

# TECHNICAL EXAMINATION OF WORKS BY CAMILLE AND LUCIEN PISSARRO FROM THE COURTAULD GALLERY

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**ABSTRACT** Technical examination of paintings in the Courtauld Gallery by Camille Pissarro and his son Lucien, provide evidence for a discussion of the relationship between father and son with regard to stylistic influence, materials and artistic practice. Correspondence between them illuminates the nature of Camille's instruction of his son in painting, and provides the context for the comparison of the paintings in this study and of their wider oeuvre. Primary source material in the Pissarro Family Archive at the Ashmolean Museum, Oxford, including Camille's drawings, Lucien's sketchbooks and family photographs, further supplement the technical evidence from the paintings. Technical analysis of the Pissarros' works has highlighted the use of similar materials by father and son, attained from reliable dealers. While Camille's painting is direct and innovative, Lucien's was influenced substantially by Neo-Impressionism. Their painting methods and attitudes to varnishing are discussed in relation to the surface aesthetic of their works.

## Introduction

Camille Pissarro (1830–1903) was undoubtedly the most influential and encouraging mentor for younger painters of his era. Of the many artists who received his guidance and advice, none were more involved with his art than his eldest son, Lucien (1863–1944). Their correspondence, undertaken upon Lucien's first visit to England in 1883, is a valuable documentary resource for scholars of the Impressionist movement, providing anecdotes about politics, art and characters central to both artists' lives during the period. Never before has this dialogue been examined within the context of an in-depth study of the technical aspects of Camille's or Lucien's art, let alone the impact of Camille's attitudes and instruction in painting of his son.

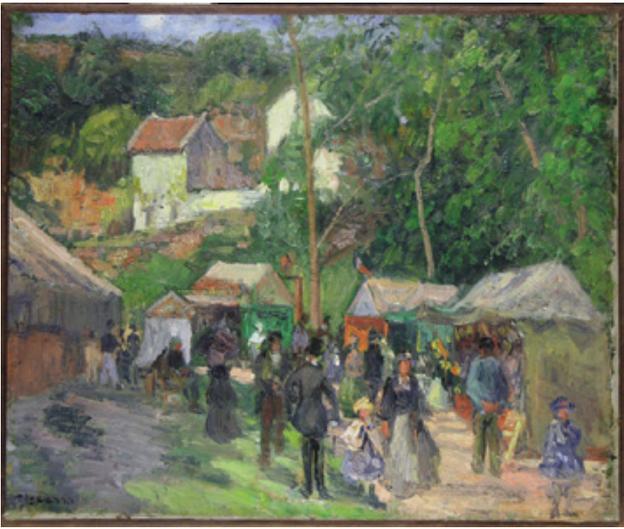
The Courtauld Gallery collections include three works each by Camille and Lucien Pissarro, providing a unique opportunity to examine their relationship, using evidence from technical study of their paintings in the context of their written correspondence. The paintings by Camille in the collection represent important periods concerning the evolution of his technique (1871–1883), up to his involvement with Neo-Impressionism in the mid-1880s: *Lordship Lane, Dulwich* 1871 (Figure 1); *Festival at L'Hermitage* 1876–8 (Figure 2) and *The Quays at Rouen* 1883 (Figure 3). Lucien's works are representative of his mature technique, executed after his father's death, and

date from 1916 to 1925: *Old Mark's Field, Coldharbour* 1916 (Figure 4); *Rade des Bormes* 1923 (Figure 5) and *Le Brusq* 1925 (Figure 6). To provide further insight into Camille's technical influence on Lucien during his formative years with the Neo-Impressionists, two further works from 1886 were examined from the Ashmolean Museum, Oxford: Camille's *View from my Window, Eragny sur-Epte* 1886–8 (Figure 7), and Lucien's *Le Maison de la Sourde* 1886 (Figure 8).<sup>2</sup>

The Pissarros' painting techniques are the considered product of their aesthetic intentions: to create (with one's *sensations* through the direct observation of nature) a sense



**Figure 1** Camille Pissarro, *Lordship Lane, Dulwich* 1871, Courtauld Gallery, London, cat. no. 268, 45 × 73 cm.



**Figure 2** Camille Pissarro, *Festival at L'Hermitage* 1876-8, Courtauld Gallery, London, cat. no. 402, 45.5 × 55 cm.



**Figure 5** Lucien Pissarro, *Rade des Bormes* 1923, Courtauld Gallery, London, cat. no. 188, 54.5 × 66 cm.



**Figure 3** Camille Pissarro, *The Quays at Rouen* 1883, Courtauld Gallery, London, cat. no. 317, 46.5 × 56 cm.



**Figure 6** Lucien Pissarro, *Le Brusq* 1925, Courtauld Gallery, London, cat. no. 1946, 53.5 × 64.5 cm.



**Figure 4** Lucien Pissarro, *Old Mark's Field, Coldharbour* 1916, Courtauld Gallery, London, cat. no. 1942, 50.5 × 65 cm.



**Figure 7** Camille Pissarro, *View from my Window, Eragny sur-Epte* 1886-8, Ashmolean Museum, Oxford, 65.3 × 81.3 cm.

**Table 1** Comparison of supports and grounds of works examined.

| Camille Pissarro  |  |   |   |   |  |
|---|--|---|---|---|--|
| Title and date  | Dimensions canvas cm <sup>2</sup><br>H × W | Thread count cm <sup>2</sup><br>weft × warp | Supplier                                | Components of ground  | Media <sup>1</sup>                                   |
| <i>Lordship Lane, Dulwich</i> 1871                                    | 45 × 73cm                                  | 15 × 15                                     | Artist prepared                         | Lead white + barium sulphate + chalk + toning pigments  | Linseed oil P/S 1.6                                  |
| <i>Festival at L'Hermitage</i> 1876–8                                 | 45.5 × 55cm                                | 24 × 21                                     | Commercially prepared                   | Lower: lead white + chalk + charcoal.<br>Upper: lead white + zinc + chalk + barium sulphate + toning pigments | §  |
| <i>The Quays at Rouen</i> 1883  | 46.5 × 56cm                                | 14 × 15                                     | Latouche, Paris (stamp).                | Lead white + barium sulphate + chalk + yellow ochre   | Linseed oil P/S 1.8                                  |
| <i>View from my Window, Eragny-sur-Epte</i> 1886–8 (Ashmolean Museum) | 65.3 × 81.3cm                              | §   | Commercially prepared.                  | §   | §  |
| Lucien Pissarro   |  |   |   |   |  |
| <i>Le Maison de la Sourde</i> 1886 (Ashmolean Museum)                 | 58.5 × 72.5cm                              | §   | Artist prepared or by local colourman   | §   | §  |
| <i>Old Mark's Field, Coldharbour</i> 1916                             | 50.5 × 65cm                                | 16 × 15                                     | H.J Pursey, Hammersmith, London (stamp) | Lead white + chalk + bone black   | Linseed oil P/S 1.8                                  |
| <i>Rade des Bormes</i> 1923   | 54.5 × 66cm                                | 14 × 14                                     | Commercially prepared                   | Lead white + barium sulphate + chalk + silica + French ultramarine  | Linseed oil P/S 1.6                                  |
| <i>Le Brusq</i> 1925  | 53.5 × 64.5cm                              | 18 × 19                                     | Commercially prepared                   | Lead white + barium sulphate + silica   | Proteins (perhaps animal original: animal glue size) |

Identified using DTMS at the Netherlands Institute for Cultural Heritage (ICN).

§Analysis not undertaken.

of unity within the work, achieved through appropriate compositional design, tonal values, execution and sensitivity to the subject. In this study, particular attention is given to the artists' choices of materials and their manipulation towards achieving these aims. Primary source material in the Pissarro Family Archive at the Ashmolean Museum further supplemented the technical evidence from the paintings, particularly Camille's drawings, Lucien's sketchbooks and family photographs.<sup>3</sup>

The works were examined using standard non-invasive techniques of surface microscopy, infrared reflectography, ultraviolet light and X-radiography (except *Le Maison de la Sourde*). Examination of pigments on the Courtauld paintings was achieved through sampling and surface examination with a low-powered light microscope.<sup>4</sup> Pigments, the paint layer structure and their constituent materials were identified by examination of samples prepared as cross-sections with a microscope in incident tungsten and ultraviolet light,<sup>5</sup> and characterisation of inorganic materials was supplemented by analysis using scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDX).<sup>6</sup> Analysis of the organic binding medium used for the ground media was undertaken using direct temperature resolved mass spectrometry (DTMS).<sup>7</sup> Results are summarised in Tables 1 and 2.

## The Pissarros' ideas on painting

A close reading of the correspondence between Camille and Lucien Pissarro from 1883 until Camille's death in 1903 reveals several themes that are integral to both artists' attitudes towards artistic production, which guided their choices of materials and painting techniques. Lucien was



**Figure 8** Camille Pissarro, *Le Maison de la Sourde* 1886, Ashmolean Museum, Oxford, 58.5 × 72.5 cm.

Table 2 Pigments identified.

| Painting <sup>1</sup>   | Lead white  | Zinc white | Ivory black | Yellow ochre | Orange-red ochre | Chrome yellow | Cadmium yellow | Cobalt blue | French ultramarine | Viridian | Emerald green | Green earth | Vermilion | Redlake                       |              |
|-------------------------|---|------------|-------------|--------------|------------------|---------------|----------------|-------------|--------------------|----------|---------------|-------------|-----------|-------------------------------|--------------|
| <b>Camille Pissarro</b> | <i>Fox Hill, Upper Norwood</i> 1870*                | #          | #           |              | #                | PbCr          |                |             | #                  | #        |               |             | #         |                               |              |
|                         | <i>Lordship Lane</i> 1871*                          | *          | *           | *            |                  | PbCr          | *              | *           |                    | *        | *             | *           | *         | On Sn;<br>Starch              |              |
|                         | <i>The Avenue, Sydenham</i> 1871*                   | #          | #           | #            |                  | PbCr          |                |             | #                  | #        | #             |             | #         |                               |              |
|                         | <i>Festival at l'Hermitage</i> 1876–8*              | *          | *           |              | *                | PbCr          |                | *           | *                  | *        | *             | *           | *         | Madder on Sn;<br>Ca           |              |
|                         | <i>The Cote des Boeufs at l'Hermitage</i> 1877*     | #          | #           |              |                  | PbCr          |                |             | #                  | #        | #             |             | #         | # on Al;<br>Ca; Sn            |              |
|                         | <i>Portrait of Felix</i> 1881 <sup>@</sup>          | @          | @           | @            |                  | ZnCr;<br>BaCr |                |             |                    | @        |               |             |           |                               |              |
|                         | <i>The Quays at Rouen</i> 1883*                     | *          | *           |              |                  | PbCr;<br>ZnCr |                |             | *                  | *        | @             |             |           | @                             | Madder on Al |
|                         | <i>La Charcutiere</i> 1883 <sup>@</sup>             | @          | @           |              |                  | PbCr;<br>BaCr | @              |             |                    | @        |               |             |           | @                             | @            |
|                         | <i>View from my Window, Eragny-sur-Epte</i> 1886–8* | *          |             |              |                  |               |                |             | *                  | *        |               | *           |           |                               | *            |
|                         | <i>Le Maison de la Sourde</i> 1886*                 | *          |             |              |                  |               |                |             | *                  | *        |               | *           |           |                               | *            |
| <b>Lucien Pissarro</b>  | <i>Old Man's Field, Coldharbour</i> 1916*           | *          | *           |              |                  | PbCr          |                |             | *                  |          | *             |             | *         | Madder on Al;<br>Madder on Ca |              |
|                         | <i>Rade des Bormes</i> 1923*                        | *          | *           |              |                  | PbCr          | *              |             | *                  |          | *             |             | *         | *                             |              |
|                         | <i>Le Brusq</i> 1925*                               | *          | *           | *            |                  | ZnCr;<br>BaCr | *              |             | *                  |          | *             |             | *         | Madder on Al;<br>Ca           |              |

\* = present study, # = from Bomford et al. 1990, @ = from Tate Gallery Conservation records for cat. nos. 5574, 5576. Pigments identified by Joyce H. Townsend using UV and VIS microscopy and EDX.



**Figure 9** Lower left corner of Camille's *The Quays at Rouen* showing pinholes that were used to separate wet paintings in transit.

highly receptive to his father's opinions in all matters, and each artist sought to materialise in his own paintings an overall aesthetic unity,<sup>8</sup> achieved through an acute understanding of compositional design learnt through the direct emulation of nature and old masters; tonal values based on an understanding of current scientific theory; and the evolution of a style of execution appropriate to one's temperament, subject and vision. There is a pervading sense of Camille's fearfulness for his son's career through their association, evidenced in Camille's letter to Lucien, 1893:

Although we have substantially the same ideas, these are modified in you by youth and a milieu strange to me; and I am thankful for that; what I fear most is for you to resemble me too much.<sup>9</sup>

Thus the impetus for Lucien to develop his own 'note'<sup>10</sup> distinct from Camille's, while being based on shared concepts, is particularly apparent in both artists' minds.<sup>11</sup> Lucien's correspondence with his wife Esther after Camille's death occasionally reflects this concern, referring to his own 'personality [as a] weak diminution of the poor dear old father' and 'my pictures are at best only a weak duplicate of the father's'.

What Camille found vital in all art, whether of the great masters in the Louvre, or the artisans who carved the Gothic doorways of Rouen, was '*la sensation*', the feeling roused by some immediate observation of the world around us, and the ability to pass it on.<sup>12</sup> Camille insisted that his *sensations* were the essential basis of his art, and instilled this in Lucien:

give free play to your sensations ... your problem is to discover an execution appropriate to your spirit ... Do not overdevelop a critical sense, and trust your sensations blindly.<sup>13</sup>

For the Pissarros, the realisation of one's *sensation* in paint was the ultimate aim of the Impressionist artist working in the open air, which when combined with an execution unique and appropriate to the individual artist, produced a unified image.<sup>14</sup>

*Plein air* painting, popularised by Camille and the Impressionists, was the prime means of accessing *la sensation*, which Camille proclaimed was the basis of his art. Camille had a 'rolling studio' built by a local carpenter, a two-wheeled cart mounted with a large box containing easels, brushes, pigments and canvases. Lucien followed this practice, painting in the open air before his motif to arouse *sensation*, as is seen in photographs from the 1930s. Physical evidence for this is found on Camille's *The Quays at Rouen* as canvas pins in the corners for separating wet paintings in transit (Figure 9) and in Lucien's paintings, where organic debris lies embedded in the paint layers on the outer edges.

Camille acknowledged to Lucien in 1887 the importance of contemporary nineteenth-century colour theory to their art:

But surely it is clear that we could not pursue our studies of light with much assurance if we did not have as a guide the discoveries of Chevreul and other scientists. I would not have distinguished between local colour and light if science had not given us the hint; the same holds true for complementary colours, contrasting colours, etc.<sup>15</sup>

Lucien's debut as a painter occurred in the mid-1880s during a period when Camille was struggling to realise his aesthetic regarding colour values and execution in producing a unified image, and together with Lucien adopted the method of pure tone division being developed by Seurat and Signac. Camille's association with the Neo-Impressionists was brief, from which he emerged 'with a difference: he kept his colours purer, and got a more scientific kind of division'.<sup>16</sup> He adapted tone division to suit his temperament, as the painstaking pointillist predetermination of hues and method that involved allowing each brushstroke to dry before applying another stifled what drove Camille as an artist, his *sensation*. Lucien remained an advocate of Neo-Impressionist tone division throughout his painting career, he judiciously copied Seurat's disc, constructed according to Chevreul's and Rood's principles,<sup>17</sup> and also recorded the various principles that guided Seurat and his friends in the application of the disc to their work.<sup>18</sup> The laws of simultaneous contrast are applied in modified form in Lucien's paintings, predominantly based on complementary relationships between green / red-purple and blue / orange. From early on, Lucien mixed a high proportion of white into his hues, so that the 'discord' between the hues was lessened, resulting in the distinctive matt 'blondness' that characterises his work and differs from the 'violent purity of tints which hurts the eye'<sup>19</sup> aimed at by the Neo-Impressionists.

The striving for overall aesthetic unity in their work guided the Pissarros' choices of materials and techniques whereby all elements could be combined and realised harmoniously on the paint surface. Lucien modified his lessons from Camille into his own style or 'vision', and as a result his works are technically distinct from his father's.

## The Pissarros' materials

### Canvases

From the works examined, the Pissarros displayed a preference for commercially prepared plain weave fine linen canvases of standard formats, bought from various suppliers throughout their lifetimes<sup>20</sup> (Table 1). Camille preferentially ordered canvases from the artists' colourman Latouche,<sup>21</sup> whose stamp appears on *Quays at Rouen*, Contet,<sup>22</sup> and Julian Pere Tanguy. In France, Lucien bought his canvases from his father's supplier Contet, and in England he may have occasionally have bought from Roberson & Co, Percy Young<sup>23</sup> and H.J. Pursey of Hammersmith, whose stamp appears on *Old Mark's Field, Coldharbour*. Camille's *Lordship Lane* and perhaps Lucien's *La Maison de la Sourde* are artist-prepared supports, and while both are standard format, indicating off-the-shelf stretchers, the canvas is attached haphazardly with nails through the bare threads around the tacking edges.<sup>24</sup> Camille's request to Lucien in 1887 for Contet to send a prepared canvas to fit an existing stretcher or strainer reaffirms this practice, as well as his close relationship with Contet and preference for the quality of his wares.<sup>25</sup>



**Figure 10** Cross-section from Lucien's *Rade de Bormes* showing coarse particles of barium sulphate in the ground.



**Figure 11** Detail of a typical abraded canvas used for Camille's *The Quays at Rouen*.

### Priming

The Pissarros generally preferred whitish, smooth double-primed supports, the priming thoroughly filling the canvas weave in most of the works examined. The colour of the ground plays a fundamental role and both artists exploited this as a unifying tone that modifies through simultaneous contrast each hue rendered upon it. Most of Camille's grounds are off white, although he experimented using coloured priming. He mixes coloured pigments into his priming for *Lordship Lane*,<sup>26</sup> producing a pale creamy tone, intended to render his paint layers more brilliant. The pinkish priming on *The Quays at Rouen* has dictated Camille's colour scheme, as the complementary pigment emerald green predominates throughout the paint mixtures. Lucien's primings are consistently white according to Neo-Impressionist aesthetic, now somewhat darkened through discoloration of the components and lining treatments.<sup>27</sup> The saturating varnish coatings on Camille's works in the Courtauld further lend to a disrupted impression of the originally sought aesthetic.<sup>28</sup>

Both painters sought an effect of surface mattness and roughness, attained by using semi-absorbent grounds that would 'wick' away medium from the paint and promote rapid drying, helping to produce porous, rough paint surfaces which scatter light.<sup>29</sup> *Le Maison de la Sourde* exhibits an extremely chalky and brittle ground, so leanly bound and poorly adhered to the support that the fine craquelure interpenetrates throughout the paint layers. The fragile cohesion of the ground also found in *Lordship Lane*, *The Quays at Rouen* and *Rade des Bormes*, reinforces a preference for leanly bound semi-absorbent priming materials.

Both Camille's and Lucien's grounds are bound leanly in linseed oil,<sup>30</sup> however Lucien's *Le Brusq* included an animal glue (Table 1). EDX analysis shows lead white as the principal component for their grounds, with calcium carbonate (natural chalk), barium sulphate or calcium sulphate occasionally present as extenders and additional coloured pigments to provide tone.<sup>31</sup> In *Rade des Bormes* and *Le Brusq*, EDX analysis identified elements consistent with the presence of barium sulphate, chalk and silica, with the lead white, and a small amount of zinc, that may be indicative of the addition of lithopone. The large particle size of the extenders creates texture and has a glistening effect, further enhancing the light-scattering matt effects of a rough surface (Figure 10). Darkening of the appearance of the ground, caused by retention of dirt and aged coatings in the fine cracking of the surface has changed the originally intended effect, especially in *Rade des Bormes*.<sup>32</sup> The particular absorbency of grounds that contain glue binding media is demonstrated here.<sup>33</sup>

A phenomenon identified on several works is the intentional abrasion of the priming exposing the canvas indicated by drawing, underpainting and paint layers running across the exposed weave. The abrasion is localised across the sky in *Lordship Lane* and *Le Brusq*, and in *The Quays at Rouen* it is confined to a horizontal strip across the centre, corresponding to the orientation of the river (Figure 11). Exposing

the pale weave originally would have enhanced the light tone of those areas, particularly desirable for emulating, for instance, the reflection of light across water or the diffusion of light within the sky's atmosphere. This intended aesthetic has now altered significantly due to degradation of the canvas and accumulation surface material perhaps from former treatments, rendering these passages dark.

### Drawing and underpainting

Camille and Lucien recorded the world around them by making numerous drawings in sketchbooks throughout their careers, emphasising the importance of drawing as part of the preparation for painting. For Camille, drawings were done as a means of establishing compositional formula or studying independent figures and objects, forming a visual library for future reference, but no direct preparatory drawings have been identified for his Courtauld paintings. This lends credence to the notion that drawings were intentionally made for structuring the pictorial surface<sup>34</sup> before *sensation* was realised in paint.

Lucien's sketchbooks record his surroundings and compositional drawings, however unlike Camille, many of these did evolve into paintings. Compositional drawings directly relating to *Old Mark's Field*, *Rade des Bormes* and *Le Brusq* are accompanied with several variants of the same view, which are summarised in the underdrawing stage for his paintings. Both artists' preference for charcoal sketching media is reflected in their underdrawing, visible in *The Quays at Rouen* and all of Lucien's works studied.

Camille employs a calligraphic type of brushwork for his underpainting in *Lordship Lane*, using charcoal in a fluid, probably oil-based medium, diluted with turpentine. The lines applied with a thin brush describe the general composition and features of the landscapes, and are intentionally exposed beneath the paint layers, reinforcing contours. This evolves into a dark blue line on Camille's paintings from the early 1870s, similar to the technique used by Paul Cézanne,<sup>35</sup> not consistently applied as a preliminary stage (Figure 12). Lucien clearly emulates his father's working practice, although his preliminary stages of underdrawing and sketched blue underpainting are formulaic. Lucien first sketches out his composition using charcoal or conté crayon, and then reinforces and elaborates upon the lines with French ultramarine in a fluid medium, applied with a thin brush (Figure 13).<sup>36</sup> The line denotes contour and is consistently exposed between the blocking in of pale impasted paint layers for different forms, thus lending three-dimensionality through its darker tone and physical presence as a flat layer upon the ground. This contrasts with Camille's overworking of his lines in *Lordship Lane* and *View from my Window*, and although both artists tend to reinforce the lines in their upper paint layers, Lucien's underpainting plays a significant role in the final aesthetic of his image, in which the lines fulfil an autonomous, unadulterated role.

### Pigments

In the 1880s, Camille asked Contet, his chief supplier of paints, to prepare colours, probably to order, 'on a base of zinc', presumably zinc white.<sup>37</sup> This would have resulted in increased opacity and mattness for his paints, and analysis of samples confirms the continuous use of zinc combined with lead white as a manufactured mixture (Table 2).

In 1877–9, Camille composed a landscape on his palette from six hues, demonstrating his method of *peinture claire*,<sup>38</sup> intended to give a unifying harmony to a work by mixing hues from a limited palette of 'spectral' colours. Georges Lecomte in 1890 stressed Camille's achievement of a *peinture blonde*:

Since 1865, the painter has initially expurged his pallet of black, this 'non' colour; a little later the ochres and the brown ones were proscribed: he does not paint any more but with the six colours of the rainbow.<sup>39</sup>

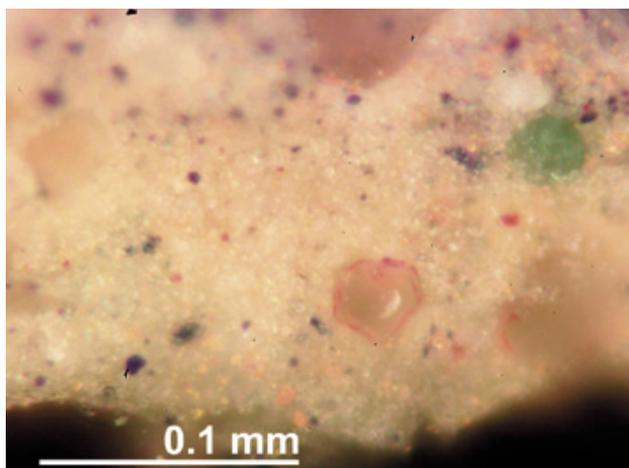
Technical analysis in this study however has identified calcium phosphate (bone or ivory black) and carbon black pigments in Camille's paintings from 1870 and 1871<sup>40</sup> (Table



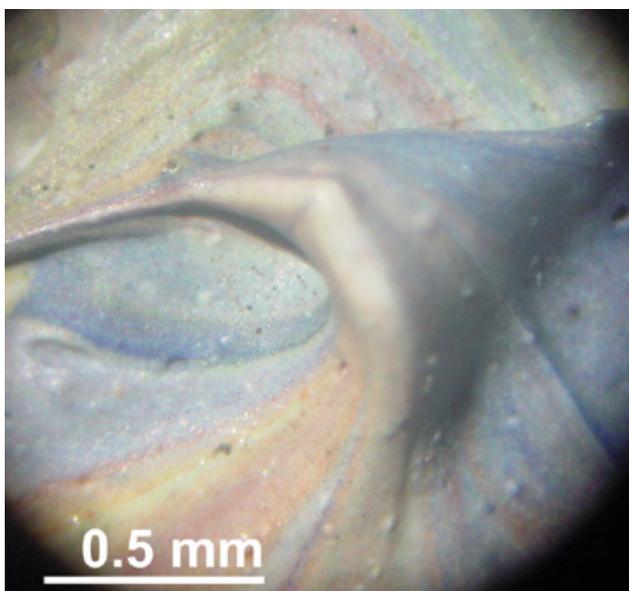
Figure 12 Camille's use of underdrawing and a charcoal and blue painted line from *The Quays at Rouen*.



Figure 13 Detail from Lucien's *Rade de Bormes* showing his underdrawing in charcoal or conté crayon, followed by French ultramarine in a fluid medium.



**Figure 14** Cross-section from the sky of Camille's *The Quays at Rouen* including a red lake cast onto a combined tin and calcium substrate and associated with starch that exhibits fading.



**Figure 15** Surface bubbles in Lucien's impasto from *Rade de Bormes* due to water evaporation from pigment pre-ground in an aqueous medium before mixing with an oil binding medium.

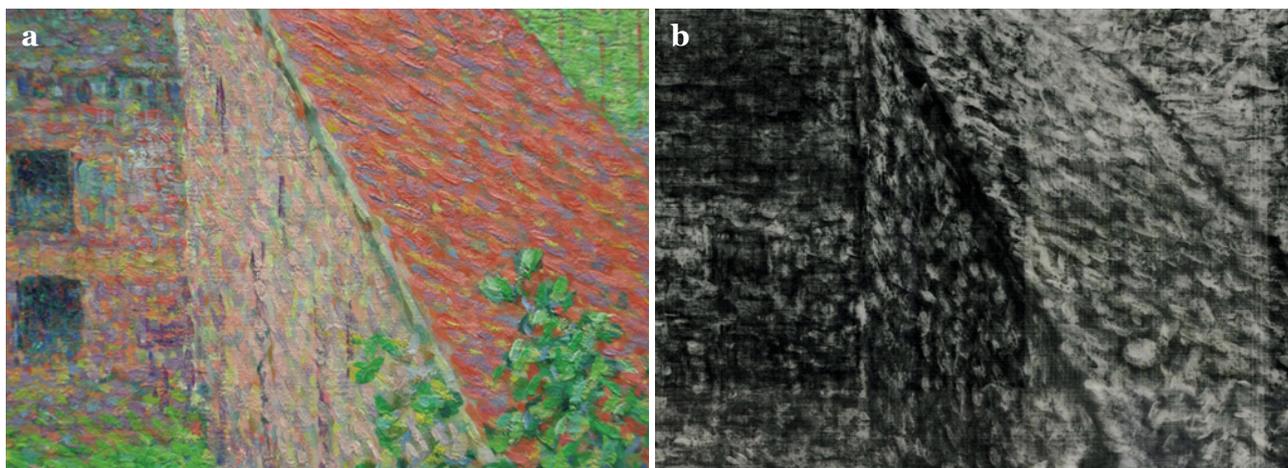
2). Consistent with Camille's development towards *peinture claire*, in *Lordship Lane* the colour is modified by other pigments, and is exploited as a colour in its own right for fences and features of the landscape as well as a toning pigment, lending overcast greyness to the skies. After this period, black (charcoal) seems to be restricted to underdrawing in both Camille's and Lucien's paintings. Fairly bright green earth, red, yellow and orange iron oxide pigments are used in Camille's works up to the 1880s, combined with high-keyed pigments in complex mixtures. Their use then ceases, and as such no earth pigments appear to have been used intentionally by Lucien; the yellow ochre present for the green-yellow mixture in *Le Brusq* is probably a manufacturer's addition.<sup>41</sup>

Chrome yellow is used predominantly by Camille, although the more expensive cadmium yellow features intermittently. Lucien's paintings reflect this trend, and

cadmium yellow is preferred in later years.<sup>42</sup> In addition, Lucien used a mixed orange (chrome yellow and vermilion) and a yellow composed of lead / barium or zinc chromate, and no deterioration phenomenon was noted for chromate pigments.

Vermilion features strongly in Camille's and Lucien's palettes. Camille exploits the intense brilliance both in mixtures and unblended on the central roof of *Festival at L'Hermitage* against the emerald green underlayer. Lucien's use of the pigment is more timid: it appears consistently in mixtures with white and yellows to produce bright pinks, oranges and purples. In common with the other Impressionists, the Pissarros used red lake pigments for their colour intensity, and up to three types of red lake appear on Camille's palette, two on Lucien's. A red lake cast onto a combined tin and calcium substrate and associated with starch was identified in Camille's works examined, which exhibits fading (Figure 14). The pigment resembles the carmine-type lake used by Renoir from 1868 to 1919, and similar starch-containing red lake paints have been identified in paintings by Van Gogh, Monet and Seurat.<sup>43</sup> The intense orange fluorescence in UV light of a second lake pigment in *The Quays at Rouen* suggests natural madder (*laque de garance*), which may contain bromine in its substrate. UV-fluorescent madder lakes on alumina substrates have been identified on the later Tate and National Gallery works, perhaps showing Camille's developing preference for the more stable madder extracts. Lucien consistently uses a lake based on an alumina substrate, which has a marbled orange-pink fluorescence in UV light, characteristics similar to madder lakes used by Renoir.<sup>44</sup> Bright orange UV fluorescence on the unvarnished paintings' surfaces shows Lucien's extensive and preferred use of this lake pigment, used pure or mixed with French ultramarine to make purple.

Camille and Lucien seem to have preferred the cheaper French ultramarine pigment, although cobalt blue is found in Camille's earlier works. In *The Quays at Rouen*, starch grains associated with French ultramarine were probably included as an extender and drier.<sup>45</sup> Starch has been identified on Impressionist paintings associated with poorly drying red lake, bone black or viridian pigments, probably as a manufacturer's addition to enhance drying properties.<sup>46</sup> Starch paste was mixed with oil paints during the nineteenth century, and starch derived from potatoes 'prepared by the laundress' could be bluish due to staining with smalt prior to drying,<sup>47</sup> consistent with the blue coloration of the grains seen here. The water sensitivity of the French ultramarine oil paint for the central foliage in *Rade des Bormes* is most evident where it is used unmixed; elsewhere in the painting and in other works examined the pigment is combined with white and other pigments, rendering it less sensitive to aqueous solvents.<sup>48</sup> Sensitivity to protic solvents is indicated in passages of paint containing cadmium yellow. SEM images of the surface of paint containing cadmium yellow from *Le Brusq* showed the characteristic rod-shaped particles of hygroscopic magnesium sulphate hydrate



**Figure 16** (a) Detail of the surface and (b) corresponding X-radiograph from Camille's *View from my Window, Eragny sur-Epte* showing the close correspondence between the drawing and the painting.

associated with water sensitivity in modern artists' paints containing the pigment.<sup>49</sup>

Emerald green and viridian were used by Camille up until the 1880s, after which he seems to have preferred emerald green alone. This preference is reflected in Lucien's palette, which solely features emerald green. Camille uses both pigments combined during the 1870s, and it is not clear whether these are deliberate mixings or a manufactured *vert émeraude* tube paint adulterated with the cheaper emerald green pigment.<sup>50</sup> Both viridian and emerald green pigments have proved very stable in the works examined.

Probably the most important pigments used by Camille and Lucien were white pigments, the high ratio of the pigment to other colours in mixtures being significant for the physical and optical properties of the paint. Camille's preference for using a mixture of lead and zinc white and for colours mixed with zinc white is evidenced in his correspondence,<sup>51</sup> and technical analysis confirms his consistent use of a zinc and lead white manufactured paint. The more neutral tone of zinc white enabled its use as a commercial extender for paints, and a generous addition of this white material was found with light emerald green in *The Avenue at Sydenham*.<sup>52</sup> The incorporation of the mixed white with all the pigments in the Courtauld works makes it difficult to ascertain whether zinc oxide pigment is used or whether zinc is present as the sulphide present as lithopone added by the manufacturer as an extender. Lucien seems to have preferred *blanc d'argent*,<sup>53</sup> and technical analysis confirms that lead white is predominant in his Courtauld works, however trace amounts of zinc occur indicating adulteration by the manufacturer.<sup>54</sup>

Examination of Camille's *Artists Palette with a Landscape*, suggests that he mixed his colours on the palette. Exceptionally, cobalt violet may be present on *View from my Window*, but generally he and his father preferred the more intense purple obtained by mixing French ultramarine, red lake and vermilion with lead white. Lucien employed a palette similar to Camille's post-1880 palette, and the fact that most of the paintings by Lucien examined in this study date post-1900 and are English accounts for

observed differences in the technology of the paint (e.g. the fineness of grinding and choice of extender).

It is probable that the Pissarros blotted their paints due to their lean appearance. Lucien's paintings demonstrate the gradual lightening of his palette and chalkier paint quality through an increased use of lead white in mixtures and leaching of the oil medium, resulting in brittle fracture across the surface impasto and poor cohesion of the paint. This contrasts with Camille's slightly more medium-rich paints, suggested by dripped impasto peaks. Callen mentions that manufacturers often produced 'short' (less fatty) paints, by mixing pigments with water into a paste and later adding the oil.<sup>55</sup> This particular preparation may account for surface bubbles in Lucien's impasto due to water evaporation (Figure 15). This phenomenon does not appear on Camille's works, yet demonstrates Lucien's adoption of a leaner, stiffer and chalkier paint, showing the influence of Seurat<sup>56</sup> and manipulation of his materials for achieving a specific blond effect, different from that of his father.

Camille was a harsh critic of his son's paintings, and repeatedly encouraged him to work at colour values and relationships. Camille's letters from 1894 criticise Lucien's use of high keyed tones, his 'disturbing' impasto, his inhibition and lack of mixing, in addition to a 'similarity in the ensemble' of Lucien's works to his own. However, it was through these devices that Lucien evolved his independence from his father's style.

### The Pissarros' painting techniques

In the late 1890s, Camille advised a young artist, Louis le Bail, that when starting a painting he should 'cover the canvas at the first go',<sup>57</sup> then:

work at the same time upon sky, water, branches, ground, keeping everything on an equal basis and unceasingly rework until you have got it ... paint generously and unhesitatingly, for it is best not to lose the first impression.<sup>58</sup>



**Figure 17** Detail of foliage from *Festival at L'Hermitage* showing the wet-over-wet and wet-into-wet painting techniques and an example of Camille's 'comma' brushmark.

This approach summarises the painting method aimed at by Camille and the Impressionists,<sup>59</sup> and in modified terms, Lucien's. Technical evidence from Camille's and Lucien's Courtauld paintings show an initial broad laying in of tones on the ground, modifying its colour and establishing certain elements of the composition. However Lucien's localised use of a thick paint contrasts with Camille's transparent washes.

X-radiographs of the Courtauld, National Gallery and Ashmolean paintings show reserves in the construction of the compositions, indicating that the design was determined before it was executed in paint. Contrast in the radiographs between the lead white-containing paint used to describe forms with a gap between contours revealing exposed ground shows that the painting adhered closely to the planned composition. This is reinforced by examination using IR and the stereomicroscope, and illustrated by an example of details of the surface and corresponding X-radiograph from *View from my Window* (Figures 16a and b). Occasional compositional adjustments are found, and *Festival at L'Hermitage* has been entirely repainted, possibly as the first composition was returned to the artist unsold. In Lucien's technique, the use of reserve consistently exposes the contour designated by the underpainting, forming a spatially descriptive function through its dark hue; Camille uses both this device and the pale ground in his works to simultaneously suggest and deny spatial recession.<sup>60</sup>

Camille's evolution in technique concerned a successful marriage of tonal values with execution, illustrated in the Courtauld works. He explained in 1903:

When I begin a painting, the first thing I try to fix is the accord. Between the sky, this land and this water there is necessarily a relationship. The great problem to solve is to bring everything, even the smallest details, into the harmony of the whole – that is to say, into the accord.<sup>61</sup>

Camille's *peinture claire* mixing of hues on the palette is combined with wet-in-wet broad handling in *Lordship Lane*. The same-sized brush is used throughout *Festival at L'Hermitage*, developing the buildings, roofs and landscape simultaneously in wet-over-wet and wet-into-wet blending on the canvas, exploiting tonal contrasts in a single barely blended stroke, including a combination of short parallel descriptive strokes and the typical 'comma' brushmark used to build up the surface, suggesting rapid execution before the motif (Figure 17). Lucien recalls that during the 1870s when Camille and Cezanne were working together:

they ordered especially long and very flexible [palette] knives. It is from that period that papa started painting with a knife. It is called the Claire period 1870–72 which constituted a big difference with the Courbets which are darker. Afterwards they left the knives to go back to la touché divisée. It is at this moment that Cezanne started to paint with vertical division and that papa started as well to use a paint-brush to draw miniscule commas.<sup>62</sup>

This technique further developed in *The Quays at Rouen* where wet-into-wet blending of combinations of the same pigments applied in curled rhythmic strokes provides an atmospheric sense of shifting light. In *View from my Window*, Camille's Divisionist method juxtaposes bright complementary hues using a modified 'dot', which retains its descriptive function for forms (tree trunks, foliage, figures). The slow exacting process of developing the paint layers is evident in fully hardened underlayers. A unifying device found throughout the works demonstrates Camille's search for 'accord'; accents of brilliant colour (particularly vermilion and emerald green) occur as final touches across the picture surface, harmonising the image.<sup>63</sup> Camille juxtaposes warm, cool and complementary hues in shadows, which further harmonise the image; a technique practised by Lucien, for which he was admired amongst English critics.<sup>64</sup>

Unlike Camille, Lucien's painting technique shows relatively little development in the period covered by the works examined in this study. Like Camille, he preferred a thick dry paint which, when dragged with a stiff brush across the canvas, broke up and followed the pattern of the canvas weave, creating surface patterning. The paints, premixed on the palette, are generally applied directly onto the ground in one or two layers slightly overlapping the underpainting, which is often re-strengthened in the



**Figure 18** Detail of foreground foliage from Lucien's *Rade de Bormes* showing the application of impasto and dry paint directly onto the ground.

upper paint layers with the same hue in higher pigment concentration. As a result, heavy impasto is juxtaposed with exposed ground, lending three-dimensionality (Figure 18). Lucien advocated the importance of introducing continual variety into brushstrokes to depict light and air,<sup>65</sup> learnt from Camille, and his brushwork shows adaptation of Camille's cross-hatched strokes, particularly for his skies. The Divisionist method in *Le Maison* has lasting influence for his later technique; directional brushwork similar to Camille's describes the forms of buildings, fences and tree trunks as for later works such as *Rade des Bormes*, however Lucien shows a freer painting technique, alternating between horizontal, vertical and diagonal daubs for suggesting brickwork. The pure hues mixed with white in the earlier Divisionist painting are intermixed in later works, perhaps in reaction to Camille's criticism:

one would say you practice tone division while first letting your colour dry, you are afraid to mix. If I were you I would mix freely, I would not leave so many orange-coloured commas. One feels that you are inhibited ... Mix all elements.<sup>66</sup>

Lucien preferred to apply premixed hues wet-over-wet or wet-over-dry, using wet-into-wet blending as accents. His construction of forms maintains a Divisionist technique where tones are built up in small, hatched strokes with the tip of the brush for foliage, buildings and figures in the middle and backgrounds.<sup>67</sup>

## Studio work

For Camille and Lucien, studio work played an important, yet separate role to *plein air* painting, where fleeting sensations recorded in dry media were synthesised. In 1891 Camille summarised:

work in the studio is just as difficult as work outdoors. One should not seek in the studio what cannot be

found there, even as outdoors one should strive only for direct and spontaneous sensations.<sup>68</sup>

Camille's worsening eye condition gradually caused him to work mainly indoors from the 1890s,<sup>69</sup> from when there are many references to him reworking paintings in his correspondence with Lucien.<sup>70</sup> Lucien seems to have routinely used the studio for 'finishing' works, and in his letters he frequently talks of his uncertainty about what he has achieved until he sees his canvas back in the studio in a frame.<sup>71</sup>

Camille's and Lucien's works all display evidence of reworking long after the first sitting, either in part or full, indicated by hardened brushwork beneath the upper layers. *Lordship Lane* features a small figure in the field, visible in IR; perhaps a figure has been painted out in the lower right corner of *The Quays at Rouen; View from my Window* has been reworked in the foreground with complementary orange-red cows added to the background, and Camille even re-signed and dated the work in 1888. *Festival at L'Hermitage* has been entirely reworked: the X-radiograph (Figure 19) and analysis of paint samples confirm the presence of a composition beneath the final image, separated by a thick layer of varnish (Figure 20).<sup>72</sup> The general level of completion of the original work is unclear from study of the IR images, the X-radiograph and surface microscopy, yet six vertical shapes with black silhouettes in the lower left foreground are distinctive in the radiograph and in raking light. *Cote des Boeufs* (National Gallery) painted in the same year shows similar delineation of contours through the use of strong reserves, and the texture of the paint has been thickly built up to render the trunks almost three dimensional, although in the Courtauld painting the paint is less worked. This was a technical innovation developed by Camille and Cezanne working together during the mid-1870s, portraying the physical contrast between the volumes of objects and their contours, and the objects and their backgrounds.<sup>73</sup>

Of particular interest is the different treatment of alterations during painting. Camille applies his overpaint with loose, open brushwork, perhaps as a demonstration of his continuing creative process while Lucien completely obliterates his *pentimento* by carefully repainting the area, as is clearly seen in *Rade des Bormes*. This signifies an important difference between the artists' techniques and outlook – Camille saw the act of painting as an ongoing, accumulative process, often taking a long time to paint 'the last stroke'<sup>74</sup> to bring paintings to completion, and frequently revisiting works after long periods.<sup>75</sup> Lucien does not appear to have been as rigorous – in comparison his works are much less reworked, and one feels he tried to realise them in one or two sittings.

## Varnish

The Pissarros disapproved of the varnishing of their works to the extent that they applied labels and inscriptions on

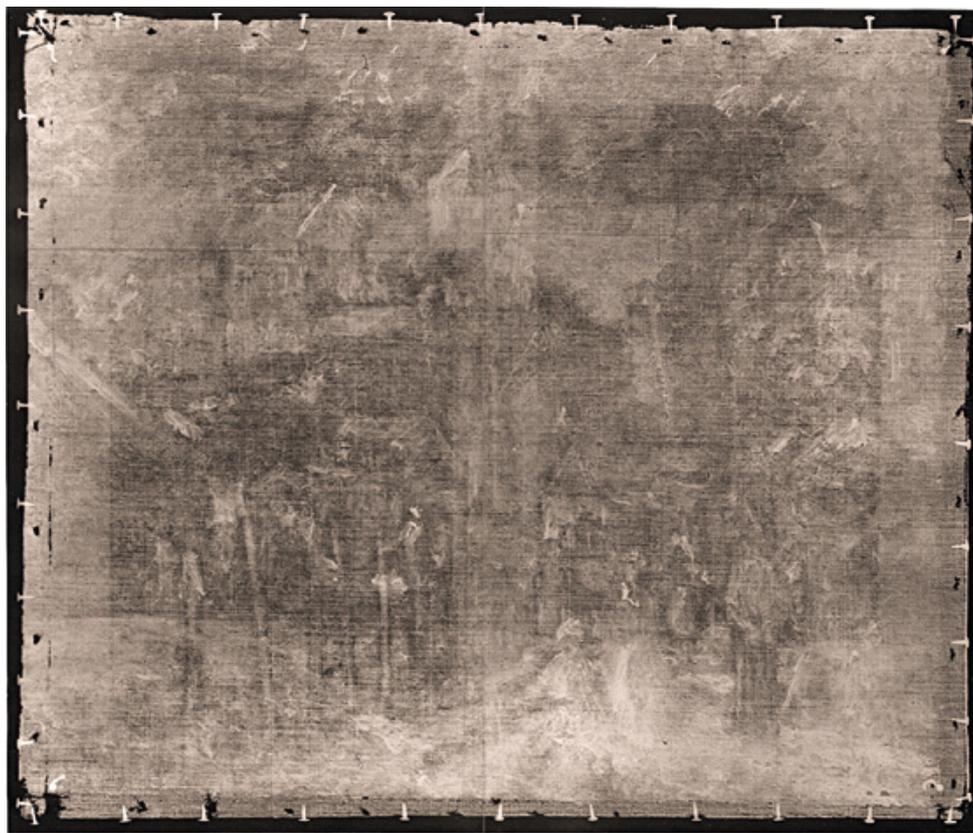


Figure 19 X-radiograph of Camille's *Festival at L'Hermitage* that has been entirely reworked.

their stretchers, requesting dealers not to do so.<sup>76</sup> Ironically, all of the works by Camille examined in this study have a thick, glossy natural resin varnish. The Impressionists felt that a saturating varnish destroyed their aesthetic, which sought to emulate the matt surfaces of nature. However, despite their protests, dealers are said to have varnished works with bituminous materials to make them more palatable to connoisseurs.<sup>77</sup> A letter from Camille to Eugene Murer in 1878 states 'I am going to recommend the dealer not to varnish [it] unless with a colourless varnish',<sup>78</sup> evidencing his permission to allow the varnishing of his work in this case, probably due to extremely poor sales during the period. Samples from *Festival at L'Hermitage* consistently

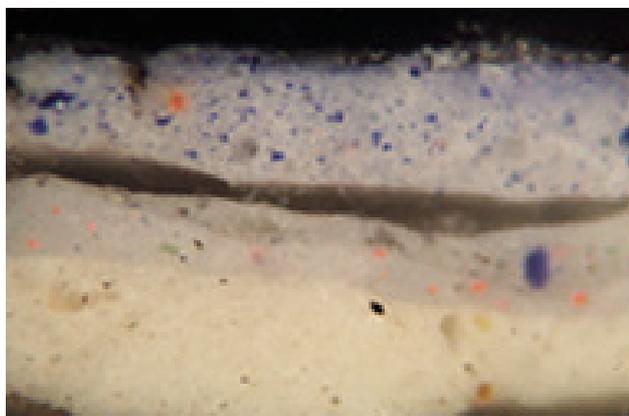


Figure 20 An example of a cross-section from Camille's *Festival at L'Hermitage* taken from the sky shows a layer of varnish separating the upper and original compositions.

show a colourless thick layer of varnish separating the upper and original compositions, probably applied by the dealer, and its lack of discoloration indicates that the painting was reworked soon after being returned to Camille unsold. Although it was not possible in the present study to analyse the composition of this varnish, it would be interesting to know what was used for varnishing for comparison with similar layers in other paintings. No published technical examination of works by Camille or other Impressionists document the dealer's practice of applying a clear varnish with the artist's consent, and this may be the first instance.

Varnishing the light-scattering matt paint surface of paintings by the Pissarros saturates the paint and thus changes the finish aimed for by the artists. The gradual discoloration of the natural resin varnish on ageing imposes further tonal changes on the works. Lucien's paintings that remain unvarnished are coated instead with a layer of microcrystalline wax that has avoided yellowing but has attracted dirt that affects the reading of the image.

## Conclusion

Technical analysis of the Pissarros' paintings has highlighted the use of similar materials by father and son, obtained from reliable dealers, but as such their choices of materials cannot account for the distinct differences in appearance between their paintings. The execution of Lucien's work differs significantly from his father's

painterly style. Camille's brushwork evolved throughout his career, illustrating his notion that execution is an expression of one's temperament,<sup>79</sup> and his restless, rigorous work ethic and desire to attain an execution appropriate to subject, colour values and an overall unity is what characterises his oeuvre, regardless of which techniques he used.<sup>80</sup> In contrast, Lucien's own painting methods evolved little and were governed by his Neo-Impressionist youth. He fuses the essential components of Impressionist technique (*plein air* painting, bright spectral palette) with a Divisionist touch, and constructs a 'method' found applied throughout the paintings examined, where *sensation* is carefully articulated. Thus, Camille's temperament, 'melancholic, harsh and savage'<sup>81</sup> produced works that were fluent and direct, unlike Lucien's, whose sensitive and retiring nature created more conscientious and constructive paintings.<sup>82</sup>

The relationship between teacher and pupil, illustrated here through technical study of selected paintings, is illuminated by the complexities of the father-son relationship demonstrated in the letters, where instruction and the need to make one's own mark is evident, and where the talent and achievements juxtapose the work of the innovative master with the more limited but accomplished art of his son.

## Acknowledgements

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## Notes

1. Discussion of Camille's paintings can be found in D. Bomford, J. Kirby, J. Leighton and A. Roy, *Art in the Making: Impressionism*. London, National Gallery, 1990, and by A. Callen, *The Art of Impressionism*. New Haven and London, Yale University Press, 2000.
2. These paintings were exhibited in the eighth and last Impressionist Exhibition, in a separate room designated for the Neo-Impressionists, which also included works by Signac and Seurat.
3. Conservation records for Camille's and Lucien's paintings in the Tate Gallery collection were made available. Published information on Camille's painting technique by the National Gallery, London, serves as useful comparison for the technical findings for the Courtauld works, in order to characterise more accurately the artists' choices of materials and methods of application aimed at achieving a particular aesthetic.
4. Sampling of works from the Ashmolean Museum was not permitted.
5. Using a Leitz Aristomet microscope. Images of samples were captured using a digital camera attached to the microscope, linked and processed with Adobe Photoshop® software.
6. SEM-EDX was carried out using a JEOL S100 SEM with an Oxford Instruments EDX detector and Inca software at King's College London.
7. Analysis undertaken by Klaas Jan van den Berg and Henk van Keulen, Netherlands Cultural Heritage Agency (RCE), Amsterdam. DTMS analyses were performed using a JEOL SX102 sector mass spectrometer. The sample was homogenised in a mini glass mortar and made into a suspension with methanol. Subsequently, the sample was applied on the Pt/Rh filament of a direct insertion probe. The current through the filament was ramped at a rate of 0.5 A/min for two min. to reach an end temperature of about 800 °C. Desorbed molecules were ionised (16eV) in an ionisation chamber kept at 200 °C and accelerated to 8 keV. The mass spectrometer was scanned from m/z 40 to m/z 800, with a cycle time of 1 s. A JEOL MP-7000 data system was used for data acquisition and processing.
8. The Pissarros' emphasis on achieving 'unity' in their art is expressed in Camille's letter to Lucien about a conversation with Renoir in 1888: 'I told [Renoir] that for us the search for unity was the end towards which every intelligent artist must bend his efforts, and that even with great faults it was more intelligent and more artistic to do this than to remain enclosed in romanticism.' 'Camille, Letter to Lucien, October 1 1888'. In J. Rewald (ed.), *Camille Pissarro: Letters to his Son Lucien*, 4th edn. London and Henley, Routledge & Kegan Paul, 1980: 132.
9. 'Camille, Letter to Lucien, Eragny, September 18 1893'. In Rewald 1980: 216.
10. Camille uses this term to describe to Lucien what he was taught by Camille Corot in the 1850s about developing a personal style or 'vision' through hard work: 'I have only a little flute, but I try to strike the right note'. 'Camille, Letter to Lucien, Paris February 23 1894'. In Rewald 1980: 235.
11. A. Thorold, *A Catalogue of the Oil Paintings of Lucien Pissarro*. London, Athelney, 1983: 14, 17, letters 22 February 1910 and 1914.
12. J. Bensusan-Butt, 'Recollections of Lucien Pissarro in his seventies'. In *Lucien Pissarro 1863-1944*, exh. cat., London, Anthony d'Offay Gallery, 1977: 11.
13. 'Camille, Letter to Lucien, Paris, June 7 1893'. In Rewald 1980: 209.
14. John House explains this as the reason for Camille's changing technique throughout his career. J. House, 'Camille Pissarro's idea of unity'. In C. Lloyd (ed.), *Studies on Camille Pissarro*. London and New York, Routledge & Kegan Paul, 1986: 15-147.
15. 'Camille, Letter to Lucien, Eragny, February 23 1887'. In Rewald 1980: 99. Michel Eugene Chevreul explained his law of simultaneous contrast, that each colour was modified by the effect of the complementary colour of the other: that a red next to a green appears redder because it is enhanced by the complementary green, that is, red; equally, the green appears greener. He composed a colour wheel and his laws of simultaneous contrast became well known in artists' handbooks in the 1860s and 70s. See Bomford et al. 1990: 81-2.
16. Bensusan-Butt 1977: 11.
17. See for example M.E. Chevreul, *The Principles of Harmony and Contrast of Colours, and Their Applications to the Arts*, 2nd edn. London, Longman, Brown, Green, and Longmans, 1855. See also O. Rood, *Modern Chromatics Students' Text-book of Color; Or, Modern Chromatics, with Applications to Art and Industry*. New York, D. Appleton and Company, 1882.
18. Excerpts of which are summarised in J. Rewald, *Post Impressionism: From Van Gogh to Gauguin*, 3rd edn. London, Abrams, 1979: 76. Lucien's notes are held in the Pissarro Family Archive at the Ashmolean Museum, Oxford.
19. Signac, in Rewald 1980: 135.
20. This is with the exception of Camille's *Lordship Lane* 1871 and perhaps Lucien's *La Maison de la Sourde* 1886, which are artist-prepared supports.

21. Georges Latouche was a small-scale paint seller and art dealer who is known to have sold canvas supports. E. Hendriks and M. Geldof, 'Van Gogh's Antwerp and Paris picture supports (1885 – 1888): reconstructing choices', *ArtMatters: Netherlands Technical Studies in Art*, 2, 2004: 47. His stamp also appears on the reverse of Alfred Sisley's *Snow at Louveciennes* c. 1874–5 in the Courtauld Gallery.
22. Contet's stamp features on *Self Portrait* 1903 and Lucien's *April, Epping* 1894 (both Tate Gallery Collection). Contet took over from Latouche's widow in 1886, and first appeared in the Parisian commercial directory, the Bottin, in 1851, located at 6 rue de Feydeau. See Callen 2000: 103.
23. The supplier labels on Lucien's sketchbooks in the Pissarro Family Archive point towards possible artist material suppliers, who are principally Contet in France, and Percy Young and Charles Roberson & Co. in England.
24. This indicates the priming was applied after stretching the canvas, unlike commercially prepared canvases, which are prepared on a large stretcher and then cut and attached to different-sized stretchers after drying. As a result the priming extends over the tacking margins and there are no exaggerated cusping marks. See Bomford et al. 1990: 49.
25. This request by Camille may be unique, however Impressionist artists often prepared their own supports; Monet's *Lavacourt Under Snow* 1881 (National Gallery, London) is an artist stretched and prepared canvas on a standard-sized stretcher. See Bomford et al. 1990: 184. Renoir is known to have used a combination of self-prepared and commercially prepared supports. See A. Burnstock, K.J. van den Berg and J. House, 'Painting techniques of Pierre-Auguste Renoir: 1868–1919', *ArtMatters: Netherlands Technical Studies in Art*, 3, 2005: 47–65, 50.
26. Chrome orange, emerald green, viridian, French ultramarine, vermilion, red lake (UV fluorescent, starch and Ca containing substrate) and yellow ochre have been identified, in addition to lead white (trace zinc), barium sulphate and chalk in the ground.
27. E. Nieder, E. Hendriks and A. Burnstock, 'Colour change in sample reconstructions of Vincent van Gogh's grounds due to wax-resin lining', *Studies in Conservation*, 56 (2), 2011: 94–103.
28. For discussion of the effects of varnish and its removal in relation to Impressionist paintings see for example A. Burnstock, 'Impressionist paintings in the Courtauld Gallery: making inferences from recent technical studies', *Zeitschrift für Kunsttechnologie und Konservierung*, 22 (2), 2008: 292–9, and a discussion of the matt aesthetic in paint is given in the same volume by A. Hoenigswald, 'New painting/new surfaces: nineteenth-century matte paints', *Zeitschrift für Kunsttechnologie und Konservierung*, 22 (2), 2008: 232–9.
29. This also had practical implications for *plein air* painting, potentially enabling the realisation of an artist's sensation in a single sitting. V. Jirat-Wasiutynski and H. Travers Newton, 'Absorbent grounds and the matt aesthetic'. In A. Roy and P. Smith (eds), *Painting Techniques, History, Materials, and Studio Practice*, contributions to the IIC Dublin Congress, 7–11 September. London, IIC, 1998: 235. In relation to nineteenth-century grounds see also E. Hendriks, 'Fluent impasto in van Gogh's Paris paintings (1886–1888): a strategic effect?', *Zeitschrift für Kunsttechnologie und Konservierung*, 22 (2), 2008: 221–31.
30. Linseed oil has been identified as the predominant media found on Impressionist paintings by Manet, Monet, Sisley, Morisot, Renoir and Cezanne at the National Gallery, London. See Bomford et al. 1990: 74–5.
31. These constituents appear to be typical for grounds during the period. Technical analysis of Impressionist works at the National Gallery, London identified lead white as the main constituent for grounds, often mixed with either chalk or barium sulphate. The presence of both extenders in samples in the current research is probably due to the use of a cheaper grade of lead white (ceruse or blanc de plomb) for primings, which incorporated another white pigment, frequently chalk, other white earths or barium sulphate. Bomford et al. 1990: 48.
32. E. Hendriks and L. Carlyle noted from reconstruction tests for Van Gogh's grounds that barytes, when mixed with an animal glue binding medium provided a white film, whereas mixing exactly the same pigment with an animal glue and oil emulsion created a greenish-beige film, and with oil a dark brownish-beige one. See E. Hendriks, *New Views on Van Gogh's Development in Antwerp and Paris: An Integrated Art Historical and Technical Study of his Paintings in the Van Gogh Museum*, PhD thesis, submitted to the University of Amsterdam, 15 November 2006, 125 n. 82. DTMS identified ground samples from *Le Brusq* containing an animal glue binder, and the whiter visual appearance of the ground on the painting compared with *Rade des Bormes* (linseed oil binder) supports Carlyle and Hendriks's findings. However, interpretation is complicated by an impregnating beeswax-resin lining on *Le Brusq*, which further darkens the tone, as well as the accumulation of surface dirt on the microcrystalline wax coating across the surfaces of both paintings.
33. See for example, Tate Papers – Historically Accurate Reconstructions of Artists' Oil Paint. <http://www.tate.org.uk/research/tateresearch/tatepapers/07spring/carlyle.htm>.
34. This process of organising the compositional structure through working drawings, which is then translated into the painting itself, is also characteristic of Cezanne from the 1870s. The close relationship between Camille and Cezanne during this period illustrates this mutual influence. See R. Brettell and C. Lloyd, *A Catalogue of the Drawings by Camille Pissarro in the Ashmolean Museum, Oxford*. Oxford, Ashmolean Museum, 1980: 16.
35. It is present on a painting dating from 1872, *Snow at Montfoucault*, as fairly transparent dark blue lines. Several works, though not examined in the present study, on visual inspection suggest the extent of his use of a dark blue sketched underpainting across his oeuvre; the perhaps unfinished *The Village of Eragny* 1885 and *Bath Road, Bedford Park* 1897 (both Ashmolean Museum, Oxford) have elaborate sketching in of the composition with the same narrow brush using blue pigment in a fluid medium. No samples were taken from the Ashmolean paintings which precluded identification of the pigment or media used for these works. The use of a blue painted underdrawing by Cezanne is discussed by E. Reissner, 'Transparency of means: "drawing" and colour in Cézanne's watercolours and oil paintings in the Courtauld Gallery'. In *The Courtauld Cézannes*. London, Paul Holberton Publishing, 2008: 49–71, and by A. Burnstock, C. Campbell, C. Hale and G. Macaro, 'Cézanne's development of the Card Players'. In *Cézanne's Card Players*, exh. cat., Courtauld Gallery / Metropolitan Museum of Art, New York. London, Paul Holberton Publishing, 2011: 31–49.
36. Charcoal or conté crayon underdrawing has also been identified in Seurat's *The Bathers*, and it appears that in the 1880s he employed long, continuous thin strokes of cobalt blue paint for outlining the design on his working sketches. These are perhaps present in his highly finished works, but are masked by thick paint, impenetrable to IR. See J. Kirby, K. Stonor, A. Roy, A. Burnstock, R. Grout and R. White, 'Seurat's painting practice: theory, development and technology', *National*

- Gallery Technical Bulletin*, 24, 2003: 4–37. [http://www.nationalgallery.org.uk/technical-bulletin/kirby\\_stonor\\_roy\\_burnstock\\_grout\\_white2003](http://www.nationalgallery.org.uk/technical-bulletin/kirby_stonor_roy_burnstock_grout_white2003). Lucien and Camille's involvement with Seurat during this period indicates the standard development amongst the Impressionists of a thin blue line for sketching and underpainting.
37. Callen 2000: 103. This preference differs from other Impressionists such as Renoir, who favoured the traditional lead white pigment over zinc white, used at the time by Vincent van Gogh. See also Burnstock et al. 2005: 47–65, 51.
  38. This method has its origins in the work of Corot, who encouraged Camille towards the study of 'values', which for him were tonal gradations based on the Barbizon school paintings. The rendering of *plein air* motifs in bright colours as opposed to Corot's tonal modelling is what separated Camille and the Impressionists from previous painting schools. Artists such as Camille and Monet in particular maintained the notion of values and sought tonal unity or *peinture claire* through the intermixing of a limited range of brilliant hues.
  39. Georges Lecomte, 'Camille Pissarro', *Les Hommes d'Aujourd'hui*, no. 366, March 1890.
  40. Ivory black is also found in works by Monet up to the mid–late 1870s in Morisot's *Summer's Day* 1879, and generally throughout Renoir's oeuvre. See Bomford et al. 1990: 200–201.
  41. Camille's earths may have been natural or synthetic iron oxide pigments called 'Mars' colours available from Lefranc, Bourgeois and English colour merchants from the late nineteenth century. EDX identified peaks for silica, potassium, manganese in addition to iron in samples. However, it was not possible to distinguish between the natural and synthetic pigments.
  42. Cadmiuims offered by Lefranc after 1850 were consistently the most expensive yellow, and by 1896 they were still about four times as expensive as the chromes or Naples yellow. See also Callen 2000: 147.
  43. Nineteenth-century artists' treatises, manuals and handbooks state that Carmine was frequently adulterated with starch. See J. Kirby, M. Spring and C. Higgitt, 'The technology of eighteenth- and nineteenth-century red lake pigments', *National Gallery Technical Bulletin*, 28, 2008: 69–87. [http://www.nationalgallery.org.uk/technical-bulletin/kirby\\_spring\\_higgitt2007](http://www.nationalgallery.org.uk/technical-bulletin/kirby_spring_higgitt2007); see also Burnstock et al. 2005: 65 and L. Carlyle, 'Authenticity and adulteration: what materials were 19th century artists really using?', *The Conservator*, 17, 1993: 57.
  44. Burnstock et al. 2005: 51.
  45. The highly UV fluorescent rounded grains were confirmed by staining tests using a 10% solution of potassium iodine (KI).
  46. Particularly in paintings by Renoir, see Burnstock et al. 2005: 55.
  47. L. Carlyle, *A Critical Analysis of Artists' Handbooks, Manuals & Treatises on Oil Painting in Britain Between 1800–1900*, PhD thesis, 2 vols, Courtauld Institute of Art, vol. 1, 1991: 156.
  48. A. Burnstock, K.J. van den Berg, S. de Wijnberg Groot and L. Wijnberg, 'An investigation of water-sensitive oil paints in 20th century paintings'. In T.J.S. Learner, P. Smithen, J.W. Krueger and M.R. Schilling (eds), *Modern Paints Uncovered*. Los Angeles, Getty Conservation Institute, 2006: 177–88.
  49. For a discussion of the causes of water sensitivity see G. Silvester, A. Burnstock, L. Megens, T. Learner, G. Chiari and K.J. van den Berg, 'A cause of water-sensitivity in modern oil paint films: the formation of magnesium sulphate', *Studies in Conservation*, 2013 forthcoming.
  50. Other instances of the mixed pigments are found on Cézanne's *Hillside in Provence*, c. 1886, National Gallery, London, see Bomford et al. 1990; and in Van Gogh's paintings from the mid-1880s, see Hendriks 2006: 157.
  51. Camille specifically ordered colours 'on a base of zinc' from the Parisian colourman P. Contet in the 1880s. Callen 2000: 103.
  52. Bomford et al. 1990: 66.
  53. A finer grade of lead white pigment, noted in his pigment listings in his sketchbooks.
  54. Lucien experimented with a 'thinner' white in 1913 (possibly zinc with various extenders), which he remarked 'requires a lot of working.' Lucien, at Blackpool in Devon, 8 April 1913. Thorold 1983: xiii.
  55. Callen 2000: 101.
  56. Surface bubbles across the impasto have been identified in many of Seurat's works, whose paints are similarly chalky and stiff in consistency, presumably to retain the pure structure of the 'dot' brushmark. See Kirby et al. 2003: 4–37.
  57. Bomford et al. 1990: 97.
  58. '1896–7, Notes of Louis Le Bail recording Pissarro's instruction'. In J. Rewald, *The History of Impressionism*. London, Secker & Warburg, 1980: 458.
  59. Monet is reported to have stated: 'the first painting should cover as much of the canvas as possible, no matter how roughly, so as to determine at the outset the tonality of the whole'. See Bomford et al. 1990: 97.
  60. *Lordship Lane* and *The Quays at Rouen* exemplify the use of the coloured ground to exaggerate surface reflectiveness. While Lucien used this technique consistently, Camille used the ground in different ways to achieve his desired atmospheric effect.
  61. R. de la Villeherve, 'Choses du Havre: les dernières semaines du peintre Camille Pissarro', *Havre-Éclair*, 25, 1904: 2.
  62. Lucien Pissarro, notes from Sketchbook no. 52, 1912, 96–99, *Pissarro Family Archive* (Ashmolean Museum, Oxford).
  63. This device is also used by Cézanne, who often applied bright vermilion accents across his predominantly French ultramarine and emerald green landscapes, lifting and uniting the scene. See Reissner 2008.
  64. Frank Rutter, critic to *The Sunday Times*, praised Lucien's 'delicate analysis of the colour in shadow' and claimed: 'Lucien Pissarro is a true heir of the French Impressionists in his tireless pursuit of the colour in shadow'. See F. Rutter, *Some Contemporary English Artists*. London, L. Parsons, 1922: 27.
  65. Letter to John Bensusan-Butt, August 17th 1937. Bensusan-Butt 1977: 14.
  66. 'Camille, Letter to Lucien Paris, March 4 1894'. In Rewald 1980: 236.
  67. Lucien's Divisionist technique is revealed in a letter to his nephew: 'It consists in putting side by side, without any attempt at brushwork, observation of the variety of tone you may observe in the subject you are painting. (Helps to understand the basis of the division of colour)', Bensusan-Butt 1977: 17.
  68. 'Camille, Letter to Lucien May 13 1891'. In Rewald 1980: 169.
  69. From 1887 and for the rest of his life, Camille suffered from an inflamed tear gland, which periodically flared up and necessitated the wearing of a bandage. When his eye was inflamed, he had to give up working outdoors, and eventually had to do most of his painting from behind a protective window or in the studio. See R.E. Shikes, *Pissarro: His Life and Work*. New York, Horizon, 1980: 249–50.
  70. Many paintings from his Neo-Impressionist period were reworked due to Camille's frustration with the technique. For example, 'Camille, Letter to Lucien Paris November 22 1894'. In Rewald 1980: 251–1; 'Camille, Letter to Lucien Eragny

- November 30 1894'. In Rewald 1980: 252; 'Camille, Letter to Lucien Eragny January 14 1895. In Rewald 1980: 256.
71. Bensusan-Butt, 'Introduction' in Thorold 1983: xiii.
72. It is likely that Camille would have reused the unsold canvas, however the extent of the original composition is unknown due to the original canvas having been cut on its top and right sides.
73. J. Pissarro, *Pioneering Modern Painting: Cézanne and Pissarro 1865–1885*. New York, The Museum of Modern Art, New York, 2005: 52–4.
74. Camille wrote to Lucien on November 13 1891 that 'the last stroke is the most difficult and takes the longest! I have also gone back to my Two Women in a Farmyard'. See Rewald 1980: 185.
75. An example being *The Cote des Boeufs*. Sickert reported that Camille had referred to the picture as 'the work of a Benedictine Monk'; see Bomford et al. 1990: 161.
76. On the back of his now heavily varnished painting *Landscape at Chaponval* 1880 (Musée d'Orsay, Paris) Camille wrote 'please do not varnish this picture, C. Pissarro', see A. Callen, 'The unvarnished truth: mattness, "Primitivism" and modernity in French painting, c.1870–1907', *The Burlington Magazine* 136 (1100), 1994: 739.
77. As revealed in a letter from the dealer Durand-Ruel to Monet: 'collectors find your canvases too plastery; to sell them, I am obliged to varnish them with bitumen'. See Callen 1994: 739.
78. See Bomford et al. 1990: 101.
79. Quoted above in a letter from Camille to Lucien in 1893: 'your problem is to discover an execution appropriate to your spirit'. 'Camille, Letter to Lucien, Paris, June 7 1893'. In Rewald 1980: 209.
80. Camille relates his quest for 'unity' in a letter to his future daughter-in-law, Esther on 5 May 1890: 'When I was 40 I began to understand my sensations, in 1880 at 50, I formulated the idea of unity, without being able to realise it, and now at 60 I am approaching that realisation.' *Archives de Camille Pissarro, Hotel Drouot, Paris*, no. 146, quoted in Lloyd 1986: 16.
81. Camille describes his own personality with these terms in a letter to Lucien, Rouen, November 20 1883, Rewald 1980: 66.
82. J. Rothenstein, *Modern English Painters*, vol. 1. London and Sydney, MacDonald & Co, 1984: 84.

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