# DANTE: Annotation and Transformation of Web Pages for Visually Impaired Users

Yeliz Yesilada, Simon Harper, Carole Goble and Robert Stevens
Information Management Group
Department of Computer Science
University of Manchester
Oxford Road
Manchester M13 9PL, UK
yesilady@cs.man.ac.uk

## 1. ABSTRACT

Most Web pages are designed for visual interaction so the mobility, or ease of travel, of visually impaired Web travellers is reduced [2]. Objects that support travel and mobility are not in an appropriate form for nonvisual interaction. Our goal is to enhance the mobility of visually impaired Web travellers by annotating pages with a travel ontology that aims to encapsulate rich structural and navigational knowledge. We propose a semi-automated tool '**Dante**' which aims to analyse Web pages to extract travel objects, discover their roles, annotate them with a travel ontology and transform pages based on the annotations to enhance the provided mobility support. This poster introduces the travel ontology and presents how Web pages are annotated with this ontology to guide the transformations.

## Categories and Subject Descriptors

H.1.2 [**Models and Principles**]: User/ Machine Systems—*human factors, human information processing*; H.5.4 [**Information Interfaces and Presentation**]: Hypertext/ Hypermedia—*user issues, navigation*; K.4.2 [**Computers and Society**]: Social Issues—*assistive technologies for persons with disabilities*

## General Terms

Human Factors, Experimentation

## Keywords

Travel, mobility, visual impairment, semantic annotation, tool.

## 2. INTRODUCTION

Screen readers are assistive technologies that are commonly used by visually impaired people to access Web pages. Most screen readers use HTML tags for presenting pages in audio; this therefore requires pages to be properly tagged. However, most pages are designed for visual interaction so the underlying HTML code represents the visual presentation rather than the structure. Although there are guidelines [1] to create accessible pages, not many designers follow them. Consequently, the features supported by screen readers (e.g., Jaws) to ease interaction, such as providing lists of headings, generate misleading information.

One particular form of interaction with Web pages that is difficult is the task of making a journey about a page or site. *Travel* is the whole Web journey experience and *mobility* is the ease of travel [2]. The travel analysis framework, which is the foundation for our mobility support tool, **Dante**, is introduced in [4]. The architecture of **Dante** is depicted in Figure 1. The main aim of Dante is to analyse Web pages to semi-automatically:

1. Identify travel objects [4];
2. Discover their roles;
3. Annotate the identified objects by using a travel ontology;
4. Transform the page with respect to these annotations.

This poster briefly introduces the travel ontology that is used for annotation within **Dante** and presents how this ontology can be used to drive the transformation process.

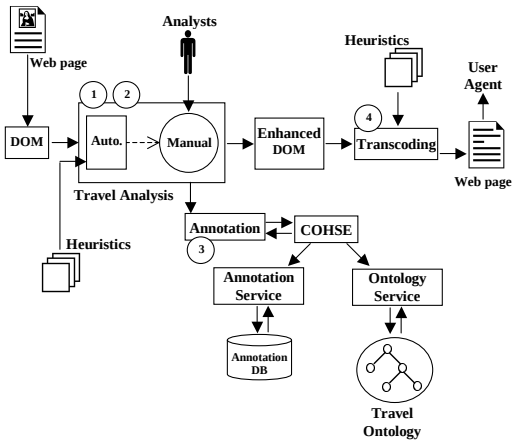


**Figure 1: The basic architecture of Dante.**

In the Semantic Web framework, our goal is to make role of the travel objects explicit by annotating them so that the agents such as screen readers can understand the structure of the page and support interaction accordingly. This can be considered as an extension to *semantic annotation* because it is not about the meaning of resources but it is rather about the role and structure of the resources.

Knowledge of how visually impaired people actually travel gives a context for their travel on the Web [2]. Our travel ontology aims to encapsulate that knowledge. It is used as a mechanism for applying physical travelling metaphors to Web world. Fundamentally, the travel ontology is used as a controlled vocabulary for the transformation part of **Dante**. The COHSE[1] annotator is used to annotate

[1]The COHSE Project (http//cohse.semanticweb.org).


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pages with this ontology, the annotations are stored externally and accessed by the transformation part (see Figure 1).

The travel ontology consists of three main parts that have information about mobility concepts, authoring concepts and context of a journey. The annotation process is encoded in an annotation pipeline and the first two parts of the ontology play an important role in this annotation pipeline.

## 3. TRAVEL ONTOLOGY

The travel ontology is a controlled, shared vocabulary that can be communicated across applications to provide information about the structure and mobility support of a page. In our tool, the ontology is used as the controlled vocabulary to drive page transformations. A description of early work on the ontology can be found in [3]. Fundamentally, the ontology encodes three groups of concepts which in summary hold information about[2]:

- *Mobility* concepts: address the knowledge about the travel objects from real world mobility studies (how these objects are *used*) [2]. Objects can have a journey role which depends on the context of the journey being undertaken (e.g., Obstacle, Cue, OutOfView, etc.) and can also have one or more environmental roles (e.g., WayPoint, TravelAssistant, etc.);
- *Authoring* concepts: provide information about including hypermedia concepts and refer to previous work on transcoding and content management systems– encapsulate information about how the objects are *structured* and *presented* in Web pages. The four higher level concepts in this part are: Atom (e.g., Headline, Caption, etc.), Chunk (Footer, Header, etc.), Node (represent a page) and Collection (represent a site);
- The *context* of a journey: a Web journey can take place in different contexts [2] and concepts in this group provide contextual knowledge about a journey such as the purpose of the journey being undertaken (e.g., Browsing, Scanning, etc.).

## 4. DANTE- ANNOTATION

Here we explain how different parts of the ontology, particularly authoring and mobility concepts, are facilitated in **Dante**. We use a pipeline approach to maintain flexibility of handling different annotation formats. Annotations can be received in different formats and translated into a canonical form, which we propose to use *authoring concepts*. After we acquire authoring concepts, we use a set of rules to translate authoring concepts to mobility concepts in order to accumulate enough knowledge about how these objects are *used* in a typical journey. We can of course bypass the translations by using COHSE and our authoring, or mobility concepts to directly annotate the page.

The COHSE annotator uses XPointer expressions to identify the region of the document and annotations are stored in an annotation service. In **Dante**, the Mozilla plug-in version of COHSE is used for annotation. The prototype transformation part of **Dante** is also implemented as a plug-in to Mozilla, and using both create a single environment for authoring and publishing the annotations.

After annotating pages with authoring concepts, we use a set of heuristic mapping rules and the underlying HTML source code in combination with the ontology to create an enhanced DOM annotated with both authoring and mobility concepts. The mapping rules are encoded in JESS[3] which is implemented as a Java servlet. We use the internal DOM tree of Mozilla to obtain the properties of annotated authoring concepts and send these to JESS in order to infer the mobility concepts based on the mapping rules. After we acquire the mobility concepts, we extend the internal DOM tree by using both annotated authoring and inferred mobility concepts. This new DOM is now in a suitable format for transcoding and the usually complex process of transcoding is dramatically simplified.

[2]For the complete ontology, refer to `http://augmented.man.ac.uk/ontologies/TravelOntology.owl`.

[3]http://herzberg.ca.sandia.gov/jess/.

## 5. DANTE- TRANSFORMATION

The annotations are used to provide several techniques for enhancing provided mobility support. Essentially, the heuristics and transformations that we explain here are all simple but have high impact on the provided mobility support of the page and are good enough to illustrate how the annotations can drive the transformation of the pages. Some of these transformations can be summarised as follows:

- *Providing the Overview of the Page*: this is done by providing a kind of table of contents (TOC). The TOC can be considered as a way of providing the *bird's eye view* (overview) of the page. Based on the headings (identification points) and sections or chunks (way edges) in the page, we logically fragment the page and allow user to have the preview of these logical fragments. Links are added from TOC to fragments and v.v. These logical fragments aim to represent the implicit chunks within the page.
- *Eliminating Repetitions*: Some structures such as headers and footers can easily become repetitive and not quite useful if the page is accessed more than once. Sighted users tend not to read such constructs by skipping and directly focusing to the relevant part of the page. However, screen readers cannot recognise such constructs and in consequence do not support features, for instance skipping them. In our approach, in order to provide shorter and concise page, we remove annotated header and footer.

## 6. SUMMARY AND DISCUSSION

We presented the travel ontology that aims to encode the knowledge from real world mobility studies, previous work on transcoding and information about hypermedia concepts. We described a possible annotation and transformation approach based on this ontology. In particular, an annotation pipeline was introduced which can be considered as the core of this approach. Some annotation and transformation examples were also presented to illustrate the application and usage of this pipeline.

Our main goal is to improve the mobility support for visually impaired Web users and using the proposed travel ontology and also the annotation pipeline lead us to achieve our goal. The work presented here is still continuing and there is still some work to be done, in particular an evaluation of the annotation accumulation process.

## 7. ACKNOWLEDGMENTS

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