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Comparison of Node Based Versus Layer Based Compositing

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Comparison of Node Based Versus Layer Based Compositing

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Abstract

In movie post-production, compositing is the art of combining visual elements into one seamless shot. There are two classes of programs used to accomplish this: those that are node based and those that are layer based. This research report tries to determine whether there is a great difference between the workflow from two types of compositing software, and if the same result can be achieved by both types of programs. Therefore, it would be especially interesting to small businesses, schools or private users, since most node based programs are usually too expensive to purchase. To perform this experiment, a short film clip requiring a moderate amount of post-production is composited in two different programs; one node based and one layer based, in order that the differences can be studied. The final results are that there is little difference in the visual quality of the end result between the two programs, and that the higher cost of a node based program may not necessarily be worth it for smaller businesses and single users.

Keywords: post-production, compositing, layer based, node based, Adobe After Effects, The Foundry Nuke

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1 Introduction

Compositing is an element of the post-production process that almost all films, TV-shows and commercials go through today. [1] Although, the amount of post-production may vary greatly between different projects.

The compositing tasks usually involve combining several different visual elements from different sources into a single image, such as removing a blue screen behind an actor and replacing it with a computer generated background. The difficult part is then to match these two elements where they seamlessly fit together, providing the illusion that they were both shot at the same time. [2]

Traditionally, this has been created by several optical and chemical processes performed on the film negatives. However, compositing, like much of the post-production, is now an entirely digital practice. [3]

In this research, I will compare the workflow of two different kinds of digital compositing programs, to find out whether one can be substituted for the other.

1.1 Purpose

There are two distinct groups of digital compositing software on the market today; those that use a node based workflow, and those that use a layer based one.

The first category is generally aimed at higher end productions, and can be very expensive to purchase. This may not be a problem for projects with a large budget; however for smaller companies the differences in price can be significant. This brings up the question whether it is necessary for a small company to invest in a higher end program, or if a cheaper one would be sufficient?

Therefore, the purpose of this research is to compare two digital compositing programs, one node based and one layer based, and then analyze how the respective workflows handles the basic compositing tasks, as well as if one could be substituted for the other and still obtain the same result.

1.2 Limitations

In this research, only one program from each category will be used and compared. The layer based program is After Effects CS4 from Adobe. The node based program that I will be using is Nuke 6.0v1 by The Foundry. Both of these programs are commonly used in the industry. [4] This will be discussed more in chapter 2.3.

Furthermore, the compositing problems being solved will be the more common ones, and thus some advanced or very specialized techniques will not be used. These problems include grain removal, chroma keying, tracking, inserting new footage, color correction and grading.

Also, software specific features will not be taken into consideration, since the aim of this research is not to compare specific programs, but rather the general workflow they employ.

1.3 Expected results

After having two internships in companies with compositing, I have a general knowledge of what the results would be. Since node based software is generally used in all higher end production studios and cost much more to acquire, I would expect those programs to function at a higher level. However, I also expect to find that layer based software may very well be able to produce an acceptable result. And, the layer based software can be a better solution for smaller companies or ones with a limited budget.

2 Theoretical background

Compositing, the art of combining several visual elements to appear as if they have been shot at the same time, is not a modern technique. It has been used in movie making for over a century, and can be traced back to Georges Méliès short trick films from the late 1800s. [5] From these early physical techniques, compositing has evolved to be performed digitally by computer artists.

2.1 Non-digital compositing

Non-digital compositing can refer to a range of different mediums, including chemical, optical and physical compositing.

Physical compositing is a term used for techniques where the separate visual elements are physically placed on set in front of the camera and then photographed in a single exposure. Physical compositing techniques can for example be glass paintings or partial models. [6]

When using glass paintings, a glass pane large enough to cover the entire camera frame is placed in front of the camera, and one or more objects is painted on specific parts of the glass, in order that actors and other parts of the background scene can be seen through the clear areas of the painting. If shooting a scene that takes place on a grassy meadow, a glass painting could be used to add in extra buildings that do not exist on the real set. The limit with this technique is that all painted objects will be static, therefore glass paintings will not work with moving objects, such as water or animals.

Another commonly used technique is building so called partial models. If, for example, a very large building is needed on a set, such as a tall tower, it can be very expensive, impractical or even impossible to build a full scale model. Partial models solves these problems where only the first story could be constructed and the rest of the object can be replaced with a smaller scale model instead of building a whole object. The technique to make this effect is to place this model closer to the camera, providing the illusion of being the same size as the real set. However, the model needs to be far enough from the camera so that both model and set are in focus.

Other non-digital compositing techniques are front and rear projection, multiple exposure and analogue chroma keying. [7] However, creating an analogue key can be a very lengthy and complex process compared to its digital counterpart, but allowed for spectacular effects to be made when first introduced in the middle of the 20th century.

To create a chroma-composite, the foreground object is first shot against the blue screen (see Figure 1.1 in the picture below). This footage is then reprinted on a set of new filmstrips using color filters to render the blue screen black. Any unwanted objects (such as camera rigs and film equipment) are masked off by covering them with black cards. The resulting footage is a travelling matte, a silhouette of the foreground object, called the foreground matte as in Figure 1.2. From this matte, another copy is made on a new strip of film, however this copy will have its colors inversed, creating what is called a background matte (Figure 1.3). Using these two mattes as masks, both the foreground and background footage is then reprinted on a blank piece of film. Any black areas on the mattes will stop any light from reaching and exposing the film negative, preventing any form of double exposure in the final image as in Figure 1.4 and 1.5. Finally, these two strips of film can then be photographed on top of each other, creating the final composite (Figure 1.6). [8]

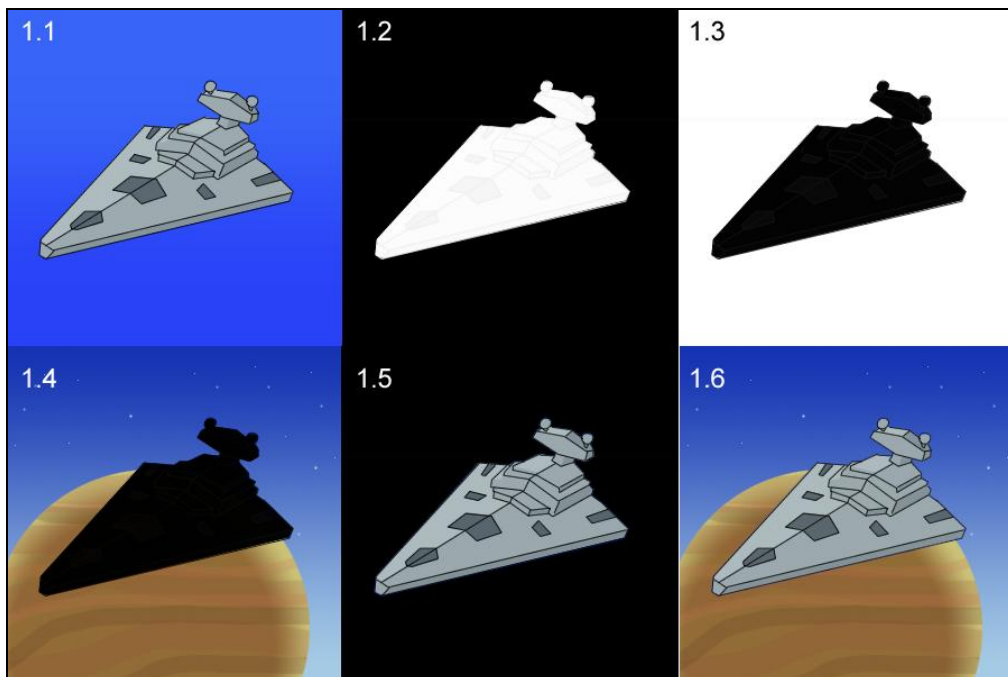


Figure 1. The steps of analogue blue screen compositing.

The above process uses several pieces of film negatives, and each time a copy is made, it is important that the film is lined up perfectly, or artefacts around the edges of the foreground object may appear in the final composite. It is also important to note, that every time the film is copied, there is a slight loss of image quality.

Also, if more than one blue screen element is to be used, for example three characters shot independently, several extra passes must be made, further degrading the film quality, as well as increasing the risk of edge artefacts.

2.2 Digital compositing

Digital compositing is the logical evolution of the analogue counterpart. It works much on the same principles too, albeit in a completely non-linear fashion. When editing, cutting or in some other method altering a physical piece of film negative, it will be changed from its original form irreversibly. [9] This means that if no copies have been made, there is no going back and redoing any unwanted changes. However every time a copy is made, there is a slight loss of quality.

Moving the compositing process into the digital realm solves all of these problems. A digital movie file can be copied and distributed infinitely without any quality degradation. And since the source file itself is never changed or altered when working digitally, an artist does not have to worry about ruining the original clip. This allows for a greater artistic freedom and experimenting.

A digital composite, is created from a number of operations that in some manner alters the image. These operations are in turn made up from mathematical functions that manipulate the color data of an image. [10] Even though all of the mathematical calculations are performed by computers, the digital compositing process is similar to the non-digital process.

2.3 Software

There exist many compositing programs in use today. Some are widely available to both companies and for private use, while other are developed solely for in-house use by large VFX studios. They range from being freeware to costing several hundred thousand dollars. [11] Most big productions, such as the “Hollywood blockbusters,” are composited with node based software (for example Nuke or Shake), while layer based programs (such as After Effects or Combustion) are more commonly used for television and commercials.

2.3.1 Node based software

Node based software is handling the often complex compositing tasks by linking together several simple image operations. Each of these operations is referred to as a “node,” and together they make up a schematic node-tree that appears similar to a flowchart. Figure 2 shows an example of a very simple node-tree.

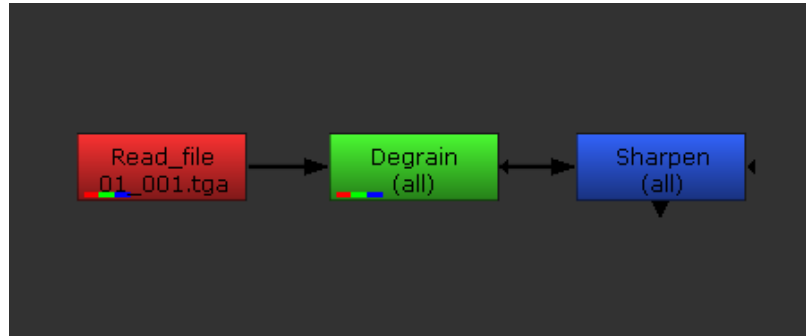


Figure 2. A simple chain of nodes.

In the image above (Figure 2), the colored squares are the nodes. The first node (the red one) is reading an image sequence from the computer's hard drive. This is then connected to a Degrain-node (the green node) that will remove any unwanted grain from the image. The blue node is then sharpening the whole image to remove some of the blur that may have been caused by removing the grain.

The order in which each operation is performed is shown by the arrows connecting the nodes. This order can in some cases be very important to the final image, since the result may vary greatly depending on where in the chain a specific node is used.

A slightly more complex node-tree is shown in Figure 3. The same nodes are used as in the previous example, except with an additional "branch" connected to the tree. The two new nodes that make up the upper branch (cyan and yellow) read in a single image file and then scale it down in size. The final, magenta node is then taking this image and placing it on top of the first one.

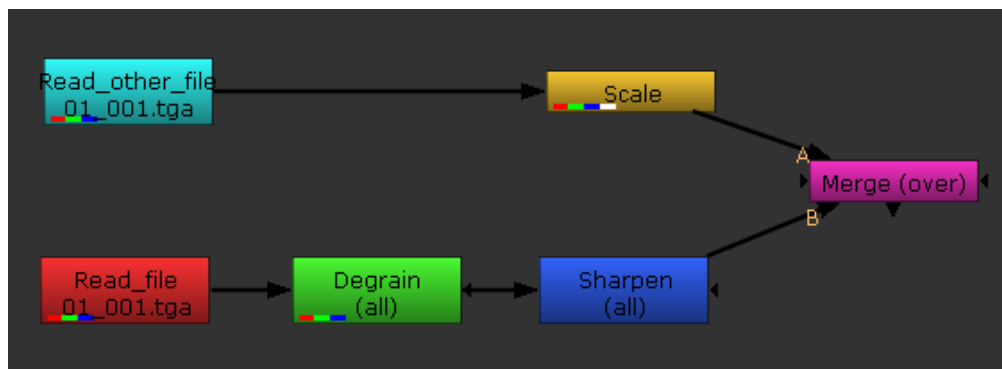


Figure 3. Node-tree with two branches.

In reality, projects are rarely that simple, and a complex shot may consist of hundreds of different nodes. In these cases, it is important to structure the trees where the nodes are easy to find, and the process is easy to follow. This is especially true if more than one person will be using the same file.

2.3.2 Layer based software

Layer based software works on a different principle than the node based form. Instead of connecting nodes in a tree, each image element is stacked on top of each other. For example, in the bottom of the stack, there may be an image of a spruce. On top of this, a new layer containing some silver tinsel could be placed, followed by another layer containing images of candles at the top of the stack.

Any applied effects (such as removing grain or sharpen) are usually assigned to a specific layer. Since there are no nodes to show where these effects are applied, they could instead be shown in a list associated with each layer. Figure 4.1 shows how Autodesk Combustion 2008 creates the same result as the node-tree in Figure 3 would produce, while Figure 4.2 show the exact same set-up in After Effects CS4.

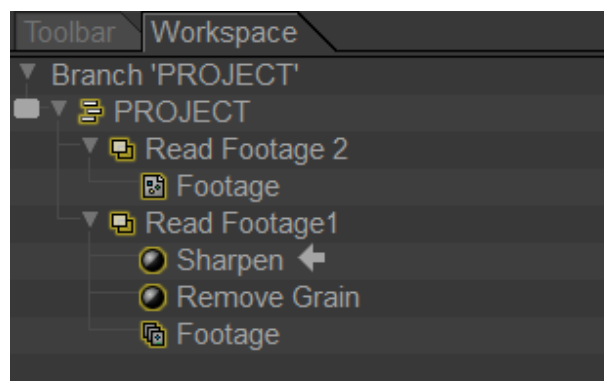


Figure 4.1. Layers and effects in Combustion.



Figure 4.2. Layers and effects in After Effects.

In both of the layer based examples, “Footage 2” will be on top of, and thus occluding “Footage 1,” since it is higher up in the stack. This closely resembles how cel animated movies were shot before the use of computers, where the characters were drawn on transparent plastic film and then placed on top of a painted background.

3 Material and Procedure

The scale of this project is quite small, and there was no need for a great deal of material to perform the comparison that was the goal. Only three things were essential to obtain the needed results: hardware to run the compositing software, filmed material that would be composited, and the two different types of compositing software. These are explained more in detail below.

3.1 Material

I will only briefly examine the hardware used for this project, while the source material of the film clip will be described more in depth. This is because the hardware will not affect the workflow in any significant manner. Below are the hardware specifications of the used computer:

HP xw6600 Workstation

Processor	Intel Xeon E5450, 4 Cores, 3.0GHz
RAM	Hynix 8.0 GB (4*2 GB) DDR2, 666Mhz
Graphics card	Nvidia Quadro FX4600, 1.1Ghz, 740Mb
Hard drives	Western Digital 160 GB, 10000 rpm Seagate 250GB, 7200rpm
Operating system	Windows 7 Professional, 64-bit

In addition to this, two Dell monitors with a 1600x1200 resolution were used.

3.1.1 Used software

The two compositing programs being used in this project are: Nuke 6.0v1 by The Foundry and After Effects CS4 by Adobe. Nuke which is a node based program, while After Effects is layer based. A few other programs are also used for other tasks. These are: Adobe Photoshop CS4 to create and manipulate 2D images and IrfanView v4.25 for batch image processing.

Nuke was chosen because it is used by many post-production companies around the world, including for example Framestore, Weta Digital and Industrial Light & Magic. [12] Nuke also has the advantage of sharing some of its technologies (such as Keylight and Kronos) with After Effects, making the same functions available on both programs. It was originally developed by Los Angeles-based VFX company Digital Domain as its own compositing tool. It has since then been acquired by The Foundry in London, which has completely taken over the development and distribution of the software. Version 6.0v1 of Nuke, which is the one used for these experiments was released in January 2010.

After Effects is arguably the most widely used of the layer based compositing programs. After Effects is also much cheaper than most node based software (about \$2,500 cheaper than Nuke), for example making it popular among small and medium businesses, as well as schools and universities. Version CS4 (9.0.2) was released in May 2009. [13] [14]

3.1.2 Source material

The source material utilized was shot in a blue screen studio using an unknown 35mm camera. The lens type is also unknown, however a fixed focal length and rather short depth of field was used.

This analogue material has then been scanned and scaled to a 1920 by 1080 pixels resolution before being outputted as an 8-bits per channel TARGA sequence. A time code and two black bars have also been added along the top and bottom edges to crop the effective image area to a 2.35:1 cinematic aspect ratio (see Figure 5).

The full film clip is 64 frames long, or 2.56 seconds when played back at 25 frames per second.



Figure 5. Single frame of the raw footage (scaled down).

There are several reasons this clip was chosen for this project. First, it features a large amount of blue screen, making it very suitable for keying. This is very important, since keying is a major part of compositing. The blue screens in this shot are also of different shades of blue, as can be seen in Figure 5 above, which means accomplishing a high-quality result will require some extra experimentation. This is helpful because having a shot that is too easy to work with will not show the capabilities of each compositing program as clear as a more complex shot.

Second, the camera is moving. This means that any footage inserted must be tracked to match the original camera movement, where it appears that the new footage is a part of the original shot.

Third, the clip shows several tracking markers throughout the scene. A tracking marker (the little white square above the right monitor in the picture above) is a guide for the compositing software, where it has a clear and easily recognized feature to follow. These must be removed before a background can be added, since they are not part of the actual set. However because they cannot be removed automatically, a method called rotoscoping is required to delete all markers by hand.

And finally, there are some technical issues, such as a shallow depth of field, some motion blur, and a great deal of grain present in the shot. All of these things make it slightly more difficult to work with the compositing. For example, the grain needs to be removed (or at least reduced) before a high-quality and solid matte can be

created. And then in the finishing stages, this grain needs to be reapplied in order that everything looks as realistic as possible.

3.2 Procedure

The research project was first planned where each compositing task would be performed with the two programs in parallel. For example, the plate was cleaned up in both Nuke and After Effects, before moving on to the next step. A quick “test run” was first created to determine what compositing tasks were needed and to acquire a feel of how much time would be spent on each step. Although, during this test some changes to the initial plan were made. I thought stopping the production and constantly switching programs lead to an inefficient workflow that did not seem optimal. Instead, I chose to first complete the whole composite with one program before switching to the other.

3.2.1 Planning

Before any practical work was produced, some project guidelines had to be established. These included settings for both programs, such as frame rate, bit-depth, and resolution to ensure consistency between the two versions.

In order to be able to make a fair comparison, a great deal of time was spent on learning each program well enough to complete all the necessary tasks without effort. Hopefully, this will lead to reducing user errors affecting the result.

A list of tasks that needed to be followed to complete the compositing was also created, where the exact same steps could be performed in the same order for both compositing programs. These are the basic tasks that are required:

- Clean plate (remove grain and sharpen)
- Key the blue screen
- Remove tracking markers (rotoscoping)
- Track and insert background
- Track and insert computer screens
- Color match all elements
- Color grade
- Clean up and finishing
- Add grain

After the initial preparation and set-up, the practical work could begin.

3.2.2 Process in Nuke

Following the guide created in the planning stage, the first step was to remove some of the excess grain from the images. This was necessary to be able to get a clean matte when pulling the chroma key in the following step. The algorithm by which the grain

is removed often introduces some blurriness to the image, which is why the clip had to be sharpened by a small amount afterwards to restore some of the original details.

After this, the alpha matte was created with Nuke's Primatte keyer. Obtaining a clean matte is perhaps the most crucial part for the composite, since an inadequate key may cause noise and artefacts along the edges of the material. This would in turn make it difficult to blend the foreground and background elements into a convincing result.

The outcome of the keying was not entirely successful, largely due to the heavily blurred foreground objects. As a result, some extra rotoscoping and changes were needed to fix some of the flaws in the matte.

The next step was to remove all of the tracking markers. Since these are black and white in color, the keyer is not able to remove them in the same technique as the blue screen. Instead, they had to be manually erased using a technique called rotoscoping. Rotoscoping is a technique where the artist draws a shape around an object, and then animates this shape to constantly follow the object as it moves through the scene. This process can sometimes be very time consuming, especially if the contour of the object changes over time. In this case however, the rotoscoping could be completed quickly, because the tracking markers stayed roughly the same size and shape throughout the whole clip. The only difficulty was when the main character passes in front of a marker, partially covering it. Having an object pass in front of a marker means extra care has to be taken, where no parts of the moving object is removed accidentally. Figure 6 shows a tracking marker being removed in Nuke.

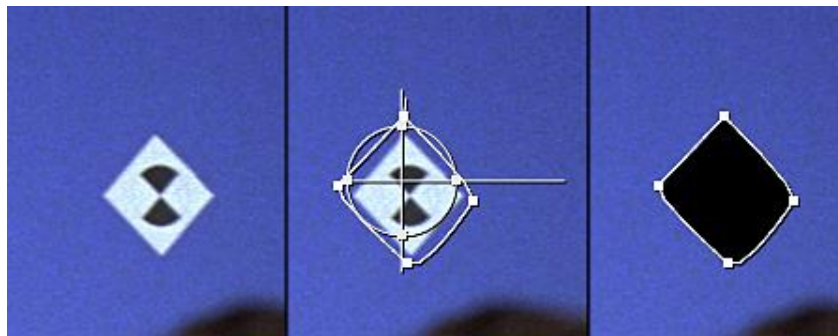


Figure 6. A tracking marker gets removed by rotoscoping.

After the foreground had been extracted, the color bleeding from the blue screen needed to be cleaned up. Color bleeding, or color spill, is the result from the lights bouncing off the blue screen and hitting the foreground objects. This causes a blue tint around the edges of the objects. This blue color must be removed or the foreground will not match the background properly. The technique for removing color spill is called "spill suppression," and is sometimes built into the keying algorithm. However, for this particular experiment, a manual spill suppression was created instead.



Figure 7. Original frame (top), and with blue screen replaced (bottom).

Next, a new background had to be inserted to replace the blue screen. Since the background would not be showing anything in motion, a still image was used instead of a movie file or an image sequence. Using still images have the advantage of being smaller in file size than movie clips, which makes working with the program faster. Because the camera is moving, the background had to be tracked and animated to follow the rest of the scene.

The computer monitors visible in the scene also needed new footage to replace the blue screens. This was prepared using the same method as the background. Each individual screen had to be tracked separately, and then resized to fit the existing monitors. Because the original computer monitors are out of focus, the inserted footage had to be blurred to match. Figure 7 above shows the current state of the composite, compared to the original image.

Since all of the elements (foreground, background and computer screens) in the image were from different sources, their light and colors did not match. This is almost always the case when shooting scenes in front of a blue screen, because a chroma studio needs to be lit in a certain manner to ensure a good and evenly colored blue screen. Usually, the light direction also needs to be carefully planned and set up in the

studio, where the light falls from the same angle as in the background. However, in this scene the background had a very ambient lightning which made this problem less visible.

The colors still did not match. Therefore some color correction was performed in the foreground and background. The foreground was too heavy in the shadows, therefore these were brightened slightly. The background had originally too much of a green tint, which was shifted more towards red, before the contrast and brightness was increased.

Because the sky in the background was very bright, a “light wrap” was added to the foreground. A light wrap is a simulation of natural occurring phenomena where light wraps around an object lit by a strong backlight, causing a more or less pronounced “light bleed” around the edges. Adding a light wrap to a composite can greatly help sell the effect of the foreground and background being shot at the same time.

In earlier years, light wraps had to be created entirely by the artist by a series of channel operations and manipulations. However, since filming against blue screen has become so common, Nuke can now allow the user to create a light wrap automatically.

The final step of the color correction was to fix the light intensity of the newly added computer screens. The original screens were brighter than the sky in the background, which looked unrealistic. The screens were therefore darkened somewhat. This also helped the overall composition of the image, by putting less focus on the main character behind the monitors. Figure 8 shows the image before and after color corrections were applied.

The next step was to add some of the grain that was removed in the beginning. The reason the grain was removed in the first place was not to make the image look better, but solely to make the keying process easier. If the scene had actually been shot at a real location instead of against a blue screen, there would be no need to remove it and therefore the final image would contain some grain. This is why new grain has to be added, since the goal is to make the composite appear as realistic as possible.



Figure 8. The same frame with and without the color corrections.

The final step was to clean up everything and fix any problems still remaining. One of these problems was that the background was still in perfect focus, even though it should not be. A lens blur effect had to be applied to the image to make the background appear as if it was far off in the distance.

Another detail that was added during this stage was a small reflection in the window pane from the man.

After this the whole sequence was rendered out in its original resolution without any compression. The render time was about 4 minutes, or 3.5 seconds per frame.

3.2.3 Process in After Effects

The same composite that was just created in Nuke would now be performed in After Effects, where the workflow would be compared. The same hardware and source material was used, and the same guideline from the planning stages was followed.

After Effects and Nuke share many of the same functions, but in some cases there were no matching or equal functions available. In such cases, another method providing a similar result was used.

Just as with Nuke, the first step was to remove the grain and then sharpen the image. After this was completed, the blue screen was removed using the Keylight keyer. However, there were some difficulties getting a good result with this keyer. In particular, some bright artefacts along the edges of a few parts of the image were very hard to remove. An example of this is shown in Figure 9 below. After too much time was spent on trying to obtain an acceptable result, the alpha channel created in Nuke was imported to speed things up.

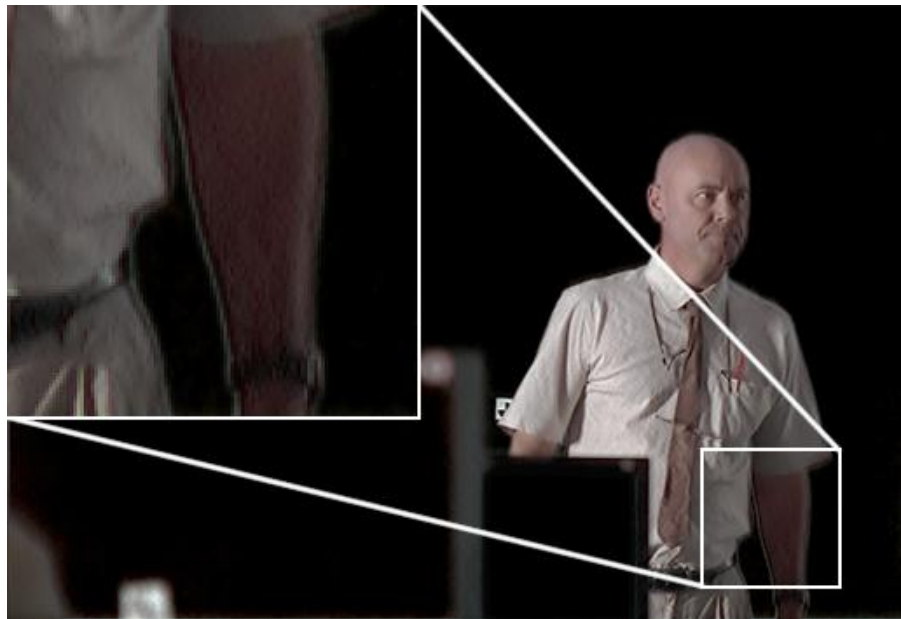


Figure 9. Artefact caused by Keylight.

After the foreground had been successfully extracted, the background and computer screens were added to the composite. These were then resized, tracked and manipulated to fit the scene using the same methods as in Nuke.

When all of the elements were in place and the tracking did not require any more corrections, everything was color corrected. The movie from Nuke was used as a reference in order that the color correction would be as identical as possible. This also made the color matching process much easier this time. However, After Effects does not have a light wrap effect available, instead this had to be created manually.

To create a light wrap, first the foreground was used to create an “edge matte,” which basically is a white outline over a solid black background. It is, however, important that the outer edge is sharp, while the inner edge is feathered. If the whole outline was blurred, a glowing edge around the foreground would be the result. This edge matte was then used as a mask over a blurred copy of the background image. The contrast of this masked image was then increased, before it was added on top of the composite using a screen-blending mode. When setting the blending mode of a layer to “screen,” only the brighter parts of the top layer will show. Since a light wrap is the

result of light wrapping around an object, it is important that the light wrap does not contain any dark parts. Figure 10 shows a short step-by-step process of creating an edge matte and a light wrap.

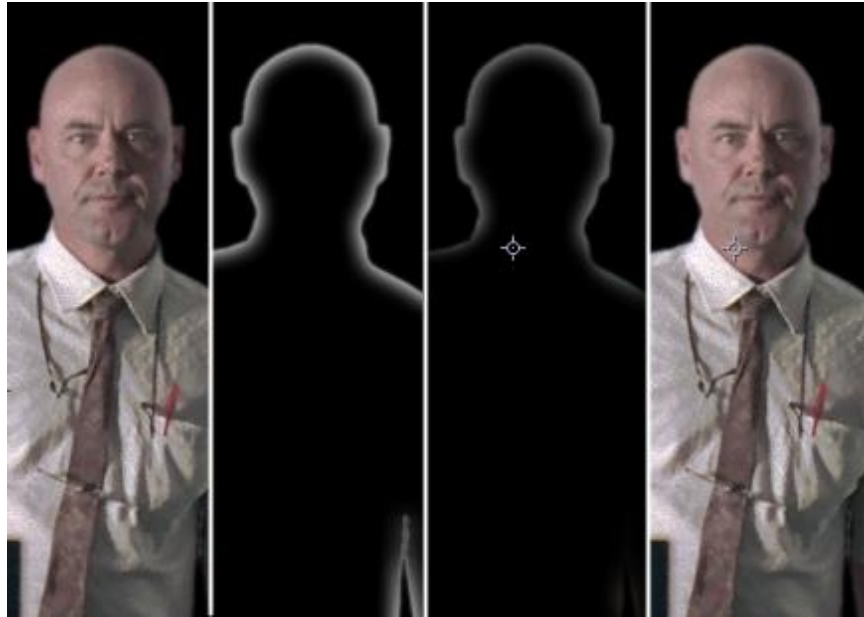


Figure 10. Original image, edge matte, light wrap and final composite.

In the next step, all the remaining details, such as grain and reflections, were finally added to complete the composite. The whole clip was then rendered out to an uncompressed Quicktime movie file.

The render time in After Effects was about the same as in Nuke, and no major difference could be observed.

3.2.4 Grading

In a typical large feature film production, most shots will go through a color grading stage. A color grade is a process where colors are altered or enhanced to create a certain appearance or help visualize a specific mood. [15] In some movies, such as 300 and Sin City, the color grading can be very stylized to produce a bold artistic style as seen in Figure 11. In other movies, the grading is more discreet, and simply used to add to the production value of the film.



Figure 11. Sin City(left) and 300(right) both have very stylized coloring.

On movies with bigger post-production budgets, the color grading is performed by a colorist (sometimes also called digital intermediate) and not by the compositing artists. [16] Coloring is also created with special coloring software and tools, and not in compositing programs. Most compositing software, however, do contain tools for color management, but not as sophisticated and extensive as the specialized software.

Because of this, the color grading created in these experiments were performed in a 3rd-party plug-in, and not with Nukes or After Effects built-in tools. This is why the color grading process is not taken into consideration when studying the workflow of both compositing programs. However, since grading is a crucial part of most real production pipe-lines, a graded result was also deemed as necessary.

The color grading was first performed on the finished Nuke composite using Magic Bullet Looks v1.2 by Red Giant. A strong orange tint was added to create a warmer look. The contrast of the foreground was then increased, before a slight glow was added to the sky. The goal of the grade was to enhance to overall look of the image, and make it more interesting.

The exact same color grade was then applied to the After Effects version of the completed shot. Figure 12 shows the difference between a graded and ungraded image.



Figure 12. The same frame shown with and without color grading.

4 Results

Four separate movie clips were created for this experiment: one graded and one ungraded version from each program. Once every movie was completed, they were then rendered out as standard definition resolution (1024 by 576 pixels), non-compressed Quicktime files. These were then played side-by-side to compare to final results.

In addition to these movies, still frames of each clip were also rendered out to use for comparison. These stills were created in the same resolution as the movie files, and saved as PNG images. The still frames were used to examine smaller details more easily, since many minor flaws can be hard to spot in a moving picture.

Figure 13 and 14 shows a comparison between the same frame from both After Effects and Nuke. As seen on the following pages, the images are very similar, and the small differences are in this case too insignificant to be noteworthy.



Figure 13. Graded results



Figure 14. Ungraded results.

4.1 Node based result

From start to finish, the time it took to complete the composite in Nuke was about seven days, with roughly five to six hours spent per day.

In total, it took 74 nodes to perform all the necessary operations. This excludes render and viewer nodes, since these do not affect the appearance of the composite. Figure 15 shows the entire node-tree that makes up the completed shot. The left-most nodes with the green backdrop are not connected to the rest of the tree. These nodes create an edge matte and a light wrap with the same method as the same effect was prepared in After Effects. However, since Nuke can automatically create a light wrap using a single node, there was no need for the manual nodes to be used. They were only left in the project for comparison reasons.

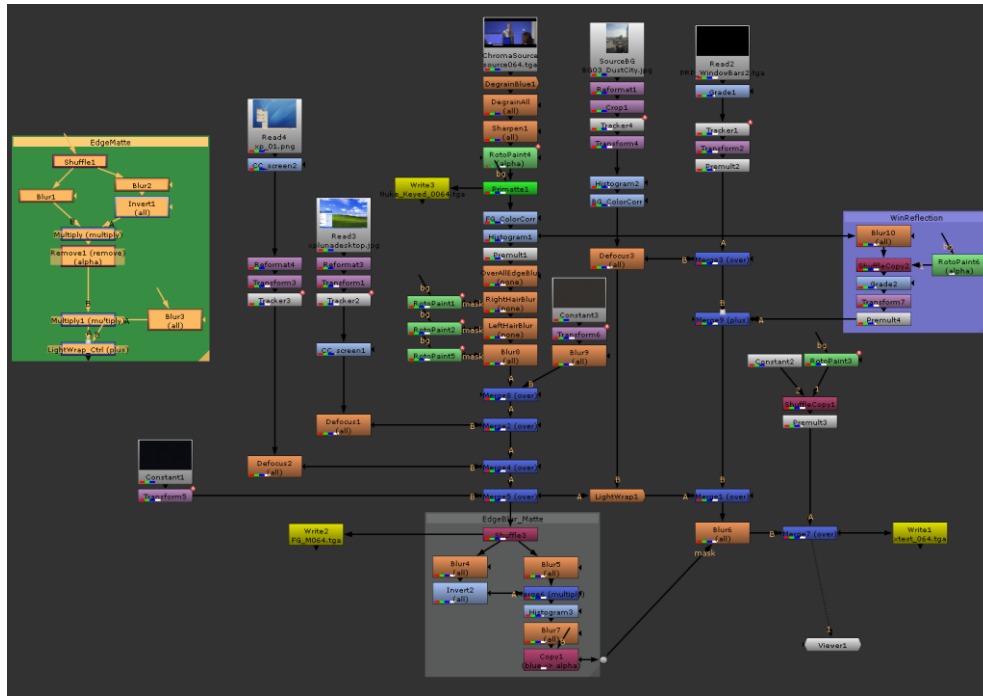


Figure 15. The complete node-tree in Nuke.

4.2 Layer based result

Less time was required to finish all the tasks in After Effects, which was largely due to the fact that a solution to most problems was already found from working with Nuke. This also meant that more time could be spent on practical work instead of searching for a solution. All in all, about five days were needed to complete the composite when working around five or six hours per day.

A total of seventeen layers that together used twenty-two effects were required in After Effects to make a complete composite. This is less than the number of nodes used in Nuke.

After Effects is able to show a schematic view of the current work in a flowchart. This flowchart looks similar to the node-trees from node based compositing programs, but cannot be used for creating nodes or changing their relationships with each other. The flowchart in Figure 16 shows the completed After Effects composition.

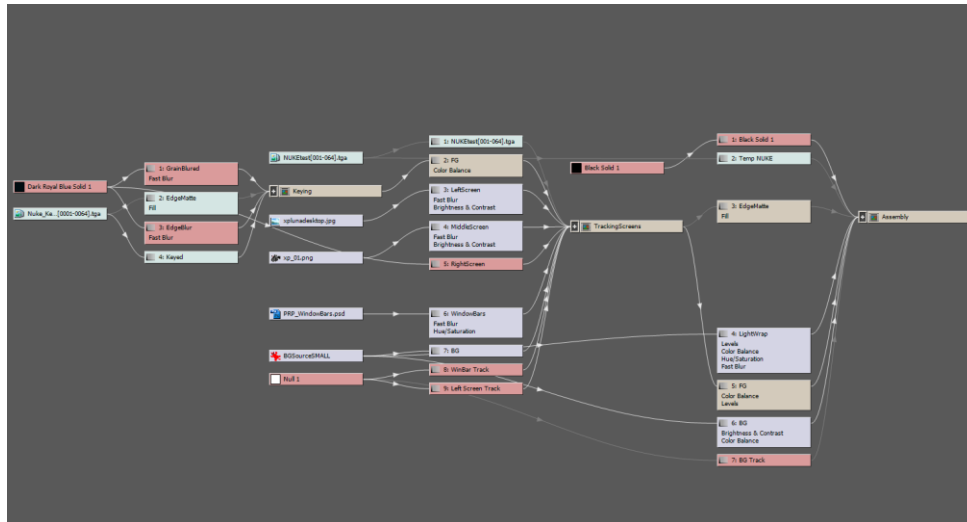


Figure 16. A flowchart of all After Effects layers used for the shot.

5 Conclusion

As seen in the results in the previous section, the outcome for both programs does not differ very much in the end. By solely looking on the end results, it appears as if it does not necessarily matter what type of software that is used. Both node based and layer based software were able to produce a pleasing result and reach the same level of quality in this case. However, the final result does not only depend on software alone. The skill of the compositing artist, as well as the time and resources put into a project will also affect the quality of the outcome to a great extent.

When it comes to efficiency and ease-of-use, it is more difficult to draw any definite conclusions. On the one hand, when working with a node based workflow the relationship between the different nodes is very clear, in obtaining a complete overview of the whole project. When working on a large project in a layer based program, it can sometimes become difficult to find specific effects or grasp a good sense of how all layers interact with each other.

On the other hand in layer based software, some controls and properties are all associated with the same layer, whereas in a node based program the same functions are separated into several different nodes that need to be connected. For example, in After Effects, an image layer contains controls over transformation, opacity and masks all together. In Nuke, this would require at least four different nodes, plus separate nodes to place images over each other. Therefore in After Effects, there would be fewer assets to manage in the work area, which could make organizing the process easier.

Another item to note is that when working with a node based software, because all nodes exist independent of each other, you may at anytime chose to view the image processing up to a specific point in the node-tree without making any actual changes to the final image. This is especially handy when troubleshooting bugs and errors, or when comparing the effect of different operations.

Usually when working on bigger projects, the compositing is just part of a larger post-production pipeline. In such cases, it is important to keep everything logically organized and easy for other people to use than the original artist. I found it easier to structure the work in Nuke, mainly because there is only one area where all of the different assets are kept. However in After Effects, there is one panel that contains all imported images and then another panel where the actual work is performed. Therefore, the same asset can exist in several places, and the resource in the two different areas have to be named and organized on both places, which may eventually be more confusing for a second user.

One disadvantage with using node based software is the lack of a global timeline. It makes working with movie clips that are not of the same lengths less convenient. And perhaps this is the strongest advantage with layer based programs, since these are generally more focused around a main timeline, which allows for a greater flexibility when working with video clips of different lengths.

Generally, it felt as if any temporal operations and effects that needed to be animated over time were all more effortless to manage in After Effects, due to the more flexible timeline. Features such as adding, editing and moving keyframes all seem more intuitive in a layer based environment. By having all layers stacked in a single window, the keyframes from several layers and effects may be displayed and manipulated simultaneously. However, this can be created in Nuke as well, but in a less accessible and intuitive form.

Another disadvantage to node based programs is that it seems to be more difficult working with images of different sizes. This may have to do with the method Nuke handles alpha channels and bounding boxes, however more research is needed to confirm this idea. From my experiments, it appears as if After Effects was easier to work with when dealing with different sized material.

To summarize the findings of this research and answer the questions posed in the beginning of this paper, it can be said that quality-wise there is little difference between the two types of programs. However, a node based workflow is easier to organize and structure, while layer based can be better suited for working with files of different sizes and lengths. Since layer based software also has basic audio and editing capabilities, they can be also be used for more than just compositing purposes. These abilities can be beneficial, especially for small projects with short deadlines where there is no time to switch between different programs.

Nuke, and other node based programs, offers more advanced features than After Effects, such as full three dimensional workspaces, 3D camera matching and full stereoscopic capabilities. For some projects, these functions may be critical to complete a composite, and in such cases After Effects will be inadequate. However, this has nothing to do with node and layer based workflows, and After Effects could at least theoretically be able to obtain the same functionality in a feature version.

Because After Effects is much cheaper to purchase, I think it would offer a greater value for smaller businesses and single users in most cases.

6 Future development

There have been many advances over the last years where functions from one kind of program have been incorporated into another type of program. With Photoshop CS4, Adobe introduced advanced 3D layers to their famous program. [17] Many of the more advance compositing programs have the ability to manipulate and work with simple 3D geometry without the need for a separate 3D package. Most video editing programs have the functionality to perform basic color and audio manipulation for example.

It seems to be a growing trend to make programs more versatile and multifunctional. This allows for a greater flexibility, as well as making software purchases easier since there is no need to acquire separate programs for each different task.

However, at this time, there have been few noticeable attempts to combine the strengths of both node and layer based video compositing. A node based program with a fully functional timeline would be able to perform both complex compositing tasks, as well as demanding motion graphic tasks. The reason there is no combined layer and node based program may be because the two methods are too different to be easily integrated. I do not think this should be impossible. According to director and filmmaker Stu Maschwitz, After Effects is actually already a node based compositor with a layer based user interface added on top of it. [18] If this is the case, I do not see why in the future there could not be a program that finally brings the best of both worlds together in one package.

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