

# 3D Search Engine

- Using Computer Graphics and Film Techniques to Improve Searching

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Building the Search Engine

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## Informatics 5<sup>th</sup> Semester

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### Abstract:

Search engines as Google are used by most people on an everyday basis. This report will investigate if it is possible to improve search engines using visual effects and film techniques.

The problem is introduced and a prototype called 3D Search is developed for testing purposes. A test is conducted using an eye tracker and a survey was completed by the test participants. The test data is then analyzed in regards to search engine speed, video feedback and survey responds.

The data is presented in the data chapter. Afterwards it is discussed and found to be valid and fairly useful.

It is concluded that it is possible to create a search engine prototype using the fore mentioned techniques. The test data shows that, speed wise Google is faster in most cases. However logos and flags give 3D Search some advantages.



## ACKNOWLEDGEMENTS

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## PREFACE

The reader of this report should have the knowledge of an Informatics or Medialogy 5<sup>th</sup> semester student. Furthermore the report should be read in the order of which it is presented, to gain the full understanding. However if one is in a hurry the Theory chapter could be skipped and the Data chapter skimmed in order to understand the main points of the Discussion and Conclusion.

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# INTRODUCTION

In this section, the problem domain will be introduced and based on this introduction a problem statement will be formulated.

Every day, people use internet search engines for different things. This could be a person looking for a picture of the Empire State building, or a consumer looking for the cheapest online store to buy his new flat screen. Either way, search engines are the fastest and most efficient way to find the information that is required to make a decision.

In this project, when mentioning search engines, we will have our main focus on Google, since it is the largest and most used search engine in the world.

Today you can hardly find a person that does not know how to "Google" something, and just to put things into perspective, Google has the most powerful brand in the world (MILLWARD-BROWN, 2010), and has over one billion search requests every day (WIKIPEDIA, GOOGLE, 2010). This is no coincidence, since searching the web for information has become a big part of our everyday.

A Google search is fast and efficient. We all know where to look when hitting that "search" button, and almost none of us scroll past the first page of results. This is because Google has a almost mystical way of finding exactly what we are looking for - and for most parts it's in the top three page suggestions. (WEBECONOMY, 2010).

In the search engine context, film making would seem to be a totally different subject. But when one thinks about it these two subjects have some common ground. The search engine wants to guide its user to find the information they are looking for. The movie makers use different film techniques to guide people to certain clues or areas in the movie. But is there a way to use film making techniques and computer graphics to enhance the speed of which we find the search result we need. Is it possible to shave off precious milliseconds of the time it takes to find the right information?

To investigate this subject, we will have to create a way to present the data to the user in form of a web page. This web page will simulate a search engine, but present the results in a different way, than Google normally would. We will draw knowledge from the two PE courses "Screen media" and "Computer Graphics and Digital Scenography" to create this, but also knowledge from previous projects to create the page functionality.

## PROBLEM STATEMENT:

Can computer graphics and film techniques be used to represent search data and can this visualization of search results improve the speed, of which one finds the desired information?

### DELIMITATION:

The following delimitations were chosen.

- Create a prototype for testing purposes.
- Use HTML and JavaScript to create the prototype.
- Use 3ds Max to create the 3D environment.
- Use an eye tracker to test the speed of searching.

# THEORY

This chapter contains theory that is relevant to the project.

## MISE-EN-SCENE

This French expression means “putting into the scene” (BORDWELL, DAVID AND THOMPSON, 2010). This is anything the director of a scene has decided to place inside the frame presented to the audience. It essentially means “visual theme” (WIKIPEDIA, MISE-EN-SCENE, 2010).

## DIEGESIS

Everything incorporated in a scene. Objects, the events, characters, sounds etc. is diegetic. Non-diegetic is anything that is not incorporated in the world of the story. Voice over, background music etc. (BJØRNER, THOMAS, 2010)

## SIGNIFIANT AND SIGNIFIÉ

The signifiant is the physical expression of the media – meaning what the viewer sees. Signifié is the idea or term it gives the viewer (WIKIPEDIA, SIGN, 2010). For example, if one sees a photo, from a scene in a movie, the viewer forms opinions and ideas of what is happening in the scene, and what has happened before the scene. Meaning that a viewer makes up parts of a scene before he or her has even seen it. In film references one could say that the movie starts when you have read the title. (BJØRNER, THOMAS, 2010)

## LIGHTING

Lighting is very important in creating a scene. It helps guide the attention to what the director wants the audience to see.

*“Lighter and darker areas within the frame help create the overall composition of each shot and thus guide our attention to certain objects and actions.”* (BORDWELL, DAVID AND THOMPSON, 2010)

It can help articulate textures, and highlights shapes. It also creates shadows which is critical in computer graphics (CG) to make a scene look realistic. This is because shadows help create our sense of a scene’s space.

## KEY LIGHT AND SPOTLIGHT

In the basic three-point lighting there will be a key light, fill light and a backlight. But in this theory section only the key light will be discussed.

The key light is the most influential of the three lights. The best way to set up a key light is to look at the shadows it casts. Usually one would place the key light above the subject(s) to some degree, since one would usually see things illuminated from the top.

A very good example of a key light is the sun, since it often would outshine other light sources. Also the sunlight is a direct light and therefore it casts, almost, parallel light rays in a single direction, giving uniform shadows to objects in the scene.

A spotlight is another kind of light. Spotlights can play a major role in the design of many lighting schemes due to their controllable nature. For example one can use spotlights to enhance the focus on an object. (BROOKER, 2008)

## EMPHASIS

Careful and considered placement of lights can help to reinforce the location of a focal point. An image can have more than one focal point. These can be emphasized by using contrasts. Contrasts are the most effective way to draw attention to an area. There are several ways of making an element contrast with its surroundings: these can be color, size, shape, texture etc. The greater the contrast is, the more obvious the focal point of the image will be. For example, if you have a lot of objects in the same shape and all of them are blue except one, this one object would be the focus of the image. (BROOKER, 2008)

## GO-BETWEENS (GOBO'S)

There are different types of ways to break up light. Gels can be mounted in front of a light to tint and match colors of other light sources. Go-Betweens (Gobo's) in real-life cinema can be rectangular panels of wood or metal, with patterns cut into them, placed very close to or in the light. The best known is probably the one that sits in front of Gotham City's police department's searchlight, the one calling Batman. In CG one would either put an object in front of the light or use projector map which is exactly like a cookie. A cookie, also known as a cucalorus, is placed further away from the light source, so the material does not necessarily need to be heat resistant. By placing the cookie in the path of the light, the cut out areas create light and shadow shapes that are projected onto a background. Generally because of render times the use of projector maps is preferable over the use of shadow casting objects. Braking up a scene's key light like this can be a very effective way of giving a scene much more visual detail than it actually has. For example light passing through objects such as trees, whose leaves are semitransparent, will be tinted green and result in a subtle level of detail to the lighting scheme. (BROOKER, 2008)

## IMPORTANCE OF SHADOWS

When looking around in a room, it is not certain that one takes notice of the lights and shadows that are present. But if, for example, a large object was missing its shadow, one would probably notice this at once. The same goes for computer graphics (CG).

*“We are so used to looking in fact, that we can easily spot when something, especially in CG, does not look quite right. To ensure that your lighting efforts in 3D appear convincing, there are several characteristics that make a light source look real, and these qualities of light must be thoroughly understood and simulated in 3D.” (BROOKER, 2008)*

One may not think about them, but shadows give a lot of information about the placement of objects in space - especially in CG. If CG scenes do not relate to normality you cannot suspend the audience's disbelief and therefore the scene will, most likely, not work as intended.

*“If you want an audience to accept a scene which is somewhat implausible, the shadow can be a great tool in creating convincing interaction that assures the viewer that what they are seeing is actually happening. Without the subtle interplay of shadows, even the most photorealistic of scenes becomes less credible, and the human eye is so used to seeing shadows that even for the most casual observer it does not take much to stretch the illusion too far.” (BROOKER, 2008)*

Shadows can also help us determining the size and relative position of the objects in scenes; as can the use of several other techniques. (BROOKER, 2008)

## DEPTH

When trying to process a picture's depth we look at different clues, in order to see which object is closer to the camera. For example, this could be to compare two objects relative size against each other: If two elephants stand opposite each other and one of them is unnaturally smaller than the other, this could be seen as if it is further away.

*“The closer objects are, the larger they look. The farther away, the smaller they look. This happens because the objects visual angle decreases.” (WIKIPEDIA, PERSPECTIVE, 2010)*

But without a context to place the objects (elephants) in, it could be impossible to judge where the objects are situated. However, overlap of two objects could be used to make it apparent which object is nearer since common sense tells us, that the hidden object is further away. Lines can also help to build depth in an image. These could be either vertical or horizontal. The vertical lines help with movement and built environments for example a vanishing point.

*“A vanishing point is where the two parallel lines (e.g. two rail road tracks) meet at a distant point. The vanishing point is placed on a line called the geometrical horizon” (WIKIPEDIA, PERSPECTIVE, 2010)*

The horizontal lines reflect the lines of the landscape and horizon. The eye will search for and follow paths within an image based on repeated elements, sightlines and edges, amongst other things. If two repeated elements make for a linear path that the eye will follow and the

eye will be drawn to other objects along this path. Also repeating elements in an image are a powerful way of channeling a person's focus through an image. (BROOKER, 2008)

*“Our eyes will be drawn between these similar elements as the brain makes comparative judgments between them. In this way, repetition of shape and color can not only bring about a sense of harmony to an image, but can also set up routes through the image, which the eye will naturally follow.”* (BROOKER, 2008)

## CAMERA ANGLE

The camera angle is the camera's view direction relative to the horizon. There are three camera angles used in general cinematography: The straight-on angle, the high angle and the low angle. Where the straight-on angle is the most used, the high angle looks down on the scene, and the low angle looks up. (BORDWELL, DAVID AND THOMPSON, 2010)

# METHOD

## 3D SCENE

The project aims to explore if there are any benefits in converting the 2D layout of search results (Google) into a 3D world. In order to do this a 3D world is needed, this world will be created using Autodesk's 3ds Max. The following sections will explain how this world was built and what thoughts have been put into it.

### 3D SEARCH (3DS)

The world of 3D Search is fairly simple its Mise-en-scene consists of a plane, 12 boxes - all the same size, 12 spotlights, a key light (sun), and of course a camera to choose what to render. The first of four images, from a search, can be seen in figure 1. This also shows what the world looks like.



**Figure 1:** This shows the first of four images of the search: "eiffel tower". All 12 boxes (or hit/results) can be seen to some extent and the plane which is the "ground" of 3D Search's world is also visible.

### THE PLANE

First of all the scene needed a plane to position the boxes, see figure 1 or the next section for more information. The plane is flat in order to have the best possible overview of the boxes. Several different textures were considered: One that was totally black, a black plane with a white lattice - the inverse of the colors it has now and of course the chosen one shown in figure 1. With the black plane, it was like something was missing. It should guide the eye, but it seemed like the direction of the boxes were not enough. Therefore, another black texture was made, this one with a square white lattice. On the positive side the lattice helped in creating the illusion of a landscape that continued out of the screen as the one in figure 2. On the negative side it was very hard to see spotlights on the black surface, and it did not seem too cheerful. It was then decided to try and inverse the black surface, so it became white (seem gray because of the sunlight) with a black square lattice instead. This texture had the lines that could help guide users from box to box. It also had the illusion of a landscape and the spotlights could be easily seen on the white surface.





**Figure 2:** The left side of the figure shows what the 3D world looks like with the square lattice. The right side shows the figure without the lattice. The left side looks more like a landscape that continues further into the world, whereas the right looks like it is an empty space where the boxes float around.

## THE BOXES

In the beginning of the project two different 3D environments were investigated. One was the box environment, and the other was the Icons environment. The setting for the two environments should be the same, but the icons, in the icons environment, would mimic the shape of the search results. For example if the search result was a webpage, the 3ds max shape on which the information was portrayed would look like a piece of paper with one corner bent. (See figure 3). The other shapes were: A photo for images, a map for locations and a piece of film strip for movies.



**Figure 3:** The figure shows the early stages of the icons search environment - here the paper icon is shown.

On the icon there is a screenshot and the URL for the webpage.

The icons environment was never fully developed, but the ideas of icons prevailed and got incorporated in the box engine (3D Search engine). The reason for choosing the box engine was that it had more space for information. The icons engine only had one surface, but the box engine had three (that were viewable at one time). The three sides hold different information. One shows an icon, URL and hyperlink text (The blue text one gets when searching in Google).

One shows a logo and the last shows a screenshot of the webpage. The three sides of the box have three different textures applied to them (in this case jpg's).

In figure 4 an example of a box is shown with the three sides: screenshot, logo and icon.



**Figure 4:** The figure shows an example of a search hit in 3D Search. 1) Shows the left side which contains the screenshot/image/map. 2) Shows the top side which contains a logo/resolution/address. 3) Shows the right side which contains an icon, URL and hyperlink text.

#### ICON SIDE OF THE BOX (THE RIGHT SIDE)

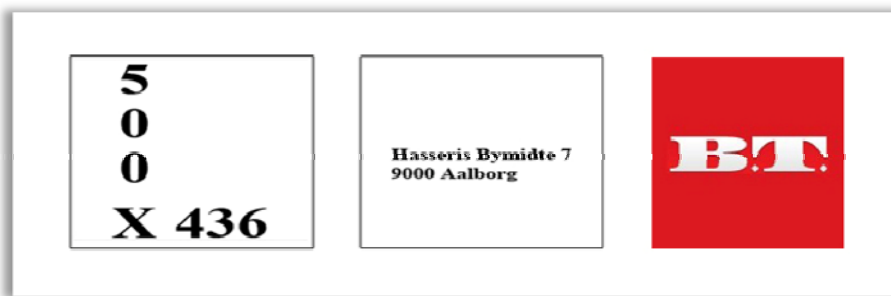
The icon side of the box is where the most information is displayed. Here one can look at the icon and see what type of search result the box displays. These consist of a webpage, an image or a map icon. The webpage icon displays the URL and hyperlink text, the image icon displays the filename and extension and the map icon displays the name of the place or location one has searched for. (See figure 5)



**Figure 5:** The figure shows the three icons that can be applied to the right side of the box. To the left the webpage icon is shown, which includes an URL and the hyperlink text. In the middle the image icon is shown, which includes the name of the picture and the extension. To the right the map icon is shown, which shows the name of the place or location.

#### THE LOGO SIDE OF THE BOX (TOP SIDE)

The top side of the box is the logo side and this is where the logo from the webpage is displayed. If a image is presented the top will consist of the resolution of the image. And lastly for a map an address is shown. The three types of logos are displayed in figure 6.

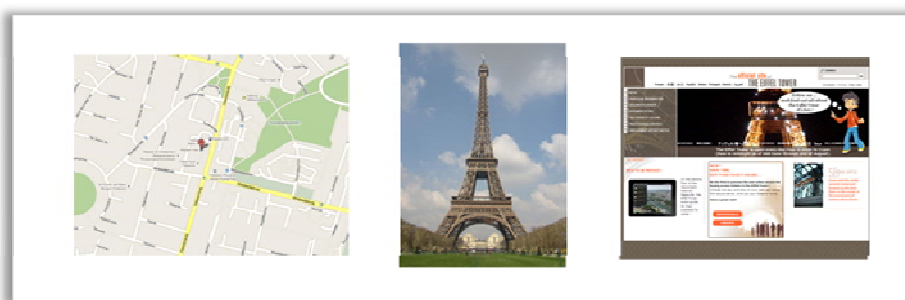


**Figure 6:** The figure shows examples of the three logos the top of the box can display. The left shows the resolution logo which contains information about the size of an image. The middle logo shows the address of a map location. The right logo is the actual logo from the B.T. website.

The reason why logos were chosen for this side of the box was that logos generally have high recognition rate among users (WIKIPEDIA, BRANDS, 2010). For example a lot of people would be able to recognize the Coca Cola, Nike or Wikipedia logo. This could then help users make faster decisions, especially if they are looking for special websites (with easily recognized logos) or companies. Image resolutions got a place on the top of the box because this spot should have some sort of information. Also the pictures shown in a regular Google search does not have this information. Google has an address besides its maps so this was very natural that the 3D search had the same with its presented maps.

#### THE SCREENSHOT SIDE OF THE BOX (THE LEFT SIDE)

The left side displays a screenshot of the webpage. This was meant to awake a feeling of recognition if the user saw it. This was a functionality that Google did not have at the beginning of the project. However, around half way through the project, Google made something similar to this feature available too. If the result in question is an image, this image is shown here. If a map is presented, a screenshot of the map is shown here (see figure 7).



**Figure 7:** The figure shows the three elements that can be portrayed on the screenshot side of the box. To the left is a screenshot of a map to show where an address is located. The middle is an image result from a search for "eiffel tower". The right is a screenshot from a webpage.

### THE KEY LIGHT (SUN)

In 3ds max, light from the sun is simulated using the sunlight system. When you place a sun in the scene, one can choose place, date and time. This means that you can select a place on earth - for example a city in Denmark. Then a date and a time of day can be selected, and the light will mimic the real sun in the given location. This is very effective when using CG combined with real footage.

The sunlight system was used as a light source in 3ds Max because it was particular easy to control the resulting shadows. The shadows were needed in order to make the 3D scene look more convincing and believable (See figure 8). Since the sunlight system uses a direct light, which casts its light in single direction, all the boxes would have a shadow of the same shape. The shadows were not meant to backdrop on the boxes behind the box casting the shadow. This is also why the shadows are not bigger than they are.



**Figure 8:** The figure shows the first image of the search: "eiffel tower". The left side has shadows turned on and the right side has them turned off. It is easy to see that the right side looks less plausible and it is hard to see if the boxes are actually situated on the plane.

### THE SPOTLIGHTS

Spots in 3ds Max work like a flashlight. The light emanates from a single point and casts a focused beam of light onto an object. The illumination is confined to a cone and therefore it has to be aimed at the object/place one wants illuminated. The cone has two angular values one is the hotspot, and the other is the falloff. The light intensity falls off gradually from 100% at the hotspot angle to 0% at the falloff angle that defines the very edge of the spot. If the angle between the hotspot and falloff is small one will get a very sharply defined circle, and the further apart they are one will get a softer transition between light and shadow.

In order to give the users even more information about the webpages it was decided to incorporate spotlights. These spotlights should give information about the language of the search result in question. In 3ds Max this was done by adding a projection map to a spotlight. This projection map works like a "cookie" (cucalorus). In the real world this is something one puts in front of a spotlight to create shadows with shapes. In this project it was used to project the shape and colors of the different nation's flags onto the plane, just under the box in question. However, normally the light would envelop the box as well, so the box that was

under the light had to be excluded from the list of things that the light should affect. This then gave the effect of flags under the boxes. (See figure 9)



**Figure 9:** The figure shows how spotlights are incorporated into the scene to show the language of the search results in question. In this picture there are 3 different languages displayed British, Danish and American.

## THE CAMERA

The images were rendered at 1440x470 because the screen resolution of the test monitor was 1440x900. When looking at the screen size, html and browser window this was the best size that the pictures could have without looking disfigured.

## SEARCH ENGINE

In order to create a test environment, a page simulating a search engine was created. The page is coded in HTML and JavaScript. HTML is used to create the visual aspect of the page, where the JavaScript is used to create the functionality needed. On this page, one should be able to type in search phrases, and based on the input, the page should show a pre-rendered picture. The page should have a significant similar to Google in order to increase the familiarity for our test participants. In this picture, the hits from Google would be presented but in a 3D environment. The functionality of this page is explained in the appendix A.

## TEST

In order to test our search engine prototype we used an eye tracker. This machine tracks where your eyes are looking at, on the computer screen and records when you click the mouse or type on the keyboard.

In the eye tracker software the test could be set up. It worked with some similarities to a slide show, so we were able to insert instructions followed by a browser window, and so on.

## TUTORIAL

Before the test, we made the participant go through a tutorial. This was done in order to make the participants as familiar as possible with the 3D Search engine.

The tutorial was constructed so the test subjects would get a general understanding of how the 3D Search engine worked, and how to use it. It was also designed to make the participants more confident with the 3D Search engine. This was deemed necessary to be able to compare 3D Search to Google.

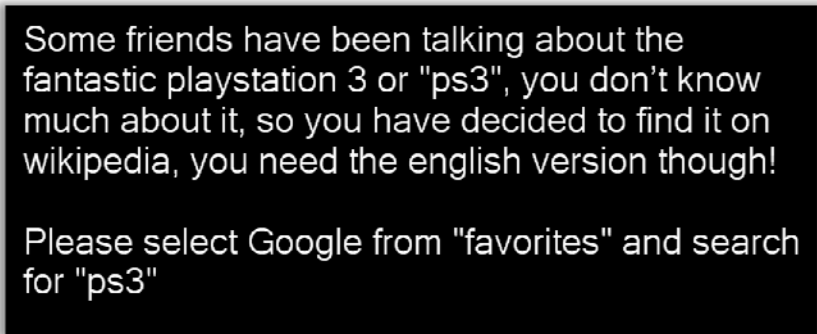
The tutorial was also important in order to inform the participants on how the Eye tracker software and 3D Search's interface worked. Also to warn them of the minor bugs, in 3D Search which they should ignore.

After these instructions, the test subjects were able to try it out for themselves, in an example on how the interface worked. A few small tasks were described, and after they were finished, the test could begin.

## TEST – EYE TRACKER

We had rendered pictures for 10 searches in 3DS, but we also needed Google searches to compare them to. It was decided to have half of the participants do five tasks in Google and then five in 3D Search. The other half of participants did the same searches, but with the search engine order switched.

The test was modeled so the participant would first be presented to a scenario they should relate to. This was described in plain text (see figure 10). Then further instructions told them what they were looking for and what search engine they should use for the task. When the participant understood the instructions, they would go to the next step, and a browser window would open. In this browser they would complete the task.



Some friends have been talking about the fantastic playstation 3 or "ps3", you don't know much about it, so you have decided to find it on wikipedia, you need the english version though!

Please select Google from "favorites" and search for "ps3"

**Figure 10:** One of the instructions in the test.

In order for our test to work it was constructed so that the participants could not add additional words to the search phrases. Since the images were pre-rendered it would be an impossible task to render every known search phrase imaginable, therefore they had to be predefined. Normally people would add words to their search phrase in Google if they did not find what they were looking for on the first page. If this had been allowed the test would not be able to measure the speed of the two search engines equally. Google would be able to



search for specific user defined phrases as opposed to 3DS. Thus, we would not be able to control the test.

In any case, we decided to go with the next best solution. In this test we did not focus on the content of the query, but rather the page needed to be found in the presentation environment. This way, the Google scenarios did not become unrealistic. The test was designed so that the results of the predefined queries, were the same as the ones Google would show. This caused a problem though, since many different variables are used to calculate the most fitting results in Google (location, popularity etc.) the results differ from time to time. The Google search could, in theory, be saved as a HTML file and used in the test, in order to overcome this problem. The reason why this was not done was that the test should feel as real as possible and the potential lack of different objects and functionality could obscure this.

Due to Google's changing search results, 3DS had to be kept up to date. This meant that if two search results switched places in the Google search, the following would have to be done: Change the order of the image maps in the code, change the pictures and logos on the two boxes and render four new pictures. This is unfortunately the cost of hard coding, but in order to create the functionality for doing this seamlessly, it would have taken a lot more time and skill.

## SURVEY

We used Google docs to create a survey for our test participants. The goal with this survey was merely to get an idea of what their thoughts were. Furthermore to get input on what they thought were critical issues that needed to be dealt with. More or less, data we could not get from the eye tracker test. The survey can be found in appendix B.

# DATA

## SEARCH SPEED

This section describes data from the eye tracker test. The speed of result finding is in focus in order to give an idea of which search engine is fastest in the different scenarios.

The results were divided into three major groups:

- One group where the two search engines was relatively equal in speed.
- One group where 3DS was faster than Google,
- One group where Google was faster than 3DS.

The test involved 10 participants each conducting respectively five tasks in 3DS and five tasks in Google.

The data in each group is displayed as following. First a table with the searches in question is shown, this table contains average speeds and the difference in the two search engines is calculated using percentage. After that each task will be shown. Each task will first show the instruction from the test. Thereafter two graphs will be shown. One with a success rate, in case a test was unnaturally long or if the test person chooses a result that wasn't the desired one. Then a graph which shows the average time from clicking the search button, to finding the correct result and the minimum and maximum recorded times. Lastly this information will be clarified in text after the graphs.

## ALMOST EQUAL RESULTS

The two results which were the closest to each other was task number 07 and 09.

| Task name | Task Search phrase | Type of search result | Google (Average seconds) | 3D Search (Average seconds) | Percentage faster |
|-----------|--------------------|-----------------------|--------------------------|-----------------------------|-------------------|
| 07        | Nyheder            | Page                  | 3.98                     | 4.69                        | 15.1%             |
| 09        | Sony Høretelefoner | Page                  | 10.18                    | 9.34                        | 8.3%              |

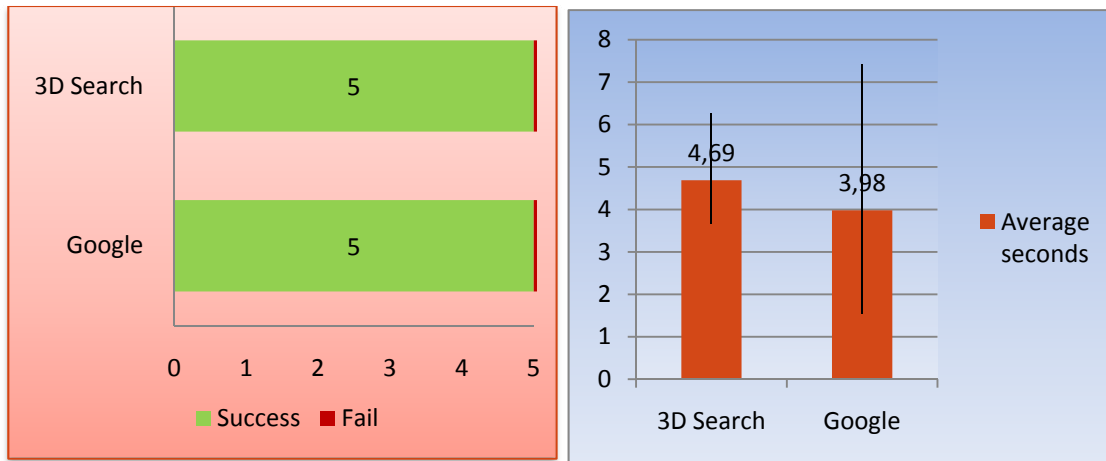
**Figure 11:** The table shows the two searches that where almost identical in regards to speed. "nyheder" and "sony høretelefoner"



## TASK 07

## The instruction:

*"You are looking for your favorite newspaper "B.T." online.  
Find B.T's website."*



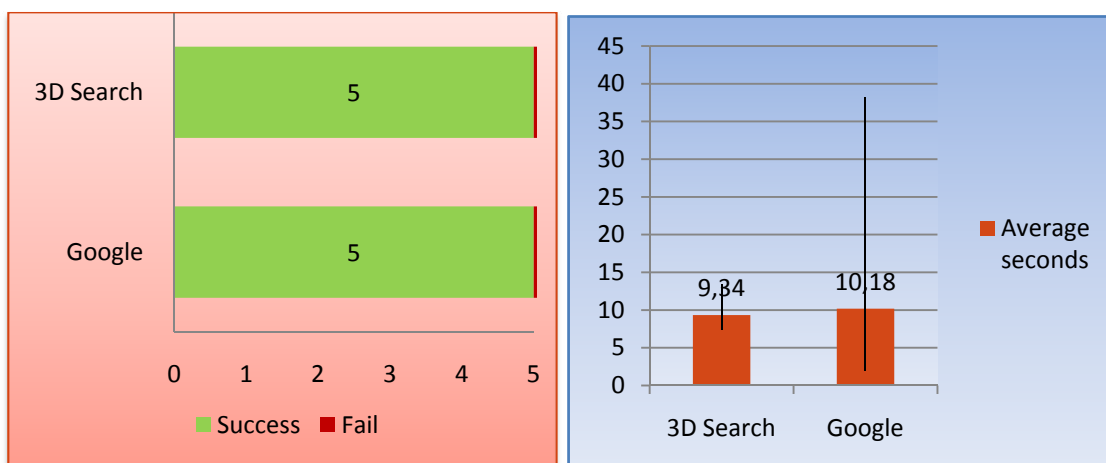
**Figure 12:** The figure shows that both 3DS and Google has 5 successful searches. The speed difference between the two searches is 0.71 seconds.

Both 3DS and Google have full success rates in this search. 3DS is 0.71 seconds faster, in average, than Google in this search. B.T. is written with large letters in Google's title text, and the logo in 3DS incorporated the two large letters as well.

## TASK 09

## The instruction:

*"You have had your eye on some Sony h retelefoner for a while now.  
Find them (any pair) on Sony's main site."*



**Figure 13:** The figure shows that both 3DS and Google has 5 successful searches. The speed difference between the two searches is 0.84 seconds.

Both 3DS and Google have full success rates in this search. 3DS is 0.84 seconds faster, in average. Sonys logo helped out in 3DS whereas participants often clicked one of the first two results. Both being correct.

## WHERE 3D SEARCH WAS FASTER

In three task results, the 3DS engine proved to work faster than Google.

| Task name | Task Search phrase | Type of search result | Google (Average seconds) | 3D Search (Average seconds) | Percentage faster |
|-----------|--------------------|-----------------------|--------------------------|-----------------------------|-------------------|
| 04        | Julefrokost        | Page                  | 57.93                    | 28.89                       | 50.1%             |
| 05        | Lasagne            | Page                  | 59.16                    | 23.65                       | 60%               |
| 08        | PS3                | Page (Wiki)           | 25.44                    | 14.01                       | 44.9%             |

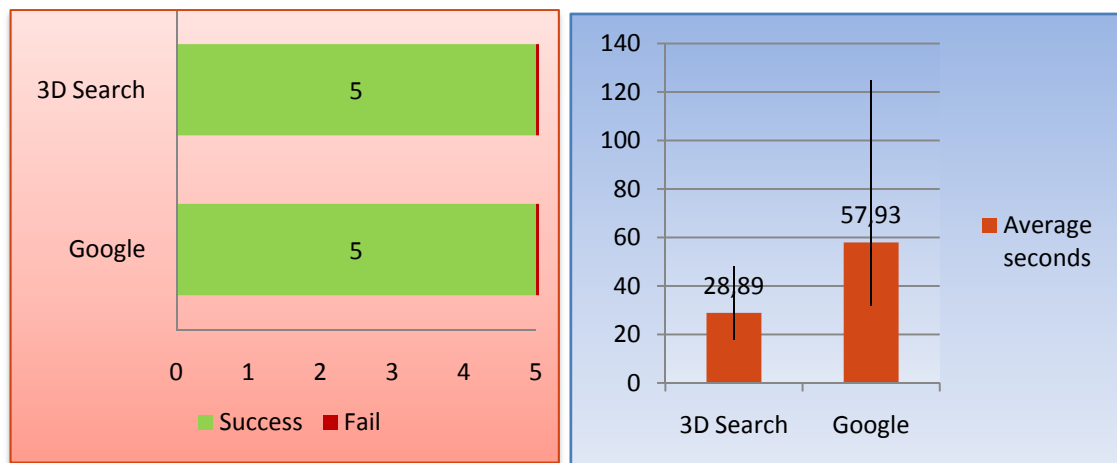
**Figure 14:** The table shows the three searches where 3D Search was fastest. "julefrokost, lasagna and ps3" where just about 50% faster than Google.

## TASK 04

**The instruction:**

*"It's Christmas time and you have been chosen to find a place where you and your friends can have your "julefrokost". You have a cunning plan that you want to throw this party at sea.*

*Find a website where you can arrange a "julefrokost" at sea."*



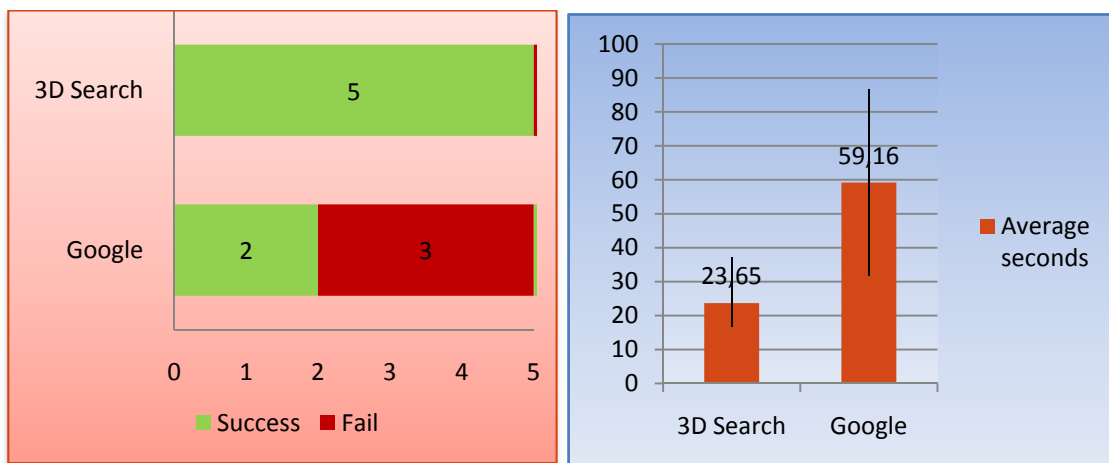
**Figur 15:** The figure shows that both 3DS and Google had 5 successful searches. 3D search took an average of 28.89 seconds whereas Google took 57.93 seconds. The difference between them is 29.04.

Both Google and 3D Search had 5 successful searches. The two searches were done in 28.89 seconds for 3DS and 57.93 seconds for Google which is a difference of 50.1%. The Search result could be found as the number eleven box in 3DS and on the second page when using Google.

## TASK 05

## The instruction:

*"You are in the mood for a nice piece of "lasagne". But you have gotten bored of your old recipe, so you decide to search the internet for a new one. You are looking for a recipe for "hjemmelavet lasagne"."*



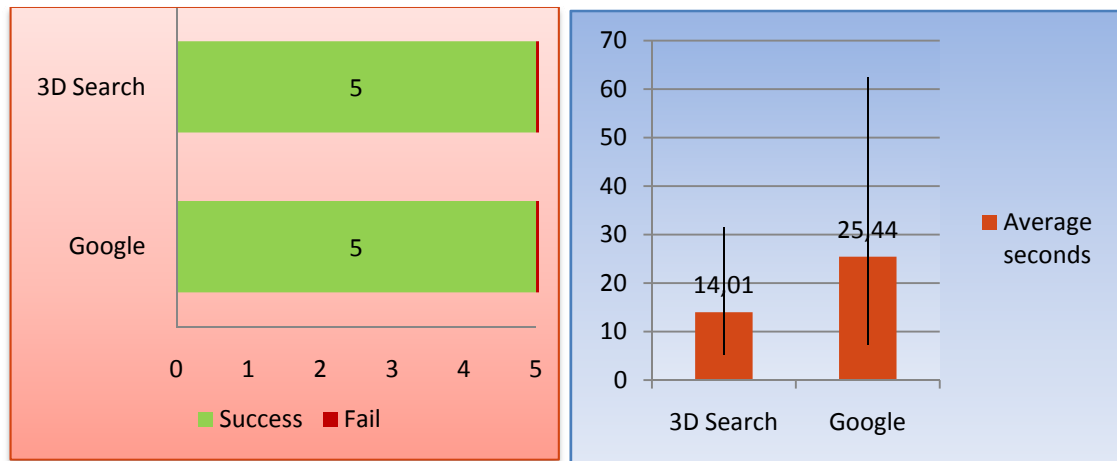
**Figure 16:** The figure shows that 3DS had 5 successful searches, Google had 2 successful and 3 failed. The average speed of 3DS is 23.65 seconds. The average for Google is 59.16 seconds. This is a difference of 35.51.

There were 5 successful searches in 3DS and 2 successful and 3 failed searches in Google. The 3 failed searches are due to users spending time looking for the phrase "hjemmelavet lasagne" on websites instead of in the search results. The two searches were done in 23.65 seconds for 3DS and 59.16 this is a difference of 35.51 seconds or 60%.

## TASK 08

## The instruction:

*“Some friends have been talking about the fantastic playstation 3 or “ps3”. You don’t know much about it, so you have decided to find it on Wikipedia. You need the english version though.*



**Figure 17:** The figure shows that searches had a 5 task success rate. The 3DS search was done in 14.01 seconds and the Google search was done in 25.44 seconds. This is a difference of 11.43 seconds.

Both 3DS and Google had 5 successful searches. The 3DS was done in an average of 14.01 seconds and the Google search was done in 25.44 seconds. This is a difference of 11.43 seconds which comes to 44.9%. The 3DS search had flags telling the user which language the search was in.

## WHERE GOOGLE WAS FASTER

In five task results, Google proved to work faster than 3DS.

| Task name | Task Search phrase | Type of search result | Google (Average seconds) | 3D Search (Average seconds) | Percentage faster |
|-----------|--------------------|-----------------------|--------------------------|-----------------------------|-------------------|
| 01        | Disneyland         | Page                  | 19.95                    | 82.74                       | 75.9%             |
| 02        | Eiffel Tower       | Page (Wiki)           | 6.64                     | 12.35                       | 46.2%             |
| 03        | Hudpleje Aalborg   | Page                  | 11.17                    | 37.23                       | 70%               |
| 06        | Macbook Pro        | Image                 | 37.18                    | 60.75                       | 38.8%             |
| 10        | Aalborg Tårnet     | Address (Map)         | 3.91                     | 9.38                        | 58.3%             |

**Figure 18:** The table shows the five searches where Google was fastest. “Disneyland, Eiffel tower, hudpleje Aalborg, macbook pro and Aalborg Tårnet” where all 40-75% faster than 3DS.

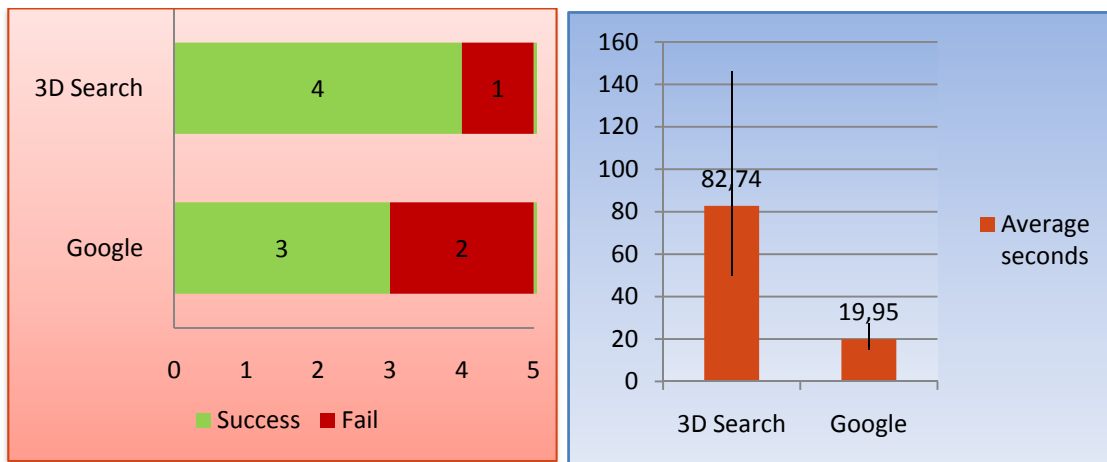
## TASK 01

**The instruction:**

*"You and a friend have long been talking about planning a trip to Hong Kong. You have heard that they have a Disneyland there. To find information and prices about the resort and park you decide to search the internet.*

*You're looking for the Hong Kong website where you can calculate and plan the trip.*

*HINT: Remember the result is not in danish."*



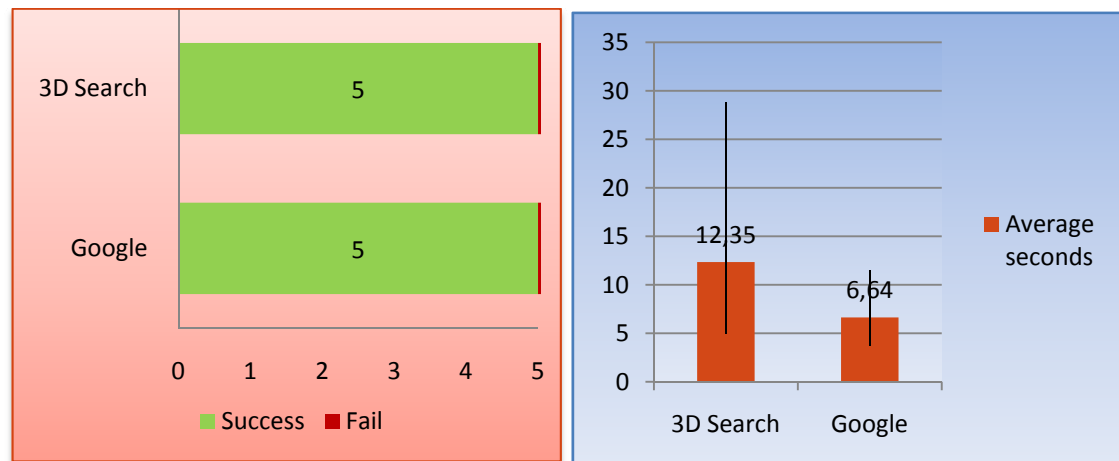
**Figure 19:** The figure shows that 3DS had 4 successful searches and 1 failed. Google had 3 successful searches and 2 failed. 3DS did the search on an average of 82.74 seconds. Google did the search on an average of 19.95 seconds. This is a difference of 62.79 seconds.

3DS had 4 successful searches and 1 failed search. The failed search was due to the test person misinterpreting the test, the result was found through another webpage and not through the searches. Google had 3 successful searches and 2 failed. They also failed due to misinterpretation. The 3DS searches were done in 82.74 seconds and the Google searches were done in 19.95 seconds this is a difference of 62.79 seconds or 75.9%. This was the first search that was done using the 3DS engine, besides the tutorial. The result was placed as the number 12 box in 3DS and is among the searches of the first page of Google.

## TASK 02

## The instruction:

*"You have just been having a discussion with a friend about how tall the Eiffel tower is. You decide to search the web for the information, so you can prove your friend wrong. How tall is the Eiffel tower? The info is on a british Wikipedia page."*



**Figure 20:** The figure shows that both 3DS and Google has 5 successful searches. The 3DS searches were done in an average of 12.35 seconds and the Google searches were done in 6.64 seconds. This is a difference of 5.71 seconds.

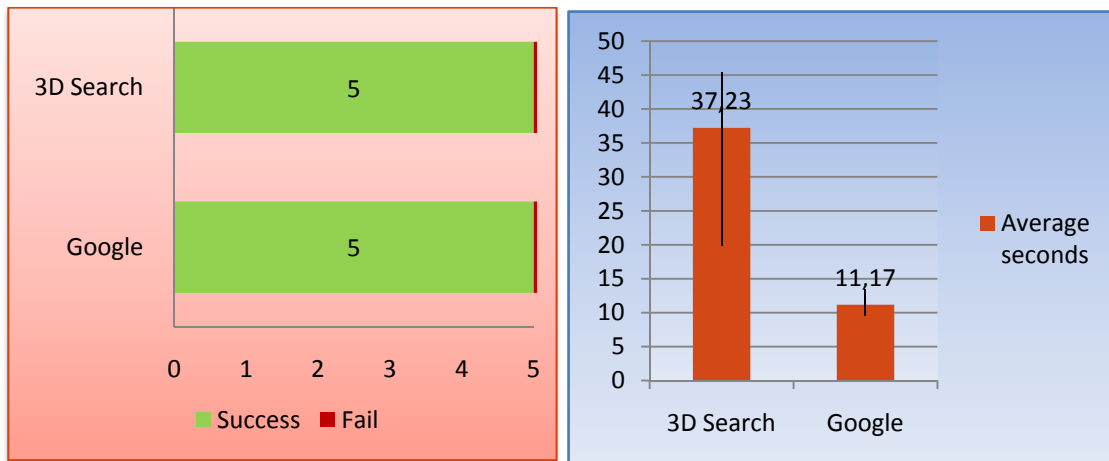
Both the searches had a success rate of 5. The 3DS searches were done on an average of 12.35 seconds and the Google searches was done in 6.64 seconds this is a difference in 5.71 second or 46.2%. The 3DS search had flags to show which language the different searches were in.

## TASK 03

**The instruction:**

*"It's winter and you have gotten very dry hands, so you are looking for someone to take care of it. You decide to search for "hudpleje aalborg" remembering that a friend told you about some products called something with "Dermalogica"*

*Find a website where you can buy "Dermalogica" products."*



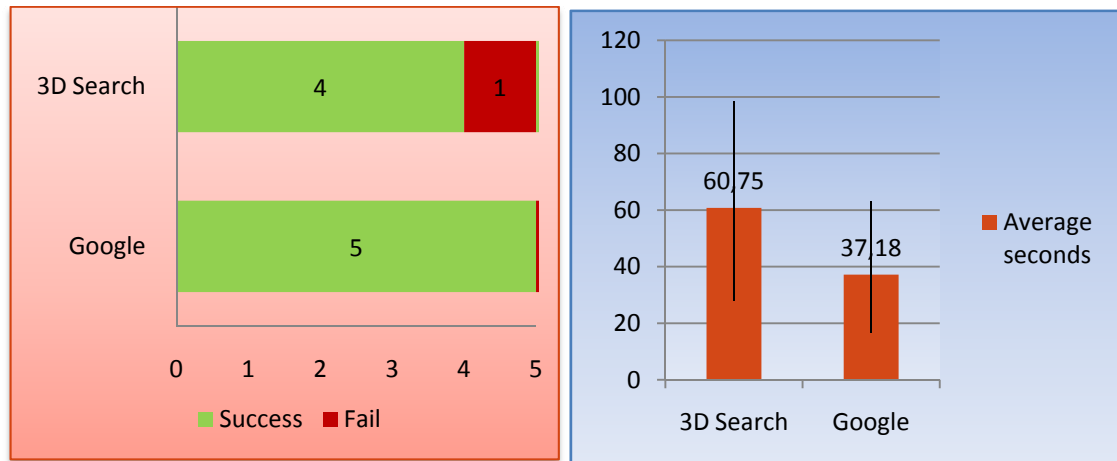
**Figure 21:** The figure shows that both 3DS and Google had 5 successful searches. The 3DS searches were done in average of 37.23 seconds and the Google were done in 11.17. This is a difference of 26.06 seconds.

Both 3DS and Google had 5 successful searches. 3DS did the searches on an average of 37.23 seconds and Google did it on an average of 11.17 seconds, this is a difference of 26.06 seconds or 70%. Dermalogica was a part of the hyperlink text.

## TASK 06

**The instruction:**

*"You have just bought a "macbook pro" and you have fallen in love with it so much, so you have decided to find a wallpaper that shows a Mac. The only problem is that it needs to be the same resolution as your monitor. Can you find one that is 1024x768 pixels (+/- 10 pixels) It is placed on an american website."*



**Figure 22:** The figure shows that 3DS had 4 successful searches and 1 failed. Google had 5 successful searches. The 3DS searches were done on an average of 60.75 seconds and the Google searches were done in 37.18 seconds. This is a difference of 23.57 seconds.

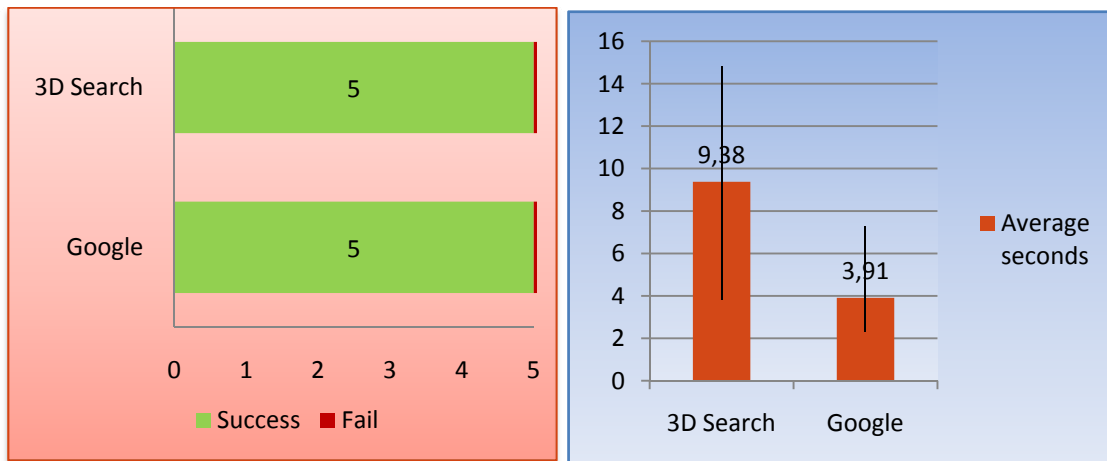
The 3DS had 4 successful searches and 1 failed search. The failed search is due to a misinterpreted task, the test person went to Apple's homepage to find the image, but it could have been found between the search results. The 3DS searches took an average of 60.75 seconds and the Google searches took 37.18 seconds, this is a difference of 23.57 seconds or 38.8%. The test person were allowed to use the Google image search function during this test, due to the fact that 3DS search already showed the resolution directly on the searches.



## TASK 10

## The instructions:

*"You have invited some friends from out of town to meet you at the trademark of Aalborg – Aalborg Tårnet. But you can't remember the address, so you decide to search for it. Find the address of Aalborg tårnet."*



**Figure 23:** The figure shows that both 3DS and Google has 5 successful searches. The 3DS searches were done in an average of 9.38 seconds and the Google searches were done in 3.91. This is a difference of 5.47 seconds.

Both searches had 5 successful searches. The 3DS searches were done in an average of 9.38 seconds and the Google searches were done in 3.91, this is a difference of 5.47 seconds or 58.3%

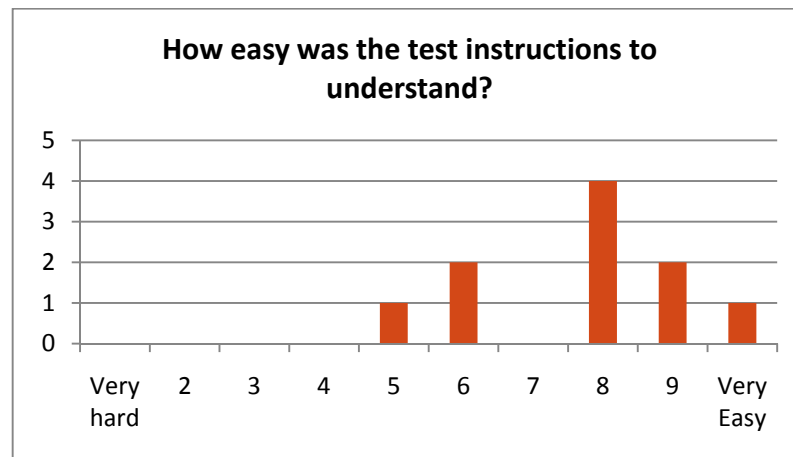
## SURVEY

After the test participants had finished the test, we asked them to fill out a survey regarding the test. In this next section we will briefly present some of their answers.

Our test subjects consisted of 10 persons; three women and seven men.

### HOW EASY WAS THE TEST INSTRUCTIONS TO UNDERSTAND?

When asked how easy the test was to understand, the majority – 70% rated “8” or above. (1 being “Very hard” and 10 being “Very easy”)



**Figure 24:** The figure shows that 70% of the participants rated 8 or above.

Three participants had a hard time remembering all the instructions, but explained that it got better after the first couple of tasks.

### HOW SIMILAR WAS THE SEARCH TASKS COMPARED TO WHAT YOU NORMALLY WOULD SEARCH FOR, IN A SEARCH ENGINE?

The majority (80%) answered above “6” in this question.

Two of the participants mentioned the fact that they normally use more specific queries in a search engine.

### HOW WOULD YOU RATE THE TEST AS A WHOLE

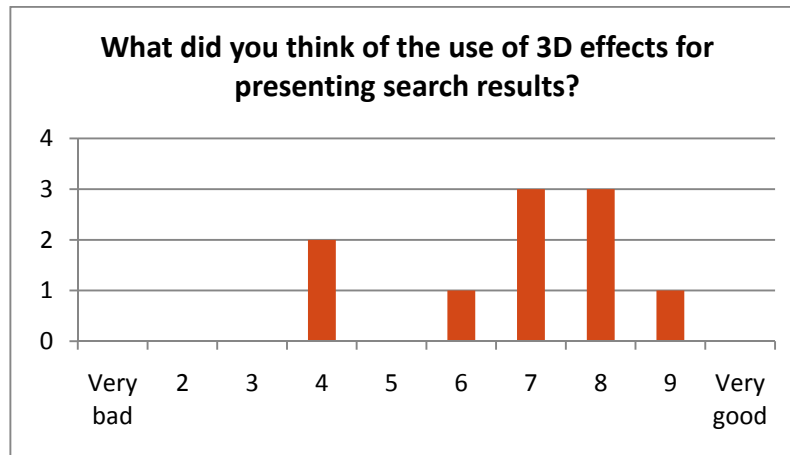
When asked to rate the test as a whole, 100% was on “6” or above (1 being very bad, and 10 being very good).

### WHICH SEARCH ENGINE DO YOU NORMALLY USE?

When asked this, 100% answered “Google”.

### WHAT DID YOU THINK OF THE USE OF 3D EFFECTS FOR PRESENTING SEARCH RESULTS?

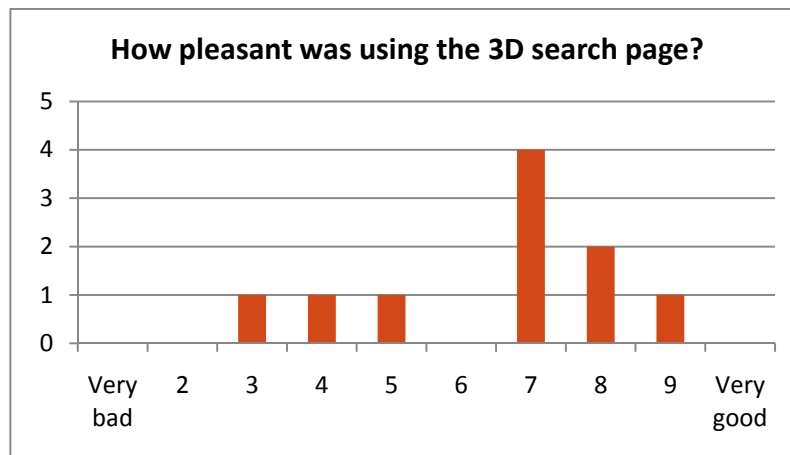
Results were in the high end. Only 20% answered “4”. The rest was “6” or above (1 being very bad, and 10 being very good). When asked to elaborate their answers, the general feedback was positive, especially the idea of showing flags. Also the way images were presented got credit. On the negative side, the lack of a general overview was mentioned.



**Figure 25:** The figure shows that the main part of the participants liked the idea of using 3D effects for presenting search results.

### HOW PLEASANT WAS USING THE 3D SEARCH PAGE?

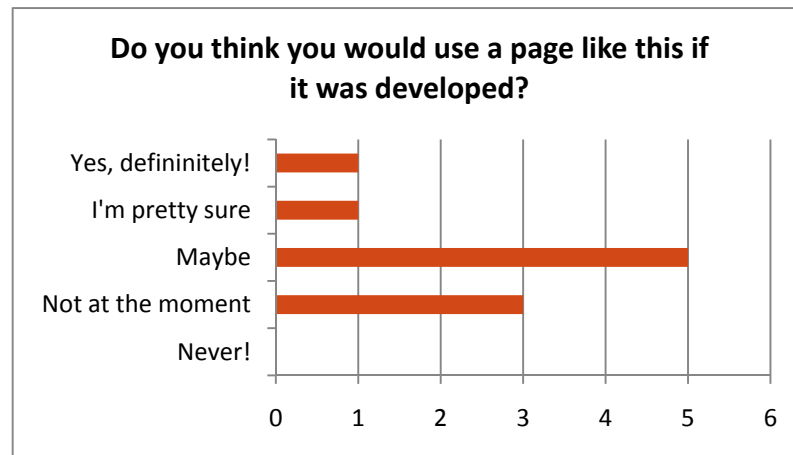
Mostly positive remarks but there were also some complaints about the lack of overview. 70% were 7 or above (1 being very bad, and 10 being very good).



**Figure 26:** The figure shows that 70% of the participants rated 7 or above.

### DO YOU THINK YOU WOULD USE A PAGE LIKE THIS IF IT WAS DEVELOPED?

The answers to this question were both for and against. Some mentioned that they would use it if it was offered to them. Others again mentioned the lack of overview. One mentioned that it is good, when you do not know what you are searching for (Page, image or map), but when you know you are searching for something specific it's not the best compared to Google.



**Figure 27:** The figure shows that most of the participants would maybe use the product if developed. 30% would not use it at the moment.

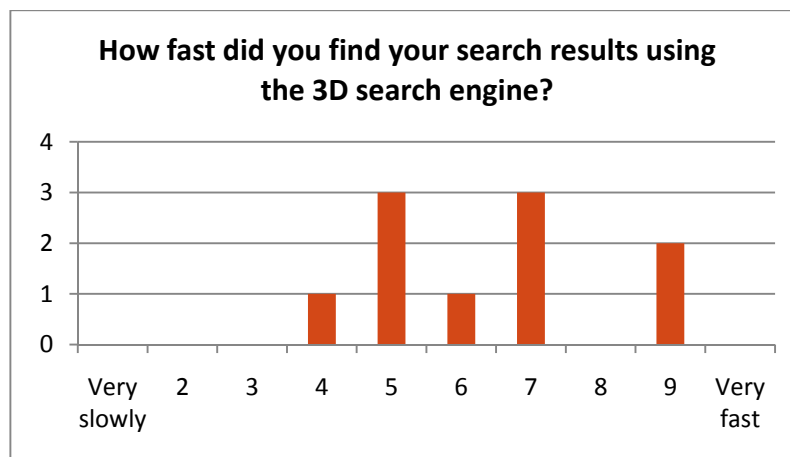
### IS THERE ANYTHING ABOUT THE 3D SEARCH ENGINE THAT YOU WOULD LIKE TO BE IMPROVED?

70% would like to see something improved about the 3D search engine. When asked what, the majority would like to have a better overview.

### HOW FAST DID YOU FIND YOUR SEARCH RESULTS USING THE 3D SEARCH ENGINE?

When asked how fast the participants found their search results using 3D Search, the answers were somewhat mixed (1 is very slowly and 10 is very fast).

One mentioned that results were more conspicuous in 3D Search than Google. And one mentioned that it was faster than Google once you got the hang of it. One mentioned the top of the boxes was hard to spot. Several participants mentioned that the problem was they were not used to using 3D Search compared to Google.



**Figure 28:** The figure shows that the participants meant that they found the results at speeds around average when using 3DS.

#### HOW FAST DID YOU FIND YOUR SEARCH RESULTS USING GOOGLE?

The answers were above average (1 is very slowly and 10 is very fast).



**Figure 29:** The figure shows that the participants meant that they found the results at speeds above average when using Google.

#### WHICH SEARCH ENGINE WORKED BEST IN THESE CATEGORIES? [OVERVIEW]

When asked about which search engine worked best in the category “Overview”, it was a 50-50 tie.

#### WHICH SEARCH ENGINE WORKED BEST IN THESE CATEGORIES? [SIMPLICITY]

When asked about which search engine worked best in the category “Simplicity”, 90% answered “Google”.

### WHICH SEARCH ENGINE WORKED BEST IN THESE CATEGORIES? [SPEED]

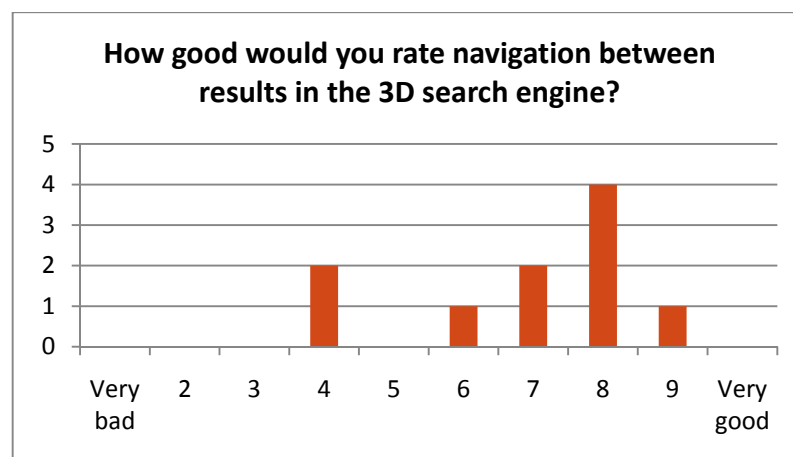
When asked about which search engine worked best in the category “Speed”, it was a 50-50 tie.

### WHICH SEARCH ENGINE WORKED BEST IN THESE CATEGORIES? [USER FRIENDLINESS]

When asked about which search engine worked best in the category “User friendliness”, 100% answered “Google”.

### HOW GOOD WOULD YOU RATE NAVIGATION BETWEEN RESULTS IN THE 3D SEARCH ENGINE?

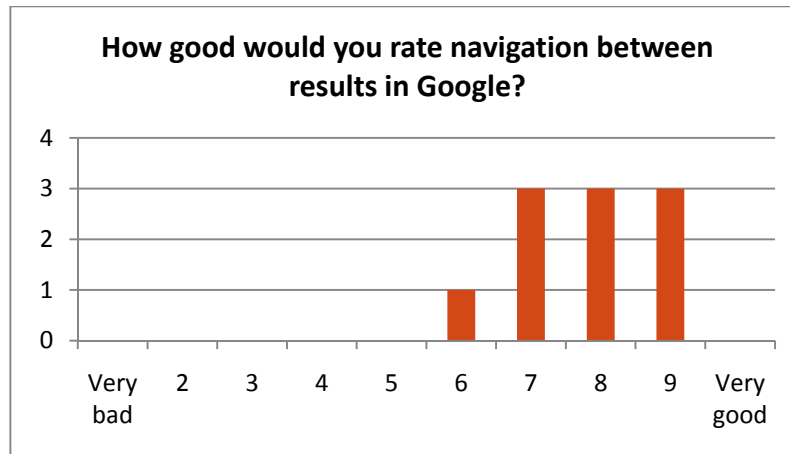
The navigation between search results in the 3D Search engine got 80% at “6” or above (1 being very bad, and 10 being very good). One thing that was mentioned by two participants was the need for a mouse scrolling function.



**Figure 30:** The figure shows that 70% of participants rated the navigation between results 7 or above.

### HOW GOOD WOULD YOU RATE NAVIGATION BETWEEN RESULTS IN GOOGLE?

100% at “6” or above (1 being very bad and 10 being very good).

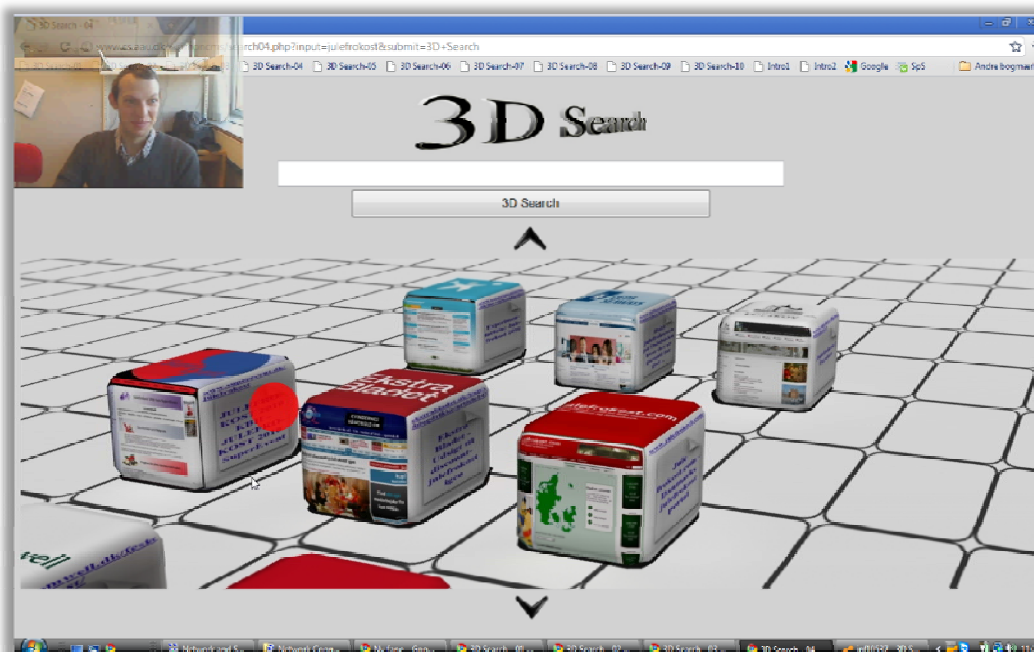


**Figure 31:** The figure shows that 90% of the participants rated the navigation between results 7 or above.

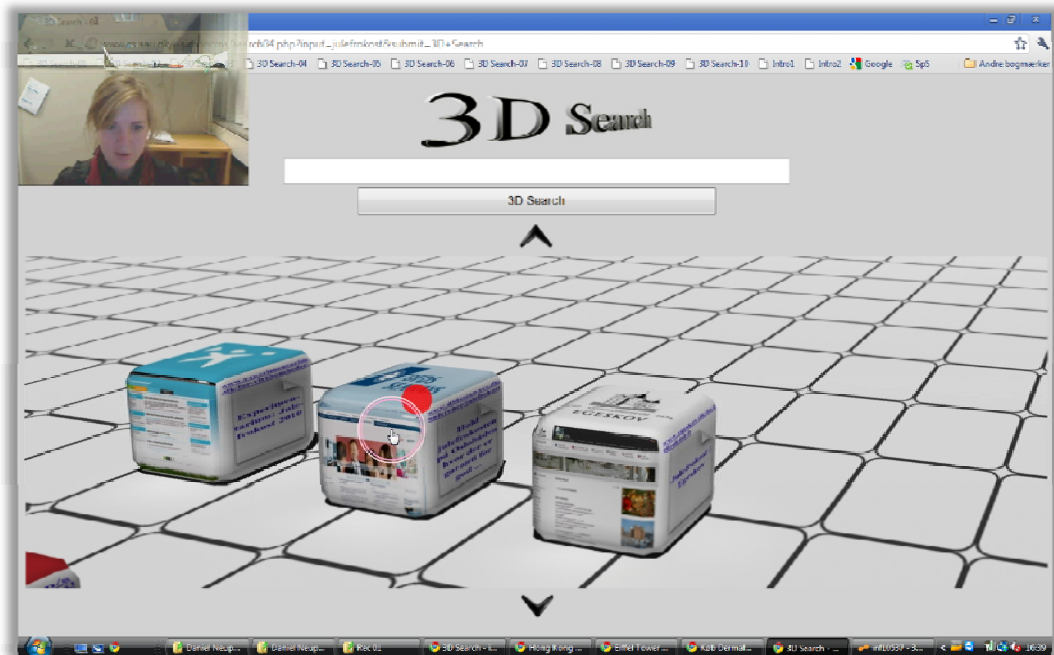
The full survey results can be found on the attached DVD.

### EYE TRACKER FOCUS

In the following screenshots different tests are shown. The red dot in the screen dumps shows where the participant is focusing at the given moment. The larger the dot, the longer time he or she have been focusing. In the upper left corner is webcam video of the participant, and their voice was also recorded. This is merely to give an idea of how the eye tracking data looks.



**Figure 32:** In this screenshot the participant is reading the side of a box, this is clearly shown by the red dot.



**Figure 33:** In this screenshot the participant is focusing on the logo of a box. In this example, this was the correct search result, and as the participant clicked the box, a pink ring circles the mouse – also portrayed in the image.



**Figure 34:** In this screenshot the participant is focusing on the flags in the bottom right of the image. In this task, the goal was to find a British Wikipedia page.

This concludes the data chapter. The data will be discussed in the following chapter.



## DISCUSSION

In this section the data chapter will be discussed. First the speed data will be discussed in the three groups as they were presented in the data chapter. Afterwards the survey data will be discussed and lastly the general eye tracker data will be discussed. The eye tracker data will mostly rely on the videos that were made during the test, so in order to verify these, one would need to look at the videos. These videos can be found on the DVD.

### SEARCH SPEED DATA

#### ALMOST EQUAL RESULTS

One of the things these tasks had in common was that the search results both had an easily recognizable logo. This helped the participants to spot both pages in 3DS almost instantaneously.

There was another aspect that helped the participants solve the tasks fast. This was due to the correct site being among the first five presented results.

The result site from task number 07 was easily recognizable – both in clear text (Google) and as a logo in 3DS.

The link in Google is spelled with large letters (B.T.), and this made it stand out. Also the newspapers logo stands out, being bright red, and with B.T. being written in white text, made it easily recognizable in 3DS.

One could argue that the fact that the name of this newspaper consists of only two letters, made it easier for the participants to find the site. Another thing that made this task so equal could be that the name and the logo are much alike.

In task number 09, one could discuss that the big “Sony” logo in 3DS seemed to help out most of our participants. Also the fact that the two first results in the search was the correct site, could have helped both in Google and 3DS.

#### 3DS FASTER

In task number 04, the site described in the task instructions, was placed on the second page of results in the Google search. That could be the reason why people did not discover it at first. The difference between the amounts of search results presented on the first page of a search could have resulted in 3DS outpacing Google by 50 percent.

In task 05, the lack of clarity in the instructions could have caused the failed tasks. Perhaps if these had been better formulated, the test subjects would maybe have had a better idea of what they were looking for. Unfortunately the three times this happened were all in the Google test. One could argue that this was due to the way people normally use Google to find this kind of result. Therefore, the average time for the Google tasks was calculated from only two test results. One can question if two results were enough to draw any reliable conclusion.

But since, the result times were accepted, one could argue that this was to 3DS' advantage, since there were five successful search results, this search was not as prone to deviation as the Google search with only 2 successes results.

In task 08, it seemed like both the icons on top of the boxes and the flags accentuated the search results in 3DS, but this could also be due to the test person's familiarity with 3DS had increased.

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### GOOGLE FASTER

In task 01, the 3DS task clearly showed that this was the initial task. One can discuss that task 06 would also have time issues. But in task 01 the result is located as the twelfth box in 3DS which is situated in the last row of boxes. In the Google search this result was placed on the first page after a line of pictures and could have been easier to locate.

The test persons seemed to have gotten used to the interface during the introduction, but maybe the introductions' lack of the last six hits meant that they did not expect to find any results there. Some participants were surprised that the Disneyland Hong Kong webpage had an American flag, this could mean that the instructions were not precisely formulated regarding the functionality of the flags.

In task 02, it seemed that the test persons still had some problems with 3DS. This was of course not necessarily the only reason for Google being faster. The 3DS flags did not seem to have the same positive effect as it had shown on other tasks. Maybe there were too many visual impressions for the beginning of the test. This could confuse the participants more than it benefited them.

In task 03, it seemed that the text "Dermalogica" was easier to locate in Google search result text. This could be because the text on the right side of the box was not as easy to read as it was in Google. Also it could be discussed that the test persons did not have a clear idea of what they were looking for therefore the other visual cues were to no use. This meant they had to look at the text on the box or the title text that was produced when hovering over the box.

In task 06, it seemed that the participants did not think that they could find the information they were looking for using only the search function in 3DS. It could be discussed if the image search function in Google is so integrated in people's habits, that they are not used to search for images among "normal" search results, as presented in 3DS. This could mean that they hesitate before getting completely comfortable with the mixture of results, meaning that they spend more time finding the image. It could be argued that this is also the reason why most participants used the image search function build into Google, rather than looking among the images presented in normal Google.

In task 10, one could argue if the "map logo" worked since most of the participants chose "Aalborg Tårnet's" official website instead of the Google maps map. Maybe if the task instructions had been rephrased from an address to a map, more participants had solved the task as intended.

## SURVEY DATA

It was important to be objective when analyzing the results, because of all the test subjects were friends. This could result in some answers being biased.

According to the survey, the majority rated the test very easy to understand. However, some participants thought the instructions were too complex in the beginning, but after the first few tasks it became more transparent. It could be argued that the instructions should have been simpler in their construction.

A couple of the participants stated that they had a hard time remembering all of the instructions. This could either be referring to the tutorial instructions or the task instructions. When going through the eye tracker data, it seemed that in task 01 and 02 some of the participants could not remember or fully utilize the tutorial instructions on how 3DS worked. With that being said, the participants agreed that after a few tasks, it became easier to remember. Maybe if the tutorial had been more hands on rather than instructive, this would not have been such a big issue. Also the use of English in the test was mentioned. Perhaps the test should also have been written in Danish, in order not to exclude any participants from fully comprehending the test.

The similarity of the test searches compared to the participant's normal searches got high ratings but some test subjects mentioned that normally they would use more specific search queries. The fact that this also was mentioned several times during the test could mean that the high rating could have been somewhat biased.

It was expected that the participants would want to use more specific queries, but it was not an option for our early prototype. One could argue that it would have made the test more realistic and the test result data would have been more equal.

The majority of participants were positive when asked if they liked the use of 3D effects for presenting search results. Some participants would even use 3DS if offered. Especially the flags and the presentation of images were positively mentioned. The flags could maybe save some time when looking for results in a certain language. For example when looking for a Wikipedia page that comes in several languages. One could argue that Google's lack of resolution information in the normal search results is a shortcoming, but it could also be discussed how important the resolution of an image actually is in a normal Google search.

One stated that 3DS was good at distinguishing types of search results (Page, image or map) compared to Google. However Google was better when you know exactly what you are looking for. It could be discussed if this was because 3DS puts all search results on one page rather than also having a dedicated image search engine.

The need for a better scroll function was mentioned several times. People are used to using scroll in general and it comes natural to them. It seemed that clicking on the forward and backwards arrows were not the optimal solution, and perhaps a mouse scrolling function could solve this problem.

In many cases, the title shown when hovering over a link with the cursor, were helpful in finding results. However one could argue that we should not have implemented this function, since it might defeat the purpose of the 3D effects.

The need for a better overview was emphasized throughout the answers. In nearly all elaborations regarding 3DS, this was mentioned. This could be the reason why Google outpaces 3DS in so many scenarios. The lack of experience with 3DS could also be a reason for this.

### EYE TRACKER DATA

When looking at the eye tracker videos, one could mention that the participant seemed to have had a hard time reading the right side of the boxes on the far right. It seemed that the hover title was used here the most. Perhaps a better camera angle would help solve this problem.

It seemed that some people looked at the first row of boxes and then scrolled once, in order to see the next row. However, some participants looked at up to nine boxes before scrolling. This could indicate that some users actually used the extended overview that 3D gives them, though the effectiveness of this overview could be discussed in regards to the feedback from the survey.

It can be seen from the data that some users read the boxes from the left to the right, like one would normally do, but in some cases the box nearest to the camera (Box 3) caught the user's eye first. It is not quite certain why this was, but it is speculated that this was in situations where this box had a more attractive logo. However, this was inconclusive.

When looking at the videos it is easy to see that the logo of especially Wikipedia catches the participant's eye. This is probably because many people know how the logo looks and because Wikipedia was used in several tasks. It can also be seen, that some participants are disturbed by being talked to or by some other commotion just after, they have pressed the search button. This could have meant that some of the tasks could have taken longer than they should, but it seems that these disturbances are fairly minute so they probably did not do much difference.

Another thing that can be seen in the videos is that a lot of times people need to ensure that they click the "right" link. Meaning that they move the cursor to the right link or box and keep it there while they jump back to look at previous link texts just to be sure that they have the right one. This could mean that the participants could have felt uneasy in the test environment and the speed measured is not the same as it could have been if it was under normal conditions. This along with the fact that 3DS was new to the participants could mean that Google has a rather large advantage. But the tendency to hesitate can also be seen in the Google searches, so one could argue that this had an overall effect on the test. This ends the discussion. A conclusion is presented in the following chapter.

## CONCLUSION

In this project, it can be concluded that it is definitely possible to present search data using computer graphics and film techniques. A search engine prototype (3DS) was created using HTML and JavaScript. Furthermore, a 3D environment was created using 3ds Max in order to present search results. A test was created and participants were found. The testing was conducted using an eye tracker.

Testing worked rather well, and much of the test data emphasizes this. The test results were in some cases inconclusive, but in general, we have gotten a good picture of which scenarios fitted the two tested search engines best. However there were some drawbacks: We can conclude that testing on a group this small was not ideal. And using friends as test subjects is not the optimal solution since they could be biased in regards of answering the survey. Also we can conclude that the development of the test should have had been more thoroughly executed. The instructions should have been more specific and simple. The tutorial should have been more hands on so the participants would feel more comfortable when using 3DS. Being in a test environment is different than everyday use of a search engine. Therefore, the results have most likely not reflected the normal use completely accurately.

One of the biggest issues in the test was the inequality in recognition. 3DS is characterized by not being known by the participants and therefore Google has a large advantage.

In a scenario where one is searching for a specific text phrase or word, Google would be preferable because of their presentation of search results. This suggests that 3DS would need a lot of work on the text presentation – the right side of the boxes.

The visualization of search results in 3DS was not as good when it came to looking for a page with little distinction compared to the remaining search results. If there is no visual distinction compared to the rest of the search results, it is very hard to find the specific page. Here text is preferable.

The need for a better overview in 3DS was mentioned several times in the survey and during the test and should definitely be optimized in order to be able to equally compete with Google. It can also be concluded that people are generally very used to scroll using their mouse, and clicking between results in 3DS was not the best solution.

The test showed that when a search result has a recognizable logo, 3DS was equal to Google in speed. The visual aspect can in many cases be concluded to be faster when trying to identify a known website.

If a specific search result is not placed on the first page of a Google search, it seems the users use a lot more time finding it. This is because it seems that people would rather write more specific search queries than go to the next page. The fact that 3DS had 12 items in a search result page, instead of Google's 10 was therefore an advantage for 3DS. However this was only the case when Google did not present pictures along with its results. In these situations, Google could have about 15 search results in one page.

It can be concluded that using flags for presenting different language sites is useful. It helps the person searching find their results faster. However it could be unimportant in situations where this information is indifferent.

To summarize this conclusion: The visualization of search results can in some circumstances make the finding of a specific site go faster. The use of language visualization and logos could be ideas to improve search engines, since users in some situations recognize the visual cues faster than plain text. Especially logos since businesses use a lot of resources in branding themselves to be easily recognizable. This could be better utilized in search engines today. However in most situations, it is better and simpler to just have the searches presented in the text form known from Google rather than a 3D environment.

## PUTTING INTO PERSPECTIVE

This chapter will look at what could be done to improve the current product. This is in regards to testing and development.

In order to conduct a more thorough test and create more accurate test results, there are some things that could be done. One thing would be to make the 3D Search engine more functional. If there had been more time, one could have looked into the possibility of using a 3D engine in the browser to create the 3DS environment, perhaps HTML5. This would have meant that searches could have been executed in real time in 3DS, thus minimizing the feeling of being in a test environment. This would also realize the possibilities for creating many further tasks, since there would be no need for the massive preparatory work involved in creating a single task as it is at the moment.

There was a general need to be able to specify your search queries. This would be necessary in order to create a more realistic environment. The possibilities this would create are also vast. We could specify whole new types of tasks, and investigate the different scenarios much more in depth. For example, participants could change their search queries to make a more accurate search, the same as in Google, rather than utilizing the scroll function in 3DS further. Another thing that would be positive to implement would be an actual scroll function. This way the feel of the site would be more similar to other pages, and there would be no need for the scroll buttons.

A function to turn and tile the boxes (place them in a grid), would mean that one could look at only the logos, the text or the screenshots which could mean a better overview. If this was created one could have a lot more freedom with the 3D aspect of the engine.

A thing that could be done in order to enhance the overview is to move the text and URL from the right to the left side of the boxes. This is due to the fact that this side seems to be more visible and, more or less, at the same angle on all boxes.

If 3DS was further developed it could have a continuing stream of search results so websites that are not among the results on the first page, in for example Google, would have a better chance of getting hits.

The testing of the product should also receive some enhancements, using an eye tracker seemed like a good testing method, but without the two products being at the same stage of exposure and development, 3DS had a hard time competing with Google. In order to help surpass this problem, a better and more in-depth tutorial would be needed. In this tutorial there should be more tasks similar to what the participant would experience in the test.

Also it could be a good idea to release 3DS in a beta version for our test subjects to use on an everyday basis before another test was executed. Furthermore the test should have started a bit softer. The use of flags both in task 01 and 02 should have been presented as later tasks in order to make the participants get a feel for 3DS before having to think about this extra feature. Task 06 should also have been moved to the end so that the participants starting out with 3DS here would have a more normal search instead of the wallpaper search.

In order to conclude more from the presentation of maps in 3DS we should have had some more tasks be about this. Finding a better way of presenting pictures is also needed, maybe a dedicated image search in 3DS could be the solution instead of mixing the results. Another way to work around this would be to make the pictures stand out more.

If another test was to be performed at a later time, some of the tasks would probably need to be rephrased and the test managers should be more focused on how the test would run and what the user should be looking for. Also there should have been more guidance for the participants to avoid some of the failed tasks. The instructions should clearly state what the test deals with, and that the information needed is the data from the search engine and not another web site.

The data has not been analyzed using statistics, so in order to see if the data is valid one would have to analyze these. This is however out of our competences, so this would have to be an ability that should be learned and applied to the data.



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# APPENDIX A

## PAGE FUNCTIONALITY

### HTML

The page was split into 11 different PHP files - an introduction and ten search pages, made for our test scenarios. The PHP extension was used if we needed functionality from the PHP language. However we managed to get the functionality up and going without PHP coding. In the <head> section we link to a stylesheet, containing most of the visual definitions for the page. We also link to an individual JavaScript file for this page. This JavaScript file contains the predefined search phrases and functionality for showing the search results. (See figure A.1)

```
<html>
  <head>
    <title>3D Search</title>
    <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1">
    <!-- Link to the stylesheet used -->
    <link rel="stylesheet" href="style.css" type="text/css"> </link>
    <!-- Link to the javascript used -->
    <script src="searchItem.js" type="text/javascript"></script>
  </head>
```

**Figure A.1:** The <head> section of the pages. Here is linked to a stylesheet and the JavaScript that manages the search query.

Next, in the <body> tag of the page, a basic HTML form is created to handle the input. When clicking the submit button it runs a function that clears the search phrase for white spaces. (See figure A.2)

This function is described in the JavaScript section.

```
<form action="search03.php" name="picform" id="picform">
  <tr>
    <td align="center">
      <input name="input" align="left" type="text"
        value="" class="Large" style="width: 700px">
    </td>
  </tr>
  <tr>
    <td align="center">
      <input onclick="white_space(input)" align="center"
        type="submit" name="submit" value="3D Search"
        style="height: 40px; width: 500px" class="Buttontext">
    </td>
  </tr>
</form>
```

**Figure A.2:** A basic HTML form is created. It includes a text box for input and a submit button.

The "scroll buttons" are created in a <div> tag containing a hyperlink. (See figure A.3) This hyperlink refers to the JavaScript functions declared between the head and body section.

```
<div align="center">
  <A HREF="javascript:NextImage()" ">
    <IMG SRC="icons\forward.png" BORDER=0></A>
</div>
```

**Figure A.3:** The "scroll buttons" are created here. They refer to a Java Script function described in the JavaScript section.

## IMAGE MAPS

An image map is used to create several hyperlinks inside of a picture. Instead of making the whole picture link to one page, an image containing an image map can have several clickable areas. This was necessary since our search result pictures should be able to link to multiple pages.

An image map consists of a <map> tag, and one or more <area> tags. These <area> tags consist of one of the three shapes an image map can be; a circle, a rectangle or a polygon. We decided to use polygons, since they can be shaped however we wanted them to. After the shape is defined, the coordinates of the area should be defined. These coordinates are respectively X and Y coordinates in the picture's pixels. Then the hyperlink is defined. We also added a title to show text when hovering over the area with the cursor. This text was the page title, the same text as on the right side of the box. (See figure A.4)

```
<map name="1">
  <area shape="poly" coords="206,61,221,187,201,216,201,237,184,263,102,241," href="#" alt="TEST1" title="TEST1" />
  <area shape="poly" coords="243,161,323,184,325,233,292,295,208,272,202,217," href="#" alt="TEST2" title="TEST2" />
  <area shape="poly" coords="321,244,354,184,446,207,441,267,415,391,322,305," href="#" alt="TEST3" title="TEST3" />
  <area shape="poly" coords="239,104,309,121,317,153,299,173,243,161,220,155," href="#" alt="TEST4" title="TEST4" />
  <area shape="poly" coords="324,244429,203,360,183,352,184,338,215,333,183," href="#" alt="TEST5" title="TEST5" />
  <area shape="poly" coords="359,114,344,143,314,136,316,120,301,118,259,107," href="#" alt="TEST6" title="TEST6" />
  <area shape="poly" coords="407,105,457,118,453,138,439,166,392,156,392,135," href="#" alt="TEST7" title="TEST7" />
</map>
```

**Figure A.4:** Here an image map is created. Consisting of respectively: a shape, coordinates, a hyperlink, and a title. The "alt" attribute is not useful in this example and should be ignored.

## JAVASCRIPT

### SEARCH FUNCTION

Java Script was used to add functionality to the search engine. The function "searchItem" takes the input from the HTML form described earlier. It then returns a value depending on the search phrase. Below is an example of the function (See figure A.5). If the input matches the declared phrase, the function returns "1". If it does not match the declared phrase, the function returns "5" as a value.

```
function searchItem(key)
{
    if (queryString(key) == "playstation3")
    {
        return (1);
    }
    else
    {
        return (5)
    }
}
```

**Figure A.5:** If the input from the HTML form matches the declared phrase in the JavaScript this function returns "1". If not, then "5".

```
function white_space(field)
{
    field.value = (field.value).replace(' ','');
}
```

**Figure A.6:** The white\_space function was needed in order for the JavaScript to work correctly with the HTML input. It simply strips white spaces from the input.

The white\_space function replaces a white space with "nothing". This is needed so the searchItem function can work with the phrase input (See figure A.6). The reason for this is that on the main PHP page, the inserted script uses the input from the searchItem function. This is shown in figure A.7. If the number is greater than 5, the script shows a picture telling the user that nothing matched the search.

If not, then the page shows a picture, named the returned value plus a file extension. This picture is one of our pre-rendered pictures containing the search results, in this case for the "playstation 3".

The reason for the use of the number 5 instead of e.g. 2, is that we have 4 pictures for each search result and in order to scroll up and down, each of them is named with a number (1, 2, 3 and 4). This scroll function is also the reason we have made several pages for each test scenario. We could, in theory, write all the search phrases in one big if-statement in the JavaScript included, in the <head> section. However, if we did this, the scrolling functionality would not work.

```

<script language="JavaScript" type="text/javascript">
    var nothing = "nothing.jpg";

    number = searchItem("input");

    if (number > 5)
    {
        document.write("<img src=\\icons\\" + nothing + " height=\\\"100%\\\">");
    }
    else
    {
        document.write("<img src=\\images1\\" + number +
            ".jpg\\_NAME=\\VCRImage\\_usemap=\\\"#\" + number +
            \" width=\\\"100%\\_height=\\\"100px\\\">");
    }
</script>

```

**Figure A.7:** In the HTML code, a script takes the returned value from the JavaScript page and decides which image to show.

### SCROLL FUNCTION

The scroll function was needed in order to see the search result boxes in the back. The script is placed between the <head> and <body> tags. It consists of several declared variables. First is the number of used images. Then an array containing the used pictures and their path. Lastly the variable "imgNumber", that is set to "0". (See figure A.8)

```

<SCRIPT LANGUAGE="JavaScript">
    // Use the following variable to specify the number of images
    var NumberOfImages = 4
    var img = new Array(NumberOfImages)
    var imgNumber = 0

    // Use the following variables to specify the image names:
    img[0] = "images1\\1.jpg"
    img[1] = "images1\\2.jpg"
    img[2] = "images1\\3.jpg"
    img[3] = "images1\\4.jpg"

```

**Figure A.8:** The scroll function needed these variables to be declared.

Next are the functions to move back and forth between the images. We will describe the NextImage function. This function takes the "imgNumber" and add's "1" to the value. This shows the next picture. If the "imgNumber" equals the number of images in the array, it is set to "0" again. This causes the first image to be shown again. (See figure A.9)

```
function NextImage()  
{  
    imgNumber++  
    if (imgNumber == NumberOfImages)  
        imgNumber = 0  
}  
  
function PreviousImage()  
{  
    imgNumber--  
    if (imgNumber < 0)  
        imgNumber = NumberOfImages - 1  
}
```

**Figure A.9:** The scroll functions. To go forward, this function takes the `imgNumber` and add's "1" to the value. This shows the next picture. To go backwards, the function does the opposite and subtracts "1" from the value. If the `imgNumber` equals the number of images declared in the array, it is set to "0", making it go back to the first shown picture. Also if the `imgNumber` is lower than 0, it is changed the amount of items in the array minus 1.

# APPENDIX B

## THE SURVEY

Name \*

Sex: \*

- ☐ Man  
☐ Woman

Age: \*

Study direction or work: \*

What is your profession?

How easy was the test instructions to understand? \*

1 2 3 4 5 6 7 8 9 10

Very hard ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very easy

Please elaborate:

How similar was the search tasks compared to what you normally would search for, in a search engine? \*

1 2 3 4 5 6 7 8 9 10

Not similar at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very similar



Which search engine do you normally use? \*

☐ Google

☐ Bing

☐ Yahoo

☐ Altavista

☐ Andre:

Please elaborate:

What did you think of the use of 3D effects for presenting search results? \*

1 2 3 4 5 6 7 8 9 10

Works very bad ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Works very good

Please elaborate:

How pleasant was using the 3D search page? \*

1 2 3 4 5 6 7 8 9 10

Very bad ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very good

Please elaborate:

Do you think you would use a page like this if it was developed? \*

- ☐ Yes, definitely!
- ☐ I'm pretty sure
- ☐ Maybe
- ☐ Not at the moment
- ☐ Never!

Please elaborate:

Is there anything about the 3D Search engine that you would like to be improved ? \*

- ☐ Yes
- ☐ No

What would you like to see improved? \*

How fast did you find your search results using the 3D search engine? \*

1 2 3 4 5 6 7 8 9 10

Very slowly ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very fast.

How fast did you find your search results using Google? \*

1 2 3 4 5 6 7 8 9 10

Very slowly ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very fast.

Please elaborate:

Which search engine worked best in these categories? \*

Lets say this was the first time using both search engines.

Google 3D Search

|                   |                       |                       |
|-------------------|-----------------------|-----------------------|
| Overview          | <input type="radio"/> | <input type="radio"/> |
| Simplicity        | <input type="radio"/> | <input type="radio"/> |
| Speed             | <input type="radio"/> | <input type="radio"/> |
| User friendliness | <input type="radio"/> | <input type="radio"/> |

How good would you rate navigation between results in the 3D search engine? \*

1 2 3 4 5 6 7 8 9 10

Very bad ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very good

Please elaborate:

How good would you rate navigation between results in Google? \*

1 2 3 4 5 6 7 8 9 10

Very bad ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very good

Please elaborate:

How would you rate the test as a whole \*

|          |                       |                       |                       |                       |                       |                       |                       |                       |                       |           |
|----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------|
| 1        | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     | 10                    |           |
| Very bad | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very good |

Please elaborate:

How would you rate Google vs 3D Search on an overall basis? \*

|           |                       |                       |                       |                       |                       |
|-----------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|           | Very bad              | Bad                   | Mediocre              | Good                  | Very good             |
| Google    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3D Search | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |



## DVD

The DVD contains:

- A Guide that describes the what the content is and how it is indexed
  - The code for the 3D Search engine
  - The test data
  - A portfolio describing the evolution of the project
  - The report as a PDF file
-