

Exploring the Effect of Search Engine Personalization on Politically Biased Search Results

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ABSTRACT

The internet has become a widespread tool for people to find political information. As a result of this, the neutrality of the results shown by search engines has been of increasing concern for the democratic ways of many countries. With the introduction of personalized search results, the so-called ‘‘filter bubble effect’’ could result in users potentially getting results which only portrays one political side. We have used the results from 89 students who filled out our survey. We have found out that on Google’s search engine, more than 25% the participants had search results which were to some extent politically biased. However, no clear connection was found between personalization and politically biased results. Moreover, we discovered that DuckDuckGo isn’t as reliable as previously thought. DuckDuckGo states that if multiple users type in the same query, they should get the same results. Furthermore, DuckDuckGo should be clear of any political biases due to the fact that it provides results based on the semantics of a query and it doesn’t collect any data of the user. Nonetheless, over 67% of the results, for one of our queries used in the survey, turned out to be politically biased. One should be well aware of the potential biases it may encounter in search engines, as the biases are not only existent in personalized search engines, they may also well be found in search engines which don’t personalize their results.

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Keywords

Google; Search Engine; User Profile; Search Engine Manipulation; Personalization; Political Bias; DuckDuckGo

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1. INTRODUCTION

There is a lot of information being stored on the Web which makes it nearly impossible to sort them all out [8]. Due to this, there is a need for search engines to use certain tools to provide its users with the relevant data that they are actually looking for. This can be achieved through the so-called personalization of search engines. Google implemented personalized search for the first time in 2005 in order to improve the user experience. This was based on the knowledge Google has gained from past searches, clicks and interactions [17]. In the beginning, this service was only available to users who had a Google account, but in 2009, it was made accessible to everyone who uses the Google search engine. It provides customized search results through the use of an anonymous cookie placed in your browser which collects data of a period of up to 180 days [11]. An example of this personalization put to practice can be seen in the following example. If a small boy, who is a fan of the animated movie named Cars, types in "Cars" in the search engine of Google, it is highly likely that the results will be mostly from the animated movie "cars" instead of actual cars. While on the other hand, if someone else who never heard of the movie before, types in "cars" in Google's search engine, the results will most probably be about actual cars. This is the result of personalization.

Personalization anticipates the user's needs and it does so through constant monitoring of the interactions that happen while browsing the Web. With all the data that Google has collected, it creates a specific profile for the user, also called the e-profile. This profile contains everything that Google knows about you, such as whether you are male or female, your approximate age, your location as well as your major interests [8]. It uses this profile to maximize the user experience and to give you the best personalized search results. However, with all this personalization happening, a question arises of whether the search results might be biased, or even manipulative. When we talk about manipulation we mean "the action of influencing or controlling someone or something to your advantage, often without anyone knowing it" [15]. The goal of this paper is to find out whether personalized search engines provide results which are politically biased and to what extent are these results caused by personalization. Moreover, we want to find out whether one-sided results have an influence on the user's decision making. The main research question for this research is:

To what extent do personalized search engines manipulate user's decision making by providing one-sided views based on their political preference?

Moreover, in this research we will use the search engine called "DuckDuckGo" as a benchmark to compare with Google to find out whether the results on Google are a result of personalization. This search engine states that it doesn't collect any information about the user, this is to avoid having biased results due to the "filter bubble" effect.

Furthermore, we will test whether the results on DuckDuckGo are biased towards either the left-wing or right-wing political ideology. A sub question for this research will be:

Do the results from DuckDuckGo contain any political bias?

2. THEORY

Algorithms are inventions created by humans, as a result of this, the algorithms for the Google search engine will be created with certain beliefs and biases which might affect the design and function of the algorithm [1,5]. This means that a certain developer who worked on Google's search engine algorithm, could knowingly or unknowingly, have left a digital footprint of his political views in the algorithm. This raises the question whether there is any inherent bias within the algorithm from Google.

2.1 Filter bubble

Although personalization has been proven to provide higher user satisfaction amongst its users, there are a few potential drawbacks. One of them is the "filter bubble" effect, which was explained by Nguyen et al as a "self-reinforcing pattern of narrowing exposure that reduces user creativity, learning and connection" [16]. This is the result of personalization, the results shown are being filtered so that they match the user's interests and preferences [16]. As a result of this, the user might not be able to discover new topics or different views. Furthermore, personalization doesn't only limit the user of finding new ideas, it could also possibly result in providing one-sided views based on their preference. Moreover, the results may become biased and the so-called "manipulation effect" might occur. The effect of this was shown by Epstein and Robertson in 2015, where they found out that the manipulation of search engine rankings based on queries which are election-related could change the voting preference of the user by 20% after a single search [19].

2.2 DuckDuckGo

Due to the filter bubble and even some questions regarding privacy violation, other search engines such as DuckDuckGo, which doesn't collect any data from the user, has seen an increase in popularity. DuckDuckGo is a search engine which aims to protect the user's privacy as well as avoiding the filter bubble effect due to personalized search results [4]. DuckDuckGo provides results based on the semantics of the query and can be seen as an expert oriented search engine [22]. One of the reasons why someone might want to use the DuckDuckGo search engine is that there is no, so-called, "search leakage". This happens when you search for something which is private, by unknowingly sharing the data of what you actually searched, not only with the search engine you're using, but also with the sites that you visited as a result of that search. This information can be used to identify who the person who visited these websites is [6].

Another reason to use DuckDuckGo is that it doesn't save your search history after you close it. Other search engines who do save the search history, they also save other information such as your IP address, the User agent and a unique identifier which is usually stored in a browser cookie [6]. However, DuckDuckGo only has a 0.68% market share, compared to Google which holds 86.95% [22].

2.3 Left-wing vs Right-wing

In most democratic countries, we will find that there are mostly two different sides in politics, namely the "Left" and the "Right". According to the Oxford dictionary the definition of the "left wing" is "the radical, reforming, or socialist section of a political party or system." [14]. While the definition of the "Right wing" is "the conservative or reactionary section of a political party or system." [20]. Furthermore, the political left wing tends to be more liberal, focussing on moving forward, while the political right wing tends to be more conservative and traditional in nature. However, most of the people don't see themselves as fully left-wing supporters or fully right-wing supporters. Most probably, they support some ideas from the left and some ideas from the right.

We expect that quite a bit of people might have neutral views about certain topics. For example, there might be people who aren't living in Europe and have neutral views about the refugee crisis in Europe.

For this research we will be looking whether a person's political preference, which is anywhere from left to right, will influence the results on the search engine and in particular if it will provide one-sided views based on that political preference.

2.4 Related work

According to a study conducted by CanIRank, which collected the results from over 1,200 URLs on queries which are politically-charged, such as "abortion" and "gun control", they found out that there is a 40% chance that the results will be more in favour of liberal or "left" politics rather than their "right wing" counterpart [7].

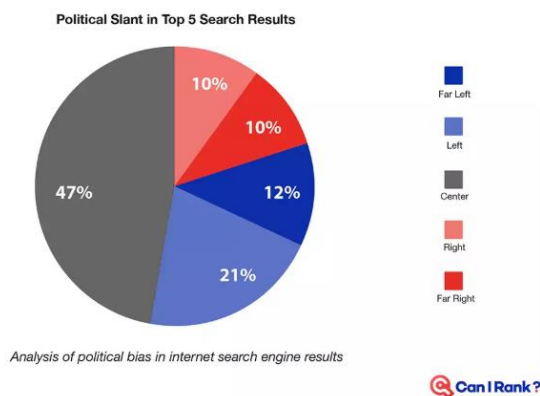


Figure 1. CanIRank.com [7]

As one can see in figure 1, there is a 33% chance to come across left-wing views in the first 5 search results, as opposed to the 20% of coming across results which contain right-wing views. Furthermore, CanIRank wanted to find out whether Google's algorithm contains any political bias.

They did this by looking at a few ranking factors such as: *keyword usage in title, related term usage, relevancy of indexed pages, relevancy of home page* and more. They concluded however that there was no clear evidence to prove that there is any "inherent bias within Google's algorithm" [7].

Another study which was conducted by Epstein Robertson in 2015, found out that the rankings of the search results have a 20% can influence undecided voters to vote for a certain political option [19]. In general, the U.S. Presidential elections have been won by margins which were less than 7.6% [13]. Due to the fact that elections are often won by small vote margins, the search ranking manipulation might have a huge impact on the democratic way of voting.

Hannak et al. measured and identified which kind of factors caused personalization such as gender, location etc. They found out that most personalization happens when a user is logged in to their Google account. Their experiments showed that only 11.7% of the differences in search results were caused due to personalization [9]. This proves that personalization does not have a great impact on the results, but only slightly.

According to research conducted in the year 2000 by Introna and Nissenbaum, they suggest that search engines can systematically exclude specific websites [23]. They state that especially those powerful, popular and rich websites have a higher possibility of appearing on the search results at the expense of other websites which are less popular or powerful. This can be seen as an attack to the democratic ways of the World Wide Web. As a result of this, people looking for certain information online might be susceptible to getting biased results.

2.5 Relevance

Although previously conducted research proved the existence of the "search engine manipulation effect" also known as "SEME", there was no prior research conducted to find out whether the results shown on Google could be manipulating the user based on their political preference due to personalization.

The practical relevance of this research is that it will shed light on the fact whether personalization affects the results to be politically biased. It will also create awareness of how reliable DuckDuckGo actually is. Reliability can be defined as "the extent to which an experiment, test, or measuring procedure yields the same results on repeated trials" [18].

3. METHODOLOGY

In order to do find out whether the users of the Google search engine are in fact being manipulated due to them getting one-sided results because of personalization, we will conduct a survey. The survey is going to be obtrusive, which means that the subjects are aware that they are being monitored and that their responses will be used for this research. We acknowledge the fact that this could influence their responses in the survey. "The unit of observation is the who about which data is collected in a survey" [21]. For this research, the unit of observation will be students who are 18 years or older. The students can

be from any country in the world. The unit of analysis can be defined as the major entity which is being analyzed [2]. Our unit of analysis is going to be the two search engines, namely Google and DuckDuckGo.

First, we need to define what we wish to find out with our survey. The goal for this survey is to find out whether our survey respondents are being manipulated through the search results that they will provide to us during the survey. In this paper we will define manipulation as the search results only showing information from one point of view as a result of one's political view. We also want to find out whether DuckDuckGo contains any political bias in its search results.

3.1 Participants

As mentioned earlier, all our participants have to be students and at least 18 years of age in order for them to be used in our research. They should currently be studying or have finished their studies, because that way we can prevent any biases that could be caused by differences in educational levels. They can reside in any country of the world. However, we anticipate that most of our respondents will be from Europe. All of the participants shouldn't have deleted their cookies in the past one month. This is to make sure that the participant will receive results which are personalized. A cookie can be defined as "a small piece of data that a server sends to the user's web browser, which the browser may sort and sent it back with the next request to the same server" [12]. The main search engine of the participants should be Google, but they can also have used other search engines from time to time. All of the participants have to complete the survey on their own personal laptop or PC (personal computer). This is because only then will their searches be personalized due to their online profiles. Any surveys which are completed elsewhere such as a phone or a public computer won't be used for this study.

3.2 Procedure

We will compare the results from two different queries with Google and DuckDuckGo. The participants will make a screenshot of the first six organic results, which means that we don't include results which are paid advertisements from both Google and DuckDuckGo. They will do this for the both search queries which are "how is trump doing overall" and "European refugee crisis result". Which we will respectively shorten in this report as "query #1" and "query #2". We will look at the first six results and find out whether the majority of the results shown are biased towards the left-wing or the right-wing ideology. If it turns out that the results aren't politically biased for a specific participant, we will call the results to be neutral.

These two queries were chosen due to the fact that at the moment of writing this paper, both Trump and the European refugee crisis have been in the news quite a bit and there has been an ongoing debate about the positive and negative sides. The queries themselves are neutral in nature and should be clear of any political bias. The query about Trump is asking how Trump is doing overall, so the results

should be mostly facts about the progress he made and what he has achieved so far. The second query about the European refugee crisis specifically asks what the result of this crisis has been. We expect results which should show what kind of impact the European refugee crises has had on Europe. However, there are people who like the things Trump did and there are people who are criticizing his achievements. There's also a lot of mixed feelings about the European refugee crisis. One part of the people think that the European country should help out the refugees and that this as a result increases the multicultural diversity, while on the other hand, there are people who are against the refugees and are saying that they take away the culture and values of the European countries.

To find out whether the respondents of the survey are more "leftist", "rightist" or "neutral", they will be asked two questions near the end of the survey which are "what is your opinion about Trump?" and "what is your opinion about the refugees in Europe?". These questions have five different multiple-choice answers which are: "Very positive"; "Positive"; "Neutral"; "Negative"; "Very negative". Based on the answers the respondents give on these questions, we can approximately put them in a group of being, either "leftist", "rightist" or "neutral". This information will be used to see whether the user is indeed being manipulated by the search engine by getting one-sided search results.

Based on the results from the survey, we will put every respondent in two different groups. The first group is going to consist of respondents who viewed themselves as either a "leftist" or "rightist" for one of the search queries, while the other group will consist of those who see themselves as "neutral". This will be done for both queries as we don't expect that all our participants will have the same views on both topics.

3.3 Web page classification

In order to find out whether the results shown on Google and DuckDuckGo contain any political bias, we will have to classify the results. This will firstly be done by looking at the title. Example of a left-wing title from one of our participants is: "Trump Is a Hothead Who Is Doing a Bad Job". Another example of a right-wing title is: "Here's why Donald Trump is doing so well". As one can see there is a clear difference between the two articles based on the title. We consider an article to be neutral if it points out facts instead of having subjective statements. An example of this is "How is Donald Trump actually doing?". If it is unclear from the title what kind of sentiment the article contains, we will look at the article to find out whether it has any politically biased views or not. After looking at all the 6 results from a specific participant, if there are 2 or more articles which are left-wing or right-wing we consider this person to have politically biased results for either left-wing or right-wing views. If it doesn't have 2 or more politically biased views it will be seen as neutral.

3.4 Expectations

In theory, we expect that if a person is more leaning towards the right-wing ideology, he should be given search results which are against the immigration of the refugees in Europe. Those who are supporters of the left-wing ideology should have search results which put the refugees in Europe in a much more positive light, such as listing the benefits of having them in Europe.

The same goes with the query about Trump, the people who identify themselves as a supporter of the ‘right’, should get results praising Trump while the people who identify themselves as a supporter of the ‘left’, should get the opposite results, which are predominantly criticizing Trump.

4. RESULTS

In this chapter we will discuss the research results. First, we will elaborate on the demographic characteristics of the sample. After this, we will go more in depth into the actual search engine results and we will discuss whether there is any sign of manipulation existent due to the personalization of search engines.

4.1 Demographic characteristics

Our sample consists out of a total of 89 participants. All of these have stated that they didn’t remove their cookies in at least one month. This is important so that the search engine will give the respondents personalized search results. 48 of these participants are male while the other 42 are female. The age of all our participants is between 18 and 29 with the average age being 22. We have participants from 8 different countries. However, most of them reside currently in the Netherlands.

4.2 DuckDuckGo results

First, we will look at the results from DuckDuckGo and find out whether the results are politically biased in any way. According to the creators of DuckDuckGo, if multiple people type in the same query in the search bar, they should receive the same results [6]. However, based on the results from our research we found this not to be correct.

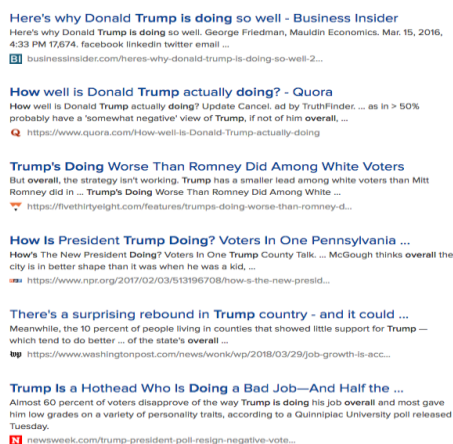


Figure 2. Participant #5 search results for query #1 on DuckDuckGo

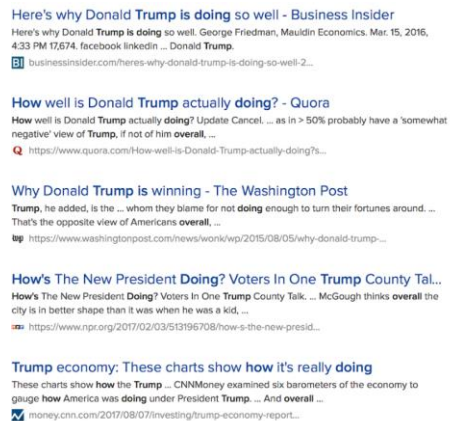


Figure 3. Participant #16 search results for query #1 on DuckDuckGo

As one can see in the two figures above, figure 2 has results which contain more left-wing views. In fact, the results shown are biased against Trump. In figure 3 this is not the case and it even has two different results which have right-wing views and are praising Trump of how well he actually is doing so far. According to the results from our survey, we found out that for the query ‘how is Trump doing overall’, 46% of the results were leftist, 33% of the results were neutral while the remaining 23% were rightist. For the second query however, ‘European refugee crisis result’, we found out that 25% of the results contained left-wing views, while 75% contained neutral results. There was no significant bias in the second query.

	Query #1	Query #2
Left-wing views	46% (N=41)	25% (N=22)
Neutral views	33% (N=29)	75% (N=67)
Right-wing views	21% (N=19)	0%

Figure 4. Query results on DuckDuckGo

4.3 Google results

Looking at the results from the first search query, ‘How is trump doing overall’, we found out that 80% of the respondents had left-wing views, which were views opposing Trump. 18% of the respondents were neutral, which means they weren’t either in favor or opposing Trump. The remaining 2% have right-wing views, which means that they are supporters of Trump. Political views changed slightly for the second query, ‘european refugee crisis result’. There we found out that 38% of the respondents had left-wing views, 48% of them had neutral views and 14% had right-wing views.

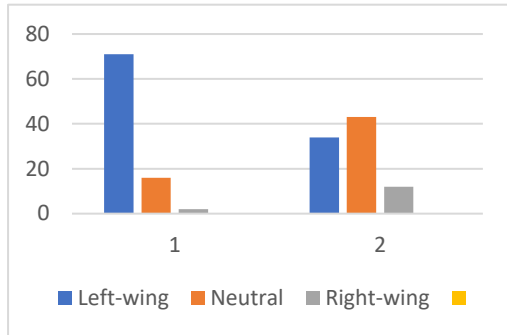


Figure 5. Political views of the respondents (N=89)

For the first query, ‘how is Trump doing overall’, we found out that only 2% of the results were biased towards left-wing ideology. 76% of the results were neutral and showed predominantly facts instead of having views which were left-wing or right-wing, in other words, against Trump or supporting Trump. The last 22% of the results contained a slightly more right-wing view of Trump, showing articles such as ‘Donald Trump Is the Most Successful First-Year President of All Time’.



Figure 6. Participant #57 Right-wing results for query #1 on Google

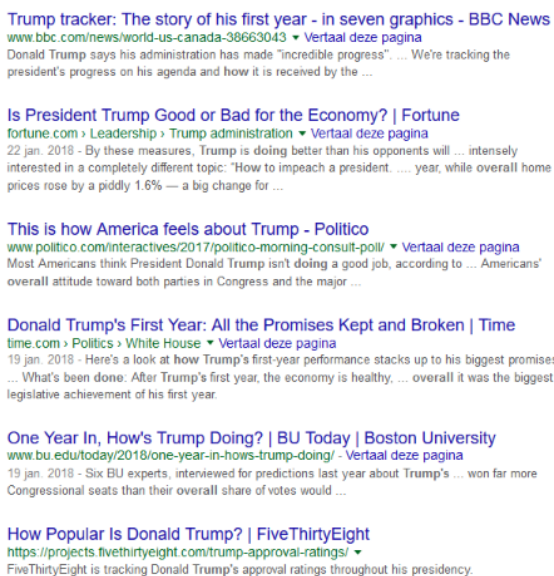


Figure 7. Participant #13 Neutral results for query #1 on Google

As one can see from figure 6, the article which is called ‘Donald Trump Is the Most Successful First-Year President of All Time’ is not shown for participant #13, as can be seen in figure 7.

For the second query, ‘European refugee crisis result’, the results were rather similar to the first query. 12% of the participants received results which were more right-wing, showing results from charities and as well as articles which are saying that Europe isn’t doing enough to help the refugees in Europe.

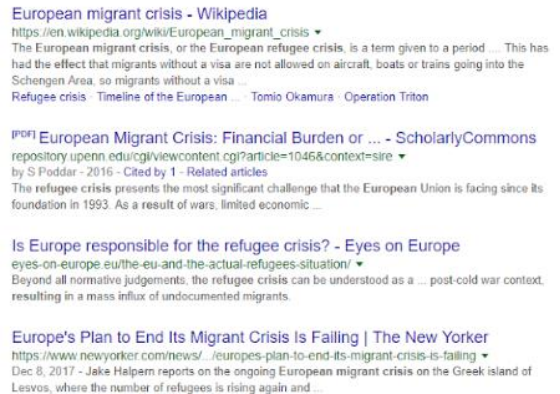


Figure 8. Participant #61 Left-wing results for query #2 on Google

The figure above shows results which are rather left-wing in nature as there is one article which is blaming Europe for the refugee crisis. 67% of the participants had results which were mostly neutral, giving facts and other data which is not biased in a political view. The remaining 21% of the respondents of our survey had results which were more leaning towards the right-wing ideology. One of the main articles those people had was ‘How is the migrant crisis dividing EU countries?’. This article explains the negative effects the refugees have on European countries.



Figure 9. Participant #4 Right-wing results for query #2 on Google

	Query #1	Query #2
Left-wing views	2% (N=2)	12% (N=11)
Neutral views	76% (N=68)	67% (N=60)
Right-wing views	22% (N=19)	21% (N=17)

Figure 10. Query results on Google

4.3.1 Google Search Engine Manipulation Results

In order to find out whether Google could possibly be manipulating its users, we will look at our participants whose results were biased towards either left-wing or right-wing views. Those participants who had neutral results won't be used for this part of the research.

For query #1, which is 'how is Trump doing overall', there were a total of 21 respondents who had results which were biased towards either left-wing or right-wing views. Out of those people, 14% had their views enforced. In example, people who are against Trump got left-wing results and those that support Trump got right-wing results in only 14% of the cases. The remaining 86% showed no sign of manipulation, because they didn't have their views enforced based on the given results.

For query #2, which is 'European refugee crisis result', there were 28 respondents who had biased results in favor of either political side. Here 36% of them had their views enforced while the other 64% didn't.

	Query #1	Query #2
Views enforced	14% (N=3)	36% (N=10)
Views not enforced	86% (N=18)	64% (N=18)

Figure 11. Results of political views enforced on Google

5. DISCUSSION

In this study, we questioned how many of our respondents used Google as their main search engine. We found that 100% of our participants stated that Google was their main search engine. Out of these people, only 5% weren't aware of the fact that Google personalized its results for each user. We have discovered that the results from Google had a chance of over 25% to be politically biased. However, we found no clear connection between personalization and the results being politically biased. Most of the participants which received politically biased results, didn't have their views enforced, namely 86% of them in the first query and 64% in the second query. In general, the participants which stated in the survey that they had negative thoughts about Trump didn't get more results which were left-wing than the ones who had positive thoughts about him. Same goes for the query about the European refugee crisis, the people who have positive thoughts about it didn't receive more left-wing articles than those who have negative thoughts.

As such, we can't proof that Google provides one-sided results based on one's political preference because there is no explicit evidence.

Furthermore, we focused on DuckDuckGo to find out whether the search results could potentially be biased. Contrary to the believe that DuckDuckGo should provide the same results if different people type in the same query, we discovered this not to be true. We have found that different people had different results. This discovery wasn't very strange due to the fact that we had participants from different countries. However, we were surprised by the fact that the search results on DuckDuckGo were, for at least the query about Trump, to some extent politically biased. We found out that for the first query, 46% of the results were biased towards the leftist political ideology while 21% contained results which were mostly rightist. The remaining 33% contained neutral results. This result was unexpected due to the fact that DuckDuckGo doesn't collect any data and thus shouldn't have results which might have been a result of the so-called 'filter bubble'. For the second query, which was about the European refugee crisis, there was a slightly smaller bias visible compared to the first query. Only 25% of the results were leaning more towards the leftist ideology. While, on the other hand, 75% of the results were considered to be neutral. It is worth noting that out of the 89 participants used for the survey, 76% of them were from the Netherlands. Due to this, there is a 24% possibility that the different results on DuckDuckGo can be explained due to the other participants residing in another country instead of the Netherlands. It's also worth noting that the participants took our survey in a time span of 2 weeks, so this might have some effect for the results of DuckDuckGo.

5.1 Conclusion

There have been numerous debates on whether search engines, especially Google are giving politically biased search results. The primary concern in this paper was to find out whether people could get manipulated by the search engines due to personalized results, however based on the findings of this research there is no evidence to prove this. As this research has shown, search engines which claim to not collect any data about its users such as DuckDuckGo still can provide politically biased results. Even though it seems like personalization does not directly manipulate its users by enforcing their views, it can still happen. Moreover, people should be aware when looking up information on the internet and they shouldn't settle for the first results they see, but instead dig deeper to avoid stumbling upon possible biases.

5.2 Limitations

There were several limitations in this study. First, even though we originally had over 120 participants who conducted our survey, we could only use 89 of them since others didn't fit all our criteria. Second, we have no way of finding out whether the participants which have been used for this survey actually didn't delete their cookies in a month. They might have deleted them by accident or they forgot that they deleted them in the first place.

As a result of this, their search results might not be that personalized after all. Lastly, for the first query, “how is Trump doing overall”, more than 80% of our survey respondents stated that their opinion about Trump is “negative” or “very negative”. However, considering the fact that our participants knew that their results would be used for the research, they could have not stated their true opinion about him. Lastly, the web page classification is conducted by ourselves instead of the participants. This means that the results could unintentionally be biased.

6. ACKNOWLEDGEMENTS

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