Effects of the spiral of silence on minority groups in recommender systems

Shah Noor Khan
s.n.khan1@uu.nl
Utrecht University
The Netherlands

Eelco Herder
e.herder@uu.nl
Utrecht University
The Netherlands

ABSTRACT

Recommender systems play a critical role in today's data-rich landscape, where the abundance of information necessitates their ability to present the most relevant choices for individual users. However, it has been noted that recommender systems often fail to offer the most suitable options for minority groups. Therefore, this paper examines one of the potential reasons behind the underrepresentation of minority opinions within recommender systems through a literature review. Specifically, we explore the connection and importance between the spiral of silence concept and the dearth of suitable recommendations for minorities.

CCS CONCEPTS

• **Human-centered computing** → Interaction paradigms; *Empirical studies in HCI*.

KEYWORDS

Spiral of Silence, Recommender Systems, Fear of Isolation, Doctoral Consortium

1 INTRODUCTION

This paper addresses the challenges and issues encountered by current recommender systems in effectively fulfilling their intended purpose of providing users with relevant recommendations. It is a known issue that several factors introduce unfairness into the system, primarily stemming from inadequate data and misrepresentation compared to the user's real preferences. These variables impede the accuracy of recommender systems, as the generated recommendations may not align with users' genuine preferences and needs [21].

As we will discuss, minority groups within specific domains or areas are particularly vulnerable to the adverse effects of misrepresentation in recommender systems. Algorithms that are typically

utilized in these systems often exhibit a bias towards items that are popular among majority users [39], thereby offering minority users recommendations that may be less relevant to their specific interests and preferences. Hence, these users may feel disconnected or alienated from the recommender system's suggestions, potentially leading to reduced usage or even platform abandonment [24]. In this paper, we will shed light on the underrepresentation of minorities in recommender systems, as this factor significantly contributes to the inherent unfairness in system outcomes [5].

We aim to provide arguments supporting the assertion that the so-called *spiral of silence* effect [28] contributes to the insufficient data provided by minority users [18]; the phenomenon of the spiral of silence creates an uncomfortable atmosphere where minority users hesitate to express their true opinions openly. Consequently, this phenomenon directly impacts the experience of social networks as well as the outcomes of recommender systems. The silencing effect, as described by the spiral of silence theory, has shown to be particularly pronounced in the online realm, influencing minority users to either conform to the prevailing majority opinion or choose to withhold their own perspectives, as this results in ineffective recommender systems for these users. The impact is particularly significant in the climate of controversial and political topics [22], thereby challenging the fundamental principles of democracy.

This paper presents a theoretical framework that highlights the significance of the spiral of silence phenomenon in the context of the online environment and recommender systems. Additionally, it offers suggestions and ideas for future directions in addressing this topic. Section 2 provides theoretical definitions and perspectives on the concepts involved, Section 3 explores the issues and presents examples from previous research, Section 4 discusses and interprets the findings of the previous work, and Section 5 concludes the paper and suggests potential directions for future research.

2 THEORETICAL FRAMEWORK

In this section, we introduce the spiral of silence theory and its consequences for recommender systems.

2.1 The Spiral of Silence theory

There exist several theoretical frameworks pertaining to public behavior, and one such framework is the theory of the Spiral of Silence (SOS) [28]. This theory describes the process of the formation of public opinion on specific topics and how a state of silence emerges among individuals who exhibit deviant behavior. The foundation of this theory lies in the proposition that individuals who align their opinions with minority viewpoints face a significant challenge of potential expulsion from their social group or environment. Consequently, these individuals conform their behavior to the prevailing

opinion climate surrounding them, refraining from raising their voices, fearing social isolation [28].

This theory emphasizes the aspect of social isolation, which influences individuals' willingness to express their views and affects the extent to which they disclose their opinions. When the phenomenon of silencing the minority occurs, it initiates a spiral that amplifies the prominence and acceptance of the majority view, further marginalizing the minority [19]. The theory underscores the potential consequences of such a situation: over the course of time, the prevalence of the majority view leads to an increasingly growing inclination to follow the majority viewpoint, dampening the readiness of minority view holders to articulate their perspectives openly [18].

Democracy, by definition, promotes the expression of ideas from individuals representing diverse backgrounds. A lack of diverse opinions can undermine the very concept of democracy in democratic nations [26, 38], while simultaneously depriving the minority of a sense of belonging within the social fabric. Over time, minority opinions can indeed be suppressed and silenced [31, 38], which can even escalate to the complete erasure of the minority. Consequently, numerous studies have been conducted to investigate the repercussions of this phenomenon more comprehensively [9, 31].

In the past, research on the spiral of silence primarily focused on traditional mass media as a platform to understand consensus forming [27]. However, the internet has brought about a significant transformation in the SOS landscape, as it enables users to create and consume content [30], therewith empowering them to express their opinions on politically and controversially charged topics [13]. This digital environment provides opportunities as well as barriers for individuals [29] who may feel uncomfortable expressing their viewpoints in traditional settings, fostering a more diverse and accepting space for varying perspectives [11, 14]. Despite a considerable body of literature, research specifically analyzing the Spiral of Silence in online settings remains limited.

2.2 Recommender systems and the spiral of silence

The advancement of technology has resulted in an immense increase in information and choices provided to the users, leading to individuals being encountered with an abundance of alternatives, resulting in information excess, and causing the decision-making process challenging. Recommendation systems (RS) are widely prevalent to address this issue across various domains. They possess the potential to impact not only the consumption of products, but also individuals' perceptions of the world and even decisions that could have a profound impact on their lives [2]. RS has garnered significant attention from an academic research community perspective as well as the industrial one [18].

The spiral of silence theory has an impact on recommender systems, as RS tends to amplify biases present in the data: when trained on imbalanced item distribution without minority perspectives, RS disproportionately recommends items from dominant groups, reinforcing existing inequalities [39]. Traditional RS methods rely on historical interactions that reflect inherent biases, resulting in bias amplification and excessive recommendations of majority, mainstream items [33]. This can lead to homogenization, feedback loops,

and the alteration of minority preferences. As a consequence, accurately capturing users' genuine (non-mainstream) preferences becomes challenging [21], and minority users are more likely to receive poor recommendations [15].

The recommendation process inherently involves interaction with a user interface, with various factors that must be considered in the development of effective recommender systems. Therefore, a multidisciplinary approach is essential for the successful design and deployment of recommender systems [5]. The application of subjective standards in interface design creates opportunities for bias to arise, resulting in negative user experiences and possible feelings of exclusion or alienation among individuals from marginalized identity groups within online environments. To mitigate such outcomes, it is crucial to gain a deep understanding of bias and actively work to control it in designing and implementing user interfaces [24].

3 SURVEY OF RELEVANT PREVIOUS WORK

As mentioned in the introduction, the theory of the spiral of silence is of significant importance in the climate of recommender systems, as the standard for recommendations in different recommendation systems can vary significantly due to various user attributes, such as race, gender, and personality [4].

This section is divided into subsections that address the issues stemming from the spiral of silence within recommender systems. It also encompasses studies examining the spiral of silence concept and its impact on social networking sites and recommender systems.

3.1 Fairness issues in recommender systems

Fairness and accuracy are crucial aspects of recommender systems, and one way to ensure fairness is by considering all relevant and genuine information in the recommendations. However, the existence of the spiral of silence makes it highly unlikely to fully achieve this goal.

Concerns regarding fairness towards particular people, communities, and cultures at large have acquired greater prominence in recent years [5]. There are different reasons why a recommender system might exhibit behavior that may be considered unfair [5]: when certain minority groups are underrepresented, this may result in recommendations that do not sufficiently align with their preferences. Conversely, other user groups in the majority may receive recommendations that accurately match their preferences [1], but do not sufficiently cover non-mainstream choices, views or preferences.

For instance, Friends is a tv series that is highly popular around the world, but that contains elements that some members of the LGBTQ+ community consider slightly offensive [1]. However, as the large majority loves the series, people may choose not to voice their non-mainstream opinion, resulting in this voice not sufficiently being heard or taken into account.

3.2 Missing data in recommender systems

In this section, we seek to understand the essence of the spiral of silence in data collection and analysis, particularly in situations where individuals refrain from expressing their opinions.

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[1]https://www.vox.com/culture/2019/9/20/20875107/friends-25th-anniversary-polarizing-legacy-homophobia

Liu et al [18] delved into investigating the existence of a spiral of silence process in RS, along with finding patterns in missing data that is a result of this process, as the accuracy and effectiveness of recommender systems heavily rely on reliable underlying data that accurately represents users' opinions. They found that there are cases where these systems encounter sparse rating data, and insufficient research has been conducted to comprehensively comprehend the causes and patterns associated with the absence of ratings in this context, including uncertainty among minority users, leading to their reluctance to provide ratings compared to the majority thus increasing the dominance of the majority view while shrinking minority opinion within the rating data. Unlike hypothetical willingness-to-rate surveys often conducted in controlled lab settings [23], this study took an empirical approach to provide a more realistic understanding of rating behavior. Notably, an earlier survey [17] has indicated indeed that hypothetical willingness to rate may not accurately reflect real-world scenarios.

Furthermore, the study [18] not only identified and validated the concept of what they termed 'hardcore' (mainstream) users, but also provided insights into their characteristics, which could be valuable in marketing scenarios and related applications. The study not only validated the spiral of silence theory in wide-ranging recommender systems, which confirms the presence of hardcore users and their associated characteristics, but it also uncovered that the occurrence of missing ratings follows a non-random pattern.

3.3 Spiral of silence effects in online environments

This subsection compiles studies that investigate essential aspects of the spiral of silence concept in the online environment, such as willingness to speak, anonymity's role, social isolation, user types, and the influence of social cues.

The readiness of people to communicate their thoughts is a crucial aspect of the spiral of silence theory. Noelle-Neumann, the pioneer of the theory, conducted a study [28] where she attempted to measure this willingness through a *train test*: participants were requested to imagine a scenario where they had to express their opinion to a stranger during a train journey. Neumann distinguished between two types of users: the avant-garde who express their opinions even when in the minority, and hardcore users who are unwilling to align themselves with the perceived majority opinion and are not deterred by disadvantages they may face.

The relative anonymity provided by various media platforms such as Facebook and Twitter presents an opportunity for users to express divergent opinions. Chaudhry and Guzd [3], explored whether individuals with racist views, who are a minority group as well, are less inclined to express their opinions that contradict the majority view, as they fear social isolation. Contrary to expectations, the study revealed that Facebook, being primarily a non-anonymous and moderated platform, actually provides an environment where vocal users belonging to the perceived minority feel comfortable expressing their opinions while questioning the prevailing popular view within the online context.

However, it is essential to note that the lack of social interaction, physical presence, and contextual signals in virtual environments can contribute to the emergence of aggressive and emotionally charged statements. This can further intensify polarization among different groups, suppress diverse perspectives, and impede the free expression of opinions. Consequently, this dynamic can fuel the spiral of silence, particularly for minority viewpoints [3, 16].

Another study [17] suggests that users are more affected by the opinions of the majority in online settings than would be the case in the real world. Individuals who believe that their online community will align with their views are more inclined to express themselves [10], whereas those on the opposing side are less likely to do so [36]. One of the key factors impeding users from expressing their opinions is the fear of social isolation, as indicated by a study [36] that revealed the existence of a spiral of silence effect in social networking sites. Expanding on this argument, it is likely that the presence or absence of the spiral of silence in a virtual environment may vary.

A comprehensive meta-analysis conducted in a study [22] examined the relationship between users' political opinions and the opinion climate, both in online and offline environments. Contrary to initial assumptions, the study found that the online environment did not exhibit weaker relationships between these two factors than offline environments. The findings of the meta-analysis revealed that the association between the opinion climate and personal political opinions is more *robust* than previously assumed.

Social networking sites like Facebook have provided valuable insights into how individuals express their views, particularly on political and controversial topics. Studies within the spiral of silence framework have examined the impact of the opinion climate on user choices. Research on cases such as Edward Snowden's revelations [10] and online surveillance [34] revealed that users were hesitant to express divergent opinions unless they aligned them with the majority view. Similar patterns were observed in studies on topics like nuclear power generation [25] and gender identity expression on Facebook [8]. These findings highlight the silencing effect experienced by individuals with minority viewpoints or non-conforming identities within their social networks.

DiMicco and Bender [6] presented a tool called the 'Second Messenger', with the primary objective to enhance the visibility of minority voices in a discussion environment. The tool aimed to achieve this by filtering out dominant voices and amplifying the voices of minority group members, which could result in enhancing the urges among the minority to express their views, thus countering the spiral of silence effect in a way.

4 DISCUSSION AND INTERPRETATIONS

The accumulated research and studies conducted on the spiral of silence theory, as discussed in the previous sections, have consistently demonstrated its significant impact, suggesting that the effects of this theory are unlikely to disappear in the foreseeable future [12]. Despite the potential of online environments for making minority voices heard [32], studies have shown that the spiral of silence effect persists and does not weaken [22]. Furthermore, it has been observed that many online media platforms are digital versions of the offline mainstream media [35]. This implies that the online environment often reflects the same dominant opinions and narratives as found offline.

Social media and online environments often elicit user responses through actions like likes and comments, with the accumulated actions representing the majority view. This can lead to individuals fearing criticism and isolation, triggering the spiral of silence [37]. Moreover, the overlap between online and offline contacts amplifies the potential for offline isolation. The spiral of silence can occur regardless of the opinion climate, as long as cues regarding majority and minority perspectives exist. Liu et al. [20] propose FAiR, an end-to-end fairness-centric model for recommender systems. FAiR addresses the limitations of previous studies by integrating fairness for both users and items, adapting to individual characteristics. A similar approach can balance fairness between the minority and majority in recommendation systems by considering the preferences of both groups. This ensures equitable representation and user satisfaction.

Some studies propose that anonymous opinion expression can help mitigate the spiral of silence in online environments and recommender systems. However, it is important to acknowledge that online platforms allow for direct interaction between users – anonymous or not – which implies that minorities still may face backlash and abuse from the majority. This can discourage minority users from participating in such interactions. When encountering politically or controversially charged topics, users' responses may vary based on their position within the user spectrum: avant-garde users may express their opinions to convey their perspectives, while hardcore users may remain silent or present confrontational ideas. For instance, in video streaming platforms, recommendations may for these reasons not align with an individual's initial preferences, leading to unintentional deviation from their original interests [21].

In addition, it is crucial to distinguish between individuals who genuinely express their true opinions and take a stand on the issue, and those who simply comment without giving much thought on their real opinion [23]. This distinction is significant because comments that are largely driven by the desire to conform to majority opinions cannot be considered genuine expressions of opinion. Consequently, it raises the question of whether such behavior can be recognized as silencing the minority in terms of expression.

Further exploration is needed on the acceptance of minority opinions by the majority to mitigate the spiral of silence. Giving equal weight to minority views alongside majority views in recommender systems could be a potential solution. However, implementing this approach faces challenges, such as maintaining accuracy for the majority as well as ensuring acceptance of minority suggestions by the perceived majority. Therefore, dealing with the spiral of silence in online environments and recommender systems requires a comprehensive and multifaceted approach. As a first step, it is crucial to recognize and represent the existence of minority groups, even if they are not recognized by the majority. Further, the representation of minorities in the form of *role models* is expected to play a vital role in bridging this gap and fostering solidarity and confidence among minority users.

5 CONCLUSIONS AND OUTLOOK

This paper emphasizes the continued relevance of the spiral of silence in the context of online environments and recommender systems. While previous studies have addressed aspects related to this phenomenon, there are still many unanswered questions that need to be explored to enhance the recommender systems' environment for all users. Particularly, this paper highlights several issues present in online environments that result from spiral of silence effects. These include missing data, the presentation of relevant opinions, the effects of anonymity on the results and context, and the fear of isolation.

Addressing the fear of isolation among individuals in the minority is crucial in improving recommendations impacted by the spiral of silence. Therefore, it is important to study and quantify the spiral of silence effects experienced by different minorities in different environments and systems. A further research direction involves designing interfaces that represent minority views along with popular opinions and that encourage users to express non-mainstream opinions. Finally, studying the acceptance of recommender systems that prioritize inclusiveness could yield valuable insights. Ferraro et al. [7] introduce "commonality" as a metric to evaluate how well a recommender system promotes content that fosters a shared cultural experience among users. These future directions offer valuable avenues for research and improvement in representing the minority effectively in recommender systems.

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