Deep Reading Driver Model and Validation in the New Media Environment: A Schema Theory Perspective (Postprint)

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Abstract

[Purpose/Significance] Nationwide reading has gradually ascended to the level of national strategy. In the new media environment, shallow reading has risen prominently, creating a need to drive deep reading to maintain a balanced reading ecology and promote the advancement and deepening of nationwide reading initiatives. [Method/Process] From a cognitive perspective grounded in schema theory, this study examines the differences between deep reading and shallow reading, arguing that their essential distinction lies in the varying degrees of completeness of schema chains during reading. Based on this analysis, it investigates the triggers for deep reading in the new media environment, distills three driving elements—"expectation," "logic," and "regression"—and constructs a deep reading driving model, which is subsequently validated through reading experiments to assess its effectiveness. [Results/Conclusion] The reading experiment results indicate that introducing certain interference factors can facilitate deeper reading engagement. The deep reading driving model proposed in this study proves effective in enhancing reading outcomes and demonstrates certain applicability.

Full Text

Preamble

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A Drive Model and Empirical Test of Deep Reading in New Media Environments: A Schema Theory Perspective

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Abstract: [Purpose/Significance] With the sudden emergence of shallow reading in new media environments, driving deep reading has become crucial for maintaining a balanced reading ecology and promoting nationwide reading initiatives. [Method/Process] From a cognitive perspective grounded in schema theory, this paper examines the differences between deep and shallow reading, arguing that they fundamentally differ in the completeness of schematic chains during reading. Based on this analysis, we identify three driving elements for deep reading in new media contexts—"expectation," "logic," and "regression"—and construct a deep reading drive model, which we test through a reading experiment. [Result/Conclusion] Experimental results demonstrate that introducing certain interference factors can promote reading depth. The proposed deep reading drive model effectively enhances reading outcomes and exhibits general applicability.

Keywords: new media environment; deep reading; shallow reading; schema theory
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Introduction

Amid ongoing debates, new media reading has already achieved massive scale. According to the 15th National Reading Survey Report [1], China's comprehensive media reading rate reached 80.3%, with digital reading (online, mobile, e-reader) accounting for 73.0%. The impact of new media—enabled by digital, internet, and mobile communication technologies—on reading has become irreversible. New media environments, characterized by massive, diverse information and frequent, convenient interaction, have transformed both reading content and methods, most notably through the proliferation of shallow reading. A Pew Research Center report on American reading habits found that entertainment and staying informed are primary reading motivations, with 80% of respondents supporting reading for entertainment [3].

Although shallow reading predates the internet era, its current expansion has made skimming the norm. As information volume exploded, skimming became widespread. With the June 2017 implementation of the National Reading Promotion Regulations (Draft), China entered a critical period for advancing nationwide reading, intensifying societal focus on the balance between deep and

shallow reading.

Academic debates surrounding this issue have grown increasingly vigorous. Some scholars support the ubiquity of shallow reading as an effective response to information overload [4], while others view it as merely seeking transient visual pleasure and psychological gratification [5]. This "deep versus shallow" debate essentially reflects the self-regulating mechanism of the reading ecosystem responding to the psychological discomfort caused by new media's influence [6]. The prevailing view accepts shallow reading's existence but advocates controlling it within limits: shallow reading can be an important information acquisition method, but knowledge acquisition should occur through deep reading. Over-reliance on shallow reading is harmful because deep reading, with its concentrated attention, establishes richer mental connections [7]. Readers habituated to shallow reading in new media environments develop reading difficulties that make deep reading increasingly challenging [8].

Scholars have defined deep and shallow reading from various perspectives. Zhou Ya distinguishes them by reading outcomes, arguing that shallow reading involves low brain engagement at the level of basic comprehension, while deep reading achieves high familiarity, understanding, and mastery [9]. Li Jin defines shallow reading as skimming without reflection [5]. Li Guihua, drawing on "enactive cognition" theory, defines deep reading as high-participation behavior emerging when readers as mindful organisms encounter suitable reading objects in appropriate contexts [10]. Most current explorations of these concepts begin at the cognitive level. Experimental psychologist G.T. Buswell [11] proposed that reading itself is a cognitive process. Therefore, examining deep and shallow reading differences from a cognitive perspective more readily reveals their essential distinctions and clarifies deep reading triggers throughout the entire reading process.

Psychology has long studied reading. Since experimental psychology's early days in the late 19th century, reading has been investigated through various experiments [12]. By the mid-to-late 20th century, psychological experiments laid the foundation for cognitive psychology, which examines how humans perceive, learn, remember, and think about information [13]. Jean Piaget made significant contributions by proposing that adaptation involves equilibrium between assimilation and accommodation [14], using schema theory to explain cognitive structures and their formation and operation. This theory has been widely applied to reading research, effectively characterizing cognitive processes during reading. This paper employs schema theory to explore deep reading triggers in new media environments and how to drive deep reading, testing the model's effectiveness through experiments.

2. Schema Theory Support for Deep Reading Drive

Kant first introduced the concept of "schema" in 1781 as a product of pure a priori imagination or learners' previously acquired knowledge structures [15].

Cognitive psychologist Jean Piaget proposed that schemas are cognitive structures in the brain that store and retrieve knowledge and can be continuously refined. Human adaptation to external stimuli occurs through two interactive processes: assimilation and accommodation, forming states of relative equilibrium and absolute disequilibrium. As old equilibria are broken and new ones formed, cognitive abilities develop [16]. As cognitive structures, schemas contain multiple information units that intersect to form primary and sub-schemas, creating a vast, complex network [17]. Piaget identified four elements in cognitive processes: schema, assimilation, accommodation, and equilibrium [16]. During reading, information input activates existing schemas for matching and comprehension. New knowledge either assimilates into original schemas or, if incompatible, breaks the original equilibrium through accommodation, ultimately establishing new balance [18].

Reading activates schemas through information input, triggering matching, association, assimilation, and accommodation activities that produce new equilibrium [18]. Deep reading's immersive state and profound memory essentially reflect frequent assimilation-accommodation processes generating new cognitive structures, while shallow reading's superficial state and transient memory result from failing to activate schemas deeply, preventing assimilation and accommodation [18]. From a schema theory perspective, deep reading completes schema matching, association, assimilation, and accommodation after information input activates schematic structures, achieving schema deepening and updating, often manifested as sustained excitement. Shallow reading features incomplete schematic chains that cannot complete assimilation and accommodation.

Thus, deep and shallow reading differ primarily in schematic chain completeness. Shallow reading involves incomplete, easily interrupted, and often jumpy schematic chains, while deep reading features complete chains with frequent assimilation and accommodation, appearing immersive and expansive. Driving deep reading means driving the frequent occurrence of complete schematic chains. New media reading involves information input, processing, and output. Li Guihua [10] proposed three paths for deep reading in the digital age: creating encounters, enriching experiences, and returning to dialogue, suggesting opportunities for readers to meet suitable texts, using new technologies to enrich reading experiences for immersion and belonging, and strengthening reading participation through social technology. From a cognitive process perspective, external forces can stimulate reading depth before, during, and after reading. Therefore, adding external forces during information input, processing, and output can drive deep reading. The input process directly affects schema activation; post-activation schema activities constitute information processing; output processes like interaction can 反向推动 (reverse-drive) new schema refinement. Driving deep reading in new media environments requires considering impacts across all three processes to design different drive elements and construct a deep reading drive model.

3. Deep Reading in New Media Environments Based on Schema Theory

3.1 Impact of New Media Environment on User Reading Depth

M. Wolf found that adults engaged in simple reading for extended periods struggle to return to complex abstract concepts, describing it as "the equivalent of visual molasses" [8]. Long-term exposure to easily digestible content anesthetizes reading and thinking abilities, creating habits of non-reflection that negatively affect deep reading.

New media environments feature explosive information growth. While reading volume increases, most becomes shallow reading with minimal promotion of deep reading. Massive shallow reading inertia severely impacts traditional reading habits. This imbalanced and abnormally developing state adversely affects knowledge accumulation and innovative thinking.

In reading's psychological mechanism, information undergoes three stages: input, processing, and output. Processing is the core stage where new media features primarily affect the information processing system.

3.1.1 Impact on Information Input Stage New media affects reading depth during input primarily through information quantity and quality. Resources exhibit large scale, rapid growth, and diverse content [19], influencing the input stage and deep reading's gateway.

(1) **Massive information volume creates heavy input load.** The enormous information volume in new media environments burdens the input stage. Readers have limited energy, and concentration requires significant self-control [20]. Maintaining focus during digital reading is difficult yet essential for effective reading [21]. Information volume expansion often negatively impacts deep reading.

(2) **Accelerated information updates overwhelm input capacity.** New media features rapid information push. When update speed exceeds analytical thinking speed, comprehension becomes fragmented. During the "Red-Yellow-Blue Kindergarten" incident, information updated so quickly that most people's understanding became 跳跃性 (discontinuous) and incoherent. Many rumors could have been debunked with slight analysis, but overwhelming information created "thinking foam" that hindered deep reflection.

(3) **Diverse content bidirectionally affects input.** Information diversity greatly enhances content comprehensibility. New media presents rich formats—text, images, video, audio—that improve understandability and lay foundations for depth. However, prolonged exposure to simple content degrades learning and thinking abilities.

3.1.2 Impact on Information Processing Stage Information processing is reading's core stage. Schema operations involve "bottom-up" and "top-down" processing [22]. Schemas are hierarchical: more specific, micro-level schemas are lower-level, while more general, macro-level schemas are higher-level [23]. Top-down processing depends on readers' prior knowledge, using existing experience to understand information with expectations and predictions. Bottom-up processing works inversely, feeding concrete information like text and images upward through perception to match and connect with existing schemas, establishing meaning. New media content is unstructured with complex multidimensional relationships [23], affecting processing.

(1) **Unstructured information bidirectionally impacts deep reading.** Unstructured information offers timeliness and documentary value, solving immediate problems and promoting depth. However, it's also highly fragmented with short lifespans [23]. Fragmented content jumps excessively, lacks focus and systematic organization, and obscures main themes. Research shows unstructured text increases cognitive load, making comprehension more difficult, especially for readers with less prior knowledge [24]. For high-knowledge readers, unstructured text can be more beneficial [25].

(2) **Complex multidimensional relationships hinder bottom-up feedback.** In new media, user-generated content (UGC) is substantial. Original information around themes forms information clusters with high intra-cluster correlation but complex inter-cluster relationships [23]. Such complexity causes discontinuity in understanding [26] and impedes establishing semantic relationships between information nodes [27]. Multi-threaded, multi-dimensional information distribution leads to confusion, misattribution, and disrupted bottom-up processing, preventing genuine comprehension.

3.1.3 Impact on Information Output Stage Deep reading in the digital age is necessarily participatory [10]. New media provides rich output channels, expression methods, and communication forms that promote depth. Convenient publishing enhances user participation, increasing chances of repeated reading, reflection, and memory, thereby deepening reading. Enhanced interactivity around topics stimulates new ideas, advancing reading purposes and fostering positive reading mindsets conducive to deep reading.

3.2 Analysis of Deep Reading Drive Elements

3.2.1 "Expectation" Drive Element in Information Input Stage The input stage initiates reading and activates the schematic chain. While information fragmentation is unavoidable [28], appropriate reading services can guide fragmented reading toward depth, such as enabling readers to encounter suitable texts at suitable times [10]. Creating encounters that match readers' "reading expectations" is crucial for guiding deep reading. Further enhancing expecta-

tions after encounters can better promote depth. Expectancy theory states that expectations can motivate and mobilize enthusiasm [29]. By stimulating interest in reading information and raising expectations, we can promote effective schema activation to drive deep reading.

At this stage, we must address fragmented information's characteristics—massive volume, rapid updates, and diversity—avoiding negative effects while leveraging diversity to enhance complex information's comprehensibility without over-reliance, thereby effectively activating schemas. Expectancy theory proves that higher expectations (greater probability of achieving goals) generate stronger motivation [29]. We can help readers establish reading goals and clarify directions to enhance expectations: (1) Clarifying content helps set reading goals, significantly affecting outcomes. Goals can transform into motivations under certain conditions [17]. (2) Expectations relate not only to goals but also to perceived probability of achievement, which depends on readers' autonomous predictions about content, logical flow, and emotional tone. Structured overviews help readers organize logic and improve predictive values.

When first encountering texts, readers grasp prominent information to make predictions based on prior knowledge. The "expectation" drive applies external stimulation during early reading stages, extracting core values and providing highly summarized or key-point-highlighted materials to clarify content and stimulate interest upon "encounter."

3.2.2 "Logic" Drive Element in Information Processing Stage During mid-reading, deep readers often exhibit immersion. New media inherently provides rich, diverse reading experiences, but unstructured information and complex associations also increase cognitive load, hindering comprehension. Reading logic sequence affects scenario construction [30]; using "logic" drive to organize content aids understanding. Like experienced riddle solvers anticipating traps, mastering linguistic structure patterns helps extract key points and organize complex relationships, thereby bottom-up driving deep reading. Understanding logical development patterns also enhances comprehension and promotes depth.

"Logic" drive requires text processing such as highlighting key content and providing clear structures to help readers organize thoughts. Applied during mid-reading, it uses external forces to drive comprehension and absorption, improving information processing efficiency.

3.2.3 "Regression" Drive Element in Information Output Stage Research shows participation and interaction enhance reading effects [31]. Information output during interaction creates "regression" force on deep reading, 反向加深 (deepening understanding in reverse) and even elevating previous thinking. "Participatory interaction" is the primary regression pathway. New media provides 畅通的渠道 (unobstructed channels) for such interaction, which consolidates reading depth. When readers comment or discuss, they often achieve

intentional regression through repeated reading and memory, or unintentional regression through new insights that prompt fresh thinking, further promoting depth. The "regression" drive, applied during late reading stages, uses social media and other technical means to deepen and sublimate content.

3.3 Deep Reading Drive Model Construction

Based on schema theory, new media characteristics, and their impact on deep reading, we constructed a deep reading drive model (Figure 2 [Figure 2: see original paper]) after analyzing drive elements.

Through expectation drive, we amplify new media's content diversity to boost reading motivation, reduce pressure from massive information volume, promote effective schema activation, and enhance schema excitability. During information processing, logic drive highlights key content, organizes article structure, offsets negative effects of unstructured and complex multidimensional associations, enhances comprehensibility, and promotes complete schematic chain occurrence. During output, regression drive amplifies new media's convenient interactive features to 反向推动 (reverse-drive) schematic chains, achieving deep reading's core goal of schema deepening and updating.

4. Deep Reading Drive Model Validation Experiment Design

4.1 Experiment Purpose and Basis

This experiment measures whether the deep reading drive model improves reading outcomes in new media contexts. The questionnaire design draws on the Programme for International Student Assessment (PISA) reading literacy framework. PISA, developed by the Organisation for Economic Co-operation and Development (OECD), assesses educational outcomes in reading, mathematics, and science literacy [32]. The PISA framework has been applied to compare print and digital reading comprehension [33]. Its five assessment indicators (information location, text understanding, interpretation, reflection/evaluation of content, reflection/evaluation of form) are typically condensed into three aspects: information acquisition, text integration and understanding, and content association and inference.

4.2 Test Materials

To minimize article selection effects, we chose three highly-viewed online articles on "China's first domestically-built aircraft carrier," "AlphaGo," and "the Belt and Road Initiative." Selection criteria: (1) presented as new media reading with high popularity; (2) cover military, technology, and politics with substantial knowledge content; (3) moderate length (~3,500 characters) with sufficient but not excessive information.

The experimental group received articles processed according to the deep reading drive model: expectation drive elements included pre-reading guides highlighting 精华内容 (essential content) to stimulate interest; logic drive elements included subheadings, bolded key content, and illustrations to clarify structure and language patterns; regression drive elements included comment sections at article ends.

4.3 Participant Selection

Participants were divided into control and experimental groups. To control for individual differences in age, education, and expertise, we recruited from Jilin University's Information Management department. Total participants: 51, all in the same age range, familiar with new media reading, with similar information reception and analysis abilities, minimizing individual article reception differences.

4.4 Questionnaire Design

Based on PISA's widely-used framework, the test assessed information acquisition, text integration, and content inference. Each article had 10 questions across three types: detail questions (testing specific knowledge points), comprehension questions (testing main content and important knowledge understanding), and thinking questions (testing internalization). The 1:2:1 score distribution reflected the two aspects of comprehension questions.

4.5 Experiment Process

(1) All participants followed a WeChat public account designed for the experiment and were randomly assigned to Group 1 (control) or Group 2 (experimental).

(2) Group 1 read three unprocessed plain-text articles in order, then clicked "Read Original" to complete the questionnaire.

(3) Group 2 read three processed articles in order, browsed comment sections after each article, and submitted a comment.

4.6 Results Analysis

After screening for duplicate IP addresses and non-compliant responses, 144 valid responses remained (24 per group). Independent samples t-tests were appropriate for between-group differences. As shown in Figure 3 [Figure 3: see original paper], total score distributions approximated normal distribution, meeting test assumptions.

Table 2 presents t-test results. Overall, Levene's test for homogeneity of variance was non-significant (p=0.759), and the t-test for equal variances was significant

($p<0.05$), indicating significant between-group differences. Article-specific analyses showed: Article 1 ($p=0.037$) and Article 3 ($p=0.040$) showed significant differences; Article 2 ($p=0.072$) showed marginally significant differences.

As shown in Figure 3 [Figure 3: see original paper], Group 2's distribution curve was right-shifted relative to Group 1's, indicating higher mean scores and better overall reading effects. Curve shapes were similar across articles, suggesting consistent standard deviations and comparable score dispersion. The model produced overall improvement across participants.

Conclusion

This study demonstrates that applying external forces can drive deep reading in new media environments, with the model showing general applicability. Experimental group participants achieved higher average comprehension scores across all three articles. From a cognitive perspective, reading involves information absorption through schema mechanisms. External factors can facilitate or hinder schema activities, manifesting as deep or shallow reading. The "expectation," "logic," and "regression" elements collectively enhance comprehension, clarify structure, and improve memory, achieving greater schema deepening and updating.

This research reveals essential differences beneath deep and shallow reading's surface manifestations. By analyzing schematic activity during reading and new media's characteristics, we identified triggers for complete schematic chains and designed a practical drive mechanism. However, limitations remain: the experiment tested overall model effectiveness without isolating each element's contribution. Future research should design multiple control experiments for each element and combination to further refine the model. Additionally, as new media evolves and reading forms diversify (e.g., immersive reading), the deep reading drive model requires further development beyond its current focus on conventional planar content.

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Author Contributions

Pu Hongyu: Experimental design and execution, paper writing and revision.
Ma Jie: Research proposition, overall framework design, experimental concept development, paper revision and finalization.
Ge Yan: Revision of key sections.
Zhao Tianyuan: Literature collection and English translation.

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