A Framework for Information Accessibility in Large Video Repositories

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ABSTRACT

Online videos are a medium of choice for young adults to access or receive information, and recent work has highlighted that it is a particularly effective medium for adults with intellectual disability, by its visual nature. Reflecting on a case study presenting fieldwork observations of how adults with intellectual disability engage with videos on the Youtube platform, we propose a framework to define and evaluate the accessibility of such large video repositories, from an informational perspective. The proposed framework nuances the concept of information accessibility from that of the accessibility of information access interfaces themselves (generally catered for under web accessibility guidelines), or that of the documents (generally covered in general accessibility guidelines). It also includes a notion of search (or browsing) accessibility, which reflects the ability to reach the document containing the information. In the context of large information repositories, this concept goes beyond how the documents are organized into how automated processes (browsing or searching) can support users. In addition to the framework we also detail specifics of document accessibility for videos. The framework suggests a multi-dimensional approach to information accessibility evaluation which includes both cognitive and sensory aspects. This framework can serve as a basis for practitioners when designing video information repositories accessible to people with intellectual disability, and extends on the information presentation guidelines such as suggested by the WCAG.

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CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**; **Accessibility**; • **Information systems → Users and interactive retrieval**.

KEYWORDS

Accessibility, intellectual disability, video search

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1 INTRODUCTION

The profusion of online videos, including instructional videos, is one of the greatest opportunities that the digital information age has brought to people with intellectual disability. Indeed, people with intellectual disability [1] can rely on the visual and audio features of videos in order to access the information it contains, and the multiple ways that a single type of instruction (for example, cooking pasta) may be presented enhances the chances that there exists an instructional video that suits both the preferences and needs of each individual. Indeed, one of the recommendations for cognitive accessibility is that text (language) be augmented or replaced by visuals [1].

The challenge that remains is to provide users access to these videos that suit their needs and interests. Most search interfaces are failing to embed visuals in every step of the process, with querying (except for querying with emojis) and search engine results pages (SERPs) (except for thumbnails) relying highly on words. Further

[1] Intellectual disability is also referred to as cognitive impairment, and sometimes learning disability. It can include a number of cognitive difficulties (eg. memory, reading, sequencing) and can be recognised through support needed in daily living [18]

to this, while there has been research considering the inclusion of accessibility of documents (more often in the form of readability measure) as part of search results ranking, what makes a video accessible remains uncertain.

Inspired by field observations of people with intellectual disability engaging on the YouTube platform, we present in this perspectives paper a framework to situate the various aspects of accessibility. We propose that they need to be accounted for when building a large video repository that inclusively supports people with intellectual disability to access information through these videos. Through this framework, we make apparent search accessibility as an essential feature. After introducing relevant related work, we present the case study and field observations. We then present the framework, and discuss its broader applicability.

2 RELATED WORK

2.1 Information Accessibility Guidelines

While opportunities for people with intellectual disabilities (ID) are improving due to developments in technologies, people with ID are not accessing them to the same degree as other groups of the population [10]. The accessibility of technology not only depends on what it can be used for, how easy it is to use and its appearance, but also how well it satisfies the needs of the user [9]. Many efforts such as the Web Accessibility Guidelines (WCAG) are designed to assist in making the Web more accessible to people with disabilities and creating a more inclusive society [1]. Researchers have investigated the barriers which impede Web access for people with ID. Social barriers include lack of education and training, financial barriers, and limited policy and governmental support [11]. Individual barriers, are associated with the cognitive and physical demands of Web access. The efforts made to build a more accessible Web (i.e. WCAG [1]) have been criticised for being insufficient to support the needs of people with ID [9]. The authors observe that WCAG focuses on non-cognitive impairments (i.e. visual and sensori-motor impairments), leaving cognitive impairments such as limitations in sequential reasoning unaddressed.

2.2 Document Retrievability

Outside of research investigating access for people with disability (or special needs), information accessibility is defined and measured for a given document (or a set of documents presenting a piece of information) as the likelihood that it will be found by a user who searches for it. It can be done from a system's perspective, as retrievability, where simulations can then expose the limitations of a search function in this regard [4]. This approach can provide a great insight into the best scenario of what users may achieve within a large-scale system, but does not account for how users may actually search. It can also be considered from a user's perspective, as findability, by involving users in using their own strategies to retrieve the information and measure how often they are successful [12]. Although this is still a measure of the system, not of the users, this approach also does not account for user's individual preferences and strategies, and typically assumes that the access platform itself is appropriate.

2.3 Information Access by People with Intellectual Disability

Rocha and colleagues have established a program of research to support online information access for people with intellectual disability [13–15]. Through their research, they found that people with intellectual disability are keen to access information online, and that they are motivated to complete tasks. They also found that when using a purpose designed application to access videos, which uses only visuals for interactions, they were able to complete pre-determined queries. Sitbon and colleagues [5, 6, 16] have observed how young adults perform various information access tasks, through search engines, voice search and social media. They have shown that users were able to use support from people around them to perform the various aspect of online information seeking, and that visuals were a key feature that supported them [16]. They also found that a large majority of young adults with intellectual disability were using Youtube [6], that voice search can be empowering and effective for querying but more support is needed for information access beyond the query [5], particularly in instances where the system cannot understand a user properly. Because of their visual nature, platforms that provide information in video form are good candidates to provide information that is accessible and in an accessible manner to people with intellectual disability [2].

3 FIELDWORK

We wish to point to a number of observations that we (the authors) have made through 4 years of field work, on of how users with intellectual disability approach and use Youtube, including but not exclusively for accessing information.

It should be noted that, at the time of writing, information can be accessed on Youtube thanks to the following features: textual query (the traditional search bar), subscriptions (get content from select sources), recommendations (get related videos tailored to user activity), browsing using topic and categories, and other users activity (trending videos). Youtube autoplays recommended or channel videos in sequence, acting as an unilateral information distribution device. Youtube also offers a social media platform where people can discuss videos and generate additional information. Other video delivery platforms offer similar information access features.

3.1 Context

The observations we have made were during fieldwork conducted by 4 members of the research team. Some of these observations were made incidentally during time spent in one of four community based centers over a period of 4 years where we explored how people use information access technology [16] and social media [6], but also investigated new types of interactions [17]. Some of the observations were made during technology use workshops, called "Techshops", which we conducted over a one year period. These workshops engaged young adults with ID from two of the community centers in learning how to use everyday technologies including YouTube and social Media [7]. Other observations were made during an ethnography of four participants with complex communication needs who also attend one of the community centers, for more details see one of the case studies [8].

3.1.1 Participants. Each center hosts between 20 and 30 adults with intellectual disability. In this context, intellectual disability is defined in participant's terms, where they have been requesting support by the organisation to help them develop skills in day-to-day living and social participation skills, including functioning in literacy and numeracy. It is not attached to a specific diagnosis or an average intellectual quotient.

3.1.2 Data collection and analysis. The observations presented in this paper constitute a reflection on the fieldwork conducted, either as part of studies addressing different research questions, or incidentally to other studies. As a result, there is no single methodology of data collection or analysis that can be pointed to here.

3.2 Observations

In a study focusing on social media and conducted in 2018 [6], we formally observed that 100% of people with ID used YouTube, with a few sparingly using among social media and Google. The characterization of participation in YouTube was however solely for entertainment purposes such as listening to their favorite music, watching movies (drama, or children's shows). Participants with complex communication needs also all use Youtube to watch videos.

In a separate study [17], we formally observed that participants browsed through with content on YouTube using recommended videos on YouTube. However, browsing is typically based on what appears, not necessarily selective. Also, we haven't observed them skip forward or go to another video when the video they are watching does not seem relevant, most likely because they are not approaching the platform with a specific goal or purpose in mind. During the ethnography [8], we have observed that three of the participants with complex communication needs operate the platform collaboratively with a person who supports them. One of them, who is non-verbal, operates it independently, effectively browsing using the recommendations. He has demonstrated his ability to use the recommendation very rapidly and in an ontological manner in order to reach a very specific video he is searching for.

During the Techshops[7], searching was found challenging due to issues with typing and spelling. We introduced the workshop participants to voice search. While they truly enjoyed it, its usability was difficult across participants. Also, we found in a previous study involving search using voice on mobile devices [5] that this is generally because recognition is not robust when people have stutters, simply speak quietly, or pause too long between hearing a question and thinking of answer (when using voice assistants in this case). Also, voice search does not support people in phrasing their query any more than an empty text box, and quite often participants need prompting, discussion and suggestion in order to establish clearly what they may query.

4 PROPOSED FRAMEWORK

Considering Youtube's widespread adoption amongst adults with intellectual disability, an argument could be made that the platform is already accessible to people with intellectual disability. However, our observations suggest that while that may be the case for "shallow" features, the platform does not support agency in an information access scenario. From there, we suggest that the notion of accessibility needs to be established in a way that accounts for not only web accessibility (ie. accessibility of menus or buttons with a screen reader), but also search (or browsing) accessibility (ie. how accessible are interactions with the system) and media accessibility (ie. whether a search result itself, in this case a video, is accessible). Our proposed framework in Figure 1 illustrates how information access can indeed be decomposed into information availability, information organisation and information presentation and how each of these need to be accounted for to ensure that information provided through video media can reach users in their terms. We further define what aspects of search accessibility and media accessibility may require attention when establishing the accessibility of a large video repository in sections 4.1 and 4.2 respectively.

The framework also illustrates how existing measures employed by video platforms (or to evaluate them) contribute to the broader notion of accessibility: how relevant to the user are the results of a platform to an expressed information need (information need relevance), what is the likelihood of a relevant video to be retrieved by the platform (information retrievability), and how well does a video convey a piece of information (information quality). These measures can and should also be adapted to embed accessibility, in a similar fashion that relevance measures of text document can account for their readability. Using this systems-centered perspective, one could for example chose to devise a measure of the accessibility (ie. retrievability) of the accessible documents in the collection. Measures of the quality and veracity of the information may also be accounted for, as well as approaches that may consider the relevance of documents provided to a user on the basis of their information need. These may be implemented using classical information retrieval approach, however would likely need to be adapted to a wider audience.

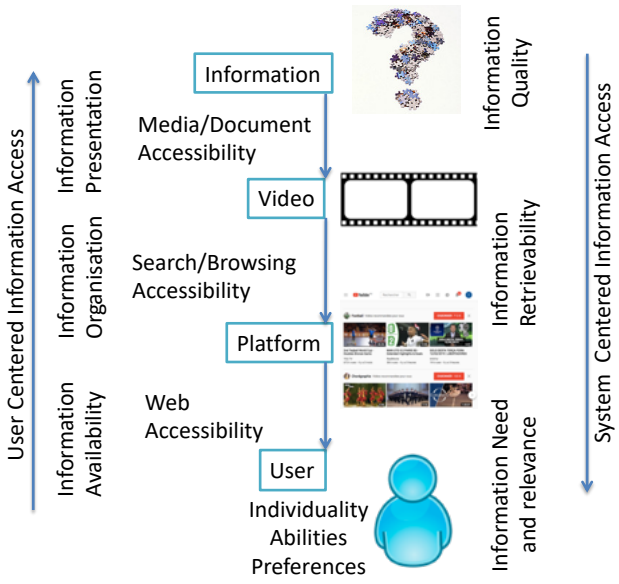

Figure 1: Information accessibility in video repositories

4.1 Search accessibility

While there is in theory a lot of elements of multimodality in a platform such as Youtube (ie. text, images and videos can all be actionnable content), the actual search interface is not truly multimodal and makes surprisingly little use of images for representing content outside navigation. Yet the main opportunity for agency in accessing information is currently the use of images in recommendations lists. Still, recommendation algorithms are not necessarily supportive of (or intended to) helping users express and refine an information need, but rather building on popularity and a little bit of serendipity. The voice search alternative presents a first step in extending the accessibility of the querying stage in the search process, but may still not be accessible to users with intellectual disability and does not support visuals and suggestions

The other aspect that need to be inspected in terms of search accessibility are the results lists, which at the moment tend to consist of a single caption image (which is not always representative, and often contains text), and text, as well as popularity features. A results list that could be more accessible should include several images for each video in the list, in a way that describes its content. It may also have a stronger emphasis on the accessibility features of the video, or the list itself could favor more accessible content.

4.2 Media/Document Accessibility

While any video could be considered accessible by a person with no visual or hearing difficulty, there is a range of factors that may make them not appropriate to provide information to users with intellectual disability. These include:

- Understandability of the language used in the video
- Sensory overload (voice and music, movements, colours, ...)
- Pace (speed of language, sequences duration, pauses, ...)
- Use of visuals to support meaning (instead of visuals of someone talking, or unrelated images).

There is probably no one size fits all when it comes to cognitive appropriateness of a video (and therefore accessibility to its information). Perhaps an accessible platform would ensure that all information is available in a variety of media, supporting diversity of information presentation and providing choice to users.

5 DISCUSSION

The framework that we propose in this paper highlights various aspects of accessibility that should be accounted for when designing a large video repository accessible to people with intellectual disability. We presented suggestions of what could make search more accessible from a video collection perspective, and what could make videos more accessible from an information perspective. However, these are not yet guidelines, and further research is needed to establish what criteria may be measurable and worth measuring.

It is also important to keep in mind that every user is different, and that there may be several strategies employed to reach accessibility. Personalisation is one approach, where users are presented with interactions that are tailored to them. Diversifying search results is another approach, where a system may seek diversity of styles of videos, as users can choose the one that suits them best. Restriction may be another approach, by only selecting features and content that is built to be accessible to all. Depending on the audience, a video repository provider may want to consider any of these approaches at any stage in our framework.

Implementation of our proposed framework, or parts of it, can explore and make use of technologies developed for large video collections, search as video linking [3] and recommender systems (which may provide advances in browsing), or video summarisation (which may support media accessibility).

While the framework is inspired by people with intellectual disability it likely has applicability to people with other sets of abilities, as well as situational abilities. For example, video captioning [3] can enhance the accessibility of videos, not only to people who have hearing difficulties or impairments, but also in situation where people may want to watch images without the sound (eg. in a cafe). Similarly, considerations for web accessibility apply beyond including people with disabilities, and consider accessibility of websites through a variety of platforms, using visuals or audio or touch as a variety of ways to interact.

Further suggestions to improve the accessibility of a video access platform may include: represent content of videos in results (keyframes, content summarisation or description generation); account for and display content accessibility ratings; help with query composition (accessible voice search; suggest reformulations; attach images to phrases); bridge search and browsing facilities (i.e. include topics in search results, queries in categories); help users focus (disable advertising, highlight important parts of the sequence).

While our framework covers aspects of interface and functionality, it does not account for the context of use. Yet, this is essential in considering long term use and accessibility by people with intellectual disability. For example, our case study included people participating in technology workshops, who will develop competencies and habits to use such platforms. What may not be immediately accessible, or may be confusing or overwhelming at first, may become appropriated in the long term. Another example that our case study highlighted is the use by people in an interdependent setting, where a user with complex communication needs may partner with a supporter in order to reach their information goals. Finally, our framework does not include aspects of information use, including storing, sharing and recalling. For example, a video may lend itself better to recalling how to cook if the setup displayed in the video is similar to that of the user.

6 CONCLUSION

The framework we are proposing can serve as a basis to establish comprehensive accessibility criteria or measures, whether it is to establish the inclusiveness of a general purpose video access platform, or to design access to a specific video collection in a website dedicated to users with intellectual disability. While the framework does not in itself establish such criteria, it suggests some aspects that can be considered. We suggested a number of approaches to improving accessibility, which opens up avenues for future research.

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REFERENCES

[1] [n.d.]. Web Content Accessibility Guidelines (WCAG) 2.1. https://www.w3.org/TR/WCAG21/

[2] Hanadi Hussein Alqahtani and Naomi A. Schoenfeld. 2014. Teaching Cooking Skills to Young Women with Mild Intellectual Disability: The Effectiveness of Internet Websites. *Current Issues in Education* 17, 2 (June 2014). https://cie.asu.edu/ojs/index.php/cieatasu/article/view/1302

[3] George Awad, Asad A Butt, Keith Curtis, Yooyoung Lee, Jonathan Fiscus, Afzad Godil, David Joy, Andrew Delgado, Alan F. Smeaton, Yvette Graham, Wessel Kraaij, Georges Quénot, Joao Magalhaes, David Semedo, and Saverio Blasi. 2018. TRECVID 2018: Benchmarking Video Activity Detection, Video Captioning and Matching, Video Storytelling Linking and Video Search. In *Proceedings of TRECVID 2018*. Gaithersburg, MD, United States. https://hal.archives-ouvertes.fr/hal-01919873

[4] Leif Azzopardi and Vishwa Vinay. 2008. Accessibility in Information Retrieval. In *Proceedings of the IR Research, 30th European Conference on Advances in Information Retrieval (ECIR'08)*. Springer-Verlag, Berlin, Heidelberg, 482–489. http://dl.acm.org/citation.cfm?id=1793274.1793333 event-place: Glasgow, UK.

[5] Saminda Sundeepa Balasuriya, Laurianne Sitbon, Andrew A. Bayor, Maria Hoogstrate, and Margot Brereton. 2018. Use of Voice Activated Interfaces by People with Intellectual Disability. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction (OzCHI '18)*. ACM, New York, NY, USA, 102–112. https://doi.org/10.1145/3292147.3292161 event-place: Melbourne, Australia.

[6] Andrew Bayor, Filip Bircanin, Laurianne Sitbon, Bernd Ploderer, Stewart Koplick, and Margot Brereton. 2018. Characterizing Participation Across Social Media Sites Amongst Young Adults with Intellectual Disability. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction (OzCHI '18)*. ACM, New York, NY, USA, 113–122. https://doi.org/10.1145/3292147.3292167 event-place: Melbourne, Australia.

[7] Andrew A. Bayor, Laurianne Sitbon, Bernd Ploderer, Filip Bircanin, and Margot Brereton. 2019. "TechShops" Engaging Young Adults with Intellectual Disability in Exploratory Design Research. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems (CHI EA '19)*. ACM, New York, NY, USA, CS31:1–CS31:8. https://doi.org/10.1145/3290607.3299056 event-place: Glasgow, Scotland Uk.

[8] Filip Bircanin, Laurianne Sitbon, Benoit Favre, and Margot Brereton. 2020. Designing an IIR Research Apparatus with Users with Severe Intellectual Disability. In *Proceedings of CHIIR 2020*. Vancouver, BC, Canada. https://doi.org/10.1145/3343413.3378008

[9] Darren Chadwick, Caroline Wesson, and Chris Fullwood. 2013. Internet Access by People with Intellectual Disabilities: Inequalities and Opportunities. *Future Internet* 5, 3 (Sept. 2013), 376–397. https://doi.org/10.3390/fi5030376

[10] Darren D. Chadwick and Chris Fullwood. 2017. An Online Life Like Any Other: Identity, Self-Determination, and Social Networking Among Adults with Intellectual Disabilities. *Cyberpsychology, Behavior, and Social Networking* 21, 1 (Aug. 2017), 56–64. https://doi.org/10.1089/cyber.2016.0689

[11] Brian Scott Hoppestad. 2013. Current perspective regarding adults with intellectual and developmental disabilities accessing computer technology. *Disability and Rehabilitation: Assistive Technology* 8, 3 (May 2013), 190–194. https://doi.org/10.3109/17483107.2012.723239

[12] Hao Ma, Raman Chandrasekar, Chris Quirk, and Abhishek Gupta. 2009. Improving Search Engines Using Human Computation Games. In *Proceedings of the 18th ACM Conference on Information and Knowledge Management (CIKM '09)*. ACM, New York, NY, USA, 275–284. https://doi.org/10.1145/1645953.1645990 event-place: Hong Kong, China.

[13] Tânia Rocha, Maximino Bessa, and Luciana Cabral. 2016. Performing Universal Tasks Using a Mini iPad: Usability Assessment Per People with Intellectual Disabilities. In *Proceedings of the XVII International Conference on Human Computer Interaction (Interacción '16)*. ACM, New York, NY, USA, 23:1–23:6. https://doi.org/10.1145/2998626.2998668 event-place: Salamanca, Spain.

[14] Tania Rocha, Martinho Gonçalves, Luís Magalhães, Francisco Godinho, and Maximino Bessa. 2009. Accessibility and Usability on the Internet for people with intellectual disabilities.

[15] Tânia Rocha, Hugo Paredes, João Barroso, and Maximino Bessa. 2016. SAMi: An Accessible Web Application Solution for Video Search for People with Intellectual Disabilities. In *Computers Helping People with Special Needs (Lecture Notes in Computer Science)*, Klaus Miesenberger, Christian Bühler, and Petr Penaz (Eds.). Springer International Publishing, 310–316.

[16] L. Sitbon, A. Bayor, F. Bircanin, S. Koplick, and M. Brereton. 2018. An exploration of how people with intellectual disability engage with online information retrieval. *Conference on Human Factors in Computing Systems - Proceedings* 2018-April (2018).

[17] Laurianne Sitbon, Benoit Favre, Margot Brereton, Stewart Koplick, and Lauren Fell. 2020. Engaging the Abilities of Participants with Intellectual Disabilityin IIR Research. In *Proceedings of CHIIR 2020*. Vancouver, BC, Canada. https://doi.org/10.1145/3343413.3377972

[18] Laurianne Sitbon, Maria Hoogstrate, Julie Yule, Stewart Koplick, Filip Bircanin, and Margot Brereton. 2018. A non-clinical approach to describing participants with intellectual disability. In *Proceedings of the 30th Australian Conference on Computer-Human Interaction*. ACM, 128–132.