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Conversational Web Browsing: Where Do Existing DesignGuidelines Fall Short?

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Abstract

Conversational interaction is becoming ubiquitous, offering new opportunities to make digital content more accessible and inclusive. While numerous guidelines exist in the literature to inform the design of conversational interfaces, these typically focus on "standalone" voice agents or chatbots. In this survey, we explore guidelines for *conversational web browsing*, a paradigm in which the conversational interface acts as a middleman between users and web pages. We survey the literature on conversational interaction and web accessibility to map design guidelines for accessible and inclusive voice interaction with web content.

CCS Concepts

• **Human-centered computing** → **Accessibility design and evaluation methods**; **Interaction design process and methods**; **Natural language interfaces**.

Keywords

Conversational user interfaces, Voice user interfaces, Conversational Web Browsing, Design Guidelines

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1 Introduction

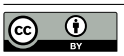
The Web has evolved over time but remains predominantly a visual experience, which can be inadequate for certain user groups or usage contexts and, in particular, for people who are blind or visually impaired (BVI). Although voice assistive technologies, such as screen readers, offer a way to access web content, their linear reading paradigm presents notable limitations [8]. These issues are compounded by the fact that many websites still fail to comply with accessibility guidelines [50], impeding screen readers from effectively interpreting HTML content. Moreover, even when websites are "technically" accessible, their design is often optimized for visual consumption, making the vocal transposition of content challenging.

Thanks to the recent advanced dialogical capabilities offered by Large Language Models (LLMs), Conversational User Interfaces (CUIs) and, more specifically, Voice User Interfaces[1] (VUIs) can offer an alternative interaction modality detached from the visual channel [2, 5]. If properly designed, VUIs could provide a more robust and operable means of interacting with Web content [39] not only for BVI users but also for other populations who might benefit from voice-based interaction in specific contexts.

Yet, contrary to textual chatbots, the potential of this technology to access the Web has not been explored. Currently conversational access to the web seems to be limited to specific tasks isolated from the main content of the page. For example, textual chatbots to handle customer care tasks [38]. With the rise of LLMs, information research tasks have become possible [42], with modern browsers like Arc [10] and extensions increasingly incorporating AI to enhance webpage access through content summarization. However, *conversational web browsing* remains a largely understudied task in VUI literature.

With *conversational web browsing*, we mean carrying out web browsing tasks, such as reading content, navigating across websites, or inputting data, through natural language interaction operated by voice. This paradigm requires voice agents to interact with and extract content from an external source (the Web), which is variable in domain, structure, and possible user actions. Furthermore, the Web has its own set of interaction patterns that must be adapted to optimally translate browsing to the voice channel. A few works in the literature that study how to improve the usability of screen reader-based navigation [19, 40, 54] offer important insights for conversational web browsing on how to overcome or mitigate specific challenges (like information overload or skimming through the content) that arise when conveying visual content through the auditory channel. On the contrary, in VUI literature, voice agents are studied as standalone applications with their own defined knowledge and capabilities. To the best of our knowledge, only one study proposes guidelines for conversational web browsing to address problems faced by BVI people [39].

Moreover, within academic literature covering design guidelines for VUIs, few works address the needs of people with disabilities, whereas other themes are more represented [30]: how to develop more human-like assistants capable of emulating elements and



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[1] In this paper we use the term VUI to refer specifically to interfaces with which users interact through spoken natural language. CUI on the other hand, is usually used more broadly to refer to interfaces where users interact though text as well

conventions of human dialogue [14, 17, 20, 29, 37], how to display empathic behaviors to their human partners [13, 27], or how to design usable VUIs [28, 41, 53]. However, the meta-analysis by Murad et al. [30] shows how accessibility is the least represented theme and how only a few guidelines were proposed starting from the needs of people with disabilities, leaving many open questions as to how to design accessible VUIs.

This paper reports on an analysis of the guidelines proposed in the literature, aimed to assess their coverage for conversational web browsing. The analysis revealed that current VUI guidelines present some key gaps, most notably related to verbalizing visual content and information hierarchy. Web accessibility literature, in particular works related to improving the usability of screen reader access to web pages provide insights that can fill these gaps. The paper is organized as follows: after discussing the state of the art (Section 1), we present the method (Section 3) of our analysis and the results (Section 4). Our finding are discussed in Section 5 and conclusions and future works are illustrated in Section 6.

2 State of the art

2.1 Web accessibility and usability for screen reader users

Web accessibility is still a prominent problem in the current Web environment, with most websites failing to comply with web accessibility guidelines [50]. However, even when a website is accessible, research has shown that web browsing still presents usability issues for users with vision impairments [18, 40]. For example, navigation can be difficult due to the sequential nature of screen readers. Information, in fact, can be communicated only in a sequential manner through audio, whereas graphical user interfaces allow sighted users to glance at a page and understand multiple characteristics at once. This can force users to listen to irrelevant content and hinder the discoverability of elements of interest, directly impacting the usability of content exploration. So, even when a website is coded respecting the WCAG guidelines (thus achieving "technical" accessibility), web browsing usability is not guaranteed.

In this context, some scholars argue that usability and accessibility should not be discussed separately and propose usability criteria targeted at addressing issues, like the one mentioned above, specific for users with vision impairments [25]. The criteria include proper content indexing to aid navigation or adding auditory feedback specific to certain actions. Other studies propose new features and approaches to improve navigation with screen readers. Zhu et al., for example, propose Sasayaki [54], a voice assistant that adds contextually relevant information to improve the understanding of web pages. Others focus on the concept of "aural glancing" [19], meaning understanding the sense of whole sections at once, to overcome the limitation of sequential rendering characteristic of screen readers. These works offer valuable input to design new VUIs that can grant usable web browsing experiences for BVI people.

2.2 Gaps conversational web browsing and VUI literature

Conversational web browsing has already been explored in the HCI literature through different approaches [3, 6, 11, 36, 49], as an alternative to screen reader-based web browsing or as an addition to it. Similarly to screen readers, this paradigm is based on the interpretation of the website HTML code; however, it allows the user to "dialog" with a website, enabling a structured discovery and fruition of the available content and functionality while prioritizing the usability of the browsing experience [39]. Baez et al., for example, propose ConWeb [4], a Web platform able to handle voice-based interaction for conversational web browsing thanks to a voice user interface deployed as a browser extension and a server module composed of microservices, each one in charge of managing a type of action users can perform on a web page, such as reading text, navigating link, or entering data. These works show how conversational web browsing has great potential in offering more usable ways of web browsing, particularly for users who have vision impairments. However, they focus on providing novel technology without offering design guidelines to generalize the design of voice interactions on the Web.

In voice interaction literature, to the authors' best knowledge, only the work by Pucci et al. [39] proposes design guidance specific for conversational web browsing derived from multi-step user research comprising interviews and co-design activities with BVI users. The user research highlighted multiple usability issues encountered by screen-reader users while browsing the Web, related especially to making sense of the global structure of the page and understanding the navigational context, which force users to intensively explore a website through trial and error before being able of operating on it. The authors then propose design patterns for a conversational interaction paradigm, which define strategies to present a website hierarchy and to enable content skimming, Q&A, and content bookmarking for easier access.

On the contrary, research on VUIs has produced various sets of guidelines [30, 31, 35, 51, 52], However, in this works, VUIs are intended as independent applications that do not interact with or have to present content extracted from another application, like websites. Additionally previous literature reviews[26, 30, 53] do not take into consideration this use case in their analysis, thus living the applicability of the current guidelines on *conversational web browsing* a topic yet to be studied.

3 Method

The overarching goal of our guidelines analysis was to answer this question: *"What is the current state of design guidance for accessible, conversational web browsing?"*. In particular, in deeper detail, we analyzed the works retrieved in the literature through the lens of the following sub-questions:

- **RQ1**: What challenges can be transposed from web accessibility literature to conversational web browsing?
- **RQ2**: What kind of knowledge is codified in inclusive VUI/CUI literature and web accessibility literature?
- **RQ3** What methods were used to generate the guidelines and heuristics proposed in the papers analyzed?
- **RQ4** How can we synthesize the knowledge offered in VUI and web accessibility literature?

With our RQ1 and RQ4 we wanted to identify insights from the present literature, by highlighting the knowledge already mapped by web accessibility research (RQ1) and by systematizing already

published guidelines (RQ4). With RQ2 and RQ3, instead, we wanted to identify gaps, either in the content of the guidelines (RQ2) or in the methods (RQ3) to suggest possible directions for future research.

To achieve our goal, we selected articles from the ACM Digital Library, Scopus, and Arxiv archives, using the queries summarized in Table 1. To search in web accessibility literature, since our focus is voice interaction with the web, we focused on screen reader navigation, because it is the closest approach to conversational web browsing being it based on audio output and relying on the verbalization of visual Web content. We included also Web Content Accessibility Guidelines (WCAG) 2.1 [12] in our corpus based on the assumption that guidelines for conversational web browsing should be coherent with web accessibility standards to fully reach the goal of having an accessible and usable conversational web. We did not include multi-modal, gesture-based, gaze, and other approaches that do not use voice as a primary channel. While we recognize that these approaches are important to grant access to the web to people with certain disabilities, since the scope of our research is understanding how to convey the web through voice, we excluded these contributions.

3.1 Selection

We retrieved only papers that contained explicit design guidance, excluding papers that provided only usability evaluations or technical prototypes, without reaching a generalized form of guidance for design; we also excluded papers not in English, not accessible online, and that did not offer guidance for voice interaction. We included all papers that, in their results, proposed structured design implications, principles, heuristics, design patterns, and guidelines. The full list of criteria is listed in Table 2.

The process is summarized in figure 1. In total, we retrieved sixteen (16) papers offering design guidance from VUI literature and six (6) papers from web accessibility research.

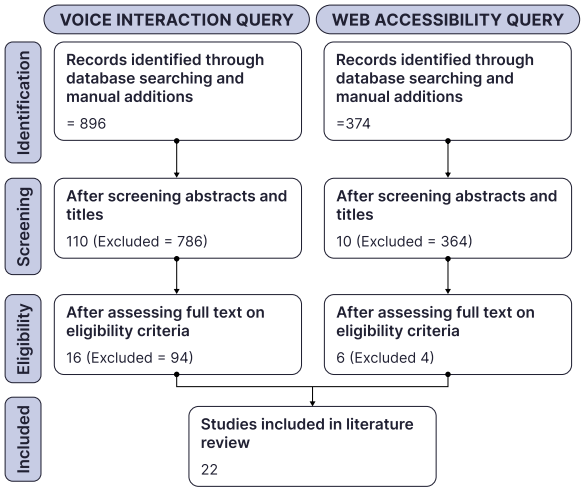


Figure 1: Diagram summarizing the selection process undertaken to identify the works to review

3.2 Analysis

The author went through the selected material, extracted all the guidelines, and compiled them in a table. The guidelines were retrieved as literally as possible; however, due to varying paper formats and result types, it was not possible to have a uniform style. Some guidelines, in fact, were formalized providing a title and a description, while others were one sentence only.

Two researchers then independently analyzed the extracted guidelines to verify their relevance and identify a suitable classification. To answer our research questions we used inductive coding to map how the contributions are formalized by the authors, across two dimensions: the *topic* of the guideline (e.g., privacy, language style, etc.), and the type of design guidance (e.g., challenges and gaps related to the design of conversational web browsing experiences, heuristics, design recommendations, etc.).

Finally, the guidelines were clustered following the categories proposed by Murad et al. [31] to arrive at a final consensus of 40 guidelines that could be applicable for conversational web browsing, which can be consulted at the link: https://github.com/anonim-author/submission-materials.

4 Results

4.1 RQ1: What challenges can be transposed from web accessibility literature to conversational web browsing?

To answer our first research question, we analyzed papers related to web accessibility and screen readers that focused on usability challenges related to the verbalization and reproduction in audio format of the information present on the web. These challenges provide insights into the complexities of accessing the web conversationally and can be useful in designing a conversational web browsing agent. Through the analysis of these works four main challenges were identified [1, 18, 19, 25, 40, 47].

Overcoming the sequential nature of audio content. The first challenging aspect of audio content is its intrinsic sequential nature. Through audio, in fact, information can be given one piece at a time, resulting in lengthy interaction sessions and hindering the discoverability of elements of interest reachable through multiple turns, directly impacting the usability of content exploration [18, 25, 40]. Thus, according to the literature, identifying strategies to reproduce the skimming mechanisms sighted users use to grasp the general meaning of a page are needed to improve navigation.

Understanding content and credibility. Another main challenge is gathering an understanding of the content presented in a webpage [19, 25]. To mitigate this, Leporini et al. [25] and Gadde et al. [19] empathize the need for clearly structured content and for delivering contextually relevant information all together. Furthermore, the work by Abdolrahmani and Kuber [1] shows a relationship between poor accessibility and lessened credibility of websites. Their work highlights how structured and topic-focused content is preferred by BVI, while the presence of unrelated content, poor tagging, and poor layout negatively impacted the participants' perception of credibility.

Navigating the content and grouping relevant information. Another fundamental usability challenge is understanding

Table 1: Keywords used to search for VUI and accessibility works

VUI queries	Web accessibility queries
("voice web browsing" OR "speech web browsing" OR "conversational web browsing" OR "voice internet" OR "voice web" OR "conversational web" OR "speech web") AND design? AND (guideline? OR principle? OR heuristic? OR consideration? OR "recommendation?" OR pattern?) accessib* AND ["voice interaction" OR "voice interfaces" OR "conversational interfaces" OR "conversational interaction" OR "dialog* interface" OR "dialog* system" OR "speech interface"] AND [guideline? OR heuristic? OR insight? OR principle? OR pattern?]	“screen reader” AND “usability principles,” “screen reader” AND “usability metrics,” “screen reader” AND “usability guidelines,” “screen reader navigation,” AND “accessible voice browsing"

Inclusion criteria	Exclusion criteria
Papers proposing formally design guidance as a result of their study in the form of guidelines, metrics, principles, heuristics	Papers not including formal design guidance
Papers explicitly about voice interaction	Papers about multi-modal or other modalities where voice is not the primary channel
Papers explicitly about voice web browsing	Papers about testing technical prototypes that do not reach any design guidance
Papers about improving the verbalization of web content	Papers not accessible to the authors
Papers about improving screen-reader navigation that explicitly offered guidance to improve the fruition of verbalized web content	Papers not in English

Table 2: The list of inclusion and exclusion criteria used to analyze the literature

how to navigate the selected content and retrieving the relevant information. Takagi et al [47] describe how BVI users navigate line by line, resulting in lengthy scanning interactions where users adopt different strategies to save time, like skipping through links at the risk of missing relevant information. Similarly, Gadde and Bolchini and Zhou et al [19, 54] illustrate how the lack of visual cues, like the visual relations between elements, also results in difficulties in distinguishing sections, re-finding information, and understanding contextually related content. Proper sectioning and hierarchy structures are thus needed for efficient navigation.

Receiving Feedback. Dynamic pages present an additional challenge to BVI users, which is being aware of changes in content [12, 25]. Users need confirmation feedback, notification of layout and structure changes. These types of feedback are usually visual and thus need to be translated to audio, either with short messages or sounds to guarantee awareness of the updates in the users.

4.2 RQ2: What kind of knowledge is codified in VUI/CUI literature and web accessibility literature?

As summarized in table 3, we identified four types of contributions: guidelines, heuristics, metrics, and design patterns.

Metrics evaluate the perceivable qualities of VUIs, like *diversity of vocabulary* or *perceived helpfulness*. They do not provide design guidance but offer parameters across different categories to systematize the evaluation of the perceived usability. For example, Borsci et al. [7] propose a new usability scale based on fifteen principles specific to chatbots, to evaluate end-users' satisfaction with the interaction. Notably, these works do not propose metrics specific to VUIs' perceived accessibility.

Differently, heuristics and guidelines both offer high-level usability guidance that can be employed by designers to design VUIs and evaluate the interaction. The difference in terms of scope between guidelines and heuristics is sometimes ambiguous; however, heuristics usually are presented as more generalized guidelines, while guidelines are derived from context-specific studies. These works propose new design guidelines and heuristics to avoid pitfalls specific to voice interfaces, such as dialogue management, data privacy, and socio-emotional qualities of the VUIs. For example, Suhm [46] and Park et al. [35] propose guidelines tailored to two different use cases: telephone speech interfaces and in-car voice assistants respectively.

Knowledge type	Number of works	Works
Guidelines	8	[15, 30, 31, 35, 44, 46, 51, 52]
Heuristics	3	[24, 34, 45]
Metrics	3	[7, 48, 53]
Design patterns	1	[39]

Table 3: Type of knowledge identified, their number and references

Topic	Number of guidelines identified
Privacy	3
Dialog	6
Personality and Empathy	3
Accessibility	1
Flexibility and efficiency of use	14
Visibility of system status	22
Error prevention	9
Error recovery and recognition	2
Help and documentation	4
Mapping between the system and the real world	24
User control and freedom	11
Consistency throughout the interface	2
Recognition rather than recall	7
Minimalism in design	11

Table 4: Topics identified in the analysis and the distribution of guidelines among them.

Lastly, design patterns are recommendations for designing solutions to interaction problems. The work by Pucci et al. [39] provides patterns for conversational web browsing and is the only source to do so.

In terms of internal organization, the guidance encoded in these works is usually mapped on classical GUI topics derived from Nielsen's [33] and Shneiderman's [43] heuristics and rules. However new categories specific to conversational interaction also emerge: dialog, with guidelines codifying how to structure the dialogue in terms of length, style and vocabulary [31, 35, 46]; empathy, explaining how to best express emotions or not [35]; and trust and privacy[31, 52], proposing principles about data management and about the perception of trust in conversational agents. Table 4 reports a summary of the distribution of the analyzed guidelines along such topics.

Notably, only Murad et al. [30] cite accessibility as a guideline category. Inclusive design guidelines are, however, proposed by the works by Striegl et al. [44] and Desai et al. [15]. They systematize their guidelines following the classical GUI classes; however their guidelines aim at providing rules to design inclusive interaction with VUIs for children and older adults.

4.3 RQ3: What methods were used to generate the guidelines and the heuristics proposed in the papers analyzed?

Two main approaches to derive the guidelines were identified: an empirical approach, where guidelines are derived from user studies with end-users [15, 39, 44]; a theoretical approach where guidelines are derived from previous literature about usability to synthesize new guidelines for voice interaction [30, 34, 51], often systematizing the new guidelines against Nielsen's [33] and Shneiderman's [43] heuristics [24, 31]. For example, Wei and Landay [51] modified Nielsen's heuristics for speech interfaces, integrating them with knowledge from other works in the literature [16, 46]. Sugisaki and Bleiker, [45] instead, combine usability heuristics with Grice [21] linguistic principles to derive a list of checkpoints to be used both for designing and evaluating text conversational agents across ten categories derived from Nielsen's heuristics. Lastly, Langevin et al. [24] propose a set of heuristics derived from Nielsen's ones, which they modified through expert feedback to evaluate both chatbots and voice interfaces.

However, most of the works analyzed lack a subsequent evaluation with designers, to assess the usability of the guidelines themselves, and with end-users, to validate the guidelines effectiveness. The work by Suhm [46] is the only work identified that presents a validation of their proposed guidelines, in which the authors apply the proposed guidelines to critique spoken dialogue systems.

4.4 RQ4: How can we synthesize the knowledge offered in VUI and web accessibility literature?

Lastly, from our analysis, we could synthesize unique guidelines that could be applicable to conversational web browsing and map them to relevant categories, merging guidelines derived from both VUI and web accessibility literature. Following the approach proposed by Murad et al. [31], two researchers began by identifying potential categories reflecting key design aspects, which would then serve as a basis for mapping the retrieved guidelines. After discussion, the set of 12 categories suggested by Murad et al. [31] was reduced to 9 categories (see Table 5) by merging some categories. For example, "Error prevention" and "Error recovery" were merged into "Error prevention and recovery", while "Flexibility and efficiency of use" and "Minimalism in design and dialogue" were merged into "Efficient communication and personalization" covering accessibility and linguistic and emotional qualities of the voice agent. The category "Considering how context affects speech interaction" was merged with "Ensure transparency/privacy" into "Trustworthiness and privacy," covering guidelines related to data management and privacy of spoken output. The choice of merging classes was due to the fact that some categories contained too few guidelines.

Semantically similar guidelines were also merged to avoid redundancy. For example, the guideline "The interaction with the Home Page must first convey the main thematic areas and the main

Class	Description	Number of guidelines	Guideline example	Sources
Mapping between system and language conventions	Dialogue should respect common conventions in terms of form and linguistic choices.	2	Follow dialogue conventions such as turn taking	[7, 24, 30, 35, 45, 46, 51]
System status and conversational context	Users should be informed when changes within the conversational context or system happen.	5	Focus on the new elements in the page first	[12, 35, 44, 51]
Recognition rather than recall	Deliver information only when relevant to not overload the user.	7	Only present information relevant to the task.	[7, 12, 15, 24, 30, 35, 44, 45, 51]
User control and freedom	Users should be provided with mechanisms to control the conversation.	8	Users should be able to skip dialogue and steps if they choose so.	[7, 12, 15, 24, 25, 30, 35, 39, 45, 46, 51]
Consistency throughout the interaction	Dialogue should follow consistent patterns for similar functions. Vocabulary should also be consistent across the system.	2	Components that have the same functions are identified using consistent and predictable vocabulary	[12, 24, 25, 30]
Error prevention and recovery	The agent should be equipped with strategies to prevent mistakes and recover from them.	4	Submissions are reversible and the agent supports mechanisms to review information.	[7, 12, 24, 30, 35, 44, 46, 51]
Efficient communication and personalization	System prompts should be brief and informative, users should be able to personalize the verbosity of the prompt and other characteristics.	5	Provide accelerators, such as shortcuts, bookmarks, abbreviations, and landmarks.	[7, 12, 15, 24, 25, 30, 35, 39, 44, 46, 51]
Help and documentation	The system should be equipped with scaffolding intents and documentation to guide users through the interaction.	4	The system should have a help function to help users discover what is possible to do.	[7, 46, 51, 52]
Trustworthiness and privacy	The system should convey trustworthiness by ensuring the privacy of user data and protecting the users' privacy and security throughout the interaction.	3	Provide opportunities for user data management. Allow the user to view and manage their personal data.	[7, 24, 30, 44, 52]

Table 5: Guidelines' classification example. The table shows the categories used to systematize the guidelines, a description of each class, the number of unique guidelines per category, an example of a representative guideline, and the sources. The full guideline list can be consulted here: https://github.com/anonim-author/submission-materials

navigational components" [39] was merged with "Logically partition the interface elements, grouping information, links, fields and so on in logical categories," [25] and "Divide the information into smaller chunks and deliver a summary first" [35] to create one unique guideline: "Divide the information into manageable chunks. Provide a concept-based organization of the information."

As a final result:

- From the voice interaction literature, we derived forty (40) guidelines conceptualizing how the conversational agent should communicate information.
- From the web accessibility works and WCAGs, a total of nine (9) unique guidelines were retained. These guidelines conceptualize how to interact with data inputs or how to notify users of changes on the website, in case of navigation updates or updates in dynamic content. They filled a gap

found in the analyzed voice interaction works, where these aspects were not explicitly defined.

The final set of guidelines[2] was further organized into two (2) broad categories, to distinguish between *browsing* and *scaffolding* guidelines. The first group comprises guidelines that regulate web browsing tasks, like navigation, the input of data, or content fruition, and includes twenty-eight (28) unique guidelines. The second group contains guidelines regulating actions to control the voice agent, such as starting and stopping the conversation or asking to repeat the last message. It comprises twelve (12) unique guidelines. This distinction reflects the peculiarity of conversational web browsing, in which it is possible to distinguish between two interaction layers: one with commands for controlling the browsing tasks and operating on the web pages, the other intrinsically needed to control the interaction between users and VUIs not related to browsing tasks.

5 Discussion

Our analysis highlights three main gaps in the current state of design guidance for conversational web browsing.

Lack of principles focused on manipulating and presenting content. Most guidelines are formulated for standalone voice applications and focus on how to match human dialog conventions and how to enable a natural conversation. Conversely, conversational web browsing requires interacting with external, highly variable web content, presenting challenges such as dynamic updates, complex hierarchical structures, all of which are not addressed in current guidelines. As our categorization shows, conversational web browsing involves both browsing tasks (content navigation and interaction) and control tasks (managing the conversational flow and agent behavior). However, few guidelines distinguish between these layers or address how to design for seamless transitions between them. Principles described in RQ1 stemming from screen reader usability literature address these gaps, providing guidance on how to best structure long form content for audio reproduction, how to support skimming or adapting visual content to audio. The inclusion of such principles in VUI guidelines challenges specific to conversational web browsing could be addressed. With the guidelines presented in RQ4 we propose a first synthesis of these guidelines.

Limited representation of diverse needs. As our RQ3 shows, most of the works analyzed had a theoretical derivation, with only three works [15, 39, 44] reporting on user studies involving people with disabilities or other groups with specific needs, like children and older adults. This confirms that also in academia diverse needs and abilities are still underrepresented in the design guidance, like the work by Branham et al. [9] already highlighted for commercial guidelines. Results from previous works on screen reader usability already contain valuable contributions illustrating the needs of BVI people when interacting with audio content. They provide guidance on how to tackle important challenges in voice interaction, such as skimming, summarizing, and creating a hierarchy to lessen the cognitive load.

Lack of validation with experts. Our results presented in RQ3 show how guidelines proposed until now have yet to be validated. Indeed, there is a lack of awareness of such guidelines among practitioners [23, 32], and practitioners also have a tendency to not adopt them due to the rapidly changing context they work in, or because they view them as too limiting or difficult to fit into their practice. Thus, a key point would be testing conversational web browsing guidelines with practitioners to arrive at a set of guidelines that can be easily referenced in design practice.

[2]The full list can be consulted here: https://github.com/anonim-author/submission-materials

5.1 Limitations and Implications for Future Work

The scope of our research was limited to structured contributions in the field of VUIs. However, many works involving people with disabilities do not prescribe formal design guidelines. Nonetheless, these studies contain potentially valuable insights that would be useful for making conversational web browsing accessible and inclusive. A separate analysis of their content could be conducted to include works that propose design recommendations or implications, to further strengthen the results of this work. Another limitation lies in the choice of keywords. For this work, we focused on literature that analyzed web usability from the perspective of BVI screen-reader users. However, we could extend the work to include more diverse needs, from the perspective of people with other disabilities or people who use other assistive technologies to browse the web.

In addition to the already presented limitations, our findings suggest relevant insights for the definition of design frameworks for conversational web browsing. Below, we outline key directions to guide our future work.

Develop Accessibility-Focused Design Guidelines. There is a clear need for user-centered studies, particularly involving BVI and people from other disability groups, to derive guidelines that address accessibility concerns specific to conversational web browsing. Future work should be aimed at conducting user studies to validate guidelines for conversational web browsing with end-users by testing the usability and accessibility of this paradigm with a diverse user group.

Bridge insights between screen reader and conversational interaction research. Screen reader usability literature offers valuable insights, such as strategies for content summarization, auditory feedback for dynamic content changes, and skimming, that can inform the design of conversational agents for web interaction. The guidelines here identified should be tested with end-users to validate whether they address the complexities of handling dynamic web content and are adequate to support usable multi-step conversational interactions typical of modern web experiences.

Define adequate design and development frameworks. To support the design of websites that are not only accessible but also navigable through conversation, it is essential to develop frameworks that natively accommodate this interaction modality. Achieving this requires understanding the tools and methodologies that designers need to create such websites, which can be achieved by involving them in co-design workshops. Furthermore, these frameworks should integrate accessibility and conversational guidelines directly into the design and development workflow, enabling practitioners to identify and address potential issues at every stage of the process.

Contribute to Standardization Efforts. Finally, there is an opportunity for the HCI and accessibility communities to contribute to standardization efforts. Bodies such as the W3C Web Accessibility Initiative (WAI) should consider conversational interaction modalities in future iterations of web accessibility guidelines. In the Italian context, public entities, like AGID that promote the adoption of accessibility guidelines and the standardization of public entities' websites through initiatives like Designers Italia [22], could invest in supporting this new modality as well.

6 Conclusion

Our analysis highlights VUI literature gaps in supporting conversational web browsing and how insights from the web accessibility literature can instead provide useful design guidance. To validate these results, the authors will conduct workshops with designers to assess the relevance of the identified guidelines for designing conversational web browsing experiences, and how guidelines should be systematized to be applicable. Studies evaluating the usability and accessibility of the final applications will further strengthen the guidelines' validity. The ultimate goal is to define a design framework that can assist the design of websites accessible through conversational web browsing paradigms.

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