

# **LUISA**

*Learning Content Management System Using Innovative Semantic Web  
Services Architecture*

**IST- FP6 – 027149**



## **Deliverable 3.4.2 Annotation Tool documentation**

Fredrik Enoksson  
Matthias Palmér  
Ambjörn Naeve  
Mikael Nilsson

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Fredrik Enoksson  
Uppsala Learning Lab

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## EXECUTIVE SUMMARY

This deliverable describes how to use the Annotation Tool developed in work package 3 from the end-user perspective. The Annotation Tool is designed to be a configurable form-based metadata editor, and the primary focus in LUISA has been the possibility of editing metadata on Learning Resources. The configuration mechanism for the Annotation Tool is called Annotation Profiles and it defines *what* metadata that can be edited, and it also contains a template of *how* the metadata should be edited by the end-user. When using Annotation Profiles, three different roles have been foreseen to be involved in the Annotation Process (1) the *Annotation Profile Author*, who constructs or modifies Annotation Profiles, (2) the *Annotation Tool Facilitator*, who selects the Annotation Profiles to be used, and (3) the *end-user*, who uses the Annotation Tool. This document is aimed to be useful primarily for the *end-user* and describes the different parts of the user interface. The main part of the Annotation Tool is the form where the metadata is edited. In the form-based way of editing metadata two basic styles of interaction are possible, based on free text or choosing among predefined values. When the latter interaction style is used in the form, several ways of letting the end-user interact are possible, and they are described in more detail in the document. However, even if the Annotation Tool supports several ways of doing this, all of them have not been possible to use in LUISA due to technical problems in the underlying encoding. This document furthermore briefly describes different aspects of choosing the set of Annotation Profiles to be used as a help for the Annotation Tool Facilitator.

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<b>Abstract (for dissemination)</b>	This deliverable is aimed at describing how the annotation tool should be used. It describes the different user roles involved in the process of annotating metadata around a resource, such as a learning object, with the main focus on describing how to use the graphical user interface of the Annotation Tool.			
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<b>Authors (Partner)</b>	Fredrik Enoksson (ULL), Matthias Palmér (ULL), Ambjörn Naeve (ULL), Mikael Nilsson (ULL)			
<b>Responsible Author</b>	Fredrik Enoksson		<b>Email</b>	<a href="mailto:fen@nada.kth.se">fen@nada.kth.se</a>
	<b>Partner</b>	ULL	<b>Phone</b>	+46 18 471 62 90

## Project Consortium Information

Partner	Acronym	Contact
Atos Origin S.A.E. (Coordinator)	ATOS 	Nuria de Lama Atos Origin S.A.E. c/ Albasanz 12 E-28037 Madrid, Spain Email: nuria.delama@atosorigin.com Tel.: +34 91 214 9321 Fax: +34 91 754 3252
University of Alcalá de Henares	UAH 	Dr. Miguel-Angel Sicilia Information Research Unit University of Alcalá Ctra. De Barcelona, Km 33.6 E-28871Alcalá de Henares (Madrid), Spain Email: msicilia@uah.es Tel.: +34 91 886 6603 Fax: +34 91 885 6646
University of Uppsala	ULL 	Dr. Ambjorn Naeve University of Uppsala Kyrkogårdsgatan 2 C Uppsala Email: amb@nada.kth.se Fax: +46 184-716-294
Open University	OU 	Dr. John Domingue Knowledge Media Institute, The Open University, Walton Hall, Milton Keynes, MK7 6AA, United Kingdom Email: j.b.domingue@open.ac.uk Tel.: +44 1908 655014 Fax: +44 1908-653-169
University Henri Poincaré	UHP 	Dr. Monique Grandbastien University Henri Poincaré Vandoeuvre les Nancy 54506, PO Box 239, France. Email: monique.grandbastien@loria.fr Fax: : +33 383-278-319
Giunti Labs S.r.l.	GIUNTI 	Fabrizio Giorgini Giunti Labs S.r.l. Abbazia dell'Annunziata Via Portobello Baia del Silenzio 16039 Sestri Levante (GE), Italy Tel.: +39.0185.42123 Fax: +39.0185.43347
EADS FRANCE– Innovation works	EADS 	Anne Monceaux EADS FRANCE– Innovation works Avenue Didier Daurat - Centreda 1, Toulouse, 31700, France. Email: anne.monceaux@eads.com Tel.: +33 561-168-825 Fax: +33 561-187-611

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## 1 INTRODUCTION

This document describes how to use the Annotation Tool developed in work package 3. The document is focused on describing how an end-user should use the tool for annotation of metadata records. It also describes the end users' annotation process as well as how Annotation Tool facilitators select a set of suitable annotation profiles. This document also describes how the metadata records are managed in the tool.

The Annotation Tool has a modular design that makes it easy to integrate into different settings and environments. Therefore the term **Annotation Tool** is used for any installation of the tool, while the term **LUISA Annotation Tool** is used for the specific implementation to be used in LUISA. For technical documentation of the code structure and how to develop and integrate the Annotation Tool into other applications, the reader is referred to the deliverable 3.3 [\[1\]](#), *Annotation Tool*. For help with developing or modifying annotation profiles look see the deliverable 3.2, *Annotation Profile Specification* [\[2\]](#).

### 1.1 Background

In deliverable 3.2, three approaches are described for building annotation tools, *fixed*, *configurable*, and *generic* editors. From the deliverable 3.1 [\[3\]](#) the requirements on modern annotation tools can be summarized as demands for increasing interoperability, standards compliancy, and user friendliness. It is also acknowledged that the complexity of the editing task increases, hence, treating the annotation tool as an independent and reusable component is preferred. Consequently, the configurable approach is concluded to be the best fit. In addition, it is crucial to acknowledge the shift towards AJAX-based web applications and the proliferation of services and content within what is referred to as the web2.0 movement. AJAX is short for **A**synchronous **J**avaScript **A**nd **X**ML, and it is a technique where a webpage can make incremental updates to itself by using JavaScript to call different services on a server instead of requesting the whole webpage to be updated. Thus, a webapplication can be built into the browser that combines several services into a so called mash-up. For the annotation tool to be a successful independent and reusable component, it is crucial to provide an AJAX-based responsive user interface that can be easily embedded into various web applications.

### 1.2 How the Annotation Tool is designed

The intention of the LUISA Annotation Tool is to be a configurable form-based metadata editor, that supports editing of metadata records, expressed in RDF, in an end-user friendly manner. The underlying encoding in RDF or the syntax chosen should therefore be transparent to the end-user. However, the end-user is required to have knowledge of the relevant domain of metadata. In LUISA this is primarily metadata records of Learning Resources that are annotated using

concepts from different Competency Ontologies. It should be noted that in LUISA the created RDF has to be translated into WSML, which leads to some technical implications that we will shortly describe below.

Our approach of making the encoding transparent to the user in LUISA is to use Annotation Profiles. As described in deliverable 3.2, such a profile expresses the structure of the metadata and also acts as a template of the form presented to the end-user. The Annotation Profiles are defined in advance and act as input to the tool, and the Annotation Tool is designed to touch only data that is defined in the Annotation Profile.

For a more lengthy discussion on the design of the Annotation Tool, see the deliverable 3.3, *Annotation Tool*.

### 1.3 User Roles in the Annotation Process

As described above, the Annotation Tool needs to be configured with one or more Annotation Profiles. The creation of these Profiles is preferably done by a person with knowledge about the metadata domain to be used and the underlying encoding, which in LUISA is RDF. Given that a sufficient amount of Annotation Profiles have been created, a facilitator can make a selection of the available Profiles within an editing environment, i.e. an annotation tool. An end-user may then edit according to a few recommended Annotation Profiles, rather than first having to locate, assess, and choose an appropriate Annotation Profile before starting to input metadata. To summarize, the foreseen roles, as introduced in deliverable 3.2, are:

- **Annotation Profile author** - This role is responsible for creating new profiles and a person holding it is skilled both in the metadata-domain and the underlying encoding.
- **Annotation Tool facilitator** – A person holding this role will decide which Annotation Profiles should be available to which end-users. It is also the responsibility of this role to be in contact with the Annotation Profile authors for suggesting modifications as well as new Annotation Profiles.
- **End user** – Annotates metadata using the Annotation Tool. Depending on the skills and knowledge, the end-user gets access to edit specific metadata, which is defined in a set of Annotation Profiles.

### 1.4 Scope of this report

As stated earlier, the focus of this document is to describe how an end-user can use the Annotation Tool and especially the LUISA Annotation Tool. Some information relevant for the other AQP roles is included as well, but the main document for the Annotation Profile author is the deliverable 3.2, *Annotation Profile Specification*. Furthermore, how to administrate the annotation tool will be described in the deliverable 3.6, *Documentation on the use of Annotation*



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*Profiles.*

## 1.5 List of abbreviation used in the rest of this document

**AJAX** - Asynchronous JavaScript And XML

**AP** – Annotation Profile

**AT** – Annotation Tool

**GUI** – Graphical User Interface

**RDF** – Resource Description Framework

**REST** - Representational State Transfer

**WSML** – Web Service Modelling Language

## 2 METADATA AND ANNOTATION PROFILES

In order to perform a semantic search among Learning Resources/Objects, they need to be provided with structured information, i.e. metadata. This means that the successful matching of Learning Resources in a search depends heavily on available metadata. That is also the reason why a flexible Annotation Tool has been developed and will be used in LUISA, since the metadata for a Learning Resource can be easily changed with the LUISA Annotation Tool. If new metadata elements need to be added, this can be achieved by adding or extending Annotation Profiles. If this configuration was not possible, the changes would have to be done in code by a programmer (that is usually not a metadata expert). Now the changes can instead be totally handled by an Annotation Profile author (that should be a metadata expert).

### 2.1 What is metadata?

Metadata is commonly interpreted as "data about data", but in the world of the Semantic Web it should probably be rephrased as "data about resources". A resource is basically anything that can be identified, including both physical objects like books, philosophical ideas, and retrievable digital objects like web-pages. In the general case, the resource itself cannot be edited, and hence, when using an annotation tool, the intention is to support the editing of data about a resource, not the resource itself (even if it is a digital object). To provide the descriptive information on a resource, a metadata record is created separately. A relation from the metadata record to the resource is maintained via the resources URI-reference.

Metadata, data about resources, can broadly be seen as descriptive information that is intended to be used by humans or machines. For the data to be useful there need to be agreements on what to express and what the interpretation should be. Such agreements are often summarized into metadata standards or metadata schemas, depending on the degree of consensus and formal endorsement strived for. The Semantic Web provides a framework for expressing agreements on interpretation in a formalized and standardized manner. This allows machines to process metadata by drawing conclusions from the formal definitions and relating various agreements to each other.

### 2.2 What are Annotation Profiles?

An Annotation Profile is a configuration mechanism for annotation tools [\[4\]](#). Using Annotation Profiles, several editors (where different metadata is edited) can be created using the same tool. One profile defines what metadata it can edit and can therefore be tailored to the needs of a specific user by providing a specific set of metadata elements possible to edit. The profile may coincide with the intention of a specific metadata standard or schema, but it might also combine metadata elements from different sources. Such "mix-and-match" for

annotation, using elements from different standards is becoming increasingly important. This kind of strategy was first adopted in [5] under the name Application Profiles. Annotation Profiles can be seen as a special kind of Application Profile aimed at the annotation of metadata

In the *Annotation Profile Specification*, D3.2, the Annotation Profile model is described on a more technical level. Here we will be satisfied by acknowledging that it consists two parts: First, the *graph pattern*, which describes the exact structure of the metadata expressed in RDF. Second, the *form template*, which describes how the form-based graphical user interface should look like. This includes how to render or manipulate different kinds of metadata, e.g. via text-fields, a set of selectable choices, as well as cardinality restrictions.

## 2.3 Finding the right profiles

The Annotation Tool facilitator has the responsibility to find the Annotation Profiles to be used. If all necessary profiles cannot be found, the facilitator needs to ask the Annotation Profile author to create the missing profile. In this work the facilitator needs to consider several aspects, among them:

- **Standard / Schema compliance** – In order to be interoperable with others it is a good choice to choose APs that produces RDF that is compliant with standards.
- **Domain-specific needs** – If domain-specific metadata elements or perhaps whole domain-specific vocabularies (complemented and/or restricted) exist, then it is a good idea to use them in order to be compatible.
- **A single generic catch all AP or several specific APs** – Does the organization need specifically constructed APs for its own usage. Is a single generic AP enough, or should there be several slightly different APs to cover different needs?
- **Provide instructions for the users on how to use the AP** – Is the label and the description of the AP understandable for the end user.
- **Decide on whether an AP is multilingual or not** – Is it of importance to present the form, i.e. the labels and descriptions in multiple languages?

Note that these issues for the facilitator are still tentative and may need further refinement depending on the situation. For example, the facilitator might need a substantially different approach if there is already a lot of metadata available for the end-users to work with. In this case, there is less freedom in choosing an AP, since it is probably necessary to be compatible with existing metadata expressions.

### 3 USING THE ANNOTATION TOOL AS AN END-USER

The main purpose of the Annotation Tool is to create forms where metadata on a resource can be edited. As stated in section 2.1 a relation from the resource to the metadata record is maintained via a URI-reference, and in order to make a useful tool, some functionality to manage the metadata records of the resources is needed. Figure 1 shows a screenshot of the Graphical User Interface of the LUISA Annotation Tool. It is built as a web application to work inside a web-browser in a REST-based manner, using JavaScript and especially the web 2.0 techniques AJAX. The LUISA Annotation Tool is set up at a specific URL and can be loaded into a web-browser.

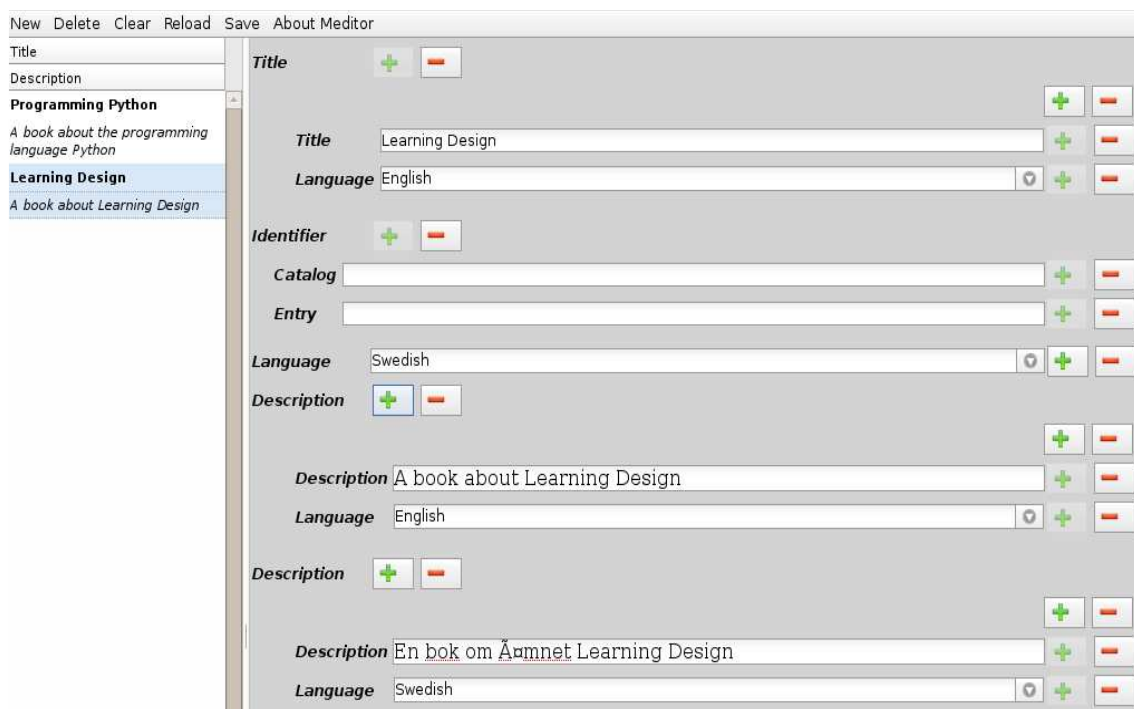


Figure 1: A screenshot of the LUISA Annotation Tool

The user interface is divided into 3 sections, as seen in the screenshot in figure 1. To the left there is a list of Learning Resources on which metadata can be edited. When a resource in this list is clicked, its metadata is displayed in the form in the right section of the screenshot. The third section is the toolbar at the top, where the metadata records of the resources can be managed.

The purpose of the toolbar in the LUISA Annotation Tool is to manage the metadata records. It is used to find resources, delete all metadata of a resource, create new metadata records for a resource, and to save the metadata on a resource when it has been edited. By clicking on the button:

- **New**, a new metadata record for a resource is created, and an empty

form will be displayed in the right window of the tool. Here metadata on the resource can be edited, but the metadata will not be saved before the save-button is clicked. After clicking on the New-button, it will be inactivated until the edited metadata record has been saved.

- **Delete**, all the metadata on the resource will be deleted. The list of resources will also be updated after a successful deletion. The button will be inactivated when it is not possible to delete a metadata record, for example when there is no form displayed.
- **Clear**, will reset the current form. If there is no form displayed, the button will be inactivated.
- **Save**, the metadata on the current resource displayed in the form will be saved, together with the changes made to it. It is only possible to save if changes have been made to the form, in other cases this button will be deactivated. Note that the list will not be updated automatically, but this can be done by clicking the Reload-button.
- **Reload**, will update the list of resources displayed in the left side of the screen.

The left part of the screenshot is a list of available resources on which metadata can be edited. In LUISA, this is a list of Learning Objects, and information about these LOs is retrieved by querying the Learning Object Metadata Repository (LOMR) that the Annotation Tool is set to work with. The list is populated when the tool is loaded into the browser and can be reloaded with the Reload-button, as mentioned above. An item in the list represents a Learning Object, and it displays the title and description of its metadata elements. When an item is clicked, a form appears in the right part of the tool, where the metadata on that resource can be edited. In order to save the metadata, the Save-button in the toolbar has to be clicked.

The only part not described in detail yet is the form, which will be described in the following sections. The form-based Annotation Tool provides two basic interaction styles, free text or choosing among predefined values. Which interaction style that is used is specified in the Annotation Profile for each field. The predefined values can either be specified explicitly in the Annotation Profile, or they can be detected from a vocabulary or ontology associated with the profile. In addition to the two main interaction styles, there are many ways to interact with the form when choosing a value, for example by a drop-down menu, different kinds of buttons, sliders, hierarchy trees and so on.

### 3.1 Labels and descriptions

The right section of the screenshot in figure 1 shows a typical form generated from an AP. To the left of each text-field or choice item is a text string referred to as a label, which gives the user information of the metadata expected to be edited there. A longer description in the AP can be accessed as a tool-tip on the

label. When placing the mouse cursor over such a label, the description will appear in a pop-up window next to the mouse-pointer.

### 3.2 The Text-field

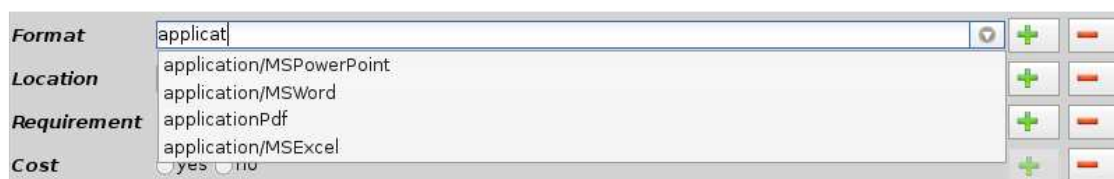
The text-fields can either have single or multiple lines, and it is up to the AP author to choose what is the most suitable for each situation. In general, the choice indicates how much input is expected from the user. As can be seen in the example screenshot in figure 1, the description first appears to only have one line, but this field is expandable when new lines are needed. This is done in order to save some space in the form.

Some metadata elements edited by a text-field could be expressed in several languages, and therefore a choice of language is provided underneath. Typical metadata that could use a language choice are title and description of a resource, whereas dates and person names are metadata elements that most of them do not need to be expressed in different languages. This is decided by the Annotation Profile author when defining the Annotation Profile.

It should be noted that the Annotation Tool supports the language coded literals available in RDF. Unfortunately, this feature could not be used in the LUISA Annotation Tool, due to incompatibility problems with WSMML. Instead, language-coded literals are expressed through a grouping of two input fields, one for the free-text literal and one for choosing a language from the controlled list of available languages. The available languages are detected from one of the provided WSMML ontologies.

### 3.3 Choices

A common way to annotate a value from a predefined set of choices is to use a drop-down menu. An example of this is shown in figure 2 below.

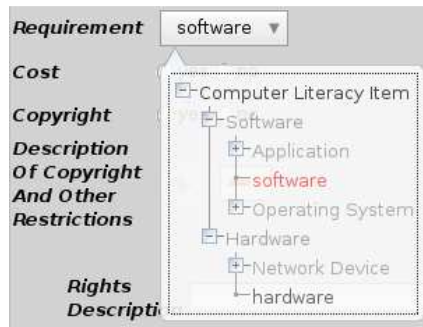


**Figure 2: An example of a dropdown menu**

One useful feature of the drop-down menus implemented for the LUISA Annotation Tool is the text-search of possible values. The search is performed by editing the field where the value is displayed and matching possible values are listed below, as can be seen in the screenshot. This mechanism is called type-ahead completion and can be helpful when the list of possible choices is long.

### 3.3.1 Hierarchy trees

If the possible choices have relations in the underlying ontology or vocabulary that allow them to be ordered into a hierarchy, a tree-based dialog may be used instead. An example from the academic use case in LUISA is shown in figure 3.



**Figure 3: Choices in hierarchy tree derived from the ontology**

A typical example is when the choices are instances of a set of classes that form a class hierarchy. In the screenshot, the choices have to be of type 'Computer Literacy Item', and when that class is expanded by clicking the plus-sign, the two subclasses 'hardware' and 'software' are discovered which in turn also have subclasses, but also instances. The instances are themselves not classes but candidates for selection, and they are acceptable choices, which the classes themselves are not.

For the end-user this way of annotating is helpful when the list of possible choices is long, since the value is located with the help of the structure that shows how it relates to other values.

### 3.3.2 Buttons

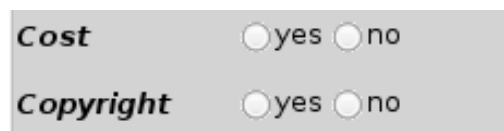
The third possible way of choosing value in the LUISA Annotation Tool is to use radio-buttons as shown in figure 4. This option is used when the number of choices is less than four and not in a hierarchical structure. The maximum of four buttons is configurable, and this is simply believed to be a good default maximum number of buttons to display at the same time

### 3.3.3 Other possible choice interactions

There are other possible ways to choose a value for metadata in a form. Examples that would be useful in LUISA would be a date-chooser that displays a calendar from which the value can be chosen, a slider that, when changed, changes number when the value has to be an integer. These ways of editing are very useful when the value has to be in a certain format in order to be understood by the computer. The standardized way to do this is to use

datatypes, but due to technical restrictions in the translation between RDF and WSML (described in more detail in LUISA deliverable 3.3) the use of datatypes

is not possible, and therefore these ways of annotating are not possible in the LUISA Annotation Tool although the underlying system has support for it. The Annotation Tool would also ensure the correct text-format if datatypes could be used. This is very useful for example in the datatype for date, where the



Cost  yes  no  
Copyright  yes  no

**Figure 4: Example of radio buttons**

numbers for year, month and day can appear in different places in the string which therefore needs to be typed in order to insure a correct interpretation. But, since datatypes cannot be used, it is up to the user to enter the value in the correct format.

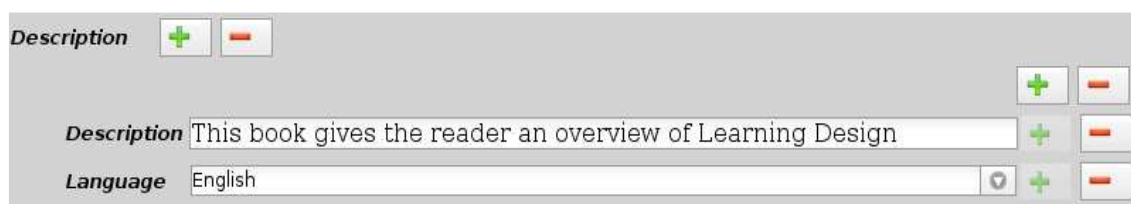
### 3.4 Groupings

The text-fields and the choices can also be grouped, as seen in figure 1. For example, under the label *Identifier* there is a grouping with the labels *identifier* and *catalogue*. The choice to do so may reflect the structure in the metadata and / or the intent to show that a set of metadata is closely related to the end-user.

### 3.5 Multiplicity

When annotating a resource it is sometimes possible to add more than one value. For example, the title of a resource can be given in several languages. When this is possible, the '+'-button is activated in the form next to where the value is annotated. Close to the '+'-sign is also a '-'-sign that is used to remove a value. These buttons are not only used to add a single value, but also to provide groupings. This means that the buttons are not only placed where a value can be edited, but also in those cases where they represent groupings.

Consider the following example on how the buttons can be used for editing the values for description of a Learning Object in LUISA. As can be seen in figure 5



Description

Description

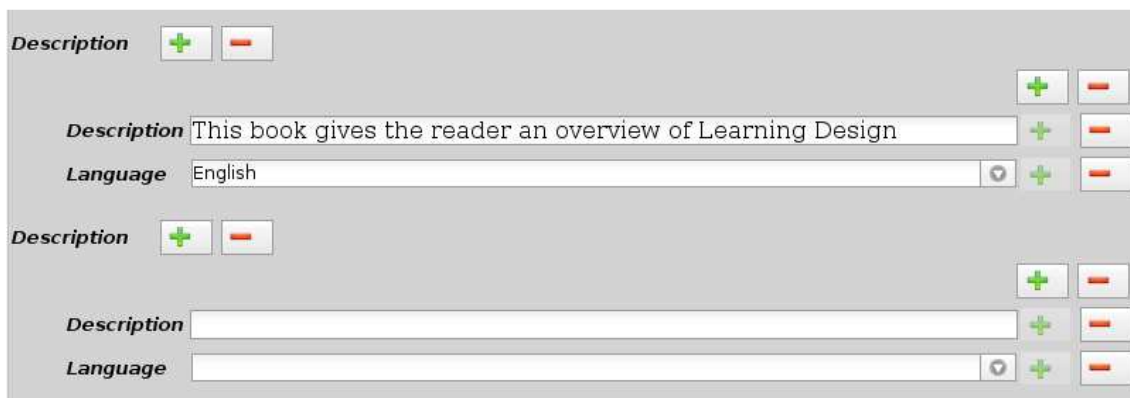
Language

**Figure 5: One description is given in English**

a description already exists and there are two '+'-buttons (that are not inactivated) to click. When adding metadata for description, two cases can be considered:

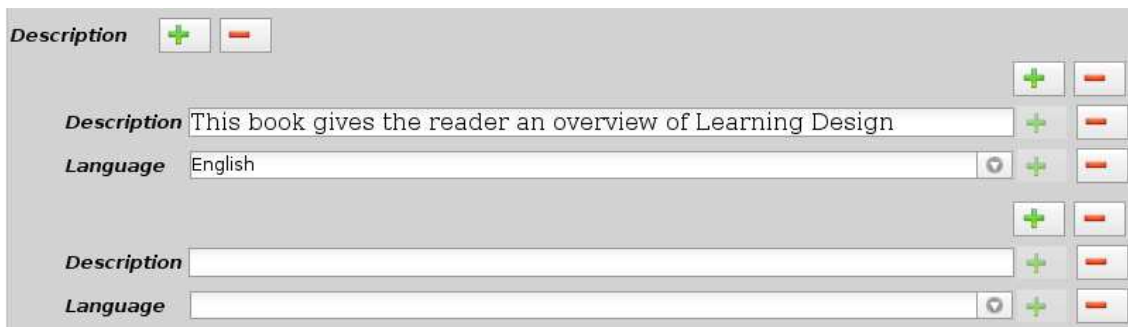
1. A totally new description needs to be added or,
2. the existing description should be added to, but in another language.

In case of 1) the first (counting from the top) '+'-sign should be clicked, and then the form will expand and add another grouping for a new description as can be seen in figure 6.



**Figure 6: The form after the first plus-button has been clicked**

In the case of 2) the second '+'-button should be clicked, and then a new grouping consisting of a text-field and a drop-down menu is added to the form as can be seen in figure 7.



**Figure 7: The form after the second plus-button has been clicked**

This example is taken from a specific grouping structure in the LUISA Annotation Tool and shows the importance of knowing what it means to add a value and which '+'-sign to use.

Whether it is possible to add or remove a text-field or a choice item is defined in metadata standards, if the tool has such machine-processable information available. If not, the tool will look in the AP and see what information is provided



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there (given by the AP author). In the form created by the LUISA Annotation Tool it is not possible to add more values than expressed as the maximum. The lowest number of values are expressed in the minimum cardinality restrictions, and it is not possible to have fewer values than defined as the minimum number of values. The third cardinality option in an AP is the preferred number of values, which acts as a input to the Annotation Tool on how many textfields, choice-items or groupings to initially create. This option is specific to the AP and the editing case, and cannot be found in metadata standards. It is therefore fully under the control of the AP author. The only way that the end-user is affected by the preferred cardinality is that she/he will see how many text-fields or choice items that are created initially in the form. The most usual values for the cardinality are restricting the minimum to zero or one, the maximum to one or no limit, and the preferred cardinality to one

## 4 CONCLUSION

This deliverable has described how the Annotation Tool is to be used by an end-user and specifically the implementation created for LUISA in order to make changes in the metadata of the Learning Resources used in the project. The tool is web-based and uses techniques like AJAX and JavaScript in a REST-based manner. The LUISA Annotation Tool can be accessed via a URL and can be run in any modern web-browser supporting JavaScript, which means most of the browsers used today. When the URL is loaded into the browser, an interface that has been split into the following three parts is presented to the end-user:

- A toolbar, mainly used for managing (creating, deleting, saving etc.) the metadata records on the resources, which in LUISA are primarily Learning Resources,
- a list of the Learning Resources possible to edit,
- a form where metadata for the chosen Learning Resource from the list can be edited.

The form provides possibilities to edit metadata either by filling in a text-field or by making a choice via a drop-down menu, hierarchy trees or radio-buttons. As stated in this document, more ways of choosing a value are supported in the code, by making use of datatypes in RDF. The datatypes can however not be translated to WSML by the translator used in LUISA, but if a later version of the translator makes this possible, the support for creating other ways of choosing a value is there. This however also requires some small changes in the Annotation Profiles made to annotate resources in LUISA in order to include the datatype in the profile. It could be the case that translating RDF, that contains datatypes, to WSML is not possible at all. This can happen if the way datatypes are modelled in WSML is incompatible with how it is done in RDF. If so, there is no simple solution to the datatype problem.

The metadata that is edited is encoded in RDF, but this is kept transparent for the end-user. This was one requirement when designing the tool stating that no knowledge about RDF or the Semantic Web should be required by the end-user. It is however required of the end-user to have knowledge about the metadata that is edited, and also the possible structures in order to use the groupings in a correct way.

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