

Post-print Analysis of the Causes of Information Cocoons from a User Perspective

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Abstract

[Purpose/Significance] In the era of big data, media diversification and information overload have increasingly drawn academic attention to negative information phenomena, represented by information cocoons. Analyzing the causes of information cocoons is of great significance for eliminating their negative impact on cyberspace governance and guiding the orderly development of information space. [Method/Process] Based on existing research, from the user perspective, and using a logical normalization method, the formation causes of information cocoons are explored from the information space, personal information space, and their interactive relationships. [Results/Conclusion] The research results indicate that the formation of information cocoons possesses historical inevitability, technical facilitation, and user-driven nature; information cocoons represent an inevitable trend of the times, wherein technology plays a catalytic role and individual cognition occupies a dominant position.

Full Text

Analysis on the Causes of Information Cocoons from User Perspectives

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Abstract

[Purpose/Significance] In the age of big data, the diversification of media and information overload have caused negative information phenomena such

as information cocoons to attract increasing attention from academia. Analyzing the causes of information cocoons is of great significance for eliminating their negative impact on cyberspace governance and guiding the orderly development of information space. **[Method/Process]** Based on existing research and from the user perspective, this study employs logical normalization methods to explore the formation causes of information cocoons from the perspectives of information space, personal information space, and their interactive relationships. **[Result/Conclusion]** The findings indicate that the formation of information cocoons possesses historical necessity, technical causality, and user self-adaptability. Information cocoons represent an inevitable trend of the times, in which technology plays a catalytic role and individual cognition occupies a dominant position.

Keywords: user perspectives; information cocoons; formation causes; historical necessity; technical causality; user self-adaptation

The Internet has become a crucial channel for most people to obtain information, expand knowledge, and express opinions, serving as the fifth living space for humanity beyond land, sea, air, and outer space. Particularly with the rapid development of 5G technology, the proliferation of wireless networks, and declining prices of electronic products, China's internet user population has grown substantially, reaching 904 million by March 2020, with an internet penetration rate of 64.5% [1]. The rapid growth in information volume and user scale has transformed traditional methods of information dissemination, acquisition, and utilization, gradually extending the "information age" into the "intelligent age." However, the Internet's rapid development and massive information characteristics, coupled with unbalanced and irrational development, have increasingly highlighted the problem of information resource overload. Due to users' relatively limited capacity to perceive and process information, they typically exhibit selective exposure to reduce their cognitive load, choosing information that interests them, brings ease and pleasure, or benefits them. Over time, this confines them to a closed environment resembling a "cocoon" —the so-called "information cocoon" phenomenon [2].

Information cocoons are not merely individual phenomena but also demonstrate strong group organizational characteristics, as exemplified by the 2016 U.S. presidential election. Their existence not only exacerbates social fragmentation but also signals the threat information cocoons pose to the public sphere [3]. Jürgen Habermas conceptualized the public sphere as a domain of social life where public opinion can be formed [4]. With the accelerated development of informatization and intelligence, the public sphere has gradually extended into virtual space. As a virtual social public sphere, cyberspace essentially possesses the fundamental attributes of the public sphere. Social media platforms such as WeChat, Weibo, and Facebook can be regarded as networked public domains, where the formation of information cocoons among users seriously hinders the healthy and sustainable development of cyberspace and imposes additional bur-

dens on network information space governance.

Through literature review, we find that while academia has reached a consensus on information cocoons, research on the formation causes of this phenomenon from the user perspective has not yet emerged. This study attempts to explore the formation mechanism of information cocoons from the user perspective, analyzing their causes from the perspectives of human information space, personal information space, and their interactive relationships, and proposes targeted countermeasures and suggestions. This contributes to a deeper understanding of the new challenges facing Internet information exchange and network information space governance.

2. Information Cocoons and Related Concepts

2.1 Conceptualization of Information Cocoons

In the early days of the Internet, Nicholas Negroponte predicted the emergence of *The Daily Me*, a fully personalized newspaper where everyone could select their preferred topics and viewpoints. For real society, *The Daily Me* represents both opportunities and challenges. The concept of information cocoons was first proposed by Cass Sunstein in his 2006 book *Infotopia: How Many Minds Produce Knowledge*. He argued that in Internet information dissemination, because the public's information needs are not comprehensive, they only pay attention to content they enjoy or that brings them pleasure, rarely actively searching for other information. Over time, the breadth and depth of information individuals encounter become increasingly limited, thereby confining themselves to a closed space resembling a silkworm cocoon [2].

The concept of information cocoons is relatively new in academia. In China, it gradually entered scholars' research perspective after Liang Feng conceptualized and elaborated on it [5]. In fact, information cocoon phenomena are ubiquitous in modern information society, potentially existing in varying degrees and with different consequences in people's study, work, and daily life—such as strong versus weak cocoons, or high-quality versus low-quality cocoons. Moreover, as an information phenomenon, information cocoons form a unique information environment, but they are not new products of the Internet or new media era. Rather, they have long existed throughout social development and information movement processes. From information explosion to information management, selection, and avoidance, these phenomena reflect users' inevitable response to dramatic increases in information volume—a form of self-protection behavior in an era of information surplus, particularly prominent during the flourishing period of user-generated content, affecting information exchange efficiency and utilization outcomes, and thus increasingly drawing public and researcher attention.

2.2 Characteristics of Information Cocoons

2.2.1 Convenience and One-sidedness of Information Acquisition The convenience and one-sidedness of information acquisition constitute one of the prominent features of information cocoons. When users face network problems such as information disorientation and overload, autonomous filtering and personalized recommendations enable them to easily, quickly, and accurately find interesting or problem-solving information. However, this simultaneously results in the most significant consequence: the one-sidedness and homogenization of acquired content. Users typically only focus on information they select or that is pushed to them, forming persistent attention habits that lead them to recognize or understand only certain aspects of issues, emphasizing parts while neglecting the whole. Weibo, a representative of China's self-media, features personalized and autonomous information consumption. Weibo users often filter and customize their follow lists according to their interests or professions, resulting in limited attention domains that easily lead to single-sourced, homogenized information sources, causing one-sidedness and homogenization in information acquisition content [6].

2.2.2 Stability and Closedness of Personal Information Space The stability and closedness of personal information space represent another significant characteristic of information cocoons. Immersion in self-selected content prevents different content or viewpoints from entering personal information space, gradually presenting a relatively closed and fixed state while simultaneously providing individuals with security, comfort, and belonging, forming a stable but limited cognitive domain. For example, university campuses constitute relatively closed information environments where individual students have fixed social circles and stable network relationships within this closed information space [7].

2.2.3 Group Solidarity and Segmentation Information cocoons also exhibit strong group organizational characteristics. Groups formed due to shared or similar knowledge effects possess common cognitive structures and value concepts. Internal information publication, limited inter-group information flow, and influences such as opinion leaders and the spiral of silence may facilitate intra-group solidarity but can also cause group contagion and polarization [8]. Especially in the era of flourishing online groups, virtual social phenomena of intra-group homogeneity and inter-group heterogeneity easily emerge.

2.3 Related Concepts

2.3.1 Echo Chamber Effect With the emergence of network media, people increasingly rely on digital and information-based means to obtain information resources, accompanied by numerous new problems such as information overload, information homogenization, social differentiation, and online group polarization, triggering a phenomenon known as online echo chambers. Sunstein

metaphorically described the echo chamber effect as a network group communication phenomenon and defined it in *Republic.com* [9]. Some scholars believe echo chambers are relatively closed opinion perception environments created by network media, where people more easily immerse themselves in like-minded voices, becoming more isolated and unable to hear contradictory opinions. The echo chamber effect easily evokes the key concept of the “spiral of silence” theory – “quasi-statistical sense” –where everyone possesses some ability to perceive and judge the external opinion climate [3]. If the public remains in social networks for extended periods without effective inter-individual communication, they unconsciously transform the public opinion presented in social media into individual cognition of society.

Many scholars use the concepts of information cocoons and echo chamber effects interchangeably without deliberate distinction, but echo chamber effects are not entirely equivalent to information cocoons; certain differences exist. First, their research perspectives differ: information cocoons are primarily based on users’ selective exposure, while echo chamber effects focus on the perspective of circular living. Second, their emphases differ: information cocoons mainly emphasize the narrowing and accumulation phenomenon of user contact, selection, and acquisition of information during dissemination, while echo chamber effects emphasize the “echo” –the reinforcement of individual or group opinions in closed environments. However, both share homogeneity in behavioral subjects and causes: they are both results of active selection by individuals or groups, while being indirectly influenced by media environments and technical factors. Fundamentally, information cocoons and echo chamber effects share many content characteristics, and echo chamber effects also contain information cocoon phenomena, leading many scholars to treat them equivalently without strict distinction.

2.3.2 Filter Bubbles The echo chamber effect in social media often produces a result called filter bubbles, with the two concepts frequently intertwined and used interchangeably in mainstream media and academic literature [10]. The term “filter bubble” was first used to explain how Internet search engines and their algorithms cause users to receive increasingly more information that confirms their existing beliefs [11]. Search algorithms lead to narrower perceptions of available online information, creating filter bubbles—a process invisible to users but still exerting tremendous influence on personally visible and usable information. Filter bubbles provide each user with a unique information world, but concerns arise that personalized content and services may limit the diversity of media information people encounter, thereby damaging democracy, thought, and the healthy development of the public sphere [12]. H. Holone found that filter bubbles enhance confirmation bias, affecting online health information search methods [13]; domestic scholars discovered that filter bubbles exhibit endogenous structures that may spontaneously exclude unwelcome information and lead to polarization [14]. Despite serious concerns, no empirical evidence proves the need for stronger worry about filter bubbles. Exploratory research

on the impact of personalized recommendations on content diversity in Google News found that personalization has minimal impact on content diversity, suggesting that the negative role of algorithmic recommendations in forming filter bubbles may be exaggerated [15].

Regarding the concepts of filter bubbles and information cocoons, foreign scholars more commonly adopt “filter bubbles,” while domestic scholars prefer “information cocoons.” Both share similarities and are closely related to technology. Filter bubbles emphasize the information filtering effects brought by computer technology, whereas information cocoons are not products of technological development—technology can serve as a catalyst for their formation. However, both produce consistent impacts, constructing closed information spaces for users. While information acquisition becomes convenient, they may cause imbalances in information or cognitive structures and group polarization problems. They also differ in user behavior’s active versus passive nature: filter bubbles mostly form through users’ passive acceptance or selection of information, while information cocoons result from users’ active choices.

3. Analysis of the Causes of Information Cocoons

Why does the information cocoon phenomenon occur during users’ information behavior processes? What impact does it have on personal information space and overall human information space? From the user perspective, what main factors influence its evolution? In formal communication contexts, information producers and consumers connect through information media and systems to achieve indirect exchange. Network-based formal communication can be viewed as an extension of paper-based formal communication onto the Internet, adding new formal communication channels to traditional printing. Typically, specialized databases are established according to user needs to provide targeted services, users employ network tools to browse and download information resources that meet their personalized requirements, and directories and indexes are provided to facilitate targeted information searches, accelerating information exchange efficiency and improving targeting [16]. In most cases, users heavily rely on “one-stop” fixed information acquisition and behavior service models, tending to passively accept and use controlled content that meets their specific needs. However, this content covers small areas, easily forming fixed thinking patterns, causing narrowing of perspectives and triggering information cocoon effects.

With network technology development, information production forms have expanded from passive information use to active content generation. User-Generated Content (UGC) has changed social information flow patterns, enriched information exchange systems, heralded the prosperous and powerful return of informal communication, and realized the user-centered concept. UGC forms have increased the diversity of informal information exchange, with their forms, quantities, and content far exceeding formal information exchange, widely applied in education [17], e-commerce [18], democratic politics

[19], libraries and museums [20], and other fields. However, its fragmented, personalized, and openly accessible information content frequently appears, easily causing user information narrowing. Especially when there is information asymmetry between information-rich UGC and user information needs, coupled with practical problems such as information quality, opinion leaders, false subject identification, and emotional tendencies [21], the information cocoon phenomenon is further intensified, as shown in Figure 2 [Figure 2: see original paper].

3.1 Historical Necessity of Information Cocoons

First, due to the rapid development of social information resource production, organization technologies, and methods, the total information volume in the overall human information space has increased dramatically, and information exchange patterns have changed, causing users to feel overwhelmed when processing information beyond their relevant scope. They tend to favor information service models that filter redundancy, enable personalized customization, and provide precise push services—a trend consistent with information space changes and development, which we term the historical necessity of information cocoons.

The information asymmetry problem is mainly manifested in that UGC, as a form of big data, features large volumes and diversity, making it increasingly difficult to efficiently and quickly find information sources that meet user needs during interaction. Information overload itself is not problematic, but when choices become so numerous that they exceed basic needs and capacity, they seriously affect users psychologically and behaviorally. Psychologically, excessive information expands the breadth of information choice, easily increasing users' psychological burden and accompanied by negative emotions such as anxiety, burnout, or frustration. Behaviorally, information overload affects users' information screening, discrimination, and integration behaviors, placing higher demands on information literacy capabilities [22]. Simultaneously, information overload or oversaturation not only fails to improve quality of life but may also cause anxiety, confusion, and ignorance [23], leaving users at a loss and even beginning to avoid and resist information beyond relevant scopes, subsequently immersing themselves long-term in narrow information environments. Therefore, the powerful return of informal communication is an inevitable trend, and UGC's intensification of information cocoon formation is also an inevitable result and trend of the times.

3.2 Technical Causality of Information Cocoons

Due to the enormous volume of UGC in networks, ordinary users struggle to find UGC that matches their needs. However, with continuous development and innovation in information technology, algorithm-based search technologies and personalized recommendation technologies have greatly enriched information exchange channels between users and network information space, accelerating dissemination speed and expanding scope and forms of expression. The grad-

ual maturation of search and personalized recommendation algorithms has, to some extent, circumvented problems arising from individual differences, high information acquisition costs, and information overload, while fully catering to user interest preferences. The rapid iterative development of Internet information technology makes everything possible, but it also means that seemingly free information exchange may conceal information cocoon traps. Moreover, precise services provided through algorithmic technology act as catalysts, promoting the rapid formation of individual-centered information cocoons (see Figure 3 [Figure 3: see original paper]).

Users typically need to actively employ search technologies to find information that meets their needs amid massive, dispersed, and disordered network information content, such as using retrieval tools to search network resources through keywords or topics, then screening required information. Common retrieval tools include directory-based retrieval tools, search engines, and web navigation. Directory-based retrieval tools establish online directories to help users conveniently query needed information, allowing users to browse Web site lists by topic and retrieve relevant information. Compared to online directories, search engine retrieval systems are more widely used, better suited for specific information and specialized, in-depth topics with relatively unclear categories, but they suffer from problems such as low information quality, content duplication, and time-consuming effort [24]. Different from the former two, web navigation uses hyperlinks to establish navigation systems that guide users to information resources according to specific user information needs, such as database navigation and electronic literature navigation [25]. Search technology corresponds to formal information communication contexts in information exchange patterns, and its digital and intelligent development satisfies users' specific needs while weakening their subjective efforts, making them dependent on information systems that filter various types of already-organized information. Over time, this powerful filtering force limits the breadth and depth of information individuals encounter, thereby breeding information cocoon phenomena.

Personalized recommendation is a new technology adopted by network media. Based on user historical behavior data, it analyzes user information usage habits, interest preferences, and user psychology through data mining algorithms to filter and recommend information of interest to users. Providing personalized information recommendation services has facilitated the gradual transition from the information age to the recommendation age, typified by the Douyin phenomenon. Users with smart devices can create short videos themselves, and the system selectively sorts and pushes information content according to users' followed accounts and browsing preferences to meet user needs [26]. Users can not only view short videos from local users but also, based on permissions, access mobile contacts to help users discover more potentially known people, continuously pushing videos from possible acquaintances or followers. While providing multiple types of social relationships, this creates a relatively closed information domain for users, forming fixed path dependence that actually accelerates cocoon formation speed. When users immerse themselves long-term in homog-

enized recommended content, losing their subjective initiative, they easily lead to closed, narrow, and isolated negative outcomes. This makes consensus areas between people increasingly narrow, making them more dependent on so-called trustworthy paths to obtain information rather than willing to attempt new approaches, unconsciously falling into the abyss of information cocoons and posing significant challenges to expanding new knowledge and perspectives.

The development of network information technologies such as search and personalized recommendation fully caters to user interest preferences, circumventing troubles from information acquisition costs and information overload, while gradually weakening users' subjective efforts and causing them to lose subjective initiative. This creates dependence on solidified information exchange channels and unconscious immersion in individual-centered information cocoons.

3.3 User Self-adaptation in Information Cocoons

User self-adaptation refers to users' subjective judgments, choices, or behavioral intentions made according to their ideological level, knowledge structure, value pursuit, and development needs to address practical problems. Self-adaptation represents the reasonable form of things hoped for and expected from the perspective of subject needs. Without special pressure, users actively generate rejection reactions to mismatched information. If technological catalysis is considered an external factor in information cocoon formation, then the internal driving force of the phenomenon depends on users themselves, with user self-adaptation playing a decisive role and becoming the conscious source of information cocoon construction.

In response to social development, user behavior is guided by their own cognition and other factors, such as information preferences, information demand differences, and social capital, manifesting information cocoon phenomena to varying degrees, as shown in Figure 4 [Figure 4: see original paper].

User cognitive processes are mainly influenced by multiple factors including personal information preferences, information needs, value concepts, and social capital. From the perspective of information channels, information preferences guide users to use, trust, and prefer using one or several specific channels over others, reflecting users' inertia and fixed thinking patterns in information selection behavior [27], generally changing with users' information needs. The "Uses and Gratifications" theory stands from the users' position, viewing users as individuals with specific needs whose media channel usage is entirely based on personal needs and desires. However, immersed in vast information oceans, people struggle to precisely obtain desired information to satisfy themselves and consciously avoid troublesome, complex, or low-quality information sources, following the "principle of least effort" to spend minimal time and energy selecting and acquiring needed information. As Sunstein argued, people prefer browsing and selecting information that matches their preferences while actively avoiding disliked or knowledge-structure-mismatched information. Preferences to some

extent cause biases, which narrow people's perspectives and trap them in self-woven information cocoons.

Information users' cognitive psychology is typically determined by information needs, manifesting as user information behavior under certain conditions. User information selection and avoidance behaviors lead to information cocoon formation, which mutually confirms Sunstein's definition—information cocoons ultimately originate from people's selective psychology. Individual characteristics such as gender, personality traits, value concepts, and emotions create certain differences in individual network information behavior and construct information cocoons of varying degrees [28, 29]. As limited living beings in the process of social interaction and information processing, users possess finite cognitive capacities, and information selection and avoidance behaviors unconsciously emerge. Users select information based on their preferences and value concepts, screening information that matches their concepts while avoiding and rejecting mismatched information to reduce cognitive load—a natural process. From the information behavior field perspective, on one hand, selective theory is a component of individual information selection and avoidance processes, with “selectivity” as its core, and information selection behavior constitutes an important part of selective theory research. On the other hand, the result of selective psychology is information acquisition, usage, and sharing behavior, with information sharing behavior also being a later manifestation of individual selectivity, becoming more diverse and abundant [30]. Individual selective psychology determines the evolution of their information behavior, binding users to narrow information cocoons guided by their existing concepts and interests, and this phenomenon objectively exists.

In daily life, users' conforming or herd behavior, which also constitutes an internal driving factor for information cocoon formation, is highly associated with user cognition and information contexts. Herd psychology drives people with similar cognitive needs, attitudes, and values to gather together. Influenced by emotional factors and group pressure, users often fear isolation and avoid group elimination. When individual opinions diverge from group opinions, they are easily influenced by others' attitudes and behaviors, passively conforming to group opinions and isolating contradictory views. This causes information to flow only within groups, easily forming closed information cocoon environments. Once formed, even if abundant information resources exist in networks, they lose their value due to homogeneity among them. Users' selective psychology continuously reinforces similar information, and seemingly personalized information constrained by this herd psychology makes democratic communication difficult to achieve [31].

From the user perspective, people often exhibit tendencies when facing information and viewpoints, preferring to select information that interests them or satisfies their needs, which is why they fall into self-woven information cocoons. Therefore, users' subjective cognition and behavioral choices constitute the deep-level driving forces of information cocoon formation, representing the conscious

source of information cocoons and users' inevitable choice in response to complex information environments.

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Author Contributions

Ren Qiuju: Literature review, writing and revising the paper;

Zhao Xin: Revising parts of the paper;

Han Yi: Proposing research ideas and framework, revising and improving the paper.

Note: Figure translations are in progress. See original paper for figures.

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