CS449/549 — News UI A/B Experiment Platform

Final Comprehensive Technical & Research Document
(UI-A Baseline vs UI-B Focus Mode)

Sabancı University — CS449/549 Human-Computer Interaction
Team: (add names here)
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1. Overview

This document consolidates the full rationale, interaction design, experiment protocol, logging schema, and analysis plan for the CS449/549 News UI A/B Experiment. The primary objective is to increase *reading rate* (the extent to which participants actually read the article content), operationalized through scroll depth, reading time, and explicit completion signals. UI-B introduces focus- and usability-oriented mechanisms (e.g., Focus Mode, progress feedback, readability controls) as supporting means to achieve deeper reading and stronger completion, while preserving comprehension.

1.1 Research goals and hypotheses

Primary aim clarification: UI-B is designed first to increase the *rate of reading* (more of the article content consumed per session), with focus and usability improvements as mechanisms that support this primary outcome.

- Goal G1 (Primary): Increase reading rate (how much of an article is actually read) and overall reading completion across the session.
- Goal G2 (Supporting): Improve perceived focus and reduce distraction during reading (UI-B mechanisms such as Focus Mode + reduced competing stimuli).
- Goal G3 (Supporting): Improve usability and interaction efficiency so users start reading faster and with less friction (e.g., lower decision cost, clearer controls, faster time-to-first-read).
- Project motto (one sentence): "We are not guessing — we are measuring reading."
- H1 — UI-B yields higher perceived focus ratings than UI-A.
- H2 — UI-B yields higher perceived readability ratings than UI-A.
- H3 — UI-B yields equal or better comprehension (MCQ correctness) than UI-A.
- H4 — UI-B yields fewer distraction interactions (e.g., sidebar/related clicks) and more linear scroll behavior.

1.2 Scope of what is in the system

- A controlled study flow: show consent → collect participant profile → assign condition order → run two reading scenarios → collect post-reading questionnaires → show completion code.
- Two UI variants: UI-A (baseline) and UI-B (experimental with focus mode + reading aids).
- A logging pipeline that captures participant-level attributes, per-session metrics, and optional fine-grained event logs.

2. Design ideology and theory grounding

Our design philosophy is to treat focus as an interaction outcome produced by: (1) reducing irrelevant stimuli (external distraction control), (2) lowering decision complexity (choice architecture), and (3) providing clear, user-controlled reading aids (internal support). We intentionally connect design elements to classic HCI principles so that the A/B differences are explainable and testable.

2.1 Hick's Law (choice complexity)

Hick's Law predicts decision time increases with the number/complexity of choices. UI-B reduces selection burden via progressive disclosure and clearer grouping, aiming to shorten time-to-first-article and lower error/hesitation.

2.2 Fitts' Law (target acquisition)

Fitts' Law predicts faster, more accurate selection for larger targets closer to the cursor/finger. UI-B uses a large, high-contrast focus-mode control and prominent reading controls (font/line spacing) to make key actions quick and low-effort.

2.3 Norman's 7 stages of action

- Goal formation: Users emphasize "read carefully and answer questions". We provide a task card with steps.
- Intention + action specification: UI-B exposes a single, dominant 'Focus Mode' control to match the intention "remove distractions".
- Execution: Controls are large and near the reading context; focus toggle is one click.
- Perception: Focus mode uses a visual state change (dimming background), a timer, and a clear on/off label.
- Interpretation: The environment visibly changes to signal "now you are in focus mode".
- Evaluation: End-of-article checks (MCQ + Likert) provide closure and measurable outcomes.

2.4 4 pillars of interaction design

- Visibility: Key actions (start, focus toggle, finish reading, submit questionnaire) are visually prominent.
- Feedback: Timers, progress indicator, focus-mode state color/label, and confirmation screens provide immediate feedback.
- Constraints: Study flow restricts navigation to preserve experimental validity (e.g., guided steps, clear completion CTA).
- Consistency & mapping: Similar component styles across screens; labels match user mental models (e.g., "Okumayı Tamamladım", "Okuma Değerlendirmesi").

2.5 Primary outcome: reading rate and engagement

In this project, the main dependent variable is *reading rate*: the extent to which participants actually consume article content. We operationalize reading rate with objective behavior signals (scroll depth and reading time) and session-level completion signals (end-of-article completion + post-reading comprehension). Focus and usability are treated as supporting mechanisms: they should help participants start reading sooner, stay on task, and reach deeper parts of the article.

3. Study protocol and interaction flow

The study is a within-subject A/B experiment: each participant experiences both UI versions. To control order effects, the platform assigns either AB or BA (counterbalanced).

3.1 High-level flow (wireflow)

The wireflow defines the required screens and what we log at each step: landing/intro → consent → participant profile (required + optional) → assign condition order → feed view → article reader → end-of-article check (MCQ + ratings) → switch UI and repeat → thank you + completion code.
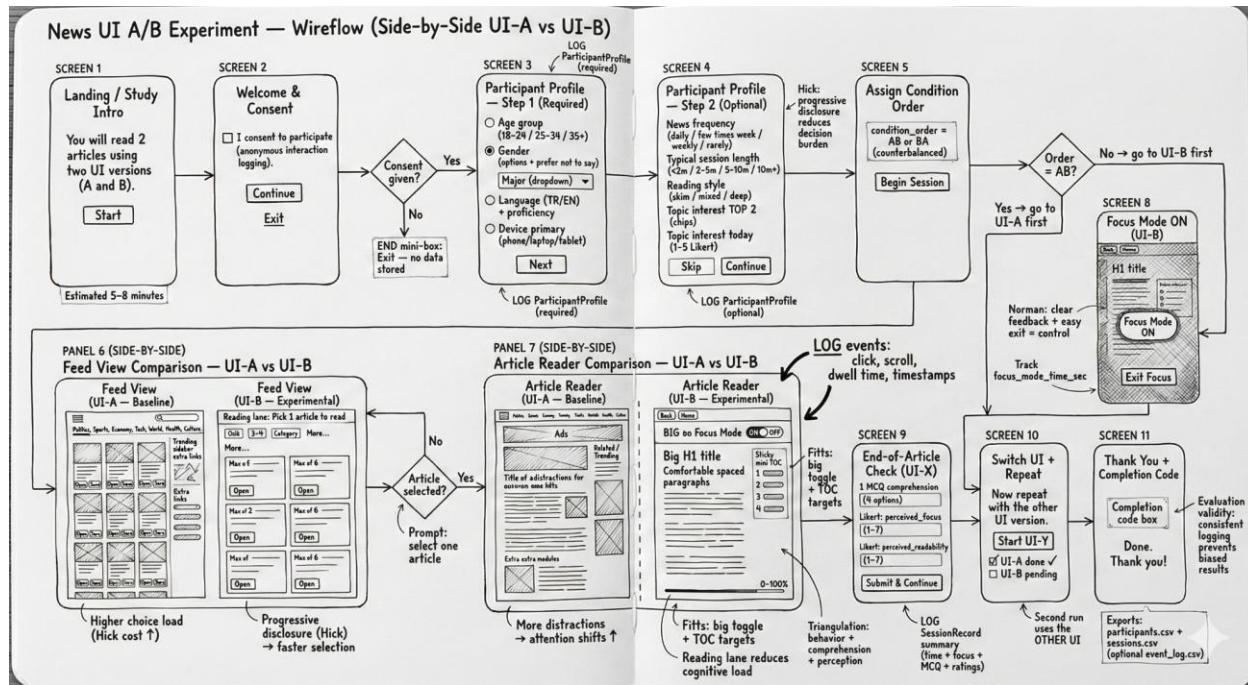
Figure 1. Wireflow overview (UI-A vs UI-B) with theory notes and logging points.

3.2 Key task instructions (what participants do)

1. Select one news article from the list.
2. Read the article carefully.
3. When finished, complete the short post-reading questionnaire (MCQ + Likert scales).
4. Repeat the same task with the other UI version.

3.3 Counterbalancing and validity checks

- Condition order: AB vs BA. Stored as participant-level field `condition_order` and repeated in each session row.
- Same task structure for both runs to isolate UI effects.
- Attention/comprehension check: 1 multiple-choice question derived from the article summary/body.
- Consistency checks in logs: timestamps are monotonic; scroll depth should not exceed 100%; reading time should be plausible given article length.

4. UI designs (from implemented screens)

4.1 Study onboarding screens

Screens include: a landing page explaining the two-article A/B procedure, a consent step, and participant profile collection. These steps reduce ambiguity and support ethical participation and controlled experimental validity.
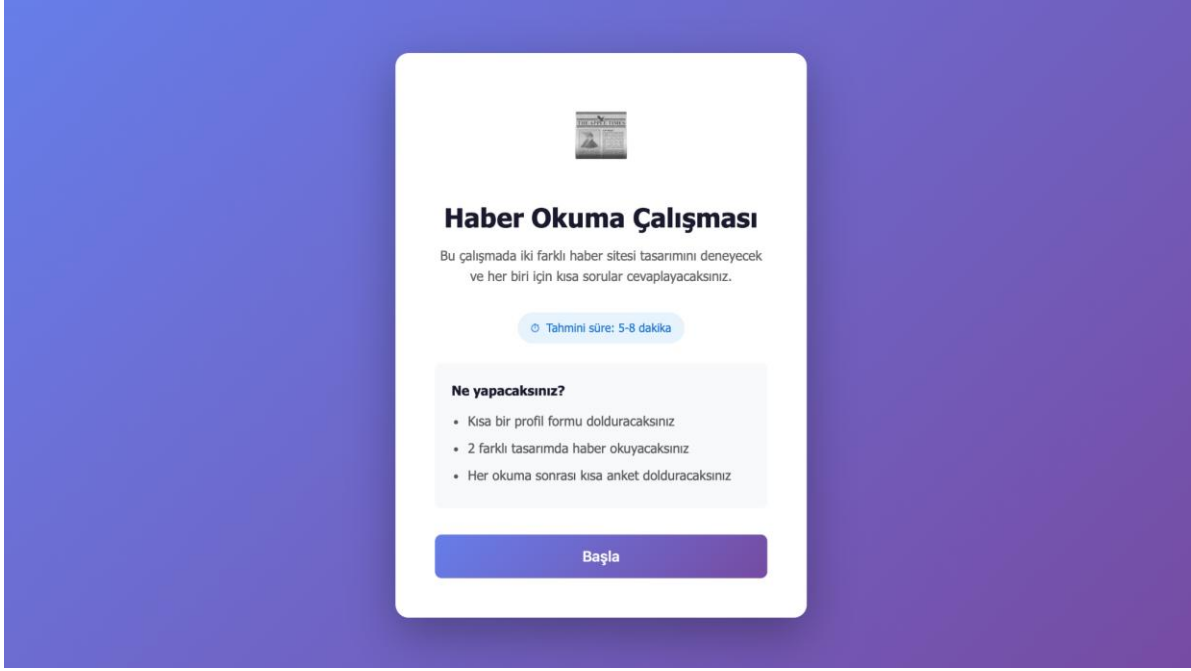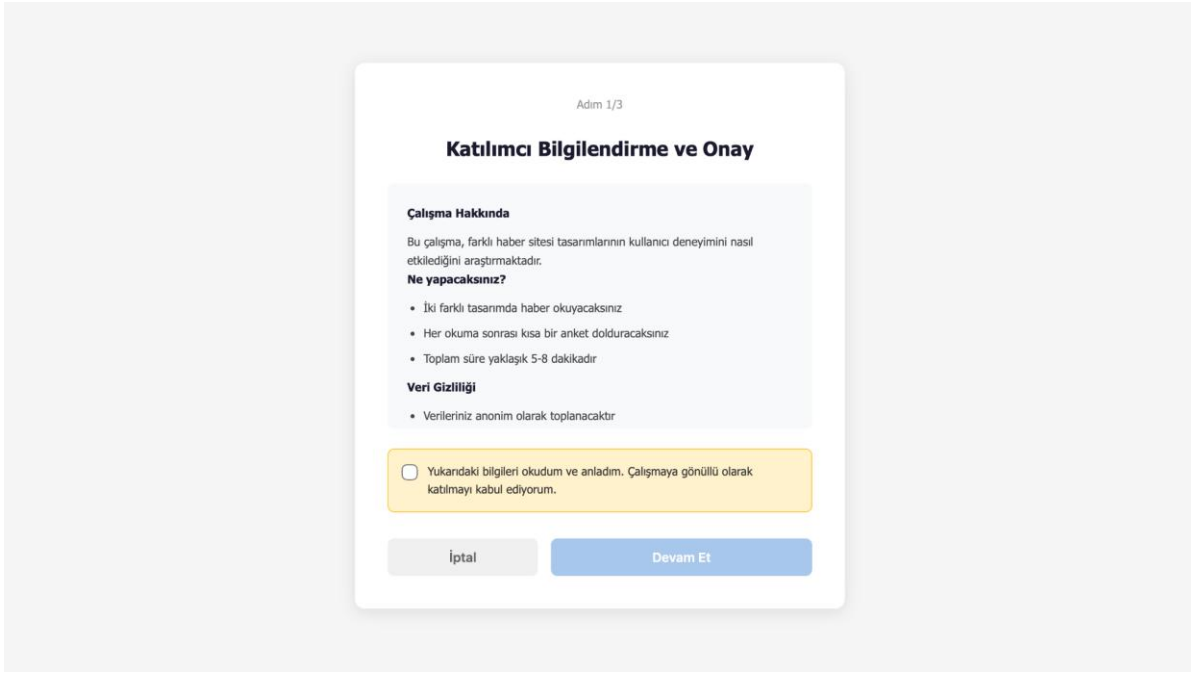
Figure. Landing / Study intro screen.

Figure. Consent screen (Step 1/3).

Figure. Participant profile (required demographics).

4.2 UI-A (baseline)

UI-A is intentionally closer to a typical news site: a visually dense feed, multiple navigation elements, and a standard article view with additional modules. This provides a realistic baseline with higher choice load and more potential distractors.
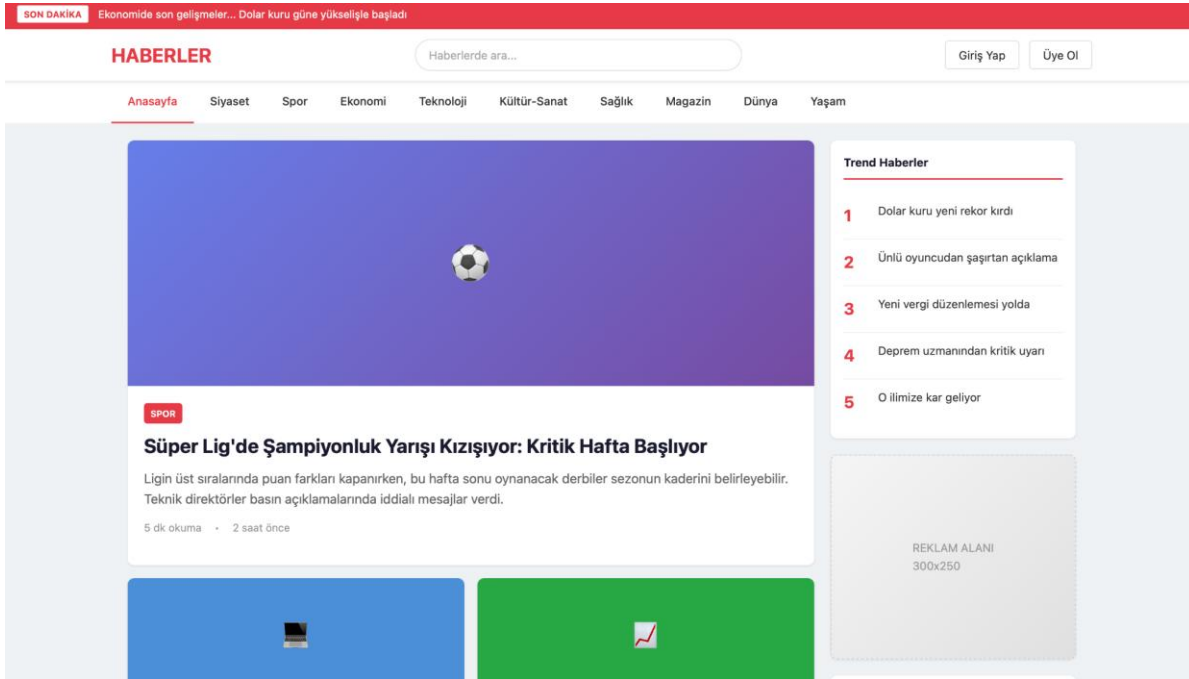

Figure. UI-A feed view (baseline; higher visible choice set).

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SPOR

Süper Lig'de Şampiyonluk Yarışı Kızışıyor: Kritik Hafta Başlıyor

📅 28 Aralık 2024   ⏱ 5 dk okuma   👁 12.4K görüntülenme

Süper Lig'de şampiyonluk yarışı her geçen hafta daha da heyecanlı bir hal alıyor. Ligin zirvesindeki takımlar arasındaki puan farkları oldukça yakın seyrediyor ve bu durum sezonun son haftalarına doğru büyük bir gerilim yaratıyor.

Galatasaray, son haftalarda gösterdiği istikrarlı performansla liderlik koltuğunda oturuyor. Sarı-kırmızılı ekip, özellikle deplasman maçlarında aldığı galibiyetlerle rakiplerinin önünde yer almayı başarıyor. Teknik direktör, basın toplantısında "Hedefiniz nedir?" sorusuna "Tabii ki şampiyonluk. Başka bir hedefimiz olamaz" yanıtını verdi.

REKLAM ALANI - 728x90

Fenerbahçe ise liderle arasındaki puan farkını kapatmak için mücadele ediyor. Sarı-lacivertli takım, son beş maçta dört galibiyet alarak formunu yükseltti. Özellikle hücum hattındaki performans, taraftarları umutlandırıyor. Yıldız forvet, bu sezon şimdiye kadar 15 gol atarak gol krallığı yarışının da en güçlü adaylarından biri konumunda.

Trend Haberler

1   Son dakika transfer haberi!

2   Teknik direktör istifa etti

3   Sakatlık şoku yaşandı

REKLAM ALANI
300x250

En Çok Okunanlar

1   Yıldız oyuncu kadro dışı kaldı

2   Bilet fiyatları açıklandı

Figure. UI-A article view (standard reading; external modules remain visible).

00:24

niteliktir. Derbi heyecanı da eklendiğinde, Türk futbolseverleri heyecanlı bir hafta sonu bekliyor. Meteoroloji uzmanları maç günü için yağış beklendiğini açıkladı, bu da takımların oyun planlarını etkileyebilir.

Ligin alt sıralarındaki takımlar ise küme düşmeme mücadelesi veriyor. Son üç sıradaki takımlar arasındaki puan farkları da oldukça az ve bu durum sezon sonuna kadar heyecanın devam edeceğini gösteriyor.

Spor yazarları, bu sezonun son yılların en çekişmeli şampiyonluk yarışlarından biri olduğu konusunda hemfikir. Bir gazetenin anketine göre, taraftarların yüzde 40'ı Galatasaray'ı, yüzde 35'i Fenerbahçe'yi, yüzde 20'si ise Beşiktaş'ı şampiyon olarak görüyor.

İlgili Haberler
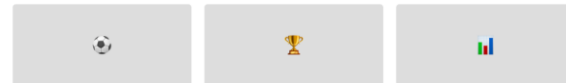
⚽	🏆	📊
Transfer dönemi hareketleniyor: Süper Lig'de kimler geliyor?	Avrupa kupalarında Türk takımlarının durumu	Sezonun en iyi 11'i belli oldu

Okumayı Tamamladım

Figure. UI-A end-of-article with related content/controls (potential distractions).

4.3 UI-B (experimental: focus + reading aids)

UI-B is designed for sustained reading: it surfaces a large Focus Mode control, provides reading aids (estimated time, summary box, typography controls), and uses a progress indicator to support self-regulation. When Focus Mode is enabled, the background is dimmed to reduce external distraction.
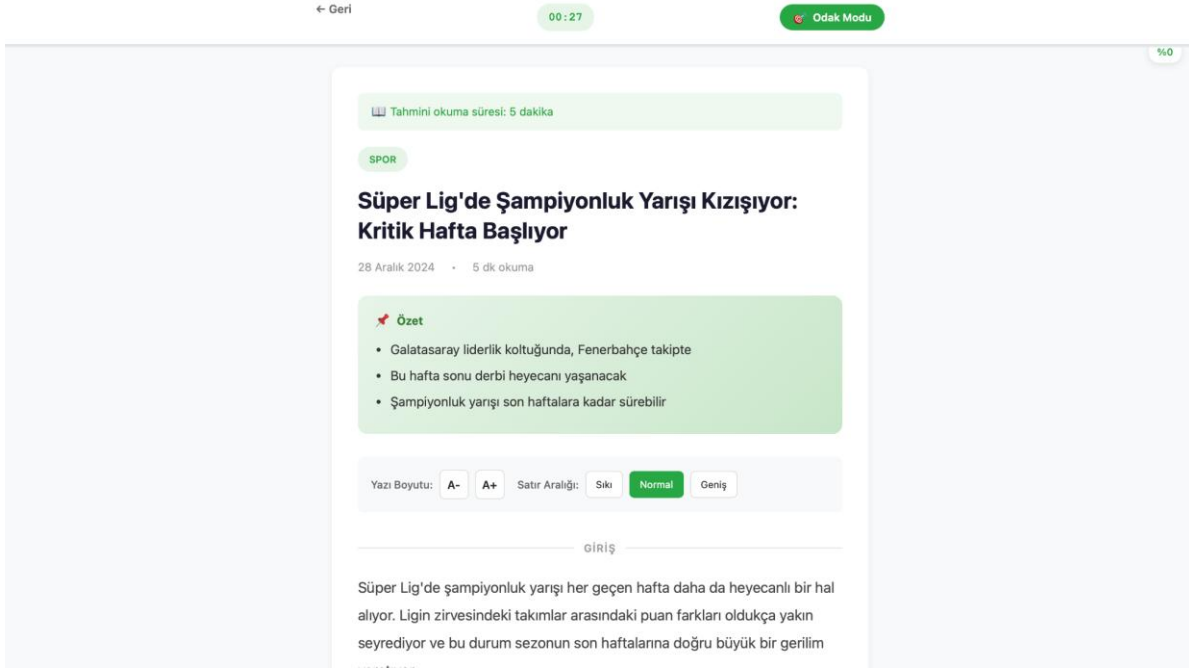
Figure. UI-B article view with Focus Mode available and progress indicator.
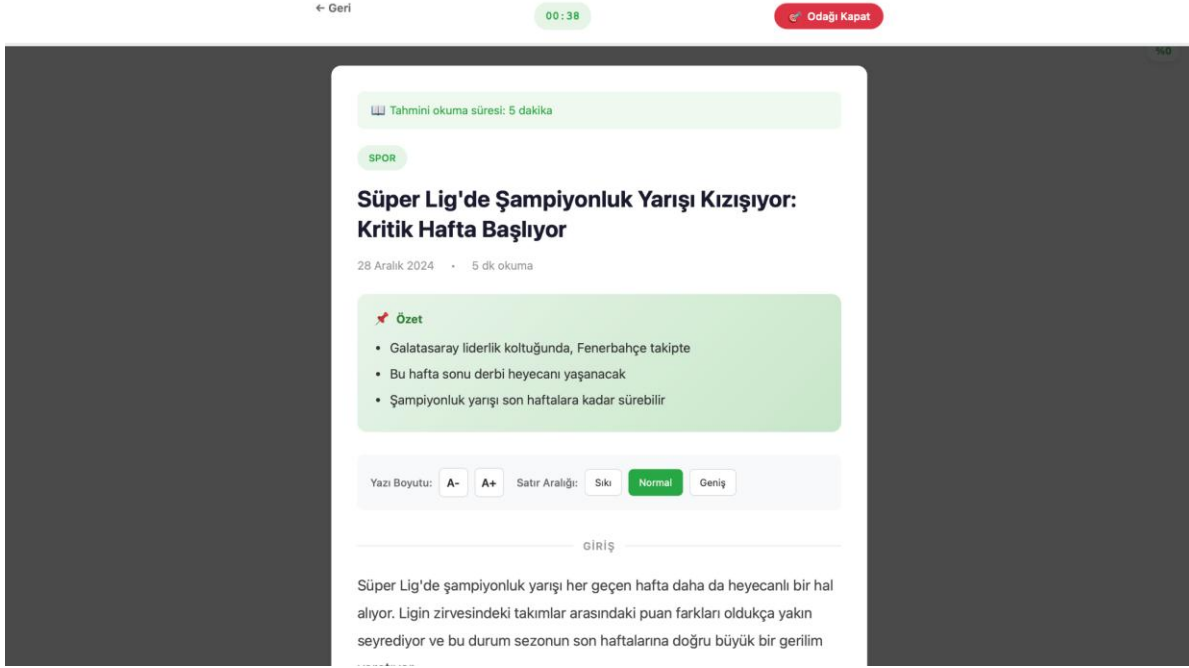
Figure. UI-B Focus Mode ON: background dimming + clear "Odağı Kapat" state.
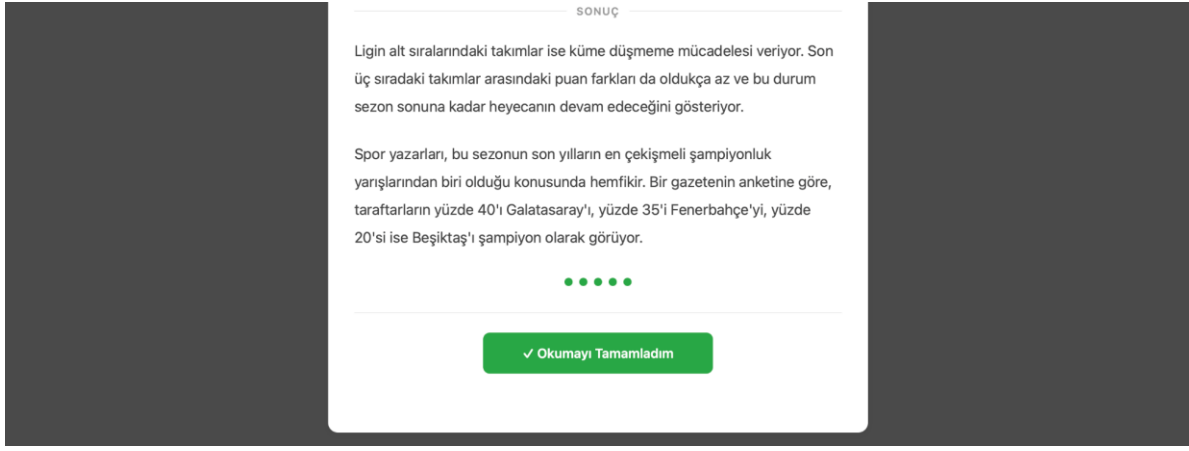
Figure. UI-B end-of-article completion CTA ("Okumayı Tamamladım").

4.4 Post-reading questionnaire screens

After each article, participants answer: (i) one comprehension question, and (ii) Likert items for perceived focus and readability. We also show run-level metrics (reading time, scroll depth, UI label) as transparent feedback, but we treat these as non-outcome UI elements in the analysis.

Figure. Post-reading questionnaire (MCQ + Likert scales).

Figure. Questionnaire continuation and submission.

Figure. Completion screen with completion code.

4.5 UI component rationale (boxes/frames), timing, and motion

This section explains *why* each major UI element (box/frame) exists, what behavioral outcome it targets (primary: reading rate; supporting: focus/usability), when it is visible, and whether it moves with scroll. This is included so the UI differences are defensible and testable, not aesthetic.

4.5.1 UI-B: Article reader components

Estimated reading time banner (Tahmini okuma süresi)

Purpose: sets expectation and increases commitment to finish reading; supports reading rate by making the effort feel bounded.

Visible: above the title at article start; sticky = No (scrolls away after initial context).

Logging: impression (shown), time_on_screen (optional), relation to completion and depth.

Summary box (Özet)

Purpose: provides quick 'hook' and scaffolding; reduces cognitive load and helps the reader build a mental model quickly, increasing chance they continue.

Visible: near top, before main body; scrolls away; can be collapsible if needed.

Logging: expand/collapse, time_to_scroll_past_summary, correlation with reading depth.

Text controls (Font size A-/A+, line spacing Sıkı/Normal/Geniş)

Purpose: improves readability and user control; supporting mechanism for reading rate by reducing friction for different preferences.

Visible: near top (before body) and should not be sticky to avoid distraction; user changes persist within the article.

Logging: control_changes (type, value), timing (before/after scrolling), effect on perceived readability + depth.

Focus Mode toggle (Odak Modu)

Purpose: primary distraction-reduction mechanism; by dimming surrounding UI and narrowing attention, supports deeper reading.

Visible: top-right and always reachable (sticky header recommended).

Logging: focus_mode_on/off events, focus_mode_time_sec, before/after comparison of scroll behavior and distraction clicks.

Reading progress indicator (0–100%)

Purpose: progress feedback increases motivation and self-regulation; supports reading rate by making remaining effort visible.

Visible: thin bar at top (or side) and sticky; should update continuously with scroll.

Logging: progress milestones reached (25/50/75/100), progress_over_time (optional), completion probability modeling.

'Okumayı Tamamladım' completion button

Purpose: explicit end-of-article confirmation; reduces ambiguity in defining completion beyond scroll depth.

Visible: at end of article; not sticky.

Logging: clicked/not clicked, time_to_click_after_reaching_end, relation to comprehension and self-reports.

4.5.2 UI-A: Baseline components (what stays minimal and why)

UI-A intentionally removes most engagement aids and focus mechanisms to serve as a baseline. The purpose is to measure whether UI-B's additions increase reading rate, not merely change aesthetics. UI-A should include only essential navigation (Back/Home), the article body, and basic structure (title, metadata). Any element present in UI-A must either be required for task completion or must be mirrored in UI-B to avoid confounds.

5. Mapping UI features to HCI principles

The table below states which parts of UI-B were intentionally designed to affect focus/readability, and which theoretical principle each feature targets.

Feature	HCI rationale / metric
Focus Mode (user-controlled blur or reading lane)	Norman: maintains user control; clear feedback/state. Log focus_mode_used/time.
Progressive Table of Contents (3–6 sections, collapsible)	Hick: fewer visible choices; supports section-by-section reading. Enables dwell-time analysis.
Read-time estimate + progress indicator	Norman: supports goal formation and evaluation; reduces uncertainty; increases completion.
Micro comprehension check (1–2 questions)	Separates 'longer time' from 'better attention'; adds a secondary outcome.
Preference-aware 'Next article' suggestions after completion	Uses topic_interest_top2; increases total session time ethically without distracting mid-read.

5.1 Why these differences are measurable

- Choice load effects can be observed via time-to-first-article, number of feed interactions, and hesitation patterns.
- Distraction reduction can be observed via fewer sidebar/related clicks and more linear scroll behavior.
- Reading aids can be observed via control usage (font/spacing changes) and their correlation with readability/focus ratings.
- Focus Mode can be observed via focus-mode time, toggle count, and changes in progress/scroll patterns.

6. Logging specification (what we store)

We use a structured logging model with: (A) participant-level table, (B) session-level table (one row per scenario per UI), and (C) optional event-level log (fine-grained interactions). This separation supports clean statistical analysis while retaining traceability for debugging and qualitative interpretation.

6.1 Participant-level schema (Participants table)

One row per person. Demographics and stable preferences go here.

Spec column	Current JSON key (expected)	Present?	Action if missing

participant_id	participantId	YES	
age_group	age_group	NO	Log once at onboarding / profile step (or auto-derive).
sex	sex	NO	Log once at onboarding / profile step (or auto-derive).
major	major	NO	Log once at onboarding / profile step (or auto-derive).
language	language	NO	Log once at onboarding / profile step (or auto-derive).
proficiency	proficiency	NO	Log once at onboarding / profile step (or auto-derive).
device_primary	device_primary	NO	Log once at onboarding / profile step (or auto-derive).
vision_correction	vision_correction	NO	Log once at onboarding / profile step (or auto-derive).
news_frequency	news_frequency	NO	Log once at onboarding / profile step (or auto-derive).
typical_session_length	typical_session_length	NO	Log once at onboarding / profile step (or auto-derive).
reading_style_selfreport	reading_style_selfreport	NO	Log once at onboarding / profile step (or auto-derive).
topic_interest_top2	topic_interest_top2	NO	Log once at onboarding / profile step (or auto-derive).
topic_interest_today	topic_interest_today	NO	Log once at onboarding / profile step (or auto-derive).
condition_order	conditionOrder	NO	Log once at onboarding / profile step (or auto-derive).
timestamp	timestamp	NO	Log once at onboarding / profile step (or auto-derive).
cluster_label	cluster_label	NO	Log once at onboarding / profile step (or auto-derive).
cluster_rule	cluster_rule	NO	Log once at onboarding / profile step (or auto-derive).
notes	notes	NO	Log once at onboarding / profile step (or auto-derive).

6.2 Session-level schema (Sessions table)

One row per run (i.e., one article read in one UI). This table is the primary unit of analysis for A/B comparisons.

Spec column	Current JSON key (expected)	Present?	Action if missing
session_id	sessionId	YES	
participant_id	participantId	YES	
ui_version	uiVersion	YES	
scenario_id	scenarioId	YES	
article_id	articleId	NO	Log a stable articleId (slug) to join across UIs.
start_time	start_time	NO	Add to session payload.
end_time	end_time	NO	Add to session payload.
reading_time_sec	readingTimeSec	YES	
completed	completed	NO	Add to session payload.
scroll_depth_pct	maxScrollDepth	YES	
focus_mode_used	focusModeUsed	YES	
focus_mode_time_sec	focusModeTimeSec	YES	
comprehension_q_score	comprehension_q_score	NO	Add to session payload.
perceived_readability	perceivedReadability	YES	
perceived_focus	perceivedFocus	YES	
distraction_events	distractionClicks	YES	
notes	notes	NO	Add to session payload.

6.3 Optional event-level schema (EventLog)

Event logs are optional but recommended if you want to reconstruct micro-behavior (e.g., exact scroll bursts, click sequences). If implemented, events should be appended with timestamps and joined to Sessions via session_id.

Field	Type	Example	Why it matters
event_id	string/uuid	evt_9f1…	Uniquely identifies an event row
session_id	string	S3927_A	Join key to session
ts_ms	int	173…	Time ordering and latency/dwell calculations
event_type	enum	click|scroll|focus_toggle|setting_change|visibility	Event categorization
target	string	focus_toggle|toc_item|related_card|font_plus	What UI element was acted on
value	string/number	1 / 72 / 'Normal'	Payload (e.g., scroll %, setting value)
page_context	enum	feed|article|questionnaire	Where it happened

6.4 What is currently logged (from the provided JSON)

From the sample log JSON, the system currently records per-run fields such as reading time, scroll depth, UI version, focus/readability ratings, MCQ correctness, and interaction counts (e.g., focus toggles, TOC usage, font/spacing changes, sidebar/related clicks). It also includes a session identifier and completion timestamps.

Observed keys in the current JSON (union of summary + run records):

Logged keys (current JSON)
_firebaseKey
completedAt
comprehensionScore
distractionClicks
finishedAt
focusModeTimeSec
focusModeUsed
focusToggleDetails
focusToggles
maxScrollDepth
participantId
perceivedFocus
perceivedReadability
readingTimeMs
readingTimeSec
relatedPanelSeen
scenarioId
sessionId
sidebarClickDetails
sidebarClicks
textSizeChanges
uiA
uiB
uiVersion

6.5 Gaps vs target schema (what to add before final submission)

Target field	Covered by current logs?	Current key (if mapped)	Note
session_id	Yes	sessionId	
participant_id	Yes	participantId	
ui_version	No		Add to logger (session record).
scenario_id	No		Condition order exists in summary; replicate into each session row for easier analysis.
article_id	No		Add to logger (session record).
start_time	No		Add to logger (session record).
end_time	No		Add to logger (session record).
reading_time_sec	No		Add to logger (session record).

completed	No			Add to logger (session record).
scroll_depth_pct	No			Add to logger (session record).
focus_mode_used	No			Add to logger (session record).
focus_mode_time_sec	No			Add to logger (session record).
comprehension_q_score	No			Add to logger (session record).
perceived_readability	No			Add to logger (session record).
perceived_focus	No			Add to logger (session record).
distraction_events	No			Add to logger (session record).
notes	No			Optional field for anomalies (e.g., participant reported interruption).

6.6 Expanded logging plan for reading-rate objective (UI-A & UI-B)

The current prototype logs core reading outcomes (readingTimeSec, maxScrollDepth, focusModeUsed/focusModeTimeSec, distractionClicks, comprehensionScore, perceivedFocus, perceivedReadability). To align with the clarified primary aim (increase reading rate) and to support additional analyses (conversion, expectation, topic clustering), we extend the event schema to capture *session time on site*, *time-to-first-click*, *feed-to-article expectation proxies*, and *screen-to-screen transition rates*. All metrics are collected for both UI-A and UI-B, with ui_version included in every event.

Metric / Parameter to log	Definition (how computed)	Event(s) needed	Used for (analysis)	Applies to
session_duration_sec	Time from Landing/Intro page load to Thank You screen (or explicit Exit).	page_view(landing), page_view(thank_you) OR session_start/session_end timestamps	Overall engagement; compare A/B and AB/BA orders; dropout analysis	UI-A & UI-B (overall study session)
ui_feed_dwell_sec	Time spent on the feed/list screen before opening an article.	page_view(feed), click(article_open) timestamps	Decision cost (Hick); engagement; time-to-read readiness	UI-A & UI-B
time_to_first_click_sec	Latency from feed screen render to first meaningful interaction (open article / choose category / open).	feed_render, first_interaction events with timestamps	Usability/efficiency; 'start reading faster' supporting aim	UI-A & UI-B
article_click_through_rate	P(open_article | feed_view) computed per participant/session.	feed_view count + article_open count	Expectation/appeal of feed; interaction design	UI-A & UI-B

			effectiveness	
expected_to_read_score (optional self-report)	1–7 Likert right after feed: "I expect I can find an article worth reading here."	short_survey(feed_expectation)	Direct measure of expectation; triangulate with CTR & time_to_first_click	UI-A & UI-B (if added)
screen_transition_from_to	Conversion rates between consecutive containers/screens (e.g., Intro→Consent, Feed→Article, Article→Quiz).	page_view with screen_id + transition events	Identify friction/drop-offs; compare UI-A vs UI-B; validate wireflow	UI-A & UI-B
scroll_depth_series	Optional: time series of scroll depth (pct over time), not only max.	scroll events (timestamp, pct) throttled	Reading-rate curve; detect skimming vs deep reading; pacing	UI-A & UI-B
reading_speed_wpm (approx)	Approx words-per-minute: article_word_count / (reading_time_sec/ 60).	article metadata + reading_time_sec	Check whether higher depth is due to slower reading or longer engagement; outlier detection	UI-A & UI-B
topic_interests (profile)	Participant-selected topic chips (Top 2) + selected article topic category.	profile_step2 (chips), article_open (category/tag)	User clustering; segment comparisons of A/B effects by interest	UI-A & UI-B
interaction_counts	Counts of UI controls used (font+/-, spacing, focus toggles, summary expand, etc.).	ui_control_change events	Mechanism analysis (which features drive reading rate); usability behavior	UI-B (and any controls in UI-A)

- On questionnaire submit → store mcq_correct + Likert ratings; mark session as complete.

Participant-level gaps are more significant: demographics/preferences are shown in the UI profile screens, but they must be persisted in a `participants` table (or embedded in the JSON export) so that analysis can control for device/language/reading style.

7. Analysis plan (how we use the parameters)

7.1 Derived metrics
- Engagement: reading_time_sec, dwell_time_sec, and scroll_depth_pct.
- Session duration: session_duration_sec (landing→thank_you), plus dropout stage (last_screen_id).
- Time-to-start-reading: time_to_first_click_sec and ui_feed_dwell_sec before opening an article.
- Feed expectation proxies: article_click_through_rate and (if added) expected_to_read_score; relate these to later completion and depth.

- Transition rates between containers: compute screen_transition_from_to conversion rates to locate friction points (e.g., Consent→Profile, Feed→Article, Article→Survey).
- Focus behavior: focus_mode_used (binary), focus_mode_time_sec, focus_mode_toggles; changes in distraction click rates when focus is ON vs OFF.
- Distraction index: sidebar_clicks + related_clicks + other_out_of_article_interactions per minute.
- Reading aid usage: font_size_changes and line_spacing_changes; correlation with readability and focus ratings.
- Comprehension: mcq_correct (0/1) and optionally response_time for MCQ if logged.
- Progress dynamics: progress at key timestamps (0→100%); compute 'time to 50% scroll' as a proxy for reading pace.

7.2 Statistical comparisons
- Primary: within-subject comparison UI-A vs UI-B for perceived_focus and perceived_readability (paired t-test or Wilcoxon).
- Secondary: UI-A vs UI-B for mcq_correct (McNemar's test for paired binary outcomes or mixed-effects logistic regression).
- Behavioral: compare distraction index, reading_time_sec, scroll_depth_pct across UIs.
- Order effects: include condition_order (AB/BA) as a factor; verify no strong carryover by comparing first-run vs second-run outcomes.

7.3 Interpretation and triangulation
- Triangulate self-report (Likert) with behavior (scroll patterns, distraction clicks, focus-mode time).
- Check for tradeoffs: if focus increases but comprehension decreases, adjust summary/reading aids.
- Segment participants using profile variables (reading style, news frequency, device type) and explore heterogeneous treatment effects.

7.4 Topic-based clustering and transition-funnel analysis
Topic clustering: represent each participant with a topic vector constructed from (a) selected topic-interest chips (Top 2) and (b) the topic category of the article they chose. Use simple clustering (e.g., k-means on one-hot topic vectors or hierarchical clustering) to form segments such as Sports-focused, Economy-focused, etc. Then evaluate the UI-B effect (Δ reading rate, Δ comprehension, Δ perceived focus) within each cluster to see whether the design benefits some reader types more than others.

Transition/funnel analysis: treat each screen/container in the wireflow as a state. Compute transition probabilities and drop-off rates per UI and per order (AB/BA). This reveals where UI-A vs UI-B causes friction (e.g., longer time_to_first_click, lower feed→article conversion) and supports targeted iteration without changing the experimental hypothesis.

8. Implementation notes (for final engineering update)
This section is written as 'handoff-ready' guidance for the teammate maintaining the HTML/CSS/JS codebase.

8.1 Data model and exports
- Persist participant profile once (participants table). Use participant_id as the stable join key.
- Create a session row at article open (start_time_iso) and finalize at 'Okumayı Tamamladım' (end_time_iso). Compute dwell_time_sec.

- Replicate condition_order (AB/BA) into each session row to simplify analysis.
- Export at the end: participants.json + sessions.json (and optional eventlog.json) OR one combined JSON with arrays `participants`, `sessions`, `events`.

8.2 Logging triggers (minimum required)
- On consent accepted → log consent timestamp and participant_id creation.
- On profile submit → persist demographics + optional preferences.
- On UI assignment → persist condition_order.
- On article open → create session row (session_id, ui_version, article_id/title, start_time).
- On scroll → update max scroll_depth_pct and progress.
- On focus toggle → increment focus_mode_toggles and accumulate focus_mode_time_sec (start/stop timer).
- On typography changes → increment counts and store final settings.
- On related/sidebar clicks → increment counters (distraction proxy).
- On end-of-article CTA → finalize session row (end_time, dwell_time).

8.3 Quality safeguards
- Clamp scroll_depth_pct to [0,100].
- Avoid double-counting focus time: only accumulate while focus is ON.
- Debounce scroll events; log only aggregated stats unless you also store eventlog.
- Use monotonic timestamps (Date.now()) and ISO strings for exports.
- Anonymize: do not store names/emails; participant_id should be random.

9. Ethics, privacy, and limitations
- Collect only non-identifying demographics; store with participant_id pseudonym.
- Make consent explicit and allow exit without data storage.
- Limitations: small sample sizes, possible novelty effects for focus mode, and content/topic effects even with counterbalancing.
- Mitigation: keep article difficulty comparable; randomize article assignment within topic categories; report order effects.

Appendix A — Color palette and typography rationale

Color and typography choices aim to support extended reading: low visual noise, high contrast for text, and controlled accent colors for actionable controls (focus toggle, primary buttons). UI-B emphasizes calm, consistent surfaces and uses green for 'focus' state signaling.

Token	Hex	Swatch
BG	#F8F7F3	
Surface 1	#FFFFFF	
Surface 2	#FDFCFA	
Border	#E6E1D8	
Text 1	#111826	
Text 2	#4B5462	
Text 3	#6D737F	
Accent	#1D4ED8	
Accent Tint	#E7EFFE	
Highlight	#F49E0B	
Highlight Tint	#FEF6E5	

Appendix B — Typography control spec

Style	Recommendation
H1 Article Title	44–52 pt, Bold, Text 1 (#111826)
Body reading text	18–20 pt, Regular, Text 1 (#111826), line-height ~1.5–1.7
Secondary (snippet)	16–18 pt, Regular, Text 2 (#4B5462)
Meta (source • time • read)	12–14 pt, Regular, Text 3 (#6D737F)

Appendix C — Participant clustering (optional segmentation)

Optional: segment participants into reading-behavior clusters to explore heterogeneous effects. Clustering can be rule-based using profile answers (news frequency, reading style, focus preference), or data-driven using behavioral logs (reading time, distraction index, focus mode usage).

Cluster label	Rule (store as cluster_rule)
Heavy Reader	news_frequency = daily AND typical_session_length in {5–10m, 10m+}
Skimmer	reading_style_selfreport = skim OR typical_session_length in {<2m, 2–5m}
Casual	news_frequency in {weekly, rarely}
Mobile-first	device_primary = phone (can overlap with others)

Appendix D — Example export format

Recommended export structure (single JSON file) so analysis scripts can load all data in one step:

```json
{
  "participants": [
    {
      "participant_id": "P001",
      "condition_order": "AB",
      "age_group": "18-24",
      "device_type": "desktop",
      "...": "..."
    }
  ],
  "sessions": [
    {
      "session_id": "S001",
      "participant_id": "P001",
      "ui_version": "A",
      "scenario_id": 1,
      "article_id": "a01",
      "start_time_iso": "2026-01-02T08:10:00+03:00",
      "end_time_iso": "2026-01-02T08:12:10+03:00",
      "dwell_time_sec": 130,
      "scroll_depth_pct": 92,
      "focus_mode_time_sec": 0,
      "focus_mode_toggles": 0,
      "mcq_correct": 1,
      "perceived_focus": 3,
      "perceived_readability": 4
    }
  ],
  "events": [
    {
      "event_id": "evt_001",
      "session_id": "S001",
      "ts_ms": 1735795800123,
      "event_type": "scroll",
      "target": "article_body",
      "value": 35
    }
  ]
}
```