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Table of abstracts

Name	Abstract title
Juan Broto-Ortega	Translating Easy-to-Read Standards into LLM-Based Cognitive Accessibility Strategies
José da Silva	System for Identifying Muscle Fatigue through Facial Patterns, Physiological Parameters, and Subjective Perception of Effort in People with Amyotrophic Lateral Sclerosis (ALS)
Maria Therese El Fakhry	Evaluating the Impact of CookiNUM Digital Tools on the Self-Determination of Learners with Neurodevelopmental Disorders in Professional Culinary Training
Kerstin Hirsch	Digital Care Coordination in Long-Term Care: Development of a Prototype to Support Informal Caregivers with a Conceptual ELGA Integration
Ning Li	Towards Entrance-Level Navigation Assistance for Blind and Visually Impaired People Using Visual Localisation and Object Detection
Luis Javier Manobanda-Tutasig	Easy-to-Read Adaptation of Spanish Data Privacy Forms
Gregor Mayr	From Accessibility Data Gaps to User Behavior: Toward Inclusive Recommender Systems
Vedad Misirlic	Neuroinclusive Design in Recommender Systems and Online Discourse
Mohamed Rayane Mokhtari*	Towards Socially Aware and Socially Interactive Shared Control for Intelligent Powered Wheelchairs
Hunter Sheills	WebMoti-Employ: Real-Time Interview Support for Neurodiverse Job Seekers
Jan Supierz	Finding Friends: a Graph Representation of Relations in Novels for Serious Games

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Translating Easy-to-Read Standards into LLM-Based Cognitive Accessibility Strategies

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1 Introduction

The rapid adoption of Generative AI and Large Language Models (LLMs) is transforming how written information is produced, but generated texts often remain difficult to understand for people with cognitive disabilities, potentially reinforcing accessibility barriers.

Easy-to-Read (E2R) guidelines provide structured linguistic principles to improve comprehensibility; however, translating these guidelines into effective LLM prompting strategies remains an open challenge, as current approaches largely rely on ad-hoc prompt engineering with limited methodological grounding, little reproducibility, and scarce empirical validation.

This work constitutes the initial stage of an ongoing doctoral research line within the HumanAI project on cognitively accessible AI-mediated communication and accessibility-aware LLM systems. The study is guided by the following research questions:

- RQ1: How effectively can E2R standards be translated into prompting strategies for LLM-based text simplification?
- RQ2: How do different prompting strategies affect semantic fidelity, hallucinations, and guideline compliance?
- RQ3: To what extent can E2R compliance be reliably evaluated through conventional automatic metrics?

2 State of the Art

Easy-to-Read (E2R) standards, defined through frameworks such as the Spanish UNE [1] guidelines, establish linguistic and structural principles to ensure text comprehensibility for people with cognitive disabilities. However, producing E2R content remains a time-consuming process that typically depends on expert revision and user validation. LLMs are increasingly applied to tasks such as text simplification and content adaptation for different audiences. Nevertheless, their application in cognitive accessibility contexts still presents significant limitations, including hallucinations and omission of relevant information. To address these issues, prompt engineering has become one of the main approaches for guiding LLM behavior. Previous studies indicate that the structure, specificity,

and design of prompts can substantially affect the quality of generated outputs [3]. However, little work has systematically explored how normative accessibility standards can be systematically operationalized into prompting strategies through controlled and reproducible methodologies. This gap becomes particularly relevant in cognitive accessibility contexts, where conventional readability metrics alone may fail to capture whether texts genuinely comply with accessibility requirements, while manual guideline-based evaluation remains costly and difficult to scale. Consequently, there is a need for methodologies capable of combining linguistic simplification, normative compliance, and meaning preservation within unified evaluation frameworks.

3 Design and Methodology

As an initial step of this doctoral research line, an experimental study explored how prompting strategies can operationalize E2R principles in LLM-based text simplification, establishing the basis for future adaptive and evaluation-oriented accessibility workflows. To this end, several prompting configurations were compared using the Gemma3 4B model, progressively increasing the level of guidance and explicitness provided in the prompts. The evaluated strategies include baseline simplification, role prompting, explicit inclusion of E2R guidelines, grouped guideline structures, and one-shot and few-shot prompting examples. This progression enabled the analysis of how prompt design influences the model’s ability to generate cognitively accessible text aligned with E2R standards.

The prompting strategies were grounded in the Spanish Easy-to-Read standard UNE 153101:2018 [1], from which 53 linguistic and syntactic guidelines relevant to LLM-based text generation were selected. To evaluate the proposed approach, we constructed a mixed corpus of real-world and synthetic texts. The dataset includes administrative documents from the ClearSim corpus [2], selected for their diversity of E2R violations, together with synthetic texts specifically designed to incorporate underrepresented accessibility violations. Overall, the corpus consists of 20 annotated texts.

Generated outputs were evaluated across three complementary dimensions: linguistic complexity, guideline compliance, and content preservation. Linguistic complexity were assessed using readability and syntactic metrics commonly applied in text simplification research [4], while guideline compliance were evaluated through manual and semi-automatic annotation of E2R criteria satisfaction and content preservation were measured using both human judgments and automatic metrics.

To further validate the proposed framework under external evaluation conditions, the prompting strategies are also being explored within the IberLEF 2026 MER-TRANS shared task across different LLMs, including Mistral 7.2B, Mistral Instruct, Llama3.2 3.2B and Phi4-mini 3.8B. Preliminary observations suggest that model size significantly affects how models interpret prompting strategies and perform text adaptations, with larger instruction-tuned models generally producing more consistent simplifications. In parallel, ongoing work

explores a multi-agent architecture in which specialized agents iteratively adapt, review, and validate texts according to grouped accessibility constraints. This line aims to move beyond static prompting toward adaptive and revision-oriented accessibility workflows capable of progressively refining compliance and comprehensibility.

4 Preliminary Results and Discussion

Preliminary results indicate that all prompting strategies reduce linguistic and syntactic complexity to some extent. However, the largest differences between configurations emerge in normative E2R compliance rather than in conventional readability metrics, suggesting that conventional readability metrics alone do not adequately capture compliance with normative accessibility requirements.

Role prompting achieves stronger reductions in surface-level complexity, while configurations explicitly incorporating E2R guidelines (particularly one-shot and few-shot) produce substantially larger improvements in guideline compliance.

The results also suggest the existence of a trade-off between general simplification and normative adherence. Example-based prompting appears especially promising for operationalizing accessibility constraints that are too abstract or underspecified to be reliably followed through instruction-only prompts. Although the current study provides encouraging preliminary evidence, the findings should be interpreted cautiously due to the limited corpus size and the absence of large-scale user validation.

Future research will investigate which accessibility requirements can be reliably operationalized through prompting, improve hallucination control, and develop scalable methodologies for evaluating E2R compliance beyond conventional readability metrics, combining automatic and guideline-based evaluation approaches. Additional work will extend the evaluation to iterative multi-agent architectures, and participatory evaluations involving users with cognitive accessibility needs. Overall, this doctoral research aims to contribute toward more reliable and cognitively accessible GenAI systems grounded in explicit accessibility principles and human-centered evaluation methodologies.

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System for Identifying Muscle Fatigue through Facial Patterns, Physiological Parameters, and Subjective Perception of Effort in People with Amyotrophic Lateral Sclerosis – ALS: Under development

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Introduction

Amyotrophic Lateral Sclerosis (ALS) is a progressive and fatal neurodegenerative disease characterized by degeneration of upper and lower motor neurons, resulting in muscle weakness, atrophy, spasticity, fasciculations, and progressive loss of functional capacity (Meyer, 2021; Vick & Askwith, 2015). As the disease progresses, patients develop impairments in gait, posture, swallowing, speech, and respiratory function, substantially compromising quality of life and independence (Monjo & Forestier, 2016). Epidemiological studies estimate that ALS affects approximately 4.1 to 8.4 individuals per 100,000 inhabitants worldwide, with prevalence expected to increase due to population aging (Longinetti & Fang, 2019). In Brazil, prevalence rates range from 0.9 to 5.0 cases per 100,000 inhabitants depending on the geographic region studied, highlighting the growing public health relevance of ALS in the country (Longinetti & Fang, 2019; Marques Couto et al., 2022).

Recent investigations in ALS have focused on identifying objective biomarkers capable of detecting early neuromuscular deterioration and fatigue-related alterations before substantial functional decline occurs (Monjo & Forestier, 2016). Studies using multimodal magnetic resonance imaging (MRI), diffusion-weighted imaging, and T2-weighted muscle MRI demonstrated structural and functional abnormalities in both the central nervous system and skeletal muscles even during early disease stages (Pisharady et al., 2023). Furthermore, investigations using surface electromyography (sEMG), high-density electromyography (HD-sEMG), and motor unit MRI identified significant alterations in motor unit recruitment, neuronal hyperexcitability, and abnormal muscle activation patterns associated with neuromuscular fatigue and exercise intolerance in ALS patients (Fernandes et al., 2026; Pisharady et al., 2023). These findings reinforce the importance of integrating physiological and biomechanical assessments for monitoring disease progression.

Advances in artificial intelligence and computational neuroscience have enabled the integration of physiological and behavioral biomarkers for fatigue detection and disease monitoring in ALS (Kitaoka et al., 2025). Recent studies combining facial electromyography, acoustic analysis, and machine learning algorithms demonstrated greater sensitivity for identifying subtle motor impairments compared with isolated assessments (Rong et al., 2024). In addition, deep learning architectures applied to electromyographic signal processing achieved high accuracy in differentiating ALS-related neuromuscular patterns and detecting fatigue states during physical tasks (Bai et al., 2010). These results suggest that muscle fatigue in ALS emerges from complex interactions involving impaired motor unit recruitment, respiratory dysfunction, altered biomechanics, metabolic stress, and central nervous system degeneration (Behan et al., 2013; Braga et al., 2018).

Therefore, the present study proposes an innovative multimodal system for early muscle fatigue detection during exercise in individuals with ALS, integrating facial interpretation through computer vision, physiological monitoring including heart rate and peripheral oxygen saturation, movement measurements during adapted dry rowing exercise, and potential electromyographic biomarkers. Unlike previous approaches that evaluated isolated variables independently, the proposed system aims to synchronize multiple physiological and biomechanical signals in real time to identify subtle fatigue-related changes during rehabilitation activities. This strategy may improve individualized exercise prescription, enhance rehabilitation safety, optimize training intensity, and contribute to earlier identification of functional decline in ALS patients, representing a relevant advancement in neurorehabilitation and assistive monitoring technologies.

Methodology

The project proposal is to develop a multimodal integrative system that combines variables of surface electromyography (sEMG), inertial signals (tremor/oscillation) of the hand, physiological parameters (heart rate and peripheral saturation), and seat displacement in people with the neurodegenerative disease amyotrophic lateral sclerosis (ALS). Previously, the system would measure the variables to determine the actual functioning of the measurements that will be analyzed in people without neurodegenerative disease, in order to establish a pattern for identifying fatigue via facial expressions, physiological parameters, irregular seat movements, or a combination of all variables. This information will be presented in Figure 1 shows a demonstration of the

system with facial recognition variables, seat displacement measurement data, and text information for heart rate and peripheral oxygen saturation variables. taken during a test on the device developed for the lower limbs (Rowing device for assisting in the maintenance of posture, muscles, and bones: National Institute of Intellectual Property - INPI (Case Number: BR 10 2020 025298 4, demonstrating the relevant variables. See Figure1).

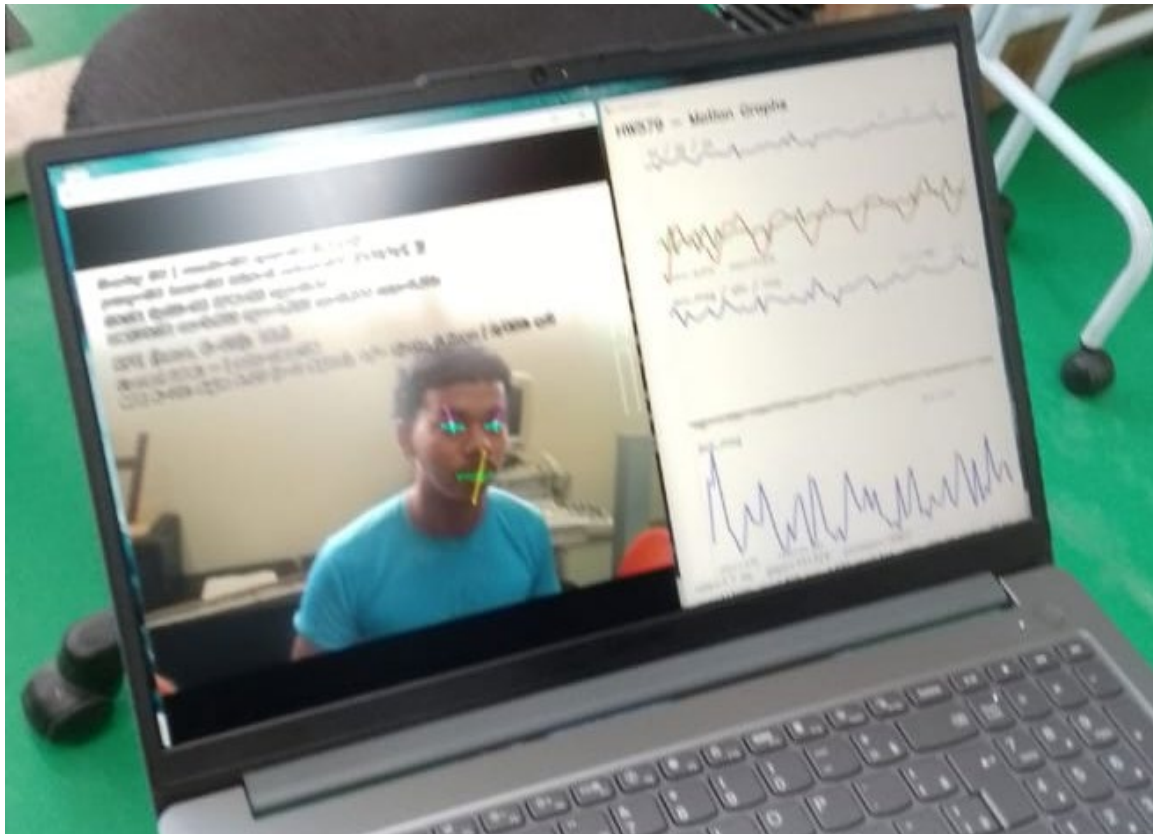


Figure 1: Demonstration of the system during a measurement with all variables.

The analyzed facial data is interpreted using pre-established facial anatomical point recognition bases, a laptop camera (full HD® webcam, 4k resolution) was used. See Figure 1.

The parameters of heart rate and oxygen saturation variables will be analyzed using an oximetry system (Incoterm® portable Bluetooth pulse oximeter OX500 BLE).

For the information on the measures of subjective perception of effort (PSE) This scale ranges from 6 (no exertion at all) to 20 (maximal exertion). Bor G 1998, familiarization was carried out one week before with the system and information on how the question would be asked at the minute (Perchthaler et al., 2015).

Expected Results

The system should be able to detect muscle fatigue early in people with the neurodegenerative disease amyotrophic lateral sclerosis, based on information from people without a diagnosis of neurodegenerative diseases. This will enable safe exercise without increased oxidative stress, improving quality of life and contributing to physical exercise and physiotherapy programs for improved quality of life.

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Evaluating the Impact of CookiNUM Digital Tools on the Self-Determination of Learners with Neurodevelopmental Disorders in Professional Culinary Training

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1 Introduction and Motivation for Research

The integration of digital technologies in education has increasingly been recognized as a potential driver of inclusion (UNESCO, 2023), particularly for learners with diverse cognitive and developmental profiles. Previous work in speech-language pathology has highlighted the need for tailored technological solutions to support remote intervention and learning (master's thesis in speech therapy at the Lebanese university). During the COVID-19 pandemic, the rapid shift to teletherapy highlighted the absence of appropriate tools, generating frustration among both practitioners and patients. Prior master's thesis research investigated the challenges associated with online therapy through a survey for speech-language pathologists. Findings revealed a critical lack of resources adapted to the Lebanese context, particularly in the local language. The complexity of supporting learners with developmental disorders, especially when interaction is primarily limited to verbal communication, raises important questions regarding motivation in digitally mediated learning environments. This experience motivated my pursuit of first a masters in "Technology and Disability" at Paris 8 university in France then a PhD within the CookiNUM project at Université Paris-Est Creteil, aiming not only to co-design inclusive pedagogical digital tools but also to evaluate their impact on learners' self-determination in vocational culinary training.

2 Research Questions and Objectives

This research aims to investigate how the pedagogical digital tools, developed by the CookiNUM project affect the self-determination of learners with neurodevelopmental disorders (NDD) enrolled in professional culinary training. The primary research question is: How does the integration of the CookiNUM digital tools affect the self-determination of learners with NDDs in culinary vocational programs? The study also examines how digital tools can enhance motivation, facilitate repetition, and provide feedback in the development of practical skills within heterogeneous learning groups. The hypotheses guiding this study are that (H1) the use of digital tools will enhance learners' self-determination, and (H2) learners will develop greater autonomy and perceive themselves as more capable of independently performing professional culinary tasks.

3 Brief State-of-the-Art

Traditional educational practices remain largely standardized, often inadequately addressing the diverse needs of learners, particularly those with disabilities (Bergeron, 2012). Digital tools have been proposed as mechanisms to support personalized learning and inclusion (UNESCO, 2023). Previous studies on learners with developmental disorders and learning difficulties indicate that motivation and autonomy are critical for successful learning outcomes (Adhikari, 2017; Ayyildiz et al., 2024; Zakharov, 2019; Seyed et al., 2017). Digital environments, including mobile applications, immersive reality, and video-based resources, can facilitate individualized learning by reducing cognitive load, providing immediate feedback, and offering repeated opportunities for observation and practice (Jdaitawi et al., 2022; Wehmeyer, 2006; Yogyakarta, 2022). In fact, the use of inclusive pedagogy, grounded in the Universal Design for Learning framework, has been shown to support diverse learners by integrating multiple modes of representation, engagement, and action (Capp, 2017; Katz,

2013). Despite these advances, empirical studies evaluating the impact of digital tools on self-determination in professional training for learners with NDDs remain scarce, particularly in France, where research is predominantly focused on schools and higher education (Fluckiger, 2023). This study aims to address the gap by assessing the CookiNUM digital ecosystem in vocational training, specifically in culinary education for students with special educational needs.

4 System Design

The CookiNUM project was developed as an answer to a France 2030 call for proposals, aiming to address the needs of vulnerable learners training for high-demand sectors such as culinary professions. Its objective is to support traditional pedagogical methods and make learning accessible to all. The project encompasses four complementary digital tools designed to facilitate learning and enhance autonomy among learners with difficulties. CookiNUMmobile is a mobile application that provides structured resources, including visual step-by-step guides allowing learners to plan, monitor, and consolidate culinary tasks autonomously. CookiNUMnetwork captures real-time demonstrations of technical gestures, projected for collective or individual observation, enabling repeated analysis and feedback without reliance on verbal or written instructions. CookiNUMprogram delivers Web TV-based tutorials, scenario-based fictions and reportages contextualizing culinary skills within professional settings, aiming to stimulate motivation and professional projection. CookiNUMskills employs immersive virtual reality scenarios, facilitating safe, experiential repetition of key skills with immediate visual and auditory feedback. Collectively, these tools are designed according to accessibility principles, with multimodal support to accommodate learners with attention and memory difficulties. These tools support planning, observation, repetition, and self-evaluation through visual guidance, segmentation, and immediate or replayable feedback, which reduces cognitive load and strengthens perceived competence. By enabling autonomy in repetition and access to resources while providing clear success criteria and engaging formats, they can enhance learners' motivation.

5 Research methodology

This study adopts a quasi-experimental design with independent groups, including an experimental group using CookiNUM digital tools and a control group following traditional instructional methods. The participant group consists of learners aged 15–30 enrolled in culinary vocational programs across multiple training centers in France (GRETA, CFA), including individuals with NDD profiles such as ADHD¹, learning disorders, or ASD² as well as learners with limited proficiency in French. Classes are allocated to experimental or control conditions to avoid intra-class inequality and potential stigma. The intervention spans nearly four months, with bi-weekly sessions integrating digital tools into practical culinary activities. Data collection involves pre- and post-test questionnaires assessing self-determination (Deci & Ryan, 2000; Fenouillet, 2015; Wehmeyer, 2006), along with observational notes and measures of skill acquisition. Additional qualitative feedback from instructors and open-ended reflections from learners supplement quantitative data, allowing triangulation of results and contextual interpretation.

6 Preliminary Results and Discussion

As the study is currently ongoing, empirical results are not yet available. However, it is anticipated that the CookiNUM tools will enhance learner autonomy and better adapt the learning environment to learners' needs by providing individualized support. The multimodal and accessible design of these tools is expected to reduce cognitive load and support the internalisation of professional gestures, in line with theories of self-determination and inclusive pedagogy (Carré, 2005; Wehmeyer, 2006).

¹ ADHD: Attention Deficit and Hyperactivity Disorder

² ASD: Autism spectrum disorder

These expected outcomes have implications for the design of inclusive vocational training environments, offering a model for integrating technology to foster empowerment and professional agency among learners with NDDs.

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Digital Care Coordination in Long-Term Care: Development of a Prototype to Support Informal Caregivers with a Conceptual ELGA Integration

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Abstract. Informal caregivers are often responsible for coordinating medications, appointments and communication in long-term care settings. However, existing digital solutions rarely focus on collaborative care coordination. Therefore, this paper presents the development of a high-fidelity prototype for digital care coordination, including a conceptual integration of the Austrian electronic health record system ELGA. Using a Human-Centered Design approach, a literature review, qualitative interviews, prototype development and usability testing were conducted. Preliminary findings indicate positive acceptance, particularly regarding centralized information sharing and simplified communication between family members and home care professionals.

Keywords: Long-Term Care, Informal Caregivers, Care Coordination, ELGA, Usability.

1 Introduction and Research Objectives

Population aging and the increasing number of people requiring long-term care place growing pressure on informal caregivers and healthcare systems. Family caregivers are often responsible for organizing appointments, medications, communication with healthcare professionals and information exchange between different stakeholders [1]. This coordination work is frequently associated with stress and a high organizational burden [2].

Digital solutions could help address these challenges. However, existing applications mainly focus on monitoring, reminders or organizational tasks, while support for collaborative care coordination remains limited [3]. For example, Linked Care (LICA) focuses on connecting healthcare stakeholders through digital platforms and includes medication-related coordination processes [4], while Care about Care supports communication and organization in mobile care settings [5]. However, communication between family members, healthcare professionals and mobile care services is still often handled via phone calls, handwritten notes or messaging applications, resulting in fragmented and inconsistently shared information. Research also indicates that many

mHealth applications still lack integrated care planning functionalities and integration with national eHealth infrastructures such as ELGA [6].

To address these challenges, this research focuses on developing a digital prototype for care coordination in long-term home care settings. The work explores how digital technologies can support informal caregivers in managing coordination tasks and investigates the potential added value of integrating Austria's electronic health record system ELGA. The following research questions are addressed:

- i) How should a digital solution be designed to effectively support family caregivers in managing day-to-day coordination tasks?
- ii) What potential added value could be achieved through a future integration with ELGA particularly regarding access to medication data, medical findings and discharge reports?

2 Methodology

The research followed a Human-Centered Design approach (ISO 9241-210) consisting of four iterative phases. First, a systematic literature review identified current research and challenges related to informal caregiving and digital care coordination. Second, seven semi-structured interviews with informal caregivers and key stakeholders were conducted using purposive sampling to identify coordination challenges and user needs. Based on these findings, a high-fidelity prototype was developed. Finally, the prototype was evaluated with eleven informal caregivers using the Think-Aloud method and the Affinity for Technology Interaction (ATI) Scale. The evaluation focused on task completion, navigation, required support, perceived usefulness, and overall acceptance.

3 System Design

Based on the literature review and qualitative interviews, a high-fidelity prototype for care coordination in long-term care settings was developed. The prototype provides functionalities for medication management, digital documentation and document storage, care visit overviews, appointment and task management, and shared notes. It was implemented using Flutter, while backend infrastructure and parts of the data were simulated due to the focus on usability and interaction design.

Special attention was given to usability and accessibility following principles of the Web Content Accessibility Guidelines (WCAG), including large touch targets, simple navigation and reduced interface complexity. In addition, the work proposes a conceptual integration with the Austrian electronic health record system ELGA through existing ELGA-enabled healthcare provider systems using the ELGA Adapter (ELGAAD).

4 Preliminary Results and Discussion

The following preliminary results refer to the usability evaluation of the developed prototype. Overall, the prototype was perceived positively. Eight out of eleven participants stated that they would use such an application in their daily lives. Participants particularly appreciated the centralized overview of information, information sharing with family members and the coordination of medications, appointments and care visits in one place. They also highlighted the potential to reduce phone calls and repetitive communication between informal caregivers and mobile care services. The conceptual ELGA integration was viewed positively, especially regarding access to discharge reports and medical documents. In addition, AI-based summaries and question-answering functions for medical findings were perceived as especially helpful. At the same time, the evaluation revealed several usability challenges. Some participants expected care visits to appear directly within the calendar and had difficulties identifying specific functions. Older participants generally required more support during task completion. An interesting finding was that perceived usefulness appeared to have a stronger influence on acceptance than general technology affinity.

Overall, the findings suggest that digital care coordination could support informal caregivers by improving communication and shared access to information. Future work should further investigate long-term usage, the practical implementation of ELGA and the integration of the platform into the workflows and systems of mobile care services.

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Easy-to-Read Adaptation of Spanish Data Privacy Forms [★]

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Abstract. This paper proposes a neuro-symbolic architecture to generate accessible and legally equivalent E2R adaptations of Spanish legal forms.

Keywords: Easy-to-Read · Text Adaptation · Cognitive Accessibility · Data Privacy · Legal

1 Introduction and Background

Data privacy and consent forms are legally binding documents that citizens must understand before signing. However, their linguistic complexity frequently excludes people with cognitive disabilities, a group explicitly protected by the UN CRPD¹ (Article 9) and the EU Directive 2019/882².

Two primary frameworks address cognitive accessibility in written communication. Plain Language (ISO 24495-1:2023) targets general audiences and is rarely validated with people with cognitive disabilities. Easy-to-Read (E2R), standardised in Spain through UNE 153101:2018 EX [10], is specifically designed for this population and mandates end-user validation as an integral part of the adaptation process. This work therefore adopts E2R as its accessibility framework.

Despite its potential, E2R adaptation remains largely manual, making large-scale production time-consuming and subjective. Existing automatic approaches for Spanish have followed three paradigms. Lexical simplification systems, including LexSIS [2], DysWebxia [7], and EASIER [5], substitute complex words with simpler synonyms. Lexical-syntactic systems, such as Simplext [8], FACILE [9], and Simple.Text [1], apply rule-based and NLP-hybrid methods to address specific E2R guidelines. LLM-based approaches have shown critical shortcomings: users with cognitive disabilities unanimously rejected ChatGPT outputs on core

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¹ United Nations Convention on the Rights of Persons with Disabilities.

² European Accessibility Act, 2019.

E2R tasks [3], and a fine-tuned Llama2 7B exhibited degraded performance on unseen domains [4].

No existing system simultaneously addresses legal documents, enforces legal equivalence³, and complies with formal E2R guidelines. This gap motivates the neuro-symbolic approach proposed in the present work.

2 Open Research Problem and Hypothesis

Existing systems cannot simultaneously satisfy cognitive accessibility requirements and preserve legal equivalence, where omission of mandated clauses carries direct legal consequences. This work therefore asks: *How can a Spanish LLM ensure legal equivalence of data privacy forms adapted to E2R standards for people with cognitive disabilities?* and hypothesises that a neuro-symbolic architecture combining a fine-tuned LLM with an Natural Language Inference (NLI) validator can produce adaptations that are simultaneously accessible and legally equivalent.

3 Objectives and Sub-Objectives

This work aims to: (O1) characterise the legal features that must be preserved in an E2R adaptation; (O2) develop LLM-based adaptation algorithms incorporating NLI control mechanisms that enforce legal equivalence while adjusting linguistic complexity; and (O3) deliver a functional system empirically validated through automated metrics and comprehension studies with people with cognitive disabilities.

4 Research Methodology

The methodology comprises four sequential phases: baseline evaluation, corpus construction, system implementation, and user-centred evaluation.

Phase 1: Practical and Comparative Analysis with State-of-the-Art Tools. The analysis process was conducted in a clear sequence involving corpus selection, tool classification, and evaluation. First, the evaluation corpus was established, consisting of two pairs of real-world data privacy forms and their corresponding Easy-to-Read (E2R) adaptations. These documents were used exclusively to evaluate the performance of the selected tools.

Second, the original source forms were processed using various tools, which were divided into three approach-based groups to identify the most effective strategy. The first group, G1, consists of four pre-parameterized assistant, which are expert-configured ChatGPT assistants that operate without manual prompt engineering from the end user. The second group, G2, includes four general-purpose Large Language Models: Claude Sonnet 4.6, GPT 5.4 Think, Gemini 3.1 Pro, and DeepSeek-V3.2. These models were evaluated using a uniform

³ Retention of the same rights, obligations, and consequences as the original.

zero-shot prompt derived directly from the UNE guidelines. Finally, group G3 includes three normative and standardized tools: FACILE [9], Simple.Text [1], and Qwen3.5-9B [6].⁴ Specifically, FACILE uses basic rules combined with natural language processing (NLP) methods. In contrast, Simple.Text uses rule-based modules along with Large Language Model (LLM) for transformations that require linguistic information, such as finding synonyms.

Third, quantitative and qualitative metrics were calculated to evaluate the E2R output of each tool against a certified expert adaptation, which served as the gold-standard reference. The evaluation was split into two main dimensions: readability and legal accuracy. For the quantitative analysis, readability was measured using the Fernandez Huerta Index, alongside standard linguistic metrics including BLEU, BERTScore, and SARI. For the qualitative analysis, a legal completeness checklist was used to verify whether any legal clauses were modified or removed. This checklist was constructed according to the General Data Protection Regulation (GDPR) and the clause-drafting guidelines established by the Spanish Data Protection Agency (Agencia Española de Protección de Datos, AEPD).

Phase 2 – Corpus Construction. To ensure that the assembled parallel corpus reflects real-world variety, the collection process is structured around two complementary dimensions. The first dimension focuses on source entities, which include public universities, private technology companies, regional government administrations, and official cultural institutions. The second dimension addresses document types, specifically image and audiovisual rights authorizations, as well as consent forms for scientific research and academic programs. This diverse structure ensures that the fine-tuned models can successfully handle different vocabularies and legal contexts.

Phase 3 – System Implementation. A selected Spanish LLM will serve as the backbone of an architecture with two components: (a) a **Text Adaptation Engine**, fine-tuned on the constructed corpus, and (b) a **Legal Equivalence Validator**, applying a Spanish NLI model to verify bidirectional entailment at the clause level, with thresholds calibrated against expert legal judgements.

Phase 4 – Evaluation. Evaluation combines automated metrics (SARI, BLEU, BERTScore, MeaningBERT), the Fernández-Huerta readability index, and comprehension tests with people who have cognitive disabilities. These comprehension tests are necessary because user validation is a mandatory requirement within the Easy-to-Read (E2R) methodology.

5 Preliminary Results and Discussion

Baseline evaluation reveals that existing E2R tools systematically fail to preserve legal content. Critical elements, including the legal basis for processing (Article 6.1.b GDPR), data subject identification, and the scope of authorisation, were omitted or distorted across all outputs; several tools produced summaries

⁴ This version of Qwen3.5-9B was fine-tuned internally by the research group for Easy-to-Read adaptation, using pairs of original and simplified documents.

rather than genuine E2R adaptations. Only 35% of outputs retained the legitimation clause and the data controller’s identification, both mandatory in a valid consent form.

Crucially, high BLEU and SARI scores did not correlate with legal clause preservation, demonstrating that surface-level metrics are insufficient for legal domain evaluation and motivating the need for dedicated legal equivalence measures.

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From Accessibility Data Gaps to User Behavior: Toward Inclusive Recommender Systems

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Introduction. Recommender Systems (RS) are typically optimized for a *normative* user, defined as an implicit model of common user behavior and preference patterns in the training data, reinforced by the system’s objective function (e.g., recommendation accuracy or user engagement maximization). This can inadvertently propagate existing real-world inequalities into digital spaces.

In the physical domain, Point-of-Interest recommendation systems (POI-RS) play a central role in navigation and local economies [5]. However, they often fail to account for the needs of individuals with disabilities¹. When accessibility information is missing, these systems are trained on incomplete data, which can introduce bias and amplify existing disparities by systematically under-recommending accessible locations [3]. As a result, recommendation quality may be lower for users with mobility-related needs.

In the digital domain, short-form video platforms (e.g., TikTok, Instagram Reels) rely on highly personalized, continuous content streams optimized for engagement [11]. These systems create feedback loops that encourage prolonged consumption [14]. While effective in increasing engagement, such dynamics can introduce disparities across user groups. In particular, individuals with Attention-Deficit/Hyperactivity Disorder (ADHD) may exhibit different interaction patterns due to variations in executive function [4], potentially leading to disproportionate negative outcomes.

This dissertation aims to identify, quantify, and model these disparities, and to design recommender systems that account for missing data and diverse user behavior and needs. The research is guided by the following research questions:

- RQ1:** How do accessibility data gaps and geographic disparities in metadata propagate through point-of-interest recommender systems, and how do they affect recommendation outcomes across different user needs?
- RQ2:** How do engagement-optimized recommender systems influence user behavior, and how do these effects differ across user groups, particularly for users with ADHD?
- RQ3:** How can fairness-aware algorithms and data augmentation strategies mitigate these disparities in recommendation outcomes and user behavior?

State of the Art. Existing fairness-aware recommender systems research primarily focuses on biases related to user demographics or item popularity, while disability and neurodiversity remain underexplored.

¹ <https://www.who.int/news-room/fact-sheets/detail/disability-and-health>

In POI-RS, while some works have studied accessibility-aware routing [1], systems that explicitly model accessibility remain limited [8]. State-of-the-art models require rich metadata, yet widely used benchmark datasets in the domain of point-of-interest recommender systems do not provide metadata related to accessibility needs. While community-driven initiatives partially address this gap²³, coverage remains unevenly distributed, particularly in rural areas. Systematic approaches for handling missing accessibility data are yet limited.

Similarly, in the context of digital media consumption, related work has studied the psychological effects of algorithmic engagement-driven systems [10]. However, stratified analyses that account for neurodiversity are lacking, in particular of how recommendation loops affect the behavior of users with executive dysfunction. While qualitative studies identify challenges faced by users with ADHD [7], large-scale empirical evidence validating these effects remains limited [12].

A growing movement in participatory design within HCI research has been observed in recent years [15]. The inclusion of affected communities has many positive effects, such as making algorithmic systems fairer, more localised, and emancipatory [2]. Many valuable contributions due to different perspectives can be gained, though initial barriers can be expected [6].

Algorithmic Design and Evaluation. This dissertation aims to develop inclusive recommender systems at both the algorithmic and interaction levels:

- Design of POI-RS algorithms, evaluation metrics, and fairness constraints that account for sparse accessibility data. This includes establishing strict thresholds to limit inaccessible recommendations and ensuring quality-of-service parity across user groups.
- Development of data augmentation techniques and fairness-aware post-processing (re-ranking) strategies to mitigate bias propagation.
- Generation of evaluation frameworks to detect and quantify behavioral disparities in engagement-driven recommender systems.

To effectively measure these fairness outcomes, this work will evaluate the miscalibration between user profiles and their generated recommendations. Furthermore, standard ranking metrics (e.g., NDCG) will be adapted to strictly penalize inaccessible POIs in the results. The expected outcome of a fair system is to minimize user-profile miscalibration while ensuring that overall recommendation utility does not statistically deviate between user groups.

Methodology. This research employs a mixed-methods approach, combining large-scale data analysis, algorithmic evaluation, and controlled user studies.

To assess disparities in point-of-interest recommender systems, we utilize geographic datasets derived from map providers [13] and enrich them with population statistics. Multiple recommender models are evaluated to quantify how incomplete accessibility data affects recommendation quality and to quantify disparities between regions with differing metadata coverage.

To assess behavioral effects, a stratified user study comprising 302 participants (149 female, 149 male, 3 diverse; 150 with ADHD, 152 without) compares

² <https://map.accessnow.com/>

³ <https://wheelmap.org/>

interaction patterns between individuals with and without ADHD. A post-hoc G*Power analysis confirmed a statistical power of 0.99, ensuring the identification of group-specific differences in engagement, consumption behavior, and post-usage outcomes.

Future phases of this research will integrate participatory, disability-led methodologies to ensure lived experiences guide system governance. Neurodivergent users and individuals with physical accessibility needs will co-design iteratively to shape UI/UX interventions and validate algorithmic fairness metrics. All user involvement, data privacy protections, and mitigation strategies against algorithmic harms will strictly adhere to the university’s Institutional Review Board (IRB) guidelines.

Results & Discussion. Preliminary results provide evidence of systematic disparities across both domains:

- Accessibility metadata is unevenly distributed, with rural areas significantly underrepresented. POI-RS trained on this data amplify these gaps, resulting in reduced recommendation quality for users with mobility-related needs. See [9] for a corresponding study by the author and colleagues.
- Engagement-driven recommender systems affect all users but disproportionately impact individuals with ADHD, increasing time misperception, emotional distress, and post-usage regret. A corresponding paper reporting on these findings is currently under review.

These results indicate that both data quality and optimization objectives are primary drivers of inequitable outcomes in recommender systems, highlighting the need for approaches that explicitly account for missing accessibility data and diverse user needs to support more equitable outcomes.

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Neuroinclusive Design in Recommender Systems and Online Discourse

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1 Introduction, Motivation, Research Questions

Recommender systems are central to modern social media platforms, delivering highly personalized content such as short-form content videos (e.g., TikToks, YouTube Shorts). These systems are typically optimized for engagement, encouraging prolonged consumption and potentially problematic usage patterns such as addictive behavior [9]. However, these effects are not evenly distributed across user groups and may disproportionately affect neurodivergent populations [10, 2, 6].

Engagement-optimized recommender systems also play an integral role in online forums and discussion platforms, where similar personalization mechanisms influence which content and viewpoints users are exposed to. While such systems can support exchange of opinions and exposure to diverse perspectives [1], they can also introduce barriers to participation, particularly for users with differences in cognitive and emotional processing.

Hence, across both domains, recommender systems not only shape exposure but also how users engage with and respond to the recommended content.

Existing work largely treats recommender systems and online discourse as separate domains and does not provide a unified understanding of how accessibility challenges affect neurodivergent users across these environments. In particular, current systems rarely account for differences in cognitive processing, as well as in emotional regulation and disengagement behavior, i.e., prolonged interaction with content and delays in terminating or switching away from it.

This dissertation addresses these challenges through empirical analysis and neuroinclusive system design, guided by the following research questions:

RQ1: How do engagement-optimized recommender systems influence emotional regulation and interaction patterns in neurodivergent users?

RQ2: Which design interventions can support neurodivergent users in managing content exposure and disengagement in recommender-driven environments?

RQ3: How can such design interventions be adapted to algorithmically-supported online discourse systems to support accessible and constructive participation?

2 State of the Art

Prior research identified challenges that neurodivergent individuals encounter in algorithmic systems, including misalignment between system behavior and user

needs, reduced recommendation quality, and the need to adapt to neurotypical interaction patterns through chatbot usage [7]. Additionally, qualitative studies have identified critical challenges neurodivergent individuals experience when working with large language models (LLMs) [3], including neurotypical LLM responses and unimodal, text-based output. Other work explored expectations in conversational agents interactions in neurotypical populations [4], highlighting the importance of non-judgmental communication spaces. Additional work studied the long-term effects of LLM use on neurodivergent power users, underscoring everyday challenges encountered in current, normative digital environments [5]. While these works provide valuable insights, they largely focus on individual systems in isolation. Hence, there is limited understanding of how accessibility challenges manifest across different digital spaces mediated by recommender systems. Furthermore, there is a lack of unified design principles to support neurodivergent users across both content consumption and online discourse.

3 Methodology and System Design

This thesis explores algorithmic harm on neurodivergent populations through a mixed-methods approach. It further develops system prototypes for neuroinclusive recommender systems design to foster more inclusive digital participation: i) **Empirical analysis:** Two user studies ($N = 606$) combining quantitative and qualitative methods to measure engagement patterns, emotional responses, and disengagement behavior across neurodivergent and neurotypical user groups. Followup interviews ($N = 16$) with neurodivergent individuals with ADHD were conducted to further explore usage patterns and emotional dysregulation in the scope of short-form video platforms [8]. All studies received approval of the Institutional Review Board (IRB) of TU Graz. ii) **Design and evaluation of interventions:** Development of neuroinclusive design interventions and prototype systems that support self-regulation, awareness, and disengagement in recommender-driven environments. These interventions are evaluated through user studies and behavioral metrics. iii) **Extension to online discourse:** Adaptation of the identified design interventions to LLM-supported discussion systems, including mechanisms for reframing arguments and supporting constructive interaction. These systems are evaluated with respect to participation quality, accessibility, and user experience.

This approach aligns with the research questions by first identifying behavioral patterns (RQ1), developing and evaluating targeted interventions (RQ2), and finally extending these interventions to online discourse settings (RQ3).

4 Preliminary Results & Discussions

Empirical analyses provide initial evidence of significant systematic differences in how users with ADHD interact with engagement-optimized short-form video recommender systems. Results indicate that users with ADHD exhibit different

engagement patterns compared to users without ADHD, including more prolonged interaction (i.e., longer scrolling sessions) with personalized content and greater difficulty in terminating such interaction. These patterns are associated with more negative post-usage experiences, such as increased feelings of guilt or regret. Further analyses examine the relationship between emotional regulation and prolonged content consumption, highlighting how engagement-driven system design may negatively affect users with ADHD (RQ1).

Building on these findings, this work includes the development of neuroinclusive design interventions and prototype systems that aim to mitigate these effects. One line of work investigates interface-level interventions to support awareness and self-regulation in recommender-driven environments (RQ2). Another line focuses on online discourse, including a prototype tool that makes transparent how arguments are framed and supports users in selecting an appropriate tone, including adjustments in emotional intensity and level of confrontational language during discussions (RQ3).

These research directions are reflected in three manuscripts currently under review as (co-)first author.

The broader impact of this work is to advance neuroinclusive recommender and AI-supported systems that better support diverse user needs and enable more accessible and inclusive digital participation.

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Towards Socially Aware and Socially Interactive Shared Control for Intelligent Powered Wheelchairs

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Abstract. Powered wheelchairs are essential mobility devices for individuals with motor impairments, yet navigating socially complex environments remains cognitively demanding. Beyond obstacle avoidance, users must interpret pedestrian behaviour, regulate interpersonal distances, and coordinate their motion with others. Existing research remains fragmented across user behaviour modelling, shared control, and socially aware navigation. This paper outlines an ongoing doctoral research project exploring a socially aware shared control framework for intelligent powered wheelchairs. The approach combines a probabilistic formulation of shared control with an empirical study designed to characterise real-world social navigation and cognitive load. The objective is to establish conceptual and empirical foundations for future assistive systems that preserve autonomy while reducing cognitive effort.

Keywords: Powered wheelchairs · Shared control · Social navigation · Proxemics · Cognitive load.

1 Introduction and Motivation

Powered wheelchairs (PWCs) enable autonomy and participation for individuals with motor impairments. However, navigating real-world environments remains challenging due to the need to interpret social cues, anticipate pedestrian behaviour, and adapt to dynamic situations.

Navigation is inherently social. Users must negotiate trajectories with pedestrians, respect interpersonal distances, and sometimes coordinate with an accompanying person. These factors significantly increase cognitive load, especially in crowded environments, while current assistive systems largely focus on obstacle avoidance.

This research investigates how a powered wheelchair can assist navigation in socially complex environments by integrating social interaction and shared control, while reducing cognitive load and preserving user autonomy.

2 Brief State of the Art

Smart wheelchair research has primarily focused on navigation safety and obstacle avoidance. Early systems such as NavChair introduced collaborative control

to support users during manoeuvres [1]. However, recent reviews highlight the limited integration of social interaction in current systems [2].

User behaviour modelling approaches aim to adapt assistance to individual driving styles. Onyango et al. propose a steering model based on potential fields [3], but such models do not consider interaction with other agents.

Shared control methods combine user input and autonomous assistance. Collaborative control frameworks preserve user autonomy while supporting difficult manoeuvres [4]. Probabilistic approaches further improve decision-making under uncertainty [5,6], but rarely integrate social interaction explicitly.

Socially aware navigation introduces proxemic constraints to generate acceptable trajectories [7]. However, most approaches assume autonomous systems and neglect real-time interaction with pedestrians.

Recent studies show that pedestrian–wheelchair interactions exhibit specific proxemic behaviours compared to pedestrian–pedestrian interactions [8]. These findings highlight the need for models explicitly addressing social asymmetry.

Cognitive load is also a critical factor in assistive systems. Existing methods provide tools for its measurement [9,10], but its relationship with socially complex navigation remains largely unexplored.

3 System Design and Methodology

The proposed system is explored as a probabilistic shared control framework integrating multiple agents: the user, the wheelchair, pedestrians, and a potential accompanying person. The objective is not to present a finalized system, but to structure the research through a preliminary formulation.

Navigation is modelled as an inference problem over trajectories:

$$\xi_R^* = \arg \max p(\xi_R \mid u, z) \quad (1)$$

where u denotes user input and z observations. The selected trajectory balances user intention, wheelchair dynamics, obstacle avoidance, and social constraints such as proxemics and coordination.

The methodology combines two complementary phases. First, naturalistic observations in real environments (e.g., university campus) are conducted to identify typical social navigation situations, analyse trajectories, and detect interaction patterns. Second, controlled experiments with powered wheelchair users collect behavioural and multimodal data, including eye-tracking, IMU signals, and standardized questionnaires such as NASA-TLX.

A user-centred approach is adopted through the involvement of powered wheelchair users at different stages of the research. This includes an advisory group of users who contribute to the identification of relevant scenarios, the interpretation of observed behaviours, and the refinement of the system design.

4 Preliminary Insights and Contributions

This work highlights that wheelchair navigation involves asymmetric interactions with pedestrians and cannot be reduced to standard pedestrian or robotic mod-

els. Social environments significantly increase cognitive load, and coordination with accompanying persons remains underexplored.

The expected contributions are: (i) a probabilistic framework for socially aware shared control; (ii) the integration of accompanying persons in navigation modelling; (iii) empirical insights into pedestrian–wheelchair interaction; and (iv) evaluation criteria linking social navigation and cognitive load.

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Towards Entrance-Level Navigation Assistance for Blind and Visually Impaired People Using Visual Localisation and Object Detection

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Abstract. This work presents a smartphone-based navigation assistance system designed to support blind and visually impaired (BVI) users in locating building entrances. Conventional navigation systems can guide users to a destination address but often provide limited support in identifying the correct entrance and interpreting surrounding environmental cues. This study investigates whether combining visual localisation and semantic perception on a standard smartphone can support navigation near entrances. The proposed Android prototype uses Oriented FAST and Rotated BRIEF (ORB) feature matching and geometric verification to estimate alignment between the live camera view and the destination area before delivering guidance. Preliminary real-world testing suggests that this approach may help reduce ambiguity near entrances, while informal testing with two participants indicated that the prototype was generally easy to use. Ethical approval has been obtained, and participant evaluation is currently in progress.

Keywords: Accessible navigation · Visual localisation · Object detection

1 Introduction

Smartphone navigation applications have become widely used for outdoor mobility, but navigation to a destination does not necessarily solve the problem of locating a specific entrance. Users may receive an arrival notification while still facing the wrong side of a building or an ambiguous surrounding environment. For blind and visually impaired users, this final stage of navigation can require additional orientation effort and may reduce confidence during independent travel.

Existing navigation systems primarily focus on route guidance or obstacle awareness. However, identifying a suitable entrance often requires contextual understanding of the environment, including user orientation and nearby semantic cues. Guidance delivered without sufficient contextual verification may negatively affect usability and user trust.

This work investigates whether combining visual localisation and semantic perception on a standard smartphone can support users in locating and approaching building entrances. The proposed system integrates route navigation,

Street View-based orientation estimation, and object detection to support users once they arrive near the destination.

2 Related Work

Research on assistive navigation for blind and visually impaired users has explored route guidance, environmental awareness, and computer vision-based assistance. NavCog introduced smartphone-based turn-by-turn navigation support [1], while recent studies have explored vision-based navigation [2] and YOLO-based environmental perception [3]. However, many existing systems focus on either route guidance or environmental perception separately. Comparatively little work has explored how visual localisation and semantic perception can be combined to provide context-aware guidance near building entrances.

3 System Design

The proposed Android application combines route guidance, visual localisation, and semantic perception to support BVI users during navigation near building entrances.

The navigation component provides walking guidance from the user's current location to the selected destination using map-based routing and voice instructions. Once users arrive near the destination area, the system activates the camera-based assistance module. A gravity sensor is used to monitor the orientation of the smartphone and provide feedback when the device is not held in an appropriate position for visual analysis. Users are then prompted to slowly scan the surrounding environment with the smartphone camera.

Live camera frames are compared with Street View reference images surrounding the destination using visual feature matching and geometric verification. When consistent visual alignment is detected, the system informs the user that the relevant direction has been identified. Semantic object detection is then used to identify navigation-relevant objects, with guidance delivered through speech and haptic output.

4 Methodology

This study combines technical and user-centred evaluation methods. For visual localisation, live smartphone camera input is compared with Street View reference images using ORB feature extraction and feature matching. For semantic perception, multiple YOLO variants were trained using open-source and self-collected datasets and evaluated using standard object detection metrics and preliminary real-world testing.

The user study investigates both task performance and user experience. Participants will complete outdoor navigation tasks requiring them to locate and approach selected building entrances using the prototype. The system will be

tested from different starting points around the destination area to evaluate its use under varying approach directions.

During each task, observations will be made regarding task completion, successful entrance identification, navigation difficulties, and situations requiring researcher assistance. Following the tasks, participants will provide feedback on the usability, clarity, and usefulness of the audio and haptic guidance. Semi-structured interviews will also be conducted to identify usability issues, user preferences, and requirements for further system development.

5 Preliminary Results and Discussion

The current implementation demonstrates a working Android prototype that combines route-level navigation, visual localisation, and semantic object detection within a single accessibility system. Preliminary technical testing was carried out in real-world environments involving entrances under varying viewpoints and lighting conditions.

Initial informal testing with two participants suggested that the prototype was generally easy to use and that both participants were able to successfully identify the target entrance during the navigation task. Although these observations are preliminary and not intended as a formal usability evaluation, they provided useful feedback for the ongoing development of the system.

Initial observations suggest that combining visual localisation with semantic object detection may help reduce ambiguity during navigation near entrances.

Several limitations remain at the current stage. Environmental changes, lighting variation, and Street View availability may affect localisation reliability. Larger-scale participant studies are still required to assess usability and real-world effectiveness.

Future work will investigate user experience, navigation confidence, and the practical usefulness of context-aware guidance during independent travel.

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WebMoti-Employ: Real-Time Interview Support for Neurodiverse Job Seekers

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Abstract. Neurodiverse job seekers may encounter barriers in virtual interviews when candidates must manage interview content, timing, social cues, and video-call interaction simultaneously. WebMoti-Employ is a real-time interview support system that provides low-load feedback through gaze-based emoticon cues, AI-generated hints, timer feedback, and filler-word feedback. A preliminary study with 14 neurodiverse job seekers examined participant experience, perceived control, self-presentation, and interviewee support. Participants rated the system positively for ease of use, learning, self-presentation, perceived control, and support for interviewee needs. Open-ended responses suggested that feedback supported attention and response awareness, while also identifying the need to refine how feedback is explained, displayed, and customized. These findings will guide future thematic analysis and revisions to feedback visibility, placement, and user-controlled display options.

Keywords: Neurodiversity, Virtual Interviews, Real-Time Feedback

1 Introduction and Background

Neurodiverse job seekers encounter barriers when hiring practices rely on conventional interview behaviours that do not always reflect job-relevant abilities [1, 2]. Virtual interviews may further complicate these barriers because candidates must manage interview content, video-call interaction, timing, and social cues within the same interface [3]. Prior work on real-time cueing suggests that live prompts can support performance when feedback is brief and not overly distracting [4], while eye-tracking research suggests that attention and self-regulation can be examined during simulated interview interactions [5]. However, less work has examined how low-load, real-time feedback can support neurodiverse job seekers during the interview itself.

WebMoti-Employ is designed to address this gap through a virtual interview interface that provides brief feedback during a mock virtual interview, including gaze-based emoticon cues, AI-generated hints, timer feedback, and filler-word feedback. Rather than automating candidate assessment, WebMoti-Employ explores how low-load interface feedback may support awareness, communication, and self-regulation during virtual interviews.

The objective is to examine how real-time feedback can support neurodiverse job seekers during virtual interviews. The study is guided by two research questions: (1) How does real-time interface feedback affect neurodiverse interviewees' perceived control and self-presentation during virtual interviews? and (2) How does WebMoti-Employ affect the perceived usability and usefulness of virtual interviews for neurodiverse job seekers?

2 System Design and Methodology

WebMoti-Employ uses a computer with an eye tracker and a custom-built video-call interface (Figure 1). During a real-time interview, the interface provides four forms of feedback: [A] emoticon feedback to indicate if gaze toward the interviewer is occurring; [B] a count-up timer indicating response length (in seconds); [C] two one-word AI-generated hints based on the interview question; and [D] feedback when repeated filler words are being used.

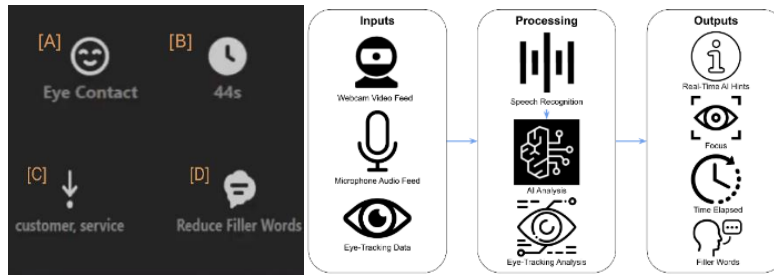


Figure 1: WebMoti-Employ Feedback **Figure 2: WebMoti-Employ system flow**

Figure 2 shows the system flow. Webcam video, microphone audio, and eye-tracking data are used as system inputs. Speech recognition and AI analysis process the participant's spoken responses, while eye-tracking analysis detects whether visual attention is directed toward the interviewer. These processes generate real-time outputs in the interface, including AI hints, focus feedback, elapsed time, and filler-word feedback. The system does not make hiring decisions or score candidates.

This study was approved by TMU's REB. Fourteen neurodiverse participants were recruited. Participants completed a one-hour in-person session that included consent confirmation, pre-study questionnaire, system orientation, eye-tracking calibration, one 15-minute mock virtual interview, a post-study questionnaire, and a brief semi-structured interview. The mock interview used general interview questions and did not involve real hiring decisions. Participants selected either a helpdesk or government clerk interview scenario, and no job-specific knowledge was required.

Post-study measures included closed-ended ratings of system experience and perceived interviewee support rated on a five-point scale from 1 = strongly disagree to 5 = strongly agree, summarized using medians and interquartile ranges. Open-ended comments were reviewed using a narrative analysis approach to contextualize the questionnaire findings.

3 Results and Discussion

Participants rated WebMoti-Employ positively across the system experience questions. Ease of use, learning the system quickly, and ability to present oneself as intended each had a median of 5.00 (IQR = 1.00). Feeling in control was also rated positively, with a median of 4.50 (IQR = 1.25). Interviewee support was high for the interviewer, Mdn = 5.00, IQR = 0.25, and the WebMoti-Employ system, Mdn = 5.00, IQR = 1.00.

Open-ended responses helped explain these ratings. Participants described the system as understandable and smooth to use, with one noting that it was “easy and straightforward to use after receiving an explanation” (P1). Feedback features were also described as useful for attention and response awareness, including the “AI generated hint words” when one participant’s “eyes drifted off” (P5). Comments also identified areas for refinement, particularly around whether gaze-based feedback matched individual processing styles. One participant explained that their “eyes WILL BE roaming” because looking away helped them think (P6).

Overall, the findings suggest WebMoti-Employ was experienced as usable and supportive, while participant comments indicate that future work should refine how feedback was explained, displayed, and customized. The open-ended responses will be further examined through thematic analysis to guide revisions to feedback visibility, placement, and user-controlled display options, and be presented at ICCHP if accepted.

4 Conclusion

WebMoti-Employ provides an initial exploration of real-time interview support for neurodiverse job seekers in virtual interviews. Preliminary findings suggest that participants experienced the system as usable and supportive, particularly for ease of use, self-presentation, and interviewee support.

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Finding Friends: a Graph Representation of Relations in Novels for Serious Games

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Abstract. Narrative-based serious games and therapeutic role-playing have shown promise for improving social skills and mental well-being, yet extracting the relationships embedded in literary material remains a manual and time-consuming task. I present an automated construction pipeline for friendship-centered character networks from novel texts. I plan to evaluate the accuracy of the extracted relationships against an existing dataset of manually annotated character relations in 109 literary texts (RQ1) and to assess the practical utility for game designers through a controlled prototyping study (RQ2). This work aims to provide the first automated tool that moves beyond mere co-occurrence, enabling therapists and developers to rapidly identify supportive fictional relationships for personalized serious games. This research initiates a doctoral project that extends network extraction to fine-grained emotions (e.g., trust, mentorship) and validates its integration into various contexts (e.g. therapy, education, entertainment).

Keywords: Serious Games · Character Networks · Natural Language Processing · Machine Learning · Digital Humanities

1 Introduction

Serious games paired with in-person discussion can improve social skills [8]. Therapeutic Tabletop Role-Playing Games (TTRPGs) show promise for social skills and mental health: the cooperative, story-driven play builds collaboration, conflict management, and empathy, and fictional friendships often become catalysts for personal growth [1]. Belongingness and emotional well-being can be restored simply by thinking about favourite fictional characters from books or series [5]. Informed by these findings, I aim to develop a method that extracts social bonds from literature and presents them as a character network. Such a network would allow the identification of the most supportive relationships across an individual’s favorite stories, enabling personalized therapeutic games, or tabletop scenarios; without the bottleneck of first reading the entire source.

In order to guide this work, the following research questions are formed:

1. **RQ1:** How accurately can a machine-learning-based pipeline extract relationship networks of characters from literary texts?
2. **RQ2:** How does the availability of an extracted relationship graph influence the design efficiency of serious games by therapists and game developers?

2 State of the Art

The extraction pipeline proceeds in three steps [4]: (i) character occurrences are detected and unified through coreference resolution; (ii) interactions are identified according to criteria such as co-occurrence, direct conversation, or physical actions, yielding a time-ordered list; (iii) this list is aggregated into a static or dynamic graph, optionally merging or filtering characters. Perri et al. [6] analyzed Tolkien’s legendarium as an interaction graph without encoding the affect between characters. For detecting friendship, Zehe et al. [7] fine-tuned BERT on a manually labeled *Harry Potter* dataset, building on the earlier GRU-based approach of Kim and Klinger [3]. Recent mentioned studies employ the BOOKNLP pipeline.

Consequently, a distinct gap remains: existing graphs represent *interactions* but not *affective* relationships weighted by friendship strength. The proposed system is designed to address this gap.

3 System Design

A set of out-of-copyright novels is obtained from *Project Gutenberg*¹. The pipeline consists of three stages, followed by the classification of relationships and construction of a color-coded character network: **1. Character extraction.** The raw text is processed with the BOOKNLP pipeline, which performs tokenization, part-of-speech tagging, named entity recognition, and coreference resolution. **2. Interaction extraction.** For every pair of characters, all pairs of mentions that appear within N tokens are located. **3. Interaction classification.** A pre-trained BERT_{base} model is fine-tuned on the relational-emotions fan-fiction corpus². Each interaction context is passed through the classifier to determine if the interaction is positive or negative. **4. Graph construction.** For a pair of characters (u, v) , the relationship weight w_{uv} is computed by aggregating their interactions across all chapters.

$$w_{uv} = \sum_{c \in C} \frac{p_c(u, v) - n_c(u, v)}{t_c(u, v)} \quad (1)$$

where C is the set of chapters where u and v share an interaction context, $t_c(u, v)$ is the total number of interactions involving either u or v in chapter c , while $p_c(u, v)$ and $n_c(u, v)$ represent the number of positive and negative interactions between u and v in that chapter. The undirected weighted graph is built using *pathpy* [2]. **5. Visualization.** Nodes are the character names; edge weight equals w_{uv} . To visualize affect, edge colors are mapped from the global minimum weight (hostile; red) to the global maximum weight (friendly; green).

¹ <https://www.gutenberg.org>

² <https://www.ims.uni-stuttgart.de/forschung/ressourcen/korpora/relationalemotions/>

4 Methodology

To assess whether the extracted edge weights agree with human judgement, the friendship weight w_{uv} will be discretised into three categories: negative $[0.0 - 0.4]$, neutral $(0.4 - 0.6)$, and positive $[0.6 - 1.0]$.

To answer **RQ1**, these categories will then be compared against the annotated relations in a publicly available dataset³ that contains 2,170 human labels of character relations across 109 literary texts. Standard classification metrics will be computed (accuracy, precision, recall, $F1$). To answer **RQ2**, a controlled experiment will be conducted in which game designers and therapists are asked to design a short prototype (game or therapeutic scenario) centered on friendship based on a novel they have not previously read. The control group will receive only the raw text of the novel, while the experimental group will additionally receive the automatically generated character network. The time to complete the design task and the self-reported usefulness of the network as a design aid will be recorded and compared between the two groups.

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³ <https://github.com/dbamman/characterRelations>