Online Appendix for "Ephemeral State-dependent Recommendation for Digital Content"

Appendix A. Recent Experimental Studies in Information Systems on Recommender Systems

Authors	Context	Focus and Key Findings	Diversification or Assimilation	Method
Adomavicius et al. (2018)	Digital Content (Songs)	Effects of personalized recommendations on willingness to pay	Assim.	Laboratory Experiment
Mousavi et al. (2023)	Digital Content (Movies)	The interplay between Decoy effect and recommendations	Assim.	Laboratory Experiment
Kumar and Hosanagar. (2019)	E-commerce	Effects of recommendation links of substitutes on sales	Assim.	Field Experiment
Lee et al. (2020)	E-commerce	Effects of recommendations on PC and Mobile Channels	Assim. (CF)	Field Experiment
Lee and Hosanagar (2019)	E-commerce	Effects of collaborative filtering on sales diversity	Assim.	Field Experiment
Li et al. (2022)	E-commerce	Mediating roles of consideration set breadth and depth on purchases	Assim. (CF)	Field Experiment
Li and Tuzhilin (2024)	E-commerce	Development of a variety-seeking recommendation framework	Div.	Field Experiment
Peng and Liang (2023)	E-commerce	Differential impact of View-also-view and purchase-also-purchase-designs	Assim. (CF)	Field Experiment
Song et al. (2019)	Digital Content (News Articles)	Development of a multi-category utility model for diversity	Div.	Offline Simulation
Wan et al. (2024 a)	E-commerce	Uncovering drivers of how recommendations help consumers search	Assim. (CF)	Field Experiment
Wan et al. (2024 b)	E-commerce	Differential effects of retargeted vs. generic recommendations	Assim.	Field Experiment
Yin et al. (2022)	Social Network	Development of a novel link recommendation method	Div.	Offline Evaluation
Our study	Digital Content (E-books)	Effects of state-dependent schemes on content consumption	State-dependent Div. & Assim.	Field Experiment

Appendix B. Experimental Design

Ephemeral Preference. By inspecting the reading behavior of 1,294 randomly selected consumers, we find that 32% of the books appearing on a consumer's virtual bookshelf in a prior week are completed within 3 days and 95% within 7 days (median), suggesting a 7-day consumption cycle.

Enduring Preference. We also calculate these consumers' average number of genres read from 1 month to 6 months prior to the experiment, with a monthly increment. Figure B1 below shows that this number stabilizes after 3 months. We further contrast each consumer's ephemeral preference and enduring preference. On average, the ephemeral preference covers one-third of the genres in enduring preference. Also, the ephemeral preference is not among the top three genres in terms of the enduring preference of one-third of consumers. All these indicate that the *ephemeral preference* offers distinct and more nuanced information about a consumer's content consumption beyond their *enduring preference*.

Ephemeral State. In our analysis of the same 1,294 consumers, we observe 1 as the median number of genres read over the prior 7 days, providing empirical support for our operationalization. Figure B2 below displays a stylized example of a consumer oscillating between the two ephemeral states over time, highlighting the importance of integrating such a critical and fine-grained characteristic of digital content consumption into content recommender systems.

Figure B1. Number of Genres Read by a Consumer over 6 Months

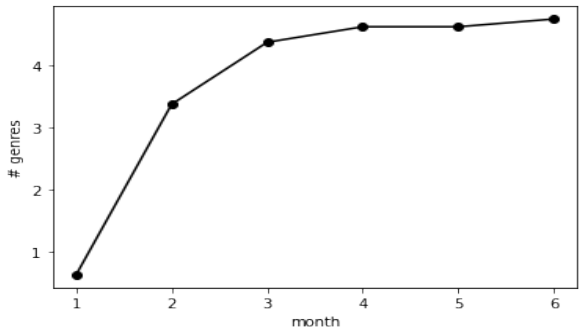

Figure B2. Stylized Example of a Consumer's Dynamic Ephemeral State

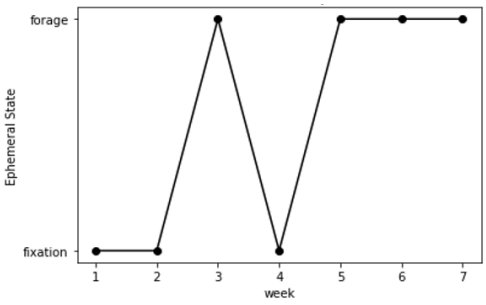

Figure B3. Mock-up Visualization of Recommendation

Table B1. Stylized Examples of Recommendations in Each Experimental Group

Group	Description	Enduring Preference (prior 3	Ephemeral Preference (prior 7 days)	Ephemeral State (prior 7 days)	Recommend. Received (experimental day)
C1	always assimilation based on enduring	Genres G1, G2, G3			Genres G1, G2, or G3
C2	always diversification based on enduring	G1, G2, G3			G4 = any genre other than G1, G2,
T1	always assimilation irrespective of ephemeral state (A-0, B-0)	G1, G2, G3	If G1 If G1, G2		Then G1 Then G1 or G2
T2	always diversification irrespective of ephemeral state (A-1, B-1)	G1, G2, G3	If G1 If G1, G2		Then G2, G3, or G4 Then G3 or G4
T3	diversification when fixation, assimilation when foraging (A-1, B-0)	G1, G2, G3	If G1 If G1, G2	fixation foraging	Then G2, G3 or G4 Then G1 or G2
T4	assimilation when fixation, diversification when foraging (A-0, B-1)	G1, G2, G3	If G1 If G1, G2	fixation foraging	Then G1 Then G3 or G4

Table B2. Balance Check across Experimental Groups

B2A. Consumer Characteristics

Group	# Obs.	*age*	*gender*	*occupation*	*spending*	*author_preferen*	*active_days*
C1	18,059	2.4315 (1.0570	1.3353 (0.4726	0.7639 (0.8242)	0.8065 (2.5109)	0.9216 (0.8931)	3.9247 (2.1421)
C2	18,257	2.4253 (1.1105	1.3399 (0.4737	0.7615 (0.8437)	0.7913 (2.6284)	0.9191 (0.8942)	3.9348 (2.2746)
T1	17,936	2.4341 (1.0825	1.3443 (0.4752	0.7725 (0.8229)	0.7994 (2.7714)	0.9161 (0.8957)	3.9348 (2.2264)
T2	17,949	2.4188 (1.1353	1.3414 (0.4754	0.7769 (0.8226)	0.7625 (2.6110)	0.9132 (0.9043)	3.9177 (2.2932)
T3	18,015	2.4329 (1.1243	1.3440 (0.4767	0.7772 (0.8267)	0.7636 (2.5724)	0.9291 (0.9085)	3.9344 (2.1931)
T4	17,942	2.4152 (1.0923	1.3434 (0.4760	0.7678 (0.8204)	0.8033 (2.6051)	0.9149 (0.8931)	3.8901 (2.1519)
p-value		0.4647	0.4531	0.3269	0.3976	0.5893	0.3501

* Means and standard deviations (in parentheses) are reported. *age* = 1 (10~20), 2 (20~30), 3 (30~40), 4 (40~50), 5 (50+). *gender* = 1 (male), 2 (female). *occupation* = 1 (student), 2 (employed). *spending* = 1 (low spending per book), 2 (high spending per book) based on the platform's historical study. *author_preference* signifies the preference type assigned by the collaborating platform based on a consumer's historical consumption data. *author_preference* = 1 (indicating no preference for well-known authors), 2 (indicating preference for well-known authors) based on the platform's book sales. *spending* summarizes consumer's weekly spending in dollars. *active_days* counts # days out of a week a consumer having activities prior to the experiment. The *p*-values are reported by testing equal means across groups.

B2B. Book Characteristics

Group	*booksale*	*bookage*	*bookreview*
C1	5.9145 (0.4099)	534.8143	3.0519
C2	5.9117 (0.6340)	534.3733	3.0584
T1	5.9105 (0.3805)	533.9485	3.0553
T2	5.9133 (0.8126)	535.4127	3.0551
T3	5.9110 (0.5220)	536.9382	3.0541
T4	5.9146 (0.4311)	536.7141	3.0520
p-value	0.5700	0.7082	0.8032

Note. * Means and standard deviations (in parentheses) are reported. *booksale* = average of log (book sales) (in units of $1370 USD after currency transformation). *bookage* = average of # days since each book's publication. *bookreview* = average of log (#reviews). The *p*-values are reported by testing equal means across groups.

Appendix C. Economic Impact and Demand Spillover

Table C1. Effect of Recommendation Scheme on Paying

	payment (OLS)
C2	-0.0173***
	(0.0049)
T1	0.0030
	(0.0049)
T2	-0.0154***
	(0.0050)
T3	0.0090*
	(0.0049)
T4	0.0267***
	(0.0049)
Constant	0.0008
	(0.0046)
Controls	√
p-value (T3 = T4)	<0.0001
# obs.	108,158
R^2	0.0027

Note. C1 serves as baseline. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Appendix D. Robust Studies

Table D1. Effect of Recommendation Scheme on Reading (5 experimental days)

	readrate	***readtime***
C2	-0.5400***	-0.1190***
	(0.1030)	(0.0192)
T1	0.2800***	0.0076
	(0.0843)	(0.0191)
T2	-0.3820***	-0.1060***
	(0.0958)	(0.0196)
T3	0.4250***	0.0173
	(0.0952)	(0.0192)
T4	0.9210***	0.0936***
	(0.0872)	(0.0191)
Constant	-5.4470***	0.1010***
	(0.0906)	(0.0178)
Controls	√	√
# obs.	108,158	108,158
R^2	0.0289	0.0024

Note. C1 serves as baseline. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D2. Effect of Recommendation Scheme on Reading: Alternative Model Specifications

	readrate (OLS)
C2	-0.0183***
	(0.0013)
T1	0.0052***
	(0.0013)
T2	-0.0053***
	(0.0014)
T3	0.0142***
	(0.0013)
T4	0.0283***
	(0.0013)
Constant	0.0211***
	(0.0012)
Controls	√
# obs.	108,158
R^2	0.0184

Note. C1 serves as baseline. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table D3. Effects of Recommendation Scheme on Reading: Subsample Analysis

	readrate *(Fractional Logit)*	***readtime*** *(OLS)*
C2	-0.7370***	-21.9000***
	(0.0530)	(4.8490)
T1	0.1210***	2.86400
	(0.0422)	(4.6210)
T2	-0.0725	-15.4900***
	(0.0499)	(4.7580)
T3	0.4770***	9.3710**
	(0.0450)	(4.6530)
T4	0.6750***	15.8000***
	(0.0433)	(4.6440)
Constant	-3.2910***	8.4820*
	(0.0461)	(4.5880)
Controls	√	√
# obs.	72,731	72,731
R^2	0.0224	0.0365

Note. Excluding consumers who read only one book in measuring ephemeral state. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D4. Effects of Recommendation Scheme on Reading: Alternative Operationalization and Time Frames

	Prior 3 Days		***Prior 5 Days***		***Prior 7 Days***	
	readrate	***readtime***	***readrate***	***readtime***	***readrate***	***readtime***
C2	-0.8760***	-15.8400***	-0.8730***	-15.8900***	-0.8750***	-15.9300***
	(0.0482)	(2.9040)	(0.0482)	(2.8870)	(0.0481)	(2.9200)
T1	0.1230***	4.9990*	0.1220***	5.2690*	0.1360***	4.7890*
	(0.0376)	(2.8830)	(0.0376)	(2.8670)	(0.0377)	(2.9010)
T2	-0.1380***	-10.8600***	-0.1320***	-10.9300***	-0.1370***	-11.0300***
	(0.0463)	(2.9650)	(0.0463)	(2.9490)	(0.0460)	(2.9810)
T3	0.2060***	7.0910**	0.3520***	7.3110**	0.4750***	8.3790*
	(0.0490)	(3.3220)	(0.0491)	(3.4780)	(0.0652)	(4.7970)
T4	0.5930***	12.4800***	0.5750***	10.7000***	0.7320***	15.8200***
	(0.0434)	(3.2230)	(0.0442)	(3.2660)	(0.0385)	(2.8910)
Constant	-3.7520***	5.0950*	-3.7520***	7.1730***	-3.6640***	4.8290*
	(0.0428)	(2.7730)	(0.0428)	(2.7720)	(0.0414)	(2.7960)
Controls	√	√	√	√	√	√
# obs.	94,954	94,954	92,568	92,568	94,060	94,060
R^2	0.0243	0.0316	0.0247	0.0312	0.0311	0.0308

Note. C1 serves as baseline. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D5. Daily Panel Analysis Excluding Occasional Foragers

	isread	***readtime***
C2	-0.2140*	-0.0430
	(0.1230)	(0.0464)
T1	0.1420	0.0540
	(0.1170)	(0.0466)
T2	-0.0688	-0.0242
	(0.1190)	(0.0475)
T3	0.5510***	0.1700***
	(0.1070)	(0.0468)
T4	1.0940***	0.2060***
	(0.1000)	(0.0462)
Constant	-6.7560***	0.0186
	(0.1070)	(0.0430)
Controls	√	√
p-val (T3 = T4)	<0.0001	0.4447
# obs.	520,794	520,794
R^2	0.0306	0.0016

Note. C1 serves as baseline. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table D6. Effects of Recommendation Scheme on Reading:

Accounting for User Engagement within Genres

	readrate	***readtime***
C2	-0.8770*** (0.0484)	-16.9500*** (3.0550)
T1	0.1830*** (0.0378)	6.0610** (3.0370)
T2	-0.1470*** (0.0461)	-12.7500*** (3.1170)
T3	0.4240*** (0.0413)	6.6870** (3.0600)
T4	0.716*** (0.0386)	15.6000*** (3.0280)
Constant	-3.4820*** (0.0865)	21.3700*** (6.2130)
HHI_average	-0.2790*** (0.0752)	-17.6400*** (5.6110)
Controls	√	√
p-value (T3 = T4)	<0.0001	0.0033
# obs.	108,158	108,158
R^2	0.0301	0.0332

Note. C1 serves as baseline. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D7. Subsample Analysis: Initial Reactions

	readrate *(Fractional Logit)*	***readtime*** *(OLS)*
C2	-0.4680***	-0.1600
	(0.1210)	(0.1500)
T1	0.4370***	0.2680*
	(0.1110)	(0.1490)
T2	-0.0807	-0.5620***
	(0.1220)	(0.1520)
T3	0.7850***	0.5120***
	(0.1010)	(0.1490)
T4	1.2000***	0.7080***
	(0.0961)	(0.1480)
Constant	-4.8520***	0.6210***
	(0.1010)	(0.1390)
Controls	√	√
# obs.	108,158	108,158
R^2	0.0412	0.0019

Note. C1 serves as baseline. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table D8. Daily Panel Analysis with Controls

	isread	***readtime***
C2	-0.1810 (0.1210)	-0.0359 (0.0469)
T1	0.2350** (0.1130)	0.0586 (0.0467)
T2	0.0056 (0.1160)	-0.0128 (0.0479)
T3	0.6070*** (0.1040)	0.1640*** (0.0470)
T4	1.1360*** (0.0987)	0.2530*** (0.0466)
$readbooks_{t-1}$	-0.1390*** (0.0244)	-0.0091 (0.0109)
$readgenres_{t-1}$	-0.1160*** (0.0329)	-0.0105 (0.0183)
$isread_{t-1}$	1.8150*** (0.2130)	1.5160*** (0.2680)
Constant	-6.6760*** (0.1080)	0.0187 (0.0448)
Controls	√	√
# obs.	540,790	540,790
R^2	0.0360	0.0017

Note. C1 serves as baseline. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. $readbooks_{t-1}$ represents the number of books consumed by a consumer at period t-1; $readgenres_{t-1}$ denotes the number of unique genres engaged with by a consumer over a rolling 7-period window preceding time t;; and $isread_{t-1}$ is the dependent variable signifying whether a consumer accept platform's recommendation at preceding period t-1.

Table D9. Effect of Recommendation Scheme on Reading: Excluding Student Population

	readrate	***readtime***
C2	-0.7110***	-8.7180**
	(0.0550)	(3.4390)
T1	0.2540***	7.8880**
	(0.0449)	(3.4430)
T2	-0.0683	-4.2190
	(0.0548)	(3.557)
T3	0.4990***	13.9300***
	(0.0488)	(3.4700)
T4	0.7770***	21.7300***
	(0.0460)	(3.4400)
Constant	-3.9400***	-1.5740
	(0.0484)	(3.2880)
Controls	√	√
# obs.	79,646	79,646
R^2	0.0000	0.0244

Note. C1 serves as baseline. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix E. Content Analysis on Genres

We conduct an in-depth textual analysis of the e-books, aiming to validate that reading different genres reflects a more distinctive preference compared to reading a single genre. Our analysis proceeds as follows:

Step 1: Random Sampling: We randomly select 0.5% of the e-books on the platform, resulting in a sample of 9,735 books.

Step 2: Data Collection: We collect three types of book features—book title, book keywords, and book description—to capture the content. We apply an established BERT model[1] to calculate the embedding representations of each book based on these three features respectively.

Step 3: Content Distance Calculation: We calculate the pairwise content distance for each pair of books in this sample using the *cosine distance* (1-*cosine similarity*), which ranges from 0 to 2.

Step 4: Statistical Testing: We conduct *t*-tests to compare the distributions of the content distances of the book pairs from the same genre versus those from different genres. As shown in the table below, the books from the same genre have significantly smaller distances compared to those from different genres. These results are consistent across different content measures (columns 1, 2, and 3).

Table E1. Content Distance of Within-genre versus Between-genre Books

	(1) Title Cosine Distance	(2) Keywords Cosine Distance	(3) Description Cosine Distance
Same-genre pairs	0.6451	0.4840	0.4605
Different-genres pairs	0.7178	0.6425	0.6248
F-stats *p*-value	<0.0001	<0.0001	<0.0001

[1] Model: Chinese Sentence BERT (https://huggingface.co/uer/sbert-base-chinese-nli).

Appendix F. Survey Design

Experiment procedure:

Each participant enters the survey to complete the first two questions. We then end the survey for those who have not read online novels in the past three months or seven days. We randomly assign the remaining participants to Group 1 (the *incongruence* group) or Group 2 (the *congruence* group). Based on their answers to Q3, we asked their *intention to read* based on the treatment group. For instance, a participant in a fixation state is presented with Q4B. For simplicity, we only solicit a single response. Q5 and Q6 explore potential mechanisms.

Survey questions:

Q1: In the past three months, how many days have you read online novels?

A. 0 day
B. 1~7 days
C. 8~14 days
D. 15~21 days
E. 22~28 days
F. above 28 days

Q2: In the past seven days, have you read any online novels?

A. Yes
B. No

Q3: Which one or more of the following genres is closest to what you've read in the past seven days? If you have only read one genre, please select the closest one only.

A-S: a complete list of 20 genres (omit for brevity)

Q4A: If a novel from one of the genres you selected above were recommended to you, would you choose to read it?

A. Yes
B. No

Q4B: If a novel outside the genres you selected were recommended to you, would you choose to read it?

A. Yes
B. No

Q5: To what extent does the element of *surprise* influence your decision to accept our recommendation?

1 2 3 4 5 6 7
(1 = Extremely unlikely; 7 = Extremely likely)

Q6: To what extent does the feeling of *familiarity* or *meeting your expectations* influence your decision to accept our recommendation?

1 2 3 4 5 6 7
(1 = Extremely unlikely; 7 = Extremely likely)

Q7: Please select your gender.

A. Male
B. Female

Q8: Please select your age group.

A. 0-20
B. 21-30
C. 31-40
D. 41-50
E. 51-60
F. Above 60

Q9: Please select your occupation type.

A. Student
B. Office Worker
C. Others