

Accessible Tourism for Users with Hearing Loss*

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ABSTRACT

Tourism activities should be inclusive to all persons, no matter if they are adults, children, or disabled people. Websites and apps are powerful tools to plan and organize tours and trips, but in order to be targeted to a wide range of users, and to provide an effective and satisfying experience they should be accessible and usable. This paper concentrates on users with hearing loss, and presents some guidelines for the development of accessible and also usable tourism websites for them. It then proposes and discusses the specific case study of an accessible tourism website specifically targeted to users with hearing loss that want to visit the city of Venice, Italy in an enjoyable and inclusive way.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in accessibility**; **Accessibility design and evaluation methods**; **Accessibility technologies**; **Accessibility design and evaluation methods**; **Empirical studies in accessibility**; **Accessibility design and evaluation methods**;

KEYWORDS

Accessibility, Usability, Tourism

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1 INTRODUCTION

In 2001 the World Health Organization (WHO) publishes the “International Classification of Functioning, Disability and Health” (ICF), pointing out the effect that the environment and the social condition can have on the health state of a person, and also indicating a health condition as a combination of physical, mental, relational and social wellness [24]. The European Network for Accessible Tourism (ENAT) emphasises the relevant role of an inclusive Web design for tourism and promotes accessible tourism [21]. In Italy, a very important date is September 3, 2017, when the Italian Senate

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approves the legislative proposal “Proposta di legge 3 ott 2017, n. 302”, dedicated to deaf people, called the “*Legge quadro sui diritti di cittadinanza delle persone sorde, con disabilità uditiva in genere e sordocieche*”¹, which guarantees some rights for deaf people, and underlines the importance of accessible technological instruments dedicated to them. These instruments, and any other type of communication tools, should provide accessibility to historic, artistic and cultural events, and in general to tourism activities [20].

Given the importance of inclusion of people with impairments, in this paper we present some guidelines for the development of accessible and usable websites and tourism activities for deaf users, and we discuss a case study of a dedicated tourism website of the city of Venice.

The hearing loss illness. Hearing loss is one of the most common neurosensory deficit that can compromise the spoken language acquisition in children if it is not properly treated on time.

The medical term for this disability is *hyposcusia* when there is a reduction in hearing ability, *deafness* when the hearing loss is profound. The limited hearing capability can either be inherited or acquired: In the first case it is caused by a genetic factor, some viral infection or a toxic disease passed by the mother, in the second case by some viral infection or toxic disease acquired during childhood, or by some birth trauma [23]. From an audiometric point of view, the illness might be a *neurosensory hearing loss* which implies a damage to the vestibulocochlear nerve or to the inner ear or cochlea, a *conductive hearing loss* that is an interruption in the transmission of sound through the outer or middle ear, and *mixed hearing loss* which is a combination of neurosensory and conductive hearing loss. The gravity of the illness (mild/moderate/severe/profound hearing loss) is measured in terms of dB HL (decibels Hearing Level), i.e., dB relative to the quietest sounds that a young healthy individual hears. The normal threshold ranges between -10 and +20 dB HL, people that have a threshold above 20 dB HL are diagnosed with a hearing loss that is more severe when the minimal level increases. There is a relationship between frequencies and the level of a sound: The higher is the frequency, the higher is the level of the sound. People with a high frequency hearing loss have more difficulty hearing sounds like 'f', 's' and 'th' [11, 12]. Finally, depending on the time of appearance of the illness, the abilities of the person might be different: the preverbal deafness appears within 12 months of age when the child is still non-verbal, if it appears within 1 and 3 years of age, the child has acquired some minimal grammar and language structure, between 3 and 7 years the child has some communicative abilities, between 7 and 18 years the person is able to communicate but he might have a limited psycho-intellectual level.

Educational methods in Italy. Depending on the gravity of the illness and on the ability of the person, different educational

¹Translated as: Framework law for the citizenship right of people, with deafness, general hearing loss, and deaf-blindness.

methods might be applied. There are three major therapeutic approaches which are used in Italy: the *bilingual method* uses the verbal sounds of the Italian language, together with the standard *Italian Sign Language* (LIS), i.e., a visual language (for Italian) based on the use of signs; the *oral method* assumes the immediate application of a cochlear implant and the use of speech therapy rehabilitation therapies; the *bimodal method* assumes the use of verbal sounds and a set of signs, called *Italiano Segnato Esatto* (ISE), that is based on the LIS and some other signs that include prepositions, conjunctions, etc., or alternatively it uses the *Italiano Segnato* (IS), that uses LIS and the grammatical structure of the spoken language. Research on the topic [9] shows that the most efficient method is the first one, since LIS helps building both conceptual representations and the acquisition of the verbal language².

LIS is a way to let people with hearing loss communicate with the rest of the world and it is also used by part of the verbal community (i.e., parents, communication assistants, etc.) to hold a discussion. While LIS is a sign language used by Italian people, there are many other sign languages depending on the location in the world, e.g., we have the American Sign Language (ASL), the British Sign Language (BSL), etc., and only in the European Community there are 31 different sign languages, each of which might use the same sign with a different meaning [30]. LIS has its own grammar, morphology, iconicity, lexicon, and it can be considered as a real language. Finally, observe that LIS might be used also by other disabled users such as non-verbal Autistic users, people with Landau Kleffner or Down syndrome, etc..

Paper structure. In this paper we present some general guidelines for the development of accessible and usable tourism websites for deaf users, and we discuss a case study of a specific tourism website of the city of Venice.

The paper is organised as follows: Section 2 introduces the concept of accessibility, explores the state of art and related work regarding the design of a tourism website for deaf users, and proposes general guidelines for its development. It also points out the importance of an inclusive tourism activity. Section 3 presents our case study, focused on a accessible tourism website for deaf users. Section 3.3 describes our experimental results, and finally Section 4 ends the paper with some proposal for future work.

2 WEBSITE ACCESSIBILITY: RELATED WORK AND GUIDELINES

Accessible apps and websites allow users with different impairments such as different disabilities, age related limitations, old technologies, to use them without any limitation. On the other hand, usability, is related to the effectiveness, efficiency, and satisfaction of a product [31].

The Web Accessibility Initiative (WAI), is a W3C (World Wide Web Consortium) group that defines Web accessibility guidelines [31]. The first general Web accessibility guidelines for users with cognitive or neuronal disabilities were posed in 2012, by the Cognitive and Learning Disabilities Accessibility Task Force (COGA) group [1, 5, 7]. This group has worked from there on, and the most recent guidelines are dated 3 October 2018 [28]. In the literature we

can find other guidelines for usable and accessible websites dedicated to users with disabilities in general [4, 6, 10, 13, 19, 22, 26, 28]. For what concerns more specific disabilities, e.g., users with Autism Spectrum Disorders (ASD,) we can find different works, and some of them are also dedicated to tourism activities [2–4, 10, 13, 16–18, 22, 25, 26, 32]. Other guidelines are related to tourism activities for children [14, 15].

Focusing on people with hearing loss, we observe that they may not be able to enjoy a journey inside a website as the content may not be accessible to them. The first problem is the language: People with profound deafness that has started from the delivery, might have learned only a very simple and basic language with simple syntax, structure, etc. The sign language itself does not include articles, pronouns, prepositions, etc., thus, complicated and long sentences may not be easily understood. Another problem is the audio content: These users may not be able to hear audio tracks or videos.

Based on the above facts, different guidelines have been proposed in literature to make a site accessible to users with hearing loss. We will now discuss all the guidelines we have collected and we propose a systematic classification.

Firstly, we followed the standard international accessibility reference model of WCAG 1.0, WCAG 2.0, and WCAG 2.1 [6], and other guidelines provided in [27–29, 31]. To these, we have added new proposed features, and we thus now provide a list of specific guidelines for an accessible and usable tourism website for people with hearing loss (these guidelines cover also the standard accessibility design). In Table 1 we will consider aspects such as Language, Navigation, Design, and Users.

As we can see in Table 1, a very important role is played by the language that should be very simple, pronouns, conjunctions should be limited (they are not used in LIS), sentences should be short.

Navigation should be simple, *predictable* and consistent in every page to avoid that the user gets lost.

The design and the structure should be predictable, simple, and clear; the content focused on the target of the website. Multimedia content, such as audio and videos, should have captions that contain a translation into text of all the words and also a description of other audio features such as the tone of voice, music and sound effect, etc. Each audio should also be accompanied by a video in sign language (either outside or inside the original video). The interface should be *perceivable* and *responsive*, blinking and moving objects should be avoided.

The website should engage the users providing clear information and at the same time proposing tourism activities that can be enjoyed and are physically accessible also by the targeted users. An example could be a visit to a museum illustrated by a LIS interpreter, a Holy Mass in LIS, etc. To this aim, note that on the Web there are many proposals of tourism activities for deaf users. A novelty here is that we are focusing on accessible and usable websites that also propose and illustrate in a simple way physically accessible tours. We are convinced that accessibility should thus be provided at 360 degrees.

As a final remark note that, while most of the proposed guidelines apply to accessibility in general (i.e., follow a Universal Design), we are also adding some specific ones to improve the journey to

²Following this philosophy, in this work we concentrate on deaf people that have limited knowledge of the language and mostly use sign language to communicate.

Table 1: Accessibility and usability guidelines for users with hearing loss

Language	
1	Simple and precise language, use short sentences and lists.
2	Specify the subject and do not use the impersonal form.
3	Use standard terms and remove redundant ones.
4	Avoid acronym, abbreviations, non-literal texts, and jargon.
5	Nouns should replace verbs.
6	Define logical order of sentences (divide in steps).
7	Use only a positive language (avoid negation).
Navigation	
1	Navigation should be simple and predictable.
2	The navigational structure should be consistent in every page.
Design	
1	The design and website structure should be simple, clear and predictable.
2	The content should be focused on the target of the website.
3	Blinking and moving objects should be avoided.
4	Multimedia content (audio and videos) and images should contain captions.
5	Each audio/video should also be accompanied by a video in sign language.
6	The interface should be perceivable and responsive.
7	The text should be distinguishable (with a good contrast and size).
8	Text fonts should be compatible (to be displayed on all screens/browsers).
User	
1	Try to engage the user.
2	Propose tourism activities which are inclusive.

people with hearing loss. These new guidelines are a plus, and are not limiting accessibility to other categories of users.

3 LIS VIVE: AN ACCESSIBLE TOURISM WEBSITE FOR THE CITY OF VENICE

In this section we describe our case study, i.e., an accessible website for users with hearing loss that want to visit the city of Venice and want to know which activities are dedicated to them. All the details are illustrated in [8]. Note that, while the site is dedicated to this specific category of users, it also follows standard accessibility rules and is thus enjoyable by any user (disabled, old, etc.).

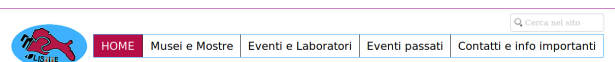


Figure 1: The menu of LIS viVE.

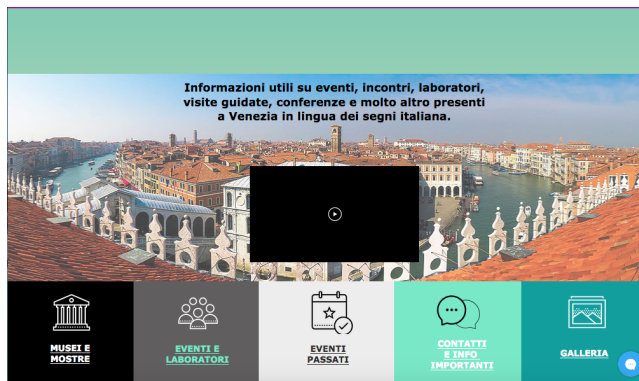


Figure 2: Part of the Home Page of LIS viVE.

3.1 The LIS viVE website

This website, called *LIS viVE*³, has the aim of being:

- (1) very simple in the navigation and the content;
- (2) accessible to all users, and in particular to users with hearing loss;
- (3) exhaustive regarding all the tourism activities offered to deaf users in Venice⁴.

The site has been developed using Wix⁵, following the accessibility and usability guidelines presented in previous Section 2, in order to be particularly inclusive for the chosen target (and in general for all users). Also the proposed tourism activities are physically accessible and enjoyable.

The website contains a menu with four pages besides the Home Page (see Figure 1) that include different tourism activities in Venice for people with hearing loss (see Figure 2):

- Museums and Exhibitions (Musei e Mostre, see Figure 3) contains information about institutions that offer tours for deaf people (e.g., Palazzo Grassi or the Museo Archeologico Nazionale).
- Events and Labs (Eventi e Laboratori) contains different posts on activities offered to deaf people, such as Holy masses in LIS, accessible movies, etc..
- Old Events (Eventi Passati) that have been offered in the past.
- Contacts and Important Information (Contatti e Info Importanti) which includes a gallery of photos and posts arranged according to different topics. There are also accessibility information regarding support offered to disabled people at the train station, at the hospital, e.g., videos in LIS, etc. (see Figure 4).

³www.beltramelisa.wixsite.com/lisvive. The content is written in Italian.

⁴The content is targeted to these users.

⁵https://www.wix.com/

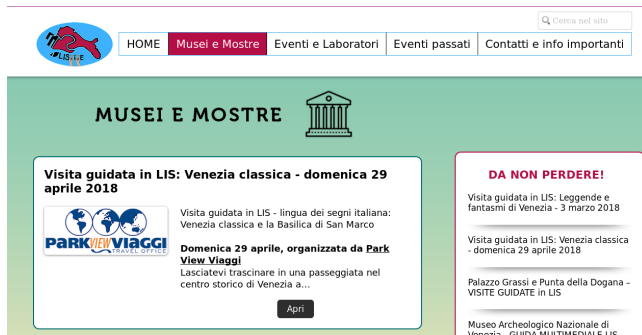


Figure 3: Part of the Museums and Exhibitions page.



Figure 4: Important information in LIS viVE.



Figure 5: The logo of LIS viVE.

There is a search tool called “Cerca nel sito”. The logo contains a sketched map of Venice and the title “LIS viVe” refers to the LIS language, to the term Ve (Venice), and to the term viVe that in Italian means “Is alive”. Moreover, the letters V have been depicted using the LIS sign for letter V (see Figure 5).

3.2 Accessibility and Usability of LIS viVe.

We now refer to the accessibility and usability guidelines defined in Section 2. From an accessibility point of view, the site is:

- *Responsive*: may adapt to mobile phones, to different screens and browsers.
- *Compatible*: the font is Verdana and the font-family sans-serif which can be well displayed by all browsers and also by low resolution screens.
- *Distinguishable*: text is in black inside a white square (or vice versa), providing a very good contrast between the colours of the background and the one of the text, and the font size is bigger than standard one.



Figure 6: The newsletter and suggestion form of LIS viVE.

- *Perceivable*: the language of the page has been specified, and for each image there is an alternative text that can be used by screen readers.

From a usability point of view:

- *Home Page*: adaptable to the requests of different users.
- *Navigation*: the user may follow a simple navigation menu. Links to secondary or external pages are indicated using a bold blue text, while links to Google Maps are in blue underlined text.
- *Structure, Layout and graphics*: very functional and simple. The main page contains a video in LIS with a description of the site content.
- *Text*: the length of the text is quite short and easy to read, and important words are emphasized using the bold font to be easily distinguishable.
- *Syntax* of the content: is simple and clear.

Regarding the layout and the navigation, they are very simple and easily understandable. To improve the quality of the website in the contacts page we have included a form that users may fill to give suggestions. Users may also subscribe to a newsletter to receive more information on the offered events and on new posts (see Figure 6). In both forms only name and email are requested to simplify the filling of the form and to limit the private information that has to be provided.

The text is short, and some words have been written in bold to be more noticeable (see Figure 7). While this, together with colored and underlined links is not appreciable by users with visual impairments, it is however not limiting as the text remains clear and readable.

Regarding the content, only relevant information has been provided and more details may be accessed by clicking a link that connects to the official page of the event (see Figure 4, the word to click is **Apri**, i.e., open). Regarding the evolution of the content in the website we are presently removing old posts and adding new ones, in order to limit their number and to simplify the search inside the site.

The real novelty with respect to existing websites is the proposal of a video in LIS that illustrates the content of the whole website (see Figure 7). In this way, the site is more predictable and users with hearing loss might improve their navigation ability.



Figure 7: The video in LIS.

The used language is, simple and clear, paragraphs are short. Moreover, to simplify the comprehension and to ensure thoroughness in the coverage of the topic, we have followed the **5W rules**⁶ (partially is shown in Figure 3), by including in each post: **Who** organizes the event; **What** is offered or proposed; **When** the event is offered (day, time, etc.); **Where** the event or the activity takes place; and **Why** the event is offered.

Finally, observe that while developing the website we have followed all the standard accessibility guidelines. The site has been successfully tested with ChromeVox and Chirpy, two extensions for Chrome that can be used by blind users that want to navigate inside the site. We have also run a standard accessibility check and while standard accessibility guidelines are all followed, there are very minor issues in the css code generated by Wix that cannot be fixed being the code not open source. Despite this, experiments have shown very positive feedbacks given by the users (see the next section).

3.3 Experimental results

In this section we describe the *methodology* we have followed to develop the LIS viVe website, and we then illustrate our experimental results. We have developed the website following four different phases:

- **Literature survey:** The collection of related material is fundamental. We have searched all the existing guidelines that, to the best of our knowledges, have been proposed in the literature to establish accessibility features for tourism websites for users with hearing loss. Following these guidelines we have defined the features that the site should have, e.g., just to mention few of them, the use of a very simple language, the inclusion of a video in LIS (in LIS as the website is in Italian), etc..
- **Interviews:** In the second phase, we have conducted an interview to a set 36 users with different hearing loss impairments. The idea was to understand if a dedicated website for tourism activities in Venice was an interesting proposal, and what users with hearing loss would expect to find inside.

The questions were divided into two parts:

- (1) The first part was composed of standard questions such as age, if the user had already visited Venice, if they wanted to

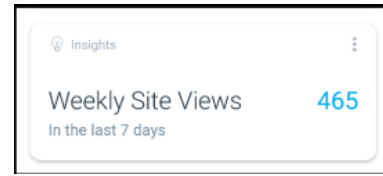


Figure 8: Number of visualizations of Lis viVe in a week.

visit it in the next future, and if they have never used some LIS interpreter for a visit. The answers clearly showed the interest of visiting Venice and having tours in LIS (29 Yes out of 36 answers, i.e., 80%).

- (2) The second part was related to the use of the Web: 86, 1% of the users use it all the time, 13, 9% sometimes, 51, 4% of the users usually navigate in sites dedicated deaf people, 48, 6% no. Finally, 41, 7% of the users would greatly be interested in navigating in dedicated websites with information about tourism activities in Venice, 30, 6% would be interested enough, 16, 7% would use it sometimes. Regarding the content, the users were asked what they wanted to find inside the site (answers could be multiple), and 75% of the users replied a video in Italian with captions, 55, 6% a video in LIS, 38, 9% written text, and 36, 1% chats to retrieve information.

More details can be found in [8]. In conclusion, according to these interviews it emerges the great importance of developing a dedicated website containing videos (with captions or in LIS), written material, information on dedicated tourism activities in LIS in Venice (this result is totally independent from the use or not of cochlear implants by the interviewed users).

- **Website development:** In the third phase we have developed the dedicated website applying the usability and accessibility guidelines discussed in Section 2, and the suggestions an hints collected in the literary survey and interview phases. We have also conducted an interview with a colleague that is an expert in people with hearing loss and LIS language in order to understand if the first draft of the website was accessible or not. Then, we have changed and finalized the website according to some interesting suggestions that we have received.
- **Assessment questionnaire:** In the final phase we have collected the impressions of the users through an assessment questionnaire, and we have evaluated the perceived impression of the website. We have advertised the website through institutions, associations, social groups (Facebook), and deaf friends. In a week we gained 465 website visualizations, as it is reported in Figure 8.

Questionnaire results: The contacted persons navigated into the site and 69 of them have filled out the questionnaire. The first questions were general as the city of origin, which includes many cities inside Italy and also London, and how they found out about the website, and most of the users replied that they became aware of the website thanks to a friend friend (65, 2%), or Facebook (27, 5%).

⁶These rules have been attributed to Hermagoras of Temnos, 1st century BC.

Table 2: Results of the assessment questionnaire proposed to 69 users.

QUESTIONS	Score 1	Score 2	Score 3	Score 4
Available information is clear?	0	0	28	41
The site content is accurate and exhaustive?	0	0	28	41
Navigation is simple?	0	0	28	41

Table 3: Results of the general satisfaction questionnaire proposed to 69 users.

QUESTIONS	Score 1	Score 2	Score 3	Score 4
Are you satisfied about this website?	0	0	28	41

Regarding the user satisfaction, we have created a scale from 1 to 4, where 1 is not at all, 2 is little, 3 is enough, 4 is a lot. In general, the users were very much satisfied about Lis viVe website. The main results are summarised in Table 2, and more details may be found in [8].

Regarding the general customer satisfaction we have asked to reply with a score that ranges from 1 (very unsatisfied) to 5 (very satisfied). The results are summarised in Table 3.

In conclusion, the users were all very satisfied and they claimed they would recommend the LIS viVe website to other users.

4 CONCLUSION AND FUTURE WORK

In this paper we have underlined the importance of inclusion in the organization and proposal of tourism activities. We have focused on a specific set of users, i.e., people with hearing loss, and we have shown the importance of developing dedicated websites that can improve the satisfaction in the navigational phases, i.e., during the organization of a tourism activity. We have also underlined the relevance of the proposal of specific dedicated activities, in this specific case guided tours or activities in sign language. While we have focused on this specific set of users, the discussed guidelines and the website remain accessible to all the users.

We are currently studying accessibility guidelines for blind users, and we are developing an accessible dedicated website for people with visual impairments that want to visit the city of Venice.

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