Towards a Universal Accessibility for Textual Information

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ABSTRACT
This paper describes how the major textual information representations and access limitations can be structured in a universal view. A web platform composed of web services and technologies is proposed as a solution for the identified access limitations. The importance of web services orchestration is emphasized in order to obtain novel and useful results in the area of accessibility. Other benefits, like universal accessibility evaluation, resulting from this universal view are listed.

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces; H.m [MISCELLANEOUS]

General Terms
Design, Experimentation, Human Factors, Standardization, Languages.

Keywords
textual information, accessibility, web services, cloud computing.

1. INTRODUCTION
This research focuses on increasing the accessibility to textual information. This includes web accessibility, documents accessibility, desktop application accessibility, printed text, spoken text accessibility and so on.
The start point for this accessibility research has been an experimental tool (done for my diploma project) consisting of a software application that could read printed text in different languages by using a webcam, Optical Character Recognition, Google Translate and Text To Speech. The result has proven to be usefull and this motivated the start of a longer research in the field of textual information accessibility.

2. TEXTUAL INFORMATION REPRESENTATION
Textual information may have multiple representation types. It can be classified by the *media format* (for instance it can be digital text, printed text or audio text), by *language* (English, Romanian ...) or by *language specificity* (lay, medical, technical...). Each of these classifications can be considered an access *layer* between a certain *instance* of text and the information itself. Figure 1 shows a proposal for a universal view over text, covering the classifications mentioned above.

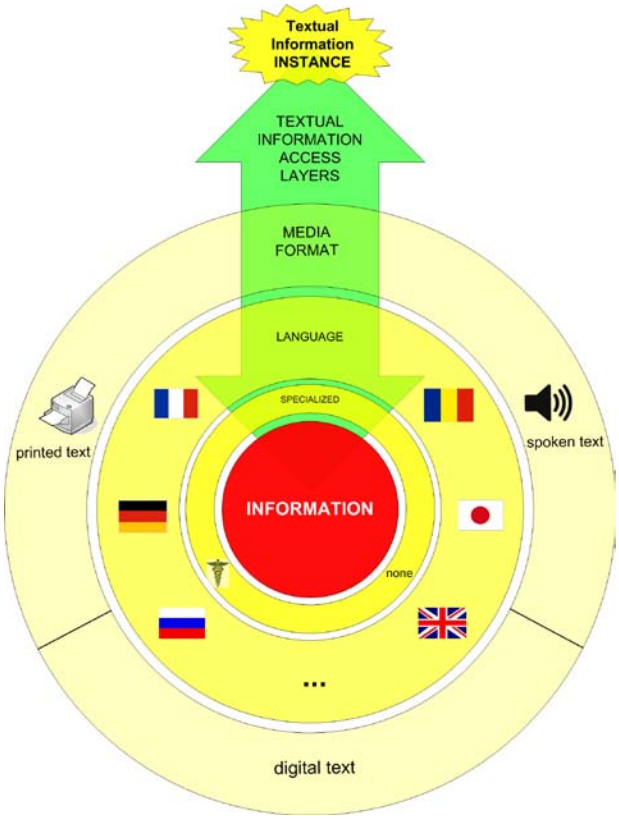

Figure 1.
Textual Information Universal Representation

Each textual information instance represents a unique combination of the layers elements described in Figure 1. Starting from this view, accessibility limitations and solutions can be identified for each of the possible text representation.

3. TEXTUAL INFORMATION ACCESSIBILITY
Accessibility issues are usually addressed when dealing with impaired users; however they should not be limited to this, *we all*

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have disabilities! One can have a limitation (call it <temporary> disability) accessing textual information in a foreign language, or a lay person accessing a text written in a specialized language (like medical language – e.g. diagnostics).
Each textual information instance has its own accessibility limitations, depending on the specific instance and the person accessing it. For most of the limitations there are specific accessibility solutions. In order to be effective and to cover more cases (instances) these solutions need to intercommunicate.
Text technology integration has been successfully used in other projects resulting in browsers accessible for visually impaired users [4] or platforms like WAMI Toolkit [1] or Olympus [2] (integrating Speech Recognition, Text to Speech (TTS), Natural Language Processing and AI specific technology). Also Google and Microsoft have online machine translation services and SDKs that incorporate both language technologies and speech technologies, illustrating the need for combining text technologies and the usefulness for the end user.
The problem with most of the text specific technologies is that they have high hardware requirements, and most important they can be hard to install/use by end users. Due to this, given the emergence of cloud computing in the last few years, and also its advantages, many text or accessibility technologies are moving to the cloud. For example WebAnyware [3] is an online screen reader that makes the life of the users that need this kind of tools far more easy, not requiring any installation nor high hardware requirements.

The major focus in this research falls on designing tools and platforms that integrate existing and novel accessibility solutions (like OCR, TTS, machine translation, Speech Recognition, NLP, text simplification...) based on the structure from Figure 1 to achieve novel and most important useful results. Experimental tools [5] designed were proven useful, but not very convenient in terms of requirements, and installation for the end users. So in this phase of the research I'm implementing this kind of platform on the cloud side, making it available online via browsers. The platform will have some predefined templates for common accessibility limitations, using different combinations of web services. One predefined template example is speech to speech translation, aggregating services like Speech recognition, machine translation, and TTS. Beside these templates the user will be able to include or exclude any existing text transformation component in the system. By doing this, the number of possible combinations and the area of usage for the system will increase a lot.

Besides this, two other secondary research topics are derived from the universal representation from Figure 1.
- Developing a service to interpreter specialized terminology. This service addresses a much disregarded issue related to specialized language accessibility for lay persons (specialized language layer in Figure 1). A functional version of this service, used for medical language (currently for English and Romanian) has been incorporated in a tele-assistance system, to improve the accessibility of assisted people to the medical information. This work has been described in more details in paper [6].
- Define universal accessibility evaluation framework/guidelines for websites and apps that deliver textual information content. For example an evaluation related to textual information accessibility performed on YouTube web site by using the universal representation model illustrates (see Figure 2) the existing accessibility capabilities, and what can be done to increase it.

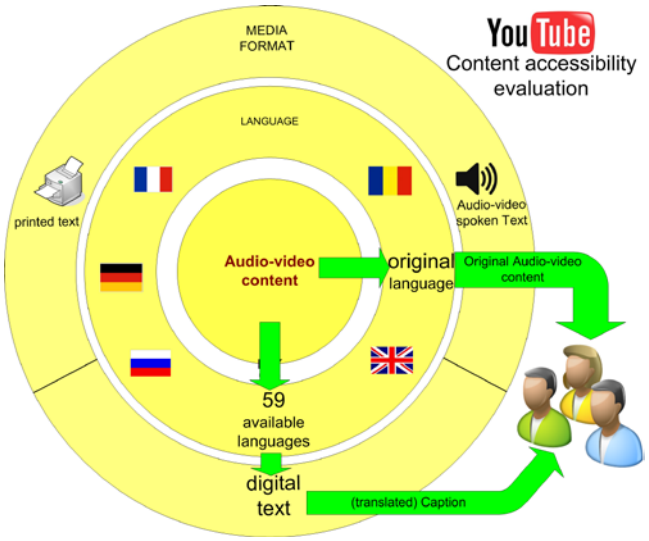

Figure 2.
YouTube content universal accessibility evaluation

One can easily see that YouTube covers multiple text representations output (1 in audio format and 59 in digital format), but can also see what is missing. Adding *multilingual audio output* and *multilingual printable captions* would make YouTube cover most of the existing textual information representations, increasing accessibility and usability.

4. ACKNOWLEDGMENTS

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