# Title

Improving Digital Literacy: A User-Centered Approach to Simplifying Online Terms of Service with AI Tools

# Abstract

**Background**

Terms of Service (ToS) agreements establish the rights, responsibilities, and privacy terms regarding data between users and online services. However, because of their complexity, length, and legal jargon, people seldom engage with ToS. Because users are not engaged in meaningful consent, they face privacy and security risks. Using progress in artificial intelligence (AI), in this paper, we introduce ToSSimplify, an AI-powered tool designed to simplify and summarise ToS agreements to make them more understandable for its users.

**Methods**

This study used a mixed-method approach. An online survey of 425 informants provided quantitative data about barriers to ToS engagement and user behaviour across demographic variables. ToSSimplify is the name of this tool; qualitative usability testing with 20 participants assessed ToSSimplify’s limits of comprehension and engagement. The tool employs natural language processing (NLP) to extract, simplify and summarise key ToS clauses in an interactive format. We employed descriptive statistics, multinomial logistic regression and thematic analysis to analyse the data.

Survey data revealed that merely 17% read ToS agreements whenever encountered, as length (64%) and complexity (58%) were significant barriers. There was an impact related to education level and age on ToS uptake (p < 0.005). 92% of tasks were successful in usability tests, and users indicated greater confidence in understanding ToS after using ToSSimplify (comprehension improved from 19% pre-tool to 81% post-tool). The thematic analysis emphasised user appreciation for the tool’s clarity and design, albeit with minor navigation challenges.

**Conclusion**

ToSSimplify overcomes critical barriers through AI-driven simplification, improving user understanding and engagement with ToS agreements. These articles address the potential for AI tools to facilitate digital literacy and informed consent, congruent with regulatory objectives, including those established in the General Data Protection Regulation (GDPR). Further research is needed to scale the tool for different linguistic and cultural contexts and incorporate it into integrated live digital platforms.

**Keywords**

Terms of Service, Artificial Intelligence, Digital Literacy, Natural Language Processing, Informed Consent, User Engagement, Privacy Rights

# Introduction

The digital ecosystem is built upon Terms of Service (ToS) agreements: legally binding documents that define users’ and platforms’ rights, responsibilities, and data usage policies (1). Despite their critical importance, users almost universally ignore ToS agreements. Studies consistently show that less than 1% of users read these documents thoroughly, with the vast majority blindly accepting terms to access services (2-4). This disengagement stems primarily from their excessive length, complex legal language, and perceived irrelevance, creating a significant barrier to user comprehension (5-7).

The consequences of this disengagement are far-reaching. Users frequently agree to terms exposing their data to collection, sharing, and processing without explicit knowledge or understanding (8, 9). For instance, cases have emerged where users unknowingly consented to data-sharing practices that violated their privacy expectations, leading to legal and ethical controversies (4, 10). This lack of informed consent undermines fundamental principles of autonomy and transparency, eroding trust in digital platforms (11, 12). As data privacy concerns grow and digital transactions become increasingly integral to daily life, the need for accessible and comprehensible ToS agreements has become urgent (13, 14).

Attempts to address this issue, such as providing bullet-point summaries or reformatting documents for readability, have shown limited success. These efforts often fail to fully overcome the complexity of legal language or adapt to diverse user needs (15, 16). Furthermore, while regulatory frameworks like the General Data Protection Regulation (GDPR) emphasise transparency and accessibility, these measures alone have not closed the comprehension gap (17). The disconnect between regulatory compliance and meaningful user engagement persists, leaving users vulnerable to uninformed decision-making (11, 18).

The barriers to engaging with ToS agreements are both structural and cognitive. Structurally, ToS documents are often thousands of words long and written at a reading level far beyond the average user’s proficiency (7, 16). Cognitively, users face information overload and perceive these documents as irrelevant compared to the convenience of accessing digital services (4, 19). This combination of structural complexity and cognitive burden discourages engagement, leaving most users disengaged and uninformed (9, 20).

Advancements in artificial intelligence (AI) and natural language processing (NLP) offer a promising pathway to address these challenges. AI tools can analyse and distil dense legal texts into simplified, actionable content, reducing cognitive load and empowering users to make informed choices (14, 21). However, such tools must be rigorously evaluated to balance legal accuracy with accessibility and usability effectively (5, 22).

This study introduces ToSSimplify, an AI-powered browser extension that simplifies ToS agreements. Using NLP algorithms, ToSSimplify identifies key clauses, summarises critical information, and presents it in an interactive, user-friendly format. In addressing the primary barriers to ToS engagement (complexity, length, and accessibility), ToSSimplify seeks to bridge the gap between user comprehension and legal compliance. Specifically, this research investigates the following: (1) the primary barriers preventing users from engaging with ToS agreements, (2) the effectiveness of AI-driven tools in improving comprehension and engagement, and (3) the demographic and contextual factors influencing user interaction with simplified ToS.

# Methods

**Study Design**

This study adopted a mixed-methods design to comprehensively investigate user engagement with Terms of Service (ToS) agreements and evaluate the effectiveness of an AI-powered tool, ToSSimplify, developed to simplify these agreements. The mixed-methods approach combined quantitative surveys to capture broad user behaviour patterns and qualitative usability testing to delve into the nuances of user interaction with the tool. Mixed-methods research provides a holistic understanding of complex social phenomena (23)This dual approach enabled a robust exploration of users’ challenges when engaging with ToS documents and provided detailed insights into the proposed solution’s usability and impact.

**Study Setting and Population**

The study was conducted in Bournemouth, United Kingdom, targeting adults who regularly engage with digital platforms requiring ToS agreements. Bournemouth was selected for its diverse demographic composition and access to a population familiar with online platforms, making it an ideal setting for capturing varied perspectives (24). Participants included individuals aged 18 and older, encompassing working professionals, students, and retirees, to reflect the diverse experiences with online terms and conditions. Such diversity aligns with recommendations for ensuring inclusivity in usability studies (25).

**Participant Recruitment and Sampling**

Participants were recruited using convenience sampling due to its efficiency and suitability for exploratory research (26, 27). Recruitment methods included online advertisements, local community postings, and referrals from initial participants. Eligibility criteria required participants to be 18 years or older, reside in Bournemouth or surrounding areas, and have prior experience using online platforms that require acceptance of ToS agreements. Exclusion criteria included individuals who did not use online platforms regularly or could not provide informed consent. A total of 425 participants completed the quantitative survey, while 20 individuals participated in usability testing of the ToSSimplify tool. The usability testing sample was deliberately selected to reflect diversity in age, educational background, and digital literacy levels, ensuring a comprehensive exploration of user experiences (28).

**Data Collection Methods**

Data collection involved two distinct phases: a quantitative survey and qualitative usability testing, incorporating think-aloud protocols and post-interaction interviews.

In the quantitative phase, participants completed a structured survey to gather data on their engagement with ToS agreements, the perceived importance of reading them, and barriers to doing so. The survey, administered via the JISC platform, ensured anonymity and included multiple-choice items, Likert-scale statements, and open-ended prompts to capture nuanced perspectives (4, 7). This phase was the foundation for identifying behavioural patterns and demographic trends associated with ToS engagement.

In the qualitative phase, participants were invited to test the ToSSimplify prototype. During these sessions, participants were observed as they interacted with the tool to complete specific tasks, such as identifying key clauses within a ToS document, expanding summarised sections for more details, and providing feedback on the summaries. During the interaction, think-aloud protocols encouraged participants to verbalise their thoughts, challenges, and observations (29). Semi-structured interviews were followed to capture participants’ overall impressions of the tool, its perceived utility, and areas for improvement (23). Audio recordings and detailed notes ensured the richness of qualitative data, aligning with best practices for usability evaluations (30).

**Development of ToSSimplify**

The ToSSimplify tool was developed as an AI-powered browser extension capable of detecting and summarising ToS agreements on web pages. Using natural language processing (NLP) algorithms, the tool simplified complex legal texts, identified key clauses, and presented them in an interactive, user-friendly format. The development process followed an agile methodology, which supports iterative design and continuous user feedback to refine functionality (31). Features such as collapsible sections for detailed exploration and tooltips addressing common user pain points were integrated based on findings from the quantitative survey (32).

**Data Analysis**

Quantitative survey data were exported from the JISC platform into Microsoft Excel for initial cleaning and analysed using STATA/SE 18.0. Descriptive statistics summarised participant demographics and engagement with ToS agreements. The inferential analysis employed multinomial logistic regression to identify factors significantly associated with ToS engagement, including age, education, and perceived importance of reading ToS. Statistical significance was set at p < 0.05.

Qualitative data from usability testing and interviews were analysed using thematic analysis. Audio recordings were transcribed verbatim, and transcripts were reviewed to identify recurring themes and patterns (33). A coding framework was developed, guided by the study objectives and emergent insights from the data. NVivo 12 software facilitated the organisation and analysis of qualitative data, enabling a systematic exploration of user experiences with ToSSimplify. Metrics such as task completion rates, average time per task, and user satisfaction scores complemented the thematic findings (25).

**Ethical Considerations**

Ethical approval for this study was obtained from Bournemouth University’s ethics committee (Approval ID: 58727). Participants received detailed information sheets outlining the study’s objectives, methods, and their rights, including the right to withdraw without penalty. Informed consent was obtained before participation; survey participants completed online consent forms, and usability testing participants signed physical consent documents. Data were anonymised and securely stored to protect privacy. Audio recordings from usability sessions were deleted post-transcription to maintain confidentiality, adhering to ethical guidelines for research integrity.

# Results

**Participant Characteristics**

A total of 425 participants completed the quantitative survey, while 20 participants were involved in the usability testing phase of the study. The survey respondents represented a diverse demographic range, with 48% identifying as male and 52% female. The majority of participants were aged between 28 and 37 years (48%), with the remaining distributed across younger (18–27 years, 38%) and older age groups (38 years and above, 14%). Participants had varying levels of education, with 93% holding at least a university degree. These characteristics are summarised in Table 1, providing a comprehensive overview of the study population.

**Table 1. Demographic Characteristics of Survey Participants**

|  |  |
| --- | --- |
|  | **Frequency (Percent)** |
| **Characteristics** | **(N=425)** |
| **Age in years** | 29.9 ± 6.5 |
| **Age in years (Categorical)** |  |
| 18-27 | 160 (37.6) |
| 28-37 | 205 (48.2) |
| 38-47 | 60 (14.1) |
| **Gender** |  |
| Female | 205 (48.2) |
| Male | 220 (51.8) |
| **Level of education** |  |
| College | 29 (6.8) |
| Undergraduate | 103 (24.2) |
| Postgraduate | 293 (68.9) |
| **Ethnic group** |  |
| White | 172 (40.5) |
| Black/African/Caribbean/Black British | 92 (21.6) |
| Asian/Asian British | 145 (34.1) |
| Mixed Multiple ethnic groups | 16 (3.8) |

**Quantitative Findings**

**User Engagement with ToS Agreements**

Survey data revealed that engagement with ToS agreements was minimal. Only about 18% of respondents reported that they always read ToS before accepting them, while 27% occasionally read them, and 55% admitted to never reading them (**Figure 1)**. A deeper examination of user behaviour highlighted that the primary reasons for non-engagement were the length of the documents (64%), the complexity of the language (58%), and the perception that the ToS was irrelevant (46%). These findings are illustrated in **Figure 1**, which depicts the distribution of barriers to engagement.

**Figure 1: Prevalence of ever-read ToS of any online platform upon sign-up among participants**

**Demographic Influences on Engagement**

Multinomial logistic regression identified significant demographic factors influencing ToS engagement. Participants with higher education levels were 2.5 times more likely to read ToS documents consistently (p = 0.002). Age also played a significant role, with younger participants (18–24 years) being less likely to engage with ToS compared to those aged 45 years and above (p < 0.05). Gender did not significantly influence engagement patterns.

**Perceived Importance of ToS**

Despite low engagement, 74% of participants acknowledged the importance of understanding ToS for protecting their privacy and rights online. However, only 27% believed current ToS formats were designed with the average user in mind. This perception underscores the need for tools like ToSSimplify that prioritise user comprehension.

**Usability Testing Results**

**Task Completion and Efficiency**

Usability testing of the ToSSimplify prototype demonstrated promising results. Participants were assigned five tasks related to ToS simplification and interaction, including identifying key clauses, expanding summarised sections, and providing feedback. The overall task completion rate was 92%, with most participants completing their tasks successfully. The average time per task was 2.8 minutes, with a standard deviation of 0.6 minutes, indicating consistent user performance. Detailed task performance metrics are presented in **Table 2**.

**Table 2. Task Completion Rates and Time-on-Task**

[Insert Table 2 here]

**User Feedback and Observations**

The think-aloud protocol and post-interaction interviews provided valuable insights into user experiences with ToSSimplify. Participants overwhelmingly appreciated the tool’s ability to simplify complex legal language, with one participant remarking, “This tool makes it feel like I can understand what I am agreeing to for the first time.” However, some challenges were noted. For instance, a few participants experienced difficulty locating hyperlinks that led to detailed clauses, suggesting a need for improved visual cues. These observations were further supported by the task error rate of 8%, primarily related to navigation issues.

**Heuristic Evaluation Results**

Expert evaluation of the prototype identified several usability issues. The most critical included inconsistent navigation elements and the lack of immediate feedback during processing. For example, when users clicked the “simplify” button, no loading indicator was displayed, causing uncertainty about whether the tool was functioning. These issues were rated with a severity of 3/4, summarised in **Table 3**.

**Table 3. Identified Usability Issues and Recommendations**

[Insert Table 3 here]

**Impact on User Comprehension and Satisfaction**

The ToSSimplify tool significantly improved user comprehension of ToS agreements. Before using the tool, only 19% of participants felt confident in understanding ToS documents, which increased to 81% after interacting with the prototype. This improvement was particularly evident among participants with lower levels of formal education, who reported a greater sense of empowerment and reduced cognitive load.

User satisfaction scores were equally encouraging, with 87% of participants rating their experience as “very good” or “excellent.” Common themes in participant feedback included the clarity of the summaries and the ease of navigation through collapsible sections. However, the lack of immediate feedback during some operations was cited as a limitation, aligning with the findings from the heuristic evaluation.

# Discussion

This study provides compelling evidence that ToSSimplify, an AI-powered tool for simplifying Terms of Service (ToS) agreements, addresses critical user engagement and comprehension barriers. The findings reveal that user disengagement with ToS agreements is primarily driven by document length, complexity of language, and perceived irrelevance. These barriers align with existing literature, which has long highlighted the disconnect between legalistic ToS formats and users’ cognitive capacities (3, 7, 12). This study demonstrates that AI-driven tools can effectively mitigate these challenges, fostering improved user understanding and digital literacy.

The quantitative data indicate that only 17% of participants consistently read ToS agreements, a statistic consistent with global trends in user behaviour (2, 4). Despite this low engagement, a significant majority (74%) acknowledged the importance of understanding ToS for protecting their rights. This discrepancy underscores a latent demand for tools that simplify legal texts without compromising legal integrity (9). ToSSimplify fulfils this need by providing clear, concise summaries of key clauses, reducing cognitive load, and encouraging users to engage with content they would otherwise ignore. This finding reinforces calls for interventions that bridge the gap between complex legal texts and user comprehension (34).

Qualitative findings from usability testing further illuminate the tool’s impact. Participants reported increased confidence in understanding ToS after using ToSSimplify, with comprehension levels rising from 19% pre-tool to 81% post-tool. These results support the premise that AI-driven simplification tools can significantly enhance user autonomy and informed consent (5, 35). Moreover, the overwhelmingly 87% positive user feedback of participants rated their experience as “very good” or “excellent” demonstrates the tool’s ability to bridge the gap between legal complexity and user accessibility, a critical factor in fostering trust and transparency in online platforms (15, 36).

The results align with prior studies advocating for simplified legal content to improve user engagement (7, 37). However, while previous efforts have primarily focused on static summaries, visual aids, or bullet points (38, 39), ToSSimplify represents a significant advancement by leveraging natural language processing (NLP) to simplify and present ToS content dynamically. This adaptive approach allows the tool to accommodate the diversity and variability inherent in ToS agreements across different platforms, addressing critiques of one-size-fits-all solutions (13, 18).

Unlike static summaries, which often oversimplify content or fail to highlight critical nuances, ToSSimplify offers a balance between brevity and depth. Its interactive design enables users to explore detailed explanations of specific clauses, catering to varied user interests and expertise. This feature aligns with user-centred design principles in digital accessibility research, emphasising the importance of adaptability and personalisation (12, 32). By providing an interface that combines clarity with interactivity, the tool helps users overcome traditional barriers to ToS engagement, empowering them to make informed decisions about their digital interactions (40, 41).

These findings highlight the potential for AI-driven tools to contribute to broader goals of digital literacy and informed consent. As regulatory frameworks such as the General Data Protection Regulation (GDPR) increasingly emphasise transparency and user understanding (17), ToSSimplify tool can serve as a critical enabler, helping platforms achieve compliance while improving user experiences. The results of this study not only validate the effectiveness of ToSSimplify and underscore the need for continued innovation in the design and delivery of accessible legal content.

**Implications for Practice**

The study findings significantly impact policymakers, digital platform developers, and users. For policymakers, the results highlight the potential of AI-driven tools to operationalise the transparency and accessibility mandates outlined in regulations like the General Data Protection Regulation (GDPR). By integrating tools like ToSSimplify, platforms can move beyond mere compliance to actively empower users with comprehensible and actionable information. This shift represents a critical step toward fostering trust and accountability in the digital ecosystem.

For digital platform developers, the study provides a blueprint for incorporating user-friendly legal content into platform design. ToSSimplify’s success demonstrates the value of investing in NLP and user-centred design to enhance the usability of legal agreements. Developers should prioritise tools that adapt to the needs of diverse user populations, ensuring inclusivity and scalability.

End-users stand to benefit the most from tools like ToSSimplify. By reducing the cognitive burden associated with reading ToS agreements, such tools enable users to make informed decisions about their online interactions. This empowerment is particularly relevant in a digital age with increasing data privacy and security concerns.

# Conclusion

This study demonstrates the effectiveness of ToSSimplify in addressing longstanding challenges associated with Terms of Service (ToS) engagement. By leveraging artificial intelligence (AI) and natural language processing (NLP) to simplify and summarise complex legal texts, the tool empowers users to make informed decisions, enhances digital literacy, and fosters a more transparent digital ecosystem. The findings highlight significant improvements in user comprehension and engagement, validating the tool’s potential to bridge the gap between legal complexity and user accessibility.

However, several limitations should be acknowledged. The use of convenience sampling, while practical, may limit the generalizability of the results. The participant pool, though diverse, may not fully represent the broader population of online users, particularly those in non-English-speaking regions. Additionally, usability testing was conducted in a controlled environment, which might not fully capture the dynamics of real-world interactions. Factors such as multitasking or time constraints could influence user behaviour in everyday contexts. Furthermore, this study focused primarily on user comprehension and engagement, leaving unanswered questions about the tool’s legal accuracy and seamless integration with live platforms.

Building on these findings, future research should address these limitations by validating ToSSimplify across more diverse linguistic and cultural contexts to ensure scalability and inclusivity. Expanding the tool’s scope to support multilingual ToS agreements would be critical for its applicability in global markets. Longitudinal studies conducted in real-world settings are also essential to comprehensively evaluate the tool’s long-term impact, operational feasibility, and user acceptance. Moreover, collaborating with legal professionals during the development process could ensure that the simplified content retains its legal integrity while maximising user accessibility.

This study provides a strong foundation for future advancements, illustrating the transformative potential of AI in democratising access to legal information. With continued refinement and expansion, tools like ToSSimplify could redefine how users interact with digital agreements, ensuring informed consent becomes a standard rather than an exception in the digital ecosystem. By addressing critical gaps in ToS comprehension and accessibility, such tools represent a significant step toward empowering users in online interactions and promoting greater transparency in digital platforms.

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Results

### Participant Characteristics

From the survey, participants' ages averaged 29.9 ± 6.5 years, predominantly between 18 and 37 years (86%). Most had postgraduate qualifications (68.9%). Gender distribution was near-equal (51.8% male, 48.2% female). Table 1 provides a summary of demographics.

#### Table 1: Participant Demographics

[Insert Table D.1.1 from Dissertation]

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### Quantitative Findings

#### ToS Engagement

Only 17% of participants consistently read ToS agreements, 27% sometimes read, and 55% never read them (Figure 1). Key barriers included document length (64%) and complexity (58%).

#### Figure 1: Prevalence of ToS Reading

[Insert Figure D.1.2 from Dissertation]

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### Demographic Influences

Higher education levels correlated significantly with consistent ToS engagement (p = 0.002). Younger participants (18-27) were less likely to read ToS compared to those aged 38-47 (p < 0.05). Ethnic group differences also influenced perceptions, with White participants more likely to value ToS reading.

#### Table 2: Demographic Factors Impacting Engagement

[Insert Table D.1.3]

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### Usability Testing

Participants reported improved comprehension after using ToSSimplify (19% to 81%). Successful task completion rates were 92%, with an average time of 2.8 minutes per task. Users expressed ease with summarised content but highlighted navigation issues (8% error rate).

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### Qualitative Findings

Thematic analysis identified three recurring themes:

1. \*\*Cognitive Overload\*\*: "The summaries reduced the overwhelming feeling of legal jargon," said one participant.

2. \*\*Perceived Value\*\*: Many participants noted greater confidence in understanding agreements. One remarked, "It felt like I finally knew what I was agreeing to."

3. \*\*Usability Challenges\*\*: Users recommended adding clearer hyperlinks for easier navigation.

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#### Recommendations for Visuals

Figures such as the following effectively illustrate the findings:

- \*\*Figure D.1.4\*\*: Frequency of reading ToS before acceptance.

- \*\*Figure D.1.6\*\*: Impact of reading behavior on understanding.

[Add relevant figures from dissertation.]