Adaptive Metaphor-Enabling of Web-Based Courses

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Abstract

Metaphors play an important role in learning, and are understood in context of the learner's prior knowledge and culture. Therefore, there is a need to include metaphors adaptively. We introduce a conceptual model for metaphor adaptivity, and suggest an architecture allowing to enable metaphor adaptivity both in existing and in the future e-learning web sites.

1. Introduction

A metaphor is a figure of speech that expresses concepts in the domain by making reference to concepts in another (often, unrelated) domain. The target of the metaphor is a concept in the domain we are trying to explain (target domain), while the source is a concept in the domain to which we make reference (source domain). Metaphors are known as an effective cognitive tool both in traditional, and in on-line education [2, 4].

For a metaphor to be effective, the learner needs to be familiar with the source domain. The use of a metaphor sourced in domain unfamiliar to the learner may lead to confusion, or even create misconceptions. Clearly, to fully leverage the power of metaphors, one needs to apply them in context of the target learner's culture and knowledge. For e-learning, this can be achieved by adaptively attaching metaphors to study materials, depending on the type of learner accessing the materials.

In this article, we redefine the metaphor structure to account for adaptivity to the learner's background and culture, we introduce the notion of a user (learner) type. Learners with similar background and culture are allocated to a user type, and the on-line course features are decided by the user type, rather than adapted to each individual user.

To account for adaptivity to user types, we enhance the classical metaphor structure as follows.

The implications are that the same pair of source and target concepts can be connected via several instances of ground explanation, distinguished by the user type. For example, for a user type involving users very well familiar with the source domain, the ground

2. Metaphor structure

The classical metaphor structure can be expressed by the following HERM diagram (we are using HERM notation as introduced in [3]).

Figure 1. Classical metaphor structure.

Each concept in the target domain is potentially a metaphor target, and each concept in the source domain is potentially a metaphor source. A metaphor is formed when a concept in the target domain is associated with a concept in the source domain via "ground" relationship. Ground represents the common features shared by the target and by the source concepts. In context of on-line education, one can interpret ground as an explanation (targeted at the learner) of how the target concept is related to the source concept.

To manage adaptivity to the learner's background and culture, we introduce the notion of a user (learner) type. Learners with similar background and culture are allocated to a user type, and the on-line course features are decided by the user type, rather than adapted to each individual user.

To account for adaptivity to user types, we enhance the classical metaphor structure as follows.

Figure 2. Metaphor structure enhanced to account for adaptivity to user types.
explanation can be very short. On the other hand, for a
user type involving users poorly familiar with the
source domain, the ground explanation may cover
some aspects of the source domain (such an
explanation is warranted if the metaphor in question is
a very common one, so that it almost constitutes part of
the target domain knowledge). Alternatively, for a user
type involving users with no knowledge of the source
domain, no ground explanation instance may be
provided, so that for them, the metaphor is not
available, and thus, they are spared of confusion and
conceptual overload.

3. An architecture for adaptive metaphor-enabling

Metaphors can be included as an integral part of the
on-line course content, as it is done in [2]. The
drawback of this approach is that to add metaphors to
an existing on-line course, it is necessary to re-develop
the course. Also, if metaphors form an integral part of
the course, it increases the complexity, and thus
increases the costs of both development and
maintenance. Here, we propose an alternative
approach, relying on adding adaptive metaphor support
as a separate architectural layer by using the decorator
design pattern [1].

Let us call the component providing the basic e-
learning service a base service component. A base
service component could be, for example, a web server
providing access to HTML-based teaching materials.
We call the component adaptively adding metaphors to
the material served by the base service component a
metaphor-enabler component. The metaphor-enabler
component acts as a decorator by intercepting client's
request and passing it on to the base service
component.

![Diagram](image_url)

Figure 3. Adding metaphors to base service.

The response of the base service component is
intercepted by the metaphor-enabler, adaptively
transformed to add metaphors, and returned to the
client as a response to its original request. If the
response reaching the client is in the form of HTML or
XHTML markup, metaphors may be shown as hot
spots on web pages, with source concepts and ground
explanations shown to the user as tooltips or as
popups.

The metaphor enabler needs to be aware of the
current user's user type, and needs to have access to a
database relating target concepts to source concepts
and user types.

While metaphor enabler depends on the base
service component, the base service component
remains unaware of the metaphor enabler. Hence, the
proposed architecture can be used to adaptively adorn
with metaphors an existing web-based course.

4. Conclusions

We introduce a conceptual model for metaphor
adaptivity, that distinguishes source concepts and
ground explanations available for users (learners) belonging to different user (learner) types.

In addition, we suggest an architecture allowing to
enable adaptive metaphor support both in existing and
in the future e-learning web sites. The architecture
suggests decorating on-line course with metaphors by
adding a separate architectural layer, so that the base
service providing e-learning does not need to be
changed.

References


