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Echo Chambers in a Transformed Communication Environment: An Attempt to Clarify a Metaphor.


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Echo Chambers in a Transformed Communication Environment: An Attempt to Clarify a Metaphor.

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Contents

List of Figures

List of Tables

1 Introduction

They called themselves *Thunderstorm*. The Facebook group was created six years ago by several individuals, all concerned about the increasing number of refugees coming to Germany. They were scared about losing 'Western traditional moral values' and safety. They were anxious about being left behind by the 'left contaminated politic'. Up until today the Facebook group has gained over 1200 new members who regularly exchange facts, opinions and 'relevant' literature. Furthermore, *Thunderstorm* has a Twitter account and a public Telegram group. For many members, those channels provide the majority of information they consume on a daily basis. Thus, they build their political judgement on this information. With time, group members intensified their views. Now, they are not only concerned about refugees anymore but about 'Islamofacism' attacking democratic and moral values and about the increasing power of 'radical climate activists' and 'radical feminist woman groups'. Additionally, with the outbreak of COVID-19 many members are furious about the restrictive lockdowm policies and dislike the German government. Over the past six years protests against the governmental refugee policy were planned, organized and carried out in several German cities. A large protest in front of the German Reichstag is planned. Moreover, occasionally discussions have circled around self-protection against undocumented migrants and terrorists or about the legitimate level of civil disobedience targeting refugee homes or politicians. No violence in direct relation to *Thunderstorm* has occurred yet. But the atmosphere is heading into that direction.

As far as I know, there exists no Facebook group called *Thunderstorm*. I made up the whole story.[1] But unfortunately it resembles troubling real world issues. In recent years, the world has seen a new upsurge in nationalism. We all know the slogan 'America First'. For many people, it seemed strange that in times of shared economies and political interest, a slogan emphasizing isolation, protectionism and nationalism helped Donald Trump to win the U.S. presidential election in 2016. The disagreement between political partisans in the U.S. about topics like economy, racial justice, climate change or international engagement have been highlighted by several studies from the Pew Research

[1] (modified example from (C. Sunstein 2007, see Chapter Three - Polarization and Cybercascades))

Center.[2] But those differences root deeper than being just conflicts about politics and policies.[3,4,5,6,7] Eight out of ten registered voters in the U.S., for example, denoted that they had major problems with core values of the political opposition.[8] The presidential election and the subsequent issue of election fraud further highlighted those deep-seated trenches. But the U.S. is not the only country which has to deal with societal divides. In Europe, national parties are on the rise, and Marine Le Pen, Geert Wilders, Nigel Farage or Sebastian Kurz are no strangers. The immigration politics, the Brexit, Fridays for Future or the COVID-19 pandemic brought major social and divides to light. Thus, today social fragmentation seems to be very much present in our society.

Many scholars have attempted to understand and explain those societal divides and some of them see the transformed communication market with the emergence of the internet and online social media networks as tightly related.[9] One of them is Cass R. Sunstein. In his book *Republic.com* he appraises technology's effects on public discourses and thereby introduces the metaphor of an echo chamber.[10] Subsequently, the book was discussed controversially in media and academia and sparked a new wave of online network research.[11,12] Throughout this period of research, however, one problem remained. There is no clear understanding and definition of what echo chambers are. Cinelli et al., for example, concentrate more on an opinion reinforcing aspect.[13] As opposed to this, K. H. Jamieson and F. Capella have a more structural approach towards echo chambers.[14] Nguyen, on the other hand, describes echo chambers more general as "a social epistemic structure in which other relevant choices have been actively discredited".[15] In addition, Sunstein highlights the aspect that members become more confident and more extreme when their belief is shared by others.[16] Although the definitions are quite different, they all feature important aspects of echo chambers.

[2](Dimock, M., Wike R. 2021)
[3](Huddy, Mason, and Aarøe 2015)
[4](Iyengar, Sood, and Lelkes 2012)
[5](Iyengar and Westwood 2015)
[6](Mason 2015)
[7](Mason 2016)
[8](Dimock, M., Wike R. 2021)
[9](Minh Pham, Kondor, Hanel, and Thurner 2020, see p. 2)
[10]C. R. Sunstein mainly focuses on the internet and the shift from offline to online discourse
[11](C. Sunstein 2007, see pp. xi - xii)
[12](Barnidge and Peacock 2019, see p. 5)
[13](Cinelli, Morales, Galeazzi, Quattrociocchi, and Starnini 2020, see p. 2)
[14](Jamieson and Cappella 2008, see pp. 163 - 236 as cited in Nguyen, 2020, p. 3)
[15](Nguyen 2020, p. 2)
[16](C. Sunstein 2007, see pp. 64 - 67)

Therefore, the goal of my bachelor thesis is to accumulate all those important aspects in order to establish an in depth understanding of echo chambers. Furthermore, after reading my bachelor thesis, you should be able to determine whether groups like *Thunderstorm* can be considered an echo chamber or not. I will introduce in the succeeding chapters the following main three aspects.

(A) The structure of echo chambers.
(B) Selective information intake.
(C) Polarization as a result of **A** and **B**.

To this end, an understanding of how individuals' voices are shaped, manipulated, and altered by the social phenomenon of echo chambers should be established. Metaphorically speaking, I hope that by the end we will understand why the sound of a single raindrop dripping from the ceiling of a cave, amplified again and again by the reverberation and other drops, could cause a thunderstorm.

2 The Structure of Echo Chambers

People "love those who are like themselves".[1] Already back in ancient Greek, Aristotle noticed the tendency that people preferably relate to those who are similar to themselves. Later this tendency was scientifically proven and became popular under the term homophily.[2] Today, homophily is considered to be a driving force in manifesting social relations, offline as well as online. Especially with the emergence of new online technologies such as social media networks or online based communication tools, social dynamics governed by homophily have changed, since social relations are primarily not dependent on physical proximity but on personal interests. Therefore, people link together across the world and form group structures based on personal preferences, independent of geographical constraints.

In the following, I will display how those developments lead to homogeneous online structures. First, I will give a brief introduction to the principle of homophily. Building on this, I am going to present the most crucial structural aspects of echo chambers. Those aspects are later illustrated by two different examples. The first example concerns online blogs and their network structure. In the second example, I will examine echo chambers in a social media environment, using Twitter as an example.

[1] (Aristotle 1934, p. 837)
[2] (Lazarsfeld, Merton, et al. 1954)

2.1 Homophily

In this subchapter I will give a brief introduction about the homophily principle.

Homophily describes the tendency of people to connect primarily with others which are similar to them.[3] This attraction to similarity is one of the most conspicuous and dominant regularities of social life.[4,5,6,7,8] It shapes social relations like marriage, friendships, discussion groups or relations at work.[9,10,11,12,13,14] Thus, romantic partners, friends, work colleagues and other people from the social environment are more similar to one another than it would be the case with randomly selected people from the same population.[15,16] M. McPherson et al. described this relation as: "distance in terms of social characteristics translates into network distance".[17] In 1954, Lazarsfeld & Merton elaborated more on those sociodemographic factors and distinguished between status homophily and value homophily. While fixed factors such as sex, age and acquired factors like education or religion are ascribed to status homophily, value homophily includes inner states like beliefs or aspirations.[18] An example of value homophily seems to be the longstanding evidence that social relations are politically more homogeneous than it would be by chance.[19,20] Other studies have also shown that adults tend to turn primarily to others who share their own political positions.[21,22] But it is still unclear whether those behaviors are evoked by value homophily - a preference for those who share similar values - or if they are caused because they correlate to other more status homophily like factors.[23]

[3] (Ferguson 2017, see p. 71)
[4] (Lazarsfeld, Merton, et al. 1954)
[5] (Laumann 1966)
[6] (Verbrugge 1977)
[7] (J. M. McPherson and Smith-Lovin 1987)
[8] (M. McPherson, Smith-Lovin, and Cook 2001)
[9] (Kalmijn 1998, see pp. 398 - 402)
[10] (Verbrugge 1983)
[11] (Marsden 1987)
[12] (Ibarra 1992)
[13] (Ibarra 1995)
[14] (Hampton and Wellman 1999)
[15] (Similar with respect to sociodemographic dimensions like sex, ethnicity, ages, class backgrounds, educational attainment and so on.)
[16] (M. McPherson, Smith-Lovin, and Cook 2001, see p. 415)
[17] (M. McPherson, Smith-Lovin, and Cook 2001, see p. 416)
[18] (Lazarsfeld, Merton, et al. 1954, as cited in M. McPherson et al., 2001, see p. 419)
[19] (Alford, Hatemi, Hibbing, Martin, and Eaves 2011)
[20] (Martin, Eaves, Heath, Jardine, Feingold, and Eysenck 1986)
[21] (Verbrugge 1977, see pp. 586 - 587)
[22] (Knoke 1990, see pp. 1054 - 1056)
[23] (M. McPherson, Smith-Lovin, and Cook 2001, see p. 429)

One reason for the homophily principle could be that similar attributes or experiences provide a basis of common ground which makes it easier to evaluate, communicate or predict the behavior of others.[24,25,26] Therefore, building new relations with similar people appears to be easier. Furthermore, one could argue that costs for maintaining a relationship between similar people are lower than between dissimilar people. As a consequence it is easier and more comfortable to maintain relations with similar people.[27] Felmlee, Sprecher, and Bassin, for instance, claimed that homophilous relations are more stable and last longer.[28] However, sociodemographic dimensions alone do not seem sufficient to understand the causes of homophily. For example, we might get on well with a similar person, but what happens if they live in a different city far away?[29] First, we probably would never meet this person and if we do so, costs for maintaining ties over great distance are higher than for ties without distance.[30] Thus, it seemed that the geographic location is the fundamental factor and it is primarily the geographic distance between two people that translates into network distance.

In conclusion, the homophily principle describes the phenomenon that people primarily structure their social environment with others that are similar to them. Therefore, the homophily principle is responsible for almost all social relations in which sociodemographic factors like sex, ethnicities, age or education play a crucial role. But nevertheless, one of the most underlying sources of homophily in our physical world is the geographic closeness.

2.2 Homogeneous Online Networks

In this subchapter, I will outline which aspects are important when talking about structures of echo chambers.

With the evolution of the internet, online based interpersonal communication has seen its up spring.[31] The bound of effort involved in contacts over long distance decreases, since online social networks or online messengers make it easy to communicate over long distance.[32] Thus, people are, in the context of homophily, primarily not constrained

[24](Festinger 1957)
[25](Werner and Parmelee 1979)
[26](Coates 2008)
[27](Kossinets and Watts 2009, see p. 406)
[28](Felmlee, Sprecher, and Bassin 1990, see pp. 26 - 28, as cited in Kossinets Watts, 2009 p. 406)
[29](similar with regard to sociodemographic dimensions)
[30](Zipf 1949, as cited in M. McPherson, Smith-Lovin, Cook, 2001, see pp. 429 - 430)
[31](Dutton and Helsper 2007)
[32](Kaufer and Carley 1993, see review in M. McPherson, Smith-Lovin, Cook, 2001, p. 430)

by geographical matters anymore. The internet, as a digital high choice environment, provides a divers array of sources where individuals can access information.[33] Hence, it becomes easier for people to encounter information, values or beliefs they prefer.[34] In synergy, the decrease of importance of geographical proximity on the one hand, and the availability of a high choice environment on the other hand, leads, as I argue, to a situation in which value homophily becomes more likely. Therefore, people use the internet to relate with others that share similar beliefs, values, or aspirations.

For instance, in 2010, Lauw et al. investigated if LiveJournal users are more likely to be friends if they share common interests. The result showed a considerable indication for that hypothesis and they concluded: "having even a few common interests makes friendship significantly more likely.".[35]

As a result, more and more people are joining forces and forming ideologically uniform online networks. These online networks of like-minded people are a typical structure of echo chambers. Typical because they are homogeneous on the one hand and online on the other. Based on their homogeneity, those networks develop to an environment where members have primarily access to consistent information from social media, blogs, online newspapers, television and radio broadcasts, and so on.[36] The second implication is, that those networks become 'closed'. As a consequence, they do not promote interaction outside the echo chamber.[37] Actually echo chambers, according to Jamieson and Cappella, systematically discredit 'outside' sources, thus, isolating members by decreasing their epistemic independence.[38,39] C. T. Nguyen states that this mechanism has high resemblance to some aspects of cult indoctrination.[40]

Several scholars have attempted to discover these characteristic structures of echo chambers, primarily by analyzing linking behavior of internet users. Below, I present some studies to provide examples of how echo chamber structures manifest and to better understand the structure of echo chambers themselves.

[33](Van Aelst, Strömbäck, Aalberg, Esser, De Vreese, Matthes, Hopmann, Salgado, Hubé, Stępińska, et al. 2017, see p. 12)
[34](In 3 Selective Information Intake within Echo Chambers I will elaborate more on this.)
[35](Lauw, Shafer, Agrawal, and Ntoulas 2010, see p. 23)
[36](Dubois and Blank 2018, see p. 730)
[37](Jamieson and Cappella 2008, see pp. 163 - 236)
[38](Jamieson and Cappella 2008, loc. cit.)
[39]('outside' sources are all information sources that do not promote beliefs of the echo chamber)
[40](Nguyen 2020, see p. 3)

2.2.1 Echo Chamber Structures in Blog Networks

One example would be the linking pattern of websites or blogs. To simplify matters, the term blog is used. Typically, blogs are written by a single author or a team of authors. Therefore, a blog is irreversible connected to its creator. Thus, linking blogs between each other creates online networks.[41] Additionally, people can comment to other blogs, hence, creating another link between themselves and the blog, thus leading to a virtual community. The dimension of those communities are not limited and can grow enormous.

As I am writing this bachelor thesis it is estimated that there are over 600 million blogs, over 5 million new ones are created today and 77% of around 4.8 billion internet users interact with web blogs each day.[42,43] Those numbers demonstrate quite impressively the prominence of online blogs. On the other hand, it also highlights how problematic it can get to identify specific echo chambers, since they may grow indefinitely. Adamic and Glance examined the linking patterns of political blogs in 2004, prior to the 2004 U.S. presidential election.[44] Especially the linking pattern within liberal and conservative communities as well as across those communities were analyzed. They observed 1335 political blogs (676 liberal and 659 conservative blogs) for a period of two months. Findings from the top 20 liberal and top 20 conservative blogs are summarized in Table 2.1.

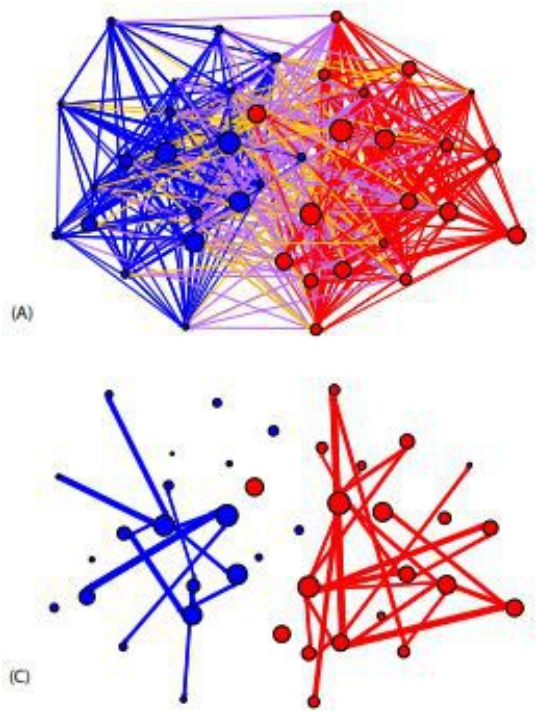

Figure 2.1: Aggregate blog citation behavior (October - November 2004). *Note.* Reprinted [adapted] from (Adamic and Glance 2005, p.39).

[41] (Chin and Chignell 2006, see p. 11)
[42] (How many blogs are there, July 25th 2021 from https://websitesetup.org/news/bloggingstatistics/)
[43] (Internet live stats, July 25th 2021 from https://www.internetlivestats.com/
[44] (Adamic and Glance 2005)

		Liberal					Conservative		
c	posts	blogs	L_l	L_r	c	posts	blogs	L_l	L_r
10053	1114	dailykos.com	292	46	8438	924	powerlineblog.com	26	195
6452	580	talkingpointsmemo.com	242	22	7813	740	instapundit.com	43	234
5468	945	astrios.blogspot.com	230	39	5298	682	littlegreenfootballs.com	10	171
4830	502	washingtonmonthly.com	165	36	3297	66	hughhewitt.com	11	146
2764	409	wonkette.com	83	30	3226	494	andrewsullivan.com	59	86
2277	211	juancole.com	149	16	3220	701	captainsquartersblog.com	5	117
1675	550	yglesias.typepad.com	104	24	3186	801	wizbangblog.com	14	125
1621	429	crookedtimber.org	81	19	2781	398	indcjournal.com	6	60
1365	348	mydd.com	107	8	2773	341	michellemalkin.com	10	191
1289	512	oliverwillis.com	97	20	2596	1027	blogforbush.com	4	208
1268	767	blog.johnkerry.com	21	2	2259	87	allahpundit.com	2	37
1257	607	pandagon.net	118	5	2156	100	belmontclub.blogspot.com	3	93
1191	949	talkleft.com	126	15	1944	50	realclearpolitics.com	13	104
1142	345	dibysblog.blogspot.com	115	3	1882	633	volokh.com	27	80
1141	722	politicalwire.com	87	16	1570	510	timblair.spleeville.com	7	80
1077	470	j-bradford-delong.net	98	11	1523	428	windsofchange.net	16	65
1002	722	prospect.org/weblog	102	11	1512	595	vodkapundit.com	9	97
991	1653	americablog.blogspot.com	64	5	1468	446	rogerlsimon.com	6	74
947	582	theleftcoaster.com	78	4	1364	899	deanesmay.com	8	79
851	115	jameswolcott.com	74	6	1310	580	mypejawa.mu.nu	0	51

Table 2.1: The top 20 liberal and conservative blogs by post citation count (c) according to BlogPulse data (October - November 2004). The two right columns show for comparison how many liberal (L_l) and conservative (L_r) blogs of the whole set link to the blog in February 2005. The total number of posts for each weblog is shown in posts. *Note.* Reprinted [adapted] from (Adamic and Glance 2005, see p. 39).

I think, taking the page link counts L_l and L_r as measures of popularity, we see some echo chamber like structures emerging. Since, besides *wonkette.com* and *andrewsullivan.com* which have great appeal among both communities, most of the blogs are linked almost exclusively by either conservatives or liberals.[45] Hence, indicating closed networks with obviously fewer links to outside sources. The fact that 91% of the links stay within the community they originated from supports this indication even further.[46] The linking patterns from all blogs from Table 2.1 are visualized in Figure 2.1. The colors correspond to political orientation with blue for liberal, red for conservative, orange for a link from liberal to conservative and purple for a link from conservative to liberal. The size of each blog reflects the number of links, and line thickness illustrates the number of citation between different blogs. In (A) all links are visualized. For (C) all edges with fewer than 25 links are left out. Liberals linked 254 times to conservative blogs, compared to 312 links from conservative blogs to liberal blogs. That implies that only 15 % of all links are outside their own community, thus leading to a more homogeneous network. Adamic and Glance conclude that "both communities acting as mild echo chambers by frequently discussing separate sets of web pages and news items".[47]

Another aspect, highlighted by Sunstein and Short in 2006, is the attempt of blogs to discredit opposing blogs. Sunstein and Short analyzed the linking pattern of 50 randomly selected political blogs and found out that links to blogs with opposing views were with 17, or 34% significantly lower compared to 41, or almost 82% of links to like-minded blogs (visualized in Table 2.2).

Political orientation	Links to opposition	No links to opposition	Links to like-minded sites	No links to like-minded sites	Total sites
Republican	3	7	7	3	10
Democrats	5	5	5	5	10
Conservative	3	13	16	0	14
Liberal	6	8	13	1	14
All	17	32	41	9	50

Table 2.2: Linking behavior of 50 randomly selected blogs. *Note*, [adapted] from (C. Sunstein 2007, p. 55)

[45](Adamic and Glance 2005, see p. 39)
[46](Adamic and Glance 2005, see p. 38)
[47](Adamic and Glance 2005, see p. 41)

Then, they analyzed the cross ideological linking and found that most of the references are not used to produce information exchange, but illustrate how dangerous and contemptible they are.[48] Furthermore, they mention that blogs often have so called linking agreements, such as: We link you, and you link us. Moreover, links to like-minded blogs are often used as evidence, when it is about promoting fear and distrust against outside sources. Although those numbers cannot be taken as evidence, they give a good impression about how echo chambers interact with the external environment.

2.2.2 Echo Chamber Structures in Social Media: An Example

During the past 15 years online community structures have been studied intensively, and it has been argued that social media causes echo chamber alike effects.[49] Twitter, with over 1.3 billion registered users, is one example. As a microblogging environment, it provides a service to post and interact with other users via short messages, so-called tweets. Links between users are established via the follow, the like, the hashtag and the retweet function. Thereby, according to L. Rossi and M. Magnani, Twitter based communication contributes to a high interconnected structure which functions on two different levels. (**A**) a stable and consistent Twitter network, established by following users and friends and (**B**) a topical very dynamic network which follows worldwide conversations and trends created by using hashtags, retweets and likes.[50] Those distinct communication structures differentiate Twitter from other conventional social networks since Twitter is not only a tool for collaborative gossip (A) but for 'news' consumption (B) as well. Therefore, it constitutes a very good environment for studying roles of distinct user groups.[51]

Barberá et al., for example, analyzed 1.3 million Twitter users from the United States according to their ideological orientation and nearly 150 million tweets in order to examine whether the communication on Twitter resembles echo chamber like structures. First, they used the stable and consistent network (A) in order to define the ideological orientation. Afterwards, to determine whether echo chamber like structures occur, they evaluated the participation of those Twitter users in network (B) about 12 significant (political and nonpolitical) events and issues.[52] For example, they analyzed twitter

[48] (C. Sunstein 2007, see p. loc. cit.)
[49] (Dewey 2013)
[50] (Rossi and M. Magnani 2012, see p. 563)
[51] (Cha, Benevenuto, Haddadi, and Gummadi 2012, see p. 991)
[52] (2012 presidential campaign, 2013 government shutdown, 2014 minimum wage, 2013 budget, 2013 marriage equality, 2014 State of the Union Address, 2013 Boston Marathon bombing, 2012/2013 Newton school shooting, 2014 Super Bowl, 2014 Oscars, 2014 Winter Olympic Games)

behavior concerning the presidential election in 2012 showed that conservatives tended to retweet mostly tweets from other conservatives as well as liberals retweeted tweets within their group. To put it in numbers, 28% of all retweets regarding the election in 2012 happened among extreme liberals, and 38% took place among extreme conservatives, although both groups represent only 16 % of all analyzed users.[53] In this case about 64%, well over half of all Twitter interactions, took place among just two extreme groups. Furthermore, the cross-ideological retweeting was significantly lower among conservatives than liberals. For every retweet that happened within the same group of ideological preference, conservatives only retweeted between 0.20 and 0.30 tweets from liberals.[54] Liberals retweeted between 0.25 and 0.50 tweets from conservatives.[55] All together results from this study suggest that with a high level of political interest the cross-ideological interaction decreases and more interactions happen mainly within groups.[56]

2.3 Conclusion

In summary, an echo chamber is primarily a social group structure subjected to the principle of homophily. Since the internet provides a great tool set to overcome long distances, I think that value homophily becomes more important. Therefore, it is the interplay between the principle of homophily and the increasing importance of value homophily that causes echo chamber like structures. Those online structures are characterized by a very high interconnectedness within their networks. In addition, they do not promote interaction or at least have low interaction rates to individuals outside those networks. In some cases, links to opposing communities are even used to promote fear or distrust which I think causes a strong perception of 'the others' and 'us', thus, strengthening group identity within the homogeneous group. Furthermore, an individual entering such clusters might be exclusively referred to similar sources who support specific beliefs while discrediting the opposition. Although homogeneity, coherent information flow and the exclusion of outside voices do not prove the existence of echo chambers, they do show how such networks are structured and can function.

[53](Barberá, Jost, Nagler, Tucker, and Bonneau 2015, see p. 7)
[54](the variation is due to the variation of the topics)
[55](Barberá, Jost, Nagler, Tucker, and Bonneau 2015, see p. loc cit.)
[56](Barberá, Jost, Nagler, Tucker, and Bonneau 2015, see p. loc cit.)

3 Selective Information Intake within Echo Chambers

Today we are exposed to an enormous amount of information and have progressed from an industrial to an informational society.[1] The national mass media system has changed dramatically within the digital age, and everyone with a smartphone has access to thousands of stories from around the world. Today, a single Sunday edition of the New York Times, for example, contains more information than a typical 19th century citizen faced in their entire life.[2] In order to handle this sheer amount of information we all have to filter it.

In this chapter, I am going to explain why we as individuals expose ourselves to more and more selective information. In the remainder of the chapter I will concentrate only on news information.[3] First, the notion of selective exposure is outlined, since it operates on the very bottom when it comes to decisions about what information an individual consumes. Afterwards, I will outline three most important aspects which have changed within the digital mass media system in order to explain why we encounter more and selective information today. Towards the end, I will merge the introduced aspects of selective information intake with echo chambers and argue why it is such an important aspect. Therefore, I will introduce the notion of cascades and further on have a little digression about fake news. In addition to all of that, I will illustrate every aspect with examples.

[1] (Mitsch 1984, see p. 28)

[2] (Pollar 2003)

[3] ((Park 1940) defines news information as a unique form of knowledge with a very social character. First it is characterized as a short communication and only by transferring it to the consumer it becomes a fact which is stored or deleted from the consumer's perceptual schema.)

3.1 Selective Exposure

In this subchapter, I will briefly introduce the selective exposure theory.

In general, selective exposure theory, also known as congeniality bias or confirmation bias, claims that individuals have the tendency to favor information that reinforces preexisting beliefs, while actively avoiding information that challenges them.[4,5,6,7,8,9,10] Already in 1944, Lazarsfeld et al. characterized a new systematic bias in audience composition. They stated that "Exposure is always selective; in other words, a positive relationship exists between people's opinions and what they choose to listen to or read.".[11] Later, Festinger named this bias 'selective exposure'.[12] Lipset et al. stated that, "most people expose themselves, most of the time, to the kind of propaganda with which they agree to begin with.".[13] Klapper argued the way that "people tend to expose themselves to those mass communications which are in accord with their existing attitudes.".[14]Childs summarized "innumerable studies show that readers tend to read what they agree with, approve, or like.".[15] Thus, an environment of divers information does not guarantee that an individual's perspective will be equally divers[16].

For example, Dick Cheney, former vice-president of the United States, demanded that all televisions had be tuned to a conservative news channel before he entered the hotel room, hence actively avoiding information from challengers.[17] A more conventional example would be the experiment from Iyengar Hahn.[18] They interviewed a representative group of Americans and asked from source they would like to read news stories from.[19] Results showed that Republicans chose Fox by a great margin whereas Democrats preferred CNN or National Public Radio (NPR). Furthermore, it was shown that the network label was a great determining factor for individual's interest in news

[4](Eagly and Chaiken 1993)
[5](Eagly, Chaiken, et al. 1998)
[6](Eagly and Chaiken 2005)
[7](Lazarsfeld, Berelson, and Gaudet 1944, see p. 164)
[8](Hart, Albarracın, Eagly, Brechan, Lindberg, and Merrill 2009, see p. 2)
[9](Jonas, Schulz-Hardt, Frey, and Thelen 2001)
[10](In the remainder of my bachelor thesis the term selective exposure will be used.)
[11](Lazarsfeld, Berelson, and Gaudet 1944, p. 164)
[12](Festinger 1957)
[13](Lipset, Lazarsfeld, Barton, and Linz 1954, p. 1158)
[14](Klapper 1960, p. 19)
[15](H. L. Childs, 1965 as cited in Sears & Freedman, 1967, loc. cit.)
[16](Hart, Albarracın, Eagly, Brechan, Lindberg, and Merrill 2009, see p. 1)
[17](The Smoking Gun Staff 2006)
[18](Iyengar and Hahn 2009)
[19](*Fox* (known to be conservative), *National Public Radio* (known to be liberal), *CNN* (often thought to be liberal), *British Broadcasting Network* (whose politics are not widely known to Americans))

stories. Thus, labeling the same news story with different networks labels led to a systematic bias in audience composition. For Republicans, the headline became far more interesting if it was labeled with Fox. Whereas for Democrats, labeling the same headline with CNN or NPR led to a moderate increase in interest. At the same time, both groups showed a general aversion against headlines labeled with networks ascribed to the opposition.

Up to this point, one can conclude that individuals in general prefer to expose themselves to information which coincide with existing beliefs or even reinforces them. Favoring news stories from a specific network would be an example. At the same time, individuals avoid exposure to information that may challenge existing beliefs, like Dick Cheney did.

3.2 A Transformed Communication Environment

In the past, the news diet of individuals consisted mainly of local and domestic newspapers, and maybe a few channels on television.[20] Therefore, news information was limited by geographical factors and individuals within a community shared most of the news information. But with the advent of digital news technologies and an increase in communication options, the supply of news information has increased dramatically. In the context of selective exposure theory this concludes to - the bigger the news choice, the more individuals have to filter, and the more individuals have to filter, the more important their preferences become.[21] In the following, I will elaborate a bit more on these issues and present three reasons which show the extent to which our communications market has changed, according to Sunstein.

The first reason is, that the available options for information increased extremely. In the context of news, the internet provides great access to almost every source. Today everyone with a mobile phone is able to get news in seconds, at any time and at any place by just checking their social online networks, online newspapers, blogs, broadcasts etc.. And remember, a single Sunday edition of the New York Times contains more information than a typical 19th century citizen faced in their entire life.[22] Overall, not only is the amount of information increasing, but access to information via broad networks that report, share and distribute news is also becoming easier.

[20] (Trilling et al. 2013, see p. 3)

[21] (Van Aelst, Strömbäck, Aalberg, Esser, De Vreese, Matthes, Hopmann, Salgado, Hubé, Stępińska, et al. 2017, see p. 10)

[22] (Pollar 2003)

Secondly, while the available options for information increases, the individual control over content increases simultaneously. For example, the Wall Street Journal, like many other newspapers, allows readers to personalize their electronic editions. Thus, you might get an individualized newspaper with a composition of news information that are matched according to your preferences. Google News, for example, already provides a service that individualize your news feed. They claim: "Es ist so gut wie unmöglich, bei jeder Meldung, die Sie interessiert, auf dem Laufenden zu bleiben. Mit Ihrer Auswahl können Sie einen Überblick über die Dinge behalten, die wichtig und relevant für Sie sind.".[23] It follows, according to selective exposure theory, that an increase in individuals control over news content leads to a decrease in news diversity. Therefore, the news diet of individuals shifts toward a more selective one. Furthermore, individuals gather news for their social networks, selecting and sharing only news information which generate more attention, and filter out 'non-relevant' news. It is a crucial aspect because individuals gather and share mostly news that align with their views while filtering out non-conforming ones. The result is a socially negotiated informational news product that mostly relies on opinions, which is produced by its consumers.[24] Thus, the distinction between news consumers and producers becomes ambiguous. Bruns called these forms of bottom-up news the 'produsage' of news stories.[25] According to Gans, those types of news stories may replace the journalistic goal of objectivity and multiple perspectivity.[26]

The third reason is the decrease of so-called general interest intermediaries.[27] Today, more and more individuals consume news via digital and social media, leading to a decrease of traditional news media like newspapers.[28] The Reuters Institute Digital News Report (**RIDNR**) from 2016 showed, that individuals younger than 44 consider online media as the most important source of news.[29,30] A study in the U.S. from 2014 showed that 51% of 10,000 interviewed individuals younger than 68 years retrieved political news from Facebook alone.[31] And another study along the same lines as the 2016 RIDNR study, found that around 86% of individuals younger than 38 years, use

[23](App Store, September 1st, 2021, from https://apps.apple.com/de/app/google-news/id459182288)
[24](Pentina and Tarafdar 2014, see p. 211)
[25](Bruns 2008)
[26](Gans 1979, as cited in Pentina & Tarafdar, 2014 see p. 211)
[27](Sunstein defines interest intermediaries as sources that expose the consumer to a wider range of information, increasing also the chance of exposure to materials and topics the consumer does not seek out on purpose. Newspaper, broadcast or magazines are examples (C. Sunstein 2007, see pp. 8 - 9))
[28](Van Aelst, Strömbäck, Aalberg, Esser, De Vreese, Matthes, Hopmann, Salgado, Hubé, Stępińska, et al. 2017, see p. 7)
[29](The RIDNR is the largest comparative study of news consumption with data based on a survey of more than 50,000 individuals from 26 countries)
[30](Newman, Fletcher, Levy, and Nielsen 2015, see p. 53 as cited in V. Aelst et al., 2017, loc. cit.)
[31](Mitchell, Gottfried, and Matsa 2015, see p. 1)

social media to access 'diverse' opinions.[32] Altogether, I think those numbers illustrate quite demonstrative a great shift from using traditional news media towards digital and social media. The main issue is, according to Sunstein, that this shift decreases the chance of being accidentally exposed to a wide range of information and topics. Thus, leading to a more selective and individualized news diet.

In summary, the transformation of the communication market can be reduced to three main factors. Firstly, the available options for information increased significantly. Secondly, the individual control over content increases simultaneously. Thirdly, the decrease of general interest intermediaries. In synergy with selective exposure the result is - the bigger the news choice, the more individuals have to filter, and the more individuals have to filter, the more important their preferences become.

3.3 Selective Information Intake in the Context of Echo Chambers

As I have outlined in the previous subchapter, the change of national mass media systems within the digital age has led to a more selective and individualized news information diet. In the following, I will argue why this is one of the key aspects of echo chambers. Therefore, I will transfer previous findings into the context of echo chambers. Furthermore, I will introduce the notion of cascades. Along with this illustration, I will have a brief digression on fake news and argue why they are a good example of the information flow in echo chambers. As before, I will underline everything with suitable examples.

3.3.1 Information Cocoons

Due to the far-reaching changes in the media landscape, as I have described above, it is easier for individuals to find their individual 'niche of opinion'.[33] For example, a person that is very interested in miniature Donkeys can read the book *Caring for your Miniature Donkey - Spiral Bound Edition*, a book just about miniature donkeys.[34] But the individual can also team up on social networks to find like-minded individuals in order to exchange experiences, opinions or information about miniature donkeys. In this way, they create a homogeneous group of like-minded individuals with regard to liking minia-

[32] (Howe and Teufel 2014, see p. 84)

[33] (I define a 'niche of opinion' as a sphere in which individuals are exposed to information that aligns with their opinion. It can be a homogeneous group, a sport magazine focusing on the sport of choice or a news channel mainly covering news stories that are consistent with existing beliefs.)

[34] (Gross 2011)

ture Donkeys. Similar to them, many other individuals also find their niche of opinion easily nowadays. This dynamic is enhanced, since social media platforms are highly interconnected networks which tend to be more focused on niche content than general interest intermediaries.[35] As a result, the virtual space gets more and more divided into special interest groups.[36] This fragmentation was first described by Van Alstyne and Brynjolfsson´s article in 1996.[37] They named it 'cyberbalkanization'. Later on, Brainard advanced this online phenomenon more into the political context in the way that: "people seek out only like-minded others and thereby close themselves off from ideological opposition, alternative understandings, and uncomfortable discussions".[38] Sunstein described that phenomenon as 'information cocoons' where individuals primarily gather and share news that align with their views while filtering out non-conforming ones.[39] Therefore, individuals encounter a selective news information diet, because unlike someone from the 19th century, they can decide for themselves what information they expose themselves to. Additionally, a study from Greitemeyer et al. found out, that group discussions mainly focus on information which is known by all group members instead of discussing information known by just one group member.[40] Thus, information exchange inside echo chamber like structures is affected by the personal preferences of all group members. Consequently, selective exposure does not only function on an individual basis, but on a group level as well.

For example, imagine a group of climate change deniers in the U.S.. Which news story is more likely to be shared? "Biden's Green New Deal means no meat for the 4th of July, have grilled Brussels sprouts instead" or "Facing a climate crisis, these youth activists stay focused on solutions".[41,42] You have guessed right - it's probably the first one.
For context, the story was broadcasted by the 'Fox News' and 'Fox Business' network April 23, 2021, despite the fact that this story promoted false claims by linking Biden's climate goals to an unlinked study on meat consumption, it spread fast.[43] For example, Ainsley Earhardt, co-host of the morning talk show "Fox and Friends", claimed: "He [Biden] wants to cut out 90% of the red meat that you all eat.".[44] After that, many other Fox journalists, like Kudlow, Charles Payne, Jesse Watters, Sean Hannity Jeanine

[35](Phang, Zhang, and Sutanto 2013, see p. 669)
[36](Chan and Fu 2017, see p. 267)
[37](Alstyne and Brynjolfsson 1996)
[38](Brainard 2009, p. 598 as cited in Chan Fu, 2017, loc. cit.)
[39](C. R. Sunstein 2008, p. 94 as cited in Chan Fu, 2017, loc. cit.)
[40](Greitemeyer, Schulz-Hardt, Brodbeck, and Frey 2006)
[41](Fox Business Staff 2021)
[42](Chapman Isabelle, Janfaza Rachel 2021)
[43](McCarthy Bill 2021)
[44](Earhardt, A. (2021, April 23), *Fox & Friends*, as cited in (McCarthy Bill 2021))

Pirro or John Roberts followed. John Roberts, Fox News White House correspondent, started his April 23 article on 'American Reports' with: "Say goodbye to your burgers if you want to sign up for the climate agenda.".[45,46] From there on, the narrative about Biden banning burgers cropped up on social media. Online contributions covering 'Bidens climate' in relation to 'meat consumption' increased to 23,000 in just 4 days.[47] Based on the false narrative, Republicans such as Rep. Marjorie Taylor Greene, R-Ga. or Texas Gov. Greg Abbott, attacked Biden, yet fact-checkers and many news channels already showed that those claims were false.

I think it is a good example, because it highlights already introduced aspects. First, we see that the story was mainly spread by the Fox News network. Thus, underlining a distinct group structure, as I have described in the first chapter. Remember, very conservative blogs are much more likely to link and thereby share blogs which are in agreement to their own beliefs. Moreover, the example demonstrated what Bruns meant by 'produsage' of news, because individuals, like Rep. Marjorie Taylor Greene, R-Ga., consumed and then further shared the story, but not based on the truth value but mainly based on their belief.

In conclusion, the unbounded range of possible information sources leads to a balkanized online landscape of many special interest groups. Inside those interest groups, mostly information aligning with group beliefs are shared. Furthermore, group discussions are governed by selective exposure. Therefore, information encounters within special interest groups are selective and determined by group beliefs.

3.3.2 Cascades

In the following, I will elaborate a bit more on how information flows within social networks and thereby introduce the notion of cascade.

Have you ever wondered, while listening to radio music, why this song is so popular? Is it because of the quality of the music or rather the social influence, in the sense of - Do individuals prefer music that is heard by others? A study from 2006 investigated this question by creating and observing an artificial music market with 14,341 participants.[48] Within the study all participants had a brief selection of unknown songs from unknown bands and were asked to listen, to decide which songs to download and later to rate the songs. While one half of the participants (the condition-independent group) were

[45](Roberts, J., (2021, April 23), *American Reports*, as cited in (McCarthy Bill 2021))
[46](McCarthy Bill 2021)
[47](Bauder David, Swenson Ali 2021)
[48](Salganik, Dodds, and Watts 2006)

asked to rate the songs only based on the names of the bands and their songs, the other half (the social influence group) could additionally see how many times each song had been downloaded.[49] In addition, every participant of the social influence group was assigned to one of eight independent 'worlds', with each world developing its own 'music market' and participants of one world could only see downloads from their own world. By comparing ratings from the condition-independent group with the social influence group, it was shown, that participants from the social influence group were affected significantly by the choices of others. Since, in all eight 'worlds' the participants were more likely to download songs that had been downloaded previously.[50] Thus, in the experiment, most songs could become very popular in one world while being unpopular in another, just depending on which song was downloaded first. Although "the best songs never do very badly, and the worst songs never do extremely well", the success of songs was unpredictable.[51] Therefore, one can say that popular songs do not have to be of good quality, but rather have to create a social momentum (via media attention, advertising or product placement) that everyone else then follows. It is the same with information. Whereby information is more than just news or data since it also includes the action or decision of individuals.

In general, a cascade defines a rapid move into the direction of one set of beliefs within a social network.[52] It usually starts with a person sharing new information. From then on, this information spreads in social networks via social relationships or organizational structures. If individuals accept the new information depends on their 'thresholds' to accept or believe new information.[53] At first, individuals with a low threshold start to accept the new information. Then, individuals with higher thresholds join, thus creating a considerable large group of individuals which are in favor of the new information. This group grows until a certain point, the tipping point, at which even individuals with high thresholds join.[54]

We as humans are greatly influenced by others, since, when individuals lack information, they base their decision on others information whom they trust. For example, when you think about the following issues, you could ask yourself how well you understood them and to what degree you may rely on statements from others: Global warming is a serious problem, there is a risk of war in Ukraine, Pluto is not a planet, radiation is

[49] (Salganik, Dodds, and Watts 2006, see p. 854)
[50] (ibid.)
[51] (Salganik, Dodds, and Watts 2006, p. 855)
[52] (Bikhchandani, D. Hirshleifer, and Welch 1998, see pp. 161 - 162)
[53] ('threshold' describes the level at which an individual is willing to accept unknown information and takes it for granted)
[54] (C. Sunstein 2007, see pp. 89 - 90)

bad for your body, how is energy 'produced', how does a battery work or why is gold so heavy. In case you found out that you lack a bit of information concerning those arbitrary issues, I can reassure you, you are not alone. Even specialists like doctors do. They, for example, often just rely on what their colleagues have done which sometimes causes surgical fads and treatment caused illnesses.[55] John F. Burnham found so-called 'bandwagon diseases' where doctors pushed certain diseases and treatments mainly because everyone else was doing the same.[56] However, a cascade does not exclusively describe the distribution of harmful information, but refers to a distribution of all information. Therefore, information cascades can also have a positive effects. The ALS ice bucket challenge from 2014, for instance, is in my opinion a good example of 'positive' information spread.

In conclusion, a cascade describes the phenomenon that information spreads from a few individuals until it is eventually accepted by the majority.

In relation to the internet, where sharing information does not take more than clicking some buttons, cascades become more likely, function faster and can cause greater consequences.[57] The study from Choi et al. investigating rumor propagation inside echo chambers on Twitter found out that, especially in echo chamber like structures, cascades tend to be "larger, deeper, wider [and] viral.".[58,59] In addition, they showed that members of echo chambers have a lower threshold to accept, belief and propagate new information and therefore are more likely to participate in early cascade stages.[60] As with the songs, the first stage of a cascade is usually the most important because it decides whether the information is spread or not. Furthermore, they found that information is actively disseminated by some group members. The 10% most active echo chamber members, for example, were responsible for 24% of all rumor cascades and elicited more than 36% of retweets.[61]

An example to illustrate how cascades function would be the so called 'pizza gate'. In 2016, during the presidential election, Wikileaks released emails from John Podesta, Hillary Clinton's former campaign chairman. As a result, a few individuals came together on online forums such as 4chan or Reddit to decipher a possible secret code from those

[55](D. A. Hirshleifer 1995, as cited in C. Sunstein, see p. 85)
[56](Burnham 1987, as cited in C. Sunstein, see p. 85)
[57](Choi, Chun, Oh, Han, et al. 2020)
[57](C. Sunstein 2007)
[58]("relating to the rapid propagation of information, ideas, or trends by means of social networks rather than conventional mass media"(Dictionary 2014)
[59](Choi, Chun, Oh, Han, et al. 2020, p. 3)
[60](Choi, Chun, Oh, Han, et al. 2020, see pp. 4- 5)
[61](Choi, Chun, Oh, Han, et al. 2020, see p. 2)

emails. Since pizza was mentioned frequently, it became that pizza was deciphered as a complex code for pedophilia. Although it is likely that many of the conspiracy originators were joking first, forums like '/r/pizzagate', 'alt-right' or 'The Donald' were flooded with actual 'true believers'. From then on, it did not took much time until pizza gate became widely popular by conservative news websites, among white supremacists and among Donald Trump supporters from the extremist white nationalists wing. The cascade went even further and attracted also groups outside the U.S.. For example, supporters of the Turkish President used pizzagate on Twitter to accuse political opponents of hypocrisy because the opposition was outraged about a current child abuse scandal at a Turkish government foundation but did not comment on pizza gate, the much worse 'injustice'. In response to those accusations, the liberal opposition in Turkey started to pick up on the pizza gate rumors as well. Consequently, a great number of individuals all around the world became attracted to the topic, and almost everything that could be associated with Pizza and Podesta was used as evidence. So it came about, that for example Comet Ping Pong, owned by James Alefantis, a big Democratic Party supporter was designated as the headquarter of a child sex ring controlled by powerful individuals. As a result, demonstrations popped up in front of the restaurant and Alefantis, his staff and customers received death threats. On top of that, Edgar Welch, a 28-year-old man from North Carolina, went inside Comet Ping Pong with a gun to as he later described "self investigate" pizza gate. Fortunately, no one was injured and after finding nothing, he turned himself in to the police. In five weeks, over 1.4 million tweets about pizza gate were posted by more than 250,000 accounts.[62] Moreover, the rumor supported the anti-elite sentiment which I think might have helped Donald Trump to win the election.

Unfortunately, I cannot go into all aspects of this example, otherwise it would go beyond the scope of my bachelor thesis. Therefore, I will not be able to deal with the psychological mechanisms that operate when talking about conspiracy theories. But nevertheless, I chose this example deliberately because it shows the individual stages of a cascade well. First, there were a few individuals on Reddit or 4chan, probably joking. But it didn't stop there. Quite the reverse, pizza gate was quickly picked up by groups of like-minded individuals. They then distributed pizza gate via various online channels. On Twitter alone, 1.4 million tweets related to pizza gate were shared within 5 weeks. Thus, more and more individuals, also outside those groups were reached. For example, individuals in Turkey first perceived pizza gate as a real scandal, probably because it already went viral and many individuals believed it. It also showed how quickly people become so convinced of a story that they are willing to use violence.

[62](Carlton Genevieve, Loeffler John 2020)

3.3.3 Fake News

In the following, I will have a little digression on fake news.

Although the internet was once applauded to be an unprecedented source of 'unlimited' knowledge, it has become a greenhouse for seeds like fake news, conspiracy theories, mistrust or paranoia.[63] In accordance to this evolution, fake news as phenomenon has seen its renaissance recently. Events, such as the close Brexit referendum in the U.K. or the win of Donald Trump in the U.S. presidential election from 2016, are just two famous examples. But fake news are not something new. It is a phenomenon that has been around since news became a concept, as the following example, described in the book *Trent 1475: Stories of a Ritual Murder Trial*, indicates.[64,65] Back in 1475, in Trent, Italy, a two and a half year old boy went missing. As a result, a preacher, named Bernardino da Feltre, accused the Jewish community for murdering the child and claimed that the body was found in a basement of a Jewish house. The accusation spread fast and within a day the Prince-Bishop of Trent Johannes IV Hinderbach ordered to arrest and torture the city's entire Jewish community. As a result of those accusations, fifteen Jews were found guilty and were burned. In the following, those rumors rapidly spread to other communities and inspired them to perpetrate similar actions. Although the papacy recognized the events as a false story and ordered to stop the murdering, Hinderbach refused the papal order and instead distributed even more rumors, such as Jewish individuals drinking blood of Christian children's. Those rumors spread so fast and wide that in the end the papacy had no chance to interfere with Hinderbach and later even had to canonize the young boy.

In theory, according to Axelf Gelfer, fake news is a phenomenon, that describes cases in which typically false or misleading claims as news are presented deliberately. It is important to add that those news are misleading by design.[66,67] If we take a closer look at our example from Italy again, we see the conditions met, since the Prince-Bishop Hinderbach presented false and misleading claims and even continued with new ones, after receiving the papal legate. He did this by design to manipulate the Trentino community in order to strengthen his position vis-à-vis the papacy. Thus, already back in 1475 fake news was a powerful and dangerous tool.

[63] (Törnberg 2018, see p. 2)
[64] (Hsia 1992)
[65] (Soll Jakob 2016)
[66] (Gelfert 2018, see p. 108)
[67] (he defines *by design* as: "systemic features of the design of the sources and channels by which fake news propagates and, thereby, manipulates the audience's cognitive processes"(Gelfert 2018, p. 84))

Today, with the internet and the simultaneous emergence of social networks, fake news are back on stage. But now we can ask, why are fake news relevant when talking about the information flow inside echo chambers? I think it is relevant because it demonstrates the influence which echo chamber like clusters can have on the flow of information, whether true or false, in two different ways. First, echo chamber like structures play a reinforcing role when it comes to spreading information. Secondly, it gives us insights about how individuals become isolated to other news sources.

For the first aspect, taking a closer look at a metaphor, introduced by the World Economic Forum in 2013, will help to visualize it. Therefore, we have to think about fake news, which by definition spread misleading information by design, as a wildfire. In this scenario, an echo chamber like cluster acts like a very dry tinder that lies in the forest. Thereby, it provides a great kick-start and functions as fuel for the initially small flame. With time and thanks to the tinder, flames will spread to close brushwood, larger branches, trees to finally seize the whole forest. To transfer this metaphor more into the direction of real world implications we can conclude that homogeneous networks have indeed a catalytic effect.[68] Thus, because of echo chamber like structures, fake news spread easier and faster. Moreover, it was shown that news which originate in echo chamber like structures tend to proliferate further than they would in a heterogeneous network structure.[69] It was furthermore observed that misleading and false information, emerging of echo chamber like structures, are more prone to induce global cascades.[70] I am aware about differences in the flow of information according to whether they are fake news or not. But still I think that basic conclusions can be transferred, because of two reasons. In the first place, since basic mechanism like the 'produsage' of news or information cascades apply to both 'information types' when it comes to spreading information inside a homogeneous cluster. Secondly, because in many cases, the truth value of an information is not the most important factor for individuals when it comes to determine whether to share a news story or not. In many cases it is not the truth value but rather the relation between source and retriever.[71] Since like-minded individuals group together, as explained in chapter 2, I argue that they have a higher level of trust among each other. Thus, I conclude that in echo chamber like clusters information spreads easier, faster, wider and are more likely to cause global cascades.

[68] (Schelling 2006, as cited in Törnberg, 2018, see p. 2)
[69] (Törnberg 2018, see p. 6)
[70] (Törnberg 2018, see p. 8)
[71] (Millgram 2015, pp. 27 - 44 as cited in Nguyen, 2020, pp. 19 - 20)

Concerning the second aspect, regarding the isolation of individuals, we should go to Veles, a small city in the Republic of North Macedonia. In 2016, during the presidential election, the small city gained dubious notoriety, as from there over 140 websites published only fictional and rather lurid stories in order to generate ad revenues. All stories related to the U.S. presidential election were distributed via online social networks in order to get more clicks on those websites. So it came about that stories like "Your Prayers Have Been Answered", announcing Hillary Clinton's indictment in 2017, were shared, reacted and commented on over 140´000 times on Facebook alone[72]. In 2020, during the U.S. presidential election campaign, Veles was back on the map. Again, websites spread misleading and false information via social networks. One of those websites was called resiststhemainstream.com and on it's 'about us' page it claimed to be: "a project created with a mission to report the news the mainstream media won't.".[73] Upon closer inspection of this statement, there are at least two interesting presumption's which the statement is based on. Namely, there is something called 'mainstream media' and they do not cover all essential news stories, which leads us directly to the aspect of isolation.[74] Remember, echo chamber like structures are often closed and further try to systematically discredit outside sources. According to Jamieson and Capella inventing a 'private' language with new terms or abbreviations seems to be one way to amplify the separateness and isolation.[75] 'Mainstream media' is just a very well known example and "report[ing] the news the mainstream media won't." might sound like a good additional source, but in general it connotes to - "[we will provide] counter-explanations of all contrary views, intended not only to attack each particular view, but also to undermine the general trustworthiness and integrity of anybody expressing a contrary view" as Nguyen claims.[76]

Therefore, I conclude that fake news are a powerful tool, as it was already used back in 1475. Just like back then, today fake news are often used to discredit sources. Thus, individuals become dependent on a very narrow array of sources and are resistant to information from other sources.

[72](Silvermann C., Alexander L. 2016)
[73](Internet Archive, (n.d.), WayBackMachine, https://web.archive.org/web/20201005024441/https://resistthemainstream.com/about/)
[74](essential according to "resistthemainstream.com")
[75](Jamieson and Cappella 2008, see pp. 140 - 76 as cited in Nguyen, 2020, p. 9)
[76](Nguyen 2020, pp. 9 - 10)

3.4 Conclusion

The evolution of our media landscape has brought three main changes. Firstly, the available options for information increased remarkably. Secondly, the individual control over content increases simultaneously. The third factor describes the decrease of general interest intermediaries. As a result, the effect of selective exposure is reinforced and personal preferences have become a predominant factor in information consumption, in the sense of - the bigger the news choice, the more information has to be filtered and the more information has to be filtered, the more important personal preferences become. Hence, it becomes easy for individuals to find their individual niche of opinion. The result is an information cocoon where individuals consume primarily a selective information diet. Moreover, it is likely that groups move rapidly into the direction of one set of information, because individuals base their decision often on the decision of others. It is called a cascade, and inside echo chambers its effect is accelerated. Mainly because individuals inside echo chambers show higher acceptance rates towards favorable information. Thus, information spreads faster, further and has a higher chance of spreading. Fake news are a great example, since they spread easier and faster within echo chambers. In addition, echo chambers reinforce the chance of inducing global cascades. And last but not least, fake news are often used to discredit outside sources, causing an isolation of individuals inside echo chambers. All together, one can conclude that an environment of diverse information does not guarantee that an individual's perspective will be equally diverse, because a person is motivated to defend their views, beliefs and behaviors against challengers. In order to do so, individual's actively seek out material that supports their opinions, while disliking and avoiding material that challenges them.

4 Group Polarization

Have you ever broken the law? Would you ever consider committing a crime?

Although you might have thought about it before, chances are still high that you would answer 'No' right away, without hesitation. It is against the law. You probably would get arrested. And most of all, you are aware that everybody is abiding the law in order to maintain peace and order. But what would you say, if everyone else was doing something illegal? For example, imagine you are in a supermarket and all of a sudden the customers around you start stealing. They grab anything from the shelves and leave the market. No one bothers to pay. Would you consider stealing now? Perhaps you would again say 'No' for the sake of your conscience. But under these circumstances, you're more likely to grab an avocado and run out the door.[1]

The scenario works as a great example of group polarization, and I hope the following chapter provides you with insights about how people around you affect the way you think. For that, I am going to explain the concept of group polarization and argue why it is a result of echo chambers. First, I will explain the concept of group polarization and briefly introduce the three most prominent theories behind it. Afterwards those explanations are linked to, (**A**) the structure of echo chambers, and (**B**) the selective information intake inside echo chambers.

4.1 Notion of Group Polarization

In this subchapter, I am going to introduce the notion of group polarization.

Group polarization, first discovered and mentioned as risky shift, is a social psychological phenomenon that describes a group-induced attitude polarization of its members.[2,3] Hence, it portrays the enhancement of pre-existing tendencies via group interactions. Scientifically, it is defined as the hypothesis that the "average postgroup response will tend

[1] (Ravelo Lach 2021)
[2] (Stoner 1961)
[3] (Moscovici and Zavalloni 1969)

to be more extreme in the same direction as the average of the pregroup responses".[4,5] That direction of thoughts is crucial when talking about polarization, since it differentiates the concept of polarization from the related concept of extremization as Myers and Lamm argue. Whereas polarization intensifies a pre-existing opinion, extremization describes an opinion shift away from neutrality, without regard to its direction. Hence, all cases of group polarization are also examples of extremization, but not vice versa. Today, the phenomenon is widely accepted and accounts to a wide range of discussion items.[6,7,8,9]

For instance, consider the study from Hastie et al. in 2007.[10] They brought sixty Americans together and assembled them into ten groups. As the study was designed, members were distributed according to their political positions into five 'blue state' groups and five 'red state' groups.[11] All members of each group were asked to state their opinions on the following three controversial issues: Should states allow same-sex couples to enter into civil unions? Should employers engage in 'affirmative action' by giving a preference to members of traditionally disadvantaged groups? Should the United States sign an international treaty to combat global warming?[12] To determine the effect of the group interaction, they were asked privately for their opinions before and after a fifteen-minute group discussion. The results were straightforward. With twenty-six out of thirty group decisions, or 87%, in almost every group, members ended up with an ideological amplification.[13] Conservatives, for example, were neutral on signing an international treaty against global warming before discussion, but strongly opposed to it after discussion. Furthermore, group discussions led to more homogeneous groups, both for blue and red state groups. After group discussion, members tended in their anonymous statements too much more consensus than before and overlapping pregroup opinions disappeared after group discussion.[14]

[4](Myers and Lamm 1976, p. 603 as cited in Turner, Hogg, Oakes, Reicher, Wetherell, 1987, p. 142)

[5](All group polarization studies employ a similar procedure. The responses of the same subject are collected and compared at different stages. Pregroup denotes the stage in which individuals privately present their own view. It is before group discussion. Postgroup denotes the stage in which individuals privately present the own view after group discussion.)

[6](J. C. Turner, M. A. Hogg, Oakes, Reicher, and M. S. Wetherell 1987, see pp. 412 - 414)

[7](Myers 1975)

[8](Myers and Lamm 1976)

[9](C. R. Sunstein, Schkade, Ellman, and Sawicki 2007)

[10](Hastie, Schkade, and C. R. Sunstein 2007)

[11]('blue state' groups - all members tended toward liberal positions, 'red state' groups - all members tended toward conservative positions)

[12](C. R. Sunstein 2008, see p. 91)

[13](Hastie, Schkade, and C. R. Sunstein 2007, see p. 922)

[14](Hastie, Schkade, and C. R. Sunstein 2007, see p. 923)

In summary, group polarization refers to an intensification of pre-existing attitudes. In the case of our introductory scenario, the attitude towards stealing increases as individuals around you start stealing. So you may end up walking out of the supermarket with an avocado in your pocket.

4.2 Group Polarization Inside Echo Chambers

When thinking about the supermarket scenario, several questions arise. For example, why should your action intensify in this way? Why do individuals not become more moderate when discussing with others? In the following subchapter and with a focus on those questions, I am going to introduce the three most important theories separately. Every section starts with a short theoretical introduction. Afterwards, I will relate the theoretical background with (**A**) homogeneous online structures or (**B**) selective information intake. Furthermore, I am going to argue why group polarization is the third aspect of echo chambers and why it follows directly from the previous two aspects of echo chambers.

4.2.1 Echo Chambers Limiting the Pool of Arguments

In the following, I will introduce the persuasive argument theory and illustrate why selective information intake in echo chambers can lead to group polarization.

The persuasive argument theory, developed by Burstein and Vinokur, takes a highly cognitive approach and emphasizes the importance of information and persuasive arguments.[15,16,17] They suggest, that during the pregroup phase individuals review a pool of arguments familiar and relevant to the issue and base their decision on that. The composition of the pool of arguments, the balance between pro and con arguments and their persuasiveness then determines the direction of opinion. Because any group shows a pregroup trend towards one inclination, Burnstein and Vinokur argue that a disproportional large number of supporting arguments and a disproportional small number of counterarguments are reviewed during a group discussion.[18,19] As a result, individuals update their argument pool according to the favored pregroup group disposition.

For example, think about going back to the supermarket, where all the people around you start stealing. In this case, you are more likely to encounter individuals which are

[15](Burnstein and Vinokur 1973)
[16](Burnstein and Vinokur 1975)
[17](Burnstein and Vinokur 1977)
[18](J. C. Turner, M. A. Hogg, Oakes, Reicher, and M. S. Wetherell 1987, see pp. 144 - 145)
[19](Baron, Hoppe, Kao, Brunsman, Linneweh, and Rogers 1996, see p. 219)

in favor of stealing. So, in case of a discussion, they would provide a wide array of arguments in favor of stealing while arguments criticizing or questioning such actions would be fewer and weaker. As a consequence, you get exposed to new persuasive arguments emphasizing the importance or rightness of stealing. Those new and previously unfamiliar pro arguments get added to your pool of arguments. According to the persuasive theory, deliberation then leads you towards a more amplified opinion aligned with the initial beliefs of the discussion.

Thinking about echo chambers, we have to remember that people tend to gather and share news that align with their views while filtering out non-conforming ones. Therefore, the pregroup argument pool is already limited, containing mostly favorable arguments. As a consequence, individuals primarily share pro-attitudinal information during group discussions. Stround, for example, demonstrated, that individuals have the tendency to prefer arguments that are in line with their political beliefs.[20] Thus, mostly favorable information is shared during group discussion and individuals update their pool of arguments predominately with favorable information. As a consequence, individuals end up with an even more biased information representation. In relation to the persuasive argument theory, this should cause group polarization. In addition, the structure of echo chambers does not promote interactions to outside sources. Hence, members of echo chambers are less likely to encounter contra-attitudinal arguments, which is reflected by an unbalanced representation of pro and con arguments within the pool of arguments. Several studies have found evidence for a relationship between continual exposure to pro-attitudinal information and increased polarized attitudes.[21,22] For instance, Lawrence et al. found that blog networks which inherit echo chamber like structures cause readers to read blogs they are inclined to.[23] Thus, they "are more likely to be polarized than non-blog-reader".[24]

To summarize, the structure of echo chambers is characterized by ideological homogeneous clusters. Within those cluster, individuals have a selective information diet. While mainly pro-attitudinal arguments are exchanged, the exposure to contra-attitudinal arguments is limited. As a consequence, the pool of arguments of echo chamber members is heavily inclined into the direction of the pregroup opinion and counterarguments are underrepresented. According to persuasive argument theory, individuals' deliberation is based on the unbalanced pool of arguments which then causes polarization.

[20] (Stroud 2011)
[21] (Hollander 2008)
[22] (Tsfati, Stroud, and Chotiner 2014)
[23] (Lawrence, Sides, and Farrell 2010, pp. 141 - 157 as cited in Barbera, 2020, see p. 4)
[24] (Persily and Tucker 2020, p. 38)

4.2.2 Social Comparison Theory

In the following, I will elaborate more on the social comparison theory.

The social comparison theory, introduced by Festinger in 1954, claims that self-presentational strategies are the cause for polarization. Wetherell et al. further assume that during group interaction "one side of a choice dilemma ... is more socially desirable, valued, admired or associated with positive characteristics".[25] Therefore, individuals confronted with a choice dilemma, adapt their behavior or opinion according to their social surroundings and perform an action which is perceived as most favorable by others.

Thus, inside echo chambers, individuals adjust their own position more into the direction of the most desirable or valued position in order to be liked by others.[26] For instance, thinking back to the shoplifting example, according to the social comparison theory, you would steal because you assume that it is socially more desirable. Especially, in terms of social networks, where the main goal is to generate attention, likes and shares, I think the polarization of attitudes due to reputational concerns should not be underestimated. Aside from reputational concerns with others, individuals also want to be favorably perceived by themselves, as Hastie et al. argue.[27] During a group discussion, individuals might notice that others are more extreme than themselves. In order to restore lost self-esteem, individuals adapt to even more polarized attitudes.[28] For example, if individuals think of themselves as slightly 'left-of-center', and they join a more liberal group, they might shift a bit more to the 'left', in order to sustain that self-perception of being slightly 'left'.[29] As a consequence, group polarization into the liberal direction is favored. Moreover, Jellison and Arkin argue that people tend to adapt to a more amplified position because an extreme position is perceived to be associated with more expertise.[30] Or it happens that group members are competing to take the most valued and extreme position in order to increase distinctiveness to others in the same direction of opinion.[31]

In conclusion, the social comparison theory claims that individuals polarize in order to strengthen their self-esteem. They do this by adapting their behavior or attitude so that they are accepted by other group members. In addition, individuals might polarize to preserve their self-perception.

[25] (J. C. Turner, M. A. Hogg, Oakes, Reicher, and M. S. Wetherell 1987, p. 146)
[26] (Hastie, Schkade, and C. R. Sunstein 2007, see p. 932)
[27] (Hastie, Schkade, and C. R. Sunstein 2007, see loc. cit.)
[28] (Levinger and Schneider 1969, as cited in Turner, Hogg, Oakes, Reicher, Wetherell, 1987, see p.146)
[29] (Schkade, C. R. Sunstein, and Hastie 2006, see p. 15)
[30] (Jellison and Arkin 1977, see A self-presentation approach to decision-making in groups)
[31] (Myers, Bruggink, Kersting, and Schlosser 1980)

4.2.3 Echo Chambers and Group Identity

In the following section, I will expand on the social identity and self categorization theory. Later I will add some points concerning confidence and corroboration.

The self categorization theory from Turner and Oakes; and Wetherell et al. suggest that group members develop a perception about shared interest and common ideas, but also about what that group differentiates from other groups.[32,33] Based on that perception the influence and persuasiveness of arguments are determined. Therefore, according to the social identity theory, it is not the informational content, as the persuasive argument theory suggest, but the proximity to the perceived group consensus that defines how reasonable an argument is. For example, the persuasiveness and influence of the argument: 'sometimes it is appropriated to steal in order to make a symbolic statement criticizing the idea of private property', is valued differently depending on the prevailing group consensus.

Wetherell et al. further argue that when individuals share the same group identity, they are more likely to accept and believe new arguments from other group members because they expect to agree with others.[34] This effect amplifies if the importance of group membership increases. As a result, group members polarize because a strong group identity influences the relevance of arguments to the extent that arguments leading toward group consensus are easily accepted and believed. For example, some individuals identify themselves as supporters of the Democratic Party in the U.S.. Their discussion probably includes the 'New Green Deal', higher taxes for companies or a tolerant immigration policy. As a result of group discussion, individual's attitudes are more likely to move into a more amplified direction because disagreeing with discussion points would be against the shared group identity and is therefore less favorable.

In addition, individuals are often not sure what to think about some issues, and their uncertainty moves them towards a more moderate issue. But when individuals become part of a group and share the group identity, their attitude towards uncertain issues gets more extreme.[35,36] This is because recognition by others usually leads to greater self-confidence. Then, an increased self-confidence causes a shift to more extreme attitudes since group members are more sure about being right, because of a shared group identity. For instance, individuals which don't have an opinion on national security might tend

[32](J. C. Turner and Oakes 1986)
[33](M. Wetherell, J. Turner, and M. Hogg 1986)
[34](J. C. Turner, M. A. Hogg, Oakes, Reicher, and M. S. Wetherell 1987, see p. 154)
[35](Allport and Hartman 1925)
[36](Johnson 1940)

to adopt a more extreme position after they have learned that other 'people like them' are in favor of a stronger national security.

As I argued in subchapter 2.2, people connect via the internet with others who share similar beliefs, values, or aspirations. Due to the decrease of importance of geographical proximity on the one hand and a rise in personification options on the other hand, people are able to build great networks of like-minded people. Further, I argued that value homophily in a high choice environment such as the internet, is more likely. Thus, I conclude that those online clusters are ideologically deeply homogeneous and therefore have a wide range of common attributes. This wide range of common attributes is responsible for the formation of a strong group identity. People in the U.S., for example, consider partisanship as a core element of their social identity and are more likely to be connected to other co-partisans on social media networks.[37,38] Mosleh et al. reported in their Twitter field experiment "a strong causal effect of shared partisanship on the formation of social ties".[39]

As a consequence, I conclude that echo chambers are homogeneous networks with a strong group identity. In light of the social identity theory, a strong group identity, as echo chambers have, should lead to greater group polarization. In 1990, Spears et al. evidenced that argumentation line. They found that group polarization is stronger and more likely when individuals perceive themselves as part of a group with a strong group identity.[40] For example, group members, sharing the identity of being supportive towards the Democratic Party, are more likely to polarize on other topics as well because they see each other as part of a common cause. In the same sense, people might defend a more extreme group member's position against challengers, in order to defend the common cause, although they would normally disagree with the position.

But group identity is important in another way. Since, in order to strengthen group identity, echo chambers consistently try to amplify the separateness and isolation. The effect is a strong perception of 'the others' and 'us' which strengthens group identity within homogeneous groups and exaggerating the insularity and separateness even further.[41] Americans, for instance, have the tendency to distrust or dislike counter-partisans and are less likely to become friends with them.[42] As I have argued above, it follows that a strengthened group identity causes stronger group polarization.

[37](Huddy, Mason, and Aarøe 2015)
[38](Colleoni, Rozza, and Arvidsson 2014)
[39](Mosleh, Martel, Eckles, and Rand 2021, see abstract)
[40](Spears, Lea, and S. Lee 1990, see pp. 128 - 130)
[41](Nguyen 2020, see p. 9)
[42](Iyengar, Lelkes, Levendusky, Malhotra, and Westwood 2019, see pp. 136 - 137)

In addition, the amplified perception of 'the others' and 'us' might boost group polarization in the way that group discussion arguments are not valued by their validity and consistency, but according to the perception of the source, situation and message.[43,44]

In summary, echo chambers are highly homogeneous networks of like-minded people which often experience the feeling of supporting a common cause. This feeling is further strengthened by emphasizing differences between 'the others' and 'us', thus, also creating fragmentation and separation. The interplay of a homogeneous group which clearly distinguishes itself from others results in a distinctive group identity. According to the social identity theory, it is this strong group identity which causes polarization. Therefore, I argue that group polarization inside echo chambers follows directly from its homogeneous structure.

4.2.4 Further Remarks on Group Polarization

In this subchapter, I am going to add some further remarks on group polarization.

The internet, because of its high choice environment, has become the main breeding ground for echo chambers. For this reason, I think it is necessary to add some remarks on how the internet might contribute to group polarization. One challenge is the high degree of error and confusion.[45] In his book, Sunstein takes YouTube as an example. Although it has a genuine democratizing force, as he describes it, there is the risk of content being displayed in a misleading or confusing manner. Thus, individuals might end up with an inaccurate understanding.[46] Moreover, it is known that the internet provides a high degree of anonymity. In relation to anonymity, Lea and Spears found that anonymity in synergy with a strong group identity caused higher levels of group polarization.[47] Hence, the internet might enhance group polarization besides the already mentioned aspects, since it provides a great level of anonymity.

In addition, it has been shown, that awareness about political identities is heightened in social media networks since social and political content is mixed.[48] Settle argues, that "the fusion of social and political content, the ubiquity of social feedback, the ability to easily infer other users' political identity ... have a direct impact on the aggregate level of psychological polarization".[49] Her line of reasoning stands in accordance to the social

[43](Eiser and Stroebe 1972)
[44](McGuire 1985)
[45](C. Sunstein 2007, see p. 69)
[46](ibid.)
[47](Lea and Spears 1991, pp. 128 - 130)
[48](Settle 2018)
[49](Settle 2018, as cited Barberá, 2020, p. 11)

identity theory, since heightened awareness of political identities is a key factor in driving polarization.[50] Thus, increasing the potential of group polarization.

Another important remark I want to make concerns trust. We as humans are greatly influenced by others. In our hyper specialized world, individuals have to base many of their decisions on others, since they lack information. The same ascribes to the formation of opinion. Individuals which are not sure about certain topics often rely on others around them. In case of echo chambers, members are taught to distrust outside sources. This seems to be striking insomuch that arguments are not valued by their validity or consistency, but according to the perception of the source. For example, the term 'mainstream media' is often used to invalidate counterarguments by questioning the source. However, the distrust of external sources has further consequences. Pizza gate is a good example. After Edga Welch raided the Comet Ping Pong and admitted to have not found a headquarter of a child sex ring, many pizza gate believers did not take that as contradicting evidence. Instead, they used Welch's claims as evidence that the 'mainstream media' was totally controlled by the liberal conspiracy which had staged the whole raiding event to discredit pizza gate believers.[51] In this case, they turned contradicting evidence into supporting evidence, causing even greater polarization. Nguyen describes that mode of action as disagreement-reinforcement mechanism.[52] He states that the mere "existence and expression of contrary beliefs reinforces the original belief and its discrediting story".[53] Group members expect 'the others' to falsely claim that they are wrong. In the case of pizza gate, it would translate to 'In the basement of Comet Ping Pong is no child sex ring headquarter.'. When group members encounter such statements, the information is neutralized, since it was already predicted. Moreover, when group members' predictions are verified, others have a reason to increase their trust in them. Thus, increasing the trustworthiness inside the echo chamber, strengthening the group identity, and thereby increasing the probability of group polarization.

In conclusion, the internet with its anonymous and sometimes misleading characteristic might enhance group polarization. Furthermore, social media networks have been associated to have a direct impact on group polarization by strengthening group identities. Moreover, arguments are often evaluated not by their validity or consistency, but by the perception of the source. Thus, according to the disagreement-reinforcement mechanism, it could be that the mere presentation of contra-attitudinal arguments causes polarization into the pro-attitudinal direction.

[50](Iyengar, Sood, and Lelkes 2012)
[51](Nguyen 2020, see p. 7)
[52](Nguyen 2020, see p. 6)
[53](Nguyen 2020, p. 6)

4.3 Conclusion

In summary, group polarization refers to an intensification of pre-existing attitudes. It is a well documented social psychological phenomenon, and there is scientific evidence for all three theories. The persuasive argument theory claims that individuals polarize after group discussion because they encounter a wider range of substantial information. It is a highly cognitive attempt to explain group polarization and takes only the information content into consideration. In contrast, the social comparison theory takes a more affect-based approach. It suggests that individuals polarize after discussion because they want to fit inside a group. The social identity theory combines those two approaches. They argue that every group member develops a concept associating themselves to a specific group. This leads to a shared group identity which increases the acceptance of new and more extreme arguments. Thus, causing an opinion polarization. I argued that the homogeneous online structures, which are characteristic for echo chambers, are catalyzing strong group identities. Furthermore, I argued that a strong perception of 'the others' and 'us' increases fragmentation and separation, amplifying group identities even further. As a consequence and in view of the social identity theory, I conclude that group polarization follows from the general structure of echo chambers. In addition, individuals inside echo chambers mainly consume pro-attitudinal arguments. Therefore, pro-attitudinal arguments are faster retrievable and qualitative as well as quantitative superior towards contra-attitudinal arguments. As a result and according to the persuasive argument theory, individual's deliberation is based on an unbalanced and biased pool of arguments, which then causes polarization. For this reason, I state that selective information intake causes polarization. Hence, polarization inside echo chambers follows directly from (**A**) homogeneous online structures and (**B**) selective information intake. Therefore, I consider group polarization the third main aspect of echo chambers.

5 Further Comments

The online communication market is such a broad topic that even if we narrow it down to the topic of echo chambers, a great number of important matters cannot be addressed in the context of my bachelor thesis. For the sake of completeness, however, I will address two important questions about echo chambers in compact form. The first, concerns the distinctiveness of echo chambers and filter bubbles. After that, I will briefly discuss the state of the science on echo chambers.

5.1 Key Differences Between Echo Chambers and Filter Bubbles

Over the past 20 years we have witnessed a rapid and extensive increase of news, information and commentary.[1] Moreover, the comprehensive change of our communication market confronts us with an increased number of available viewpoints, perspectives, ideas and opinions, leading to the very problem of selecting the important information. As a way to tackle this flood of information, online intermediaries like Google, Twitter or Facebook use personalizing algorithms to adapt the information content to the needs and wishes of the users. As a consequence, individuals' news feed and information differs from one another, depending on their previous interaction with the network.[2] Unfortunately the literature on this topic is relatively new, small, and often confuses the metaphor of echo chambers with that of filter bubbles.[3] Although they share some similarities, I believe they are two distinct phenomena. In the following subchapter, I will explain why. To do so, I will first briefly define the term filter bubble. Based on this definition, similarities and differences will be highlighted afterwards.

The metaphor of filter bubbles in relation to information consumption was first brought to light by Eli Pariser in 2011.[4] In his book, he takes a more critical standpoint towards online social media networks and criticizes that platforms such as Facebook or Google

[1] (Bozdag 2013, see p. 209)
[2] (ibid.)
[3] (Bruns 2019, see p. 3)
[4] (Pariser 2011)

explicitly deploy recommendation systems in order to increase metrics like engagement or ad revenue. For example, search engines, news websites, or social networks personalize information using machine learning models.[5,6,7] The result is a personalized algorithmically governed internet in which every individual encounters predominantly consistent viewpoints.[8] Consequently, each individual has its own filtered and personalized information bubble, which Pariser calls a filter bubble. According to him, those bubbles, caused by the architecture of online social networks, are one of the main reasons for fragmentation and increase the insularity on the internet.

The network of filter bubbles is similar to the aspect of selective information encounter inside echo chambers. Especially filter bubbles and information cocoons. Both describe epistemic structures which exclude relevant information. But in case of information cocoons, it is an agent caused phenomenon motivated by the tendency of selective exposure. In contrast to that, filter bubbles are caused by other agents.[9] According to Pariser and Watson, those agents are mostly recommendation systems which create an individualized filtered online experience.[10,11] Consequently, filter bubbles lead to inadequate information coverage caused by architectural flaws in epistemic systems and networks rather than by individuals. Therefore, filter bubbles depend on a dysfunctional information topology resulting from a lack of communication between different beliefs.[12] Thus, filter bubbles describes a static informational architecture which causes a lack of information coverage.[13] On the other hand, echo chambers are not static but dynamic epistemic structures. They explain complex inner group mechanism covering aspects like the connection of like-minded individuals, information flow or its group polarization. Moreover, echo chambers do not depend solely on an impaired information topology, as it is the case with filter bubbles, because echo chambers invalidate challenging information simply by discrediting the source. This manipulation is often intentionally used to maintain, reinforce, or extend epistemic control.[14] In contrast, filter bubbles usually rise up randomly and without any intention.[15]

[5](Agichtein, Brill, and Dumais 2006)
[6](Das, Datar, Garg, and Rajaram 2007)
[7](Munson and Resnick 2010)
[8](Pariser 2011, as cited in Chitra Musco, 2020 see p. 116)
[9](Nguyen 2020, see p. 6)
[10](Pariser 2011, as cited in C. T. Nguyen, 2020, see p. 6)
[11](Watson and Scalambrino 2015, as cited in C. T. Nguyen, 2020, see p. 6)
[12](The impaired information topology refers to the individualized filter algorithms that cause very selective information coverage)
[13](Nguyen 2020, see p. 3)
[14](Nguyen 2020, see pp. 15 - 16)
[15](Nguyen 2020, see p. 23)

In the case of group polarization, both social structures support attitude polarization because in both cases the pool of arguments is limited. In the case of echo chambers, this happens primarily because people connect with other like-minded people, creating a group identity with a sense of representing a common cause. In contrast, the reason for polarization in filter bubbles is that individuals are isolated from conflicting perspectives. However, filter bubbles are easier to overcome than echo chambers because the isolation from relevant information can be easily solved by confronting individuals with the missing information. For members of echo chambers, sole information exposure would not be enough to escape. Sometimes, mere exposure could even strengthen the attacked belief system. Therefore, echo chambers have their own structurally resilient belief systems that are able to actively respond to external attacks.[16]

Although both concepts are different in themselves, a community can be both at once.[17] Hence, individuals can be inside a filter bubble while being part of an echo chamber. I argue, that filter bubbles can be considered as a smaller entity that is sometimes part of an echo chamber. Nguyen, for example, introduced the concept of an epistemic bubble, combining the phenomenon of information cocoons and filter bubbles.[18] He further argues that selective exposure alone, although an important aspect of echo chambers, cannot explain the phenomenon of echo chambers. Therefore, individuals dismiss information not only because of selective exposure, but also because of the manipulation of trust that results in only very specific individuals being accepted as experts or trustworthy sources.[19] However, it is important to emphasize that both concepts can also exist independently of each other.

In summary, the concept of filter bubbles describes the phenomenon of technologically mediated filtration. Unlike echo chambers, filter bubbles are caused by other agents and can be burst relatively easily. In opposition, echo chambers describe a much more dynamic system, based on the manipulation of trust. Therefore, they do not depend on an impaired information topology and have own structural belief systems. Although these are two conceptually distinct phenomena, it is possible for communities to be both at the same time. In this case, filter bubbles can always be considered a smaller entity that contributes to the effects of echo chambers.

[16](Nguyen 2018, see p. 5)
[17](ibid.)
[18](Nguyen defines an epistemic bubble as "an informational network from which relevant voices have been excluded by omission" (Nguyen 2018, p. 2)
[19](Nguyen 2018, see p. 4)

5.2 Empirical Evidence for Echo Chambers

Online social media networks, with their connected nature, complexity and non-linearity emergence are a difficult environment to investigate the metaphor of echo chambers.[20] Moreover, the academic literature on echo chambers is relative new, small and often struggles with conceptual vagueness. Especially, the evocative metaphors of echo chambers and filter bubbles are often confused and used synonymously. This bears significant problems because often studies focus on measuring exposure and connectivity alone.[21,22,23] Thereby, other important aspects of echo chambers such as group polarization are left out. So far, I have already presented numerous studies concerning the empirical evidence of echo chambers. Therefore, and in order to not go beyond the scope of my bachelor thesis, I will present just a dense overview about the state of the science on echo chambers. As I have outlined in subchapter 2.2, echo chambers are characterized by an ideological homogeneous group structure. Thus, individuals are mostly connected to sources aligning with their attitudes. After reviewing various studies that have examined this very aspect around the world and across various networks, I conclude that there are strong tendencies towards homophily in many online and social media environments.[24,25,26,27,28,29,30,31,32] Other studies, taking a more comprehensive approach towards the information environment by using survey data from individuals, provide a different picture and question selective information intake as a consequence of echo chamber like structures.[33] In these cases, it can be seen that particularly politically committed individuals also appear to engage in cross-cutting information.[34,35,36] Others provided a similar outlook. Benkler, for example, argued that a high choice environment

[20](Törnberg 2018, see pp. 1, 3 – 4)
[21](Adamic and Glance 2005)
[22](Barberá, Jost, Nagler, Tucker, and Bonneau 2015)
[23](Williams, McMurray, Kurz, and Lambert 2015)
[24](Adamic and Glance 2005)
[25](Aragón, Kappler, Kaltenbrunner, Laniado, and Volkovich 2013)
[26](Barberá 2015)
[27](Bright 2018)
[28](Colleoni, Rozza, and Arvidsson 2014)
[29](Conover, Gonçalves, Flammini, and Menczer 2012)
[30](Iyengar and Hahn 2009)
[31](Garrett 2009)
[32](Gruzd and Roy 2014)
[33](Bright, Marchal, Ganesh, and Rudinac 2020, see. p. 2)
[34](Dubois and Blank 2018)
[35](Fletcher and Nielsen 2018)
[36](Gentzkow and Shapiro 2011)

may lead to an increased exposure to diverse information.[37,38,39] So what does it say about the information intake inside echo chambers? Is it not as selective as assumed? Do we have to reject the idea of echo chambers? First, most of the studies used survey data to evaluate whether individuals engage in cross-cutting. Without questioning the validity of this data, I just want to mention briefly that often individuals are not aware to which degree they are exposed to already filtered information.[40] As I will argue in the following, we can only infer from these findings that it appears that individuals are not completely insulated from contrary views. Therefore, it would be wrong to dismiss the concept of echo chambers on the basis of these contradictory findings, because the information intake inside an echo chamber is characterized by much more than just selective exposure.

For example, Williams et al., investigated the connection and communication of Twitter communities concerning the issue of climate change. They found on the one hand a "strong homophily in follower and retweet networks" but on the other hand "a mixed pattern ... in mention networks.".[41] They further concluded that "most individuals engaged in online discussions are embedded with communities of like-minded users.".[42] Nevertheless, Bruns calls those findings 'decidedly mixed' and questions the evidence for echo chambers, since the 'mention'-networks are not strongly homophilic.[43] However, I contend that in this case 'mention'-networks describe the social aspect of communication and thereby are networks of a filter bubble rather than that of an echo chamber. Remember, echo chambers are characterized by a strong ideological homogeneous interconnectedness. Thus, only the follower and retweet network should be interpreted as a network of echo chambers. Therefore, in my opinion, the results can only be interpreted as follows. No homophily in 'mentioning networks' does not attack the concept of echo chambers, but that of filter bubbles. Indeed, it often happens in the literature that the two phenomena of filter bubbles and echo chambers are problematically mixed up. Thus, evidence against filter bubbles are often mistakenly interpreted as evidence against echo chambers. Unfortunately, there is no substantial literature about how individuals inside echo chamber like structures react to opposing information.[44] Future studies should address this gap of evidence as soon as possible, as it determines the extent to which

[37](Benkler 2008)
[38](Goel, Hofman, and Sirer 2012)
[39](Hosanagar, Fleder, D. Lee, and Buja 2014)
[40](Bright, Marchal, Ganesh, and Rudinac 2020, loc cit.)
[41](Williams, McMurray, Kurz, and Lambert 2015, p. 130)
[42](Williams, McMurray, Kurz, and Lambert 2015, p. 135)
[43](Bruns 2019, see p. 6)
[44](Bright, Marchal, Ganesh, and Rudinac 2020, see p. 2)

information intake within homogeneous networks alters aspects of echo chambers.

But nevertheless, there are also network studies like the one from Garimella et al., which do not find tendencies towards echo chambers in online social networks. One reason, according to Bruns, could be that they investigated less controversial hashtags like gameofthrones or foodporn.[45] This assumption, would be in line with the network study from Barberá et al. since they found only evidence for echo chambers when topics had a high level of political interest.[46]

Another important aspect, concerning echo chambers, is the attitude polarization. Here, summarizing, interpreting, and relating is difficult because studies conceptualize polarization differently. Moreover, it is often uncertain to what extent polarization is caused by echo chamber aspects or by individuals political interests and ideological beliefs. With that in mind, several studies seem to validate the conclusion that the emergence of echo chambers and the polarization of groups go hand in hand.[47,48] For example, the large cross national study from Yang et al. could predict individuals polarization on contended political topics just based on their general online news consumption.[49]

Most of the reviewed studies took a so-called micro level approach. It means that in every study only one social network was examined. But individuals often have several social media network accounts and therefore might participate in different echo chambers at the same time. Thus, it will be important for future research to take a macro level approach, covering all online social media networks. Moreover, I think agreeing on clear distinctive definitions about echo chambers and filter bubbles would benefit the field of research. Based on my comprehensive literature research, I propose the following definition. Echo chambers are ideologically homogeneous communities that polarize attitudes by promoting epistemological isolation and strong group identity.[50] In addition, as Bright et al. suggest, future research should investigate more into the aspect of how echo chambers motivate individuals to engage in political actions, since so far, research has only focused on the aspect of individuals being motivated by ignoring or marginalizing other viewpoints.[51]

[45] (Bruns 2019, see p. 6)

[46] (Barberá, Jost, Nagler, Tucker, and Bonneau 2015, see p. 7)

[47] (Allcott and Gentzkow 2017)

[48] (Del Vicario, Vivaldo, Bessi, Zollo, Scala, Caldarelli, and Quattrociocchi 2016)

[49] (Yang, Rojas, Wojcieszak, Aalberg, Coen, Curran, Hayashi, Iyengar, Jones, Mazzoleni, et al. 2016, as cited in A. Nguyen and Vu 2019 see p. 2)

[50] (The notion of epistemological isolation describes the fact that members of echo chambers have primarily selective information intake and strongly distrust external sources. As a result, they become isolated from external sources and trust only the information from the echo chamber.)

[51] (Bright, Marchal, Ganesh, and Rudinac 2020, see p. 22)

In summary, the literature on echo chambers is relatively new, small, and often not very precise. This may be due to the fact that studies conceptualize or define aspects differently. In addition, an echo chamber is not a scientifically defined term. Thus, the various studies were often based on different aspects and definitions. This makes it even more difficult to find a conclusive statement about the scientific justification of echo chambers. While many studies have been able to demonstrate structures of echo chambers in online media, they usually examined highly sensitive issues that were polarized from the onset. However, it seems that these findings cannot be applied to less controversial issues. Moreover, studies have shown that social media environments do not necessarily cause very selective information diets. But, as I have argued, this cannot be taken as evidence against echo chambers. Group polarization as a result of echo chamber-like structures has also been demonstrated in several studies. Thus, I conclude that there is a substantial ground of evidence for the metaphor of echo chambers. Nevertheless, question concerning a clear definition, the motivation of individuals due to echo chambers or a macro level approach remain. Those should be addressed in future research.

6 Conclusion

The internet was once hailed as a source of unlimited information and knowledge. Today, however, we can see that this environment of diverse information is no guarantee that the individual's perspective will be equally diverse. When individuals are confronted with an unlimited amount of information, several epistemic mechanisms are at play. Filtering based on the principle of selective exposure, accepting information based on cascades, or relying on others are not problematic sui generis. Rather, it is the interplay between these natural and useful social mechanisms and our changed communication environment that is problematic. I think it is problematic because it results in the following mechanism of action - the bigger the information choice, the more information has to be filtered, the more information has to be filtered, the more important personal preferences become. At this point one could argue that the growing power of consumers to 'filter' what they see, which of course increase fun, convenience and entertainment, is favorable and a consequence of our free and democratic society. However, the increased importance of personal preferences contributes also to the emergence of echo chambers. Many scholars have warned of this development, since individuals inside echo chambers, similar to a raindrop inside a large cavity, will primarily hear "echoes of their own voices" which get louder and louder.[1] Thus, individuals "polarize in a way that can breed extremism and even hatred and violence".[2] Viewed at the level of society as a whole, this leads to an intensification of social antagonism, which causes fragmentation and polarization.

It is especially this social fragmentation and polarization which should trouble us as a society, since it entails far-reaching dangers for our peaceful coexistence and democracy. Sunstein, for example, argues that societies are based on common and shared experience and information.[3] He further argues that with the emergence of echo chambers this 'social glue' disappears, causing unforeseeable consequences for our democratic ideals.[4] Already today, it seems that different intellectual communities do not share the same fundamental beliefs anymore. The ongoing polarization of the two major parties in the

[1](C. Sunstein 2007, p. 44 as cited in Warner and Neville-Shepard 2014 p. 2)
[2](ibid.)
[3](C. Sunstein 2007, see pp. 97 - 118)
[4](ibid.)

U.S. and its culmination in the 2020 presidential election with the subsequent issue of election fraud are just two examples. Furthermore, as Hardin claims, it is indispensable for a functioning democracy to have an informed debate.[5] Echo chambers also challenge this cornerstone of our democratic ideals, as their ideologically homogeneous structures, selective information intake and polarization effect prevent interactions between different groups, thus eroding a civic discourse.

However, I would like to emphasize that a wide range of communication options and a diversity of free choices is an established fact of democratic countries, the nature of which I never intended to criticize in the context of my bachelor thesis. Quite the reverse. I think it is worth protecting because I think it distinguishes a free society. Despite that, I also believe that the emergence of digital media causes great challenges, with echo chambers being one of them. Therefore, in the course of my bachelor thesis, my main goal was to elaborate on the most important aspects of echo chamber in order to establish an in depth understanding. Based on my comprehensive literature research, I finally define echo chambers as ideologically homogeneous communities that polarize attitudes by promoting epistemological isolation and strong group identity.[6]

In relation to our imaginary discussion group *Thunderstorm*, we can identify the following echo chamber-specific mechanism of action. Due to the tendency of selective exposure, individuals preferred opinions and arguments that were consistent with their existing views about refugees. In addition, they tended to primarily include other people and information sources in their social network who shared their attitudes. Thus, a ideological homogeneous online structure emerged. In order to exchange facts, points of view or beliefs with like-minded individuals, they created a discussion group and called it Thunderstorm. Over time, more and more people joined in and through group discussions views intensified and opposing arguments were marginalized. Moreover, other groups like radical climate activists or feminist woman groups seemed increasingly strange, absurd and dangerous. Thus, members of Thunderstorm started to evaluate their own group more and more positively while opposing groups were perceived more and more negatively, up to strong hostility and open hatred. Consequently, their views became more extreme, creating an atmosphere which is heading into a dangerous direction. For this reason, and given my detailed account of the structure, selective information intake, and group polarization of echo chambers, I believe 'Thunderstorm' can be considered as an echo chamber.

[5] (Hardin 2009, as cited in Bozdag and Van Den Hoven 2015 see p. 250)

[6] (The notion of epistemological isolation describes the fact that members of echo chambers have primarily selective information intake and strongly distrust external sources. As a result, they become isolated from external sources and trust only the information from the echo chamber.)

All in all, I conclude that echo chambers provide a promising approach for the advancing societal division in relation to the transformed communication market. Therefore, echo chambers will remain an extremely important and exciting topic in the future, and I am highly motivated to continue working on this topic after finishing my bachelor thesis. Unfortunately, in order not to go beyond the scope of my bachelor thesis, issues concerning the consequences of echo chambers, how to escape them chamber or to what extent individuals can be held responsible for being part of an echo chamber had to be cut out. In addition, I would have liked to dive deeper into the topic of social epistemology as it relates to 'post-truth.'[7] Nevertheless, I hope my bachelor thesis, with its clarifying approach, provides a good foundation on which future research can build.

[7](In case of existing interest interesting literature is added in the following.(Fantl 2021)(Habgood-Coote 2019)(Jamieson and Cappella 2008)(L. Magnani and Bertolotti 2011)(McIntyre 2018)(Helberger 2011)(Nguyen 2018)(Nguyen 2020)(Santos 2021)(C. Sunstein 2007)

7 Declaration of Authorship

I hereby certify that the work presented here is, to the best of my knowledge and belief, original and the result of my own investigations, except as acknowledged, and has not been submitted, either in part or whole, for a degree at this or any other university.

_____	Berlin, 8th October 2021
Signature	*City, Date*

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