A Review of Domestic and International Mobile Reading Behavior Research in the Past Decade: Postprint

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Abstract

[Purpose/Significance] To review relevant research on mobile reading behavior, thereby deepening the understanding of user behavior characteristics and identifying trends in mobile reading behavior research.

[Method/Process] Through systematic literature investigation and tracking, relevant publications on mobile reading behavior research from 2007 to 2017 were collected both domestically and internationally. After careful screening, 254 target articles were obtained. Statistical analysis was performed on their publication years, journal sources, research subjects, and research methods, and research themes were systematically discussed.

[Results/Conclusions] Research themes were summarized into four dimensions: reading motivation, reading preferences and habits, reading comprehension and performance, and reading practice and application. Based on this framework, the characteristics of existing research were synthesized, and future research directions were proposed.

Full Text

Preamble

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A Review of Domestic and International Mobile Reading Behavior Research in the Past Decade
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Abstract

[**Purpose/Significance**] This paper reviews research on mobile reading behavior to deepen understanding of user behavioral characteristics and identify research trends. [**Method/Process**] Through literature investigation and tracking, we collected relevant studies on mobile reading behavior published between 2007-2017 from domestic and international sources. After careful screening, 254 target articles were obtained, and statistical analysis was conducted on their publication years, journal sources, research objects, and research methods, with research themes also discussed. [**Result/Conclusion**] The research themes were summarized into four dimensions: reading motivation, reading preferences and habits, reading comprehension and performance, and reading practice and application. Based on this, research characteristics were summarized and future research directions were proposed.

Keywords: mobile reading behavior, reading motivation, reading preference, reading performance, reading practice
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Introduction

Reading is a social behavior, practical activity, and psychological process of acquiring meaning from written language and other written symbols [1], comprising three elements: readers, reading behavior, and reading content. Readers are the subjects of reading behavior, reading content is the object, and reading behavior is the process of meaning generation that establishes the connection between readers and content [2]. In recent years, with the popularization of handheld portable devices such as smartphones, tablets, and e-readers, people's reading activities have gradually shifted to mobile terminals, and mobile reading has emerged. Mobile reading refers to the activity of accessing, receiving, or downloading electronic resources through wireless/mobile communication networks using handheld portable devices as carriers, and reading them on mobile devices [3]. Changes in reading carriers have led to significant alterations in reading behavior, showing marked differences from traditional reading and computer-based reading, making mobile reading behavior research a hot topic in reading studies.

Ning Lujia and Li Guihua identify three main research orientations in reading behavior studies: behavioral process orientation, cognitive effect orientation, and reading experience orientation [4], and the field of mobile reading behavior research similarly exhibits these three orientations. Behavioral process-oriented research focuses on differences in behavioral patterns among different types of readers during the reading process [5], which helps grasp users' mobile reading processes from a behavioral perspective but lacks exploration of readers' information processing mechanisms and influencing factors. Cognitive effect-oriented research focuses on readers' information processing and the brain's decoding

and cognitive activities regarding reading content [6-7], which helps understand readers' psychological processing but ignores other factors affecting reading cognition, such as social and cultural factors. Reading experience-oriented research focuses on the perceptual level during reading, analyzing the interaction between readers' psychological responses, external environments, and behaviors [8-9], which helps create better reading environments and provide better reading devices but generally lacks systematic research frameworks, making effects difficult to evaluate.

Thus, mobile reading behavior research is a typical interdisciplinary study with abundant findings widely dispersed across reading science, digital publishing, psychology, information behavior science, and other fields, lacking systematic review, investigation, and synthesis. A review of existing research not only helps comprehensively understand users' mobile reading behavior but also facilitates the construction of a mobile reading behavior research framework, indicating directions and trends, thereby further expanding research space. This article reviews domestic and international mobile reading behavior research from the past decade across various fields to obtain a holistic understanding of current research and clarify development trends, with the aim of promoting theoretical construction and practical development in mobile reading behavior.

Literature Sources

This study is based on extensive literature investigation and tracking analysis, selecting well-known domestic and international citation databases and academic search engines as data sources to collect relevant literature on mobile reading behavior published between 2007-2017. For international literature, data sources included Wiley, ACM Digital Library, Springer, Web of Science, Google Scholar, etc., with the search strategy "TS=(digital reading OR online reading OR electronic reading OR e-book reading OR mobile reading OR mobile phone reading OR digital device reading OR new media reading) AND behavior" for topic retrieval. For domestic literature, CNKI and Baidu Academic were used as data sources, with the search strategy "Subject Terms=(digital reading behavior) OR (online reading behavior) OR (electronic reading behavior) OR (e-book reading behavior) OR (mobile reading behavior) OR (mobile phone reading behavior) OR (digital device reading behavior)" for topic retrieval. The retrieval period was 2007-2017, and the target literature set was expanded through references and citation tracking. Finally, machine deduplication and manual screening were conducted to remove duplicate and irrelevant literature, resulting in 254 highly relevant research articles published in the past decade, including 148 domestic and 106 international articles. These 254 articles served as the data source for basic statistical analysis to reveal the distribution characteristics of mobile reading behavior research, followed by comprehensive analysis from different dimensions.

Basic Analysis of Reading Behavior Research

3.1 Literature Growth and Journal Distribution

Statistical analysis of publication years reveals research growth patterns and allows analysis of developmental trends in the field. As shown in Figure 1 [Figure 1: see original paper], mobile reading behavior research has generally shown an upward trend since 2007, with increasing annual publication volume. Domestic research started later, with no relevant literature found in 2007, but subsequently grew continuously, peaking in 2014, while international research has maintained steady growth.

Analyzing journal distribution helps identify core journal groups in the research field. Among the 254 selected articles, there were 39 international conference papers and 67 journal articles. Journals with higher publication volumes included *Computers & Education*, *Library & Information Science Research*, and *Applied Ergonomics* (see Figure 2 [Figure 2: see original paper]), belonging to education, computer science, and library and information science fields. Domestic literature included 20 dissertations and 124 journal articles, with major publishing journals being *Library and Information Service*, *Library Tribune*, and *Library Science Research* (see Figure 3 [Figure 3: see original paper]), all in the library and information science field. Thus, mobile reading behavior research is published across a wide range of journals but remains concentrated in specific research fields.

3.2 Analysis of Mobile Reading Research Objects and Methods

In the field of information systems, user behavior research is generally divided into normative research and empirical research. Normative research refers to the research process of drawing conclusions based on hypotheses according to the internal connections of things using logical reasoning; empirical research refers to the methodological concept of scientifically summarizing meaningful conclusions or patterns from a large number of empirical facts, then deriving certain conclusions or patterns through scientific logical deduction, and testing these conclusions or patterns in reality. In other words, empirical research is a continuous cyclical research process from theoretical level to empirical level and back to theoretical level [10]. Compared with normative research, empirical research explores the process and essence of mobile reading behavior more deeply, reflecting the characteristics of mobile reading behavior research. Among the 254 selected articles, 124 domestic articles (83.8%) and 98 international articles (92.5%) were empirical research. In comparison, international research tends to favor empirical research more.

Scholars have conducted empirical research on mobile reading behavior among different groups (see Figure 4 [Figure 4: see original paper]). The most common research objects were university teachers and students and general mobile users. Among literature using university teachers and students as research objects, there were 34 international articles (35.71%) and 78 domestic articles (62.90%).

Among literature using general mobile users as research objects, there were 42 international articles (42.86%) and 30 domestic articles (24.19%). It is evident that domestic empirical research on mobile reading behavior concentrates more on university users, who are currently the most active mobile reading users, indicating that the research is representative but also showing that domestic empirical research objects are relatively homogeneous. In contrast, international research objects are more diverse, with greater attention to the general reading behavior of ordinary mobile users.

Various research methods have been employed in mobile reading behavior studies (see Figure 5 [Figure 5: see original paper]), with a tendency toward using multiple methods simultaneously. Domestic research primarily uses qualitative methods such as questionnaires and interviews, while international research integrates qualitative and quantitative methods, including questionnaires, experiments, interviews, web logs, self-reports, diaries, and focus group discussions. Due to its scientific and objective nature, the experimental method has been widely used by international scholars in mobile reading behavior research, yielding many valuable conclusions. Chinese research rarely applies experimental methods, generally preferring questionnaires to obtain data, then using statistical analysis tools such as SPSS to organize, analyze, and summarize the data to draw meaningful conclusions.

Mobile Reading Behavior Research Themes

4.1 Mobile Reading Motivation Research

Reading motivation refers to the internal psychological process and internal driving force that guides, stimulates, and maintains individual reading activities through goals related to reading [11]. Around the mid-20th century, scholars began studying reading behavior from the perspective of reading motivation [12-14]. Due to different scholars' varying understandings of the composition of reading motivation, its classification is multidimensional but shows a certain degree of universal interoperability. Numerous studies have found that university students' mobile reading motivations mainly include entertainment motivation, functional motivation, social motivation, information motivation, and professional learning motivation, with entertainment motivation being the primary motivation and professional learning motivation not yet occupying an absolute advantage [15-20]. Scholars have also explored the mobile reading motivations of other groups. Li Wu, taking Shanghai middle and high school students' WeChat reading as an example, found that youth social reading motivations are divided into intrinsic motivation, social motivation, and achievement motivation, with social motivation being the main motivation [21]. Further research found that these motivations all significantly influence social reading behavior [22]. Zhou Yijin and Wu Nuannuan investigated mobile news reading behavior, finding that users' primary motivation for reading mobile news stems from cognitive needs, followed by alleviating boredom and making full use of fragmented time. The main motivation for participating in comment interaction is the desire to

follow up on news content, with secondary motivation being the hope for recognition [23]. Research also found that casual browsing and entertainment are the primary motivations for white-collar youth's mobile reading [24]. Some scholars have explored the driving factors for users' transition from traditional print media to digital media from different perspectives. Xu Xiaojuan et al., based on a "user value orientation" perspective, found that users' transition from traditional print to digital media is mainly driven by functional, opportunistic, social, and emotional values, with attention to emotional dimensions exceeding functional dimensions [25].

The above research on mobile reading motivation tends to focus on external motivation rather than psychological motivation. Exploring the psychological motivations of mobile reading can better discover users' psychological needs for mobile reading, stimulate interest in mobile reading, cultivate mobile reading habits, and establish values for mobile reading.

4.2 Mobile Reading Preferences and Habits

In terms of mobile reading preferences and habits, demographic characteristics such as gender, age, education level, disciplinary background, and educational attainment are important entry points for understanding reading behavior among different groups [26]. Numerous studies use demographic characteristics as multidimensional variables, showing that mobile reading behavior differs among user groups with different characteristics [27-28]. Some studies use individual variables as independent analysis units. For example, L. Zhang and W. Ma found that well-educated users are willing to pay for academic papers, while other users tend to read online novels [29]. J.A. Cordón-García et al. found that in Spanish higher education, students majoring in humanities, social sciences, and law prefer traditional print books, while students in experimental sciences, technical education, and health sciences prefer e-books [30]. The above research reveals mobile reading behavior preferences among different user groups, and the results can serve as references for differentiated marketing and personalized recommendations by mobile reading service providers. However, such research lacks exploration of the internal mechanisms behind different reading preferences among different characteristic groups.

With the continuous popularization of mobile devices, users own more mobile reading devices with more diverse types. Due to significant differences in device type, screen size, resolution, and functional design, users' reading behavior differs across devices, which scholars have extensively studied. In terms of reading terminals, smartphones have the highest usage rate, followed by tablets [31]. Different devices are used in different reading scenarios: users prefer reading on phones in temporary locations and choose tablets or e-readers in fixed locations [32]. Different devices have different reading themes: users prefer using e-readers and tablets for entertainment content rather than academic works or popular science [33]. Operational behaviors also differ across devices: compared with desktop and laptop computers, browsing and scanning behaviors increased

by 51.7% and skipping behaviors increased by 55.1% during mobile phone reading [34]. Users most frequently use Kindle for listening to books, followed by note-taking, web searching, etc. [35]. Existing research results are mostly obtained through questionnaires and reading experiments. With the advancement of eye-tracking technology, eye-movement research on mobile reading has gradually emerged. E. Siegenthaler et al. explored eye-movement differences when reading e-readers based on e-Ink technology, tablets based on LCD technology, and traditional print books. The results showed that in terms of fixation duration, e-reader reading was similar to tablets but lower than print books; in terms of regression proportion, e-reader reading was similar to print books but higher than tablets; in reading speed, e-readers were faster than both print books and tablets [6,36-37]. However, D. Zambarbieri et al.'s research showed no significant differences in fixation duration, regression proportion, and reading speed across different mobile devices [38]. Further analysis of the above research revealed that what affects users' eye movements during mobile reading is not device type but image quality, artificial lighting conditions, functional design, etc. With the development of electronic display technology, mobile devices have become more comfortable and better adapted to users' reading environments, making eye-movement differences across devices gradually smaller.

Scholars have also explored mobile reading behavior preferences at different stages. Mao Yihong et al. conducted empirical studies on mobile reading seeking behavior, utilization behavior, and communication behavior based on reading cognitive theory and reading science theory. They found that users primarily seek mobile reading content through casual browsing, navigation, search, social recommendations, and advertisements; mainly read light content such as news and entertainment; average reading duration is generally within 30 minutes per session; most users communicate reading content with others; the most used communication method is chat discussion, followed by forwarding, posting logs/moods, following/viewing, etc. [32,39-40]. Liu Ya and Jian Ruiqing, based on Wilson's information behavior model, analyzed university students' mobile reading behavior from three stages: reading needs, reading seeking, and reading processing/use. They found that university students' mobile reading needs include staying informed, entertainment, utilizing fragmented time, learning, and maintaining online connections; content acquisition methods include online reading and downloading for local reading; reading environments include almost the entire campus, with commuting being a common reading environment; most university students read for more than half an hour daily, mostly before sleep [41]. Compared with previous digital reading research, current mobile reading process research focuses on descriptive analysis, grasping mobile reading behavior characteristics across three stages (pre-reading, during reading, and post-reading) to some extent but lacking mining of behavior patterns across different stages.

Thus, exploratory research on mobile reading behavior patterns has gradually emerged. Research focuses on differences and changes in mobile reading behavior habits [4], exploring behavior patterns and internal mechanisms of mobile

users in content selection, reading navigation, reading cognition, and feedback communication. Z. Liu and X. Huang found that when using mobile reading devices, users habitually browse, scan, and skip to meet reading needs in fragmented time, with characteristics of one-time, non-linear, and selective reading becoming increasingly evident [42]. P. Braslavski et al. found through web logs that mobile users tend to read multiple books simultaneously and like extensive trial reading before selecting a few interesting contents to continue reading, calling this "parallel reading pattern" and "trial-and-abandon pattern" [5]. Bi Qiumin et al. summarized social reading patterns based on interest and social interaction, believing that mobile reading increasingly reflects social relationships as bonds, emphasizing sharing, communication, and interaction [43]. Wang Youmei, from the dual perspectives of cross-media and ubiquity, systematically analyzed the O2O characteristics of cross-media reading in the mobile Internet era, constructed an O2O-based cross-media reading model, and elaborated on four patterns: continuous consistency, instant sharing, continuous compensation, and instant interaction. This cross-platform, multimedia reading model is continuously changing users' learning and reading habits [44]. With the development of big data technology, mobile reading behavior big data will provide strong support for mining mobile reading behavior patterns, and tracking and analyzing user mobile reading behavior big data will become an emerging hotspot in mobile reading behavior pattern research.

4.3 Mobile Reading Comprehension and Performance

Comprehension is the process of extracting meaning from information and a key outcome of reading [45]. Current research pays less attention to reading comprehension and performance issues in mobile reading environments, with foreign literature being predominant. Scholars are divided on whether mobile reading can achieve good reading comprehension and performance. D. Long and S. Szabo found no significant differences in reading motivation, attitude, and comprehension between middle school students using e-readers and print books [46]. S.J. Margolin et al. similarly found no differences in reading comprehension performance among mobile users reading on paper, computers, and e-readers [47]. In contrast, Y.C. Hsieh et al. investigated the effects of paper and different-sized digital reading devices on reading performance, finding that users' comprehension levels with paper reading were higher than with digital reading, and that screen size had no effect on reading performance. Therefore, they concluded that faster mobile reading speed leads to lower reading comprehension levels [48].

Domestic and international scholars have also conducted in-depth research on factors influencing mobile reading comprehension and performance, roughly dividing them into three aspects: reader factors, text factors, and environmental factors. Regarding reader factors, G. Chen et al. found that users' shallow comprehension with print books was better than with digital reading, but users highly familiar with tablets had better deep comprehension than those less fa-

miliar with tablets, indicating that reading medium is not the reason affecting reading comprehension—digital reading can also achieve good comprehension with sufficient training [49]. Regarding text factors, Y. Zeng et al. found that e-book format and reading device affect reading speed and comprehension levels, with users showing higher average comprehension when reading EPUB format files [50]. Regarding environmental factors, Y.N. Su et al. explored the impact of music on e-book reading behavior and performance, finding that music positively affects reducing learning anxiety, improving reading rates, and reading comprehension ability, but negatively affects students' explanation processes because music attracts attention and causes additional cognitive load [51]. M.C. Pattuelli and D. Rabina pointed out that mobile reading devices lack traditional reading functions such as underlining, bookmarking, and annotation, thereby affecting mobile reading usage and comprehension [35]. The specific impact degree of the above indicators on mobile reading user comprehension and performance requires further research.

Reading behavior in mobile contexts exhibits characteristics of superficiality, fragmentation, and fast-food style, which are not conducive to achieving better reading effects. How to promote "deep reading" has become one of the current research hotspots. Qiu Xiangbin used questionnaires to find that university students' reading behavior in mobile Internet environments generally exhibits fast-food style, jumping style, randomness, and utilitarianism, affecting various aspects of deep reading including reading focus and comprehension [52]. In response to this shallow reading phenomenon, K.L. Huang et al. optimized tablet function and interface design based on user reading experience, and experimental results proved that the improved tablet scored higher than the original version in perceived usefulness and perceived ease of use [53]. Chen Zhihui also mentioned that relevant departments, especially libraries, should advocate deep reading, cultivate reading habits, and reconstruct reading experiences, correctly guiding users to arrange reading time reasonably and engage in "deep reading" of classic literature [54].

With the development of mobile Internet technology, while information content surges and reading carriers change, users' reading behavior and habits also change. Whether mobile reading comprehension effects change, how they change, and how to promote mobile reading comprehension effects will become important research themes for a long time to come.

4.4 Mobile Reading Practice and Application

In mobile reading behavior research, mobile reading systems and platform design and mobile reading application interaction design have received considerable attention. In recent years, the "user-centered" design concept has gradually gained importance, with user behavior characteristics and user experience differences becoming key factors in reading product design. Regarding mobile reading systems and platform design, scholars have optimized existing reading devices, applications, or texts based on user experience differences across

different devices, applications, and texts, then designed experiments to verify whether reading experience improved. For example, Y. Lu et al., based on different user experiences when accessing news websites via mobile devices and desktop computers, suggested that news websites for mobile devices should use space more efficiently, reduce text input, enhance user control, and promote social media sharing [9]. Wu Dan and Ran Aihua, based on user experience with mobile reading applications, suggested that mobile reading applications should refine user classification, deeply mine user needs, and highlight aesthetic design of reading applications [55]. L. Hsiu-Li experimentally found that users have the highest purchase intention and lowest perceived complexity when reading static e-books, proving that static e-books better promote mobile reading behavior [56]. K.M. Alam et al. conceived a haptic e-book (HE-Book) system that combines haptic interfaces (such as haptic jackets, armbands, etc.) to receive users' haptic emotional signals, integrating home entertainment systems with user reading experiences and generating reading materials based on 3D environments enhanced with images and videos, providing users with intimate mobile reading experiences [57].

Regarding personalized recommendations for mobile reading, scholars use experimental log methods or web log methods to collect user mobile reading behavior data, summarize and construct more effective personalized recommendation models to promote user reading effects. For example, C.X. Jia et al., through analysis of mobile reading logs, found that a personalized recommendation system based on quality diffusion algorithm has outstanding performance and can help users quickly find interesting books [58]. J.H. Oh et al. proposed a new method for automatically collecting user reading pattern data (position of each sentence on screen, finger scrolling position, and exposure time of each sentence on screen), then automatically generating highlighted text to enhance user reading comprehension [59].

Mobile reading application usability evaluation has also received some attention in mobile reading behavior research. For example, C.H. Huang and C.M. Wang, based on user gesture operations and interactive behaviors when reading e-books, used Nielsen's five indicators for evaluating interactive e-book reading interfaces to analyze e-book interface usability and proposed interaction design principles for developing and improving interactive e-books [60].

Mobile Internet reading product design based on reading behavior and reading experience is still an emerging field. Current research shows that international mobile reading practice and application research is already quite rich and has significant implications for mobile reading product design, while domestic related research is relatively scarce, mostly focusing on strategic discussions about optimizing mobile reading services for mobile reading products or mobile libraries. Future research should more deeply mine user mobile reading behavior patterns and reading experience differences to optimize mobile reading products and promote mobile reading practice development.

Research Characteristics and Future Directions

Based on the above analysis, the characteristics of domestic and international mobile reading behavior research can be summarized as follows: Diverse research methods showing a trend of integrated use, with questionnaires and experiments being the main data collection methods. However, with the development of computer technology, web log analysis and eye-tracking methods are increasingly emerging. Relatively homogeneous data collection objects, mainly targeting university student groups with small sample sizes. Although mobile reading behavior among farmers, primary and secondary school students, and children has attracted scholars' attention, current research still mainly focuses on university users, especially university students. Rich research perspectives but insufficient theoretical construction and lack of integrated analysis. Current research emphasizes empirical studies on different groups' mobile reading behavior, focusing on describing mobile reading phenomena, lacking induction and revelation of mobile reading behavior patterns and regularities, and rarely exploring the essence of mobile reading behavior. There is a problem of disconnect between theoretical and empirical research.

Based on the above analysis, the author believes that future mobile reading behavior research will develop along the following directions:

(1) **More diverse data collection and analysis methods.** With the development of big data, web logs should become the main data source. Additionally, with the rapid development of human-computer interaction technology, high-tech research methods such as video capture, gaze tracking, think-aloud protocols, and eye-tracking will also become data collection methods for mobile reading behavior research. Research should also introduce new devices such as smart wearables, AI assistants, eye movement trackers, and EEG devices to record fine-grained mobile reading behavior data.

(2) **Broader research objects.** With the popularization of mobile Internet, user groups accessing mobile reading are becoming increasingly diverse. Different user groups show significantly different mobile reading behaviors. Future research will select more refined user groups, focusing on differences in mobile reading behavior among different user groups. Research will also target general mobile reading users to explore universal patterns of mobile reading behavior.

(3) **Further refinement of research variables.** First, research will focus on mobile reading behavior in different contexts, including entertainment, learning, and academic contexts. Second, research will explore behavioral characteristics of different reading tasks and stages, such as mobile reading content seeking, comprehension, and feedback. Additionally, research will refine influencing factors, exploring diverse and cross-cutting variables affecting mobile reading behavior.

(4) **Focus on mobile reading system design.** How to design reading systems to improve readers' engagement, immersion, and comprehension with content under different reading contexts is key to optimizing mobile reading systems and achieving reading tasks, but related research is still quite scarce.

(5) **Integration and construction of mobile reading theory.** Theory construction is key to sustainable research. Future research should introduce interdisciplinary theories such as social psychology, cognitive psychology, human behavior dynamics, and information behavior science to model mobile reading behavior, strengthen the construction of relevant conceptual systems and theoretical frameworks, and further explore the internal elements and mechanisms of mobile reading behavior.

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Author Contributions

Wang Xiaoguang: Topic and idea design, research framework design and guidance
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Note: Figure translations are in progress. See original paper for figures.