, stating that

> though we have also the best Oak Timber in the World, yet these senseless Artificiers in *Westminster-hall* and other Places, would work their Chestnuts from Normandy; that Timber is not natural to England, it works finely, but sooner decays than Oak.[132]

There is nothing in the records to suggest that chestnut was used in any great quantity in the seventeenth century for structural carpentry. It seems to have been out of fashion. However, softwoods such as spruce,[133] pine and fir were becoming increasingly common. Most softwood was imported. Baltic deals had been used well before Evelyn wrote of pine and fir,

> For the many and almost universal use of Trees both sea and Land will Plea, —*dant utile Lignum, Navigiis Pinos*—-They make our best Mast, Sheathing, &c. heretofore the whole Vessel. . .With Fir we likewise make Wainscot, Floors, Laths, Boxes, and wherever we use the Deal; nor does any Wood so well agree with the Glew as it, or so easie to be wrought: It is also excellent for Beams, and other Timber-work in Houses, being both light, and exceeding strong, where it may be lie dry everlasting, and an extraordinary saver of Oak where it may be had at reasonable price. I will not complain what an incredible mass of ordinary Money is yearly exported into the Northern Countrys for this sole commodity which might all be saved were we industrious at home.[134]

Timber as supplied by merchants was frequently sawn. In London, to prevent short-measure, the sizes of sawn timber were regulated by the Carpenter's Company. A list of the acceptable sizes for all types of sawn timber, and the measures in which they could be sold was included in their Company rules set down in 1607.

In seventeenth-century England, timber was still sawn by hand using a pit-saw. Sawyers, though generally lowly paid, were highly skilled, leading them to push for their own guild in London in the late seventeenth century; but this was blocked by the other building guilds, who relied heavily on their labour and low pay for their profits.[135] Elsewhere in Northern Europe saw-mills with water, wind or horse power and multi-bladed reciprocating saws had replaced this primitive tradition.[136] The boards produced by such mills were cheaper than hand-sawn timber, even allowing for transportation costs, and most sheet timber in this period was therefore imported from the Baltic states.[137] These fir 'deales' came by ship to London, where they were unloaded by lighter and stored in the timber yards, which would normally be on or near the wharves along the Thames.

Timber for ship-building and for internal uses in building had to be seasoned, but structural oak would typically be worked green.[138] This is still the practice

Table 2. Timber measures in London, set out in the Ordinances of the Carpenters Company in 1607 [Guildhall MS. 4339, 108–111].

Timber Measures		
Name	**Size**	**No. in a Load**
Load	50 solid feet (cu.ft)	1
Tonne	40 solid feet (cu.ft)	–
'Baulk'	any length, square section: 4"x 4" – 10" x 10"	Varies (measured individually)
'rafter'	12' long, 4½" x 4" at one end, 4" x 4" at the other	30
'joists'	8' 6" x 5" x 4½"	30
'pantions'	5' 5" x 5" x 4"	40
'bedsides'	6' 5"x 10" x 2"	50
'double quarters'	8' 5" x 4½' x 3'	50
'single quarters'	8' 5" x 3½" x 2"	100
'stable plancks'	5' 5" x 12" x 2"	40
'quarter boards'	Width and length varies, thickness tapers from ⅓" to 1."	Sold by flat measure (in batches of hundred sq. ft)
'seeling boards'	Width and length varies, thickness tapers from ½" to ⅓"	Sold by flat measure (in batches of hundred sq. ft)
'plancke boards'	Width and length varies, thickness 1"	Sold by flat measure (in batches
		of hundred sq. ft)
'Lathes'	4'–5' x ½" x ⅓"	Sold in bundles, 100 lathes a bundle, 30 bundles a load

in large-section timber-framing today. Seasoned hardwood is too hard to be worked easily, and the drying out of the timber and the resulting shrinkage can, in correctly designed joints, actually draw the members together. Moreover it would have been impractical to set aside the timbers for the decade or so necessary to dry out the sections of twelve or more inches which were commonly used in building in this period. Inevitably unseasoned timber developed shakes and other defects, but the sizes of timbers were such that these flaws made little, if any, difference to the structural performance of the various parts.

PAY AND WORKING HOURS

Carpenters, in common with other building craftsmen in the late seventeenth century, were usually paid by the day or half day. It was therefore important that the meaning of the term was clearly understood. The Statute of Artificers had set out the minimum working day in 1563. Between mid-March and mid-September workmen had to be at their posts by 5 a.m. and were to remain there until 7 or 8 p.m. They were allowed breaks totalling no more than two to two and a half hours. In winter they were to work the hours of daylight.[139] A typical statutory working

day was thus between twelve and thirteen working hours after breaks. Working hours may have relaxed slightly in the seventeenth century. In Bristol carpenters were required to work from 5 or 6 a.m. until 7 p.m. with time off for 'breakfast' and 'dinner',[140] while carpenters in York were required to work twelve hours, or forfeit 6*s* 8*d* for every hour lost.[141] In Hull the day was even shorter, with workmen being entitled to overtime in summer for working outside the hours of 6 a.m. to 6 p.m. .[142]

Theoretically workers in seventeenth-century England worked a six-day week, only Sunday being a day of rest. In practice the year was punctuated by numerous public holidays. The myth that the Reformation reduced the number of holidays by a fifth and thus increased the effective working year has been disproved,[143] but it remains difficult to determine the number of holidays in the late seventeenth century.[144] Some light can be thrown on the subject by examining the accounts of St Paul's Cathedral,[145] looking at three consecutive years 1686, 1687 and 1688. These show a remarkable consistency in the maximum number of working days per month (21 to 27 days) and suggest one or two days of holiday each month, with September and May only averaging 22 working days. However, some caution needs to be used in this interpretation: the difference may only indicate days lost through particularly bad weather[146] or sickness.

The effective working year was, in any case, reduced for carpenters and other building workmen by winter, when stone and bricklaying work could not be carried out. In general little work was done on site from early December to the beginning of March.[147] In these periods carpenters presumably worked indoors, making furniture and other items, or they sought a living elsewhere.

Carpenters' pay is more difficult to analyse. A survey of the daily wages of building craftsmen in the north of England has shown that they rose, but barely kept pace with inflation.[148] It seems likely that the same applied in London. Carpenters' pay at St Paul's (2*s* 6*d*) was comparable to wages in York in the same period, which varied between 2*s* 6*d* and 2*s* 8*d*.[149] It is important to remember that these figures are the amounts paid to overseers for the men under their control. The workers did not necessarily receive more than a fraction of this.[150]

EMPLOYERS AND EMPLOYEES

Elizabeth McKellar has suggested that the commercial practices of seventeenth-century building craftsmen were closer to those of modern building contractors than had hitherto been acknowledged.[151] Her concern was primarily with master builders who employed representatives of different trades, but individual trades also acted as businesses. Unfortunately the nature of contracting in seventeenth-century building operations and the lack of surviving accounts of building organisations themselves make it extremely difficult to determine the structure and nature of individual building firms.[152]

Wren left a well-known description of the various forms of contracting at the time, dividing them into *By Day*, *By Great* and *By Measure*.[153] All three systems were used for carpentry. St Paul's, for instance, was carried out mostly by day rate, the City Churches were mostly by measure, but St Michael Bassishaw was contracted by great. It was not uncommon to carry out works using a combination of several methods. Day rates might be used for scaffolding and form-work, while roofs and floors might be specified by measure or by great. By measure or by great implied the existence of carpentry firms, for it was up to the contractor to find and contract his own labour. Unfortunately these two methods leave building accounts which tell us least about the numbers employed, as all payments were made to a single person. Day rates leave accounts which record the number and names of individuals employed, but they do not necessarily reveal any

relationship between the individual craftsmen and their overseer, although presumably master carpenters would prefer to use men they knew.

The master carpenter in charge of any major work carried a considerable quantity of financial risk. The greatest and most obvious was that associated with contracting by great. Here the contractor had to estimate accurately the cost of a project before its execution. The complexity of the calculations involved had led to a literature on measuring for carpenters,[154] beginning as early as 1556 with L.Digges's *A Boke Named Technicon*, a calculating aid written specifically for 'Carpenters, Joyners, Plaisterers, Upholders and the like'. Demand led to eighteen reprints over the coming century. Other authors were quick to follow. As well as providing methods of calculating volumes and areas of timber, some of these books gave instruction in simple geometry. Both Digges's *Boke* and J.Darling's *Carpenters Rule Made Easy* (1658) were specifically aimed at those who could not read easily and consisted almost entirely of tables.

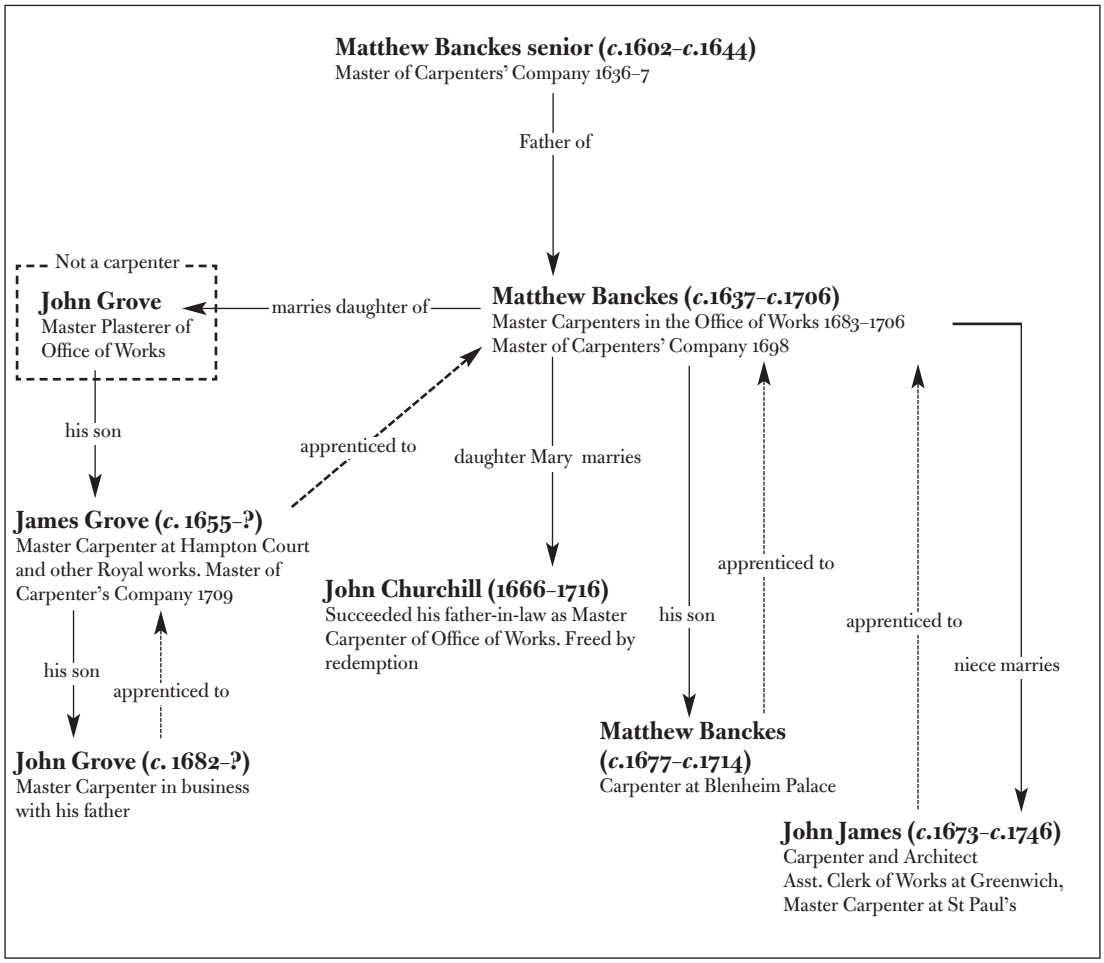
After the Restoration, books on measuring became increasingly complicated, but no less common. The surge of titles after the Great Fire may reflect a growth in the number of measurers, although they are probably too specialised for general use by carpenters, who may well have continued to use the simpler *Boke named Technicon,* readily available throughout the period. Nevertheless the sheer number of books clearly demonstrates the literacy of seventeenth-century carpenters. Modern studies have shown that the literacy rate in the seventeenth century was considerably higher than might be expected, even among the lower classes.[155] The master carpenter who managed a large number of men and controlled large sums of money was likely to be able both to read and calculate, and thus had the means to better himself. This is also suggested by the large number of carpenters who could write their own names, by surviving account books which belonged to carpenters, by receipts produced by them, and by the complexity of the contractual agreements to which they put their signatures.

Despite the literature to help them there were occasions when carpenters found themselves in debt and begging their employers for more money on completion of the work.[156] Even those who had calculated correctly, however, still carried enormous financial risks. For, whether paid by measure, by great or by day, the carpenter would have to rely on his employer for settlement and might have to wait months or years. This was particularly the case with the Crown which, unfortunately, was also one of the largest employers.[157]

The inability of the Restoration Crown to settle its debts caused serious problems for seventeenth-century craftsmen.[158] James Groves, employed on Hampton Court Palace, was still owed over £1,000 five years after the completion of work.[159] Knoop and Jones have noted that banks, which were being formed in London at this time, did not lend to masons and the situation was probably similar for carpenters.[160] It is unclear whether Groves paid his workmen in this instance or whether they had to wait for the debt to be settled. At Hampton Court at least materials were provided. Where a contract was by great the carpenter would have had to carry even larger sums as debt. If these were not passed on to the supplier they would no doubt have fallen to the individual. The carpenter employed on the Royal Works had either to find men willing to supply materials and labour on credit (presumably with the hope of receiving higher reward eventually), or had to have the means to pay for such out of his own pocket. If the latter were the case, it might explain why only a small number of men were involved at the highest levels of the craft. Men like John Longland, Israel Knowles or Matthew Banckes had enough jobs to provide a flow of capital, while others, like James Groves, who was son of the Master Plasterer of the King's Works, may have been able to borrow from friends and relatives. Pepys recounts a number of large loans that he made to friends and colleagues on

which he could charge interest. This created a useful source of income. It is not unreasonable to imagine a similar system operating between networks of craftsmen. This hypothesis is strengthened by the fact that there were strong family and master-apprentice relationships between many of the most prominent master carpenters of the day. An example of this can be found in the relationships of Matthew Banckes, Master Carpenter in the King's Works, summarised in Table 3. As this shows, James Groves was not only the son of John Grove, the Master Plasterer of the Kings Works, but was also apprenticed to Matthew Banckes (his uncle by marriage), as was John James,[161] who married Banckes's niece. One of Banckes's daughters married John Churchill, who took over from Banckes as Master Carpenter of the Works and of Windsor Castle. Another married Charles Hopson, the joiner at Greenwich.[162] Similar connections could no doubt be traced elsewhere and provided a way of spreading the risk and financial burden of individual projects.

Table 3. Matthew Banckes and his circle.



The risks in carpentry contracting were great, but equally there were ample opportunities to make a profit. If carpenters were able to carry the debts involved in dealing with the Crown, it is likely, as Colvin has proposed, that they also gained more substantially by doing so.[163] When contracting by great the Office of Works was placed in a poor bargaining position and the contracts it made were likely to be favourable to the contractor. The Great Fire had also created a huge quantity of work. The prices for oak had risen sharply with an increased demand from the Navy and an increasing shortage of timber.[164] While potential builders complained of profiteering among London timber merchants,[165] carpenters no doubt added a profit to any timber they purchased. For larger jobs it was not uncommon for the carpenter also to contract to supply some of the materials from his own sources.[166] Such sums could be used to offset unfavourable rates by measure.

Another source of profit was open to the employer-carpenter overseeing day-work. When working by day each carpenter was theoretically paid individually, but this probably was not the case in practice. In 1710 Richard Jennings, Master Carpenter at St Paul's, was charged with cheating his men by only paying them a fraction of the amount he received for their labour.[167] In his defence he answered that this was the normal practice of the time.[168] Recent analysis of the accounts of the Townsend family, Oxford masons, has confirmed this to be the case.[169] For each 2*s* 6*d* paid to a carpenter, Jennings received between 6*d* and 10*d* each a day.[170] Taking into account the one hundred and forty carpenters under his control, this amounted to at least £3 10*s* a day: a sum of between £600 and £1,000 a year.[171]

Thus, despite all the apparent problems with collecting payment, it seems likely that some carpenters, at least, amassed considerable wealth from practising their craft. This is reflected in the fact that, contrary to the trend in the previous centuries, more carpenters' sons began to follow their fathers into the family trade.[172]

The more successful master carpenter contractors of the late seventeenth century were thus far from the rough mechanics caricatured in the literature of the time. Those working on major projects were considerable businessmen, operating in a complex network of business relationships. Their literacy, numeracy and wealth would have put them on a level above the common artisan and closer to that of the gentleman architect. The frequent conversations between Hooke and master craftsmen were not between social equals, but the differences were more educational than economic.[173]

NOTES

1 The substance of this article grew out of my Ph.D. Thesis, 'Sir Christopher Wren, the Royal Society and the Development of Carpentry' (University of Cambridge, 1999) supervised by Professor Andrew Saint and Mr A.P. Baggs. Funding for the research was provided by the Worshipful Company of Carpenters, the Drapers' Company, the Tallow Chandlers' Company, the RIBA, the Dyers' Company, the Worshipful Company of Architects and Ashville College, Harrogate.

2 John Summerson, *Georgian London*, Harmondsworth, 1945.

3 David Yeomans, *The Trussed Roof*, Aldershot, 1992.

4 Elizabeth McKellar, *The birth of modern London,* Manchester, 1999, *passim,* but particularly chapters 4 & 5.

5 Howard Colvin, *A Biographical Dictionary of British Architects 1600–1840,* New Haven and London, 1995, 23.

6 R.Campbell, *The London Tradesman,* London, 1747, 158–9.

7 Hentie Louw, 'Demarcation Disputes between English Carpenters and Joiners from the Sixteenth to the Eighteenth century', *Construction History,* V, 1989, 3–20.

8 Both building contracts and accounts survive in large numbers from this period. My conclusion is chiefly drawn from those included in the collected volumes of the *Wren Society*, Oxford, 1923–43, Volumes I–XX (hereafter *WS*); the surviving contracts and accounts for the King's Works in the Public Record Office at Kew (hereafter PRO); those for the City Churches in the Guildhall Library in London (hereafter Guildhall); the accounts of the building of the Wren Library at Trinity College, Cambridge, and the Wren Chapel at Emmanuel College, Cambridge, held in the respective college archives; and the documents reprinted in R.T. Gunther, *The Architecture of Roger Pratt*, Oxford, 1928.

9 William Clift and his son worked as sawyers, carpenters and joiners in rural Dorset [James Ayres, *Building the Georgian City*, New Haven and London, 1998, chapter 6, n. 54].

10 Walter Rose, *The Village Carpenter,* Cambridge, 1952.

11 Hentie Louw, *op. cit.*; similar disputes in Hull, Chester, Newcastle and York are cited in Donald Woodward, *Men at Work: Labourers and Building Craftsmen in the Towns of Northern England, 1450–1750*, Cambridge, 1995, 18–9.

12 Details in B.W.E.Alford and T.C.Barker, *A History of the Carpenters' Company,* London, 1968 (hereafter Alford and Barker), 77–80; Edward Basil Jupp, *An Historical Account of the Worshipful Company of Carpenters of the City of London,* London, 1887, 265–67 & 304–06; Hentie Louw, *op.cit.*.

13 It has been suggested that "a 'Jage' was probably some kind of metal device for strengthening joints" [Alford and Barker, *op. cit.,* 80]. The word is not in the Oxford English Dictionary, but it does list 'jagged' as a nineteenth-century American word for dovetailing. As the above passage already mentions dovetailing it is clear that this was not the intention here. A.P.Baggs has drawn my attention to the Penguin Dictionary of Slang which lists a *Jague* as a ditch, suggesting it may have meant a groove. In other words joiners did panelling held in grooves.

14 Alford and Barker, *op.cit.*, 78–80, quoting from the Repertory of the Court of Aldermen of the City of London, 46, fols. 361–82b, 385b.

15 For instance, at St Paul's the carpenters were responsible for demolition of houses adjacent to the cathedral prior to the commencement of work [Guildhall, MS. 25 471, XVI, 6, 24, 27, 29, & 31, September 1665 – January 1665/6]. These were presumably timber, but the carpenters were also involved in demolishing a dangerous part of the old choir in September–December 1667 [Guildhall, MS. 25 471, XVI, 69].

16 At St Paul's, John Longland and four men were paid for walkways between October 1674 and June 1675 [Guildhall, MS. 25 471, XVI (b), 7] and 'Shoreing the Banks of the Foundations on the N.E. Side and End of the Quire' in August 1675 [Guildhall, MS. 25 471, XVI (b), 19].

17 In the contract for the foundations of St Olave Jewry it is stated that 'Mr Banckes Carpenter to lay a foundation of timber six inche square in hart of oake and for the Steple of St Olave Jewry about eight foot long. In manner foll. (*viz*) nine peeces to be laid one way and after the Spaces are well Ramed to a Levell, to lay nine peeces at equal distances, Cross, and up on the first' [Guildhall MS. 25 542, I, 220]. John

Longland was contracted to drive iron-tipped timber piles for the foundations of the tower of St Lawrence Jewry on 10 October 1672 [Guildhall, MS. 25 542, I, 203].

18 The brick sill may have sometimes been added after the erection of the building by propping it up until completion [Richard Harris, *Discovering Timber-Framed Buildings,* Risborough, 1978, 16–7].

19 The methods of erecting and marking buildings have been studied extensively by the Weald and Downland Museum. The results of these studies are summarised in Harris, *op.cit.* (marking of timbers is discussed on page 15), and in the journal *Mortice and Tenon,* nos. 1–7.

20 In Norwich the Guild actually passed a bylaw to prevent precisely this: '24- if a house is framed outside the city but to be set up inside the carpenters to pay for it to be searched 5*s* for a house of length 20' or under and 10*s* thereover' [Norwich, Norfolk Record Office, Rye MS. 31, 28, 'Rules & Byelaws of the Carpenters' Company of Norwich 1594–1747'].

21 For scaffolding see Banckes's estimate for the works at Winchester Palace [*WS*, VII, 56–57]. For ladders: St Paul's May 1692 'Carpenters [. . .] Make 20 New Ladders' [*WS*, XIV, 96]. Longland employed Jo Hawtin, a wheelwright, to help fix the barrows.

22 Eg. at Trinity College Library, Cambridge, Thomas Silk, carpenter, was paid for erecting a building for the masons: 'For 100 & a halfe deals for ye Masons Lodge – £8–6–8' [Trinity College, MS. 0.4.47, 119]. At St Paul's there were many occasions of sheds being erected. For example John Longland was paid for erecting sheds for the masons in July 1675 [Guildhall, MS. 25 471, XVI (b), 12].

23 The most common type was a simple A-frame termed 'Sheares'. These were employed extensively at St Paul's eg. September 1676 'Carpenters [. . .] making moving Sheeres for the Mason's Work, helping to remove them from one place to another as the Masons had occasion to crane the Stones to the Work' [Guildhall, MS. 25 471, XVII, 62].

24 Simple lifting device with only a pivoting horizontal arm. Records for St Paul's between April and June 1683 show 'Carpenters [. . .] Makeing and Setting up a Gibet to sett the Window' [Guildhall, MS. 25 471, XXIV, 27].

25 Winches usually used in conjunction with 'sheares' as at St Paul's August 1676 'Carpenters [. . .] In making & setting up Sheeres, making Capsterns and Capstern Houses' [Guildhall, MS. 25471, XVII, 56].

26 Elaborate lifting devices from the late seventeenth century are shown in André Felibien, *Des Principes de l'Architecture,* Paris, 1699, plates XX–XXII, but not in Moxon. A discussion of the mediaeval equivalents can be found in John Fitchen, *Building Construction Before Mechanization,* Cambridge, Mass., 1996, 91–7.

27 Feb 1687/8 'Carpenters. . .framing an Engine to hoist up Rubble & Morter & fixing same Engine on top of the same leg [S.W. leg of dome]. . . fixing such another Engine on the inside of the N.E. leg of the Dome' [Guildhall, MS. 25 471, XXIX, 46].

28 Guildhall, St Paul's Cathedral Building Accounts, MS. 25 471, XXXIV, 45.

29 The reconstructions in John Fitchen, *Building Before Mechanization,* Cambridge, Mass., 1996, 100–02; and John Fitchen, *The Construction of Gothic Cathedrals,* London, 1981, ch.5, although useful and interesting, are hypothetical and speculative.

30 *WS*, X, 65 & 79.

31 L.F. Salzman, *Building in England down to 1540*, Oxford, 1952, 33.

32 Louw, *op. cit.,* 4.

33 Alford and Barker, *op. cit.*, 31–2.

34 *Idem.*

35 Robert Ashton, *The City and the Court 1603–1643,* Cambridge, 1979, 48–9 and 58–9. Strictly speaking after 1634 the custom of London applied only to 'marchandizing and trades' not crafts, but the number of examples of senior carpenters being members of other guilds in the second half of the century suggests that in carpentry at least this ruling was not enforced.

36 Guildhall, MS. 15860/6, Records of the Haberdasher's Company, fol. 49.

37 *Ibid.*, MS. 15857/2, Records of the Haberdasher's Company.

38 *Ibid.*, MS. 15870, Records of the Haberdasher's Company.

39 The by-laws of the London Carpenters' Company state that a brother who had fallen on hard times must not be allowed to 'suffer or perish' and must be helped from the 'poor box' [Guildhall, MS. 4339, Byelaws of the Carpenters' Company, 84–5]. In York all brethren who had fallen upon hard times were entitled to 4*d* a week [York, York Minster Archives

(hereafter YMA), MS. QQ80/3/2, Ordinances of the Carpenters' Company of York, fol. 2r].

40 Alford and Barker, *op.cit.*, 61: 'It is ordained that if any of the said Brotherhood have need to a workman at any time & another of his Brethren is out of Work & have no work to do, that the said brother that has need of a workman shall rather take into work his brother [. . .] than any other that is not a Brother' [YMA, MS. QQ80/3/2, fol. 2r].

41 In Bristol [Bristol, Bristol City Archives (hereafter BCA), MS. 04369/1, City Ordinances 1606–1745, article 18, fols. 172–73].

42 On the role of widows see Donald Woodward, *Men at Work,* Cambridge, 1995, 84–91, and Richard Hewlings, 'Women in the Building Trades', *Georgian Group Journal,* X, 2000, 70.

43 These were relatively rare. Two fifteenth-century almshouses built for the company in London were rented out after a relatively short period [Alford and Barker, *op. cit.*, 50].

44 The method of election varied between companies. In York the previous year's searchers suggested eight names and the members then communicated their preference to the two youngest and two eldest members of the company [YMA, MS. QQ80/3/2, Ordinances of the Carpenters' Guild, article 44, fol. 13r].

45 The fine for defective work was £5 in Norwich [Norwich, Norfolk Record Office (hereafter NRO), Rye MS. 31, Laws of the Carpenters' Company, 1684, article 7, fols. 12–3] and 6*s* 8*d* in York [YMA, MS. QQ80/3/2, Ordinances of the Carpenters' Guild, article 44, fol. 3v].

46 For instance, this was the case in Bristol [BCA, MS. 04369/1, Carpenters Company Ordinances, fol. 178].

47 Normally quarterly, as was the case in Norwich [NRO, Rye MS. 31, Laws of the Carpenters' Company, 1684, article 23, fols. 27–8], which allowed the searchers to collect quarterage at the same time.

48 The fine for failing to allow entry of a searcher in Norwich was 10*s* [NRO, Rye MS. 31, Laws of the Carpenters' Company, 1684, article 21–2, fols. 25–7].

49 For example, in York searchers were liable to a fine of £10 for failing to carry out their duties [YMA, MS. QQ80/3/2, Ordinances of the Carpenters' Guild, article 45, fol. 13v]. The equivalent fine in Norwich was 20*s* [NRO, Rye MS. 31, Laws of the Carpenters' Company, 1684, article 23, fols. 27–8].

50 T.F.Reddaway, *The Rebuilding of the London after the Great Fire*, London, 1940, 21.

51 *Ibid.*, 112–136.

52 *Statutes of the Realm,* V, 606, 18° & 19° Car II c.8, Article XVI.

53 Jupp, *op.cit.,* 280–81. The Company complained about a drop in number of admissions to the Mayor in a petition in 1681: 'the number of Persons formerly made Free of the Petitioners Company, and what are lately Admitted: a true Account whereof is as followeth: In the year 1663. .74; In the year 1664. .76; In the Year 1665. . .35 (it being the sickness year); In the year 1684. .15, In the year 1685. . .14; In the year 1686. .14; In the year 1687. . .31; In the year 1688. . .20.' [Jupp, *op. cit.*, 314].

54 Reddaway, *op. cit.*, 68–90.

55 Alford and Barker, *op. cit.*, 114–20.

56 Guild regulations continued to be made in the eighteenth century and survive in the archives in Norwich, York, and Bristol.

57 On the problems of tracing apprenticeship see Joan Lane, *Apprenticeship in England 1600–1914,* London, 1996, *passim.*

58 'Only boys were apprenticed to building craftsmen in Northern towns,' [Woodward, *op. cit.*, 53]. In London there is only one recorded instance of a woman being admitted as an apprentice, that of Rebecca Gyles in 1668 who was bound to a widow and later asked to be made free by the Company [Jupp, *op. cit.*, 161]. The Company, interestingly, could see no reason for refusal. The case appears to have been exceptional. Widows, however, were usually entitled to continue their husbands' businesses unhindered and occasionally appear in Company books in this capacity [Woodward, *op. cit.*, 84–91].

59 G.J.Eltringham, 'Notes on Apprenticeship in the Carpenters' Company of London in the 16th and 17th Centuries', unpublished essay [Guildhall, dated Nov. 1954, 6]; Jupp, *op. cit.*, 363.

60 Eltringham, *op. cit.*, 7.

61 Lane, *op. cit.*, *passim*; Woodward, *op. cit.*, 53–64.

62 In London the bylaws of the Carpenters' Company relate how these rules were being generally abused and how the master had to ensure that all apprentices went to church [Guildhall MS. 4339, 90–2, 96–7].

63 Eg. *The Diary of Samuel Pepys* edited and

transcribed by Robert Latham and Robert Matthews, London, 1983, (hereafter Pepys, *Diary*), I, 39, 54; V, 99–100, 222–23; IX, 129–30, 132, 133, 152.

64 The practice is long established in France. For an explanation of the modern practice see Cameron Scott, 'Learning the Ropes', *Mortice and Tenon,* II, 1995, 10–1. For the general history see Antoine Moles, *Histoire des Charpentiers,* Paris, 1949, *passim*.

65 The exception was in York, an act requiring a 'humbling piece' being passed in 1619 [YMA, MS. QQ80/3/2, Ordinances of the Carpenters' Guild, article 46, fol. 14].

66 Quarterage in London was 1*s* 4*d* for carpenters without an apprentice, 2*s* for those with one [Guildhall MS. 4339, 80–2]; in Bristol it was only 4*d* [BCA, MS. 04369/1, fol. 170); 2*d* in Norwich [NRO, Rye MS. 31, fols. 14–5].

67 In London there was a stipulation that even those joining by patrimony had to be bound and submit to a test of competence [Guildhall MS. 4339, 90–2]. This was not the usual practice elsewhere.

68 In Bristol this practice was expressly forbidden and all those who completed their apprenticeship had to join the Company within one month [BCA, MS. 04369/1, 175].

69 As such they fail to appear on any of the City registers.

70 On problems of analysing the position of journeymen see Woodward, *op. cit.*, 64–72.

71 Cameron Scott, *op. cit.*, *passim*.

72 Forty-three per cent of apprentices enrolled in 1687 were from outside the capital [Eltringham, *op. cit.*, 2–3].

73 *Ibid.*, 3.

74 Woodward, *op. cit.*, 65, 71–2.

75 Unfranchised men were generally treated the same as men from outside the city (foreigners). In London the regulations ruled against employing foreigners [Guildhall, MS. 4339, 98–100]. In Norwich no person could work without the permission of the Headman and Wardens [NRO, Rye MS. 31, article 16, fols. 20–1]; similarly, in Bristol foreigners could only work with permission of the Master and Wardens of the Company [BCA, MS. 0439/1, articles 11–2, fol. 171] and in York no unfranchised man or foreigner could be employed without permission of the searchers [YMR, MS. QQ80/3/2, article 13, fol. 6^{v}].

76 In Bristol, no master workman was to be paid above 2*s* a day, no journeyman or 'eldest apprentice' above 20*d* a day, and all other apprentices were limited to 16*d* a day [BCA, MS. 04369/1, Ordinances of the Carpenters' Company, fol. 37].

77 Norwich [NRO, Rye MS. 31, article 11, fols. 16–7].

78 The relevant articles in the by-laws of carpenters' guilds in the various cities are as follows: London [Guildhall, MS. 4339, 98–100]; York [YMR, MS. QQ80/3/2, article 38, fol. 11^{v}]; Norwich [NRO, Rye MS. 31, article 16, fols. 20–1]; Bristol [BCA, MS. 0439/1, article 11, fol. 171].

79 Woodward, *op. cit.*, 72.

80 Guildhall, MS. 4326/10, Warden's Accounts, entry dated 19 June 1666.

81 In London the fine was five marks [Guildhall, MS. 4339, 82–3].

82 Norwich had a large number of officers, consisting of two wardens, six searchers, and a 'Headman'. Selection was by committee. The assembled Company elected a committee of four who selected eight more. This committee of twelve then appointed the Wardens and Headman [William Hudson and John C. Tingey (eds.), *The Records of the City of Norwich,* II, Norwich, 1910, 279]. In Bristol the arrangement was that the existing Master nominated a candidate, and another was put forward by the Company, the new Master being decided by an open ballot by the whole assembly. A similar system operated for the Wardens, with the newly elected Master putting forward one candidate for 'First Warden' and the Company the other. The First Warden then nominated a candidate for second Warden [BCA, MS. 04369/1, articles 5 and 6, fols. 169–70]. The Company in York seems to have been ruled by a committee of four 'searchers'. The existing searchers nominated eight candidates from whom four were selected by secret ballot [YMA, MS, QQ80/3/2, fol. 13]. In London a court of the past masters and wardens met on the second Monday in August each year to decide the master and three wardens for the following year [Guildhall MS. 4339, 74–6].

83 For instance, in London Jupp can only list the case of Sir John Cass, Kt. and Alderman, a Liveryman of the Company who was chosen as a Sheriff in 1711, and in consequence made Master in the same year [Jupp, *op.cit.,*195]. In Norwich the most prominent carpenter of the period was Palfreyman Sheffield

(*c*1605?–1661), who was made a common councillor [John Pound, *Tudor and Stuart Norwich*, Chichester, 1988, 40]. Sheffield gained his freedom by apprenticeship in 1630 [Percy Millican, *The Register of the Freemen of Norwich 1548–1713,* Norwich, 1934, 29] and on his death left behind goods and chattels worth £1049 [Inventory: PRO, PROB. 4/87, quoted in Pound, *op.cit.,* 40].

84 Analysis of the carpenters listed in the Wren Society compared with the lists on microfilm at the Guildhall [Guildhall, MF. 21 742/1–2] shows that less than 10% were members of the guild.

85 David Cressy, *Literacy and the Social Order: reading and writing in Tudor and Stuart England*, Cambridge, 1980, *passim*.

86 W.L.Goodman, 'Woodworking Apprentices and their Tools in Bristol, Norwich, Great Yarmouth and Southampton 1535–1650,' *Industrial Archaeology,* IX, 1972, no.4, November, 378–411.

87 Joseph Moxon, *Mechanick Exercises*, London, 1680.

88 He marks the hand-saw and the tenon saw out, along with the delicate knife-like compass saw, as being joiner's tools, but apprentice indentures show that they were used by carpenters and joiners alike [Goodman, Woodworking Apprentices, *op. cit.*, 387–88].

89 The carpenters' chisel was struck with a mallet rather than being guided by the hand [Moxon, *op. cit.,*120].

90 *Ibid.*, 79, 99–100, 123–24, 126–28 & plate 8.

91 Axes and adzes date back to the bronze age [W.L.Goodman, *The History of Woodworking Tools,* London, 1984, 12–22]. Discussion of the types of axe in use from the middle ages onwards see Goodman, *Woodworking Tools, cit.,* 27–38; Henry C. Mercer, *Ancient Carpenters Tools,* Doylestown, Pennsylvania, 1960, 1–11.

92 Moxon, *op.cit.*, 118–19; the hatchet is discussed in Mercer, 81–92.

93 Moxon, *op.cit.*, 119.

94 Salzman reprints fifteenth-century illustrations showing carpenters using short handled axes with two hands and it may be that carpenters' axes, although used two-handed, had considerably shorter handles than felling axes, forming an intermediate stage between the felling axe and the hatchet [Salzman, *op. cit.,* plates 13 and 14].

95 Goodman, Woodworking Apprentices, *cit.*, 386.

96 Goodman, *Woodworking Tools*, *cit.*, 12–22; Mercer, *op. cit.*, 92–5; Salzman, *op. cit.*, 342.

97 Changes in plane design are discussed in detail in Goodman, *Woodworking Tools, cit.,* 65–71, 78–88; see also Mercer, *op. cit.*, 98–130; for descriptions of the use of planes and their form in the seventeenth century see Moxon, *op. cit.,* 65–74 & plate 4.

98 Mercer, *op. cit.*, 114–15.

99 Salzman, *op. cit.*, 342 and plate 13.

100 *Idem*; Moxon, *op. cit.,* 65–74.

101 Eg. Guildhall, MS. 255 42, I, 3, Contract for the Carpentry of St Christopher, Threadneedle Street, dated 19 July 1670.

102 Moxon, *op. cit.*, 122 and plate 8.

103 The twybill [Philip Walker, *Woodworking Tools,* Princes Risborough, 1980, 13, 17; Mercer, *op. cit.,* 174–76, 302; Goodman, *op. cit., 33–5*] may have disappeared from use in England in this period. It is mentioned in Bristol indentures [Goodman, Woodworking Apprentices, *cit.*, 387] but not elsewhere.

104 Robert Greenhalgh Albion, *Forests and Sea Power: the Timber Problem of the Royal Navy 1652–1862,* Cambridge, Mass., 1926, *passim*.

105 Guy de la Bedoyere (ed.), *The Writings of John Evelyn,* Woodbridge, 1995, 172.

106 Albion, *op. cit.*, *passim.*, but particularly 95–138.

107 Timber at the end of the seventeenth century was twice the cost of timber a century before [James T.Rogers, *A History of Agriculture and Prices in England*, Oxford, 1887, V, 521].

108 For instance, in Bristol carpenters could buy timber available in the town at cost and with priority over other purchasers [BCA, MS. 04369/1, article 20, fol. 173], while in Norwich only carpenters could buy boards [NRO, MS. Rye 31, fols. 17–18].

109 See Guildhall, MSS. 4328, 4333, & 8333.

110 Oak for St Paul's was transported by sea from York at a cost of £7 4*s* 6*d* and by land and sea from Welbeck Abbey in Nottinghamshire at a cost of £56 16*s* 3*d* [*WS*, XV, 45–6].

111 His yard's location in Deptford implies this and I have not found any records of Warren being involved in supplying timber for buildings.

112 Warren's yards burnt down and he died a poor man [Bryan Latham, *Timber: Its Development and Distribution,* London, 1957, 33].

113 A 'Company of Merchant Carpenters' is listed in the accounts of St Paul's from 1696–1711 [*WS*, XV, *passim*]. Whether this was a business organization, a recognized guild, or another name for the timber

merchants operated by the Carpenters' Company is unclear.

114 Hylton Burleigh Dale, *The Fellowship of Woodmongers*, London, 1923, repr. from the 'Coal Merchant and Shipper'.

115 Wren advocates its use for roofs 'because it will bear some Negligence' [Letter to a Friend on the Commission for the Building of Fifty new Churches, C.Wren, *Parentalia or Memoirs of the Family Wren,* 1750, facsimile edn., Farnborough, 1965, 320; Lydia Soo, *Wren's Tracts on Architecture and Other Writings*, Cambridge, 1998, 114; *WS*, IX, 16; *Writings of John Evelyn,* 212–13].

116 '…our English Oak is infinitely preferable to the French, which is nothing so useful, nor comparably so strong' [*Writings of John Evelyn,* 213].

117 Lydia Soo, *op. cit.*, 85; *Parentalia*, 299; *WS*, XI, 18. Continental oak was not considered suitable for shipbuilding until 1677 [Albion, *op. cit.*, 21–2].

118 18 & 19 Car II, *c.* 8, 612.

119 Albion, *op. cit.*, 19–20.

120 Pepys, *Diary,* XI, 189–90.

121 Albion, *op. cit.*, 129.

122 On the uselessness of the Purveyor William Cooper in Pepys' time see *Diary*, III, 169; IV, 231.

123 Howard Colvin (ed.), *The History of the Kings Works,* London, 1976, V, 39–46.

124 Eg. in the transport of the Duke of Newcastle's timber for St Paul's 'Carriage of ye said Trees requiring a double Teame of Cattle 20 days at 20s a day' [*WS*, XV, 45].

125 Hence the relative ease with which John Etty could send oak from York to St Pauls [*WS*, XV, 46] compared to the enormous problems inherent in transporting timber from the Duke of Newcastle's estate at Welbeck Abbey in Nottinghamshire [*WS*, XV, 45].

126 Albion, *op. cit.*, 22, 153.

127 Cecil Hewett has suggested that the roof of Wells Cathedral may have been of larch (or pine) and that it dated from 1661 [Cecil Hewett, *English Cathedral and Monastic Carpentry*, Chichester, 1985, 63].

128 Salzman, *op. cit.*, 84, cites it as having been used for making piles for foundations in the fourteenth century. Various medieval timber buildings in the Weald and Downland Museum, Singleton, Sussex, employ elm posts.

129 References in accounts of the Office of the King's Works for the late seventeenth century show the use of elm in this capacity, for example at Kensington [*WS*, VII, 143].

130 *Writings of John Evelyn,* 217.

131 *Ibid.,* 223.

132 Wren's report on Westminster Abbey [*WS*, XI, 18; Lydia Soo, *op. cit.*, 85].

133 The first recorded use of spruce is in 1619 [T.Rogers, *op.cit.,* 525].

134 *Writings of John Evelyn*, 256.

135 Jupp, *op.cit.,* 264, 267, 307, 308.

136 The sawyers resisted the use of mechanical saws which do not seem to have been adopted until the eighteenth century [B.Latham, *Timber: its Development and Distribution,* London, 1957, 208; Pepys on sawmills, see *Diary*, III, 118]. A sawmill dating from before 1774 survives in West Wycombe Park [Jonathan Marsden, 'William Penn and Sir Francis Dashwood's Sawmill', *Georgian Group Journal*, VIII, 1998, 143–150].

137 The price of deals remained constant throughout the seventeenth century, despite other rises in costs [Rogers, *op.cit.*, V, 526].

138 Alec Clifton Taylor, *The Pattern of English Building,* London, 1987, 297.

139 6 Henry VIII, *c.*3.5; 5 Elizabeth I, *c.*4.

140 BCA, MS. 04369/1, fol. 177.

141 YCA, MS. B34, fol. 186^{v}; Woodward, *op.cit.,* 125, suggests that this included meal breaks.

142 Woodward, *op. cit.*, 125.

143 *Ibid.*, 131–32.

144 *Idem*.

145 Working days are not listed in the Wren Society. This article uses the Audited Accounts [Guildhall, MS. 25 471].

146 This would seem unlikely. Much of the site was covered and even in extremely bad weather some carpenters would still have been able to work. Moreover the months with longest 'holidays', May and September, are those when one would expect the best weather.

147 For the case of St Paul's see Guildhall, MS. 25 471, *passim*.

148 Woodward, *op. cit.*, 169–249.

149 *Ibid.*, 275.

150 Howard Colvin, 'The Townsends of Oxford: a firm of Georgian Master-Masons and its Accounts', *Georgian Group Journal*, X, 2000, 43–61, 53–8.

151 McKellar, *op. cit., passim*, but particularly chapters 4 & 5.

152 The best account of such an early eighteenth-century firm and its practices can be found in Colvin, 'The Townsends of Oxford' cited above.

153 Wren, letter to the Dean of Christ Church, Oxford, over the building of Tom Tower, 25 June 1681 [*WS*, V, 20].

154 For a general overview of the literature see David T. Yeomans, 'Early Carpenters' Manuals 1592–1820', *Construction History,* II, 1986, 13–33, and Eileen Harris, *British Architectural Books and Writers 1556–1785,* Cambridge, 1990, 38–40.

155 David Cressy, *Literacy and the Social Order: reading and writing in Tudor and Stuart England,* Cambridge, 1980, *passim.*

156 For instance, William Byrd was forced to beg his employer, New College, Oxford, for money after he underestimated the cost of building of their new Garden Quadrangle in 1683–4 [*The Victoria History of the Counties of England*, *Oxford*, III, 1954, 152].

157 The problems are discussed in full in Colvin et al., *King's Works, cit.,* V, 39–46.

158 For a discussion of the problem for masons see D. Knoop & G.P. Jones, *The London Mason in the Seventeenth Century,* Manchester, 1935, 49–54.

159 He was paid £400 towards his debt on 10 July 1697 [London, PRO, WORKS 6/2].

160 Knoop & Jones, *op.cit.*, 51–4.

161 Guildhall, MF. 21 742.

162 Sally Jeffery, 'English Baroque Architecture: the Work of John James', unpublished doctoral thesis, University of London, 1986, 34.

163 Colvin, *King's Works*, *cit.*, V, 46.

164 Rogers, *cit.*, V, 521, 529.

165 Stephen Porter, *The Great Fire of London,* Stroud, 1996, 110–11.

166 John Longland supplied considerable quantities of timber for St Paul's [*WS*, XV, xli–xlv].

167 *WS*, XVI, 150.

168 *Idem*.

169 Colvin, 'The Townsends of Oxford', *cit.*, 55.

170 *WS*, XVI, 150.

171 Assuming 140 carpenters a day working on average fifteen days a month, twelve months a year, calculated separately for 6*d* and 10*d* a carpenter. In practice the figure would probably be closer to £600 than £1,000, but nonetheless the figures are considerable and the reasons for jealousy and complaint are clear.

172 Eltringham, *op. cit.*, 6.

173 H.Robinson and W.Adams (eds.), *The Diary of Robert Hooke 1672–1680*, London, 1935, *passim*.