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Anthony van Dyck, Detail of Lady Thimbelby from *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover* (see Plate 34, p. 74).

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Peter Paul Rubens, Detail from *'Peace and War'* (see Plate 1, p. 90).

The Painter's Trade in the Seventeenth Century: Theory and Practice

JO KIRBY

THE CAREERS of Peter Paul Rubens and his most talented assistant, Anthony van Dyck, unfolded during a period of relative prosperity in Antwerp. The city no longer had the total commercial dominance it had had some fifty years earlier, but it had recovered from a period of violent struggle and economic collapse. This, together with the powerful stimulus of the Counter-Reformation, created a constant demand for the production of art works and architectural projects. There was plenty of work to be had at home and, although the reputation of Rubens was such that he could command the highest prices, many other artists also prospered: Jacob Jordaens, for example, born into already comfortable circumstances, died an extremely wealthy man owning much property after a long and successful career. However, to a greater extent than their compatriots, Rubens and Van Dyck also had an international aspect to their careers and, in addition, much of their work was for royal or court patrons. Rubens worked for aristocratic patrons in Mantua, Rome and other Italian cities, as well as for the courts of Spain, France, England and the Spanish Netherlands itself, in Brussels. Van Dyck worked in Genoa and Rome, in Brussels and in London. Indeed, the influence of Van Dyck's style and techniques on English painting cannot be overstated. Both artists were enormously prolific and could not have produced such a vast quantity of work without studio assistance; this is particularly true of Rubens, who is known to have maintained a large studio, and whose level of production is all the more astonishing when it is remembered that between 1626 and 1630 he also had a busy and successful diplomatic career.

From a technical point of view, any painting must be considered in the context of where it was produced and what materials or methods were used. In the case of Van Dyck, who worked abroad for long periods of time, it may be possible to assess the extent of the variation between the materials available in one centre and in another. The National Gallery is fortunate in that the work of both Van Dyck and Rubens, throughout their careers, is well represented in the Collection. In addition, some comparison can be made with the materials used by contemporary painters in Antwerp, London and Rome.

Antwerp

Antwerp's position as the principal commercial centre of Northern Europe, built on sea trade and the textile industry, declined during the 1570s and after years of unrest the city fell to the troops of Philip II of Spain in 1585. As a result of the general migration from the largely Catholic Southern Netherlands the population of Antwerp decreased from about 80,000 in 1584–5 to about 48,400 in October 1586.[1]

Rubens was born in 1577 in Siegen, Germany, of parents who were natives of Antwerp. His widowed mother brought her family back to Antwerp in about 1588, the same year that Anthony van Dyck's father, Frans, set up his business in the city as a merchant in silk, ribbons and similar goods. When Van Dyck was born in 1599, his father was quite wealthy; indeed, there had been a gradual improvement in the fortunes of the Southern Netherlands in general. The Twelve Years Truce between Spain and the Dutch provinces from 1609 to 1621 permitted a more sustained revival, under the sympathetic governorship of Archduke Albert of Austria and his wife Isabella, daughter of Philip II of Spain. Much of Antwerp's revitalised trade was in luxury goods, like those dealt in by Van Dyck's father and the silk merchant Daniel Fourment, the father of Rubens's second wife, Helena: silk and tapestry; diamond processing; precious metalwork and fine furniture. The city became the centre for goods moving between the north and the south as Antwerp entrepreneurs benefited from trading links they were able to develop with former emigrants, who had set up in business in the northern cities where they had settled.

The impact of the Counter-Reformation on the revival of the Southern Netherlands, and the renewal of education in, and devotion to, the Catholic faith, cannot be overestimated. Catholic literature and

religious prints were produced in enormous numbers by Antwerp presses and Antwerp printers flourished. Nowhere is this influence clearer than in architecture and the arts. New churches were built; old ones were modernised in the Baroque style; devotional paintings were required and produced in large quantity. The activity was not confined to ecclesiastical work; it extended into more secular decorative projects and portraiture and court patronage, both in the Spanish Netherlands and abroad.[2]

Netherlandish Painters in London

From the latter part of the sixteenth century and through the seventeenth, there was a tradition of painters from the Low Countries working and forming communities abroad, as they did in Rome, for example. The reasons were partly economic, partly religious: many were refugees from the consequences of the long struggle between the Netherlands and Spain. They tended to find work at court, not only in London but also in other Northern European centres such as Copenhagen and Prague.[3] Undoubtedly the overall technical competence of painters trained in the Netherlands and their mastery of the depiction of surfaces, textures and fastidious detail would have been a factor in their popularity with aristocratic patrons. Local artists, however, felt some resentment at the fact that prestigious commissions went to foreign painters. Henry Peacham, who was a Norfolk schoolmaster and, briefly, tutor to the sons of Thomas Howard, Earl of Arundel, before turning to a literary career in London, lamented in the *Epistle dedicatorie* to his manual *Graphice* (London 1612): 'Onely I am sory that our courtiers and great personages must seeke farre and neere for some Dutchman or Italian to draw their pictures, and invent their devises, our Englishmen being held for *Vaunients* [i.e. worthless persons].'[4]

Plate 1 Daniel Mytens, *Alatheia Talbot, Countess of Arundel, c.*1618. Canvas, 207 × 127 cm. London, National Portrait Gallery (no. 5293).

When Van Dyck was invited to England in 1620, he followed on the heels of Paul van Somer (*c.*1576–1622, from Antwerp) and Daniel Mytens (*c.*1590–1647, from Delft); Mytens, appointed by Charles I as his 'picture-drawer' for life in 1625 (Plate 1), was later supplanted by Van Dyck on his return in 1632.[5] Van Somer in his turn had taken over at the court of James I from John de Critz the Elder (died 1642) and Marcus Gheeraerts the Younger (died 1636), both of whom were members of families fleeing Spanish persecutions in the Netherlands in 1568.[6] Some local painters did obtain court patronage: Robert Peake and William Larkin (both of whom died in 1619) at the court of James I, and later Cornelis Jonson, appointed a picture-maker to Charles I in 1632 (Plate 2). Jonson was of German/Dutch stock and may well have received some of his training in the Netherlands. A good painter, but unable to compete with the flair and superlative skills of Van Dyck, he retired to Kent and in 1643, after the outbreak of the English Civil War, moved permanently to Utrecht.[7]

Guilds and the Training of Artists

In Antwerp painters trained in the studio of a master, under the control of the Guild of Saint Luke, much as in previous centuries. The master registered his young apprentices with the Guild on payment of a fee, and after several years' training (perhaps with more than one master), if the Guild was satisfied with the apprentice's work, he was registered as a free master. As well as the painters and panel- and frame-makers (who perhaps made up the majority of free masters), craftsmen in other related trades – printers, book-

Plate 2 Cornelis Jonson, *Thomas Coventry, 1st Baron Coventry*, 1639. Canvas, 126.4 × 100.3 cm. London, National Portrait Gallery (no. 4815).

Fig. 1 Anthony van Dyck, *Hendrick van Balen,* 1627–32. Black chalk on paper, 24.3 × 19.8 cm. Malibu, J. Paul Getty Museum (no. 84.GB.92).

binders, those working in the glass and pottery trades, embroiderers and goldsmiths – became free masters of the Guild.[8] Painters were not only simply registered as *schilders*: some are described as *doekschilders* (painters on cloth or canvas), *waterverf-* or *waterschilders* (painters in watercolour), *geconterfeytschilders* (portrait painters), *huiss childers* (house painters), and, by the 1630s, *lantschapschilders* (landscape painters) and *bloemschilders* (flower painters). Painters who had received their training elsewhere, but came to live and work in Antwerp, were required to enrol in the Antwerp Guild; the records for 1634–5 include the name of the Leiden painter Jan Lievens, who had first moved to London (where he met Van Dyck while working at court) and subsequently to Antwerp.[9]

Rubens is not recorded as an apprentice, although it is thought that he trained with Tobias Verhaecht, Adam van Noort – whose other pupils included Jacob Jordaens (in 1607) – and Otto van Veen. He was admitted as a master in 1598.[10] Jordaens became a master in 1615, being described as a *waterschilder*.[11] In 1609 Van Dyck was apprenticed at the age of ten years to the figure painter Hendrick van Balen (Fig. 1), who painted small, decorative pictures and had a busy studio in Antwerp (Plate 3).[12] It is not known when Van Dyck entered Rubens's studio, but the portrait of Van Dyck painted by Rubens in about 1615 (now in the Rubenshuis, Antwerp) suggests that he was a member of his studio by this time and possibly earlier. The association continued until 1620, two years after he had become a master, when he is the only named assistant in the contract for the cycle of paintings on the ceiling of the Jesuit Church, Antwerp (destroyed by fire in 1718).[13] As court painter to the Governors of the Spanish Netherlands Rubens was exempted from the rules of the Guild and was not obliged to register the names of his apprentices (although he did register one, Jacques Moermans, in 1621–2).[14]

Little is known about the teaching the pupils received in the master's studio at this time. They probably began by drawing: by copying the master's drawings and perhaps published engravings; by drawing from casts and other objects in the studio, such as drapery; and by drawing from the life. Inventories of the properties of artists and of the contents of their studios show that busy and successful painters, like Hendrick van Balen, possessed drawings, books of prints and plaster casts

Plate 3 Hendrick van Balen the Elder and a follower of Jan Brueghel the Elder, *Pan pursuing Syrinx* (NG 659), possibly after 1615. Copper, 25 × 19.4 cm.

that would have been suitable as teaching aids.[15] By copying, the pupil would learn how to assemble the elements of a composition; he would also learn how the paint was prepared and how to apply it. As the apprentice developed, he would progress to transferring the master's composition to the prepared support, working from a drawing or sketch; finally he would be sufficiently competent to lay in the composition for final correction and touching-up by the master. At this stage the apprentice could be more accurately described as an assistant.

In the period during which Van Dyck is likely to have been working in Rubens's studio, the majority of Rubens's apprentices seem to have received their basic training elsewhere; whether this was common practice or a particular feature of his studio, because it was extraordinarily busy and the competition to enter it was intense, is not known.[16] There was at this time no question of a more 'academic' artistic education for the young painter.

In London the painters' trade was regulated by the Painter-Stainers' Company. The Company appears to have acquired a degree of authority and recognition only relatively late in its history, being granted a Royal Charter by Elizabeth I in 1581. This was given after they had presented a petition to the Queen in 1575, complaining of their inability to control the number of foreign painters in the City and the quality of the work done. At this date freemen of the Company fell into various categories: Face Painters, History Painters, Arms Painters (responsible for heraldry) and House Painters. Among the thirty-seven articles in the Charter, one forbade anyone 'English or stranger, denizen or not, freeman or foreign' to do any work connected with painting in any form unless they were known to be skilful and approved. Various dues had to be paid by all those living within a four-mile radius of the City; foreigners were subject to the same dues, conditions and penalties as the English painters. Nobody was permitted to paint unless an apprenticeship of seven years with a painter had been served, except for 'gentlemen' pursuing the art as 'recreation or private pleasure': it is noteworthy that the interest in painting as a pleasurable activity for amateurs had grown to the point where such an exception was necessary. At the end of their apprenticeship the apprentices were examined and their work approved by the Master and Wardens of the Company. The number of apprentices that a member was permitted to have was limited and apprentices had to be presented to the Master and Wardens of the Company within a certain period, or else a fine was payable. As in Antwerp, this enabled the Company to keep a measure of control over the number of masters working, in theory at least. There were penalties for deceitful work and the Company officials were empowered to search premises for faulty goods or materials.[17]

The London guild waged a constant battle, not only with foreign painters, but also with members of other guilds, particularly those of the heralds and the plasterers, who often carried out rather similar work.[18] Part of the problem lay in the fact that, in earlier times, the painters had undertaken many lucrative, largely decorative, court commissions, but these were increasingly being given to foreign artists. In 1627, for example, a petition was presented to Charles I by a group of picture-makers, supported by the Painter-Stainers' Company, complaining that painters like Daniel Mytens, Orazio Gentileschi and others (all employed at court) were taking their livelihood. The dispute was partly resolved when in 1636 the Royal Surveyor, Inigo Jones (a member of the Company), was brought in as mediator.[19] The attempt to encourage good relations between all the warring parties appears to be marked by an invitation to Van Dyck to attend the St Katherine's Dinner on

30 November 1637 at the Painter-Stainers' Hall in the ward of Queenhithe; the other guests included Inigo Jones, John de Critz, the King's Sergeant Painter (the official responsible for arranging all the painted work for the court) and his wife, and Edward Norgate, the Windsor Herald.[20]

In order to practise a trade, it was necessary to become a freeman of a City company, but one of the simplest expedients to evade this requirement was to live outside the City walls. It has been shown that many painters lived just to the north-west or west of the City, in the parishes of St Giles-without-Cripplegate, St Andrew Holborn, St Sepulchre-without-Newgate (also in Holborn) and St Bride Fleet Street parishes. Another popular location, further west – and nearer the court – was Westminster, and particularly the parishes of St Martin-in-the-Fields and, rather later, the new parish of St Paul Covent Garden, created in its northern part. Very few lived within the City walls.[21] Marcus Gheeraerts the Younger and his son, also named Marcus, were two of the very few who did: they lived in Warwick Lane, in the parish of Christchurch Newgate Street in the ward of Farringdon Within and both were freemen of the Painter-Stainers' Company. The name of Marcus Gheeraerts the Younger, as 'Marcus Garret/ Garrett' is recorded as a 'stranger' living in the parish in 1598/9, and also in a list of aliens living in the City of London made in 1618.[22] In 1632, Van Dyck stayed with Edward Norgate until he moved into accommodation on the waterside at Blackfriars, within the City of London, in the parish of St Anne. This parish was home to many miniature painters, and also to Cornelis Jonson, and because it was the site of a former monastic foundation – and therefore a 'liberty' or 'precinct' of the City – its residents claimed various privileges, including the freedom for all artists and craftsmen, whether they were freemen of the City or not, to practise their trade without interference from the authorities. This was particularly attractive to foreign painters who had no right of citizenship unless they had become denizens of the City by right.[23]

A great many Northern European painters, including those from the North and South Netherlands, chose to spend some time in Italy at some point in their careers to broaden their artistic experience; most visited Rome. Here, in the latter part of the sixteenth and early seventeenth centuries, the guild system had less control over painters and sculptors than in Antwerp or most other Netherlandish cities, but there was some concern at the perceived ignorance of young painters. Popes Gregory XIII and, later, Sixtus V both supported the suggestion that an academy for the education of artists was necessary, presumably in addition to the training they received with a master, and the Accademia di San Luca was inaugurated in 1593. Its first president was Federigo Zuccaro, and its primary aim was educational; a lecture programme was instituted and life classes were held.[24] Netherlandish artists visiting Rome enjoyed the relative looseness of control by the painters' guild and formed a close and somewhat riotous community, as Van Dyck found to his cost.[25] Antwerp painters who had visited or worked in Rome were enrolled in the guild of Romanists, which numbered among its members not only Rubens and Van Dyck, but also Van Dyck's first master, Hendrick van Balen the Elder, Jan Brueghel the Elder, a close friend of Rubens, and Frans Snijders, one of several artists known to have collaborated with Rubens. In practice, the Academy did not have complete ascendancy over the painters' guild and in 1633 the guild levied a compulsory tax on all painters, including foreigners, much to their annoyance. It was also a fairly common practice in Italy, although not at this time in Northern Europe, for groups of artists to gather together to draw from nude models; these informal associations were also known as Academies.[26] Edward Norgate described such an Academy in his *Miniatura or the Art of Limning*

Plate 4 Paolo Veronese, *Allegory of Love, I ('Unfaithfulness')* (NG 1318), probably 1570s. Canvas, 189.9 × 189.9 cm. This composition was recorded in Van Dyck's Italian sketchbook.

(*c.*1648) and added that Rubens had told him that 'at his being in Italy, divers of his nation had followed this Academicall course for twenty Yeares together to little or noe purpose'.[27]

The influence of the work of contemporary Italian painters such as Caravaggio is immediately apparent in the work of artists of the Utrecht School such as Hendrick ter Brugghen and Gerrit van Honthorst, and it also impressed Rubens. For Van Dyck the Venetian masters of the previous century, Titian and Veronese, were of the greatest interest (Plate 4). Rubens spent eight years in Italy from 1600 to 1608 in the service of Vincenzo Gonzaga, Duke of Mantua. He also visited Spain, where he was able to see the Titians and other works in the Royal collection. Van Dyck travelled widely in Italy between 1621 and 1627, spending most time in Genoa.

Contemporary Written Sources

The painting practices and materials of seventeenth-century artists are reasonably well documented, but much useful information may also be gained from legal and commercial records: inventories, accounts, wills, price lists, records of import and export of materials, records of duties payable and so forth. Frequently, in both London and Rome, for example, much of this documentary evidence is lodged in archives and has not been the subject of research; even where it is quite well known, it may be unpublished. It is certain, therefore, that a great deal remains to be discovered on painting practice in this period. Sources fall into two broad categories: artists' handbooks and the more technical literature on seventeenth-century painting materials and methods; and literature associated with particular artists.[28]

A certain amount of information on the different materials and their making may sometimes be gained from artists' manuals, although as a rule these are more concerned with preparation of the materials for use, not their manufacture. However, an exception was often made in the case of methods for the preparation of oils and, particularly, varnishes. A good example of an Italian manuscript collection which describes not only the pigments, their sources and the theory of their mixtures, based on Giovanni Paolo Lomazzo's *Trattato dell' arte della pittura, scoltura e architettura* (Milan 1584), but also recipes for varnishes, watercolour pigments, inks and glues, some very traditional and others apparently up-to-date, is the so-called Paduan manuscript (the name given it by its nineteenth-century transcriber, Mrs Merrifield). Written in Venice, probably in the mid- to late seventeenth century, it represents the type and range of technical information that would have been current around the time Van Dyck was in Italy.[29] The manufacture or purification of pigments, or glass, or pottery, was essentially a workshop-based technology, although one need only look at the large quantities of raw materials used by the Pekstok company in Amsterdam in the production of a yellow lake pigment from buckthorn to realise that some firms operated on a very large scale.[30] The recipes they used for their day-to-day preparations were generally kept secret; the records kept by Willem Pekstok and his fellows in other technologies are rare survivals.

A popular form of technical literature, the books of 'secrets', often derive their information from much older manuscript collections. The recipes they contain on pigment manufacture may be very old indeed: the manufacture of lead white, for example, had been known from Roman times. Small instruction manuals, drawing on the same tradition as the more general 'secrets' books, but usually restricted in their content to a particular craft or group of crafts, such as dyeing or metallurgy, had quite a wide circulation in Northern Europe in the early sixteenth century. An example from the Southern Netherlands, known as the '*Traktaat om kleuren te bereiden*' ('Treatise on the preparation of colours'; Antwerp, Plantin-Moretus Museum MS 253) contains some recipes (such as that for the preparation of lead-tin yellow) that would still have been relevant, if not current, in the first decades of the seventeenth century.[31] To this craft-based and popular technical literature, one may add the more scientific literature, including the European pharmacopoeias and other medical, chemical and botanical literature.

Interest in the more theoretical aspects of painting and the development of the intellectual role of the painter may explain why books on the technique and history of painting were published in Italy long before they appeared elsewhere in Europe. Topics such as perspective, proportions and colour theory, and often the practice of painting, were discussed and some books containing a fair amount of practical information were still influential in the seventeenth century. These included Lomazzo's treatise and Giovanni Battista Armenini's *De' veri precetti della pittura* (Ravenna 1587).

Although the craft-based tradition in which painting developed did not encourage the development of a literature of practical painting, there was a well-developed amateur interest in miniature

painting in England by the last quarter of the sixteenth century. *A very proper treatise wherein is briefly sett forthe the arte of Limming* (London 1573) was the earliest English printed instruction manual on painting and similar books were published in Europe, some of which, like Valentin Boltz von Rufach's *Illuminierbuch* (Basel 1549), were quite sophisticated. Early seventeenth-century published literature on oil painting in England arose from much the same tradition: the gentleman-amateur painting as a pastime. The earliest discussion of oil painting is that of Henry Peacham in *The Compleat Gentleman* (London 1622), a book that, like his earlier work *The Art of Drawing with the Pen*, was designed to be educational.[32] An almost contemporary French example, *Essay des merveilles de nature, et des plus nobles artifices* (Rouen 1621), was published by a Jesuit priest, Etienne Binet, under the pseudonym of René François.[33] This book as a whole is very much broader in scope and more varied in its content than Peacham's; one chapter is dedicated to painting. Peacham's discussion is clearly organised and easier for the amateur to follow than Binet's: he describes how to prepare the panel; how to grind the colours and lay them on the palette; the stages in painting the portrait and the representation of various fabrics and landscapes; finally he describes how to clean the brushes, the slab and the muller, and the storage of unused colour under water. In Binet's discussion the actual process of painting is not clearly described, but the book ran into many editions so must have been both popular and widely available. It formed the basis of a manuscript entitled *Recueuil des essaies des merveilles de la peinture*, written in 1635, probably in Paris, by Pierre Lebrun, known after its publication by Mrs Merrifield in 1849 as the Brussels manuscript.[34]

Cornelis Pietersz. Biens's *De Teecken-Const* (Amsterdam 1636), which drew heavily on Karel van Mander's *Het Schilder-Boeck* (Haarlem 1604), Gerard ter Brugge's *Verlichtery Kunst-boeck* (Amsterdam 1616), a well-known manual on watercolour painting, and other texts, also contains practical information which must have been gained from artist friends. His discussion of the making of a lay figure has no precedent and the brief details included on pigments used in oil are typical of earlier seventeenth-century practice in the North and South Netherlands.[35] No equivalent text intended for amateur painters or students seems to have been published in the Spanish Netherlands.

One of the most valuable contemporary sources

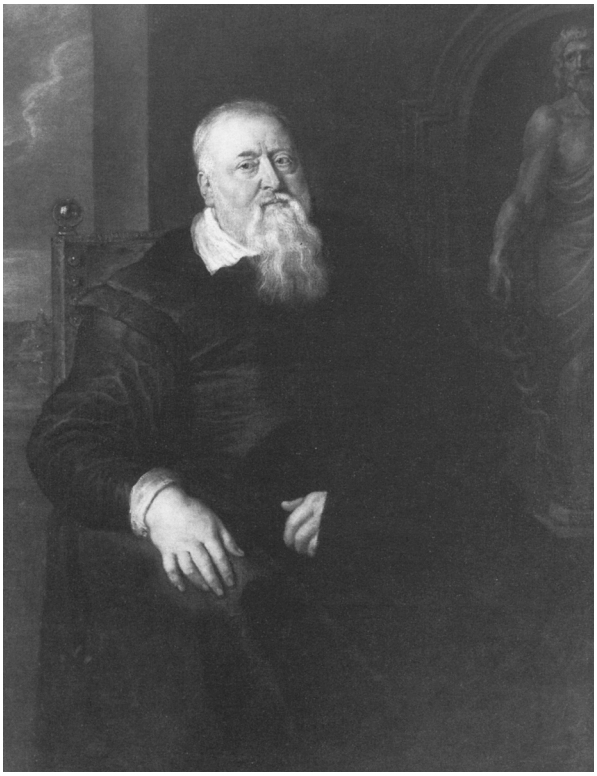

Fig. 2 Peter Paul Rubens, *Portrait of Theodore Turquet de Mayerne, c.*1630. Canvas, 137 × 109 cm. Raleigh, North Carolina Museum of Art (no. 128).

is the so-called de Mayerne manuscript, *Pictoria, Sculptoria, Tinctoria et quae subalternarum artium spectantia* (British Library MS Sloane 2052).[36] Sir Theodore de Mayerne was a Huguenot refugee, born in Geneva but settled in France, who practised as a physician at the court of James I and, subsequently, Charles I. As well as his medical practice, he was greatly interested in the materials and methods of painting. His position at court (to say nothing of his circle of friends, neighbours and patients) gave him access to both visiting and local artists, including Paul van Somer, Cornelius Johnson, Daniel Mytens, John Hoskins, Rubens, Van Dyck and many others. Edward Norgate was a friend and wrote the first version of his much-copied treatise on illumination in 1627–8 at de Mayerne's request.[37] Rubens, Hoskins and the French illuminator and enamellist Jean Petitot painted his portrait (Fig. 2). He was able to discuss their methods of painting with them, to ask questions, to make suggestions and record the conversations. He also read widely, copying out recipes from these sources, and recorded the results of his experiments.

Where he recorded the concerns of artists or copied down information that plainly relates to current practice, de Mayerne's notes are of special interest. He records pigment prices; the length of time

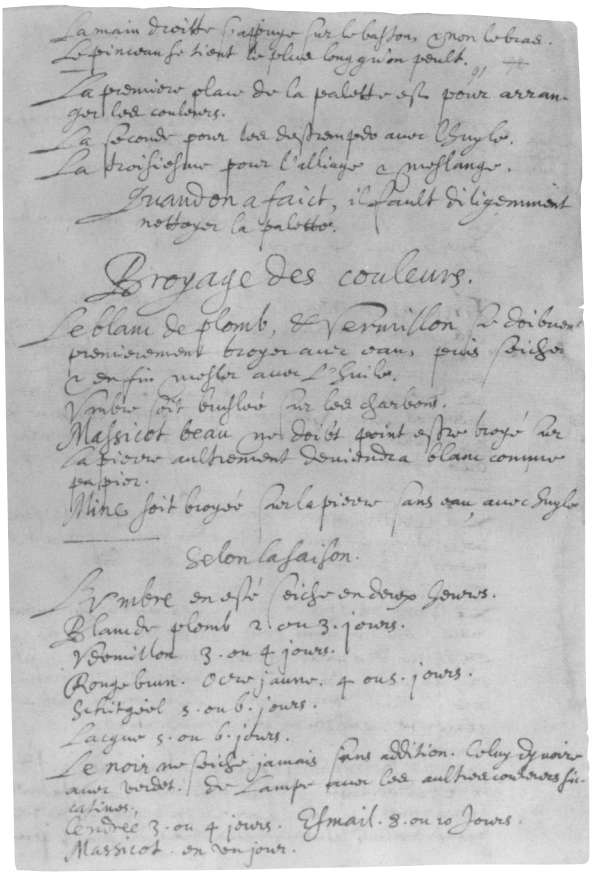

Fig. 3 T. Turquet de Mayerne, *Pictoria, Sculptoria, Tinctoria et quae subalternarum artium spectantia...*, 1620–46. British Library MS Sloane 2052, f. 91^{r}. Drying times for pigments in oil.

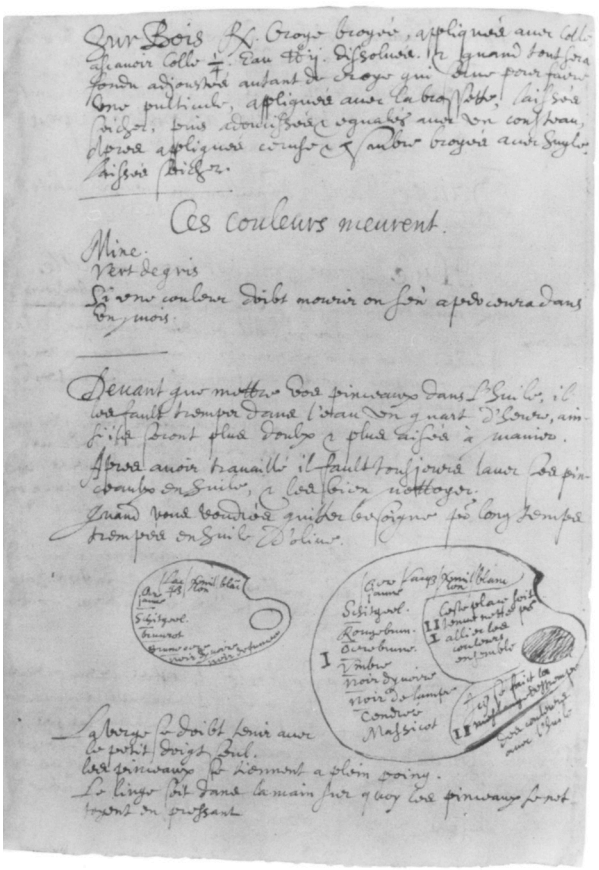

Fig. 4 T. Turquet de Mayerne, *Pictoria, Sculptoria, Tinctoria et quae subalternarum artium spectantia...*, 1620–46. British Library MS Sloane 2052, f. 90^{v}. Diagram showing how pigments should be set out on the palette.

taken for pigments to dry (Fig. 3); their properties; mixtures for different purposes; how to purify oil and prepare drying oils; how the colours could be laid out on the palette (Fig. 4); innumerable varnish recipes and a great deal of random information. His own experimental work, such as that on amber and varnishes, does not necessarily bear any relation to actual artistic practice. However, it cannot be assumed that all the information he gathered during his researches (and some of his sources, like the *Secreti* of Alessio Piemontese, derived from older literature still) was still current in his time. The manuscript was compiled in London, but many of the artists he met were Flemish or French; some, like Rubens, did not stay long. It must be borne in mind, therefore, that materials that concerned them may not have been available locally.

The information in Norgate's manuscript on miniature painting was disseminated by means of manuscript copies through a closely knit circle of gentlemen-amateurs. It also found its way into print, in an imperfect form, in William Sanderson's *Graphice* (London 1658) and subsequently in the other artists' manuals which appeared from the 1660s onwards, long after Norgate's death. One of the manuscript copies of the first version, British Library MS Harley 6376, written some time after 1641, also contains a section entitled *The Art of Painting in Oyle by the Life*, appended to that on miniature painting.[38] Some of the content, such as the descriptions of containers for cleaning and storing brushes, may derive from the author's own experience or from another unidentified source.[39] By 1679 the manuscript was owned by the York glass-painter Henry Gyles, who added recipes of his own which are very different in content and concept to the earlier sections.

Artists' own writings may also contain useful information on technique, or their attitude to painting. Rubens comments more than once on the drying of paint and he clearly knew that keeping a freshly painted oil painting in the dark would cause it to yellow and that this could be reversed by

exposing it to light.[40] Van Dyck's name is associated with several documents. The most important of these is a document in the commonplace book of the Oxford scholar and philologist Dr Thomas Marshall (Oxford, Bodleian Library, MS Marshall 80), headed '*Observat d. Ant ... Dykii*'.[41] In this Van Dyck commented briefly on the soundness of technique of *water-verw schilders* (those trained in the use of a water-based paint medium: 'tempera' in its broadest sense) who maintained the disciplined approach of that method in their oil-painting practice. In the seventeenth century a water-based paint (perhaps containing glue size or gum) would be used for tapestry cartoons and decorative projects of all sorts as well as, for example, personal landscape sketches in watercolour. The method is unforgiving in that it does not permit much in the way of alteration. Van Dyck clearly thought this good practice and developed the argument further. He maintained that forms should be sketched in such a way that there was no need to alter them at a later stage (Plate 5). In the first stage of painting, the underpaint stage termed the *maniera lavata,* lean colours should be used so that they dried with a light tone, using a similar colour for the underpaint as that intended for the final layers and paying some attention to the tonal values necessary for the composition. This was to be followed by the modelling of forms, the *maniera sbozzata*, which was supposed to give the work its final form, seemingly by means of modulating the darker areas rather than by the application of highlights. In the last stage, the *maniera finita*, the deepest shadows were applied by glazing; significantly, he drew attention to the work of Titian and other Venetian painters in this context. He also commented on the need for a correct and assured drawing technique. The procedure described is one of sound painting practice and the survey of Van Dyck's paintings in the Collection has confirmed the essential soundness of his technique, the sureness of delineation of his forms and the execution of the composition, once it reached the painting stage. It was, however, backed up by a great facility in drawing and the use of many compositional sketches and drawings where necessary; the work was done before the painting was commenced.

Throughout his Italian travels, Van Dyck noted down the colours of particular elements of the paintings he sketched; these were frequently fabrics and draperies. In his sketch of Titian's *Portrait of Pope Paul III Farnese with his Nephews Alessandro and Ottavio* (Naples, Gallerie Nazionali di Capodimonte, then in the Farnese Collection in Rome), for example, the golden colour of the curtain billowing over the heads of the Pope and his sycophantic nephew Ottavio is noted.[42]

Plate 5 Anthony van Dyck, *A Soldier on Horseback, c.*1615–16. Canvas, 91 × 55 cm. Oxford, Christ Church Picture Gallery (no. 246). Oil sketch study for *The Martyrdom of Saint Sebastian c.*1615 (Paris, Musée du Louvre). The composition has been brushed in without alterations using a dark paint; the heads were worked up further in a creamy-white paint.

On the final leaf of the sketchbook, Van Dyck noted down common ingredients for varnishes, including oil of turpentine, '*aqua di rasa*', fir balsam (from *Abies alba*), '*olio da abezzo*', and pine resin or colophony, '*rasa da pino*', together with unspecified '*vernizia*' and amber varnish. A larger collection of technical recipes is found in another document associated with Van Dyck, the so-called Antwerp sketchbook (Devonshire collection, Chatsworth). It is thought that this in part records a book of drawings from Rubens's studio, now lost, and the attribution

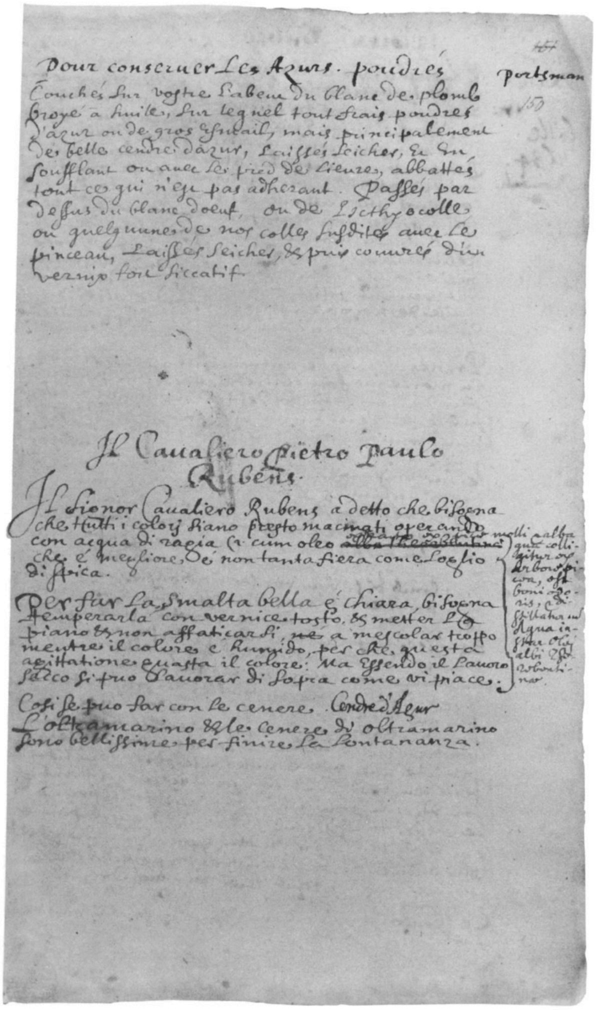

Fig. 5 T. Turquet de Mayerne, *Pictoria, Sculptoria, Tinctoria et quae subalternarum artium spectantia...*, 1620–46. British Library MS Sloane 2052, f. 150r. Remarks by Rubens on grinding pigments and on blues.

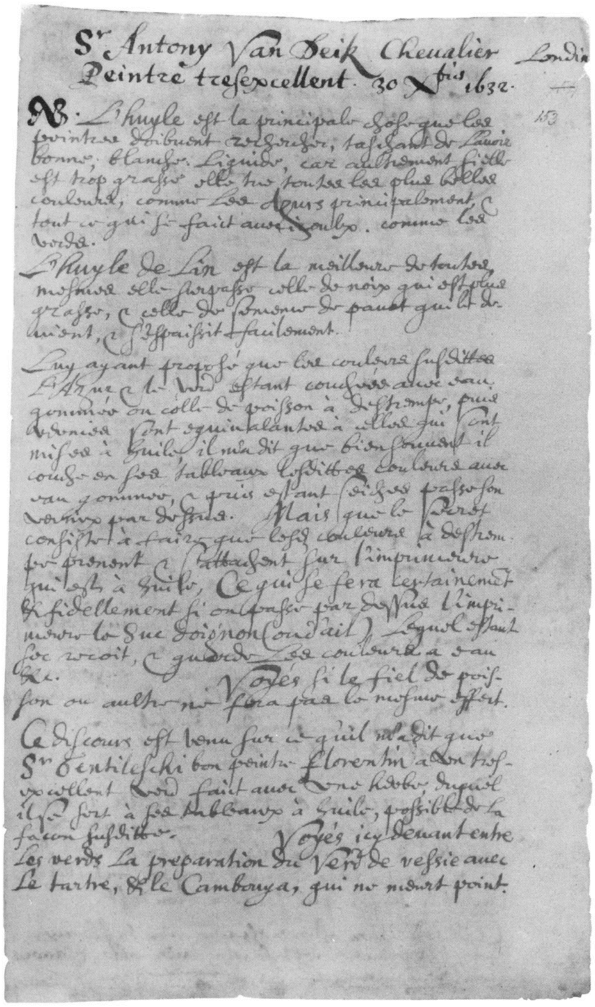

Fig. 6 T. Turquet de Mayerne, *Pictoria, Sculptoria, Tinctoria et quae subalternarum artium spectantia...*, 1620–46. British Library MS Sloane 2052, f. 153r. Remarks by Van Dyck on linseed oil and the medium for blues and greens.

to Van Dyck has been much discussed.[43] The written material begins with a rather garbled account of the purification of linseed oil with water, followed by the preparation of drying linseed oil. Mistakenly, the recipe starts from the pressed oil seed, rather than the oil, which would be unlikely in practice. 'Fat' oil is prepared by boiling it with leeks; other contemporary accounts refer to the use of onion, but this is to purify the oil, rather than to body it, so the purpose of the recipe may have been misunderstood. A later recipe for improving the drying properties of oil and bleaching it by standing it in the sun appears to have been quite standard; it is one that de Mayerne also recorded from his informants.[44] Other recipes include one for turpentine varnish (presumably using pine resin, although this is not stated); an ink from which copies could be taken; an etching ground; and preparations for refined (recrystallised) verdigris and an artificial copper-containing blue or blue green pigment from copper filings, nitric acid and chalk or white lead. At the end of the collection it is noted that Strasbourg turpentine (fir balsam) makes a very good varnish, the Venetian turpentine (larch resin) being unsuitable. In practice this is true; fir balsam produces a very much more resilient film and was recommended for uses where resilience or water-proofing was required.[45] Many of the individual instructions can be paralleled by recipes in other collections. The fact that some are misunderstood, or mistranscribed, suggests that there was an interest in the technology of contemporary materials and processes within the circle of Rubens and Van Dyck, but that the transcriber did not always have quite the technical understanding to record them accurately.

Remarks attributed to Rubens and Van Dyck recorded by de Mayerne were often of general concern. Rubens, for example, told de Mayerne that pigments should be ground quickly working with turpentine, which was better and less fierce than oil of spike lavender (this would be the preliminary grinding, before grinding with the oil medium) (Fig. 5). He also recommended dipping the brush in turpentine occasionally before blending the colours on the palette so that the paint was more easily worked and the colours did not 'die', or sink, 'as for blues'. Blue pigments seem to have been perceived as a particular problem, partly because of their handling properties in oil and their tendency to sink, but also because of the danger that they would yellow.[46] In conversation with Van Dyck, de Mayerne suggested that he might do well to use an aqueous medium for his blues and greens, then to varnish them, the problem being to apply the tempera-based colours over the oil paint beneath without their flaking off; Van Dyck apparently agreed that he had tried this.[47] It must be said, however, that where it was possible to examine passages of blue or green paint in Van Dyck's paintings in the Collection, no evidence was found for the use of anything other than oil (see pp. 84–8). Van Dyck shared the rather common concern about the quality of his oil (Fig. 6); it should be good, pale and liquid and if it was too *grasse* (fat, that is, prepolymerised and so thickened, and with improved drying qualities) it killed the other colours, particularly the blues (presumably it was darker in colour).

The notes de Mayerne made in conversation with Rubens and Van Dyck can be added to the comments made by painters, and others, who had known or worked with them in the past. Van Dyck's working habits were observed by those who had worked in his studio, such as the painter James Gandy. It is thought that a collection of notes copied by the eighteenth-century painter Ozias Humphreys was perhaps made by James's son William, based on his father's recollections and those of others who had known the painter. From these, and similar notes, it is possible to learn (from Gandy's conversation with Richard Gibson) that, in drawing a sketch for a portrait, Van Dyck drew freely on blue paper in black chalk, heightened with white. He also stored his paints under water, except for the red and yellow lakes, Cologne (or Cassel) earth and indigo, and bought oil of turpentine and mastic.[48] From such small snippets of information some picture of his studio practice may be constructed.

Contemporary biographies may contain small, but sometimes quite revealing, pieces of information on an artist's technique; they may also conflict with other accounts. Bellori's account of Van Dyck's life states that he was in the habit of working through without a break, beginning his portraits in the morning and perhaps keeping his sitters over lunch.[49] As it is thought that Bellori may have received some of his information from Van Dyck's friend Sir Kenelm Digby, whose portrait Van Dyck painted, one might suppose it to be accurate. On the other hand, Roger de Piles, recording the experiences of the Paris art-collector Everhard Jabach, who sat to the painter three times, describes a very different system, whereby the painter worked on the portrait for an hour only, making another appointment when the time was up, then being brought a fresh palette and clean brush for the next sitter. Assistants painted the clothing up to the final stage from Van Dyck's sketch and the artist applied the finishing touches.[50] Perhaps both were accurate in describing his practice in their experience; a close friend, for example, might have received a different treatment from that accorded to a patron.

Studios

Contemporary accounts of the requirements for the painter's studio, such as those of the German painter and writer Joachim von Sandrart, or the author of *The Art of Painting in Oyle by the Life* (MS Harley 6376), concentrate on two points: the size of the room and the lighting. Sandrart drew attention to the need for space and suggested the room should be about thirty feet square; according to the author of the manuscript, the model should be four to six yards away from the painter. Rubens's studio was lit from above, but usually a north-facing window, giving constant, cool light, was recommended, with blinds or curtains to control the amount of light entering the room and the amount of shadow: 'sometimes it is requisite that your pictures have but little shadowes, yt [that] sometimes ye painter must please ye female sex, for they will not be painted with deep shadowes.'[51]

Literary sources also describe the equipment necessary: easels, strainers, grinding stones of porphyry or some other stone and mullers to prepare the paint, palettes, brushes, knives and a mahlstick (Fig. 7).[52] It has been pointed out that, while there is no problem in the identification of the larger, hog's bristle brushes, the hair used for the soft hair brushes or 'pensills' is not always easy to identify: the English word 'fitch', for example, means polecat, a member

Fig. 7 Gonzalez Coques, *The Artist's Studio, c.*1665. Oil on canvas laid down on panel, 65 × 81.5 cm. Schwerin, Staatliches Museum (no. 171). The canvas on the easel has been laced into a temporary stretching frame. A mahlstick, used as an arm support during painting, leans against the table to the left. In the foreground is a paint box.

of the same family as the weasel and the ermine. Hair from the tails of these species was used for brushmaking. However, 'fitch' also referred to a square-ended brush and this is the more likely interpretation. The hairs were inserted into quills of different sizes, from the feathers of water fowl such as geese, ducks or swans, and a handle of wood or some other material was inserted into the other end.[53] The inventory of the goods of the Antwerp painter Adriaen Brouwer, taken on 5 October 1632, includes eighteen brushes – '*pinceelen*'– with sticks as well as ten brush sticks, or handles, on their own and three dozen brushes, either without handles or where none is mentioned. Following the brushes, a 'wooden manikin with its stand' is listed, conceivably a lay figure.[54] The frontispiece of John Bate's book illustrates a painter at work, showing the easel and other items of equipment; the author of MS Harley 6376 drew a diagram of a portable easel. As mentioned above, he also drew the containers for brush cleaning and storage made of 'latten' (probably tin-plated iron rather than brass in this case).[55]

Inventories of artists' property give much information on the more valuable contents of artists' studios. Almost all list easels and grinding stones, which must have been of some value.[56] In the studio of Jan Snellinck the Elder was a grinding stone, two easels, two palettes, three stools, a small cupboard or set of shelves for colours and another smaller grinding stone. Another room contained a few frames and strainers and a chest of drawings.[57] The studio of Joos de Momper contained three easels, paintings in various stages of completion, five palettes, three stools and a collection of brushes, oil and unspecified pigments.[58] Pigments could be kept in glasses, shells or pots, or indeed, in the form of dry pigment, wrapped in paper; these could be stored in wooden chests.[59] The inventory of the property of Margriet Briers, the widow of Hendrik van Balen the Elder, who died on 23 October 1638, six years after her husband, included a number of easels and a large grinding slab on a trestle, and a collection of sculptures. Among these were figures from Graeco-Roman mythology, plaster casts of busts, hands and feet, a stone figure described as an *Anothomi*, another in plaster ascribed to 'Jan de Boloni' (Giambologna, presumably) and yet another made of red wax in a wooden case.[60] The painter Steven Wils the Younger owned a similar range of sculpture and a large collection of drawings and engravings, both bound and unbound.[61] This was not unusual: many, perhaps most, artists had collections of prints and drawings for reference, although some at least would have been of their own making.

The studio played an essential role in the fulfilment of commissions and in any production of pieces for speculative sales, rather as the large successful workshops of fifteenth- and sixteenth-century painters like Robert Campin or Rogier van der Weyden had earlier: the painter as entrepreneur and the studio as a commercial enterprise were not new. Painters also specialised in particular types of painting and often collaborated: a specialist in landscapes or still-life scenes might be brought in. Frans Snijders, for example, who painted still lifes and animal scenes, is known to have collaborated with Rubens and other figure painters.[62] The Rubens studio, its structure and how far Rubens himself intervened in any particular painting has been the subject of much discussion and analysis (and see pp. 96–104 in this *Bulletin*).[63] The account of Van Dyck's portrait painting practice given by Everhard Jabach to Roger de Piles describes a studio production system very well: the master retained the intellectual responsibility for any product of the studio as he conceived and produced the original design, although the overall quality of the final product depended on the extent of his intervention.[64] Van Dyck's work for the English court often involved the production of portraits in different versions and inevitably there were variations in the quality, especially in some of the later portraits.[65] The responsibility for the quality of the product, however, rested with the master. There is evidence that Rubens, for example, corrected details on paintings that are primarily studio productions; clearly he could not ignore the possible implications of what might be seen as substandard.[66]

Supports

Although both canvas and wood panels were used as supports for easel painting in the earlier part of the seventeenth century, the use of canvas became far more common as time went on. In Italy the majority of easel paintings were on canvas, even at the beginning of the century. In Northern Europe generally, where there was a greater availability of suitable timber, panels were more widely used, particularly for smaller works, but even here there was a decline in the use of wood supports after the first half of the century. The smooth, even surface of panel, which would permit meticulous, detailed work and a flawless finish if so desired, was undoubtedly appealing to some painters and patrons; this may be one reason behind the relative popularity of metal panels as a support at this time. The slightly grainy texture of canvas is suited to a looser, freer style of painting; precision equivalent to that achieved on smooth supports cannot be obtained on even the most closely woven, finely grounded canvas. Rubens thought that panels were in any case more suitable for small works and consistently used them for preliminary studies, a practice Van Dyck seems to have followed to some extent.[67] Most of Rubens's landscapes, which show a high degree of detail and finish, but were essentially for his own pleasure and private use, are on panel. Clearly, paintings of a less intimate nature, such as the cycle of works glorifying the life of Marie de Medici (now in the Musée du Louvre, Paris), were conceived on a larger scale. They were intended to be seen and to make an impact at a distance; the handling is thus appropriately broader.[68]

For commissioned works, the wishes of the patron and the intended site for the picture would play some part in the choice of support. With certain notable exceptions discussed below, canvas was more commonly used for larger works; it was cheaper, lighter and far easier to transport from the painter's studio to the final site, which might be some distance away. For example, the paintings for the ceiling of the Banqueting House in Whitehall, commissioned by Charles I in 1630 at the end of Rubens's brief stay in London on a diplomatic mission, were painted in Antwerp so would have to be rolled, packed and transported by sea. In his letters Rubens referred several times to the packing and transport of pictures and, by this time, such movements would have been in no way unusual.[69]

Panel

The wood used for panels in both the northern and southern parts of the Netherlands and in England at this time appears to have been oak, almost exclusively.[70] Dendrochronological evidence indicates that, from the fifteenth century or earlier until about 1650, this was imported, principally from the eastern Baltic regions, generally in the form of boards or planks.[71] In contemporary documents, the Dutch *wagenschot* and English 'wainscot' appear generally to refer to oak boards or planks (quarter-sawn or cleaved), rather than to beams or other pieces of greater thickness (Fig. 8). The 1560 trading book of the Münster merchant Jakob Stöve, who dealt in Gdansk (Danzig) timber, describes how this grade of wood should be fine, free of knots and heartwood and without cracks or spiral-grained wood.[72] Gdansk, in present-day Poland, was the principal exporting centre for this timber; the town was on the edge of vast forests, the source of a limitless supply of well-

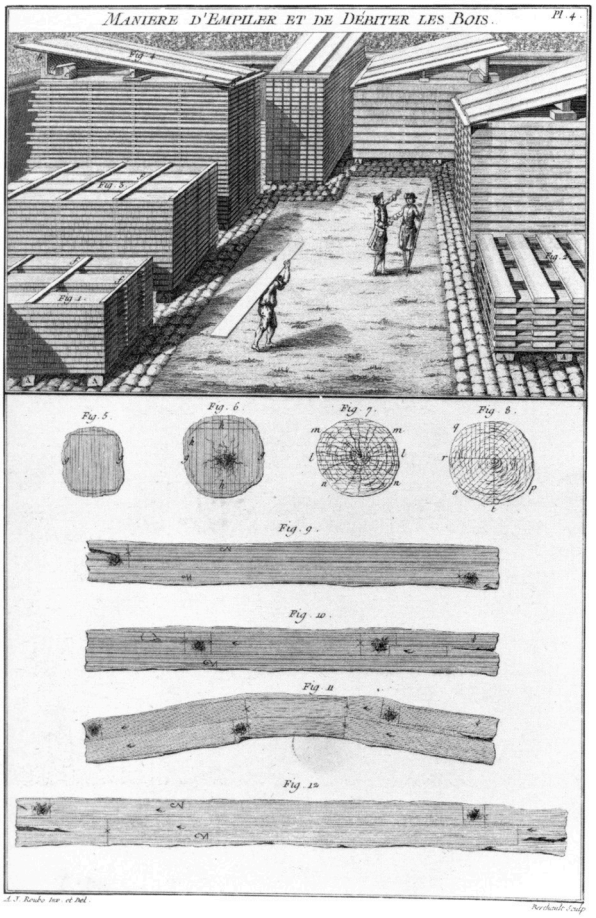

Fig. 8 Sawing logs into planks: the different cuts obtained. A.-J. Roubo, *L'Art de menuisier*, Paris 1769–75, plate 4, 'Manière d'empiler et de débiter les bois'. London, British Library.

grown, similarly sized trees. Much of the Baltic trade, including that in Gdansk timber, was with the Northern Netherlands: most of it reached Antwerp by way of Amsterdam. During the late sixteenth and the seventeenth centuries the Gdansk trade was affected by outbreaks of war, although as wood was exported from Gdansk to Spain between 1607–18, supplies in the Spanish Netherlands may not have been much affected at this time.[73] The blockade of Gdansk harbour during the war between Sweden and Poland from 1626 to1629 provoked a more serious disruption; trade was finally brought to a complete standstill by a second Swedish-Polish war from 1650 to 1655.[74]

Beams derived from this oak were on average between ten and fourteen feet long. It seems that, in seventeenth-century Antwerp, the longest available oak planks measured about twelve feet, around 344 cm (converting from the Antwerp foot of 28.68 cm).[75] The problems this caused are shown, for example, in two of six massive altarpieces painted by Rubens for Antwerp churches between 1610 and 1625; both are triptychs. The painted surface of the central panel of the earliest of these, the *Elevation of the Cross*, painted in 1610–11, measures 459.5 cm by 339.6 cm. In the second, the *Descent from the Cross*, painted for the Cathedral in 1611–14, the painted surface of the central panel measures 417 cm by 307 cm approximately. The remaining four altarpieces are single panels, but, following the Italian model developed during the previous century, are very tall: the latest, and tallest, the *Assumption of the Virgin*, painted for the Cathedral in 1625–6, is approximately 490 cm high and 325 cm wide. (It was made wider even before any painting was carried out in 1624; this is discussed below.) The other three, the *Last Communion of Saint Francis* (1618), the *Coup de Lance* (1620) and the *Adoration of the Magi* (1624), all now in the Koninklijk Museum voor Schone Kunsten, Antwerp, have heights of between 420 and 450 cm.[76] In every case, the panel – or central panel in the case of the triptychs – has been constructed using planks running horizontally rather than vertically: nineteen planks in the case of the *Elevation of the Cross* (of which the bottom one is not original) and seventeen in the *Descent from the Cross*. Aligning the planks parallel to the longest dimension was the usual construction method; this gives a stronger, more stable structure and entails fewer joints.

The structural difficulties faced are particularly apparent in the construction of the wings of the two triptychs. In the *Elevation of the Cross*, the left wing consists of six horizontal planks surmounted by six vertical to give the required height, while in the right wing this is reversed: the six vertical planks, 313.5 cm long, are topped by six horizontal planks (the painted surface of the wings is 150 cm wide). The two sets of planks are joined by a V-shaped tongue-and-groove joint (the groove being inserted into the ends of the vertical planks); otherwise open butt joints, reinforced by dowels, have been used throughout the construction. The panels are in good condition, except in the area of the joint between the vertical and horizontal planks; this inherently unstable piece of construction must have been necessary because planks of sufficient length (about 460 cm) were unobtainable. The longest planks in the altarpiece are those in the main panel (about 340 cm, or a little under twelve Antwerp feet) and in none of these six large altarpieces were the planks longer than 350 cm.[77] In the *Descent from the Cross*, a similar construction was used for the wings, but this time the V-shaped joint was placed high up in both wings,

where it would be less obvious to the viewer and structurally rather more secure.[78] It is interesting in this context that, in April 1613, the deacon and council of the Kolveniers Guild in Antwerp, who had commissioned the *Descent*, went with a joiner to St Walburga to examine the *Elevation* panel for possible faults; the panel-maker was Hans van Haecht in both cases. Conceivably this had some bearing on the orientation of the wing panels.[79]

Although wood was the traditional support for altarpieces, it was not invariably used. The three altarpieces Rubens painted in 1628 for the church of St Augustine, Antwerp (at present in the Koninklijk Museum voor Schone Kunsten) are all on canvas.[80] The choice and commissioning of the support was often the business of the client, rather than the artist. This is clearly shown by the documents for the *Elevation of the Cross*, and can be seen in the case of an altarpiece depicting the *Last Supper* for the abbey church of Sint-Winocksbergen (Bergues-Saint-Winoc) at Dunkerque, commissioned in 1611.[81] An even clearer example is the triptych of the *Miraculous Draught of Fishes*, painted by Rubens in 1618 for the Fishmongers' Guild at the church of Onze-Lieve-Vrouw-over-de-Dyle, Mechelen. The panel for this had been commissioned in 1614 and was in position on the altar, ready to be painted, the following year, but Rubens did not visit Mechelen to see the site until October 1617 and the contract was not finalised until February 1618.[82] Less is known about private commissions.

Panel-makers were registered in the Guild of Saint Luke, like the painters. In 1617, articles controlling the inspection and marking of panels and frames were incorporated in the regulations and also into those of the Schrijnwerkers (Joiners), in order that they should cover all those who were likely to supply goods of this kind. From these it is possible to learn that joined panels, large and small, were supposed to be made of dry – that is, seasoned – wood, without areas of sapwood or other weakness, fire damage or woodworm. The use of good '*wageschot*' rather than beech or softwood was required for large frames and so forth. Any panel-maker attempting to sell a panel before it had been inspected and branded by the Dean of the Guild or one of the inspectors (*keurmeesters*) was subject to a substantial fine (twelve guilders a panel) and if the wood was poor or the panel was in some other way not up to standard the inspecting officer was empowered to break it.[83] In practice the inspection was not always quite so rigorous.[84]

The inventory of the estate of Antonette Wiael, widow of the panel-maker Hans van Haecht, made on 5–7 July 1627, provides an insight into the panel-maker's trade. Van Haecht himself had died six years before, in 1621. Among the contents of the cellar or basement of the house '*de Coninck van Vranckryk*' in the Lombardenvest, Antwerp, were three carpenter's benches, wood suitable for joinery ('*schrynwerckershout*'), faulty panels to be remade or to be used as a source of wood, an iron glue kettle, a copper glue pot, joiner's cramps and a selection of tools, including an axe, shears (or knives), four saws, pliers, pincers, two drills, grinding- or whetstones and unspecified joiner's tools (Fig. 9). There were also unfinished frames and 148 eight-stuiver-sized panels, some still in the cramps used to hold the boards in place while the glue in the joints hardened. The inventory also records the presence of primed and unprimed ('*rou*') panels, in a variety of sizes and formats, and different types of frame in other parts of the property.[85]

Fig. 9 The joiner's workshop, showing a saw, an axe, planes and other tools. Hans Sachs, *Eygentliche Beschreibung aller Stände auff Erden*, with illustrations by Jost Amman, Frankfurt-am-Main 1568, f. Z.iv, 'Der Schreiner'. London, British Library.

From early in the century, the panel-maker was also responsible for having the white ground of chalk mixed with animal-skin glue applied to the panel;

this he might do himself or he might employ a *witter* (whitener), but the ground could not be applied until after the inspection.[86] In some cases the client commissioning the work paid an artist to prime the panel before the principal artist started work; however, it is not necessarily clear whether this meant simply the application of the ground, or of a thin layer of paint tinting its surface and also acting as an isolating layer (discussed below), or both. In 1625, for example, Adriaen Schut (registered in the *Liggeren* of the Guild of Saint Luke as a painter) was paid eight guilders to prime the panel for the *Assumption of the Virgin* and to paint its frame black before Rubens started work on it.[87] Ground could be applied to the back of the panel as well as to the front. It was a long-established practice to paint the back; it is seen in many fifteenth- and sixteenth-century Netherlandish panels and has the effect of protecting the wood from changes in relative humidity, thus reducing its tendency to swell, shrink or warp. The Van Haecht/Wiael inventory includes panels described as primed on both sides.[88] Examples in the National Gallery Collection include Rubens's *Minerva and Mercury conduct the Duke of Buckingham to the Temple of Virtue* (Plate 8, p. 29), painted before 1625, and *The Rape of the Sabine Women* (NG 38), painted around 1635–40. As mentioned above, movement of the wood is a particular problem for panels with structural members aligned both vertically and horizontally; the presence of a coating on the panel reverse might thus be expected. It is found, for example, on Rubens's *An Autumn Landscape with a View of Het Steen in the Early Morning* (NG 66), which is painted on a panel constructed of some nineteen planks (another two were added later) arranged horizontally and vertically.[89]

Fig. 10 Peter Paul Rubens, *The Coup de Lance* (NG 1865), before 1620. Oak, 64.8 × 49.9 cm.

In 1617 a regulation was introduced to control the number of standard sizes of panels, which from this time were to be based on models kept in the Guild office.[90] The regulation lists five sizes, from a guilder to a half-stooter (a stooter was equivalent to 2.5 stuivers), but in practice other sizes, such as sixteen stuivers, also occur, which are not listed. The fact that some of the Van Haecht/Wiael panels were described as 'long' or 'large' versions suggests also that neither the size nor the format requirements were inflexible. An attempt has been made to link the named sizes with actual measurements, based on the identification of existing paintings with those listed in inventories; this and more recent work suggest that another unlisted size, the *salvator*, measuring about 60 × 50 cm, was very widely used. The panel Rubens used for *The Coup de Lance* (NG 1865, Fig. 10), the sketch for the altarpiece for the church of the Récollets, is approximately this size (64.8 × 49.9 cm). That used by Van Dyck for *Carlo and Ubaldo see Rinaldo conquered by Love for Armida* (NG 877.2), a sketch for an engraving painted 1634–5, is a little narrow, measuring 57 × 41.5 cm, but both panels were branded on the reverse with the mark of the city of Antwerp and the latter also bears the initials of the panel-maker Michiel Vriendt. The twenty-six-stuiver size appears to measure about 75 × 110 cm.[91] This is very close to the size of the panel used by Rubens for *A Lion Hunt* (NG 853.1) painted around 1616–17, which measures 73.6 × 105.4 cm and is marked on the reverse.

Antwerp panel marks have been the subject of much study. The 1617 regulations stipulated that no panel could be sold or primed until it had been inspected and branded by the Dean of the Guild or his representative. This brand took the form of a castle and a pair of hands representing the city of Antwerp; different branding irons were used over the years (sometimes concurrently) and their design varied in detail.[92] The 1617 regulations further stipulated that the panel (or frame) should be marked by its maker's personal mark; the penalty for not so

Plate 6 Peter Paul Rubens, *Portrait of Susanna Lunden (?)* ('*Le Chapeau de Paille*') (NG 852), probably 1622–3. Oak, 79 × 54.6 cm.

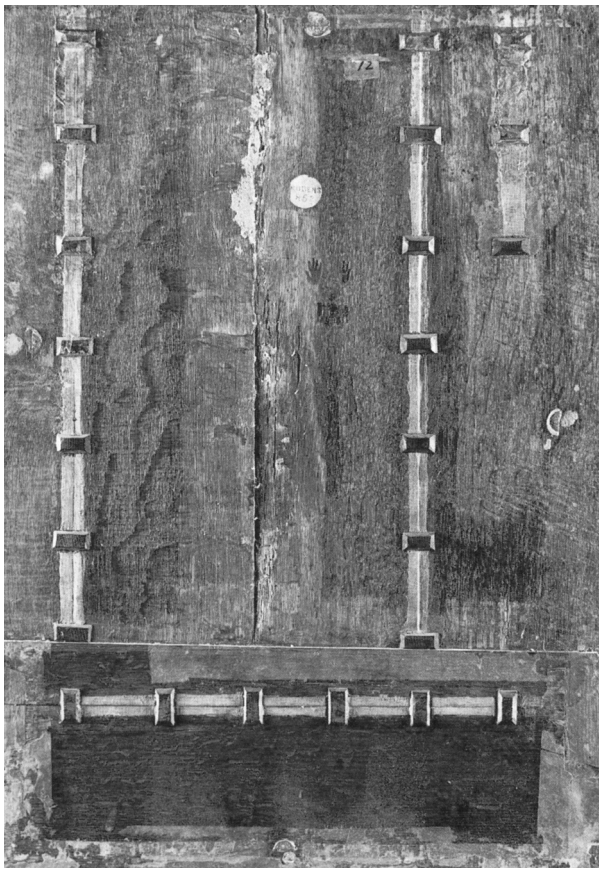

Fig. 11 Peter Paul Rubens, *Portrait of Susanna Lunden (?)*. Reverse (with later reinforcement). The original panel of two planks was extended during painting with a narrow strip seen on the left, and at the bottom by a plank with the grain running horizontally.

doing was a fine of three guilders. At this time, twenty-one panel-makers registered their marks.[93] A great many marked panels have been found and many of the panel-makers have been identified. Michiel Vriendt's mark 'MV' is found on several panels in the Collection: apart from those mentioned above it also appears on the reverse of Rubens's *Portrait of Susanna Lunden* (NG 852, probably painted 1622–3, Plate 6), and on David Teniers's *Two Men playing Cards in the Kitchen of an Inn* (NG 2600, probably 1635–40). A painting attributed to Teniers, *Peasants making Music in an Inn* (NG 154, about 1635) is marked F/ DB, the mark of the panel-maker Franchois De Bont (François de Bout).

If panel-making was so strictly controlled the question arises as to how certain panels could have been passed as satisfactory by the Guild when their construction was unsound. Many of these are associated with Rubens and with his landscapes in particular. As explained earlier, these were not commissioned, but were entirely private works, and it could be said that they constitute a special case. As a court artist Rubens was himself a special case: he was not obliged to register his apprentices with the Guild and perhaps his position may have given him other exemptions also, so that when he had panels made up for his own use at his own expense, he could have them made as economically as possible. However, there are other possible interpretations and in one or two cases, such as *Sunset Landscape with a Shepherd and his Flock* (NG 2924) and *'The Watering Place'* (NG 4815), both painted around 1615–22, it is possible that the artist reworked and extended a pre-existing composition.[94]

Additions to a pre-existing support contemporary with the painting process are not uncommon and may have been carried out for a number of reasons. The support, or the finished painting even, might turn out to be the wrong size for the site, or the intended site might be changed. When the panel for the *Assumption of the Virgin* was set up on the high altar in Antwerp Cathedral in 1624 it was found to be too

narrow and had to be enlarged, a task for which Michiel Vriendt was paid thirty-eight guilders in 1625.[95] Several of the surviving canvases for the Torre de la Parada hunting lodge, commissioned by Philip IV around 1636 and painted, following oil sketches by Rubens, by Rubens himself and other Antwerp artists, have been enlarged and it seems likely they were made to the wrong dimensions for their intended positions.[96] Another difficulty, referred to by Rubens in his letters, was that units of measurement varied from place to place; allowance was usually made for this, but not always successfully.[97] Sometimes additions were made for reasons of economy: a pre-existing, unused support was enlarged. This may partly explain the additions to the panel Rubens used for *The Three Graces* (Madrid, Museo del Prado). The central portion consists of a panel of six vertical planks, of high quality, bearing the Antwerp brand. An addition was then made on the left-hand side; then a section made up of short, vertically aligned planks, slightly narrower than those used for the original panel, was attached at the top with a half-lap joint and glue. (Examination of Rubens's landscape panels has shown that this joint was frequently used to make additions to a pre-existing panel.[98]) Finally a full-length addition was made on the right. However, there is another possibility: as the figures fit the original portion exactly, it could be that the artist decided to add to the composition during painting, as he did in the *Portrait of Susanna Lunden* (Fig. 11).

Canvas

Canvases in both twill and plain tabby weaves, woven in various widths and different degrees of coarseness, are found across Europe. Probably most are linen, although hemp fibres could also be used, particularly for coarser fabrics; hemp was apparently used in the Dutch sailcloth industry, for example.[99] As most seventeenth-century canvas paintings have been lined it is rarely possible to investigate the fibres of the original canvas itself. Twill-weave fabrics are more easily characterised, although rather rarely used; ticking is an example (discussed below). The important factors, as far as the quality of the fabric was concerned, were that it should be strong, usually relatively closely and evenly woven and with few knots.

In the Low Countries and many other Northern European countries, cloth was measured by the ell and woven to a range of standard widths based on this measure, expressed by such terms as 'six quarters', 6/4 ells, and so on. The precise dimensions of the ell varied from place to place, although the ell of Brabant, equivalent to about 69.6 cm and used in both Antwerp and Brussels, was widely used for trading purposes. Thus, for the Brabant ell, the 6/4 width would be equivalent to 104.4 cm and the 5/4 width to about 87 cm. In England the yard measure, first standardised according to an iron measuring rod during the reign of Richard I in 1196, predated the ell, and cloth widths (expressed as above, but as fractions of a yard) were based on this. The ell, 5/4 yards or 45 inches (about 114 cm), was in use by the fourteenth century, but seems not to have been defined by a standard (bronze) measure until 1588.[100] According to Lewis Roberts, in *The Merchants Mappe of Commerce* (London 1638), wool and silk were commonly measured by the yard in the City of London, while the ell was used for linen; 60 ells of London were equivalent to 100 Antwerp ells (understandably, his conversion factors are based on large quantities of goods).[101] The units of measurement in the Italian states were usually based on the *canna* (cane) or the *braccia*, which were subdivided according to local custom; frequently the subdivisions varied according to what was being measured. In Genoa, according to Roberts, the cane was subdivided into nine palms (equivalent to about 24.8 cm) for silks, but ten for linen; 100 palms were equivalent to 27 yards or about 34 Antwerp ells. The cane measure used for linen was thus equivalent to about 248 cm. In Rome the *braccia mercantile*, consisting of four *palmi da tela* (about 21.2 cm), or the *braccia da tessitore* (*tela*), three *palmi da tela*, might be used.[102]

Although linen was produced around Antwerp and other towns, Ghent was one of the most important centres for the linen industry in the Spanish Netherlands throughout the seventeenth century.[103] All types of linen were produced, from ticking for bedding to fine damask and table linen, and much was exported. After Spain and the Spanish colonies, the most important market was England. Flax was imported from the Baltic region, particularly the region around Riga in present-day Lithuania, and woven in the villages all around Ghent. The linen would then be brought into the city at the Friday Market to be assessed. In the early years of the century, the linen merchants had insisted that, at this stage, the cloth should be measured according to a standard unit, the crude or rough linen ell of about 76.5 cm (30 English inches).[104] The quality of the linen was indicated by seals: *Brabantes* and *Presillas*

cloth with the required width of 6/4 ells (about 114.75 cm, by this measure: rather more than the Brabant equivalent would be, but very close to the English ell) was marked with a black lion in 'oil colour'. Pieces that were a little too narrow were marked accordingly. The *Brabantes* was the better quality of the two and was sold in three grades: superfine (exported to Spain), fine and ordinary. *Presillas* was a more workman-like, coarser type of cloth, suitable for sails or trousers, for example, and sold in two grades. The dearest variety of linen, the *Gantes* or Ghents, was sold at the small linen market and, if of the required width of one and a quarter ells (95.6 cm), it was marked with a lead seal in the form of a crowned 'G'. Of the three grades available, the superfine was exported by land to southern Europe; the fine and ordinary went by sea to various parts of Europe, including England.

The English linen industry was small by comparison with the wool industry; much was imported from other parts of Europe, principally France and the Low Countries. Linen and, in particular, canvas for use as sailcloth were imported from Brittany and Normandy: Noyales and Vitry canvas appear in the accounts for the naval dockyards at Chatham in 1629 and 1630.[105] In this context, it is worth noting that Dutch sources mention the use of sailcloth as a support for paintings and Vitry canvas was one of the cloths used for the decorative scheme executed by Hans Holbein and others for Henry VIII at Greenwich in 1527, partly for use on the roof.[106] An indication of the varieties of linens imported may be gained from the 1642 edition of *The Rates of Merchandizes*. The list includes brown (unbleached) and white Dutch, Prussian and French canvas (including Vitry canvas), damask, lawns, calico, towelling, cloths described as Flanders and Holland cloths – Flemish, Ghentish, 'Overisils' (from Overijssel), Brabant, 'Freeze' (from Friesland), brown and bag Holland are examples – dowlas (a coarse linen from Brittany), 'Ozenbrigs' (from Osnabrück), twill and ticking (the last described as from 'the East Country' and from Scotland). The equivalent list of duties on exported goods shows that some canvas, sacking and ticking (woven in twelve-yard lengths, the width not given), was exported from England.[107]

A small handbook for drapers written in 1695 describes many of the fabrics, their widths and the lengths in which they were sold, whether or not they had been bleached or 'whitened', and suggested uses. The French canvases, the import of which was apparently prohibited at that time, were omitted. Various types of Holland were described. At this time 'Burelaps' (burlap) was one of these: later the name was applied to hemp or jute canvas, used for sacks and bags. It wore well if thick and even-threaded and came in widths of an ell (45 inches), a yard or 3/4 yard (27 inches). Many, including the Ghentish Hollands, came in widths equivalent to the English ell and yard, as can be seen from the discussion of Ghent fabrics above. 'Frize' (Friesland) Holland appeared less evenly woven, thinner and less strong than the others because it had not been calendered or thickened after bleaching, 'but is just as it comes from the whitster'; it was in fact very strong. 'Linnen – Hemp Roles', which was always imported unbleached, was a strong coarse linen a yard (91.4 cm) wide: 'although not very thick, it wears admirable strong; there is much of it used brown for ordinary Painting'. 'Ozenbrucks' (Osnabrück), a coarse linen, was also used unbleached for painting.[108]

Little is documented on the choice of textiles for painting supports in seventeenth-century England and most of our information (relating to the portrait painter Mary Beale and to Sir Peter Lely) dates from some forty years after Van Dyck's death; however, the recurrence of textile names in sources throughout the century suggests that what was chosen in the 1670s and 80s would have been available earlier. Charles Beale, the husband of Mary Beale (1632/3–99), acted as a colourman and also stretched and primed canvases. His pocket books for 1677 and 1681 record the purchase of eight types of cloth as painting supports, including the 'Oznabrug'. Sacking appears to have been quite widely used; it is also referred to in the account book of the executors of the estate of Sir Peter Lely (d. 1680) between 1679 and 1691.[109] Two of Charles Beale's other chosen textiles, flaxen and 'Gentish Holland' are discussed above. Another, 'Dutch cloth', was probably a type of Holland.

Beale's last cloth, ticking, is in one way an unexpected choice for a support as it was often striped dark blue or black (as it is today); yet it is extremely strong and closely woven and available in larger widths. Typically it was used for beds: 'ticks'.[110] Ticking seems to have been used particularly for very large works. It was used for Van Dyck's huge *Equestrian Portrait of Charles I* (NG 1172), painted in 1637–8. The support, which measures 367 cm (144 inches) high and 292.1 cm (115 inches) wide, is made up of two pieces of fabric with a horizontal seam; this gives the width of each piece as at least 72 inches (two yards) wide, and in practice it must have been more to allow for the turnover (see p. 77). One of

Plate 7 Jacob Jordaens, *Portrait of Govaert van Surpele (?) and his Wife* (NG 6293), probably 1636–8. Canvas, 213.3 × 189 cm.

the earliest commissions Van Dyck carried out on his return to England in 1632, the so-called 'Great Peece', the group portrait of *Charles I and Queen Henrietta Maria with their Two Eldest Children, Charles, Prince of Wales, and Mary, Princess Royal* (Collection of Her Majesty The Queen), is also on ticking. The painted surface originally measured 298.1 × 250.8 cm, including additions made by Van Dyck at the top and on the right, but was subsequently enlarged.[111] Larger still was the group portrait of *Philip Herbert, 4th Earl of Pembroke, and his Family* (Salisbury, Wilton House), painted between 1633 and 1637 and measuring 330 × 510 cm (see note 40 on p. 83 of this *Bulletin*).[112] Ticking was not only used in England: it has been identified in three seventeenth-century Flemish paintings, one of which, *The Coronation of the Virgin*, painted between 1636 and 1645 by Nicolas de Liemaker (Ghent, Museum voor Schone Kunsten), at 324 × 241 cm, is almost as large as the *Equestrian Portrait of Charles I*.[113] In each case, the fabric is striped dark blue, the warp threads in the stripes being dyed with indigo.

Clearly, cloth that could be used as a painting support in the Spanish Netherlands, England or anywhere else was available in a range of 'standard' widths, some of which were very much wider than those described above; an example is that used for *The Brazen Serpent* (NG 59), painted by Rubens between 1635 and 1640 (186.4 cm high and 264.5 cm wide, lined, edges covered by paper).[114] The inventory of a Rotterdam shop selling artists' materials, made in 1673, lists several widths of artists' canvas imported from Antwerp: 5/4 ells (about 87 cm), 7/4 ells (about 121 cm) and 2 ells (about 139 or 140 cm); other widths were not specified.[115] It seems highly likely that canvas in these widths was available in Antwerp, and perhaps exported elsewhere, earlier in the century. It is also likely that, as far as English paintings are concerned, most cloth would have been imported. However, it would usually be impossible to assign the canvas used for any particular painting to any particular source, as the widths of the different textiles were in practice often rather close and it is difficult to assess the original width of the fabric used for a painting support. As most canvases have been lined and have often lost any trace of their original tacking edges, there is no selvedge upon which to base the measurement and the allowance for the tacking edge must be estimated. Where there is a seam, one selvedge for each piece might be observable, but only if the edges of the pieces had been sewn butted together. One example where remains of the original selvedges could still be observed (during conservation treatment) is David Desgranges's group portrait of *The Saltonstall Family* (London, Tate Gallery), painted around 1636–7.[116]

It is frequently found that canvas supports have been pieced together, using narrower strips and pieces added to one side of a larger piece or pieces to make up the required size. Sometimes such additions indicate later modifications to the composition. Jacob Jordaens's *Portrait of Govaert van Surpele(?) and his Wife* (NG 6293, Plate 7) of about 1636–8, which is on a support made up of six pieces of canvas appears to have been conceived in at least two stages. The strips at the bottom were added by the artist when he needed to alter the composition.[117]

The relative coarseness or fineness of a canvas can be expressed in the form of a thread count, giving a measure of the thread density. When it has been possible to examine Flemish and English plain tabby-weave canvases (generally in the form of their X-radiographs, rather than directly) thread counts have been in the range 11–20 threads/cm, both in the warp and in the weft; the weft threads themselves may be less even in their thickness and (as one might expect from the weaving process) the weft counts in any one canvas may vary more than those of the warp, but only to a very small extent. Most of the

canvases used by Rembrandt and other Dutch painters fall into the same range.[118] Several of the paintings Van Dyck produced in England are on canvases of rather similar weights, the portrait of *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover* (NG 6437, about 1637) is on a canvas with 11 threads in the warp and 11–12 in the weft; that for *Lord John Stuart and his Brother, Lord Bernard Stuart* (NG 6518, about 1638) appears to be of a rather similar grade. The portraits, on single pieces of cloth, are similar in width (149 cm and 146.1 cm respectively), suggesting that the same width of canvas was used for the two. The portrait of *A Lady of the Spencer Family* (London, Tate Gallery), painted around 1633–8, is on a very similar canvas, 11 threads in the warp, about 13 in the weft.[119] It seems that this particular grade was quite popular; certainly it was not unique to Van Dyck: Cornelis Jonson's *Portrait of an Unknown Lady* (London, Tate Gallery, 1646), for example, was painted on a canvas with 11 threads in both warp and weft.[120]

Seventeenth-century Italian canvases have been less well studied. It has been pointed out that some of the works Van Dyck painted shortly after his arrival in Italy are on particularly fine canvases and this is the case with the *Portrait of George Gage with Two Attendants* (NG 49) probably painted in Rome in 1622–3 (see pp. 56–9 of this *Bulletin*).[121] Some Italian canvases are very coarse indeed, however. Richard Symonds, writing in 1651–2, quotes a comment by the English painter Robert Walker on the amount of paint used on coarse Italian canvases and their tendency to crack when rolled.[122] Caravaggio's *Saint John the Baptist* (Rome, Musei Capitolini, *c.*1602–3) is painted on a coarse canvas with a thread count of only 8 threads in the vertical direction and 9 in the horizontal, possibly made of hemp rather than linen. Hemp was certainly cultivated in parts of Italy at that time and it has been suggested that Caravaggio used heavy hemp canvases quite frequently.[123] The canvas used by Van Dyck for *The Balbi Children* (NG 6502), painted in Genoa in 1625–7, is almost as coarse (11 threads/cm warp, 8 threads/cm weft) as that described for the Caravaggio picture; a rather similar weight of canvas was used for the *Portrait of Giovanni Battista Cattaneo* (NG 2127), attributed to Van Dyck and thought to have been painted in Genoa at about the same time (9 threads/cm warp, 9–10 threads/cm weft). However, in these cases the fibre used has not been identified.Unfortunately, even on the rare occasions when it is possible to examine the canvas itself, deterioration of the threads usually makes the identification of the fibres as hemp or linen very difficult. If the coarse outer fibres of flax, or a particularly coarse grade, have been used for the textile, the distinction between flax and hemp is even more difficult.[124]

In order to be primed and used as a painting support, the canvas had to be stretched on a framework, or strainer. Probably this was done by simply lacing the cloth inside the opening of the strainer with cords. The canvas would then be sized and, when dry, primed. The pattern of distortions set up in the fabric from the points of attachment to the framework appear as a regular series of cusps or scallops around the edges of the canvas. The tension pattern is, so to speak, 'fixed' into the textile and may thus be seen in X-radiographs of paintings (Figs. 12 and 13). As it was caused during the first stretching and priming process, it records the original format of the canvas; the presence or absence of this so-called 'primary' cusping may thus provide useful evidence where, for example, it is suspected that the format of a painting has been altered.[125] There is also evidence that canvas might sometimes be primed in larger pieces, such as the long strips cut from the rolls in which the textile would be sold, and then cut to size as required. In the case of the strips, the canvas was attached as described along the length of the piece (the selvedge edges, in fact), but usually only by the corners at the two short sides.[126]

The primed canvas might remain on the same strainer for painting, or it might be restretched, perhaps inside another strainer with cords as before. Sometimes the canvas was stretched against the front surface of a strainer that was only barely larger, being laced into position. It could be nailed to the strainer, wrapping the edges of the canvas around the framework. In these cases, the canvas would in effect be on its final stretcher, ready for framing on completion. As the ground layers would not be thoroughly hardened in such a short time, the second stretching might also produce some distortion around the edge of the canvas ('secondary cusping'), although the original lacing holes would be re-used to some extent.[127] Some illustrations of seventeenth-century artists at work show the canvas stretched within a framework (Fig. 7, p. 16). The poet Sir John Suckling mentions what must, in the context, be a frame of this general type in a letter to his uncle, the Earl of Middlesex, while making a comparative point using Anthony van Dyck at work as an example: '... Van Dike with all his fine Colours and Pensills about him,

Fig. 12 Peter Paul Rubens, *Portrait of Thomas Howard, 2nd Earl of Arundel* (NG 2968), 1629–30. Canvas, 67 × 54 cm.

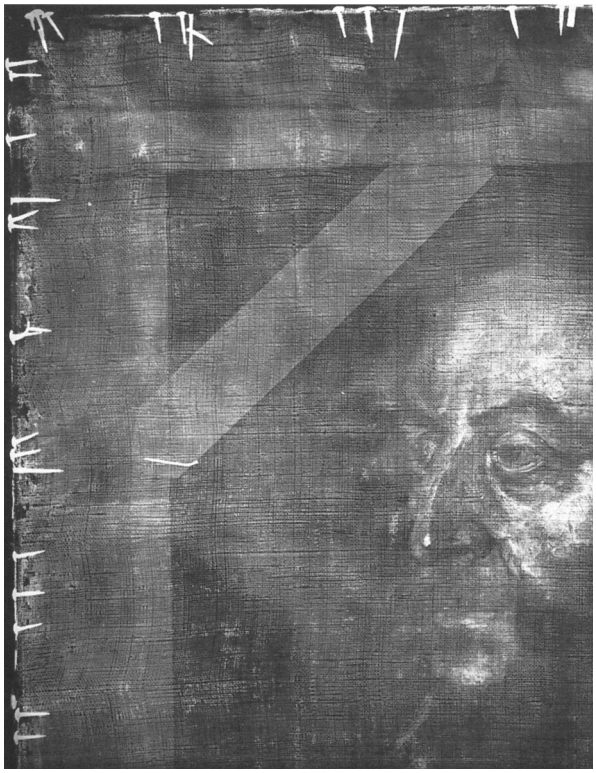

Fig. 13 Peter Paul Rubens, *Portrait of Thomas Howard, 2nd Earl of Arundel*. X-radiograph of top left corner, showing cusping along edge of canvas.

his Frame and right Light, and Everything in order ...'[128] Inventories of artists' property sometimes mention strainers, but they do not necessarily provide evidence of whether the artists primed their own canvases or bought them ready-primed.[129] However, it is clear from the 1673 Rotterdam inventory that ready-primed canvas was available at this date and there are other, earlier, Dutch references to specialist primers.[130] De Mayerne records the method for priming a canvas used by an unnamed Flemish primer – *imprimeur* – and a comment made by a Flemish painter named Portman on how to make good a picture on canvas that has split 'by the fault of the primer'.[131] If canvas primers were working in London in the 1630s, it seems inconceivable that they were not to be found in the very much more developed world of the Antwerp artistic community, particularly as so many painters from this region had come to London to work. However, undoubtedly painters also stretched and primed their own canvases; the inventory of the estate of Johanna Daragon, wife of the painter Johannes Cossiers, mentions a debt of twenty-four guilders for an order of linen for painting. The inventory of Rubens's estate also records a payment to one Hans Diericx for *schilderlynwaet* (painters' linen).[132]

Like the panels, canvases in Antwerp could be bought in standard sizes. The Van Haecht/Wiael inventory includes two primed canvases on strainers, each two *doecken* large. Other canvases and pictures are described as *halffdoecxkens* and *quaertkens doecxkens*. The pattern of double, single, half- and quarter-sizes occurs in other inventories.[133] The dimensions of a *doek* in Antwerp probably related to the Brabant ell measure, or to some commonly used canvas width. As frames were also available in standard sizes, it seems very likely that the standard canvas formats bore some relation to those for panels. By the middle of the century, if not earlier, standard-sized canvases were available in cities in the Northern Netherlands and Rome, the sizes here being indicated by price; by the 1670s (and, again, very probably earlier) they were available in London.[134]

Copper panels

Although neither Rubens nor Van Dyck seem particularly to have favoured the use of metal panels as supports for painting (only four paintings by Rubens on copper are known, for example), copper panels were quite widely used in the seventeenth century, particularly in Italy and in the Netherlands generally. In a letter referring, with great sadness, to

the death of his friend the German painter Adam Elsheimer, Rubens commented that Elsheimer's widow should send a painting of *The Flight into Egypt* on a copper panel to Antwerp for sale, as many people there were interested in small works.[135]

It is thought that the development of etching and engraving during the sixteenth century may have contributed to the use of copper plates as supports for painting, particularly as many painters also produced intaglio prints. The Antwerp painter David Teniers the Younger, for example, who painted landscapes and genre scenes, also produced etchings; a series of four paintings of activities representing the seasons in the National Gallery Collection (*Spring*, *Summer*, *Autumn* and *Winter*, NG 857–60, dated about 1644) are on copper plates. These are quite small, ranging from 21.9 × 16 cm (*Summer*) to 22.1 × 16.5 cm (*Spring*). *Pan pursuing Syrinx* (Plate 3, p. 8), in which the figures were painted by Van Dyck's first master Hendrick van Balen the Elder and the landscape by a follower of Jan Brueghel the Elder, perhaps shortly after 1615, is only slightly larger at 25 × 19.4 cm. Many paintings on copper supports (and, indeed, many etchings) are larger than this. The use of plates previously used for etching or engraving seems to be fairly uncommon, however.[136] Copper plates were occasionally coated with another metal (tin or zinc). In order that the paint should adhere to the smooth metal surface, it was necessary to prepare the plate before use. Recommended treatments included abrasion, and rubbing the plate with garlic, which is sticky when first applied; the garlic acts as a wetting agent, preventing surface tension effects between smooth shiny metal and oil paint interfering with the application of paint and formation of the film. Another treatment was to wipe the plate over with linseed oil. A thin oil-based ground, usually containing lead white mixed with other pigments, was then generally applied.

The Preparatory Layers

Panels were prepared with a white ground of chalk (calcium carbonate) in a medium of animal glue; in Antwerp, this was normally done by the panel-maker. The panel was then scraped down with a knife until it was even and the process could be repeated. It should be noted that both Henry Peacham and the author of MS Harley 6376 refer to this stage as 'whiting' the panel; priming was the next stage, where one or sometimes two layers of a suitable pigment mixture in linseed oil were applied. De Mayerne's informants preferred a mixture of lead white and umber; the author of MS Harley 6376 suggested lead white with a little red lead in the first layer, with the addition of the brown earth pigment Spanish brown and umber in the second. He noted that the first layer should be thinned with oil as some oil would inevitably sink into the white layer below; if this was not done the colours applied above would tend to sink. This layer acted as an isolation layer, as well as providing a fairly neutral brownish or greyish tint to the ground, the density of which would depend on the thickness of the layer.[137]

Fig. 14 Peter Paul Rubens, *Portrait of Susanna Lunden (?)*. Detail photographed at ×4. The priming is clearly visible through the thin paint on the sitter's forehead. A point, perhaps the brush handle, was used to draw curls of hair in the wet paint.

In those panels by Rubens and Van Dyck in the National Gallery Collection that have been examined, the priming layer is often extremely thin. It is thus difficult to identify the medium present, but in Rubens's *Samson and Delilah* (NG 6461) and in the greyish priming in Van Dyck's *Charity* it is oil.[138] It is perfectly possible that a thin priming or isolation layer, in some neutral tint, in oil medium, was applied by the panel-maker or the *witter*, perhaps routinely. If the artist wanted a particular type of priming (or none at all) he could ask for it, or apply it himself in the studio. The streaky appearance of Rubens's brown, ochre and lead white-containing primings (characteristic, perhaps, of the use of a broad, comparatively stiff, bristle brush) has often been noted: it can clearly be seen in *Samson and Delilah* and the *Portrait of Susanna Lunden* (NG 852), for example (Fig. 14). Its application is more obvious in

the oil sketches, none more so than *A Lion Hunt* (NG 853.1), where its application is particularly random.[139] Rubens's primings are so characteristic that it might be supposed that they must have been applied in his studio, but streaky primings may be found on other contemporary panels.[140]

Canvas grounds are rather variable in their colour and pigment content, and in the number of layers present, depending on local practice and, partly, on materials available. The method of application seems to be fairly constant: the chosen pigments were ground in linseed oil and spread thinly and evenly across the canvas with a knife, working in well. This would require particular care with a closely woven, calendered fabric like ticking; equally, it can be seen that the interstices in a coarse, open-weave canvas would take up quite a lot of paint. After the paint had dried, the surface was scraped with a knife, cutting away knots and protrusions from the fabric, and polished with a pumice stone. Another layer might then be applied.[141] The author of MS Harley 6376 points out that the colour should be as thick as that used for painting, and that the pigments used in the lower ground layer could be quite coarsely ground; Richard Symonds, recording the practice of the painter Giovanni Angelo Canini in Rome, observed similarly that they should be finer in the upper ground layer. This is generally borne out in practice. In MS Harley 6376 a mixture comprising lead white, red lead and the earth pigments Spanish brown and umber is suggested, with the addition of a little black in the upper layer if required. This would dry well, but the author warns against the use of too much red lead as the mixture would 'pill of in a length of time but especially on cloth when you roul it up'. De Mayerne's informants suggested English brown-red (an ochre), burnt ochre, lead white with a little umber, yellow ochre, lead white with a little red ochre and umber, and bole (a clay deriving its colour from the red iron oxide it contains) with umber.[142] The mixture used by Canini included red earth, a little lead white, *creta* and a little black; the ordinary canvas primers seem to have omitted the lead white which would act as a drier as well as modifying the colour slightly. The word '*creta*', chalk, could apparently signify other white silicaceous earths and clays. Symonds also noted that the earth used for making bricks could be ground and used for priming.[143]

Analysis of the materials present in the grounds of the paintings by Van Dyck in the National Gallery Collection shows that there is a close relationship between the chemical composition of the ground of a painting Van Dyck produced in Rome and that of the grounds of other paintings produced in Rome at that time – those of Poussin, for example – although visually the grounds may look rather different when observed under the microscope. The grounds of paintings produced in London or Brussels are dissimilar both to those produced in Rome and to each other (this is discussed further in the article on Van Dyck's paintings, pp. 50–83). This suggests that painters had their canvases primed locally, or bought them ready primed; as with the panels, another ground layer could be applied in the studio if desired. Symonds's comment on the use of an earth used for brick-making is interesting as the composition of the Roman and Genoese grounds (or the lowest layer in the case of those paintings, like the portrait of *George Gage*, where there are two) is reminiscent of locally quarried earths rather than a specifically chosen pigment mixture. Seventeenth-century Roman grounds are often reddish or brownish in colour and often single-layered, but may be translucent and the actual iron oxide content may be rather low. However, Symonds's mention of the addition of some form of white earth suggests that this practice cannot be ruled out.

The grounds applied in London often appear to have a two-layered structure, of which the lower one is reddish or orangish brown and sometimes markedly translucent; the upper is grey and may have been applied to order, or in the studio. Often chalk is present in the lower red-brown layer, mixed with ochre pigments. This is seen in Van Dyck's *Equestrian Portrait of Charles I* and *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover*. The grounds of Rubens's rather earlier *Portrait of Thomas Howard, 2nd Earl of Arundel* (NG 2968, painted during his visit to London in 1629–30 (Fig. 12, p. 26), and the central part of his *Minerva protects Pax from Mars* ('*Peace and War*') (NG 46, discussed on pp. 89–95) of about the same date, are very similar in translucency and appearance. However, other translucent white earths were also used, such as china clay (kaolin). A white clay of this type was found in the ground of Van Dyck's 'Great Peece', and the use of pipeclay in the ground of this painting was thought to be responsible for the poor adhesion between the paint and the support as early as 1676.[144]

A probable reason for the use of a locally quarried earth, or the additions of materials like chalk or china clay (which are, for practical purposes, colourless in oil medium), was their cheapness and ready

availability. The main function of this lowest layer, after all, was to help counteract the absorbency of the textile support and to provide an even working surface. Other pigments present, such as lead white, red lead or earth pigments, would improve the drying of the oil and add colour if desired. Other factors need to be borne in mind, however: these include the working properties of the mixture and the need to avoid absorption of the oil medium from the paint layers above, which causes them to 'sink', that is, to dry with a matt surface. Some pigments, notably umbers, were particularly likely to cause this, although they were suggested for use in grounds as they dry well.

The Practice and Materials of Painting

Preliminary drawings and *modelli*

The finished painting marked the last stage in the evolution of the composition. It was preceded by preliminary drawings and sketches in which the design of the composition was developed to the point where it could be transferred to the final panel or canvas, being drawn initially perhaps with black chalk or charcoal, then reworked with a brush and fluid paint (see pp. 50–83).[145] This might be backed up by drawings from a model for particular figures or poses where required, or even from a collection of patterns for particular features; Van Dyck, for example, used such drawings for the hands of his sitters, according to Everhard Jabach's account to de Piles, and also for plant and landscape forms.[146] It is possible to see such a progression taking place in the series of drawings for one of Van Dyck's earliest works, *The Carrying of the Cross*, probably painted during 1617 and 1618 for the Dominican church of Saint Paul's, Antwerp, one of a series of works commissioned from the leading painters in Antwerp, including Rubens, Jacob Jordaens, and Van Dyck's first master, Hendrick van Balen, an august company for the young Van Dyck. The final drawing in the series, which is in black chalk overlaid by a more precise drawing in pen, ink and washes, is squared up for the final transfer to the panel.[147]

A final, small-scale *modello* of the composition might be made in oil, in grisaille or in colour, to a greater or lesser degree of finish. This could be shown to the patron commissioning the work for his approval; it could also be used as a guide when the final painting was produced. A great many such *modelli* by Rubens survive; examples in the National Gallery Collection include *Saint Bavo about to receive the Monastic Habit at Ghent* (NG 57), painted for a triptych intended for the high altar of Saint Bavo, Ghent, which was commissioned in 1611 or 1612, and *Minerva and Mercury conduct the Duke of Buckingham to the Temple of Virtue* (Plate 8). This is the preparatory sketch for a ceiling painting in the London house of the Duke, commissioned around 1625. The production of *modelli* as a regular part of the compositional process, as it appears to be in the work of Rubens, must relate to the part played by his studio in the production of the final works themselves.[148] Although Van Dyck also produced small-scale versions of compositions in oil, he did not make as much use of *modelli* as Rubens, preferring to use drawings instead; his assistants worked from a sketch for portraits, according to Jabach's account. Little is known about the workings of Van Dyck's studio at any stage, but during his years travelling through Italy he cannot have had much studio assistance. In Genoa he would perhaps have been able to draw on the community of Flemish painters there; he was friendly with Cornelis de Wael and is known to have had the occasional collaboration of Jan Roos. During his time in Genoa, he may have made small oil sketches of the heads of some of his sitters, particularly women. The sketch could be made in the sitter's house and the final portrait on canvas could then be worked up in the studio, which it might have been deemed inappropriate for the sitter to visit. A study on canvas (in the National Museum of

Plate 8 Peter Paul Rubens, *Minerva and Mercury conduct the Duke of Buckingham to the Temple of Virtue* (NG 187). Oak, 64 × 63.7 cm.

American Art, Washington) was made for the portrait of *Elena Grimaldi Cattaneo* (in the National Gallery of Art, Washington); the red flower worn by the sitter in the study is replaced by a red parasol in the painting.[149]

Painting materials: pigments

The painting materials generally available for use in the seventeenth century included the natural mineral blue pigments, ultramarine and azurite; the yellow, red and brown earth pigments; the manufactured pigments, such as vermilion (which also occurred naturally), lead white, red lead, lead-tin yellow, smalt and verdigris; the red and yellow lake pigments; the insoluble blue plant dyestuff, indigo; and, finally, the different blacks. There was also a greatly increased use of artificially prepared blue and green copper pigments. The differences observed between the paint of a mid-to-late sixteenth-century painter and one working fifty or sixty years later lie more in the way the materials are used, not in the materials themselves. In practice, there were some changes, partly because certain pigments, such as azurite, became very scarce; partly, perhaps, for aesthetic reasons. Scarcity and expense were certainly factors in the changing pattern of use seen in the blue pigments, which are discussed below. However, a pigment like verdigris (the collective name for the blue-green basic copper acetates), which was 'nothing else but the rust of brasse ... as you may see many times upon foule candlestickes' and was manufactured from copper plates and vinegar, or acidic wine residues, was neither scarce nor particularly expensive, although its quality was variable and so-called distilled verdigris (neutral copper acetate, recrystallised from vinegar) was said to be preferable.[150] Its use, however, tended to decrease in the seventeenth century, particularly in landscape painting. It is possible that, for naturalistic landscapes, the colour was not to the taste of the times; more subtle, less strident foliage greens could be obtained by other means. It was more successfully used in the painting of drapery or clothing and was employed by Van Dyck, for example, for the green clothes of the central boy in *The Balbi Children* (NG 6502), painted in Genoa in about 1625–7 (see p. 63). Like other copper-containing pigments, verdigris was also a useful drier for blacks and other poorly drying pigments and it continued to be recommended for this purpose.[151]

Apart from the earths, most of the widely used pigments were manufactured. Verdigris, lead white and red lead had been manufactured from early times; the synthesis of vermilon was also a well-established process. Some were by-products of other industries: lead-tin yellow, known as *massicot* or *masticot*, derived originally from the ceramics industry; green and blue verditers were made from the copper nitrate solution remaining from the refining of silver; some red lakes, such as those from cochineal, were made from dyestuff extracted from dyed textile waste. The conditions of manufacture could thus be controlled to get a desired grade or colour of product. Many seventeenth-century sources indicate that lead-tin yellow 'type I', the form used in Northern Europe – and generally throughout Europe in the seventeenth century – was available in pale and dark shades.[152] Very few recipes for the preparation of the pigment, as such, are known; its source probably lay in another old and well-understood technology, the preparation of colorants for ceramic glazes.[153]

The chemistry of the process by which the verditers (Plate 9) were produced could not have been understood at that date. Although recipes for the preparation of artificial copper-containing blue pigments exist from early times, it is clear, from the seemingly random inclusion of unnecessary ingredients in early recipes, which were discarded as time went on, that comprehension of the craft involved and the conditions to be used was acquired gradually through practice. The products were also variable.[154] In fifteenth- and sixteenth-century versions of these recipes, the ingredients were usually verdigris, lime, sal ammoniac (ammonium chloride) and vinegar or water. It seems likely, however, that these methods for making blues were not in current use.[155] De Mayerne, inquisitive experimental scientist, was intrigued by the way in which blue verditer was produced and must have recognised there was some connection between this and the old traditional 'azures'. Even though his interest may have been partly antiquarian, de Mayerne copied out several

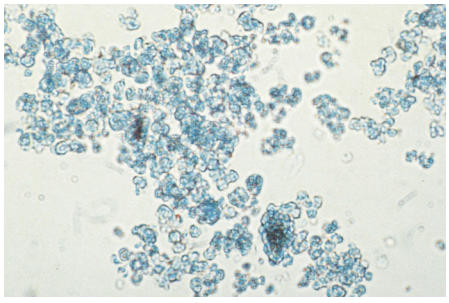

Plate 9 Blue verditer, synthetic basic copper carbonate, prepared by Peter Mactaggart. Photographed at a magnification of 700×; actual magnification 420×.

such recipes from earlier Italian and English sources. He mentions that he had been told that the green liquor from silver refining was used to make the verditers; having observed the blue colour obtained when quick lime and sal ammoniac were dissolved in water in a copper basin, he speculated that the addition of sal ammoniac and chalk or lead white to the silver refiners' liquor might indeed give something like blue verditer. He was also told that a method had been discovered accidentally by someone who had poured aqua regia (one part of concentrated nitric acid to three parts of concentrated hydrochloric acid) onto lead white or chalk. In a marginal note he added that this did not work when he tried it, not surprisingly as no copper was present.[156] However, it is likely that this method was, in fact, used: it is described, with one important difference, later in the century by Christopher Merrett, the translator of Antonio Neri's influential work on glass-making, *L'arte vetraria* (Florence 1612); the recipe for common blue ashes (blue verditer), *slechte blaù assen*, in the Antwerp sketchbook, mentioned above, is very similar. The difference was that, in the first case, copper plates were present and, in the second, copper filings were dissolved in the nitric acid used.[157] In the case of the production of blue verditer, unlike lead-tin yellow, neither craft nor technology appear to have been well understood; it was not at all clear to the early seventeenth-century English manufacturers why the product was only sometimes blue and, more often, the less valuable green: Merrett was one author who commented on the unpredictability of the process. The curious suggestion in the Antwerp sketchbook recipe that the product should be washed with smalt to obtain the blue ashes indicates that here, too, the product was liable to be green. More recent research has shown that the colour of the product depends on the temperature at which the reaction is carried out and how much the solution is stirred, factors that the seventeenth-century maker would only appreciate over time, by trial and error.[158]

The manufacture of pigments

The manufacturing, preparation and distribution of pigments in the early part of the seventeenth century seem to have been particularly well developed in the Northern Netherlands.[159] Initially manufacturers tended to specialise in a particular pigment: vermilion, say, or smalt, or lead white; later they might broaden their field of interest. As well as making the pigment the producer also prepared it to some degree by washing, grinding and whatever else was necessary; certainly they could be obtained ready ground at retail outlets.[160] This also applied to the preparation of natural mineral pigments. The letters patent granted to an ochre refiner in the Forest of Dean, Gloucestershire, in 1626 mention mills, vessels for washing and drying rooms for the grinding and refining of red ochre and the brown burnt ochre, Spanish brown.[161] As a result, the pigment would have reached the retailer in such a form that it would not require very much more preparation by the artist, assuming that it had not been adulterated. Richard Symonds was informed by Mrs Boardman, a portrait painter and copyist, in 1650–1 that vermilion was adulterated with red ochre; very possibly this was done earlier also.[162] The Dutch pigments, notably vermilion and smalt, had a good reputation; to this was added quite aggressive marketing, as the problems encountered by William Twynyho, Abraham Baker and John Artogh, who were awarded a patent for making smalt in London in 1605, seem to indicate.[163]

Painting materials: the oil medium

It is not known how much treatment the oil used by painters would have received by the time it reached the retailer and how much the artist would carry out himself, or have done on his behalf. Leaving oil on a window sill to decolorise is very easy: something the artist might do as a matter of routine. Removing cloudy traces of mucilaginous matter or other contaminants would be rather more troublesome, although not difficult. An important concern of many of de Mayerne's informants, including Paul van Somer, Daniel Mytens and Anthony van Dyck, was the clarity and paleness of the oil they used. De Mayerne was given many accounts of how oil should be purified, bleached and its drying properties improved by heating it with litharge (lead monoxide) or minium (red lead, lead tetroxide), or another suitable drier. The commonest method of purification consisted of mixing the oil with rainwater in which salt and/ or alum had been dissolved; this would help to coagulate mucilaginous plant material which would settle out. The mixture was stirred, allowed to stand, for some days as a rule, and the oil was separated off. The process could be repeated; the oil was then washed to remove the salts. Before this the oil might be filtered through sand, as described by van Somer.[164] Bleaching the fugitive plant colorants which gave the virgin oil its yellow colour could be done by leaving it in the sun, but, as both van Somer and Mytens pointed out, this also caused the oil to

thicken; if this was not wanted, they suggested that March was a good month for carrying out the process as the sun was not strong enough for the polymerisation of the oil to be encouraged.[165]

In his heading for instructions for thickening oil by leaving it to stand over hot ashes, a method with which Mytens's name was associated, de Mayerne in effect summarised the properties of a heat-prepolymerised oil: it was thicker; it had improved drying properties; it prevented pigments from sinking to the bottom of the paint layer.[166] The paint would be less likely to shrink, and thus to wrinkle, as it dried. The slightly raised refractive index of the oil also slightly increases the depth or saturation of the colour and gives a smooth, even, glossy finish, without brush marks. The method of heating the oil in this recipe is unusually gentle and, as oil does not conduct heat particularly efficiently, any prepolymerisation – the linking together of the triglyceride molecules present by carbon–oxygen or carbon–carbon bonds – would only be partial. Most methods for heat-bodied oils required them to be heated carefully over lead salts, with stirring as a rule, for a fairly brief period: van Somer's instructions were that the oil should be heated over litharge until it began to boil (that is, evolved bubbles of steam, from absorbed moisture, and carbon dioxide); it was then removed from the fire until the ebullition ceased and then replaced, this process being repeated five or six times.[167] As the mixture was stirred, probably oxygen would be incorporated, depending on how briskly this was done; thus at least a proportion of the bonds formed during the thickening process would be carbon–oxygen, carbon–carbon bonds being formed under conditions where oxygen was excluded.[168] It is unlikely that such a process would be carried out on a very large scale: little more than a litre or so of oil was heated at a time, according to most seventeenth-century sources, so it would not be impossible for the artist to carry it out himself. It could have been carried out on behalf of the retailer for sale, as oils, treated and untreated, were used in other related trades, such as varnish-making.

In his conversations with de Mayerne, Van Dyck expressed a preference for linseed oil, which he described as the best of all.[169] He was certainly not unusual in this; Rubens too employed linseed oil to a great extent, although only walnut oil was detected in the *Elevation of the Cross* in Antwerp cathedral.[170] Because walnut oil yellowed less initially during drying, it was traditionally recommended for use with pigments whose colour was particularly affected by yellowing of the medium, such as whites and blues; in practice it is quite often found in light-coloured paint in general, including flesh-colour and pale yellow. On balance, apart from the *Portrait of George Gage with Two Attendants* (NG 49) where walnut oil was used for black paint as well as for cream-coloured paint in the sky, this practice has been followed and walnut oil has been found in whites and blues, although not consistently. It was used for Charity's blue shawl, for example, but in *The Abbé Scaglia adoring the Virgin and Child* (NG 4889) linseed oil was used for the Virgin's robe, although walnut oil was used in the sky. Sometimes the oils were heat bodied, or, apparently, partially so, as in the case of much of the paint in *The Abbé Scaglia adoring the Virgin and Child*. In the case of the dark blue paint of the Virgin's robe, which contains the poorly drying pigments ultramarine and indigo, this was perhaps to aid drying, but the artist may have had the additional aim of obtaining a smooth, glossy surface, without notable brush marks and a wrinkle-free paint. In the case of a partial heat-prepolymerisation, it is not possible to say if the paint was particularly gently heated, so genuinely only partially prepolymerised, or if heat-bodied oil was added to paint which had been ground in ordinary oil.

Van Dyck consistently incorporated a trace of pine resin in the medium used in areas of translucent paint like the pinkish-red glaze on the Virgin's robe in *The Abbé Scaglia adoring the Virgin and Child* and the dark red glaze on the curtain in *Portrait of a Woman and Child* (NG 3011). This addition results in a more transparent, glossier paint, very much more effective as a glaze or as a deep translucent shadow, as the refractive index of the paint is slightly raised so that it is closer to that of the pigments present.[171] Probably it was added in the form of a small amount of ordinary pine resin varnish. This, too, was a traditional practice in Netherlandish painting. Rubens included a little pine resin in green glaze-like paint in *An Autumn Landscape with a View of Het Steen in the Early Morning* and in the dark brown shadowy background paint of *The Brazen Serpent*. Pine resin was also detected in some of the paint in the *Elevation of the Cross* and in a red glazed shadow on the drapery of a figure in the *Drunken Silenus supported by Satyrs* (NG 853).

Interestingly, a trace of larch resin, that is, Venice turpentine, was detected in red lake-containing paint present on the strip of re-used canvas attached to the right of the main piece used for the *Portrait of George Gage with Two Attendants*; the red paint was not

part of the composition and was painted over (see pp. 57–8 and p. 87, note 7). This picture was painted in Rome. Recipes for Venice turpentine varnishes occur in Italian sources and it has been identified in a varnish on the *Portrait of a Lady with the Attributes of Saint Agatha* (NG 24), attributed to Sebastiano del Piombo and probably painted in Rome around 1540; it is not known when the varnish was applied, but it must date from before the early eighteenth century.[172] Its use in this way has not previously been observed (although it should be said that it is extremely difficult to detect); conceivably it was present in the red lake paint because a little varnish was usually added and it happened to be a Venice turpentine varnish. The conventional pine resin was present in a similar red glaze in *The Balbi Children*. Some knowledge of Venice turpentine had certainly found its way into Rubens's studio, however, as it is mentioned in the Antwerp sketchbook: it was thought less suitable for a very good varnish than Strasbourg turpentine (fir balsam).[173] Paul van Somer and Van Dyck also discussed Venice turpentine varnish with de Mayerne: from the record of the conversation with Van Dyck, it could even be assumed that 'ordinary painters' varnish' was prepared from Venice turpentine.[174] As a physician, de Mayerne would have been very familar with Venice turpentine, which was an ingredient in various medical preparations and could be distilled to give a volatile oil and a solid product in exactly the same manner as ordinary pine resin.[175] However, it was not used for 'ordinary painters' varnish', in London at least: apart from the fact that pine resin made as good, or better, a varnish for most ordinary purposes, if a little darker, the import duty imposed on it suggests that Venice turpentine was far too expensive for widespread use. If Van Dyck used it while he was in London (and there is evidence that he bought mastic, but no record of Venice turpentine, although he was said to have used a Venice turpentine retouching varnish) it has not been confirmed so far.[176]

Artists' suppliers, apothecaries and colourmen

Early seventeenth-century artists probably bought their materials at an apothecary's shop, the traditional suppliers of pigments because most pigments – and many other artists' materials – were still categorised as drugs. The 1642 *Rates of Merchandizes* still listed the duties to be paid on vermilion, *flory* (woad indigo), *generall* (a pigment of lead-tin yellow type), gum lac (the source of lac dyestuff), lapis lazuli (the mineral source of ultramarine), oil of turpentine, orpiment, red and white lead, Venice and common turpentine, verdigris, 'varnish' and umber under *Drugges*. Indigo, ochre, linseed oil, rosin, smalt and verditer, for example, were listed separately.[177] The London apothecaries, like many of their European counterparts, had arisen from the same roots as the grocers and the spicers. They formed an autonomous section of the Grocers Company until they received their own charter in 1618, and probably concentrated rather more on medicinal materials, including pigments, but it is perfectly possible that someone who called himself a grocer sold pigments as well. In the latter part of the seventeenth century the position was complicated by the existence of two other related groups: the druggists, originally probably wholesalers who remained under the Grocers Company when the apothecaries left, and the dispensing chemists, who fulfilled a rather similar role to the apothecaries. The boundaries between these trades were not very distinct and clearly druggists might have included pigments among the goods they sold to retailers.[178]

These may not have been the only source of artists' materials: several sixteenth-century Serjeant Painters are known to have supplied materials for certain projects and one, Andrew Wright, who died in 1543, was a manufacturer of yellow lake pigment.[179] Other sixteenth-century Painter-Stainers also supplied materials, but it is not known if this was purely for particular court commissions or as a business venture. It is possible that some seventeenth-century members of the Company did the same. De Mayerne mentions several places where pigments could be obtained in London, all within the City walls and quite near the Exchange, including the oddly named 'Pabstset allée', by which he may have meant Popes Head Alley.[180] These are all very near present-day Cheapside and Bucklersbury, the area where spicers and apothecaries had plied their trades for centuries, as described by John Stow: 'This whole streete, called Bucklesburie, on both the sides throughout, is possessed of Grocers and Apothecaries.'[181] However, many artists lived outside the City, as de Mayerne did himself, in St Martin's Lane.[182] There were suppliers in the Holborn area by 1651–2, when Richard Symonds referred to one Fenn the Liegois – like many of his potential customers, he was of Netherlandish stock – who lived in Purpoole Lane (the area of the modern Grays Inn Road) and demanded five shillings for a pot of colours the size of a walnut.[183]

In Antwerp the apothecaries came under the *Meerseniers* (Mercers) guild. Here, too, the trade of

Fig. 15 Jerome Franken the Younger, *Jan Snellinck's Shop*, 1621. Panel, 94 × 124.7 cm. Brussels, Koninklijk Museum voor Oude Kunst (no. 2628).

kruidenier, spice merchant or grocer, developed during the sixteenth and early seventeenth centuries in a number of ways, not only in Antwerp itself; many merchants emigrated during the 1580s and were able to flourish and expand their businesses in their new homes, notably in the United Provinces.[184] In the Northern Netherlands in the sixteenth century there was no clear distinction between the trades of grocer and apothecary, much as in England, and a similar situation probably obtained in Antwerp at this time. Throughout the registers of the Guild of Saint Luke, names are assigned to trades related to painting in the broad sense, such as picture dealer, brush-maker (rarely) and even varnish-maker – one Heynderick van Thienen is described as such in 1585–6 – but also to other trades, including that of *kruidenier* (grocer).[185] Probably most of these sold pigments among their other merchandise. However they developed, there were people described as colour merchants in Antwerp by the 1580s. Four colour merchants are listed in the Guild records for 1585–6: Merten Alewyn, Pieter van Eycken, Davidt Meermans and Andries Coeck, three of whom reappear in those for 1588–9 (Alewyn, Coeck and van Eycken), together with Cornelis Nuyts.[186]

The inventory of the estate of Maria van Flinckenborch and her husband the colour merchant Aernoult Hoegaerts the Elder, made in March 1609, records the sale and the receipt of money for large quantities of certain pigments, mainly blue and green, including two grades of ashes, two grades of smalt, coarse *stroyblauw* and *olie smalt* (oil smalt), and *asur gruen* (possibly malachite). The only other pigment recorded is a red lake pigment at 10 and 12 stuivers the ounce. Perhaps Hoegaerts traded in the cheaper pigments as well, but they were not recorded in the final estate.[187] It appears that, in the inventories of artists' estates, only the valuable pigments – the different grades of ashes and smalt, occasionally ultramarine and good quality lake pigments – are recorded.

The names of several colour merchants appear in artists' inventories in the first decades of the seventeenth century. The estate of Aernoult Hoegaerts received payment for 24¾ pounds of fine ashes at 9 guilders the pound, bought in 1608 by another colour merchant, Jeremias Cock. A Jeremias Cocq, described as a merchant, is mentioned in a letter by Rubens to Hans Oberholtzer discussing arrangements for the transport of some paintings in 1620: presumably this is the same man.[188] While it is not clear from this if Cocq ever acted as a picture dealer as well, there are occasional references to art dealers in the Northern Netherlands also trading in pigments at this time, and certainly later on in the 1640s.[189] The situation in Antwerp appears to have been similar: some artists were also picture dealers – as were some panel-makers, Hans van Haecht, for example – and some dealers were also colour merchants. They may also have maintained their painting trade. David Remeus or Remeeus apparently had a profitable shop selling gilded frames, pictures and pigments, but is recorded in the *Liggeren* of the guild as a painter from the time he became a master, in 1581, until he registered his twenty-first and last pupil in 1622–3. He is also described as a colour merchant, to whom money was owed, in the 1620 inventory of the estate of the painter Peter de Noville the Elder.[190] The inventory of his estate, made in August 1626, records a quantity of gold leaf and the value of the shop wares handed over to Remeus's widow, Joanna de Prince: 2939 guilders 2 stuivers. Outstanding accounts with various customers, including Hendrick van Balen and Lucas 'living at the painter Rubens's [establishment]' are also listed. Joanna de Prince continued the business in pigments and in 1630 married the painter Jacob or Jacques Spaegnaert (Spaeingaert, etc.), who was clearly successful as a colour merchant during the 1630s, but seems not to have registered any pupils as a painter.[191]

Jan Snellinck the Elder is also described as a painter in the inventory of his, and his wife's, estate, taken in 1638, but he, too, was a picture dealer from the 1580s onwards (Fig. 15). The estate was also owed money for pigments, principally green and blue

ashes.[192] It is not surprising that the widows of painters sometimes sold off the more valuable pigments; a payment of 36 guilders is recorded from Rubens's estate to the widow of Hans van Milder for green ashes.[193]

The trade in pigments, both naturally occurring and manufactured, was considerable. In England, for example, the 1642 *Rates of Merchandizes* lists duties payable on the import of almost all the pigments then used, including ochre. As England exported red and yellow ochres, presumably this was a different colour or grade.[194] As a result, the availability of pigments did not differ greatly between one centre and another. One example of a locally available pigment which appears, from current evidence at least, to be particularly associated with Italy, and specifically Rome, is a type of *giallolino* (that is, a pigment of the lead-tin yellow variety), in this case a lead-tin-antimony oxide. Like Naples yellow, lead-tin-antimony oxide probably had its origins in the ceramics industry: antimony, in the form of the oxide, was an ingredient used in the warm yellows decorating the opaque, white, tin-containing glazes on maiolica. It has been found in works dating from the 1620s and earlier so could have been available to the young Van Dyck during his stay in Rome.[195] Richard Symonds commented that there were three or four sorts of *giallolino* on sale in Rome when he was there in 1649–51, some redder, some yellower.[196]

Symonds also noted that there were two or three sorts of green earth available, but the pigment seems to have been little known in London at this time. De Mayerne describes a green bole of little body from Italy that was useful for landscape and could be used in oil; its colour was a dirty green.[197] One variety of green earth that Symonds probably had in mind was a strongly coloured bluish-green celadonite, obtained from near Verona, which had a good reputation because of its superior colour.[198] A strongly coloured green earth is found in Roman landscape paintings of the mid-seventeenth century, for example, those by Claude and Salvator Rosa, but it seems only to have reached Northern Europe much later.

Blue pigments

The blue pigments ultramarine and azurite had always been the most expensive, and contracts and guild statutes had sometimes specified their use, or had forbidden the use of cheaper substitutes. By the seventeenth century, the expense of ultramarine and the scarcity of the basic copper carbonate mineral azurite (principally after the middle of the century) were factors contributing towards the greatly increased use of smalt and indigo. The fact that smalt and the manufactured green and blue ashes are itemised in Antwerp inventories of artists' property reveals very clearly the value that was placed on them, to say nothing of ultramarine. The inventory of the property of Margriet Briers, the widow of Hendrik van Balen the Elder, includes smalt and several small boxes of ultramarine, in at least two grades; the only other pigment listed is a red, Florentine lake.[199]

The laborious process by which ultramarine was separated from calcite and pyrites impurities also present in lapis lazuli resulted in several grades of the pigment. The best grade, with the largest particles and fewest impurities, separated out first; the last, containing much colourless material and rather few, small blue particles, was often known as ultramarine ash.[200] Where its use was required, ultramarine was frequently paid for by the client commissioning the work; this may sometimes have been the case for azurite also, although it is mentioned infrequently. In 1626, 45 guilders was paid for an ounce of ultramarine for Rubens's *Assumption of the Virgin*, painted for Antwerp Cathedral.[201] Charles I was reported to have given ultramarine to the value of £500 to be shared between Van Dyck and the painter Mrs Anne Carlisle.[202] In 1642, Jacob Jordaens received nine guilders for an unspecified amount of *assur blaeu* used in a painting of *The Visitation*, commissioned for the church in Rupelmonde, near Antwerp, in 1641; from the cost and description this was perhaps azurite rather than ultramarine.[203] The position was no different in Italy: on 7 June 1632, the Bolognese painter Guercino recorded the receipt of payment for the purchase of ultramarine and the canvas for two paintings executed for Reggio Cathedral.[204] Ultramarine was often used over an underpaint containing another blue, or even mixed with another blue. Rubens used ultramarine with smalt and lead white for the sky in *Minerva protects Pax from Mars* ('*Peace and War*'). Van Dyck used an underpaint of smalt and white under a thin ultramarine glaze in the sky of the *Equestrian Portrait of Charles I;* indigo was used in the underpaint for the blue robes in *Charity* and *The Abbé Scaglia adoring the Virgin and Child* (see pp. 65–6, 71–3). In these paintings the ultramarine was of reasonable quality, with quite large particles and little impurity.

The use of azurite declined markedly as time went on. Van Dyck used the pigment for Lord Bernard Stuart's clothing in *Lord John Stuart and his Brother, Lord Bernard Stuart*, but scumbled over an

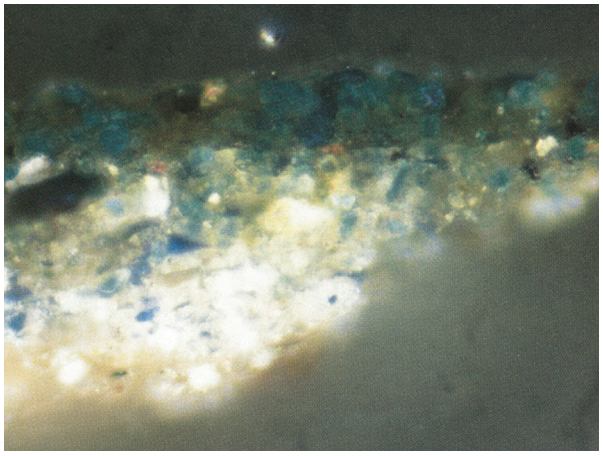

Plate 10 Peter Paul Rubens, *Peasants with Cattle by a Stream in a Woody Landscape ('The Watering Place')* (NG 4815), *c.*1620. Cross-section through dark green foliage paint. The uppermost layer comprises azurite and a yellow lake pigment; the layer below contains in addition lead white and lead-tin yellow. The lowest layer present, the pale blue sky paint, consists of lead white and ultramarine. Photographed at a magnification of 400×; actual magnification 350×.

undermodelling of indigo mixed with lead white (see pp. 80–1). Azurite is a greener blue than ultramarine and was often used as a constituent of greens, mixed with lead-tin yellow 'type I' or a yellow lake pigment. It occurs mixed with yellow lake, ochre or lead-tin yellow in the landscape and foliage greens of Rubens's *Peasants with Cattle by a Stream in a Woody Landscape* ('*The Watering Place*') (NG 4815, *c.*1615–22, Plate 10), and was used for the more intense greens in Van Dyck's *Equestrian Portrait of Charles I*. Rubens used azurite mixed with lead white in the sky of his early version of *The Judgement of Paris* (NG 6379), thought to have been painted shortly before he left for Italy in 1600, and similarly in his *Portrait of Susanna Lunden* (NG 852), of about 1622–5, but on other occasions – in the sky of '*The Watering Place*', for example – he used ultramarine mixed with lead white. A blue-green verditer might substitute for the more expensive azurite in sketches, such as *Saint Bavo about to receive the Monastic Habit at Ghent,* where it is used for the cloak of the mounted figure in the right-hand wing, and in the skirt of a female saint on the left. Although Rubens used azurite widely in greens, he also used mixtures with a blue-green verditer, in, for example, his later version of *The Judgement of Paris* (NG 194), painted around 1632–5.

Both Rubens and Van Dyck made extensive use of the blue-green verditers, smalt and indigo, and clearly these were by far the most widely used blues. It is evident both from inventories of artists' property and from the examination of samples from paintings that both smalt and verditer were available in different shades and degrees of coarseness. The estate of the colour merchant Aernoult Hoegaerts received two payments for the pigments from the painter Joos de Momper during 1607; the first was for four and a quarter pounds of blue *olie smalt* at two guilders the pound, and the second was for a bag of fine ashes weighing three pounds, four and three-quarter ounces at eight guilders the pound.[205] It is difficult to judge the relative prices of the two pigments from this evidence alone, but it appears that, on average, smalt was the cheaper of the two. This is confirmed by the London prices de Mayerne noted and to some extent by those in another price list in MS Sloane 1990, the notebook in which much of de Mayerne's work was first written down, often by his collaborators.[206] In the first list, ashes were priced at one shilling (12 pence) to six shillings an ounce; the units are missing from the smalt prices, but it was sold by the pound, like lead white and the earth pigment brown red, and was thus relatively cheap.[207] The source of the second list, which is written in French (rather than a mixture of French and English) is unknown; the prices are all by the pound and, on the whole, are more expensive than the first list. Curiously, smalt is not listed (or not under an unequivocal name), but, while the cheapest of the three grades of ashes cost £1 a pound, little more than lead white, the most expensive was £6 a pound, the most expensive pigment listed. The next most expensive pigment was vermilion, at £3 15s.(?) a pound. This must reflect the relative unpredictability of verditer manufacture.

The blue glass pigment, smalt, is very transparent and its strength of colour, derived from the presence of small amounts of cobalt, is dependent on how coarsely it is ground. The coarsest grade of smalt, Hoegaerts's *stroyblauw*, was indeed more suitable to be strewn rather used in a paint.[208] The hue also varies; thus the pigment may be obtained in different degrees of coarseness and colour, varying from a strong purplish blue, close in colour to ultramarine, to a weak greyish blue. De Mayerne's list gave four grades and examples seen in seventeenth-century paintings vary considerably in colour. The smalt used as the underpaint in the sky of Van Dyck's *Equestrian Portrait of Charles I*, beneath a very thin glaze of ultramarine, is quite strongly coloured, whereas quite a grey-blue was used for the sky of *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover*. The strong colour of the smalt used in *Charles I* meant that

ultramarine could be used very economically indeed, a point of some importance in a painting of this size. Van Dyck used smalt quite frequently, both for blue passages and in mixed greens of muted colour: it is found in the sky and, mixed with black and a yellow lake, in the discoloured foliage of the tree in *The Balbi Children* (see pp. 59, 62). Smalt is liable to discolour in oil medium, although often less so when mixed with lead white, and this has occurred in the foliage paint, where the oil medium has also darkened.[209] A greyish colour cannot always be attributed to this discoloration, however: sometimes smalt of this grade was chosen deliberately. A particularly pale grey, coarsely ground, smalt was used mixed with lead white as the underpaint for a stronger coloured blue paint in *A Distant View of a Town*, by Alexander Keirincx (London, Tate Gallery), an Antwerp painter who was employed by Charles I while in England in 1640–1.[210] The paint shows no sign of discoloration in this case and it must be assumed that this smalt was chosen for its cheapness.

Plate 11 Peter Paul Rubens, *Samson and Delilah* (NG 6461), *c.*1609. Detail of purple drapery, top.

Pigment mixtures

One of the most simple, economical, but effective pigment mixtures is that used to give purples and mauves. It was used for the child's dress in Van Dyck's *Portrait of a Woman and Child* (NG 3011), for the hanging in Rubens's *Samson and Delilah* (NG 6461, Plate 11 and Fig.16), and for the mauve drapery of one of the figures in his '*Peace and War*': in each case it is composed of a mixture of red lake, lead white and charcoal black.[211] Few example of red lakes in the works of Rubens, Van Dyck or their contemporaries have been examined, but in the case of the red lake used for Charity's dress in Van Dyck's *Charity*, the dyestuff was extracted from the cochineal insect, probably the Mexican species, *Dactylopius coccus* Costa. The same lake is probably present in the red drapery on the figure of Peace in Rubens's '*Peace and War*', possibly mixed with a madder lake.[212] Cochineal dyestuff has also been identified in red lakes in the *Elevation of the Cross*.[213] Microscopic examination of red lakes in other paintings by Rubens or Van Dyck in the Collection suggests that a lake prepared from an insect dyestuff of this type is usually present, rather than the more orange-red madder lake.[214] Cochineal lakes are often a rather blue crimson, useful for purples and mauves; admixture with yellow gives a very much greater range of colours and red lake-containing glazes are frequently found to contain a yellow translucent pigment as well, often

Fig. 16 Peter Paul Rubens, *Samson and Delilah* (NG 6461), *c.*1609. Panel, 185 × 205 cm.

a yellow lake, occasionally an ochre. The cochineal lake was mixed with a yellow lake for the glaze on Charity's dress, although the yellow dyestuff present has not been identified; a yellow lake may also be present in Peace's red drapery.

Many mixtures are based on yellow, red or brown earth pigments; reds, for example, whether in an underpaint or in the principal paint layer, are rarely based on vermilion alone, but often contain a lake

pigment or red ochre, or both. An example is Viscountess Andover's red-brown shawl in *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover*, which is painted in a mixture of all three types of pigment, with the addition of black. One reason for modulating the colour of vermilion is that it is very strong, dominating other colours to an extent that could be considered undesirable; in addition, many examples of vermilion seem to have been rather orange. Yellow ochre is very widely used, for clothing for example, often mixed with a yellow lake or other pigments: one example is Delilah's yellow cloak in *Samson and Delilah*; another is Viscountess Andover's dress, where the red iron oxide pigment haematite and other pigments are added to give a warmer, golden tone.

One of the most unobtrusively, but extensively used earth pigments in the work of both Rubens and Van Dyck is Cassel or Cologne earth. This translucent dark brown pigment gives depth of shadow in reds, browns and other colours: in Charity's dress in Van Dyck's *Charity* (see p. 66), for example, and the brownish areas in the dress of the old woman in *Samson and Delilah*. It is essentially an organic pigment, from lignitic or peat deposits, although it also contains an inorganic component, often the manganese-containing umber.[215] Its presence was indicated in some of the samples examined during analysis of organic components from the presence of a trace of fichtelite (see pp. 85–8). One of the translucent glazing pigments used by Van Dyck in England was a brownish birch bark tar. This was used in the background of *Lord John Stuart and his Brother, Lord Bernard Stuart* and to glaze shadows and folds on the sitters' clothing.[216] The same material was used to glaze the servant's yellow tunic in *William Feilding, 1st Earl of Denbigh* (see p. 85; Plate 44, p. 84). It was employed in the same manner as the asphaltum or bitumen identified in other pictures by Van Dyck or Rubens, or his studio.Those by Van Dyck include *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover, The Emperor Theodosius is forbidden by Saint Ambrose to enter Milan Cathedral* and the *Portrait of George Gage*; among Rubens's works it has been identified in the *Elevation of the Cross*.[217] Indeed, the birch bark tar was probably purchased as a bitumen-like material, rather than as a birch bark tar as such.

Van Dyck's and Rubens's palettes

If a comparison is made between the technique of Van Dyck and one of his predecessors in England, like Marcus Gheeraerts, whose technical background was similar, but who came from a generation earlier, there are similarities in the materials used. In Gheeraerts's *Portrait of Captain Thomas Lee,* painted in 1594, and *Portrait of a Woman in Red* of 1620 (Plate 12, both in the Tate Gallery, London), for example, the range of pigments is the same as that used by Van Dyck; the difference lies in the fact that, in Gheeraerts's work, the technique, with thin, carefully applied layers, meticulous brushwork and fine detail, is that of a late, but traditional, Netherlandish painter.[218] The author of MS Harley 6376 describes how a red lake glaze over a vermilion-containing underlayer should be blotted 'wth a little Lawne stuff^{t} wth cotten' to even it out; one can imagine a painter of Gheeraerts's generation doing this, but not a painter like Van Dyck (Plate 13).[219] Much of what is known about the materials and technique of Van Dyck's work in England relates to paintings produced in the manner Jabach described: a supremely well designed and controlled system of production in which Van Dyck provided the inspiration at the beginning and the breath of life at the end, but assistants did the ground work. In any discussion of the technique of painters like Rubens or Van Dyck, who organised their pattern of work so that it could be produced with considerable help from assistants, it is necessary to separate where possible the works for which the painter himself was largely responsible, and those in which studio assistants played a large part. In addition to this, some changes or developments over time, or with change of support or subject matter, may be expected. Van Dyck's studio was not on the same scale as that of Rubens, yet some of the pigment mixtures and techniques seen are closely similar and it seems likely that Van Dyck would have used much of what he had learnt during his time in Rubens's studio.

Van Dyck's *The Balbi Children*, painted in Genoa, shows a complexity and subtlety in the glazing of the draperies that is not seen in some of the later works painted in Antwerp, Brussels or London (see pp. 62–3). Such passages of painting embody a particular preoccupation in which the artist was absorbed at that time; one cannot imagine them being reproduced in a studio context. The annotations the artist made to his sketches during his travels in Italy studying the works of Titian, Veronese and others demonstrate his interest in the effects they achieved; his own

Plate 12 Marcus Gheeraerts the Younger, *Portrait of a Woman in Red*, 1620. Oak, 114.3 × 90.2 cm. London, Tate Gallery (no. T03456). Both dress and curtain are modelled in the underpaint layer using vermilion and lead white (with minor amounts of other pigments) in varying proportions; a red lake is present in the glaze paint (alone or with vermilion).

Plate 13 Anthony van Dyck, *Charity* (NG 6494), *c.*1627–8. Oak, 148.2 × 107.5 cm. Detail of red drapery, lower left. In the pinker areas the glaze paint contains a mixture of red and yellow lakes; Cassel earth is present in browner areas.

drapery construction derived much from a perceptive understanding of how the Venetian painters worked, but also from what he would have learnt from the sophisticated drapery painting technique of Rubens, shown, for example, in the painting of Delilah's crimson dress.[220] The layer structure revealed in many passages of paint, including draperies, in works by Van Dyck and Rubens where there was probably some studio assistance is often uncomplicated and economical: in the pigments chosen, but also in the fact that, by using a mixture of pigments to obtain the desired colour – red earth, vermilion, lead white and red lake, for example – it is easily and quickly modulated simply by adding a little more of one and a little less of another, without losing the overall unity of the passage. Much of the construction of the tonal values is done in this way in the underlayers, and although simple and ideally suited to work that is designed to be carried out in its preliminary stages by assistants (whether it was in practice or not), the effects obtained are often very subtle. This is partly due to the choice of pigments: for example, the use of ultramarine underpainted by mixtures of indigo and white, and even mixed with indigo, in the dresses of Charity and the Virgin in *The Abbé Scaglia adoring the Virgin and Child*, and in various garments in Rubens's *Elevation of the Cross*.[221] Indigo was less expensive than ultramarine; it has a high tinting strength and, mixed with ultramarine, tends to counteract its slightly purplish tone. Mixed with lead white it gives a very flexible, easily worked paint, quite unlike smalt or ultramarine which are difficult to handle, although less so when mixed with white.

The technical study of the works of Van Dyck and Rubens in the National Gallery Collection has shown the supreme understanding they had of the properties and behaviour of their materials, without which they could not have delegated the work to others so effectively and could not have achieved such stupendous results. Roger de Piles, a perceptive critic of both Van Dyck and Rubens, declared that Rubens had a genius of the first order, but Van Dyck 'had the happiest pencil that ever any painter was blest with, Correggio only excepted'.[222] The technical study of their works has served to reinforce his judgement.

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33. R. François [i.e. E. Binet], *Essay des merveilles de nature et des plus nobles artifices*, 9th edn., Paris 1632 (first published Rouen 1621), pp. 310–24. This is discussed in A. Massing, 'French Painting Technique in the Seventeenth and Early Eighteenth Centuries and De La Fontaine's *Académie de la peinture* (Paris 1679)', Hermens, Ouwerkerk and Costaras 1998, cited in note 30, pp. 319–90, esp. pp. 328–9.
34. P. Lebrun, *Recueuil des essaies des merveilles de la peinture*, 1635, Merrifield 1849, cited in note 29, II, pp. 757–841. The parts equivalent to Binet's chapter appear on pp. 770–85, 805, 824–7.
35. C.P. Biens, *De Teecken-Const: ofte een korte ende klaere aen-leydinghe tot die lofelijcke const van teeckenen tot dienst ende behulp van de eerstbeghinnende jeucht ende liefhebbers, in elf capittelen vervat*, Amsterdam 1636; reprinted in E.A. de Klerk, '*De Teecken-Const*, een 17de-eeuws nederlands traktaatje', *Oud Holland*, 96, 1982, pp. 16–60. The text of the treatise was taken from a manuscript transcript appended to a study by C. Müller Hofstede in the Kunstmuseum, Basel; no

printed copy of the work appears to be extant.

36. T. Turquet de Mayerne, *Pictoria, Sculptoria, Tinctoria et quae subalternarum artium spectantia...*, 1620–46, British Library MS Sloane 2052. The earliest complete transcription was published by Ernst Berger in 1901: E. Berger, *Quellen für Maltechnik während der Renaissance deren Folgezeit (XVI-XVIII. Jahrhundert)*, Munich 1901 (Beiträge zur Entwicklungsgeschichte der Maltechnik, IV). See also the annotated edition by J.A. van de Graaf, *Het de Mayerne Manuscript als bron voor de schildertechniek van de Barok* (dissertation), Utrecht 1958; all references that follow are to this edition, cited as van de Graaf 1958, except where stated otherwise. See also Talley 1981, cited in note 4, pp. 72–149. For de Mayerne himself see H. Trevor-Roper, 'Mayerne and his Manuscript', *Art and Patronage in the Caroline Courts*, 1993, cited in note 18, pp. 264–93.
37. Norgate 1997, cited in note 27.
38. *The Art of Painting in Oyle by the Life*, British Library MS Harley 6376, ff. 86–109, cited below as MS Harley 6376. The first part of the manuscript, entitled *The Art of Limning, either by the Life, Landscapes, or Histories*, ff. 1–83, consists of a variant of the first version of Norgate's treatise on miniature painting (written 1627–8), with additional information from Nicholas Hilliard's treatise and perhaps from the author's own experience. Both parts are in the same handwriting and this section of the manuscript has the date '1664' appended, in paler ink, on f. 109. The manuscript could have been written soon after Van Dyck's death on 9 December 1641, as the painter is referred to in the past tense; see Norgate 1997, cited in note 27, pp. 25, 221. The author was trained in painting by 'Mr Wm. Martins the Elder' (see Harley 1982, cited in note 28, pp. 12–13); the suggestion by Jim Murrell in *The Way Howe to Lymne: Tudor Miniatures observed*, London 1983, pp. 59–61 that 'Martins' is an Anglicised form of Mytens, whose forename was Daniel, is unlikely. In this book it is also proposed that the author of MS Harley 6376 was the painter John Hoskins, who apparently trained as an oil painter and later turned to miniature painting. The section on oil painting bears some relation to that in *The Excellency of the Pen and Pencil*, London 1668, partly because both derived their information from sources close to Norgate, Peacham or John Bate's *The Mysteryes of Nature and Art, conteined in foure severall Tretises*, London 1633 (1634 reprint). It seems unlikely that Henry Gyles, the author of the later part of the manuscript, which is very different in tenor, had any intellectual responsibility for the content of those parts of the earlier section that are not derived from Norgate or other authors: see Harley 1982, cited in note 28, pp. 12–13.
39. R. Harley, 'Artists' Brushes – Historical Evidence from the Sixteenth to the Nineteenth Century', *Conservation and Restoration of Pictorial Art*, ed. N. Brommelle and P. Smith (papers presented at the International Institute for Conservation Lisbon Congress, 1972), London 1976, pp.61–6.
40. Magurn 1955, cited in note 16: on the drying of paint see, for example, nos. 30–2, letters to Sir Dudley Carleton, 20, 26 May 1618, pp. 63–6; no. 37, to Peter de Vischere, 27 April 1619, p. 70; no. 59, to M. de Valavez, 26 December 1624, pp. 99–100; no. 143, to Pierre Dupuy, 20 January 1628. pp. 230–1; on the yellowing of oil paint see no. 196, to Nicolas-Claude Fabri de Peiresc, 9 August 1629, pp. 321–3; no. 242, to Justus Sustermans, 12 March 1638, pp. 408–9; Rooses and Ruelens, cited in note 16, II, 1898, CLXX, pp. 161–4; CLXXIV-V, pp. 170–5; CLXXXV, p. 213; III, 1900, CCCLXVI, pp. 313–19; IV, 1904, DXXII, pp. 353–6; V, 1907, DCXVI, pp. 152–9; VI, 1909, DCCCL, pp. 207–11.
41. H. Vey, 'Anton van Dijck: über Maltechnik', *Bulletin van de Koninklijke Musea voor Schone Kunsten*, 9, 1960, pp. 193–201; see also English translation in Talley 1981, cited in note 4, pp. 150–5, and in C. Christensen, M. Palmer and M. Swicklik, 'Van Dyck's Painting Technique, His Writings, and Three Paintings in the National Gallery of Art', Wheelock, Barnes and Held 1990, cited in note 13, pp. 45–52, esp. pp. 45–6.
42. G. Adriani, *Anton van Dyck: italienisches Skizzenbuch*, Vienna 1965 (first published 1940), plate 108^{v}; see also other colour notes on plates 8, 19, 50^{v}–51, 59, 62, 104^{v}. For the sketch after Veronese's *Allegory of Love, I* see plate 35^{v}.For the notes on ingredients for varnishes see p. 35 and plate 121^{v}.
43. M. Jaffé, *Van Dyck's Antwerp Sketchbook*, 2 vols., London 1966. For the recipes see Vol. 1, pp. 59–61, notes 111–18; Vol. 2, ff. 2^{r}–7^{v}, pp. 205–16. For the place of the Antwerp sketchbook in van Dyck's *oeuvre* see Brown 1991, cited in note 12, pp. 38–47; J. Müller Hofstede, 'Van Dyck's Authorship Excluded – The Sketchbook at Chatsworth', in Barnes and Wheelock 1994, cited in note 12, pp. 48–60.
44. R. White and J. Kirby, 'Rembrandt and his Circle: Seventeenth-Century Dutch Paint Media Re-examined', *National Gallery Technical Bulletin*, 15, 1994, pp. 64–78, esp. pp. 68–9; Jaffé 1966, cited in note 43, II, f. 2^{r}, pp. 205, 210–11;
45. *Secreti diversi* (Venice, Marciana Library MS Ital. IV 48, 16th century): Merrifield 1849, cited in note 29, II, no. 403, pp. 634–5; *Ricette per far ogni sorte di colore*, Merrifield 1849, II, no. 48 pp. 670–1.
46. Van de Graaf 1958, cited in note 36, nos. 121–2, pp. 190–1. See also, for example, the remarks attributed to van Somer, no. 31a, p. 150. Jill Dunkerton has suggested that the sentence apparently referring to the blue glass pigment smalt in no. 122 (that it should be tempered at once with varnish and should not be overworked while wet) is ambiguous: the Italian word used, '*smalta*', in the feminine form, is incorrect; only the masculine form has ever been used. Also the verb '*smaltare*', usually used in the context of ceramics, could mean 'glaze' in the painting sense.
47. Van de Graaf 1958, cited in note 36, no. 86, pp. 177–8.
48. Talley 1981, cited in note 4, pp. 306–29.
49. Bellori 1672, pp. 263–4 and Brown 1991, p. 22, both

cited in note 12.

50. R. de Piles, *Cours de peinture par principes*, Paris 1708, pp. 291–3; see also Brown 1991, cited in note 12, pp. 34–5.
51. J. von Sandrart, *L'academia todesca della architectura, scultura e pittura, oder, Teutsche Academie der edlen Bau-, Bild- und Mahlerey-Künste...*, 2 vols., Nuremberg, vol. 1, 1675; vol. 2, 1679; Vol. 1, Part I, Book III, Chap. XI, pp. 80–1; MS Harley 6376, cited in note 38, ff. 86–7; see also ff. 6–7.
52. See also Norgate 1997, cited in note 27, p. 61 and note 41, pp. 125–6. MS Harley 6376, cited in note 38, suggests the grinding slab should be 18 inches square, f. 87.
53. Harley 1976, cited in note 39, pp. 61–6; L. Welther, *Die Geschichte und die Herstellung des abendländischen Künstlerpinsels*, Diplomarbeit, Institut für Technologie der Malerei der Staatlichen Akademie der Bildenden Künste, Stuttgart 1991; Norgate 1997, cited in note 27, pp. 66–7 and note 59, pp.130–2; see also pp. 225–6, 242–4, the latter from MS Harley 6376, ff. 12–16.
54. Duverger 3, 1987, cited in note 15, no. 776, 5 October 1632, pp. 313–14, for brushes and esp. p. 313 'een houten Manneken met sijn pedestael'.
55. Bate 1634, cited in note 38, title page to section on painting, and see Talley 1981, cited in note 4, plate 6; Harley 1976, cited in note 39, p. 65.
56. See, for example, the will of Frans Snijders and his wife Margaretha de Vos, Duverger 3, 1987, cited in note 15, no. 621, 20 September 1627, p. 70. His 'large grinding stone and the large easel' were bequeathed to Margaretha's brother Paul and 'the other grinding stone', an easel, palettes and brushes were bequeathed to Hendrick Rosiers.
57. Duverger 4, 1989, cited in note 15, no. 1016, 9 and 11 October 1638, pp. 183–90, esp. pp. 188–9.
58. Duverger 3, 1987, cited in note 15, no. 853, 6 February 1635, pp. 429–31, esp. p. 430.
59. Inventory of the property of Jasper Becx, Duverger 4, 1989, cited in note 15, no. 933, 26 March 1637, pp. 76–7, see p. 77. Antonio de Succa the Elder also had such a chest: see Duverger 2, 1985, cited in note 15, no. 363, 16 November 1620, pp. 143–5, esp. p. 144. For a discussion of the contents of studios in a Dutch context see C. Peres, 'Materialkundliche, wirtschaftliche und soziale Aspekte zur Gemäldeherstellung in den Niederlanden im 17. Jahrhundert', *Zeitschrift für Kunsttechnologie und Konservierung*, 2, 2, 1988, pp. 263–96. An example of a chest is illustrated on p. 282.
60. Duverger 4, 1989, cited in note 15, no. 1025, 4–5 November 1638, pp. 200–11, esp. pp. 208–9.
61. Duverger 3, 1987, cited in note 15, no. 639, 6–8 July 1628, pp. 103–11; see also J. Denucé, *The Antwerp Art Galleries: Inventories of the Art-Collections in Antwerp in the 16th and 17th Centuries*, Antwerp 1932, no. 17, pp. 47–51.
62. Martin 1986, cited in note 2, pp. 238–9.
63. A. Balis, *Corpus Rubenianum Ludwig Burchard, XVIII, part II: Rubens Hunting Scenes*, London 1986, pp. 36–46; A. Balis, '"Fatto da un mio discepolo": Rubens's Studio Practices Reviewed', in *Rubens and his Workshop: 'The Flight of Lot and his Family from Sodom'*, ed. T. Nakamura, exh. cat., Tokyo 1993, pp. 97–127.
64. Magurn 1955, cited in note 16, letters to Sir Dudley Carleton, no. 28, 28 April 1618, pp. 59–61 with annotated list of paintings; no. 29, 12 May 1618, pp. 61–3; no. 31, 26 May 1618, pp. 64–6; Rooses and Ruelens, cited in note 16, II, CLXVI, pp.135–44; CLXVIII, pp. 149–60 (with description of studio); CLXXIV, pp. 170–4.
65. O. Millar, 'Van Dyck in London', Wheelock, Barnes and Held 1990, cited in note 13, pp. 53–8; R. de Piles, *Abregé de la vie des peintres, avec des réflexions sur leurs ouvrages ...*, 2nd edn., Paris 1715, pp. 403–8, esp. 404–7, for comments on slackness of workmanship in works Van Dyck painted towards the end of his life.
66. J. Wadum, 'A Preliminary Attempt to Identify Rubens's Studio Practice', *ICOM Committee for Conservation, 11th Triennial Meeting, Edinburgh, Scotland, 1–6 September 1996: Preprints*, 2 vols., ed. J. Bridgeland, London 1996, Vol. I, pp. 393–5.
67. Magurn 1955, no. 31, pp. 64–6. esp. p. 65; Rooses and Ruelens, II, CLXXIV, pp.170-4, both cited in note 64.
68. C. Brown, *Making and Meaning: Rubens's Landscapes*, exh. cat., London 1996, pp. 95–6.
69. Magurn 1955, cited in note 16, no. 8, letter to Annibale Chieppio, 24 May 1603, pp. 32–4; no. 45, letter to William Trumbull, 26 January 1621, p. 76; Rooses and Ruelens, cited in note 16, I, 1887, XXXI, pp. 144–50; II, 1898, CCXV, pp. 273–4.
70. The sketch for Rubens's *Samson and Delilah* (NG 6461) is on a softwood panel: see J. Plesters, '"Samson and Delilah": Rubens and the Art and Craft of Painting on Panel', *National Gallery Technical Bulletin*, 7, 1983, pp. 30–49, esp. p. 33 and note 9, p.47. See also J. Bauch, D. Eckstein and G. Brauner, 'Dendrochronologische Untersuchungen an Eichenholztafeln von Rubens-Gemälden', *Jahrbuch der Berliner Museen*, 20, 1978, pp. 209–21; P. Klein, D. Eckstein, T. Ważny and J. Bauch, 'New Findings for the Dendrochronological Dating of Panel Paintings of the 15th to 17th Century', *ICOM Committee for Conservation, 8th Triennial Meeting, Sydney, Australia, 6–11 September 1987: Preprints*, ed. K. Grimstad, 3 vols., Los Angeles 1987, Vol. 1, pp. 51–4; J. Vynckier, 'The structure of the supports', and 'Dendrochronological dating of the wings', *Peter Paul Rubens's Elevation of the Cross. Study, Examination and Treatment*, *Bulletin de l'Institut Royal du Patrimoine Artistique*, XXIV, 1992, pp. 55–7, 61–3.
73. Klein, Eckstein, Ważny and Bauch 1987, cited in note 70.
72. E. Schulte, 'Das Danziger Kontorbuch des Jakob Stöve aus Münster', *Hansische Geschichtsblatter*, 63, 1939, pp. 40–72, esp. pp. 44–6; A. von Ulmann, 'Über die Qualitätsbestimmung im Holzhandel. Ein Beitrag zur Materialgeschichte des ausgehenden Mittelalters',

Sculptures médiévales allemands: conservation et restauration. Actes du colloque organisé au musée du Louvre par le service culturel les 6 et 7 décembre 1991; ed. S. Guillot de Suduiraut, Paris 1993, pp. 223–32, esp. pp. 227, 232, note 9.

73. P. Klein, 'Some Aspects of the Utilization of different Wood Species in certain European Workshops', *Painting Techniques: History, Materials and Studio Practice: Contributions to the Dublin Congress, 7–11 September 1998*, ed. A. Roy and P. Smith, London 1998, pp. 112–14. From the second quarter of the seventeenth century, oak from regions other than the Baltic was used in Dutch workshops; Baltic oak was not used after 1650. In addition, wood of other species, European and tropical, was used more frequently.
74. T. Waẑny and D. Eckstein, 'Der Holzhandel von Danzig/ Gdansk – Geschichte, Umfang und Reichweite', *Holz als Roh- und Werkstoff*, 45, 1987, pp. 509–13, esp. pp. 512–13. For England, Norway was already becoming a more reliable source of timber (principally pine); see S. Tveite, *Engelsk-Norsk trelasthandel 1640–1740* (dissertation), Bergen 1961. I am grateful to Unn Plahter for this reference.
75. Wazny and Eckstein 1987, cited in note 74, p. 511; H. Verougstraete-Marcq and R. Van Schoute, *Cadres et supports dans la peinture flamande aux 15e et 16e siècles*, Heure-le-Romain, 1989, pp. 76–8.
76. 'La Descente de Croix de Rubens. Etude préalable au traitement', *Bulletin de l'Institut Royal du Patrimoine Artistique*, V, 1962, pp. 6–187; the structure of all six large altarpieces is discussed on pp. 138–41; *Peter Paul Rubens's Elevation of the Cross. Study, Examination and Treatment*, *Bulletin de l'Institut Royal du Patrimoine Artistique*, XXIV, 1992.
77. J.A. Glatigny, 'The construction of the panels', *Peter Paul Rubens's Elevation of the Cross*, 1992, cited in note 76, pp. 57–61, esp. p. 58.
78. R. Lefève, 'La Descente de Croix de Rubens. Etude préalable au traitement. Les supports', *Bulletin de l'Institut Royal du Patrimoine Artistique*, V, 1962, pp. 128–45, esp. p. 134.
79. J. van den Nieuwenhuizen, 'La Descente de Croix de Rubens. Etude préalable au traitement. Histoire matérielle', *Bulletin de l'Institut Royal du Patrimoine Artistique*, V, 1962, pp. 27–85, esp. pp. 40–1.
80. R.-A. d'Hulst, N. De Poorter and M. Vandenven, *Jacob Jordaens (1593–1678), Volume I, Paintings and Tapestries*, exh. cat., Brussels 1993, pp. 134–7; Wheelock, Barnes and Held 1990, cited in note 13, pp. 201–3.
81. F. Baudouin, 'The Elevation of the Cross in Rubens's work', *Peter Paul Rubens's Elevation of the Cross*, 1992, cited in note 76, pp. 13–31, esp. pp. 13–15, and Rooses II, 1888, cited in note 13, pp. 79–81; A. Monbaillieu, 'P.P. Rubens en het "Nachtmael" voor St.-Winoksbergen (1611), een niet uitgevoerd schilderij van de meester', *Jaarboek van het Koninklijk Museum voor Schone Kunsten Antwerpen*, 1965, pp. 183–205: Doc. 2, pp. 195–6; Doc. 6, pp. 197–8; Doc. 12, p. 199; Doc. 25, p. 203; Doc. 26, p. 204.
82. Rooses II, 1888, cited in note 13, pp. 24–5.
83. J. Van Damme, 'De Antwerpse tafereelmakers en hun merken. Identificatie en betekenis', *Jaarboek van het Koninklijk Museum voor Schone Kunsten Antwerpen*, 1990, pp. 193–236: paragraphs 1, 2, 3, p. 235; 10, p. 236; for the two frame-makers see Rombouts and Van Lerius, I, 1864, cited in note 8, pp. 636–7.
84. J. Wadum, 'The Antwerp Brand on Paintings on Panel', Hermens, Ouwerkerk and Costaras 1998, cited in note 30, pp. 179–98, esp. p. 181; Nieuwenhuizen 1962, cited in note 79, doc. 3, p. 40; Lefève 1962, cited in note 78, pp. 129–31.
85. Duverger 3, 1987, cited in note 15, no. 615, 5–7 July 1627, pp. 30–62; see also Denucé 1932, cited in note 61, no. 16, pp. 39–47, but tools and household objects are not included.
86. Van Damme 1990, cited in note 83, paragraph 5, p. 235. The names of several *witters* are recorded in the Guild registers; see Rombouts and Van Lerius, I, 1864, cited in note 8, pp. 427, 454, 568, 571, 624–6, 632.
87. Rombouts and Van Lerius, I, 1864, cited in note 8, pp. 396–7, 402–3, Rooses II, 1888, cited in note 13, p. 177; N. Van Hout, 'Meaning and Development of the Ground Layer in Seventeenth Century Painting', Hermens, Ouwerkerk and Costaras 1998, cited in note 30, pp. 199–225, esp. pp. 200–5.
88. Duverger 3, 1987, no. 615, cited in note 85, p. 41.
89. Brown 1996, cited in note 68, pp. 100, 119.
90. Van Damme 1990, cited in note 83, paragraph 7, p. 236; Wadum 1998, cited in note 84, p. 182; Duverger 3, 1987, no. 615, cited in note 85; and many other inventories, for example that of the goods of Frans Franken the Elder, Duverger 1, 1984, cited in note 15, no. 247, 15 February 1617, pp. 389–94: *troniepaneelen*, *halffstooterkensmaeten*, *achtstuyversmaet*, etc.
91. J. Bruyn, 'Een onderzoek naar 17de-eeuwse schilderijformaten, voornamelijk in Noord-Nederland', *Oud Holland*, 93, 1979, pp. 96–115; Wadum 1998, cited in note 84, pp. 182–3.
92. Wadum 1998, cited in note 84, pp. 179–80, 183–90.
93. Van Damme 1990, cited in note 83, pp. 194–6 and para 4, p. 235.
94. Brown 1996, cited in note 68, pp. 95–101 and, with A. Reeve, pp. 116–21.
95. Rooses II, 1888, cited in note 13, pp. 173–80, esp. 175–7.
96. S. Alpers, *Corpus Rubenianum Ludwig Burchard, IX: The Decoration of the Torre de la Parada*, London 1971, pp. 36–8
97. Magurn 1955, no. 43, letter to Duke Wolfgang Wilhelm of Neuburg, 24 July 1620, p. 75; Rooses and Ruelens, II, CCII, pp. 252–4, both cited in note 16. Rubens expressed his regrets that the paintings commissioned were too short for the ornamental frames already in place, even though he had been given the measurements in Neuburg feet and had had the framework on which the canvases had been stretched for painting constructed accordingly.
98. G. Bisacca and J. de la Fuente, 'Consideraciones

técnicas de la construcción y restauración del soporte de las Tres Gracias de Rubens', *Las Tres Gracias de Rubens. Estudio técnico y Restauración*, exh. cat., Museo del Prado, 16 April – 15 June 1998, Madrid 1998, pp. 51–66; Brown and Reeve in Brown 1996, cited in note 68, pp. 116–21. The structure of a number of Rubens's panels, some of them enlarged, is described in H. von Sonnenburg, 'Rubens' Bildaufbau und Technik, I: Bildträger, Grundierung und Vorskizzierung', *Maltechnik Restauro*, 85, 2, 1979, pp. 77–100, esp. pp. 78–83.

99. E. van de Wetering, 'The Canvas Support', in J. Bruyn, B. Haak, S.H. Levie and others, *A Corpus of Rembrandt Paintings*, Vol. II, The Hague/ London 1986, pp. 15–43, esp. pp. 15–19. This chapter has been updated in E. van de Wetering, *Rembrandt: The Painter at Work*, Amsterdam 1997, pp. 90–130; see pp. 92–6.
100. R.D. Connor, *The Weights and Measures of England*, London 1987, pp. 84–94.
101. L. Roberts, *The Merchants Mappe of Commerce, wherein the Universall Manner and Matter of Trade is compendiously handled* ..., London 1638, p. 37. He and other sources point out the common practice of making an allowance of about one inch a yard for errors during measuring and cutting.
102. Roberts 1638, cited in note 101, pp. 93–4; A. Martini, *Manuale di metrologia ossia misure, pesi e moneta, in uso attualmente e anticamente*, Turin 1883, pp. 223, 588. There were other palm units in Rome, including the *palmo mercantile* of about 24.9 cm, eight of which gave the *canna mercantile*.
103. J. Bastin, 'De Gentse lijnwaadmarkt en linnenhandel in de XVIIe eeuw', *Handelingen der Maatschappij voor Geschiedenis en Oudheidkunde te Gent*, 21, 1967, pp. 131–62.
104. The ell for white (bleached) linen was about 72.8 cm, and there was a third measure, the mercers' ell, of 69.8 cm which was very close to the Brabant ell of about 69.6 cm.
105. J.E. Thorold Rogers, *A History of Agriculture and Prices in England*, 7 vols., Oxford 1866–1902 (1963 reprint), Vol. VI, 1583–1702, 1887, p. 536: 1629 (Chatham) Ships' canvas: Vittery 1s 3d the ell. (Ipswich) 26s, 27s, a bolt. 1630 (Ipswich) bolt 27s. Vittery, ell, 1s 3d, 1s 6d, 1s 4d; Noyales, bale(?) £20, £19, £20 5s, £20 10s; yard 1s 6d. The French ell was equivalent to a little over 118cm, 118.2 cm before 1746. S.W. Beck, *The Drapers' Dictionary*, London 1886, 'Canvas', pp. 51–2. A charter of 1641 is cited, referring to various types of canvas, including 'French Canvas and Line, ell and half-quarter broad or upwards'; presumably the latter would measure about 50.6 inches or about 128.6 cm. Thanks are due to Penelope Rogers, Textile Research Associates, York, for this reference.
106. Van de Wetering 1986, p. 18, note 24; van de Wetering 1997, p. 95 and note 32, p. 299, both cited in note 99; *Letters and Papers, foreign and domestic, of the Reign of Henry VIII 1509–47*, ed. J.S. Brewer, J. Gairdner and R.H. Brodie, 21 vols., London 1862–1932, Vol. IV, part II, 1872, no. 3097 p. 1391, for 'Hollands' and canvas 'vetre vandalas'.
107. *The Rates of Merchandizes, that is to say, the Subsidie of Tonnage, the Subsidie of Poundage and the Subsidie of Woollen Cloathes or old Drapery, as they are rated and agreed on by the Commons House of Parliament* ..., London 1642, pp. 38–40, 55 for imported cloths, pp. 65, 75, 78 for exported. The first printed book of rates appeared in 1545; they were issued periodically thereafter. It is important to note that the monies listed are not the prices of the items, but the duties payable on them according to their estimated worth. It is unlikely that they were truly up-to-date in this respect, or entirely accurate in the list of imported items included, but they do give some idea of the range.
108. *The Merchant's Ware-house laid open, or, the Plain Dealing Linnen-Draper* (by J.F.), London 1695. Cloths discussed more or less alphabetically: canvases, pp. 5–6. The English cloth called canvas – and the name was properly given to the French textiles – was dyed yellow; it was described as better for stays than the French as it did not go out of shape; Holland, p. 1 onwards (the Amsterdam ell was equivalent to about 68.8 cm); burlap, p. 2; Ghentish Hollands, pp. 19–21; 'Frize' Holland, p. 17; 'Linnen – Hemp Roles', p. 23; 'Ozenbrucks', p. 32.
109. Talley 1981, cited in note 4, p. 366.
110. Thorold Rogers 1887, cited in note 105, p. 536: in the 1631 accounts of the Caryll family of Harting, Sussex, sixteen yards of 'feather bed tyke' were bought at 1s 2d a yard.
111. O. Millar, *Van Dyck in England*, exh. cat., London 1982, pp. 46–7. The main body of the canvas consists of two and a half strips of ticking, seamed vertically; personal communication from Viola Pemberton-Pigott.
112. E. Larsen, *The Paintings of Anthony van Dyck*, 2 vols., Freren 1988, Vol. I, pp. 325–7, Vol. II, p. 368.
113. D. De Jonghe and J. Vynckier, 'Eigenaardigheden in de weefselstructuur van sommighe dragers van 16de tot midden 18de eeuwse schilderijen uit de Vlaamse School', *Bulletin de l'Institut Royal du Patrimoine Artistique*, XXII, 1988/89, pp. 175–86, esp. pp. 180–1. I am grateful to Penelope Rogers for drawing my attention to this reference. The other paintings are *The Coronation of the Virgin*, painted by an unknown artist around 1635 (Mespelare, Sint-Aldegondekerk, 240 × 149 cm), and *The Son beheading his Father*, ascribed to Pieter Pieters and painted before 1614 (Ghent, Stedelijk Museum van de Bijloke, 247 × 215 cm). In 1610 Pieter Pieters was paid 11 pounds gross for supplying and making the painting, including the purchase of the ticking: see A. de Schryver and C. van de Velde, *Stad Gent, Oudheidkundig Museum, Abdij van de Bijloke. Catalogus van de schilderijen*, Ghent 1972, pp. 119–24, esp. p. 121. In the two representations of the *Coronation of the Virgin* the fibres have been identified as flax, spun with a Z-twist.
114. Martin 1986, cited in note 2, p. 133.

115. X. Henny, 'Hoe kwamen de Rotterdamse schilders aan hun verf?', *Rotterdamse Meesters uit de Gouden Eeuw*, ed. N. Schadee, exh. cat., Zwolle 1994, pp. 42–53, esp. p. 49 and notes 84–5, p. 53.
116. Tate Gallery Conservation dossier T02020. The painting measures 214.6 × 276.2 cm; the canvas is made up of three pieces. That used for the two larger pieces is a plain tabby weave; the third piece, used in the top left-hand corner, is a herringbone twill.
117. Martin 1986, cited in note 2, pp. 91–4; see also pp. 89–95 in this *Bulletin*.
118. Van de Wetering 1986, pp. 19–31; van de Wetering 1997, pp. 95–110, both cited in note 99..
119. Tate Gallery Conservation dossier T02139.
120. Tate Gallery Conservation dossier N02530.
121. Christensen, Palmer and Swicklik 1990, cited in note 41, p. 47.
122. Beal 1984, cited in note 24, pp. 85, 307.
123. P. Bagni, *Guercino a Cento: Le decorazioni di Casa Pannini*, Bologna 1984, p. 117 and figs. 96–7, pp. 126–7. The cultivation of hemp was one of the rural activities depicted in a series of landscapes decorating the Camera Rossa of the Casa Pannini, transferred to canvas in the nineteenth century and now in the Pinacoteca Civica, Cento. Guercino and two associates were commissioned to carry out the decorative scheme by Bartolomeo Pannini in 1615; it was completed in 1617. Guercino is thought to be responsible for the landscapes in the Camera Rossa. See also *Identificazione di un Caravaggio: Nuove tecnologie per una rilettura del 'San Giovanni Battista'*, ed. G. Correale, Venice 1990, pp. 48, 107.
124. P. Rogers, personal communication; see also van de Wetering 1986, note 23, p. 18; van de Wetering 1997, p. 94 and note 31, p. 299, both cited in note 99.
125. Van de Wetering 1986, pp. 31–3; van de Wetering 1997, pp. 111–16, both cited in note 99.
126. Such evidence may be seen in certain paintings where primary cusping may be seen on two opposite sides only: see Van de Wetering 1986, pp. 32–3; van de Wetering 1997, p. 116, both cited in note 99; see also Henny 1994, cited in note 115, p. 53, note 85 for rolls of primed canvas, for example '9 ells of primed canvas, two ells wide'.
127. Van de Wetering 1986, pp. 33–7; van de Wetering 1997, pp. 117–23, both cited in note 99.
128. J. Suckling, *The Works of Sir John Suckling – The Non-dramatic Works*, ed. T. Clayton, Oxford 1971, p. 121. A portrait of the poet, thought to have been painted by Van Dyck in about 1636–9, is in the Frick Collection, New York. The letter is thought to date from November 1631, or possibly 1637: given the proposed dating of the portrait and the fact that Van Dyck was not in England in 1631 the latter date seems more likely.
129. See the inventories of the property of Antonio de Succa the Elder and Joos de Momper, Duverger 2, 1985, no. 363, cited in note 59, p. 144; Duverger 3, 1987, no. 853, cited in note 58, p. 430.
130. Van de Wetering 1986, pp. 25, 30; van de Wetering 1997, pp. 109, 118 and notes 62–4, p. 302, both cited in note 99.
131. Van de Graaf 1958, cited in note 36, no. 6, p. 138; no. 40, p. 164. Much later, the author of *The Excellency of the Pen and Pencil* 1668, cited in note 38, commented that the work was troublesome so artists did not prime their own canvases, see p. 92.
132. Duverger 4, 1989, no. 1114, 21 July 1640, pp. 361–2, esp. p. 362; Duverger 5, 1991, no. 1383, 17 November 1645, pp. 263–86, esp. p. 277, both cited in note 15. Curiously, although the job of *witter* is listed in the guild regulations at this time, that of primer is not. It is not clear who would have stretched the canvases or primed them; it may well have been done by the frame- or panel-makers.
133. Duverger 3, 1987, no. 615, cited in note 85, pp. 39, 43; see also the inventory of the goods of Arnout de Bruijne the Elder, Duverger 3, 1987, cited in note 15, no. 778, 19–20 November 1632, pp. 315–19, esp. p. 316.
134. For standard-sized canvases in Holland, see van de Wetering 1986, p. 40, and van de Wetering 1997, pp. 125–6 and note 88, pp. 303–4, both cited in note 99; for Rome see Beal 1984, cited in note 24, p. 293; for London see Talley 1981, cited in note 4, pp. 284–5.
135. Magurn 1955, no. 21, letter to Johann Faber, 14 January 1611, pp. 53–4; Rooses and Ruelens, VI, 1909, CMXXXIV, pp. 327-31, both cited in note 16.
136. M.K. Komanecky, I. Horowitz and N. Eastaugh, 'Antwerp artists and the practice of painting on copper', Roy and Smith 1998, cited in note 73, pp. 136–9; I. Horovitz, 'Paintings on copper supports: techniques, deterioration and conservation', *The Conservator*, 10, 1986, pp. 44–8.
137. Peacham 1622, cited in note 32, p. 110; van de Graaf 1958, cited in note 36, nos. 1, 2, p. 135; MS Harley 6376, cited in note 38, ff. 94–5.
138. Plesters 1983, cited in note 70, p. 36, analysis by staining tests. For Van Dyck's *Charity* see p. 63 in this *Bulletin*; in this case the examination was by Fourier transform infra-red–microscopy. In Rubens's *Elevation of the Cross*, which has a thin grey priming containing lead white, charcoal and possibly chalk, the medium is described as oil and protein; see L. Kockaert, 'Composition and structure of the paint layers', *Peter Paul Rubens's Elevation of the Cross*, 1992, cited in note 76, pp. 63–77, esp. pp. 64, 77; microchemical tests were used for the examination. In the *Descent from the Cross*, examined in 1962 before more sophisticated instrumental methods of analysis were available, the medium of the grey priming was described as aqueous. See also von Sonnenburg 1979, part I, cited in note 98, pp. 85–7, where the medium is described as glue with added drying oil: the same limitations in analytical methods available apply here also.
139. Plesters 1983, cited in note 70, pp. 36–8, fig. 7, p. 34, fig. 14, p. 39.
140. Van Hout 1998, cited in note 87, pp. 205–7; here, *Naiads filling the Horn of Plenty* (The Hague,

Mauritshuis), which has a streaky priming, is attributed to Hendrick van Balen in collaboration either with Jan Brueghel the Elder, or Jan Brueghel the Younger. However, this has recently been attributed to the Rubens studio and Jan Brueghel the Elder: see J. Wadum 1996, cited in note 66. See also von Sonnenburg 1979, part I, cited in note 98, pp. 89–92.

141. Van de Graaf 1958, cited in note 36, no. 6, p. 138; MS Harley 6376, cited in note 38, ff. 95–6; Beal 1984, cited in note 24, pp. 87, 218–19.
142. Van de Graaf 1958, cited in note 36, nos. 6–17, pp. 138–41.
143. Beal 1984, cited in note 24, pp. 87, 218.
144. Millar 1982, cited in note 111, p, 46; O. Millar, *The Tudor, Stuart and Early Georgian Pictures in the Collection of Her Majesty the Queen*, 2 vols., London 1963, Text Vol., p. 98.
145. Plesters 1983, cited in note 70, pp. 33–4.
146. De Piles 1708, cited in note 50, p. 293; see also Brown 1991, cited in note 12, p. 35.
147. Brown 1991, cited in note 12, pp. 48–59.
148. Plesters 1983, cited in note 70, pp. 32–5.
149. S.J. Barnes, 'Van Dyck a Genova', *Van Dyck a Genova: Grande pittura e collezionismo*, ed. S.J. Barnes, P. Boccardo, C. Di Fabio and L. Tagliaferro, exh. cat., Milan 1997, pp. 64–81, esp. pp. 74–6. For the portrait studies see catalogue nos. 41–3, pp. 244–51; there is some doubt over Van Dyck's authorship of these studies. For the de Wael family and other Flemish painters in Genoa see, in the same catalogue, C. Di Fabio, 'Due generazioni di pittori fiamminghi a Genova (1602–1657) e la bottega di Cornelis de Wael', pp. 82–104.
150. Peacham 1612, cited in note 4, p. 82; H. Kühn, 'Verdigris and Copper Resinate', *Artists' Pigments: A Handbook of their History and Characteristics*, Vol. 2, ed. A. Roy, Washington/ Oxford 1993, pp. 131–58; Van de Graaf 1958, cited in note 36, no. 33, p. 152; 37g p. 162; Jaffé 1966, cited in note 43, II, no. 17, f. 4^{r}, pp. 207–8, 212–13.
151. Van de Graaf 1958, cited in note 36, nos. 34, 34a, pp. 152–3; 41, p. 164.
152. Van de Graaf 1958, cited in note 36, no. 23, p. 144.
153. Vandamme 1974, cited in note 31, p. 116; H. Kühn, 'Lead-Tin Yellow', *Artists' Pigments*, Vol. 2, 1993, cited in note 150, pp. 83–112, esp. pp. 83–91.
154. For a discussion of the preparation of synthetic blue and green copper-containing pigments see F. Ellwanger-Eckel, *Herstellung und Verwendung künstlicher grüner und blauer Kupferpigmente in der Malerei*, Diplomarbeit, Institut für Technologie der Malerei, Staatliche Akademie der Bildenden Künste, Stuttgart 1979. See also R.J. Gettens and E.W. FitzHugh, 'Azurite and Blue Verditer', and 'Malachite and Green Verditer', *Artists' Pigments*, Vol. 2, 1993, cited in note 150, pp. 23–35, esp. pp. 31–2, and pp. 183–202, esp. pp. 193–6.
155. M.V. Orna, M.J.D. Low and N.S. Baer, 'Synthetic blue pigments: ninth to sixteenth centuries. I. Literature', *Studies in Conservation*, 25, 1980, pp. 53–63; Harley 1982, cited in note 28, pp. 49–50.
156. Van de Graaf 1958, cited in note 36, no. 50, p. 170; nos. 51–62, pp. 170–3.
157. C. Merrett, *The Art of Glass: wherein are shown the Wayes to make and colour Glass, Pastes, Enamels, Lakes and other Curiosities*; translated from the Italian of A. Neri, London 1662, p. 292. Merrett's discussion of copper, brass and the production of verdigris, pp. 292–304, gives an indication of current understanding of the nature of the materials. See also Harley 1982, cited in note 28, pp. 50–1. See also Jaffé 1966, cited in note 43, II, no. 18, f. 4^{r}, pp. 208, 213.
158. P. and A. Mactaggart, 'Refiners' verditers', *Studies in Conservation*, 25, 1980, pp. 37–45.
159. J. Levy-van Halm, *Produktie en distributie van verfwaren in Nederland in de 17e eeuw*, unpublished thesis, September 1983. I am most grateful to the author for allowing me to consult her work.
160. Van de Graaf 1958, cited in note 36, no. 25, pp. 146–7.
161. Harley 1982, cited in note 28, pp. 119–20.
162. Beal 1984, cited in note 24, p. 197.
163. Harley 1982, cited in note 28, pp. 197–201.
164. Van de Graaf 1958, cited in note 36, nos. 91–7, pp. 180–2; for van Somer's instructions see no. 106, p. 185.
165. Van de Graaf 1958, cited in note 36, no. 106, p. 185; Mytens's recipes, nos. 111–12, pp. 186–7; see also nos. 98–9, 101–5, 107–8, pp. 183–5. For a brief discussion of the treatment of oil see White and Kirby 1994, cited in note 44, pp. 68–9.
166. Van de Graaf 1958, cited in note 36, no. 111, p. 186.
167. Van de Graaf 1958, cited in note 36, no. 113, p. 187; see also nos. 112, 114–20, pp. 187–90.
168. White and Kirby 1994, cited in note 44, pp. 68–9; R. White, J. Pilc and J. Kirby, 'Analyses of Paint Media', *National Gallery Technical Bulletin*, 19, 1998, pp. 74–95, esp. p. 81.
169. Van de Graaf 1958, cited in note 36, no. 86 p. 177.
170. J. Mills and R. White, 'The Gas Chromatographic Examination of Paint Media. Some Examples of Medium Identification in Paintings by Fatty Acid Analysis', Brommelle and Smith 1976, cited in note 39, pp. 72–7, esp. p. 76; J. Mills and R. White, 'Organic Analysis in the Arts: Some Further Paint Medium Analyses', *National Gallery Technical Bulletin*, 2, 1978, pp. 71–6, esp. p. 74; 'Analyses of Paint Media', *National Gallery Technical Bulletin*, 5, 1981, pp. 66–7; 'Analyses of Paint Media', *National Gallery Technical Bulletin*, 7, 1983, pp. 65–7; R. White and J. Pilc, 'Analyses of Paint Media', *National Gallery Technical Bulletin*, 16, 1995, pp. 85–95, esp. pp. 90–1, 95; R. White and A. Roy, 'GC–MS and SEM studies on the effects of solvent cleaning on old master paintings from the National Gallery, London', *Studies in Conservation*, 43, 1998, pp. 159–76, esp. pp. 166–7, 175; M. Van Bos, 'Materials and Techniques: The Binding Media', *Peter Paul Rubens's Elevation of the Cross*, 1992, cited in note 76, pp. 78–82.
171. White, Pilc and Kirby 1998, cited in note 168, pp. 74–5, 79.
172. White, Pilc and Kirby 1998, cited in note 168, pp.

76–7, 88.

173. J.S. Mills and R. White, *The Organic Chemistry of Museum Objects*, 2nd edn., London 1994, pp. 100–2. Fir balsam contains readily polymerisable components which improve the setting qualities of the resin. See also Jaffé 1966, cited in note 43, II, no. 18, f. 7^{v}, pp. 210, 215.
174. Van de Graaf 1958, cited in note 36, no. 148, p. 203.
175. *Pharmacopoeia Londinensis in qua medicamenta antiqua et nova usitatissima, sedulo collecta* ... 3rd edn., London 1627, pp. 182, 204.
176. Talley 1981, cited in note 4, p. 325; information supplied to William Gandy by his father James, who worked in Van Dyck's studio; BL MS Harley 6376, cited in note 38, ff. 108–9, includes a recipe for Sir Nathaniel Bacon's Venice turpentine/ turpentine spirit varnish for oil paintings, also said to be used by Van Dyck 'when he did work over a face again the 2nd time all over, otherwise it will hardly dry'.
177. *The Rates of Merchandizes* 1642, cited in note 107; rates for 'drugges' and other pigments will be found in their alphabetical sequence, more or less.
178. T.D. Whittet, 'Pepperers, spicers and grocers – Forerunners of the apothecaries', *Proceedings of the Royal Society of Medicine*, 61, 1968, pp. 801–6; J.G.L. Burnby, *A Study of the English Apothecary from 1660 to 1760*, London 1983 (*Medical History*, Supplement no. 3, Welcome Institute for the History of Medicine), pp. 4–20, 53–5.
179. Edmond 1978–80, cited in note 7, pp. 177–8; Foister 1993, cited in note 18, pp. 36–7.
180. Van de Graaf 1958, cited in note 36, no. 25, pp. 146–7; the location of the other shop mentioned here is less easy to identify. The other shops include 'Mr Burthon's in Lothbery', near the Exchange, 'against the Stockes by the Fishmarket' (the north east end of Walbrook Street, roughly), and in 'Newgattmarket, at the Signe of the Tabard' (north of Saint Paul's Cathedral). See Berger 1901, cited in note 36, no. 185a, p. 250.
181. J. Stow, *The Survey of London ... completely finished by the study and Labour of A.M.* [Anthony Munday], *H.D.* [Henry Dyson] *and others*, London 1633. For the Popes Head alley area see pp. 209–16; 'Lothbery', p. 287; the 'Stockes Market for Fishmongers' (not Billingsgate), p. 243; for the pepperers, grocers and apothecaries in 'Cheape Ward', Sopers Lane and Bucklersbury, pp. 275–8; the quotation is from p. 276. For 'Port Poole or Grayes Inn Lane', where Fenn lived, see p. 486.
182. Trevor-Roper 1993, cited in note 36, p. 267.
183. Beal 1984, cited in note 24, p. 311.
184. W.F.H. Oldewelt, *Amsterdamsche archiefvondsten*, Amsterdam 1942, p. 154; Levy-van Halm 1983, cited in note 159, p. 12.
185. Rombouts and Van Lerius, I, 1864, cited in note 8, p. 304. In 1585–6, for example, those giving their profession as *kruidenier* included Michiel Quinet (Coigniet, Congnet) and Bastiaen Leers, p. 305. The former, who died in December 1623, was mathematician to Archduke Albert and his wife, Isabella, governors of the Spanish Netherlands.
186. The *Liggeren* registered Jan Bollaert as *schilder en apotheker* in 1557 and there are many other examples of members with more than one trade. Cornelis Nuyts was registered as a panel-maker in 1561, but a painter in the full accounts of 26 September 1585 to 30 September 1586, and a colour merchant in the full accounts of 6 October 1588 to 2 October 1589. See Rombouts and Van Lerius, I, 1864, cited in note 8, pp. 201, 225, 304, 338; for the colour merchants see pp. 305–7, 336–8, 340.
187. Duverger 1, 1984, cited in note 15, no. 114, 16 March 1609, pp. 201–6, esp. pp. 202–3.
188. Magurn 1955, cited in note 16, no. 42, letter to Hans Oberholtzer, 3 April 1620, pp. 74, 419, 445.
189. For the Delft dealer Frans Tobiasz. van den Bosch trading in colours see J. M. Montias, *Artists and Artisans in Delft: a socio-economic Study of the Seventeenth Century*, Princeton 1982, pp. 206–7. For the shop dealing in artists' materials and pictures opened by Leendert Henricx Volmarijn in Leiden in 1643, see W. Martin, '"Een kunsthandel" in een klappermanswachthuis', *Oud Holland*, 19, 1901, pp. 86–8. See also Levy-van Halm 1983, cited in note 159, p. 22.
190. Duverger 2, 1985, cited in note 15, no. 359, 16 October 1620, pp. 139–40, esp. p. 140; no 579, 11 August 1626, pp. 477–83: for the value of the shop goods see p. 478; Lucas 'woonende totten schilder Ruebens', p. 481.
191. Spaegnaert's customers included Hendrick van Balen, Cornelis Schut and Arnout de Bruijne the Elder: Duverger 4, cited in note 15, no. 1066, 8 September 1639, pp. 273–7, esp. p. 275; no. 983, 25 February 1638, pp. 145–7, esp. p. 146; no. 922, 12–13 January 1637, pp. 56–60, esp. p. 60.
192. Duverger 4, 1989, no. 1016, cited in note 57, pp. 187, 190; Duverger 4, 1989, cited in note 15, no. 1051, 24 May 1639, pp. 250–2, esp. p. 251; see also A. Monballieu, 'Aantekeningen bij de schilderijeninventaris van het Sterfhuis van Jan Snellinck', *Jaarboek van het Koninklijk Museum voor Schone Kunsten Antwerpen*, 1976, pp. 245–68, esp. pp. 247–52, 260–1. Hans Snellincx, or Snellinck, the Younger is described as a colour merchant (perhaps working with his father?) in the 1621 inventory of the estate of Anna Vrolijck, widow of Hendrik Leunis and wife of Hubrecht Diericxs. de Clee, both painters, although by this time he was no longer living in Antwerp: Duverger 2, 1985, cited in note 15, no. 368, 8 March 1621, pp. 152–4, esp. p. 154; the debts to Hans Snellinck the Younger are listed among those outstanding from the estate.
193. Duverger 5, 1991, no. 1383, cited in note 132, p. 277; see also, for example, the payment made to the widow of Osias Beert, painter, for colours from the estate of Abraham Goyvaerts, 30 July 1629, Duverger 3, 1987, cited in note 15, pp. 162–5.
194. *The Rates of Merchandizes* 1642, cited in note 107, pp. 42, 74.
195. A. Roy and B. Berrie, 'A new lead-based yellow in the

seventeenth century', Roy and Smith 1998, cited in note 73, pp. 160–5. Naples yellow itself was used in Italy before any other country in Europe, rather later in the seventeenth century: see I.N.M. Wainwright, J.M. Taylor and R.D. Harley, 'Lead Antimonate Yellow', *Artists' Pigments: A Handbook of their History and Characteristics*, Vol. 1, ed. R.L. Feller, Washington/ Cambridge 1986, pp. 219–54, esp. pp. 223, 230–1.

196. Beal 1984, cited in note 24, p. 252.
197. Beal 1984, cited in note 24, p. 252; Van de Graaf 1958, cited in note 36, no. 32 p. 151; see also no. 22, p. 142.
198. C.A. Grissom, 'Green Earth', *Artists' Pigments*, Vol. 1, 1986, cited in note 195, pp. 141–67, esp. pp. 141–3, 148–9. The other, more common, variety of green earth is glauconite, also a clay mineral, but of sedimentary origin; celadonite is of volcanic origin.
199. Duverger 4, 1989, no. 1025, cited in note 60, pp. 204, 211.
200. J. Plesters, 'Ultramarine Blue, Natural and Artificial', *Artists' Pigments*, Vol. 2, 1993, cited in note 150, pp. 37–65, esp. pp. 37–41.
201. Rooses II, 1888, cited in note 13, p. 177.
202. R. de Piles, *The Art of Painting, with the Lives and Characters of above 300 of the most Eminent Painters, Containing a Complete Treatise of Painting, Designing and the Use of Prints ... to which is added An Essay towards an English School* [by B. Buckeridge], 2nd edn., London 1744, p. 361.
203. M. Rooses, *Jordaens: sa vie et ses oeuvres*, Amsterdam and Antwerp 1906, p. 131.
204. *Il libro dei conti del Guercino 1629–1666*, ed. B. Guelphi, Cento/ Bologna 1997, pp. 66–7.
205. Duverger 1, 1984, no. 114, cited in note 187, p. 202.
206. Van de Graaf 1958, cited in note 36, no. 25, p. 146; British Library MS Sloane 1990, f. 79^{r}.
207. Depending on whether troy weight (used for pharmaceutical products) or avoirdupois was used, there were 12 or 16 ounces to the pound respectively; the troy ounce was equivalent to about 31g, the avoirdupois ounce 28.35g.
208. B. Mühlethaler and J. Thissen, 'Smalt', *Artists' Pigments*, Vol. 2, 1993, cited in note 150, pp.113–30, esp. pp. 113–16.
209. Mühlethaler and Thissen 1993, cited in note 208, pp. 116–20.
210. Tate Gallery Conservation dossier T04168.
211. See p. 55 and Plesters 1983, cited in note 70, pp. 45, 48–9; BL MS Harley 6376, cited in note 38, f. 92.
212. Analysis by high-performance liquid chromatography (HPLC), see J. Kirby and R. White, 'The Identification of Red Lake Pigment Dyestuffs and a Discussion of their Use', *National Gallery Technical Bulletin*, 17, 1996, pp. 56–80, especially pp. 67, 73; cochineal lake was used mixed with a madder lake in a painting by William Larkin: p. 67 and note 71, p. 79. The sample from '*Peace and War*' was extremely small and the results were difficult to interpret. In some earlier investigations the presence of organic yellow or brown pigments may have interfered with the examination of red lake dyestuffs. Analysis by thin-layer chromatography of the red lake used for Delilah's dress in Rubens's *Samson and Delilah*, which in some areas was mixed with a yellow lake (or similar material), and that present in the purple curtain suggested that they contained the dyestuffs extracted from the kermes insect and madder respectively. Recent examination of samples by microspectrophotometry suggests that a cochineal lake is probably present in both cases; confirmation by another method is necessary to rule out the presence of lac dyestuff. Thin-layer chromatography, together with microspectrophotometry, suggested the presence of cochineal lake in *Lady Elizabeth Thimbelby and Dorothy, Viscountess Andover*: see Plesters 1983, cited in note 70, pp. 39, 45.
213. J. Wouters, 'Materials and Techniques: Organic Lakes', *Peter Paul Rubens's Elevation of the Cross,* 1992, cited in note 76, p. 82.
214. Microspectrophotometric examination of samples from the red curtain in Van Dyck's *Woman and Child* (NG 3011) and from Silenus's armpit in the *Drunken Silenus supported by Satyrs* (NG 853), from the Rubens studio, suggests the probable presence of a cochineal lake in both cases. Distinction between cochineal and lac dyestuffs by this method is not clear-cut; confirmation of the results by another analytical method (HPLC) is forthcoming.
215. R. White, 'Brown and Black Organic Glazes, Pigments and Paints', *National Gallery Technical Bulletin*, 10, 1986, pp. 58–71, esp. p. 65.
216. White and Pilc 1995, cited in note 170, pp. 90–1, and note 24, p. 95.
217. Van Bos 1992, cited in note 170, p. 80.
218. R. Jones, 'Marcus Gheeraerts the Younger (1561–1635/6), *Portrait of Captain Thomas Lee* 1594', *Paint and Purpose: A Study of Technique in British Art*, ed. S. Hackney, R. Jones and J. Townsend, London 1999, pp. 26–31; Tate Gallery Conservation dossier T03456.
219. BL MS Harley 6376, cited in note 38, f. 102. Similar instructions are found in sixteenth-century sources: see J. Murrell, 'John Guillim's Book: A Heraldic Painter's *Vade Mecum*', *The Walpole Society*, LVII, 1993–94, pp. 1–51, especially p. 25: 'To Make a Red Rose'.
220. Plesters 1983, cited in note 70, p. 45. Rubens's painting methods are also discussed by H. van Sonnenburg, 'Rubens' Bildaufbau und Technik, II: Farbe und Auftragstechnik', *Maltechnik Restauro*, 85, 3, 1979, pp. 181–203.
221. Kockaert 1992, cited in note 138, p. 64.
222. De Piles 1715, cited in note 65, p. 390, 403; de Piles / Buckeridge 1744, cited in note 202, p. 267.