Accessible Metadata Generation

Anastasia Cheetham, Dana Ayotte, Jonathan Hung, Joanna Vass,
Colin Clark*, Jess Mitchell, and Jutta Treviranus

Inclusive Design Research Centre, OCAD University, Toronto, ON, Canada
{acheetham,dayotte,jhung,jvass,cclark,jmitchell}@ocadu.ca

Abstract. This paper outlines a strategy and suite of tools for creating more accessible and personalizable web content by supporting the creation of accessibility metadata. The tools showcased below allow content creators to easily generate metadata at the point of creation, reducing the cost and complexity of producing and delivering content that can be tailored to a user's needs and preferences.

This work follows the AccessForAll approach, which focuses on meeting individual user's needs by matching those needs to appropriate content [1]. This level of personalization depends upon both the availability of infrastructure that can deliver alternative and adapted versions, and on the availability of content with accessibility metadata that can be used in the matchmaking process.

Keywords: Metadata, personalization, user needs and preferences, authoring, matching, AccessForAll.

1 Introduction

Users should be able to choose the type of content they consume, and they should make this choice without having to justify it, explain it, or sift through piles of content that don't match that choice. Work is being done in projects like Cloud4All [2] and Floe [3] to create tools that empower users to declare their needs and preferences. These expressions can then be mapped to content that meets those needs and preferences, thereby delivering a personalized web experience. Metadata is essential to this effort.

In order to match users' preferences to the content, that content must come with metadata that describes its features and alternatives. By meaningfully tagging online content with the appropriate metadata (particularly metadata about the accessibility features, capabilities, and adaptability of a resource) significant barriers to access can be broken down as a user's needs are matched to content that best meets those needs.

Everyone is a content creator. We take pictures with our phones and share them online instantly, we have blogs, we Tweet, we create videos, etc. But how much of that content has meaningful metadata associated with it? Few authoring or publishing applications make metadata tagging easy or compelling, and few users know what

* Corresponding author.

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metadata is or how to create it. Yet metadata is a powerful and essential piece in the larger vision of delivering personalized content to meet the needs of individuals.

The Global Public Inclusive Infrastructure (GPII) and within it, the Cloud4All Project [4, 2] are developing reusable components that can be embedded in a variety of applications and authoring tools, which provide the ability to:

- Automatically generate metadata where possible
- Easily create, edit, and maintain accessibility metadata for digital content.

Designers and developers at the Inclusive Design Research Centre (IDRC) [4], in collaboration with GPII partners within the Cloud4All [2] and Floe Projects [3], are building tools that will automatically derive or detect metadata information regarding digital resources in various formats and media, primarily on the web.

In cases where metadata cannot be automatically derived or detected, we have built easy-to-use web components for metadata creating, editing, and viewing. Because these tools can be integrated into common authoring applications, accessibility metadata will be integrated into the authoring process from the beginning rather than being neglected or left as an afterthought. As a result, more metadata will exist alongside content, enabling the GPII infrastructure to make matches between user needs and content that addresses those needs, delivering an experience tailored to the individual.

2 Background

Over the past decade, the IDRC has helped to establish and evolve a collection of interrelated standards that support the personalized delivery of user interfaces and content. These standards, as a whole, are based on an approach we have dubbed Access For All. Below, we describe the history and evolution of the Access For All approach and its relationship to various standards organizations

2.1 Access For All

The Access For All approach to accessibility is based on the idea of matching and adapting content to the individual needs and preferences of a user. This approach includes two key components:

1. A statement of the user's needs and preferences, and
2. Metadata describing the content

With these two components, content can be automatically selected to meets the needs of the user, or adaptations can be carried out on the content to adjust it to meet the user's needs.

Access For All was first developed as part of the Web-4-All project, which was an early precedent for the GPII initiative [6, 7]. Web-4-All provided users of public access facilities with the ability to log onto a Windows-based computer using a smart-card that contained their personal assistive technology needs. The taxonomy of user

needs and preferences that was defined as part of the Web-4-All project became the basis for the initial specification of Access For All.

The IMS Global Learning Consortium (IMS) published the first Access For All specification in 2003. The specification defined a common vocabulary for declaring preferences and for creating metadata. The IDRC was the initiator of the Access For All approach, and continues to be an active partner in developing the specification. A public draft of version 3 of the specification is now available [1].

In 2008, ISO/IEC JTC 1/SC 36 adopted the Access For All specification into a multi-part international standard known as ISO/IEC 24751:2008 Individualized Adaptability and Accessibility in E-learning, Education and Training. The IDRC also participated and continues to participate in the development of the ISO standard. In 2011, they began the process of updating the standard to a 2nd edition.

2.2 Schema.org

Schema.org [8] is a collaboration among Google, Bing, Yandex and Yahoo! to define common microdata formats to improve the findability of content on the Internet. In 2013, the IDRC participated in the development of a proposal to Schema.org to add accessibility metadata based on the Access For All IMS specification. In January of 2014, the proposal was accepted, and Schema.org adopted the accessibility metadata fields [9].

The adoption of the proposal by Schema.org, in conjunction with the development of metadata tools, and paired with an architecture capable of matching users with content has created an opportunity for a powerful and transformative workflow that can deliver personalized content to users.

3 Metadata Generation

3.1 Automatically Derived Metadata

To develop metadata generation tools, the team began by analyzing the properties in the Schema.org accessibility metadata set to determine what information is required and to decide how much of this information could be deduced automatically based on the media in question, the context, etc. For example, if an author is adding a video, it can reasonably be assumed that the video has both visual and auditory content. If an image is added that is known to be a math lesson, it might be reasonably assumed that the image contains math in visual format.

By comparing the schema.org metadata properties to possible media types, Table 1 was produced. This table was created using knowledge of accessibility experts, including the people who created the schema.org metadata fields, and represents the best possible “educated guess” at what metadata would be appropriate based on the content. The metadata generation tools automatically create the appropriate fields as the author edits the content.

Table 1. Metadata fields potentially auto-generated

Content Type	Metadata properties																
	auditory	**tactile**	**textual**	**visual**	**Colour-dependent**	**Text-on-visual**	**Math-on-visual**	**Chart-on-visual**	**Alt text**	**captions**	**transcripts**	**Flashing**	**No flashing**	**Motion simulation**	**No motion simulation**	**Sound hazard**	**No sound hazard**
video	S		A	S	A	A	A	A	A	R	R	A	A	A	A	A	A
audio	S										A		S		S	A	A
image				S	A				R			A	A	A	A		S
Image with text				S	A	S			R			A	A	A	A		S
Image with math				S	A		S		R			A	A	A	A		S
Image with chart				S	A			S	R			A	A	A	A		S
transcript			S										S		S		S
caption			S		A								S		S		S
sign language				S									S		S		S
audio description	S										R		S		S	A	A
music/ dialog	S								R	R	R		S		S	A	A
braille		S											S		S		S

Legend: S: Set by default R: Recommend that authors provide A: Available for authors to edit

3.2 For Content Authors

Because the automatically generated metadata is an algorithmically-determined "educated guess," there is no guarantee that it will be correct or complete. For example, an automated process can't tell if a video contains flashing lights (which might cause seizures in some viewers), or if an image has text embedded in it (which wouldn't be available to a screen reader). There will be details that the author knows about the content that cannot be deduced or inferred; the author must provide some information. To that end, the tools we have designed also present a summary of the metadata that was generated along with features for updating, improving and adding to that metadata.

3.2.1 Authoring User Interface

This section presents the designs for the metadata editing interface, developed for the Cloud4All and Floe projects by inclusive designers at the IDRC.

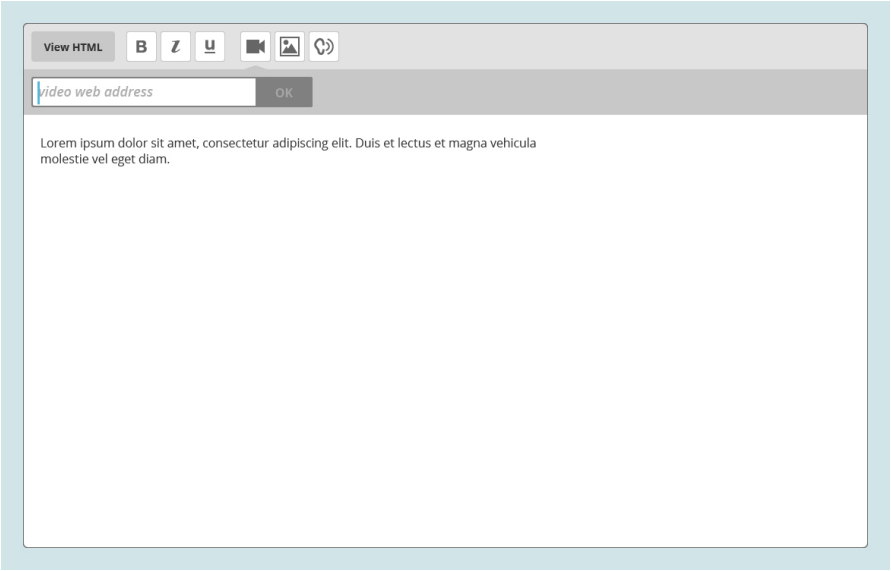

Fig. 1. Typical authoring interface

Fig. 1 shows a typical authoring interface. The metadata editor is introduced in an author's regular workflow of adding media, such as video, images, or audio to a resource.

Fig. 2 shows, on the right, the interface that will be presented when the author has added content to the authoring tool – in this case a video. After media is added, all potential features of the media are listed. The availability of a feature is visually indicated through different icon states to encourage the author to add more features. Textual descriptions are also available on hover. When a feature is selected a panel opens to the side. In the case of the 'Video' feature, the author answers a few questions for relevant metadata to be generated.

Fig. 3 show, on the right, the interface that will be presented to the author when "captions" has been selected. In this case, the author is prompted to add captions and specify the language or indicate that the video already has captions embedded. Relevant metadata is generated from the author's additions.

Fig. 4 shows, on the right, the summary of the metadata that has been generated plus "recommended" features for updating, improving and adding metadata and alternatives. The intention is that authors will be curious about other "adaptations" that the interface suggests, and could feel encouraged to create missing alternatives to see a "completed" metadata summary.

The metadata editor component is modular and designed to be embeddable in a wide range of authoring environments. Fig. 5 illustrates the metadata component floating on top of the editor. When a video feature is selected, an overlay appears on top of the page (Fig. 5). Metadata icons have different states to encourage authors to add features and to inform consumers of the availability of features.

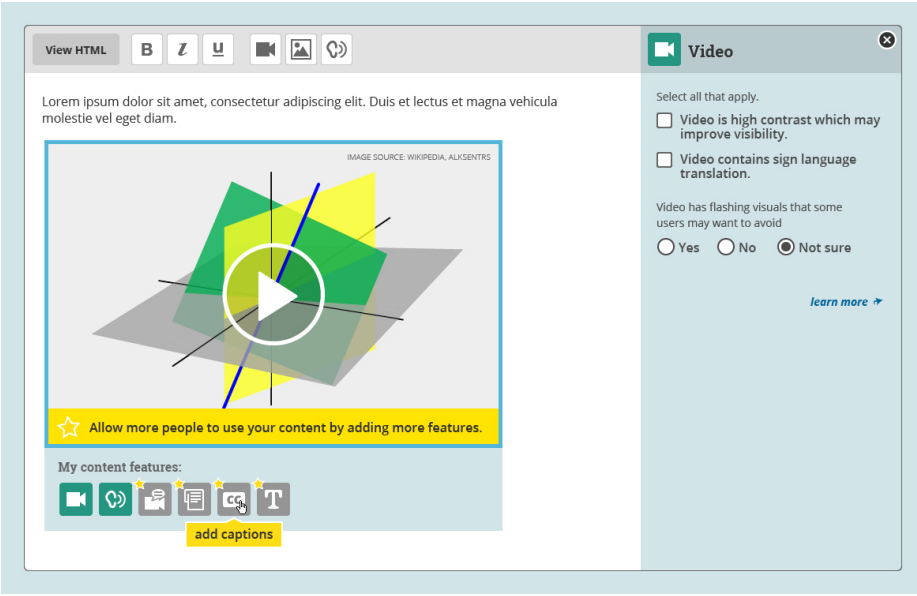

Fig. 2. Interface after a video has been added to the content

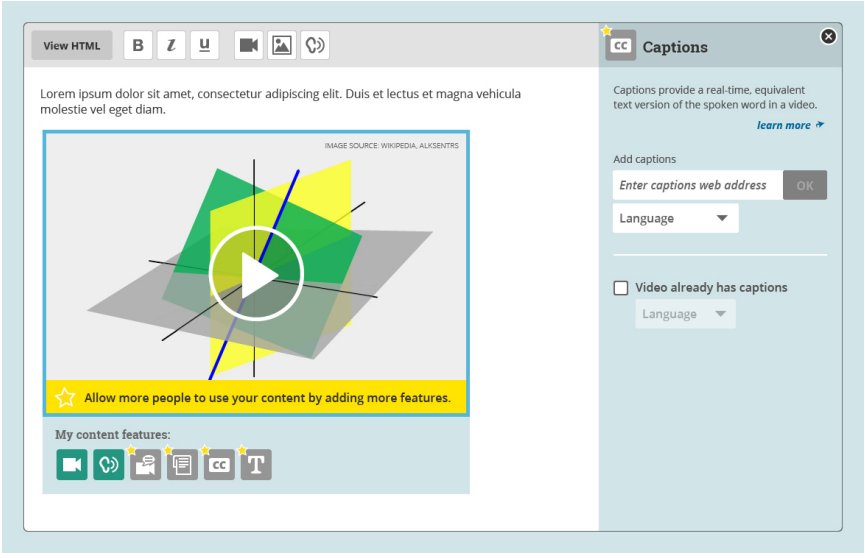

Fig. 3. Interface after author has selected "captions"

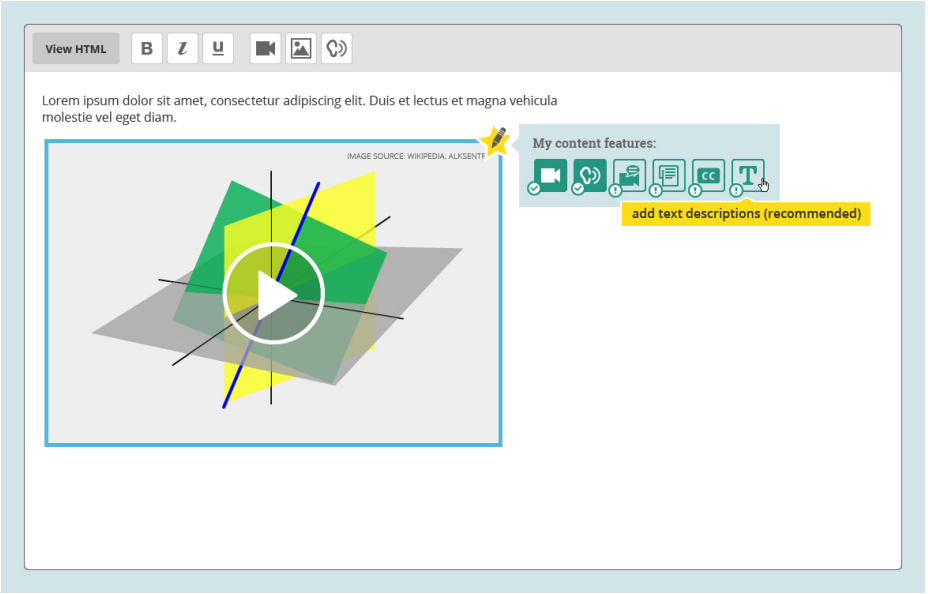

Fig. 4. Alternative interface, presented as a floating widget

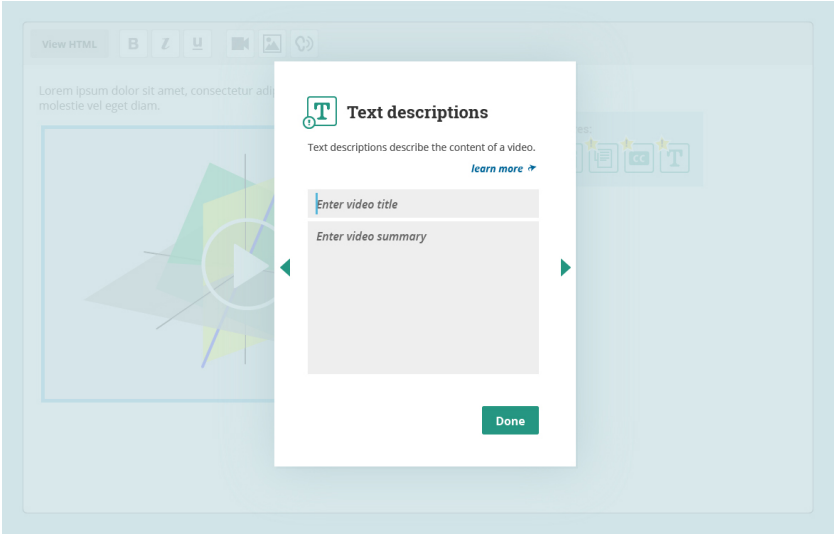

Fig. 5. Overlay presentation of dialog for text description input

4 Integration with the GPII

The reusable authoring components described above help to support the GPII goal of lowering the cost and complexity of delivering a personalized user experience across a variety devices and platforms. There are two aspects to this integration with the GPII:

1. Support for developers of authoring and content creation tools
2. Support for search engines, content delivery platforms, and matchmakers

4.1 Supporting Authoring

The components described in this paper are being implemented as open source software using web-based technologies. As such, they will be available to a broad range of developers who are building authoring tools and web content delivery systems. Reusing these components will simplify the process of incorporating accessibility metadata into these applications and promote consistent across systems. It is anticipated that these metadata components will be distributed as part of the upcoming Prosperity4All Developer Space, a comprehensive resource that helps developers find and use accessible building blocks and to integrate personalization into their software.

4.2 Supporting Delivery

In terms of the delivery side of the Access For All equation, the metadata supported by these components is directly aligned with the needs and preferences that are stored in a user's Needs and Preferences (N&P) set. As a matched pair, the combination of a user's N&P set and the metadata about a resource's accessibility characteristic provides a clear means by which web search engines and delivery tools can understand a user's requirements and deliver the most appropriate match to her. By adopting the commonly-used Schema.org microdata format, the metadata that is generated by these components can be easily parsed, indexed, and matched using the mechanisms that prominent search engines such as Google already implement.

5 Results and Next Steps

At the time of the writing of this paper, the team is actively developing and further designing the metadata tools showcased here. The schema.org work has stabilized, and the architecture is mature and in use.

There has been significant interest in integration of the metadata tool within various authoring environments. OER Commons has integrated an early design of the authoring tool that empowers content authors to include metadata into a large repository of Open Education Resources [10]. OER Pub has expressed interest in also integrating the tool for a new authoring tool currently under development [11]. And the Floe Project has been disseminating the components that contribute to the workflow

of metadata creation and increased accessibility of content where educational content is being created.

The code for the Cloud4All (and Floe Project) metadata components is available within the Fluid Project [12] Github space (a space that also contains the Fluid Infusion suite of reusable, web-based components): https://github.com/fluid-project/metadata

For the latest work, visit a (sometimes unstable) nightly build of a demo online: http://metadata.floeproject.org/demos/html/metadata.html

5.1 Next Steps

Forthcoming features for the metadata authoring tools include ways to refine and improve the accuracy and usefulness of the metadata claims through use. Users will be able to inform and affect metadata based on whether it met their needs or not, further refining matching accuracy. Means of both

a) automatically deriving usage metrics in a way that supports privacy and of
b) enlisting users and their support team to provide feedback on the utility of the resource component for specific user needs will be developed and integrated into the overall metadata processes.

Planning has begun for the interfaces that will enable end-users to easily contribute metadata back to the resource. That metadata can include information about the efficacy of the supplied resource in meeting their particular need or preference. User feedback regarding the efficacy of the supplied resource once captured can be used to rank and refine resources and services. This 'paradata' about the use and efficacy of a resource can be used to capture feedback regarding the inclusive design or accessibility of resources and then be used as a trigger for improving the resource or its alternative. This can serve as a means for users to request an alternative that doesn't yet exist, for example. There are many opportunities to match service providers with user needs once this information can be collected and shared.

6 Conclusion

The work showcased here represents a long history of conceiving of and creating a personalized approach to accessibility: from Web4All to AccessForAll to the IMS accessibility specification to Schema.org integration and now culminating in the work on the Global Public Inclusive Infrastructure.

To ensure the most accurate metadata is created and propagated, the metadata approach outlined here takes a hybrid model where the tools automate as much as possible while still allowing for human intervention. By creating easy-to-use interfaces that allow authors and users to ultimately intervene and correct and refine the gathered metadata, the GPII team is ensuring a mechanism for creating the best, personalized results. By supporting authors and end-users, the metadata tools will have a profound impact on metadata creation, propagation, and ultimately matching and delivery.

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