

**Czech University of Life Sciences Prague**

**Faculty of Economics and Management  
Department of System Engineering and Informatics**



**Bachelor Thesis**

**Visual Effects Compositing of Computer  
Graphics in Film and Video making**

**Author**

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# CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

## BACHELOR THESIS ASSIGNMENT

Selva Kumar Govindasamy Chinnadurai

Informatics

Thesis title

**Visual Effects Compositing of Computer Graphics in Film and Video making**

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### Objectives of thesis

The purpose of this thesis is to cover about different techniques currently used in the field of CG and visual effects by giving a variety of examples from the movies and TV Advertisements. Thesis covers a project aimed at finding a solution for one of the computer graphics techniques. The practical goal of this study is to analyze using a practical example which new software is the most popular one (or more) among professionals.

### Methodology

The history of visual effects and CGI, and how the development has changed the industry of cinematography will be studied and described in the first part of thesis. The method of digital compositing will be used for production of VFX in the second part of this thesis, in particular 2D and 3D digital compositing, by which are being added 2D and 3D elements into the Real video footage. There will be used all relevant standards of the software engineering and application software by Foundry and Adobe.

**The proposed extent of the thesis**

30-40 pages

**Keywords**

VFX Digital compositing, Computer Graphics, Nuke, After effects, Film and TV post Production, 2d and 3d Animation

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**Recommended information sources**

Compositing Visual Effects: Essentials for the Aspiring Artist, By Steve Wright. ISBN 13: 978-0-240-80963-2  
Digital Compositing for Film and Video (Focal Press Visual Effects and Animation), By Steve Wright. ISBN  
0-240-80455-4

The VES handbook of visual effects: industry standard VFX practices and procedures/edited by Jeffrey A.  
Okun, Susan Zwerman; co-editors, Scott Squires, Toni Pace Carstensen, Kevin Rafferty. ISBN:  
978-0-240-81242-7

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**Expected date of thesis defence**

2019/20 WS – FEM (February 2020)

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Dean

Prague on 26. 11. 2019

## **Declaration**

I declare that I have worked on my bachelor thesis titled " Visual Effects Compositing of Computer Graphics in Film and Video making " by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 30.11.2019

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## **Acknowledgment**

I would like to thank doc. Ing. **Vojtěch Merunka**, Ph.D. for their advice and support during my work on this thesis.

# Visual Effects Compositing of Computer Graphics in Film and Video making

## ABSTRACT

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The Main goal of this thesis is to review the particular department of Visual effects post production with the topic” Visual Effects Compositing of Computer Graphics in Film and Video making” is to describe the brief history of Digital Compositing and make an overview of existing compositing software’s, provide more detailed information on theory of 2D compositing as well as 3D compositing.

The main goal for practical part is to pick one complicated shot from film and do compositing with explanation of one of most popular software among compositing professionals worldwide.

The theoretical part explains detailed position of Visual effects compositing inside the pipeline of VFX, also detailed explanation of most important tools from compositing which is digital artist can ready to perform with the shots. Among these are compositing CGI materials into live-action plates, rotoscoping, Chroma keying, clean plate, finetuning and uses of lens and some other effects.

### **Keywords:**

*VFX Digital compositing, Computer Graphics, Nuke, After effects, Film and TV postproduction, 2D and 3D Animation.*

# Vizuální efekty Kompozice počítačové grafiky ve filmu a videu

## Abstrakt

Hlavním cílem této bakalářské práce je přezkoumat konkrétní oddělení postprodukce vizuálních efektů s tématem „Vizuální efekty, složení počítačové grafiky ve filmu a videu“, popsat stručnou historii digitální kompozice a udělat přehled o existujícím kompozičním softwaru, a poskytnout podrobnější informace o teorii 2D komponování i 3D komponování.

Hlavním cílem praktické části je vybrat jeden komplikovaný snímek z filmu a udělat kompozici s vysvětlením za pomoci jednoho z nejoblíbenějších softwarů mezi profesionály z celého světa.

Teoretická část vysvětluje podrobné použití kompozičních vizuálních efektů ve VFX průmyslu, také podrobné vysvětlení nejdůležitějších nástrojů z kompozičního prostředí, které je digitální umělec schopen provést se záběry. Patří mezi ně kompozice CGI do natočených záběrů, rotoskopie, klíčování pozadí, retuše a použití simulace objektivů a některé další efekty.

### **Klíčová slova:**

VFX digitální kompozice, počítačová grafika, Nuke, After effects, filmová a televizní postprodukce, 2D a 3D animace.

## **ABBREVIATIONS OF VFX FIELD**

<b>CG</b>	- Computer Generated
<b>CGI</b>	- Computer Generated Imagery
<b>CC</b>	- Color Correction
<b>BG</b>	- Background
<b>FG</b>	- Foreground
<b>VFX</b>	- Visual Effects
<b>Denoise</b>	- Removing noise from plates
<b>Live Plates</b>	- Action footage shot by Camera
<b>Matte (Alpha)</b>	- Masked Footage by using Roto
<b>DI</b>	- Digital Intermediate



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## 1. INTRODUCTION

Digital VFX Compositing is widely used in the VFX postproduction nowadays, whether or not only it's for TV commercials, Films or Videos. The intention of the compositing is to seamlessly integrate with 2 or more sequence of videos or images into one. The alternative words of computer graphics to make realistic world from unrealistic which is showing the Extraordinary visualization experience to the audience.

VFX Compositing seamlessly integrates digital assets with live-action footage to the final shot of a movie, game and TV commercials.

The VFX industries has huge transformation from last 50 years, for Example

50 years ago, Don Chaffey's Jason and the Argonauts movie was released. It used to be a movie that radically modified the future of visible results in movies.

While the plot references historic myths, it certainly used to be Ray Harryhausen's lighting fixtures hints that galvanized future generations of administrators, producers and filmmakers. It used to be stop-motion that Jason and additionally the Argonauts pioneered, via complex fighting scenes.

Most unforgettable is that the celebrated hostilities throughout which Jason defeats a army of skeletons, UN employer emerge from the world. The late Harryhausen created this improbable scene, that took four months to make and have emerge as a grant of creative notion for Tim Burton, Peter Jackson, George L, Terry Gilliam,

Here rectangular measure 5 films they created that are influenced by the visible results in Chaffey's fable epic.



Picture 1

Image source: <https://www.wired.com/2010/09/the-kraken-awakes-to-test-your-browsers-javascript-powers/>

Peter Jackson expressed that, "The Lord of the Rings is my Ray Harryhausen film. while not his womb-to-tomb love of his wondrous pics and story telling it would possibly ne'er are created – not through Pine Tree State a minimum of." quite a few of the visual effects in the Lord of the Rings trio use figurines and miniature photography. mythical being and also the Argonauts' stop-motion consequences galvanized Jackson's previously videos too, as nicely as his 1992 function Dead Alive, a comedy zombie horror movie.

Reference: By Samantha Clayton 15 Aug 2013



Picture 2

Image source: [http://www.reverseshot.org/reviews/entry/1515/lord\\_rings\\_return\\_king](http://www.reverseshot.org/reviews/entry/1515/lord_rings_return_king)

## **2. Objectives and Methodology**

### **2.1. Objectives:**

The purpose of this thesis is to cover about different techniques currently used in the field of CG and visual effects by giving a variety of examples from the movies and TV Advertisements. Thesis covers a project aimed at finding a solution for one of the computer graphics techniques. The practical goal of this study is to analyze using a practical example which new software is the most popular one (or more) among professionals.

### **2.2. Methodology:**

The history of visual effects and CGI, and how the development has changed the industry of cinematography will be studied and described in the first part of thesis. The method of digital compositing will be used for production of VFX in the second part of this thesis, in particular 2D and 3D digital compositing, by which are being added 2D and 3D elements into the Real video footage. There will be used all relevant standards of the software engineering and application software by Foundry and Adobe.

### 3. WHAT IS VFX DIGITAL COMPOSITING

Currently in VFX industry has lot of software but Here I have pick two compositing software which is most of the studios is using it currently. One is Node-based (Nuke) and another one is Layer-based (After Effects).



Digital Compositing, as we are going to be discussing it, tries mainly to deal with the manner of integrating images from a couple of sources into a single, seamless whole. While many of these methods practice to however images, we will be searching at equipment and methods which are useful and life like for massive sequences of snap shots as well. two in the first half of of this document, we will deal extra with the Science of Digital Compositing. On the 2<sup>nd</sup> part with some complicated topic and some technical deal with compositing.



Picture 3

Image source: <https://www.artofvfx.com/spider-man-far-from-home-jorn-groshans-vfx-supervisor-image-engine/>

Compositing is that the final step of the VFX pipeline. A proficient typesetter layers alongside several elements all through a method that produces them seem to naturally belong inside the identical area to allow you companion example: a production agency shoots a historical past (referred to as a plate) that contains a construct up the shut and a cityscape behind.

The Animator has animated a missile, and also the Effects creator has extra smoke effects related an explosion with constructing destruction.

Once this can be all rendered out, the typesetter layers the missile, smoke, explosion and building destruction into the shot, victimization matters like shade correction and z-depth to bring, Z-

depth is in actuality a black related white illustration of the depth of an object for the duration of a scene, and is pretty quintessential in compositing 3D components.

The typesetter could additionally be to blame of making complete worlds or merging worlds.

As a typesetter, you have received to be ready to acquire numerous one-of-a-kind tasks.

### 3.1 Digital compositing Pipeline

The visual effects pipeline has lot of benefits for every stages for film to add visual effects. The pipeline helps to organize every department, so that each artist knows their role, and a production can cross alongside inside the allocated timeline.

If you desire to work in VFX, you want to recognize each step of the visible consequences pipeline. Wherever your role sits within the pipeline, you must be familiar with each and every department's motive in order to create the pleasant and most efficient work. If your work is not executed with every step of the pipeline in mind, it can cause problems down the line and be sent back to you for redoing. This is very demanded in VFX and highly priced

In vfx compositing production pipeline application are came pretty late, this pipeline used to be get the proper track of the shots for example, what is the status of 3D animation, some effects, roto, matte paint, match move this all can be tracked through pipeline app. It is very time consuming and more effective.



Picture 4

Image source: <https://www.cgspectrum.edu.au/blog/the-visual-effects-pipeline/>

Through pipeline we will get approval from the creative director which is digital compositor can track elements and use it if its ready to comp it. And also track the machine and artist hours the artists doesn't need to go and meet everyone from different department, everything will be

available in the pipeline app. From post production pipeline will be have some basic and regular steps from the scratch. Below photo is explain about VFX pipeline steps.

Some Reference: <https://www.cgspectrum.edu.au/blog/the-visual-effects-pipeline/>

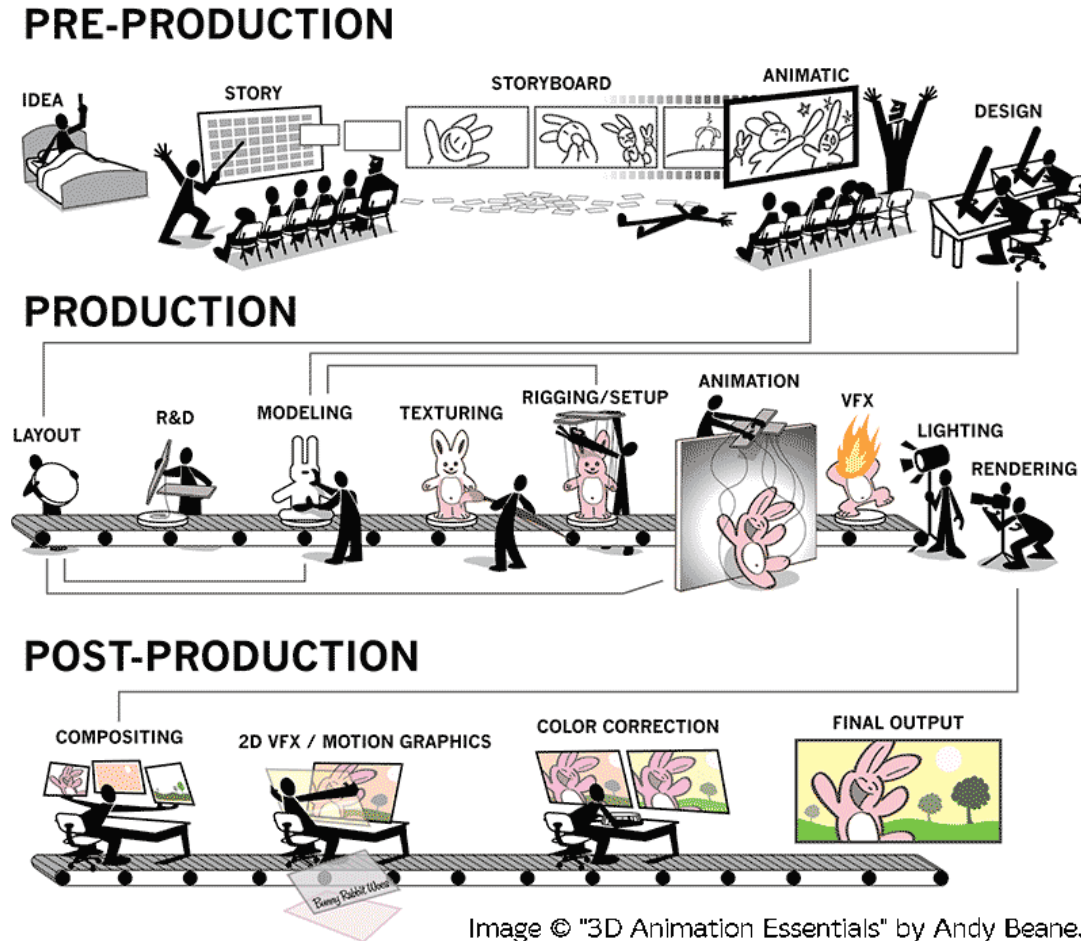


Image source: <http://vizualniefekty.cz/vfx-pipeline-filmove-triky/>



Pre-Production for VFX pipelines consists of:

- Research and Development (Idea and story)
- Pre-Visualization (Story board, animatic, design)

Production for VFX pipelines consists of:

- Layout
- R&D
- 3D Modelling
- Matte Painting
- Principal and Reference Photography

Post-Production for VFX pipelines consists of:

- Scene Preparation
  - Motion Tracking
  - Match-Moving
  - Rotoscoping
  - Color Keying/Correction
- Rigging
- Animation
- Effects/Simulations
- Texturing
- Lighting
- Composition (combining and blending all the footage, scene preparation data, matte paintings and VFX renders into one image)
- Motion graphics
- Grading (Color correction)

## 3.2. Node and Layered Based Compositing

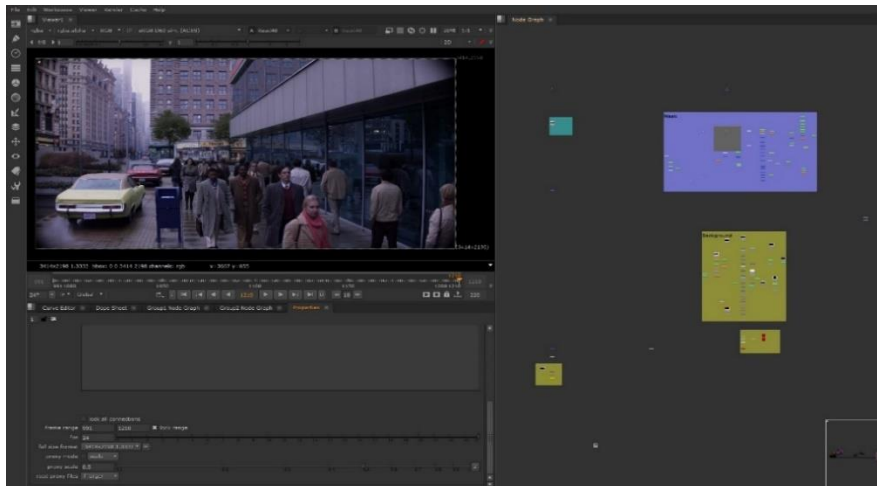
### Node-Based

Node-based software program software is dealing with the frequently elaborate compositing tasks through the use of functionality of linking together quite a few simple photograph operations. These operations are called as a “NODE” and at the same time they make up a schematic node-tree that appears same to a flowchart.



Picture 6

Node-based compositing represents associate whole composite as a tree graph, linking media objects and consequences in a very procedural map, intuitively parturition out the advance from offer enter to final output, and is in fact the way all compositing features internally cope with composites. This structure of compositing interface lets in impressive flexibility, which consist of the manageable to regulate the parameters of a beforehand photo processing step “in context” (while viewing the closing composite). Node-based compositing packages commonly deal with keyframing and time consequences poorly, as their workflow does no longer stem at as soon as from a timeline, as do layer-based compositing packages. Software which consists of a node primarily based totally interface encompass Apple Shake, Blender, Eyeon Fusion, and The Foundry’s Nuke.



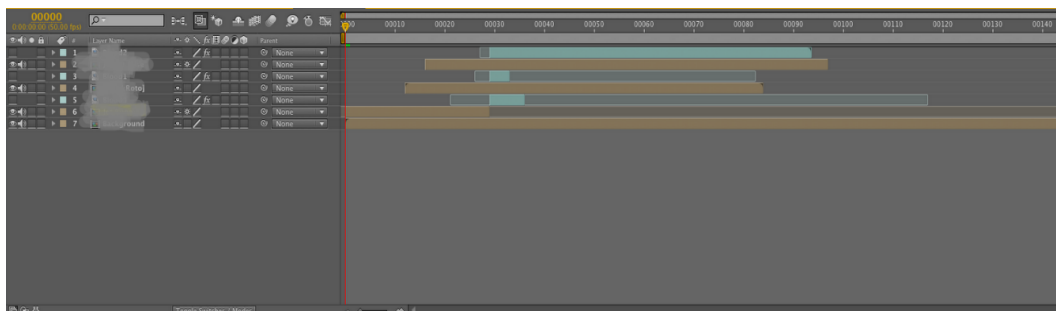
Picture 7

Image courtesy from PFX studio.

Reference: <https://sristi19.wordpress.com/2014/04/24/layer-vs-node-based-software/>

### Layer Based:

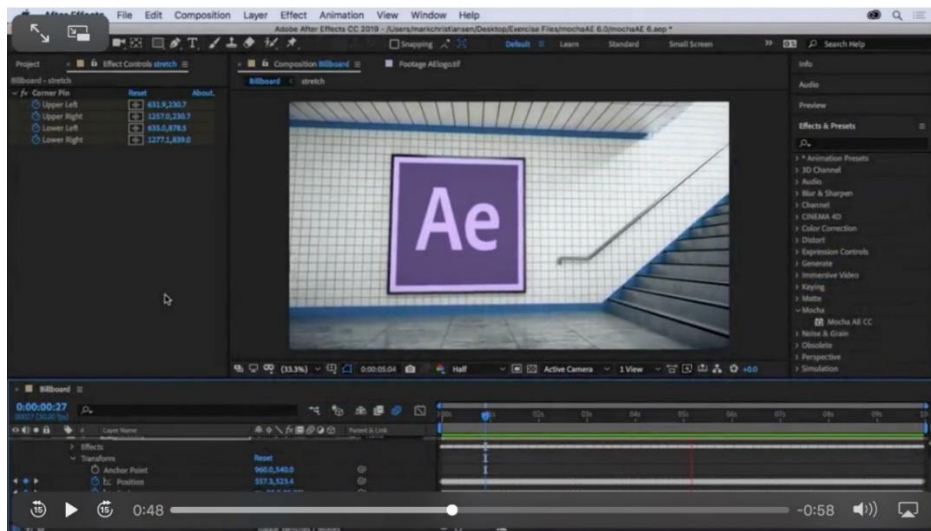
Layer based Vfx comp appear all objects in an exceedingly compositing the layer separately among a timeline, every with its terribly private timing, all effects and key frame. Layer all stacked one by one, in any preferred order; the layer of the bottom, many instances rendered as a base in the resultant images are rendered in final images, each and every greater layer being step by step rendered on pinnacle of the till now layers are composited, closing application transferring upward until all layers rendered.



Picture 8

The particular graphical user interface structure paradigm utilized by the usage of means of some compositing programs is that the layer-based comp described with the useful resource of Associate in Nursing example from Adobe when Effects in Image. This theoretical part of the comp workflow places on showing the timeline the temporal order within the difference no of footages, even so pictures, and animations within the shot.

Node-based comp artists having the equal type of manipulate over the temporal arrangement of animation and footages, however the temporal arrangement knowledge is consider lesser essential and is doubled get rid off read till the creative person until calls. The compositor of with layer based, it's unremarkably the the forepart and pivot and it is the photograph process operations that are doubled away and out of read until the creative person will calls them. The occasion in Image suggests one amongst the QuickTime moving picture layers that has been “unfolded” to reveal the visual control and audio layers.



Picture 9

Image source: <https://www.provideocoalition.com/after-effects-news-2018-october-2/>

Reference: <https://srusti19.wordpress.com/2014/04/24/layer-vs-node-based-software/>

#### 4. VFX COMPOSITING OPERATIONS

Different vary of compositing operations we have, some compositing solely we are deal with two layers which is very simple one and additionally there is multi-layer compositing which capacity we are going to work with a couple of layers such as lot of mattepaint 2D layers. Then additionally we have to work with multi omit 3D layer compositing which is the whole thing created from 3D software program and then do compositing with multi passes. For each operation we have to use exclusive tools.

## 4.1. Rotoscoping.

Always comes to skip that a personality or things of objects that used to be no longer shot on blue display screen desires some reason to be remoted for, maybe to composite some issue at the again of it or may additionally be grant it a awesome coloration correction or different treatment. This state of affairs sometimes need to make mask without using benefit of a blue screen, so the matte have to be masked, which workable it is drawn with by hand, body by using frame. This is a gradual and labor-intensive solution, however is often the completely solution. Even a blue screen shot will occasionally require rotoscoping if it used to be once now no longer photographed well and a specific matte can't be extracted.



Picture 10

Reference from: "Compositing Visual Effects: Essentials for the Aspiring Artist"-Steve wright compositing tutorial 2008

All compositing packages visually have some masking to do but some has more than expected others. There are additionally applications reachable that specialize in simply rotoscoping. Every single frame of the photograph is to put on the display and the artist should do roto and trace the outline round the outer edges of the character. After masked with roto the artist should do render with alpha to use for compositors and grader, above image for an example. large vfx studios having the separate department for roto, from the roto artist will be new junior compositors according to the experience.

## 4.2. Set extension

The actors to be viewed standing within the place of the front on the earth Mungo if you appreciated, you may additionally additionally not choose intent on pay the cash to assemble the total Palace of the exterior. higher to gather a small piece in the film set extension, neighborhood the Genius in it, set later after prolonging the utilization of CGI after you like an outsized shot. For this tiny part of arts digital, film is digitally into the laptop computer and also the CGI individuals construct a 3D mannequin palace in line important film pictures and its digicam perspective. There would possibly even be a digicam bypass in the continue to be CGI artists will do action cautiously music and match; then again eventually, the stay movement and the set in CGI ought to be color corrected after compositing to suit flawlessly. Reference



Picture 11

Reference from: “Compositing Visual Effects: Essentials for the Aspiring Artist”-Steve wright compositing tutorial 2008

Above Image may be a typical event explains about set extension however they'll even be utilized outer of set locality shot. The one-of-a-kind snap shots captures the longer-term soldier on foot aboard AN in the other case little and boring scrap pit. the middle photograph suggests the set extension hassle that was as presently as soon as AN all CGI metropolis with smoke and calculation of distance via a effects with particles and a sky from the mattepaint. the following composite suggests all factors composited jointly and matched with color to combination precise.

Another Example for set extension which is want to be replaces the green display screen and with some background.

“Reference: Digital Compositing for Film and Video (Focal Press Visual Effects and Animation), By Steve Wright”



Picture 12

*The movie name is Gabbar. Image Courtesy from Reliance Media works Studios.*

See the large difficulty in creating an endeavor to form this shot black ball the usage of vfx compositing on the set extension. you'd prefer to find an area where they had trash space from real ground road should be fine to seem and accustomed be (unhappily) at time on fire. you'd then got to anticipate the acceptable time of day to urge the time of sky and in shooting spot, equipped is incredibly high-ticket. If such a locality have to be compelled to even be found, you'd then got to fly the whole crew out there. This quantities to a awfully luxurious if not virtually out of the question production arrange. Instead, the producer exactly designated to try and do a collection extension. The trash pit was once once uncomplicated to find and shut at hand. Drove to the crew region in entirely half of associate hour. Once the film accustomed be digitally, the computer graphics integrated take branch and manipulate the historic past metropolis and effects of the smokes, at constant time because the mattepaint artist created the sky painting. once all accustomed be as presently as prepared, the digital typographer took all four elements: Raw images, Set extension from CGI, smoke effects, and paint, then composition them along and then graded to jazz band naturally. Not altogether was once this a approach tons less costly, but the creator received accurately the scene he needed. CGI and compositing will give invisible VFX scene and very less expensive then physically doing set extension.

“Reference from: “Compositing Visual Effects: Essentials for the Aspiring Artist”-Steve wright compositing tutorial 2008”

“Digital Compositing for Film and Video (Focal Press Visual Effects and Animation), By Steve Wright”

### 4.3. Keying (Chroma Keying)

Chroma keying used for removing inexperienced screen and blue display from pictures of film. Lot of chroma key tools are on hand from Node based totally software program and Layer based totally software. Keyers are very useful to get very unique mask from input. For example. Hair details, some movement blur and etc.



Picture 13

Image Courtesy from Reliance Media works Studios.

Chroma key a way for intermixture 2 pics or frames along, in which usually one color from one picture is eliminated (or created transparent), revealing another picture at the back of it. The approach is moreover cited with the aid of one-of-a-kind names, greenscreen, blue-screen, color keying and color-separation overlay. Now used extensively inside the screenland for computer pix

You need to shoot your animation against a inexperienced or blue screen. The display must be brilliant and a ordinary color.

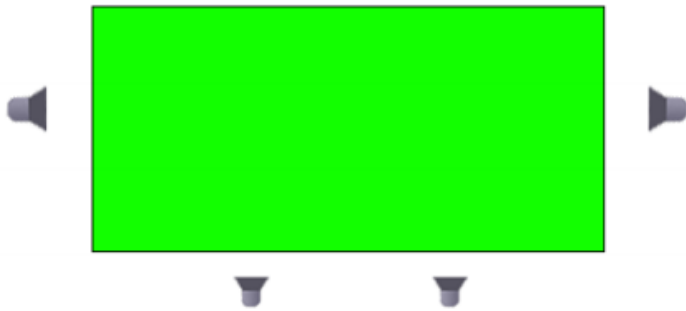
- The scene needs to be lit, any shadows on the historical past can manufacture a negative chroma key.
- each clip you shoot will have a unique image for its background.
- pictures used for the historical past ought to be as high a top fantastic as doable.
- Shoot each scene of your animation as separate clips

Chroma Keying Techniques.



This part suggests the techniques to set up a green display (cheaply if necessary) and how to use it in video productions. This part includes:

- studio set planning
- Green display fabric
- Lighting the inexperienced screen Incorporating inexperienced display screen pictures into the movies trendy inexperienced display method, and it is crucial to develop the device primarily available based resources . While putting up the screen, the following factors are considered.
- The shade and lighting of the green screen needs to be as even as possible.
- There no longer be anything in the foreground (i.e. section of the subjects) which is the same coloration as the green display screen.
- Use a strong material such as cardboard or wood, painted green.
- Use bendy or spongy cloth.
- Use some type of fabric



Picture 14

Article from: <https://motionwavetips.blogspot.com/>

Reference:

*Compositing Visual Effects*

*Essentials for the Aspiring Artist*

*Steve Wright*

#### 4.4. 2D compositing.

Today VFX digital compositing visual results are entertaining all over enterprise. To be using in Films, Television shows, and commercials and growing all the time. Even will normal drama film story have visual effects like comedy and love story movies. However, there need show something which can't do it while filming and replace or add something to the scene according to the story. That is the brief all about what visual should outcomes—adding pictures or removing pictures which they needed or don't needed on the visuals. VFX compositing is main key role of visual graphics .



**Picture 15** Movie name is Kadal Tamil movie. Image Courtesy from Reliance Media works Studios.

Here I have used two-layer 2D compositing from the left is Input and right is output. The main goal was this shot has to change to sea scene which is filmed from the river so this shot has lot of camera shaking and totally different sun light. The shot is stabilized, changed the sky and Graded.

2D Compositing is that the combination of visible components from different footages into single footage, typically to make the phantasm that each and every one those components rectangular measure elements of a comparable scene. Live action capturing for compositing is multifariously referred to as "chroma key", "blue screen", "green screen" and alternative names.



Picture 16: T- mobile Advertisement Czech.



Picture 17: Image Courtesy PFX studio. Prague

Visual Effects are the build or modification of pictures, on the sets where exclusive results are matters performed, some of the photographs and some mini set. In different words, visual outcomes specifically manipulate images. Since manipulating photos is exceptional completed with workstation, choice from the tool, so the job is acknowledged as a compositor.

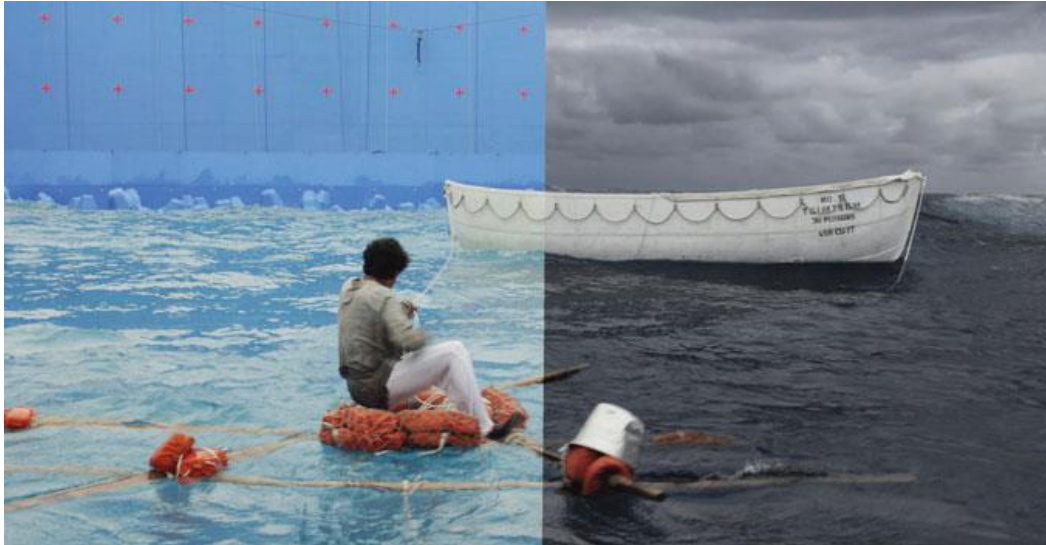
#### **4.5. 3D CGI Live Action Compositing**

Whenever we get CGI elements from 3D department, someone needs to be composite the shot. This section, Here we will see three type step of familiar CGI compositing.

1<sup>st</sup> have to place the all CGI elements in to the scene according to the scene.

2<sup>nd</sup> , this will take a appear on the set extension how should like in filmmaking ( reality).

3rd, we will add to projection on the tracked camera which is received from specialized match move software and place it or from Nuke camera track (using by model builder).



Picture 18

Image source: <http://www.cgw.com/Publications/CGW/2013/Volume-36-Issue-3-Mar-Apr-2013-/Going-Green.aspx>

Nowadays VFX creations are far past that can create jets and ships and dinosaurs. It possibly to create most extraordinary realistic scenes in compositing. In beyond the more things like water, boat, clouds and animals. Also even for the stunt scene most of the real heroes are not experienced so for we need to replace the face of the duplicate stunt man form the scene. The above example of the scene that filmed in swimming pool and needs to replace in the Ocean the movie name is “Life of Pi” here you can see the difference between how cinematographers filmed and what VFX digital artists done in the right of the Image.

#### **4.6. CGI Multi-Layer (multi pass) Compositing.**

Lighting pass is Associate in Nursing optionally available a part of multi-pass rendering, that provides flexibility and management to the compositing method. ... Passes will be rendered one at a time through rendering in any other case modified variations of your 3D scene, or some bundle will set them up mechanically or render over one ignore type directly

First let's outline some terms. it's commonly tough to hold close what somebody suggests that once they use sure tricks jargon as a end result of the phrases modification meanings reckoning on context, and commonly on who's exploitation them. Let's commence thereupon phrase: tricks. Technically, any image generated with the aid of a laptop, Fusion's rapid Noise, partner degree

animated character, or a particle system, is "computer graphics." Usually, though, as soon as somebody refers to CG or CGI, they mean the output of a 3d renderer. If a facility is cut up into 2nd and 3d departments, the 3d thing is commonly located because the CG Department.



Picture 19

Above Image is showing how CGI compositing looks like from the left and right. Image Courtesy RMW. India

Render a personal data of 1 picture in various layers (passes), a 3D creative person ought to 1st render the image or image sequence specifying that digital facts specially ought to be gift inside the render. searching on the 3D application or on a private preference, totally one of a kind layers and channels may also be preserve both in separate files or in mere one file. The file format which will embody superimposed records and utilized by way of all the important 3D and compositing software is .exr structure.

#### **4.7. Rig removal and Wire removal**

The primary comment created concerning wire elimination is “we’ll virtually paint it come in post.” then again portray out on a per frame foundation is incredibly difficult once carried out over a collection of frames, doubtless inflicting the pix to appear as if they're boiling. whereas a clone tool works nicely on one frame, Theia two lack of body to border brotherly love means that the ‘fix’ boils and will become terribly seen once the clip is complete. after all there area unit times that wires are exclusively catching the sunshine for a second, Â companion degreed thus associate degree isolated body continues to be really properly created by employing a guide painting, each by victimization scientific research or delicate painting. organic operation is way less complicated, thanks to the actual fact it clones now not sincerely color except grain or noise that's conjointly virtually perpetually a presented.



Picture 20

Image source: <https://www.sickchirpse.com/movies-without-special-effects/>

Rig Removal this technique depends on discovering a smooth frame from every other purpose inside the clip and pasting it over the best of the offensive rig or wire. This works high-quality on static cameras and does not work on folks in movement. Since the fill for the patch is static, issues ought to be created for grain and noise. varied hints will be accustomed resolve this, collectively with change of integrity or averaging many clean frames, lowering the grain/noise consequently it may be reintroduced at a later stage.



Picture 21

Image source: <https://fazy18.wordpress.com/2019/01/10/clean-plate-for-vfx/>

Another approach is to patch the wire and so use this new clip as a “reveal lower back to” clip in the course of a manual portray setting, or roto the patch again in with finer attention to element than the most patch. This has the advantage of commutation the minimum extent of the

established photograph however will go through if their square measure unique light-weight adjustments that the 'patch' isn't always matching and trailing in phrases of color.

## **4.8. Tracking Operations**

Tracking is that the method of mechanically finding some extent or collection of points from body to border in a very sequence, enabling the user to stabilize, tune to or solve object or digicam motion within the shot. the technique started out jointly motive trailing that can also stabilize an attempt or add matching movement to a composite. at present it involves superior 3D camera solutions and extends to optical glide – the technological know-how of trailing each constituent in a very shot. at some point of this series, we'll discover the records of trailing, the most tremendous methods in which to shoot fabric for trailing and provide an define of cutting-edge key product.

### **4.8.1. 2D point Tracker**

2D tracker will give tracking animation from the plate which you tracking. From that animation we can Track, Stabilize, match move, and remove jitter with this can able to relocate the image or sequence video and change the position. In that freely able to extract the expression to modify how we want. From the 2D tracker we can create track point one or more tracking points.

General steps for tracking images:

1. Connect the tracker node to which footage need to track
1. Use auto-tracking for simple tracks or place tracking anchors on features at keyframes in the image.
1. Calculate the tracking data.
1. Choose the tracking operation you want to perform- stabilize, Removw jitter, match-move, or etc.



Picture 22

Image source: <https://www.oreilly.com/library/view/nuke-101-professional/9780132639910/ch05.html>

#### 4.8.2. Planer Tracker

PlanarTracker to hint rigid objects and objects that deform barely at some point of the track. due to the fact the PlanarTracker tries to suit a plane to the item to be tracked, rigid objects get greater track consequences than objects that deform. For instance, a wall or a flat factor of partner degree object square measure smart planes, then again, you'll be in a position to conjointly get smart effects chase faces or individuals. It's conjointly crucial that the airplane you're chase has some texture which the aircraft isn't utterly obscured at any reason of the chase. chase surfaces while no longer texture and few choices to trace is not likely to furnish sensible results.

This is the general process for Planer tracking an image:

1. Create a Roto or Rotopaint node and use it to draw a Bezier structure round the plane you desire to trace. Your new shape's boundaries appear in purple within the Viewer, and a Bezier form object looks within the stroke/shape list. stays as a general roto shape till it is reborn into a music object.
2. If you're drawing quite one form, you'll be in a position to put together them within the stroke/shape list to inform PlanarTracker that they're completely extraordinary layers. Order your shapes from nearest to digital camera (top of the list) to furthest away (bottom of the list), and PlanarTracker mechanically holds out any tune layers greater than this one.



3. Make certain you're nonetheless on consistent frame as you want to draw the Bezier form.



Picture 23

Reference from Foundry / Planer tracker

[https://learn.foundry.com/nuke/content/comp\\_environment/planartracker/tracking\\_plane.html](https://learn.foundry.com/nuke/content/comp_environment/planartracker/tracking_plane.html)

#### 4.8.3. Camera Tracker (3D- Match move)

Nuke's CameraTracker node is meant to supply companion integrated digicam trailing or match-moving tool, that approves you to make a virtual digicam whose motion fits that of your unique camera. trailing digicam motion in an extraordinarily 2nd photos allow you to feature digital 3D objects to your 2d footage.

With the CameraTracker node, you can track the camera movement in 2D sequences or stills to create an animated 3D digital camera or a factor cloud and scene linked to the solve. You can mechanically tune features, add User Tracks or tracks from a Tracker node, masks out shifting objects the use of a Bezier or B-spline shape, and edit your tracks manually. CameraTracker can clear up the function of a number of kinds of cameras as nicely as clear up stereo sequences.

The following method is made public below, whether or not you propose to trace a sequence or a group of stills: Reference from foundry.

1. Connect the CameraTracker node to the sequence you wish to trace.
2. Mask out any areas of the image that will cause CameraTracker issues, like movement inside the scene or burn-in.

See Masking Out Regions of the Image.

3. If you are following stereoscopic or multi-view pictures, set the Principal read on the CameraTracker or Settings tabs.

See operating with Multi-View Scripts for additional data.

4. Set the camera parameters, like focal distance and Film Back Size, if they're famed.

These area unit represented below Setting Camera Parameters.

5. Set the supply dropdown to Sequence or Stills, and then:

See following in Stills Mode for additional data.

6. you'll conjointly place User Tracks to enhance tough solves, use a wholly manual following approach, or set 3D survey points.

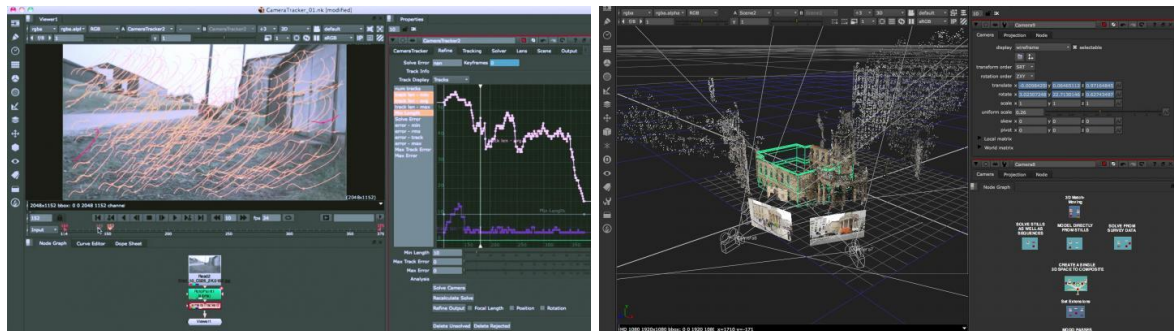
you'll use 3D survey points to tie your sequence to a famed 3D world, like those created victimization stills.

See operating with User Tracks for additional data.

7. Click Track to start following the sequence.

8. Solve the Camera position by clicking Solve and refine it, if necessary.

Reference: [from foundry – Camera tracker](#)



Picture 24

Image source: <https://www.foundry.com/products/nuke/features>

## **Match move**

An important and time-consuming mission for today's visual results gurus is the artwork of matchmoving and camera tracking literally matching the motion of the 3D digital digicam to that of its live-action counterpart. Although software program exists to function camera tracking, it is with the aid of no capacity an automatic task. A awesome deal of manual input is required to effectively tune a shot in 3D. Most present-day matchmoving software program programs have the functionality of incorporating measurement records into their mathematical digicam solvers. Indeed, most matchmoving tools advocate the use of these "constrained points" to help the algorithms in greater accurately deriving a result.

**Reference :** [The VES handbook of visual effects: industry standard VFX practices and procedures/edited by Jeffrey A. Okun, Susan Zwerman; co-editors, Scott Squires, Toni Pace Carstensen, Kevin Rafferty. ISBN: 978-0-240-81242-7](#)

## **5. Effects**

Compositing software program has lot of consequences equipment however if you compare with the Node and layer-based software, layer-based software program has lot equipment for consequences in particular After results from Adobe. Below some universal effect's tools from compositing software.

### **5.1. Noise and Grain**

Grain matching is very important in final compositing which is we are using multiple plates from main live action plate, as properly as these that were digitally generated, show up as if they had been shot on a comparable film stock - is usually one amongst the last steps in accomplishing a convincing integration of all of a composite's parts. Nuke affords effects for synthetically making grain and for reading in practically created grain (grain derived from proper movie stock).



An example of applying grain to an image: Grainless image.

An example of applying grain to an image: Grained image.

Picture 25

Image reference from Foundry- Grain.



Picture 26: Tool Interface for matching grain.

## 5.2. Lens Flare and effect

Latest Nuke has some Lens flare by default and some third-party lens flare plugins available from FX markets.

The magnificent element involving lens flare overlays is that they're well matched with any nonlinear writing or compositing code embraces has that features mix mode picks (every writing program ought to consist of some version of this). However, we have a tendency to created them generally with Adobe Premiere professional, Adobe when Effects, and movie expert in mind.

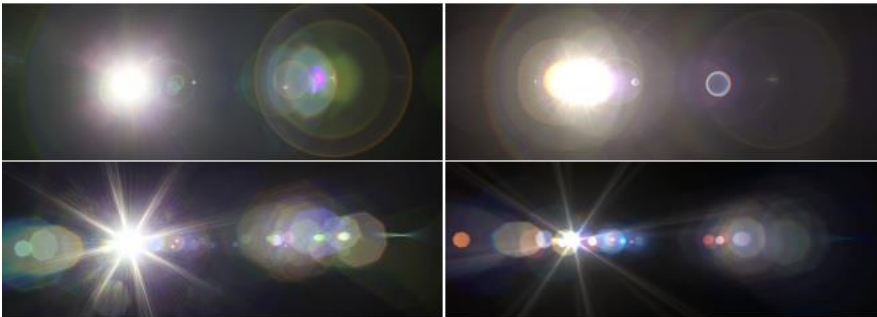
There are several Lens Flare gizmos that you can download from Nukepedia:

- Flare Factory Plus
- Personal website of Paul Hogan, author of Flare Factory Plus
- AutoFlare  
Personal website of Vincent Wauters, author of AutoFlare



Picture 27

Image source: <https://www.premiumbeat.com/blog/17-free-anamorphic-lens-flares/>



Picture 28

Reference: Physically Based Real-Time Lens Flare Rendering

### 5.3. Vignette effect

In VFX compositing software has some own Vignette effects tools and also lot of third-party plugins and Gizmos are available from FX market.

how to draw greater attention to your topics with soft, natural-looking vignettes in Compositing! Follow alongside as we edit a video using Curves Adjustment Layers to brighten up the areas that count number most, whilst darkening the corners and edges. Vignettes can be a effective tool when used successfully and this is the excellent way to practice them in Nuke or After Effects Compositing.



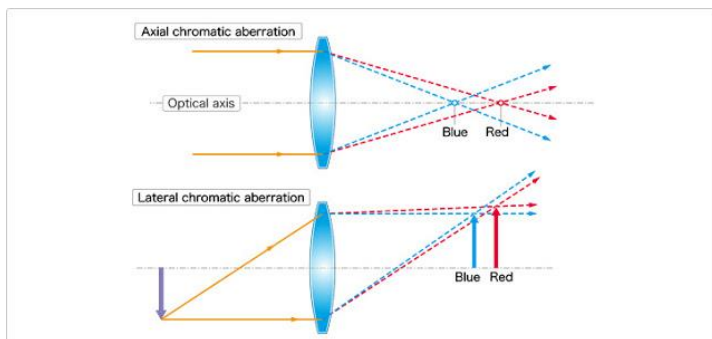
Picture 29

Image source: <https://filmora.wondershare.com/video-editing-tips/add-vignette-effect-to-video.html>

Our eyes place unit naturally drawn to lighter areas in a very image. And vignettes work with the aid of brightening the spot wherever you want viewers to show up whereas slightly darkening everything else. whereas it sounds straightforward, it is difficult to tug off whilst now not the end result looking unnatural. The key to an fantastic vignette is creating it tender and refined. Remember, little changes will have an large influence on your remaining pics.

#### 5.4. Chromatic Aberration

Chromatic aberration, additionally known as “color fringing” or “purple fringing”, ought to be a common optical downside that takes place as soon as a lens is both unable to carry all wavelengths of coloration to an equivalent focal plane, and/or once wavelengths of coloration are situated at totally one-of-a-kind positions within the focal plane.



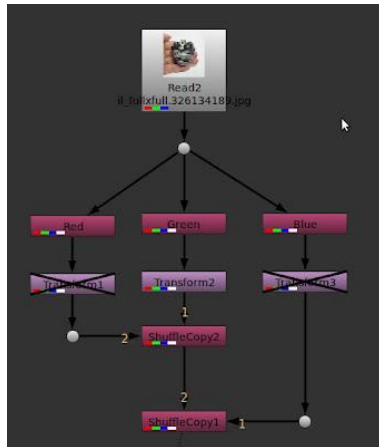
Picture 30

Image source: <https://satheeshnuketutorials.blogspot.com/2012/08/chromatic-aberration.html>

Chromatic aberration is brought on by means of lens dispersion, with definitely shades of sunshine motion at one of a kind speeds whereas passing through a lens. As a result, the

photograph will seem to be blurred or substantial colored edges (red, green, blue, yellow, purple, magenta) will appear around objects, in particular in high-contrast things.

Create chromatic aberration in Nuke is actually easy one. "Transform" "TransformMasked" and "Lens distortion" nodes will help you to create chromatic aberration effect.



Picture 31

Image source: <https://satheeshnuketutorials.blogspot.com/2012/08/chromatic-aberration.html>



Picture 32

Image source: <http://mayazest.blogspot.com/2013/08/creating-chromatic-aberration-in-after.html>

## 5.5. Lens Distortion

Lens distortion will create compositing work more challenging as a end result of the traits of the lens will purpose areas of the footage to warp, growing right placement of property problematic. a approach around this downside is to undistort your plate earlier than commencing work on a comp so redistort and merge entirely the VFX work to supply the remaining compositing.



The original plate

The undistorted plate and comp

Picture 33

Reference: Learn Foundry - Lens distortion

It's a smart plan to shoot grids with an equal lens you utilize create your footage as this make estimating distortion easier.

If you've got got the lens properties, like distance and gadget Size, and a grid shot with an equivalent lens you will discover this method abundant much less painful.

Nuke's Lens Distortion node allows you to undistort or distort a picture in preserving with many radial distortion models that ship with Nuke or a custom mannequin you define yourself.

you'll be capable to calculate the warp to be used on the input picture or output the warp to accomplice STmap to be used someplace else within the script.

Here's a quick overview of the workflow:

1. scan in companion enter sequence, connect it to a LensDistortion node (Transform & LensDistortion), and connect the output to a Viewer.
2. If you have acquired a grid shot victimization identical lens as your sequence, use Grid Detection to calculate the distortion, then apply the warp to your sequence.

See Estimating Lens Distortion employing a Grid and Removing Lens Distortion from a image for extra data.

3. If you are doing not have a grid, or Grid Detection did not work, draw choices and features manually to estimate distortion and undistort the sequence.

See Estimating and Removing Lens Distortion Victimization Lines for extra data.





The comp after redistortion

Picture 34: Reference: learn Foundry – Lens Distortion

## 5.6. Spherical Aberration

Spherical aberration should be a type of aberration found in optical systems that use components with spherical surfaces.

Lenses and bowed mirrors are most regularly created with surfaces that are spherical, as a result of this form is easier to create than non-spherical curved surfaces.

Light rays that strike a spherical surface off-center are refracted or reflected differently than those that strike close to the center.

This deviation reduces the focus of light rays made with the aid of optical systems.



Picture 35

Image source: <https://www.laserfocusworld.com/sponsored/zemax/article/16571887/correcting-six-common-types-of-lens-aberrations>

## 5.7. Depth of Field

One of the main fundamental visible cues once capturing for photo-real, is depth of field. There location unit a couple of things to think about if you are attempting to mimic the lens outcomes of a digicam as soon as it entails DOF, distance, sensing issue dimension (or movie back size on the computer), and bokeh all create a distinction within the image. having the potential to simulate physically correct depth of discipline turns into necessary.

Nuke printer Jed Smith affords some insights into simulating bodily right depth of discipline in an notably composite. Jed talks through the learner it really is basic lens physics, together with nomenclature, and conjointly consists of a check out the variables which will have an impact on the depth of area behavior in an notably lens. For example, below Images



Focal point widget under the green sign.



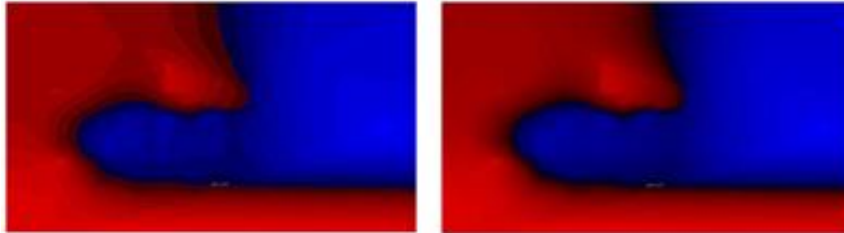
Focal point widget near the cars in the distance.

Picture 36: Ref: Learn Foundry– Depth of field

Jed has engineered one or two of equipment for Nuke which will assist you visualize and simulate physically right depth of field. Optical ZDefocus helps to manage the circle of confusion dimension supported actual lens pure arithmetic using a commonplace depth of area equation.

Another tool, DOF Calc, allows you to clearly visually the close to and a lot dying restrict for DOF in an pretty given lens distance, aperture, film back size, and focus distance.

Jed covers depth channels and the way they work among Nuke, and the way to use his 2 tools to simulate right DOF. positively honestly awesome to see it.



Depth layers set to 10.

Depth layers set to 50.

Picture 37

Ref: Foundry learning – Depth of field

Here's a fast summary of the workflow:

1. produce a ZDefocus node and connect it to your script.

See Connecting ZDefocus.

2. modify the blur settings.

See Adjusting the Blur Settings.

3. modify the form of any out-of-focus highlights.

See Adjusting the form of Out-of-Focus Highlights.

4. If necessary, enhance the highlights to create lens form effects additional visible.

See Enhancing the Out-of-Focus Highlights.

5. If necessary, mask the blur impact.

See Masking the Blur impact.

## 5.8 Warping and Morphing

Warping is the amazing thing method in visual effects. So Imaging if you have one image which is on rubber and you want to stretch it as you like. that particular image you can push or pull as you like to change it. This can be used when you need to fix it with some other elements its not easy that you only need to adjust the corners. Below example shows how to be warped image to surface according to the main object. This warped image can be animated with main object if needed.



Picture 38

Reference from: “Compositing Visual Effects: Essentials for the Aspiring Artist”-Steve wright compositing tutorial 2008

Morphs can be another amazing method. This method is warping two images or videos to morphing, the digital artist can morph two image from one image to another image which transforming one face to another face, this is digital magic. This magic can do by the digital compositor. Now most of the compositing software’s has warping and morphing tools. Also, there are lot of third party plugins from internet if tools from compositing software doesn’t work properly.

“Reference: [Compositing Visual Effects Essentials for the Aspiring Artist Steve Wright 2008](#)”

“[Digital Compositing for Film and Video \(Focal Press Visual Effects and Animation\), By Steve Wright](#)”

## 6. PRACTICAL

### **Project Description:**

In the Practical part, I did one composite shot and will be discussed step by step and overviewed. For this compositing shot I have used Nuke Software from Foundry.

Use some reference from 1960s photographs and make some changes and get high quality background image from matte paint.

Simulate some of the environment smoke in the 3D software (Maya, Houdini and etc.) Render the 3D elements.

Acquire 3D assets to be composited alongside the environment.

Import 2D and 3D assets to the composition pipeline.

Collect all necessary assets from 2D and 3D, composite along with all generated assets.

Projecting in the 3D of Nuke 3D space which we have already tracked camera.

Here the link for one of the example of VFX compositing from PFX studio.

This film name is “JAN PALACH” its Czech film about the history of Jan Palach in 1960s who was against communist and freedom fighter and he died in 1969.



*Before*

*After*

Video link: <https://www.youtube.com/watch?v=34Ueo37VkYM&feature=youtu.be>

## 7. Results and Discussion

### Practical image 1

The Film name is Prazské Orgie is a Czech Film and English. The task was to replace the background, this scene was filmed in Prague, but the client wants to be like 1960s New York (America), so the task is we have to create the 1960s

New York background mattepaint and make a mask (Matte) and Track.

The process will be

Using Color space (Aces) (Nuke software)

Track – Camera tracker (Nuke software)

Background – Mattepaint (Using software is Adobe Photoshop)

Mask (Matte) - Rotopaint (Nuke software)

Finally process will be Grading which is done in (Baselight Software)



**Practical image 1**

Green screen used for to make mask for the characters, so from the chroma keying I can get very precise alpha for the characters hair and smoke and some precise details. Apart from green screen I have used roto tool to get mask for Walls and some streetlight which needs to be stay in the scene. To make mask 2D tracker has helped me lot to finish it in less time.

## Practical Image 2

Here I have made mask for the foreground; the mask means cut the foreground separately which part do you need to keep. To make mask in Nuke software have Rotopaint or Roto tool which is mainly using for making mask and Clean plate..



Practical image 2

## Practical Image 3

Here is the final output for the shot. After I finished mask then I have to do Camera tracking, CameraTrack will give us full 3D space projection so I can project background with many buildings and trees and ground in 3D space. 3D projection will give realistic looking feel (Check demo output video link). After Camera Tracking then I will get Background as a mattepaint done it in Photoshop software.



Practical image 3

I have Projected all buildings (separate buildings), trees and ground separately After I got mattepaint background for this scene. Also see the right side of the scene there are some

reflection on the buildings so in this case I have project both side real view and reflection on the building. More complication of this shot track because it has more lens distortion and different lighting from input footage.

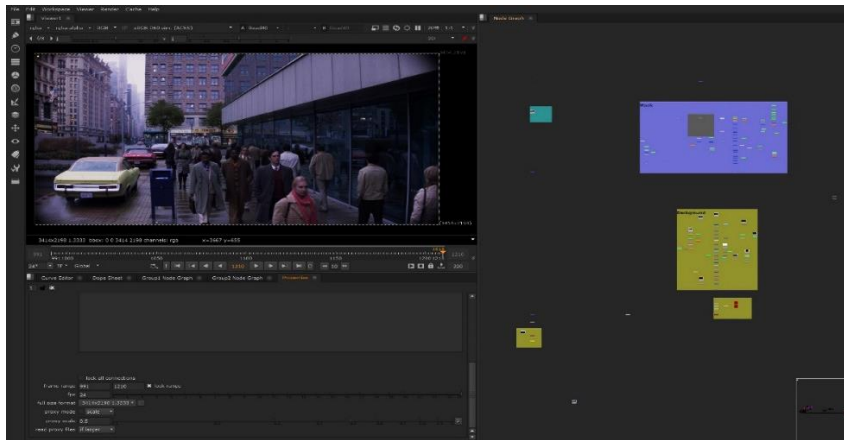
## Practical Image 4

Here I am showing how Nuke interface is and what are the tools I have used for this scene (Shot).

Left top is Viewer

Left bottom is Properties of tools

Right side is Node graph.



Practical image 4

## Step by Step

Using Software Nuke

1. Camera Tracking
2. Mask (Matte)
3. Create Background (Mattepaint)
4. Project mattepaint in 3D space
5. Matching Color with Foreground
6. Match Grain
7. Grading (Final Process)

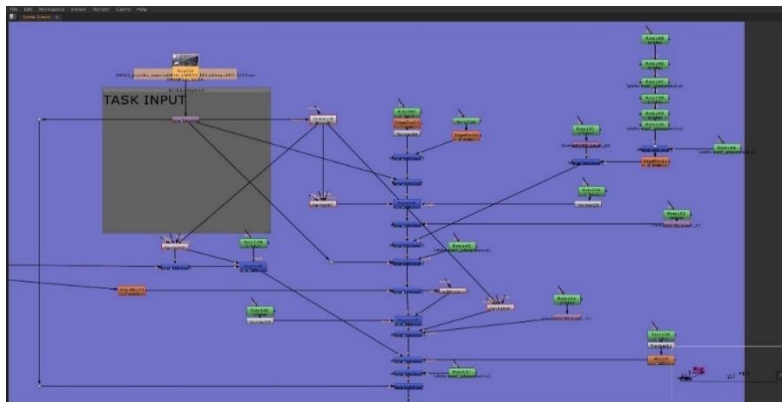


## Practical Image 5

Here I showing what are the tools I have used for to making Mask for this shot.

Rotoscoping is extremely pervasive in the world of digital compositing and is used in many visual effect's shots. I will show how rotoscoping works and develop an under-standing of the entire process of this shot.

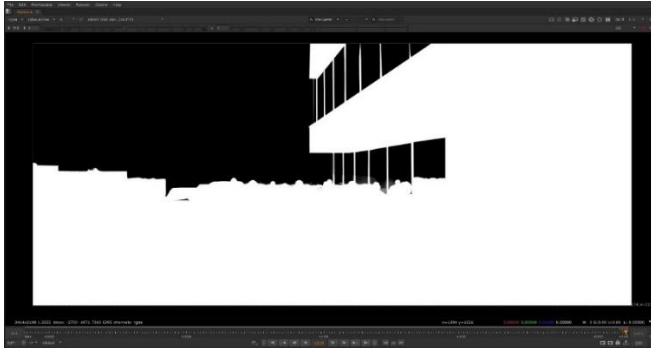
Green color nodes are Roto tool which is to make mask and here I have used some keylight node, this node uses for also do mask but this tool have some algorithms so Just I have to pick the color so then the color removed from the input so you don't need to make roto frame by frame and this tool have some adjustments so I can make some fine tuning to get proper mask.. Blue nodes are Merge node which is using to merge multiple mask and other nodes.



Practical image 5

## Practical Image 6

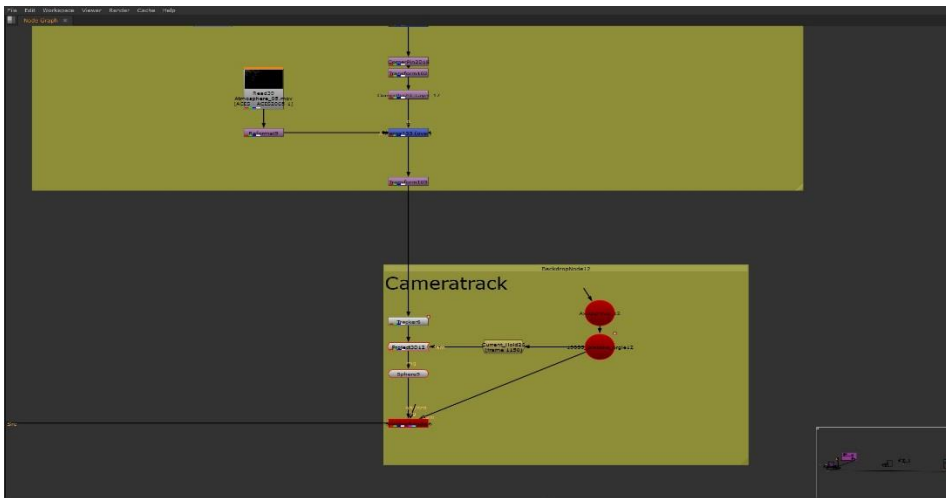
This is the output of Mask which done from above workflow. This mask I will use it for foreground. Our target will be the insufferable image 2 which provides a moving target that also changes shape frame-by-frame. Image shows the completed shape com-posed of splines with the many control points adjusted for slope, tension, and angle. The finished roto is shown in Image 6.



Practical image 6

### Practical Image 7

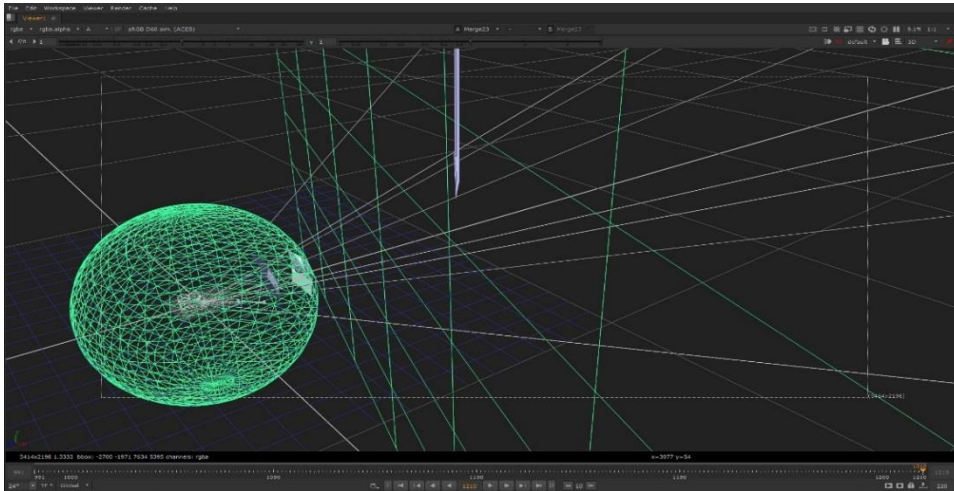
Here is screen shot of camera tracking tools from node graph. In this red color node is Camera which is I got from camera tracking. Here I have used it for 3D space projection of the background



Practical image 7

## Practical Image 8

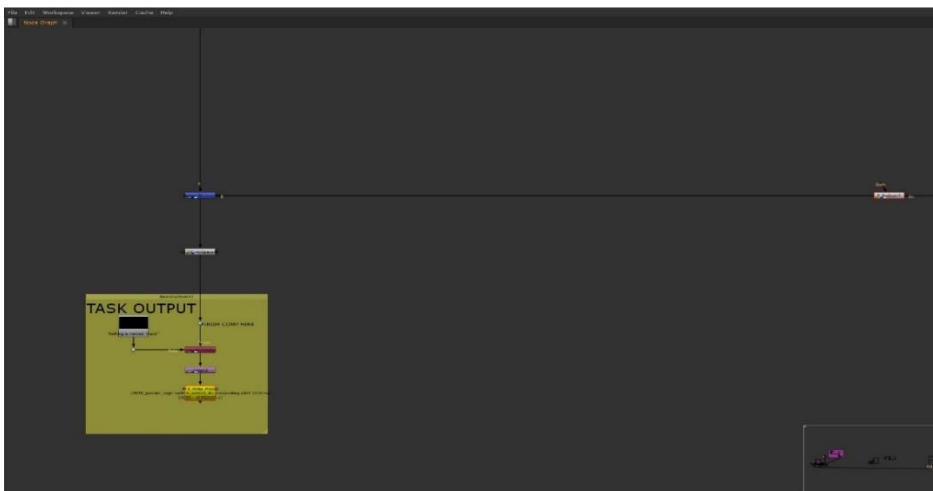
This screen shot is explained how 3D space is looks like and how I projected background, buildings, trees and Ground. Here I have used sphere for for the sky and Cards for the buildings and trees.



Practical image 8

## Practical Image 9

This screen shot of node graph is explain finally how I am rendering output, after merged with background and with blending I used Write node. Write node I have to select colorspace( for Example sRGB, Linear, Alexa, or Cineon) this shot I have used ACES colorspace and frame range( for example 1 to 100) and output file format ( for example .EXR, .DPX, .JPG, or .tiff) for this shot I have used .EXR format.



Practical image 9

In VFX postproduction most of the studios has own render farm or cloud rendering. Which is more time-consuming area of the CG field. Without render farm we need to render locally which is taking lot of time and machine power. Here the pipeline applications are more useful during render so we can monitor the shots render. Whenever I am finishing my shot, I just need hit the render button from the node after few minutes I will get notified from the pipeline if render is ready.

## Practical Image 10 and 11

Here after I finished compositing then I have to send this shot to Grading, this process is the final process in post-production.

See what the difference between before and after output Image.

### Before



Image 10

### After



Image 11

Above all reference from my practical part image courtesy from PFX studios 2019

Here is the video output link for above practical shot, In that I have explained before and after.

Video Link: <https://www.youtube.com/watch?v=4TpvXvsja5o&feature=youtu.be>

## 8. CONCLUSION:

In this thesis I made an overview about compositing software and developments. I made Digital compositing of one complicated shot which is used in movie and I have learned and worked with some default and new techniques in the VFX compositing of Computer graphics.

Nowadays visual effects are most important part of film making, all big blockbuster movies are made 80% of VFX scenes from the whole movie. Digital Compositing may want to be a powerful and extremely demanded craft. The requirement to shape a plausible phantasm on the display screen is an essential phase of fashionable intellectual imagery production. Always a lot of new special codes and new tools inventing from the technical team and more possibilities to have to make a lot of illusions from digital compositors, everyday growing of imagination of art directors and film directors concepts are cannot be dropped everyday every artist have to do many new techniques and make visual effects invisible. VFX markets growing every day.

VFX compositing is main player of computer graphics for films and games. Not totally will save workstation machine energy, deadline, money to firms and digital freelancing compositors, it increases the bounds of what concepts can do able to put into a very tight schedule. 3D application are dietary supplements of locality of the digital compositing, similarly, extra as gives compelling options for new innovative imaginary challenges.

From some extent of examine of associate innovative person, Digital compositing may want to be a captivating kind of art. it is associate impressive fusion of technical and imaginative skills. substitution backgrounds, getting rid of objects from a trial, integration splendid CG elements into sensible worlds, making delusion environments and completely enjoyable with new fun for the viewers – those vicinity has a lot of Challenges to deal with the aid of VFX Digital Compositor.

## 9. REFERENCES

Here I have mentioned some of the reference books, site, Articles and blogs which is helped me to get some reference for my thesis.

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## **10. APPENDIX**

List of Supplements...