This handbook is about postproduction, that in our case I would like to redefine as that set of practices to modify the rendered image of a model, so no longer the thing itself, but its representation, we may say.

In this phase of the process we therefore act on the grid of pixels previously defined as render output, inserting in that matrix elements coming from other sources (photomontage) and altering the very nature of the pixels (photo editing). The software is Photoshop, useless to go around it. In the following pages you will find some tips and notes about the editing process on my work on the Vermeer's Music Lesson. Obviously it is not and does not want to be an exhaustive tutorial of the possibilities that you have using such a powerful software, but I hope with this guide to introduce and intrigue you to the topic, as well as showing you that even with a few steps you can get significant results.
The image on the left is one of the many basic render outputs of the Vermeer Music Lesson, while on the right its transformation after some post-production work.
Beyond their structure - briefly explained in the Materials handbook - now we will see the practical use of render elements in the post-production phase.

As mentioned, when imported in Photoshop, every channel/render element becomes a layer, therefore giving the user the possibility to edit the output of the rendering.¹

Mainly these special levels are used to perform two functions:

1) create quick selection groups according to the lowest common denominator (same material, same position in space, ...) to perform individual actions (for example, I want to select all faces oriented to the east and increase their brightness? I will make a quick selection with the magic wand by selecting the planes with the same color in the normal channel)²

2) emphasize or decrease the effects resulting from a single rendering parameter; for example I am not satisfied with the brightness of a particular light source, if the shadows are a bit flat, or if the reflections are excessive and I want to dampen them, I will import the relative render element and play with the blending options (as shown in the next pages).

Here follows a list of the render elements I use most frequently, accompanied by an informal description of why.

1. **alpha/background** i.e. to quickly select the outside of a room, the surroundings of a building or "any part of the screen not modeled";

2. **diffuse** just flat colors and textures, excluding all the other material properties; very useful both for quick selections and to bring out a material in a flatter, abstract version if desired;

3. **render ID** extremely useful for quick selections: it assigns a different colored area to every object (surfaces or solids) in the scene;

4. **material ID**: every material created with Vray creates a different area/color: useful for quick selections in which the user wants to select non coplanar object with the same properties;

5. **raw light**: The raw diffuse direct illumination before it’s multiplied by the diffuse surface color, useful to highlight or decrease the light contrasts.

6. **reflections**: only the reflective parts of the reflective materials, useful to increase/decrease the reflections and obtains more or less realistic effects.

7. **normals**: to coplanar surfaces, even discontinuous ones, corresponds the same color (useful to select areas on which you want to insist to increase or decrease the depth effect, for example).

¹ Note that Render elements require additional storage when rendering and thus increase the amount of RAM taken during the rendering.

² Note that if you export them all together they will be read as channels once imported into Photoshop, for the distinction between layers and channels please refer to Adobe Photoshop guide.
Blending options, in detail

As reported in the Adobe Photoshop User Guide, the blending mode (a feature specified in the options bar) “controls the way pixels in the image are affected by a painting or editing tool”. As in most cases with PS, the best way to understand this set of commands is to imagine them transported to the real world, thus thinking in terms of layers of color on a canvas:

- **Normal** Edits or paints each pixel to make it the result color. This is the default mode. (Normal mode is called Threshold when you’re working with a bitmapped or indexed-color image.)
- **Dissolve** Edits or paints each pixel to make it the result color. However, the result color is a random replacement of the pixels with the base color or the blend color, depending on the opacity at any pixel location.
- **Darken** Looks at the color information in each channel and selects the base or blend color—whichever is darker—as the result color. Pixels lighter than the blend color are replaced, and pixels darker than the blend color do not change.
- **Multiply** Looks at the color information in each channel and multiplies the base color by the blend color. The result color is always a darker color. Multiplying any color with black produces black, while with white leaves the color unchanged. When you’re painting with a color other than black or white, successive strokes with a painting tool produce progressively darker colors. The effect is similar to drawing on the image with multiple marking pens.
- **Color Burn**
   - Normal** Edits or paints each pixel to make it the result color. This is the default mode. (Normal mode is called Threshold when you’re working with a bitmapped or indexed-color image.)
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   - Darken Looks at the color information in each channel and selects the base or blend color—whichever is darker—as the result color. Pixels lighter than the blend color are replaced, and pixels darker than the blend color do not change.
   - Multiply** Looks at the color information in each channel and multiplies the base color by the blend color. The result color is always a darker color. Multiplying any color with black produces black, while with white leaves the color unchanged. When you’re painting with a color other than black or white, successive strokes with a painting tool produce progressively darker colors. The effect is similar to drawing on the image with multiple marking pens.
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- **The base color** is the original color in the image;
- **The blend color** is the color being applied with the painting or editing tool on top of the base color;
- **The result color** is the color resulting from the blend.

Here follows a complete list of fusion methods, as described by the program developers, the modes signed with ** are those I use the most.

- **RGB (Normal)**
- **Reflections (Color Dodge 100%)**
- **MatteShadow (Darken 30%)**
- **RawGI (Overlay 100%)**
**Hard Lig**ht
Multiplies or screens the colors, depending on the blend color. The effect is similar to shining a harsh spotlight on the image. If the blend color (light source) is lighter than 50% gray, the image is lightened, as if it were screened. This is useful for adding highlights to an image. If the blend color is darker than 50% gray, the image is darkened, as if it were multiplied. This is useful for adding shadows to an image. Painting with pure black or white results in pure black or white.

**Vivid Light**
Burns or dodges the colors by increasing or decreasing the contrast, depending on the blend color. If the blend color (light source) is lighter than 50% gray, the image is lightened by decreasing the contrast. If the blend color is darker than 50% gray, the image is darkened by increasing the contrast.

**Linear Light**
Burns or dodges the colors by decreasing or increasing the brightness, depending on the blend color. If the blend color (light source) is lighter than 50% gray, the image is lightened by increasing the brightness. If the blend color is darker than 50% gray, the image is darkened by decreasing the brightness.

**Pin Light**
Replaces the colors, depending on the blend color. If the blend color (light source) is lighter than 50% gray, pixels darker than the blend color are replaced, and pixels lighter than the blend color do not change. If the blend color is darker than 50% gray, pixels lighter than the blend color are replaced, and pixels darker than the blend color do not change. This is useful for adding special effects to an image.

**Divide**
Looks at the color information in each channel and divides the blend color from the base color.

**Hue**
Creates a result color with the luminance and saturation of the base color and the hue of the blend color.

**Saturation**
Creates a result color with the luminance and hue of the base color and the saturation of the blend color. Painting with this mode in an area with no (0) saturation (gray) causes no change.

**Color**
Creates a result color with the luminance of the base color and the hue and saturation of the blend color. This preserves the gray levels in the image and is useful for coloring monochrome images and for tinting color images.

**Luminosity**
Creates a result color with the hue and saturation of the base color and the luminance of the blend color. This mode creates the inverse effect of Color mode.

The image on the left blends the RawLight Render Element above the RGB channel (basic render) using different blending modes just explained in detail.
Photo editing: corrections, fixing mistakes

Analyzing one by one the few adjustments made on the image turned out to be an extremely useful operation for educational purposes, because it allows me to deal with different editing issues you may encounter during your post-production journey.

1. **mirror**: a whitish halo above the mirror reflection. The mirror was "too mirroring", so to make the blurred effect typical of the antique mirrors, as in the painting, I created a layer on which I applied a white brushstroke and put it in 70% opacity to achieve the desired result (blend mode: normal).

2. **frame**: wrong material IOR (check material handbook), I removed the white side reflections simply by copying with the clone stamp other parts of the frame.

3. **chair lion heads**: I refused to model them because they were too small and compositionally irrelevant for the whole painting. I looked for a lion’s head similar to that of the fine Dutch chairs of the period, distorted with free transformation tool, then played with overlapping layers of color to obtain the desired shade.

4. **chair bangs**: a minor forgetfulness: using the smudge tool as a brush to dilute water on a watercolor, then drooling the blue pixels of the chair on the space/pixels below, I obtained uneven bangs that followed the direction of my gestures. To do this kind of work I highly recommend the use of a graphic tablet.

5. **cello “effe” detail**: since I forgot to model this detail (it happens!) I took a picture of a real “effe” and distort it according to the perspective, thus decreasing the opacity of the element to merge it with the rest of the cello (blend mode: multiply).

6. **persian carpet**: as mentioned in the materials manual, due to the particular texture of this carpet and the peculiar folds of the same, I decided to manage the texture in Photoshop. So I created a layer mask tracing the surface of the carpet (red area), cut from Vermeer’s painting the original carpet, then I pasted it inside the created mask and adjusted it following the slightly different folds that my model had.

7. **marble tiles**: a common mistake that emerges during rendering is that of treating a visualization model as a technical drawing. Snaps are such a great thing when working, but perfectly touching surfaces means no light passing through, therefore no shadows, and in the end everything will seem flat and fake if you don’t try to emulate the little discrepancies, as it happens everywhere in reality. This is exactly what happened to the marble slabs of the floor of my model: so to overcome the problem of having a unique surface where they no longer stood out from each other, I decided to take the joints and trace them (with the help of construction perspective lines) with a white brush, and in some cases (as in the piece where the number 07 lies) to create a white or black area on a separate layer, then play with opacity to simulate a more worn surface (white spot), or slightly tilted against the light (black spot).

8. **spot removals**: textures with points that contrast sharply with the rest of the mapping, although seamless, can produce annoying repetitions when applied on large surfaces. In these cases the clone stamp or the Healing Brush Tool can come to the aid by sensing the pixels and removing repeated dots (it’s a widely used tool to remove black dots and other imperfections in the photo-retouching of faces, if you think about it, the aim and so the procedure is exactly the same).
Photomontage, adding a background

By definition, “a Photomontage is the process and the result of making a composite photograph by cutting, gluing, rearranging and overlapping two or more photographs into a new image”.

When talking about photomontages, the most important factor to keep in mind is the coherence of the elements chosen to be inserted in your artwork, whether they are people (although this is not the case), inanimate objects, backgrounds or other stuff. Understanding and defining the expressive language with which you are working is fundamental to orient the choice of alien elements to insert in the picture.

In this case, being lucky enough to work with Vermeer (who in addition to many interior scenes also produced a couple of exterior views) in creating a background for the counter-field I inserted his view of Delft.

Therefore, by introducing an element in harmony with the painter’s style I didn’t risk to produce a cacophony, as probably would have happened by inserting a real photograph (obviously without retouching it very much, therefore wasting a lot of time and in any case not reaching the painter’s masterly verisimilitude).

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in the previous page, The Vermeer’s Music Lesson, camera variation: reverse shot Filippo Fanciotti, 2017

in this page:
1. detail of the reverse shot without the photomerged background.
2. Details of the windows.
This is without a doubt the most difficult part of these five handouts to explain. The reason is that it is the one, pass me the word, more artistic, less procedural and strongly influenced by your personal sensitivity, taste and accumulated experience.

The strange image on the left is an exportation of all the layers of effects applied on the top of the image, after the adjustments shown in the previous pages. This package of actions is aimed to change, we might informally say, its *patina*, although technically we are again altering the simple appearance of its pixels.

The truth is that these are layers of colour, black and white brushstrokes, in some cases imported images placed in opacity above the other layers, all combined with blending modes designed ad hoc to achieve a very personal expressive purpose, a kind of pictorial effect, which I share with you here as an example, but with the invitation to distance yourself from it and experiment until you find your own; search for brushes in the web, use them as if you are painting, play with layers and blending options, ...

Below you will finally find four different types of operations, with an excerpt here on the side and the isolated effects package:

- 01. light and shadows;
- 02. color nuances;
- 03. filters;
- 04. adjustments.
1. **light and shadows**
   - I usually create a layer (or even a folder of layers) of brushstrokes in which I enhance lights and shadows in the painting. Sometimes - just like in the example here - I directly use black and white, sometimes with the eyedropper I sample a pair of colors (normally a light one, such as golden/yellow and a dark one, such as a dark brown), then I set the blend mode of the layer to Soft Light and I start playing with brushes, highlighting some parts of the composition. Here you can see that I wanted to highlight in particular the shadows behind the mirror, so in that area I used the brush with an opacity of almost 100%, in other parts I wanted to do the same, but with less intensity. Generally I never shade with an opacity greater than 40% black, while for highlights I can reach even 60%. Anyway, I play with the layer opacity and the superimposition of layers operations like this until I get the desired result. About the brush, in 99% of cases I simply use the very basic Soft Round Pressure Opacity Brush.

2. **colour nuances**
   - I was only emulating what you've ever tried to explore the filter gallery or download actions from the web), if not, take a look at it: you will discover a very wide world of options among the most diverse (some exquisitely kitch) with which to experiment and, above all, to learn to distance yourself quickly.
   - I am not going to deal with this issue here, I will instead confine myself to share what I’ve done here, confessing that it’s more or less what I do in most situations. Usually I take a piece of dirty and aged paper, or a worn canvas, even better if with a lot of irregularities, I extend it to cover the whole size of the painting, and then I start to modify it with the clone stamp and other tools (in short, if there are stains, I want them to be where I want them to be). The success of the effect is given to the use of a proper blending mode or, like in this case, to the combination of different papers with different blending modes.

3. **filters**
   - We could open a very long parenthesis on the use of filters in Photoshop (I don’t know if you've ever tried to explore the filter gallery or download actions from the web), if not, take a look at it: you will discover a very wide world of options among the most diverse (some exquisitely kitch) with which to experiment and, above all, to learn to distance yourself quickly.
   - I simply use the very basic Soft Round Pressure Opacity Brush. Generally - and this example is no exception, although I was only emulating what emerges from the analysis of the light in the painting - I use complementary colours: orange stains where the light touches the surfaces, blue spots in the shaded areas.

4. **adjustments**
   - These special layers apply color/tonal adjustments to your image without irreversibly changing pixel values. The difference between making an alteration directly on the layer (with interventions such as correcting curves and so on) and doing so on one of these dedicated layers is that the changes are stored only in the adjustment layer and apply to all the layers below it. In this way you can both correct multiple layers by making a single adjustment, rather than adjusting each layer separately, with the help of a Clipping mask.

   - Nondestructive edits are the main advantage you have by using this tool, which means you can re-edit the adjustment layer at any time, as well as reducing the effect of the adjustment by lowering its opacity.

   - Selective editing is the second big advantage: you can paint on the adjustment layer’s mask to affect only a part of the image, even varying the adjustment by painting on the mask with different tones of gray. The adjustments in this image (check the screenshot on the right) are the ones I use the most, which are:
     - **Brightness/Contrast**
       - Increases tonal values and expands image highlights, or decreases values and expands shadows. The contrast slider expands or shrinks the overall range of tonal values in the image.
     - **Hue and saturation**
       - Adjust the hue, saturation, and lightness of a specific range of colors in an image or simultaneously adjust all the colors in an image through three different sliders.
     - **Vibrance**
       - Increases the saturation of less-saturated colors more than the colors that are already saturated, therefore avoiding oversaturated areas.

   - The middle Input slider adjusts the gamma. It moves the midtone (level 128) and changes the intensity values of the middle range of gray tones without dramatically altering the highlights and shadows.

   - **Curves**
     - Initially, the image’s tonality is represented as a straight diagonal line on a graph. When adjusting an RGB image, the upper-right area of the graph represents the highlights and the lower-left area represents the shadows. The horizontal axis of the graph represents the input levels (original image values) and the vertical axis represents the output levels (new adjusted values). As you add control points to the line and move them, the shape of the curve changes, reflecting your image adjustments. The steeper sections of the curve represent areas of higher contrast while flatter sections represent areas of lower contrast.

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* for the Adjustment layers, I used as source the online Adobe Photoshop Userguide.