Comparisons of Sculpting Efficiency Between Mudbox and ZBrush

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Comparisons of Sculpting Efficiency Between Mudbox and ZBrush

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Abstract

It is difficult to navigate throughout today's existing sculpting and modeling software. Industry drives the development in this area by “time versus quality.” It is difficult to know which software is the most suitable to learn for sculpting details, as well as which one is the most efficient for beginners. There are two software programs, Autodesk Mudbox and Pixologic ZBrush, which will be examined and reviewed for sculpting details, learning curve for beginners, and time efficiency in this research. The overall results displayed that ZBrush seems to be the better choice for more advanced modelers and artists, while Mudbox is a better choice for beginners and more technical modelers.

Keywords: Sculpting, modeling, 3D, 2.5D, base mesh, Autodesk Mudbox, Pixologic ZBrush.
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1 Introduction

Today, the variations of three-dimensional (3D) modeling and sculpting programs are many and the jungle grows thicker. It is difficult to know which software is the most suitable to learn when you are a beginner and do not know a single thing about the software. As a 3D artist, there are many programs to choose from, and when one wants to sculpt more detailed objects. There are two particular software that constantly are recommended; Autodesk Mudbox [1] and Pixologic ZBrush [2], two very similar software however very different.

The fact that these software are constantly brought up is not particularly strange since they both dominate the 3D entertainment and technology industry with their abilities to create realistic and believable sculpting results in the hands of aesthetic and great modelers and sculptors.

There are much more to both these software than simply modeling and sculpting, such as painting and rigging and many other various features. However in this thesis, there will be a major focus only on the modeling and sculpting features of both Autodesk Mudbox and Pixologic ZBrush.

1.1 Purpose

The purpose of this thesis and its research is to form a guide for artists and beginners of the software Autodesk Mudbox and Pixologic ZBrush. These guidelines works in the way that one will more easily be able to estimate which software that is best suited for the reader, as well as for getting a few tips and tricks, and basically, a simple crash course of how to use the software.

1.2 Aim

Each of these programs target different types/groups of users and focuses on the sculpting details for models and objects. Both Autodesk Mudbox and Pixologic ZBrush are obviously very popular in the industry and as well for private use. Therefore, both ought to be needed in one method or another. The question is which software is most suitable to learn for which type of user and/or project? The research topic that will be debated is; the efficiency of sculpting detailing on the models that can be created in a specific amount of time; time versus quality.

The plan is to estimate the process of time and quality for Autodesk Mudbox and Pixologic ZBrush by choosing a concept art for a character or an object and model it as similar as possible with each of these software programs. Then, the strategy is to compare results by how much time each of them took to model and the amount of the sculpting detailing that could be accomplished. A list will be created of all the pros
and cons of both software programs.

Since both of them are more sculpting programs than modeling programs, I am counting on that I might have to use supplement software, such as Autodesk Maya 2012 for the base mesh modeling.

1.3 Questions

As the industry of 3D modeling and animation expands, the expectations of the software products grow, as well as its standards, and as they do, more and more individuals not known to the business world would like to try out the software on their own, however which one should they select?

- Can the same level of details with sculpting be obtained from both software programs?
- Which software is the most suited for sculpting details when time is a factor; "time versus quality?"
- Which software is the most suitable or efficient for different users and/or projects?

2 Theoretical Background

What does both these software, Mudbox and ZBrush, do which is so different to all the other existing modeling software? There are already quite a few software that focus on everything from base mesh modeling, more detailed modeling, as well for texturing, rigging, skinning, and animation. Therefore, why are these two software needed? What makes them different from software that can provide everything that is needed for a production ready animation or game character? Since other software focus on everything, they cannot provide the extreme detailing these two can, and that in a huge reduction of time in comparison. For example, one brush stroke in Maya or Mudbox can be equalized to working for many minutes with only a tenfold of vertices, in other words, the brush easily manipulates many points on the model at once, instead of having to adjust every single one of them separately.

One feature that I found out early about both software programs is that they are very hard to handle without a Wacom board or any other pressure sensitive hardware. A Wacom board is far more recommended than working with just an ordinary mouse, even though it is possible to sculpt with one. And with that in mind, I will do my research in both programs mostly using a Wacom board.

Both software have many similarities and are built on the same basic principles, to add as many sculpting details to a model as the Artist needs. They both have many brushes to provide more artistic freedom in sculpting, as well as allowing for the reduction of
time. In this section, I will bring up the basic information about both software programs, as well as their designers and what the software has been used for in the industry.

2.1 3D Sculpting in the Industry

The creators of Computer Graphics (CG) content are very good at quickly taking on the latest discoveries in graphic- and high-performance computing hardware. There are multiple reasons why CG professionals of today, product designers, animators and architects alike, do this, especially during tight schedules and deadlines go get the desired end result without compromising with the quality.

The factors “time versus quality” constantly picks on the creators of both hardware platforms and digital content despite both money and effort put into them.

A very time consuming process, that has the requirements of both multiple resources and computer systems, are high quality 3D rendering of (CG) Computer Graphics. Rendering is an important and necessary part of digital content creation (DCC); and at various intervals it is a part that professionals must undertake such as post- and pre-production.

It is near to impossible to reach a perfect visual result the first time. Therefore multiple renders throughout the work in progress is required to be able to gradually determine how the final render result will look like. Throughout the production process the artist repeatedly will adjust materials, lighting, cameras and an immense number of other elements for the product to reflect the creative vision of the director. Valuable time is consumed during each “modify-review-render” cycle, with complex, advanced or major changes in the project; the more time will be lost to the process.

The quality is very often being held back and scaled down by the artist, compromising the look of the final product due to their software, hardware as well for their workflow and their limitation and foremost to save time in rendering.

Compromises has been forced upon artists, affecting both their craft and final work due to tight schedules and cost constrains of projects, all because of lack of a rendering solution that is capable of real-time results. [3]
As the article “Virtual 3D sculpting” [4] explains, there are ways to get better results of detailing, not only by the brushes used in the software. Many of the deformation systems that have been developed so far rely heavily on the skill of the user and on his/hers ability to use the traditional input devices, such as mouse and keyboard, in order to manipulate the system. Most of the methods developed today focuses on the deforming of free-form surfaces by, one by one, either modifying the sample points or control points. When these methods are applied to embroiled surfaces with large numbers of control points, it becomes slow and wearisome. Furthermore, these deformation systems work with traditional input devices such as mice, joysticks and keyboards.

These devices have only the freedom of one to three degrees and are often inappropriate for artistic sculpting with complicated deformations and modeling. It is desirable to be able to discover every level of the freedom of the human hand through sensing finger motions individually, within the virtual world, by facilitating more intuitive interactions. Therefore, the tool best suited for deformations and modifications for computer-based models, could in fact be the glove device, since it is the most natural interactive input tool with sensors to measure every movement on each finger. [4] However, until this product is fully developed and price worthy enough for common modelers to use, art pads are the closest one can come to the best modeling and sculpting hardware tool in both quality and price.

3D Computer Graphics has expanded a lot over the years and today it is used in a wide variety of areas and some notable expanding areas are: painting virtual images, viewing the activity within multiplayer games, treating phobias, designing medical implants, training for construction procedures, exploring scientific models, and delivering telepresence and teleimmersion. [5] Needless to say, 3D Computer Graphics is a growing industry and I believe it will continue to grow in the foreseeable future.

2.2 Mudbox

Autodesk Mudbox is a 3D software which allows the user to digitally sculpt and paint with the freedom to create production ready 3D models. With its camera manipulation, it offers a 360 degree view of the subject and is very similar to the workflow of Autodesk Maya. It also provides a real time environment for perfect evaluation of the model during creation.

The software uses stencil and brush based working tools for the creation of ultrarealistic 3D characters, props and environments for modeling and sculpting. It is designed by professional artists from the film, television, game and design industries and aims at providing the sensation of working with clay.

Mudbox was created by Skymatter [3] and is currently developed by Autodesk. The software was first used in the production of the remake of film producer Peter Jacksons King Kong, 2005 [4] and later in his movie Avatar 2009 [5] where Mudbox was responsible for many of its digital sculpting. The software has also been used in movies such as The Lord of the Rings [4], Toy Story 3 [6] Nine [7], as well as the
Clash of the Titans [8]. It was also used in Games, such as Prototype 2 and Deus Ex [9]. Avatar, Lord of the Rings, Clash of the Titans, Prototype2 images can be seen in Figure 1.

![Figure 1. Skymatter digital sculpting used in movies and game.](image1)

2.3 ZBrush

Pixologic ZBrush is a digital sculpting, modeling and painting program with tools for high definition detailed onto 3D geometry and was introduced in 1999 and was presented with the name SIGGWRAP [10]. ZBrush is a bit different compared to other 3D software since the model can only be seen from one point of view, even though the object geometry is 3D. Therefore, ZBrush has been chosen to be called a 2.5D program. It has the ability to sculpt up to a billion polygons [11]. Therefore, only your imagination will set your limitations.

ZBrush is a digital sculpting and painting program that has revolutionized the 3D industry with its powerful features and intuitive workflows. Built within an elegant interface, ZBrush offers the world’s most advanced tools for today’s digital artists. With an arsenal of features that have been developed with usability in mind, ZBrush creates a user experience that feels incredibly natural while simultaneously inspiring the artist within [12].

Just as Mudbox, ZBrush was also used in the productions of Avatar and Clash of the Titans. It was also used in hit movies such as the Pirates of the Caribbean trilogy, Alice in Wonderland, Lord of the Rings trilogy, Transformers, 300 and many more [13]. It has also been used in the game industry for games such as Little Big Planet, Assassins Creed 1 and 2, Borderlands, Aeon and World of Warcraft [13]. Pirates of the Caribbean, Alice in Wonderland, 300, and Little Big Planet are shown in the images below in Figure 2.

![Figure 2. Pixologic ZBrush digital sculpting used in movies and games.](image2)
3 Methods

The plan is to estimate the process of time and quality for Autodesk Mudbox and Pixologic ZBrush by choosing a concept art for a character or an object and model it, as similar as possible with each of these software programs. Then, the plan is to compare results by how much time each of them took to model and the amount of detailing that could be accomplished. A list will be created of all the pros and cons of both software programs that I will encounter.

I will also discuss the process of learning each software program and put that into the estimated time. The result will not be aiming to tell which one is the best software over all but rather explaining the actual differences and recommending the most suitable software, through pros and cons of time and quality of the learning and sculpting process, to the type of user and modeling. Throughout the process, it is very important that I am as impartial as possible and will not allow my own preferences bias the whole project.

3.1 Practical Approach

Throughout testing, exploring and researching of the two programs Mudbox and ZBrush, I want to find out which one of the two that is most suited for quick and low time consuming modeling and which one is most suited for sculpting details in a specified amount of time; “time versus quality.”

4 Formation of Project

There are a few items to think about before beginning with both software; the computers capabilities, as well the different hardware that can be of help in the process. There is also different additional software that might be needed during this project.

4.1 Hardware

There are different hardware that can be used to simplify the experiences and technical approaches to both software programs. Since all computers are not fit for proper 3D modeling programs, it is best to keep in mind before trying out these programs to check the computers CPU speed, RAM memory, and the Graphic card, and of course, the stronger, newer and better these are, the better and smoother the working process will turn out.
4.1.1 Mudbox Requirements

The requirements for computers using Mudbox in 2012 are [18]:

Minimum system requirements 32-bit and 64-bit:

OS; 34-bit - Windows, 64-bit – Windows and Linux
CPU: Intel® Pentium® 4 or higher and AMD Athlon™ 64, or AMD Opteron™ processors with SSE3 instructions set support
RAM: 32 bit; 2GB, 64-bit ;4GB
650 MB free hard drive space
Certified hardware-accelerated OpenGL® graphics card
Ethernet adapter or wireless Internet card
DVD-ROM drive
Three-button mouse or certified Wacom® tablet

4.1.2 ZBrush Requirements

The requirements for computers using ZBrush 4R3 are [19].

For Windows:

Minimum System Requirements:
OS: Windows Vista/Windows 7
CPU: P4 or AMD Opteron or Athlon64 Processor (Must have SSE2 : Streaming SIMD Extensions 2)
RAM: 1024MB (2048 MB recommended)
Monitor: 1024x768 monitor resolution (32 bits)

Highly Recommended:
OS: Windows Vista/Windows 7 32-bit/64-bit
CPU: Core 2 Duo or newer (or equivalent such as AMD Athlon 64 X2 or newer) with optional multithreading or hyperthreading capabilities
RAM: 6 GB
Monitor: 1280x1024 monitor resolution or higher (32 bits)

For Macintosh:

Required:
OS: Mac OSX 10.5 or newer
CPU: Intel Macintosh
RAM: 1024MB (2048MB recommended for working with multi-million-polys)
Monitor: 1024x768 monitor resolution set to Millions of Colors (recommended: 1280 x 1024 or higher)
4.1.3 Used Computer

**Capability of project used computer:**

RAM: 8,00 GB  
Monitor: LG E2240, 1920x1080  
CPU: AMD Phenom™ II X4 965 Processor 3,40 GHz  
OS: Windows 7 home Premium, 64-bit  
Graphic Card: NVIDIA GeForce GTS 450  
Wacom Intuos4

The hardware that I have been using a huge amount is, as earlier mentioned and recommended, an Artpad, and in my case a Wacom Intuos4. It is recommended for both Mudbox [20] and ZBrush [21] for the best result possible. The hardware provides the user similar feeling of working with clay. Compared to sculpting with the basic computer mouse, the pen for the Wacom board estimates the pen’s pressure towards the board. Then, it is easier to estimate the hardness and softness of the sculpt tool on the model, instead of constantly being forced to change it by hand which will save both a great deal of frustration and time. It also provides the hand more freedom in the sculpting process.

The Wacom board can be very complicated for people who are not used to drawing both traditionally and digitally. A great technique to become use to drawing is to experiment some in programs, such as Photoshop to allow the hand to learn to draw on the board while your eyes are still on the screen. The process might feel unnatural at the start, however with some practice you can easily get used to it. However, I really recommend conquering the awkwardness and train to love to use it as it is a huge help in the modeling and sculpting process which is used in industry.

4.2 Software

As ZBrush has the ability to create base mesh models directly in the program, Mudbox does not, and only has a few existing base mesh models to pick from. Therefore, a pipeline between Mudbox and other software, where a proper base mesh can be made is needed. The best software for base meshes for Mudbox is Autodesk other software called Autodesk Maya 2012; the software that I myself will be using as an additional program to create this project. Autodesk Maya is a great modeling program, both for simple base meshes, as well for more detailed models. The models can easily be exported to Mudbox, as well for imported back into Maya for animation.

Since ZBrush has the ability to create great base meshes, it is not in need of an additional software, however it still, just as Mudbox, needs supplemental software for animation, such as Messiah and Modo [22], Autodesk 3D Studio Max [23], and many others which are great alternatives.
4.3 Modeling and Sculpting the Concept Art

As earlier mentioned, I decided to estimate Mudbox and ZBrush capabilities by modeling in both from the same concept art. At a start, it was very hard to decide on a concept art that was simple enough for both due to the time restrain, as well as detailed enough to meet the conditions for this research project to be successful. In the end, I painted my own concept art of a “chubby bunny” in Photoshop that I felt was easy yet challenging enough to show off both software capabilities. The concept art can be viewed in Figure 12.

![Concept Art of Bunny by Isabell Sarstedt 2012.](image)

On the images in Figure 13, the base meshes of both bunnies in each program came out very different due to their individual handling of base meshes. A squared/rectangular bunny was created from Maya, and after many adjustments, importing and exporting back and forth from Maya to Mudbox to see how the model appeared. Finally, a final model suitable enough to be imported into Mudbox was created.
In Figure 14, a more rounded bunny was created due to the use of ZBrush, ZSpheres, which was later transformed to a perfect low polygonal 3D mesh ready for sculpting details.

5 Realization

In this section will the learning process, the sculpt tools as well for the programs limitations be brought up. What is important to keep in mind through this part is that I am not a beginner to 3D modelling; however I am a beginner to learning and sculpting in both of these software.

5.1 Mudbox

When reading on 3D modeling and sculpting forums, and similar, about Mudbox, individuals are likely to find comments on how it is simple and easy to learn and perfect for beginners. In this section, I will write some of my own comprehensions and experiences of this software during both the learning and working process.
5.1.1 Learning Process

The interface in this software is for beginners, very easy to learn and it is possible and easy to navigate through the software even without tutorials. As I thought, with only a few notes and advices, individuals can work perfectly well in this program without tutorials. Some minor steps in the process were problematic but could be learned by oneself with some time exploring the software. Although searching for a tutorial would be recommended for the person with a pressured timeline.

To be able to work properly with the model, the artist has to add subdivision levels to be able to make more details, which is shown in Figure 3. By adding one subdivision level, all the existing polygons are multiplied, replacing each single polygon with more polygons. With more polygons to work with, smaller details can be added without making the model look edgy and instead they make the model look smoother, more detailed and also makes it easier to work on.

![Figure 3. A low polygon mesh (left) and a high polygon mesh (right) in Mudbox.](image)

Mudbox also has a technique to reduce the polygon count on a model with high subdivision levels into a low polygon model and still be able to keep the details and smoothness. Simply by going to the user interface, then clicking Mesh and Rebuild Subdivision Levels, however in order to do this, you have to have painted only in the highest layer.

At first, this was not something that occurred to me, as well as the “how to sculpt.” I learned this pointer from a friend, as well as the fact that I could step down the subdivision levels to make the model basic changes and still keep the detailing on the higher subdivision layers. Therefore once this was learned, the process went more smoothly.

A peculiar problem that occurred in both software programs, though more often in Mudbox than in ZBrush was the polygons started to act strange when painted on the model which can be viewed in Figure 4. It is possibly due to the fact that the specific area contains too few polygons for the brush stroke to look smooth. It is also a problem since the only method to add polygons in Mudbox is to add a subdivision level, dividing all the existing polygons to the double amount. At this rate, it would
not be practical due to the model’s already existing huge amount of polygons, where adding the double amount of polygons, only to smooth one tiny little brush stroke is not practical. This is one of the downsides to Mudbox, adding to the statement that Mudbox Files often are very large.

Figure 4. Edgy surface in Mudbox.

One of the features in Mudbox that I loved compared to ZBrush was the mobility in the interface to rotate 360° around the model (seen in Figure 5), which is similar to Autodesk’s other 3D software Maya. Therefore if you were already familiar with Maya, Mudbox will feel perfectly natural. The object is always placed in the middle of the screen, and it is easy to zoom in or out on the object by just scrolling on the mouse or the Wacom board wheel.

Figure 5. Back of the bunny in Mudbox.

One matter individuals must constantly have in mind is not to add too many subdivision levels as the polygon amount slows down the computer. It also makes the scene “heavy” and expands the render time. By “Slowing down” the computer, it means that; if there is a high polygon count on the model, there will also be more information for the processor to work with, which takes more memory and energy from it and ultimately slows down the computer and it makes it very hard to work.
To why a high polygon count ads more render time is because the scene contains more information that shall be projected onto the final render image than a low polygon model would. This is something important to think about simply because it will provide a better result in a shorter amount of time.

5.1.2 Sculpting Tools

The Sculpting tools are very easy to handle and find in the user interface below the working space. The tools are difficult to use and to get used to when drawing with a mouse. When using a Wacom board, I personally believe it is much easier.

5.1.3 Limitations

Very few tutorials and help pages are found about this software and those to be found are all from Autodesk and can be found on their web site, as well they can be found on Youtube.

A big constrain for this program is the disability to create base meshes directly in the program since there are so many things to think about if importing it in another program, which in my case was a must. I used Autodesk Maya for this matter.

One constrain I did read about was that if by mistake you accidentally drag and drop one of the brushes into the window, it will be lost forever and would not be able to get it back unless the whole software was reinstalled. A problem I luckily did not have to deal with.

The possibilities in this software are very restrictive due to the limited amount of brushes and existing materials.

Another constrain is the File size of high polygon models as they might become almost ridiculously large, around 1,5 to 2 gigabytes (GB) and over, compared to other modeling software, even with the same model and polygon count, often are many megabyte (MB) smaller. Of course, this always is relative to the models detailing, polygon count and texturing etc.

5.2 ZBrush

When it pertains to ZBrush, the artist is likely to find comments about it being very difficult to learn and confusing at times. In this section, I will discuss the discoveries and challenges that I found during the learning and working process of ZBrush.

5.2.1 Learning Process

The learning process in this program, I found, as a beginner, fairly difficult and rather confusing at the start and it continued into the working process. It is very hard to navigate throughout the user interface and the key-bindings are fairly confusing. A
huge recommendation would be to search and find good tutorials of how to navigate through the interface. Pixologic has a variety of tutorials about everything there is to know about their product [14]. Otherwise, it can take forever and a great deal of precious time can be lost which will probably lead to frustration. Nothing was very clear at the start of learning this software, however with time, it became very efficient.

One step that is very useful in this software is that perfect polygon meshes can be created directly in the program, which saves a huge amount of time as one does not have to learn another 3D program to import a model from. I found it difficult to create a base mesh at first as I did not even know which material to start with because of their rich bank of brushes and materials.

After great guidance in video tutorials, I could create good quality low polygon base meshes with a clean topology in this software with the ZSphere material. ZSphere is an advanced ZBrush tool and no other 3D modeling or sculpting program has anything similar to it [15].

This material makes it very easy to just form the character and not worry about the polygons since the program takes care of that when the ZSphere model is converted to a 3D mesh. Every ZSphere made can be rotated, scaled or moved and to every ZSphere made one or more ZSpheres can be added that will be linked together, such as joints, forming a great base model if made correctly. An example of the ZSpheres can be seen in Figure 6.

Figure 6. Four ZSpheres material joined together.

With this tool, a 3D model can be easily sketched out, as in Figure 7, and once formed it can be “skinned” for sculpting details.
To “skin” the ZSphere model, press ‘a’ to see the preview skinned model, and press ‘a’ again to come back to the ZSphere mode if more ZSpheres or changes are needed. Once you are pleased with the results, then the model can be skinned, however in order to accomplish that, and even to start sculpting over all, the model needs to be a Polygon Mesh 3D. It can be accomplished by clicking the; make PolyMesh 3D button which will display the skinned model and is shown in Figure 8. A step in the process can be very hard to figure out without the guidance from tutorials.

As in Mudbox, there are many already existing base models to choose from and to experiment with. My recommendation though would be to create a base mesh model from scratch, both for the learning process and for the originality.

It is also possible to import base models or even detailed models into ZBrush both for further detailing, texturing and posing. For ZBrush to be able to read the files, the model has to be an .OBJ or .DXF file since that is the formats ZBrush recognizes. When the model has been imported into ZBrush, it can then be saved in ZBrush’s own
native format; .ZTOOL or .ZTL [16].

Also similar to Mudbox, subdivision levels can be added and the polygons work in the same manner. However for me, it was at first a little hard to figure out the tools compared to Mudbox, because there are a key binding (a short command on the keyboard) for this step that must be created by pressing SHIFT D.

Just as in Mudbox, ZBrush also received creases and edges, as in Figure 9. When I tried to fix this particular crease I parted the two edges and noticed a big hole in the model that was very hard to fill. I myself was not able with the knowledge that I had about the program to do this. However if the model is only supposed to be a snapshot and not movable, this is easily fixed with the Polish brush that smooth and levels the geometry and provides the result in Figure 10. Then, the seam was almost invisible, something that was not possible to accomplish in Mudbox. This might not be considered suitable enough for a movie or a game model, but quality enough for a 3D picture, if time is of the essence.

![Figure 9. Seam on bunny foot in Mudbox.](image)

![Figure 10. From opening seam to closing and hide it in Mudbox.](image)

Another step that can cause a great deal of frustration for beginners, if not known from the start, is the saving process of the models. In most programs to save a file, it is easy by clicking File > Save as, as in many other programs. This does not apply for the models in ZBrush. It only saves out a 2D-file of the model and does not save the models geometry. If the program is shut down after saving in this manner, the 3D model is lost and cannot be taken back for further sculpting. This side of ZBrush is a very frustrating part. If the beginner works hard on a 3D model and saves wrong, all of the hard work is lost. What has to be followed is to save the model as a tool in the box Tool > Save as, in order for the actual model to be saved.
5.2.2 Sculpting Tools

Compared to the amount of brushes in Mudbox, ZBrush has many more brushes to choose from and the possibility to download a variety of updated, brand new and user made brushes are also an option. As a beginner, I experienced it to be a little difficult to understand what all the brushes were used for. However after some experimenting in the program, navigation between the brushes became a minor problem as compared to the rest of the interface.

5.2.3 Limitations

The major constrain for this software is tutorials are basically needed for most things in it, if not all to understand and make sense of the interface. It is next to impossible to do anything in this software. The user interface somehow does not feel natural and has a great deal of investigating to become used to it. Therefore, the learning curve is very steep in order to be able to work in this software properly without losing momentum.

A constrain for me, due to bad memory was all the shortcuts which to me was a huge ordeal to remember. A list of all the shortcuts is almost a must to make sculpting more efficient [17].

Many times, it was very difficult to understand what went wrong in the process of sculpting for I could no longer sculpt on my model because Edit suddenly was checked off without me noticing it and it could not be unchecked. Therefore, I ended up reloading my saved base model to start all over again.

Another constrain was the moving, scaling, and rotating tools since they were constrained buttons stuck to the interface and did not provide the same 360º freedom with the mouse as in Mudbox. Also, scaling rotating and moving in ZBrush can only be accomplished in Edit mode by pressing the Q key, which is not available at all times. What I later found out was that it was such a simple thing as that the program had changed to 2.5D mode instead of 3D mode by itself. All I had to do was simply click the T key to return back, a very simple solution. This problem provided a great deal of trouble since the key bindings feels very unclear and are difficult to learn.

6 Result

In this section, I will present the result of the Bunny sculptures from multiple angles in both Mudbox and ZBrush. What surprised me the most was how different they turned out from each other even though I looked at the same art concept sketch. And to be honest, I am not sure if it was because of my sculpting skills or due to the program, however I am guessing that it could be both. Due to the time restriction, this is what the program provides in combination with my skills. If I had the time, I would have posed them as the concept art sketch and also added props as glasses and a hat! However that is for further sculpting.
6.1 Sculpting Results in Mudbox

In Figure 15, the final render of the chubby bunny is displayed, as a base mesh in Maya and imported and sculpted in Mudbox. He ended up a bit angry looking compared to the ZBrush model. Even though the sculpting process and the brushes were more restricted in this software, I felt that the body type of this bunny was closest to the original. This could be due to the fact that I already was used to creating base meshes in Maya and not used to creating them in ZBrush.

Figure 15. Final sculpting of the Bunny in Mudbox
6.2 Sculpting Results in ZBrush

As seen in the Figure 16, the final model of the sculpted bunny in ZBrush. He is a little more happy looking. The body turned out different from the Mudbox model due to the base mesh created with ZSpheres. If I had more time, I would change the legs and make them smaller, something that was too time consuming at this point.

Figure 16. Final sculpting of the bunny in ZBrush.
7 Discussion

In this section, I will discuss the differences of sculpting details and time management that I located in each software program along with the any factors that affect them, as well as compare them to one another.

7.1 Details

Mudbox and its brushes were more obvious and easy to understand, however tiny polygon edges always showed up and the brushes did not always do as they were supposed to do. Therefore, I felt the sculpting detailing completed was not the amount that I had hoped for on the Mudbox model bunny.

The ZBrush brushes was hard to understand due to, according to me, their naming, since I felt they were not obvious enough for me to understand what they did on the model. Therefore, a huge amount of time was spent trying them out in order to realize what they did. Except for the previously mentioned problem with the brushes, I felt they worked very well and did exactly what they were supposed to do on the model, resulting in much more sculpting detailing compared to Mudbox.

7.2 Time Factors

The Mudbox model’s time was the quickest of the two software due to some factors, such as the easy learned interface and the simplicity of the tools. However, one factor that was time consuming was the time spent to make a proper and acceptable base mesh for Mudbox. For those who do not know an additional software for making a base mesh as in my case it was Autodesk Maya, it would take even more time since this also would add to the time learning how to make a base mesh as well as for learning the software’s interface. Below is a reference of the time spent in Mudbox during this process:

- Modeling base mesh; 2-2.5 hours
- Tutorials; 10 minutes
- Sculpting model; 3-4 hours

When making the ZBrush model, the time spent was far more than the Mudbox model due to the time learning and adapting to the software with its difficult interface. However, with good tutorials for ZBrush, and having a reference sheet of the keybindings, it was easy enough for the workflow to run fairly smoothly. Also, below is a reference of the time spent in ZBrush during this process:
- Modeling base mesh; 20 minutes
- Tutorials; 3-4 hours
- Sculpting model; 3-4 hours

Over all, I would honestly say that the working progress in both took almost the same amount of time. What really took time in ZBrush was searching for and viewing tutorials. In Mudbox, it was due to the constraint that Mudbox cannot do base meshes.

### 7.3 Literature Search

Through the literature search of these two software programs, I noticed a huge difference between the amounts of information existing about them. Compared to ZBrush, Mudbox has less information and tutorials of the software and its interface to be found on the internet. When searching for answers and tutorials of ZBrush, already on Pixologic’s own site, there are a great deal of information and tutorials about ZBrush software, and where and how it is used, as well for how to learn the interface. When searching for Mudbox on the other hand, there was less information about the product and where it has been used as well as tutorials to be found.

Each software’s prices vary and depends on where it is bought but ZBrush is most often the less pricy of the two, especially since it does not need supplemental software. Also, trial version exists for each software, so the recommendation is to try out both.

### 7.4 Pros and Cons

In this following section is a list of some of the pros and cons of each software I discovered throughout this thesis:

<table>
<thead>
<tr>
<th></th>
<th>PRO</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autodesk Mudbox</td>
<td>Easy to learn</td>
<td>Limited selection of brushes and textures</td>
</tr>
<tr>
<td></td>
<td>Simple interface (easy to get familiar with)</td>
<td>Fewer tutorials and help sites</td>
</tr>
<tr>
<td></td>
<td>sculpting in real time 3D space</td>
<td>Unable to make base meshes- needs supplemental software</td>
</tr>
<tr>
<td></td>
<td>Seamless integration between 3D software (Maya/3DS Max) and sculpting</td>
<td>Large file size</td>
</tr>
<tr>
<td></td>
<td>Supports FBX file format</td>
<td>Very few tutorials and help sites</td>
</tr>
<tr>
<td>PRO</td>
<td>CON</td>
<td></td>
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<tr>
<td>-----</td>
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<td></td>
</tr>
<tr>
<td>Large Selection of brushes and stencils</td>
<td>Difficult user interface</td>
<td></td>
</tr>
<tr>
<td>ZSpheres - no need to import base meshes</td>
<td>Steep learning curve</td>
<td></td>
</tr>
<tr>
<td>Many tutorials and help sites</td>
<td>Lack of intuitive controls and menus</td>
<td></td>
</tr>
<tr>
<td>Once bought, one will have updates for life.</td>
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</tbody>
</table>

### Conclusion

With the now existing knowledge we have obtained about these two software, we can finally answer the research questions.

So, can the same level of details with sculpting be obtained from both software programs? I would say no to this, due to the grander range of Brushes in ZBrush. It provides more accurate detailing to the models than Mudbox.

Then which software is the most suited for sculpting details when time is a factor; “Time versus Quality?” With the “Time vs Quality” factor of each software’s sculpting abilities, I felt that, for me as a beginner to both software, Mudbox is the winner of the time factor due to its comfortable and easy learned interface, however not by much, due to its lack of being able to create its own base meshes directly in the program, especially if you become more comfortable with ZBrush and its interface. For the Quality factor, ZBrush is the superior winner due to the factors that the software handles the polygons much better. Great base meshes can be created directly in the program, and it has a greater variety of brushes, as well as tutorials than Mudbox.

As for the last question; Which software is the most suitable or efficient for different users and/or projects? As suspected from the start, Mudbox feels like the best program for beginners. It is also excellent for more technical detailing to smaller and less time consuming projects due to all its restrictions while ZBrush seems to be the best choice for more advanced modellers and artists, as well as extensive projects.
Figure 17. Final sculpting of the bunny in Mudbox (left) and ZBrush (right).

Through others comments from personal users in online forums, the idea of the results were already somewhat clear, comments such as;

“in general, mudbox will be more easy to get around coming from traditional 3D software, plus it was designed to integrate well with maya from the beginning, so if you use maya can be a little advantage, Zbrush in my opinion offer more possibility, but until you don’t take the time to use and learn it, it can be really cumbersome tool to use” [24]

And as well as;

“Well, I would suggest using zbrush. I think it is used a bit more for high res sculpting than mudbox in the industry both are good packages but I would go with zbrush. It can be a tad intimidating at first but after a few tutorials on youtube, you should be able to figure it out if you have learned other 3d programs in the past. I use it everyday at work and love it!” [25]

However, I wanted to see and test for myself what the real differences really were. After testing and researching both programs on a beginner level, I myself agree with these statements.

8.1 Proposal for Further Research

Since my research throughout this thesis has been from a beginner’s point of view of Autodesk’s Mudbox and Pixologic’s ZBrush, I believe a great deal of more advanced research about these two software can be made with more knowledge, “know how” of the product, as well for more time. Also, since this is only about the software’s sculpting processes, a great deal of research can be put into comparing both software programs in all the other areas, such as the painting, rigging and rendering processes.
References


