Seamless integration of desktop and mobile learning experience through an ontology-based adaptation engine: Report of a pilot-project

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Abstract. The paper describes a module within the distance language learning environment of the Language Centre at the Genoa University which adapts, through an ontology, learning activities to the device in use. Adaptation means not simply resizing a page but also the ability to transform the nature of a task so that it fits the device with the smallest effectiveness loss with respect to the ability the activity is meant to develop. In our environment, activities are tagged with a language-related ability so that an exercise which would not be usable on a given device can be transformed so as to be both usable and to maintain its original language learning potential. Following previous analyses of the most technical features of the engine, this paper will report on a pilot project, and the design and testing of an English course whose activities are transformable thanks to reasoning mechanisms based on the ontology. Our analysis will focus on the most important issues that have arisen during the development of the course.

Keywords: mobile language learning, ontology, distance language learning.

1.   Introduction

A major point of interest in mobile technology is its supposed ability to bring language learning outside the classroom by exploiting networking along with mobility (Kukulska-Hulme & Shield, 2008). Our project, however, is more

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institution-oriented and aims at making language learning content on a web-based platform also available to mobile devices. Adapting content from desktop computers to mobile devices is a thorny matter because of, for example, the physical features of the devices, which influence the way learners approach activities (Huang & Lin, 2011).

To accomplish the task of adapting content to different devices, we developed an ontology capable of determining the best way to transform an activity given a) the physical features of the device, b) the language ability the activity aims to train and c) the activity's task type. In our contribution, we report the results of a pilot project in which we designed a short language course which was attended on mobile phones without adaptation and on mobile phones with adaptation.

An environment, called CliRe, was designed at the Language Centre of the Genoa University to allow teachers to develop their own courses by building and combining language learning activities. Each activity is enriched by metadata (e.g. duration and ability). By using these data, users know how much time is needed to perform a learning unit and which abilities it aims at developing. The activities contained in the platform are used as a part of different courses. The Italian Ministry of Education is funding language courses for secondary school teachers to prepare them for Content and Language Integrated Learning (CLIL) teaching. A part of these courses is to be held online and the Language Centre is in charge for these online, forty-hour courses for the Liguria Region. These are interactive courses in which learners use part of the platform content. The platform, therefore, allows for a precise estimate as regards the duration of the content supplied with the course so that learners' activities and actual work can be assessed and evaluated in detail.

Our interest in mobile technology is that it could be an effective way to also deliver content in the learners' spare time, which could be an advantage to adult professional learners. Our project, therefore, is more formal and institution-centered if compared with many experiments on mobile learning which aim at integrating informal, social and mobility issues into language learning.

2.   Analysis and discussion

A major issue in mobile assisted language learning (Chinnery, 2006) is that the physical features of a device have a profound impact on its use for an activity; screen dimension and input method can make the execution of an activity hard if not impossible (Stockwell, 2012).

Content adaptation to a device's features, therefore, is a fundamental step if an activity is to be performed on a mobile device. Adaptation, however, is not simply a matter of screen dimensions or usability, but potentially entails profound transformations as, for instance, a certain input method (e.g. writing letters in a gap fill exercise) would be difficult to use on a given device. Input method, on the other hand, influences the type of task to be performed; task type, in turn, influences the kind of activity that can be done. As might be expected, some activities are more fitted than others for learning a given language ability: text reading and multiple choice questions are comprehension exercises, while sentence reconstruction is suited for morphosyntax exercises. Not all activity types can be performed on all devices.

We adopted Heift's (2003) distinction amongst task (i.e. the action the learner performs, e.g. click a button, enter some text, etc.) and type (i.e. the actual exercise, e.g. multiple choice, gap filling, etc.), and integrated into our platform an ontology-driven adaptation engine that, whenever an activity is accessed through a mobile device, determines whether the device is physically suited for that activity. In case it is not, the engine tries to transform the activity so that a suited input method and task are found for the device, but allows for an activity type which is suited for the language ability attributed to the original activity.

The ontology is made of several interacting components:
- input method and its fitness for a task;
- task and its fitness for an activity;
- activity type and its fitness for an ability.

To be able to transform activities, we formalised these interactions in an ontology. A special exercise syntax, named Proteus, was designed to allow exercises to be transformed from one type into the other; so far, exercises in this format can be rendered into gap filling form, multiple choice, matching and sentence reconstruction types.

For instance, a listening activity is made up of an audio file and a gap filling exercise. The engine will determine if the device is fitted for a) audio playback and b) a text-entering task. In case the device is not fitted for such tasks, the engine will transform the activity so that it is fitted for the device (device/task) and for the ability (activity/language ability); in this case, the gap filling exercise would be transformed into a multiple choice for devices in which text entering is assessed as non (or hardly) usable. In case the gap filling type was part of a writing activity, it would be transformed into a reconstruction exercise.

To test our engine, we designed a short course on collocations which was administered to two groups of students; the first group accessed the course without adaptation while the second group accessed a course whose activities were adapted for their devices. As the course was centered on lexis, most of the exercises were formally simple (e.g. matching between collocation and meaning) and did not contain multimedia elements, so that our engine would only work on exercise transformations.

3. Conclusion

The results of our experimentation, fully illustrated in Mercurio, Torre, and Torsani (2014), show that adapted content yields better results as regards task execution time and user perception of usability. A caveat, however, seems to be in order: usability is only one side of the matter and some work remains as regards actual usage and its potential for language learning.

In particular, the following areas will be the subject of our next experimentations:

- Formal transformation. We need further tests to determine whether the Proteus format can successfully transform activity types into one another and not only perform formal transformations; in other words we need to determine if the format is capable of actually transforming an exercise into another equally difficult exercise.

- Adherence between activity types and language learning ability. We need to verify whether our transformation engine can also successfully apply to other activity types (e.g. including multimedia) targeted at different language abilities.

- Long-term effectiveness. We need to ascertain whether success in our tests is due to the experimental setting or users are actually interested in performing activities in their spare time and, in this case, whether this format actually makes activities appealing to learners.

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