A Case Study: Developing Learning Objects with an Explicit Learning Design

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Abstract: In learning object design an emphasis on visual attractiveness and high technological impact has seemed to persist while content frequently reflects a lack of clear pedagogical basis for the application of learning objects for online learning. Most apparent is the absence of supportive scaffolding for the student user; interactivity built on an 'exploratory' approach can fall short of achieving its learning objective if support and guidance are missing for the student user who fails to grasp the learning point being offered. Research into developing an effective learning design for learning objects, undertaken by a research and development group in Modern Languages at the University of Southampton, has evolved an explicit pedagogic design for learning objects in English for Academic Purposes and study skills for international students and English native speaker students. These separable learning objects can be aggregated into resource sets or 'toolkits' with multiple usage options for students and teachers. Moreover, this approach to designing effective online language learning materials is based in a defined pedagogy, which also has applicability in developing discipline-specific learning objects. It seeks to draw on key elements and processes identified in Laurillard's 'Conversational Framework' for teaching and learning (Laurillard, 2002). This paper will present a case study of the development of a toolkit of learning objects with an explicit learning design. It will present the pedagogic basis for the development of these learning objects; outlining how they operate both as micro learning contexts and as components within the wider teaching and learning framework of a face-to-face or online course. It will also describe research findings showing how learning objects have been received by students and tutors.

Keywords: Learning Objects, learning design, blended learning, teacher development, pedagogy

1. Introduction

Despite considerable investment in learning object technology over the last decade, they do not yet appear to have realised their full potential. Discussion persists in terms of the reasons for their limited impact (Collis and Strijker, 2004); the challenge of designing them for reuse or repurposing (O'Grady et al, 2005); and more recently, the means by which, as Open Education Resources (OERs), they might be shared effectively in an educational culture where 'openness is a prerequisite to change'(Wiley and Hilton, 2009). In comparison, still very little is said about the important matter of their learning design or their pedagogical effectiveness although, in spite of the advent of social software and its different pedagogic affordances, learning objects continue to be developed and applied in a range of disciplines.

One influential factor in their limited impact may be that the power to create learning objects frequently still often lies with the technologist rather than with the usually less technically skilled, but pedagogically aware classroom teacher. Indeed, much of the software that has been available for creating 'interactive web pages' lacks a recognisable pedagogic basis or learning design. Moreover, such software does not offer support to those teachers who are learning to use it, in making the transition from producing paper-based materials for their classroom teaching to designing learning materials effective for the online environment.

This paper will address some of these issues; firstly, providing a brief overview of the different types of learning objects being produced, and then providing a case study of an approach to the creation of learning objects which is based in a defined pedagogy and which has also involved the development of a design template for creating reusable learning objects. Reference will be made to the development of one particular resource set of learning objects in English language and study skills for international students, the *EAP (English for Academic Purposes) Toolkit*. The process of developing this toolkit, in particular, has helped determine the key features of a pedagogic approach for learning objects in general. An examination of how this toolkit has been implemented and the user response to it also demonstrate how learning objects can offer versatility in the way they can be used by learners and teachers. This approach to learning object design offers teacher-developers a clear pedagogic framework for the production of effective learning objects for use with their own students.

2. Learning Objects: the simple, the complex and the reusable

Since 2004, an e-learning research and development group in Modern Languages at the University of Southampton, has been exploring and developing a range of web-based teaching and learning tools and resources for use in blended and online courses. The main activity underpinning the design and development of our online courses and resource sets (toolkits) has been the production of learning objects (LOs). LOs are a form of eLearning resource used across a range of subject areas, which are still being realised in various formats by those involved in the field of Learning Object technology. As a result, definitions of LOs abound (see Polsani, 2003) and this difficulty of 'sharing a common understanding of the term' as Hodgins (2000) notes, also points to different views held about online learning and instructional design.

In practice, at one end of the spectrum LOs take the form of simple digital resources which may offer potential for learning in relation to a particular topic but which lack development of this potential in the form of supporting information or an explicit learning activity. These have been referred to as 'media objects' by Hodgins (2000) and have more recently been described as representing a kind of 'asset' or 'pedagogic asset' (eLanguages, 2008a). These digital assets with pedagogic potential might include for example, video files or graphic images. Other LOs present as combinations of one or more digital assets with clear pedagogic intention. Some of the LOs that fall into this category are built predominantly as graphic Flash sequences supported by audio-visual resources and textual narrative and explanation; some also offer multiple choice tests for self-assessment or checking of understanding by the user in the final stages. A non linear approach is often preferred for these, allowing users to learn by exploring information presented in a variety of media about a single topic. They may involve considerable content in themselves (high granularity) and appear to be conceived and designed for stand-alone use rather than as part of a specific course or in combination with other LOs.

The approach outlined below offers a more activity-driven LO in which a pedagogic task or tasks forms the basis for the learning rather than the assets themselves. A single asset or combination of assets support the task(s), and might include video, audio, graphic or textual assets. Reflecting a more linear presentation, these LOs may appear to suggest prescription in how they should be used but in fact, they can offer considerable flexibility in how they are used by students. They also reflect a lower level of granularity, providing for 'bite-sized' chunks of learning, and can have a role alongside other LOs and other course components in teaching and learning contexts, both blended or wholly online. The LOs in the *EAP Toolkit* (eLanguages, 2008b) developed at the University of Southampton provide an example of this approach, combining pedagogic assets with staged learning activities and feedback which drives and scaffold students' learning. Furthermore, these LOs aim to be reusable.

There has been a strong impetus to add scope for reusability to a number of the different formats being adopted for LOs. Reusability is an important consideration because of the time investment involved in creating LOs, and so the need to maximise the potential for re-use in new learning and teaching contexts is widely acknowledged (e.g. Wiley 2001, South and Monson 2001; Koper et al, 2004). The re-use of an LO may be possible in its original format, or through a process of revision, known as 'repurposing'. Scope for re-use is a factor that is not generally supported by standard webpage authoring tools. Much of the available commercial authoring software supports the technical creation of web pages for interactive learning purposes but focuses on design at the level of the whole course rather than at the level of the smaller, more reusable chunk of online learning. Other software, some of which is by no means new, allows teachers to create quick and simple quizzes and question sets in a variety of interactive formats to support classroom learning, but predominantly for self testing and with questionable scope for learning.

Most of these available tools offer the user total freedom in how they create the learning materials. They do not offer a particular pedagogic approach or design template for the production of output with potential for reuse or repurposing. For the teacher-developer, failure to factor in re-use at the start of the design process can render materials unusable beyond the actual course for which they have been developed. Without a template for reuse, if an attempt is made at a later stage to repurpose learning objects, the amount of time needed to disaggregate and re-synthesise elements for a new context of use can be a lengthy exercise (Watson, 2007). Once teachers embark on the business of creating online learning materials for their students the desire to later re-use or repurpose them for different

contexts can lead to an unwelcome amount of extra work – unless re-use has been planned for in advance.

Much of the discussion around the reusability of learning objects has centred on the technical requirements to achieve this rather than on pedagogic aspects. The technical standardization of LOs has been a predominant concern, with the storing, searching and sharing of LOs through repositories as the driving force for this. However, reusability needs to be considered in the context of LO pedagogy too. Granularity or 'size' has been highlighted as a critical factor which impacts on the reusability of LOs (South and Monsoon 2001, Koper et al. 2004). As Koper et al. point out, optimally, a learning object should be as small as possible whilst maintaining internal consistency. Without guidance on what might be a suitable 'size' or level of granularity for any chunk of online learning being created, teachers developing learning objects for the first time, may produce ones of very variable size depending on the complexity of the topic or learning point encapsulated. The selection of too large a learning point/ topic coupled with a desire to deliver this in 'completeness' can result in very large LOs where focus and structure may be lost due to the amount of information provided. A complex point may be better spread over several LOs. At a later date, variably sized LOs brought together for re-use in a new course iteration are likely to require considerable work in their repurposing to produce a coherent and unified set. Maintaining general consistency of style and granularity   therefore, facilitates repurposing and reuse from the course builder's perspective, and, LOs which share a broadly similar set of design features within an online course, help to deliver an organised and balanced learning framework for the student.

2.1 Developing LOs with scope for reusability

The need to facilitate straightforward re-use and ease of repurposing of LOs was an important discovery during the design process underpinning the creation of a toolkit of 100 learning objects in English for Academic Purposes and Study Skills for international students in Higher Education. The initial selection of LOs for the *EAP Toolkit* required some considerable repurposing (see section 4 below) in order to create a coherent resource set (toolkit) in which each LO focussed on a discrete learning point and had a relatively low and consistent level of granularity for the reasons described above. This was a valuable experience and taught the importance of developing reusable learning objects with shared attributes both technically and pedagogically. All later additions to the toolkit adopted and reflect a consistent pedagogic approach which allows for reusability and ease of repurposing.

Besides consistency in level of granularity, another important feature which renders LOs more reusable is if they are made to be self-contained or separable from their context of use. Koper et al. (2004) refer to this as 'encapsulation'. This can be achieved pedagogically in several ways. In the LOs selected and modified to form the *EAP Toolkit,* the introduction or lead-in to each LO establishes a micro-context yet does not refer to the specific course context in which the LO is being used. It might seem at first glance, that the lack of internal linking to context of use could lead to weakness in terms of overall coherence; however, LOs can be effectively embedded in a specific course and linked to 'context' within the environment of use, e.g. a Virtual Learning Environment (VLE) such as Blackboard, Web CT or Moodle. In other words, additional course scaffolding can be wrapped around an LO once it has been uploaded to a VLE. Figure 1 below shows how a sequence of selected LOs can be embedded in a specific context of use within a VLE (here, a pre-arrival online course on living and studying in the UK, delivered to international students in their home countries through Moodle). Reference to the theme, unit, week (as in Figure 1) or other part of a course that represents the specific context of use for an LO can be made outside the LO itself so that it continues to retain its potential for re-use elsewhere.

Designing LOs which allow for re-use requires some rethinking in terms of how online material development is approached. The major aspects of LO design which impact on reusability need to be determined and taken into account in the design template and ultimately reflected in any authoring tool. In *the EAP Toolkit*, a range of the micro components of LOs (e.g. task instruction, specific types of task developed in Flash) also present themselves as suitable for re-use or quick repurposing, thus providing the equivalent of a mechanic's 'toolkit' for disassembling and rebuilding LOs to a general formula. To recap then, the key features that enable LOs to be reused or easily repurposed may be identified as:

- being initially developed as 'building blocks' and designed to a formula which facilitates re-use in another course or resource set;
- being self-contained and separable from individual context of use;
- being constructed using micro components which are also standardised and separable;
- being consistently sized and styled.

Figure 1: Scaffolding added in the VLE embeds re-used LOs in a new context of use

Besides highlighting the prerequisites for reusability, the development of the *EAP Toolkit* also allowed important pedagogic features shared by our LOs to emerge and be more clearly defined.

The desirable LO attributes which have been established can be summarised: LOs should focus on a clearly identified learning point, which, if complex, is unpacked and presented through several staged activities allowing for reflection, practice and productive types of activities to be combined. Through repurposing, the LOs in the *EAP Toolkit* were reorganised so that all were activity-led and aimed to engage the student in 'learning by doing' and active reflection. Activities were enhanced with more feedback, which included comments and explanations as well as answers in order to support and scaffold learning. Hints and examples are also options available to help students engage with tasks, and links are included to a glossary, online dictionaries and a web links page providing further practice or reference material associated with the learning point. The next section explains how these elements work together in the LOs, and presents the pedagogic approach in detail.

3. A pedagogic design for reusable Learning Objects

The LOs created by eLanguages combine multi-media assets such as audio or video clips, texts, graphics and web links with an activity-based approach to learning. Each LO focuses on a 'bite-sized' learning point. A sequence of staged activities around this, supported with feedback (answers, comments, explanations, hints, examples), offer a pathway through the LO. This sequence optimally provides between 20 to 40 minutes of learning activity and allows for flexible (varied) use by both the classroom teacher and the student user.

Although incorporating different media resources as 'pedagogic assets', these LOs, nevertheless, aim to be pedagogically driven. Some of the important pedagogic features that they exhibit are that:

- they are activity-centred;
- they aim to engage the student actively in reflection;
- activities allow for practice and production;
- activities are also personalised (learner-centred) where possible;

- they are enhanced with significant amounts of feedback which helps to support and drive students' learning;
- the design of the LOs accommodates different learning approaches.

An example of how these features are achieved and work together to facilitate student learning can be considered in 'Using paraphrase in writing', an LO from the *EAP Toolkit*. In Figure 2 below, a pre-activity task from this LO can be seen prompting the student to reflect about why paraphrase is more often preferred to direct quotation in academic writing. The first of three key activities is also visible – this requires the user to compare two paraphrases written by two different students in a typical course-related, assignment writing context, decide which is better, thereby recognising a good paraphrase.

Figure 2: A pre-activity task encouraging reflection in an LO on paraphrasing

Two activities follow, building on this simple recognition task. The first requires the user to analyse the better of the two student paraphrases in order to identify the specific actions from a list that were involved in producing it and so arrive at a set of good practices for the production of a paraphrase. An analysis of the less effective paraphrase allows focus on what not to do when paraphrasing. Feedback allows for comparison of students' responses and adds further comment (see Figure 3). The final activity requires the user to rise to the challenge of producing a paraphrase. Using another student-centred scenario the user practises making paraphrases of five short original text extracts for use in a student's written assignment. Feedback includes model answers to compare against and a review of the key steps involved in producing a paraphrase for use in a course assignment.

Through the process of engaging with a short sequence of three staged activities, which become increasingly challenging, and their feedback, the student user is supported through their learning; this entails recognition of what constitutes a good paraphrase, abstracting from this some key principles and then applying them. The time needed to complete all activities is not likely to exceed 40 minutes, thereby providing a bite-sized chunk suitable for online learning. The pedagogic basis for the LOs seeks to draw on key elements and processes (involving 'discussion', 'interaction', 'adaptation' and 'reflection') identified in Laurillard's model for teaching and learning (Laurillard, 2002:87). Laurillard's 'Conversational Framework' provides a model for the inclusion of learning technologies as part of the teaching and learning process in Higher Education. At a micro level, the design of our LOs aims to reflect various elements identified by Laurillard's iterative model of learning, including scope for:

- task 'interaction';
- 'reflection' about the learning concepts involved;
- 'discussion', which in the LOs is an internalised process through engagement with the activities and their feedback (when they are used for independent study);
- 'adaptation' of (students') understanding through their engagement with a sequence of increasingly challenging activities centred around the learning point.

Figure 3: Feedback scaffolds students' learning in Activity 2 of LO on paraphrasing

Activity feedback in part assumes the role of an 'automated tutor', predicting where the student might have chosen a different answer and elucidating and explaining as necessary. Whilst this form of feedback is inevitably limited to predictable areas of student misunderstanding, it can help support learning where LOs are used independently by students, who can also make their own choice about when to view feedback. . However, if LOs are inserted into a full learning context, the inclusion of a 'live' and reactive tutor in the learning framework - through face-to-face or online tutoring at the level of the macro learning context - can help realise the full iterative process described in Laurillard's framework, particularly the need for 'adaptation'. The 'discussion' element identified in Laurillard's framework can also be met more dynamically through peer (and tutor) interaction, in class or through online discussion tasks overarching concepts covered in the LOs. The next section will illustrate how tutors at the University of Southampton have aimed to realise this practically using the LOs in the *EAP Toolkit* in face to face courses.

4. LOs as a versatile technology through the use of toolkits

The development of the *EAP Toolkit* represented a first step in distilling an effective pedagogic approach for supporting our international students' online learning. The current toolkit LOs are equivalent to c. 80 hours of activity-driven learning focussing on a range of academic study skills and aspects of language development. It came into existence through the repurposing of, initially, 60 items of online learning material selected from several online EAP courses developed some years previously during a government-backed UK e-Universities (UKeU) Project by a consortium of six UK universities led by the University of Southampton. At the end of the project, in a search for a way of re-using the course material and building on the lessons learned, research and development continued at the University of Southampton.

This was the first context of re-use in which LOs were brought together to form a support resource (the *EAP Toolkit*) for a summer face-to-face pre-sessional course for international students in English for Academic Purposes. The chosen items from the existing online courses were disaggregated from assessed tasks and other course scaffolding, after which the LO design template was reworked to facilitate reusability, and a consistent style and desirable level of granularity determined for all LOs. Through the process of standardising the LOs, those exhibiting particularly effective and desirable pedagogic features were identified and refined, the basic elements of a learning design were distilled (as described in section 3 above) and an attempt made to map with Laurillard's framework. Following the repurposing and refinement of the LOs, additions were developed to produce a coherent and comprehensive resource set primarily intended for independent use by international students. The

outcome of this process was a set of LOs repurposed for use in a new format – as an online resource set (toolkit).

It was envisaged that the LOs would perform the role of a set of self-access learning aids which pre-sessional course students could access at any time through a password-protected VLE from their own computer at home, or from any public computer workstation or personal laptop at the University. Being web-based and accessible at any time and from any place immediately gave it an advantage over other location-restricted online resources delivered, for example, on CD Roms. For ease of student access, the LOs were organised into a simple and flexible set of skill-related folders and uploaded to the University's VLE, *Blackboard*. An initial set of six skill folders has since been expanded to eight as the number of LOs has increased. These are:

- Learning to study
- Academic writing
- Academic reading and critical thinking
- Vocabulary for academic purposes
- Grammar for academic purposes
- Academic listening and note-taking skills
- Academic communication skills
- Discipline-specific needs (e.g. specialised types of writing assignment)

Interactive examples from the EAP toolkit and a full list of the 100 LOs can be viewed at www.elanguages.ac.uk. The LOs in the toolkit conform to a basic set of technical standards and offer interoperability - identified as an important attribute for LOs - especially if they are to offer the appropriate level of functionality to a community sharing their use (Koper et al, 2004).   In other words, they can be uploaded and delivered via commonly used VLEs. Each LO is essentially a simple content package, comprising an html web page serving as the 'front end' containing the learning activities supported by digital assets such as embedded audio or video clips, images, with linked word document or pdf files, and so can be zipped and uploaded to a VLE. Alternatively, LOs can be organised into sets and linked together into a series of web pages and delivered through a password-accessed website.

4.1 Blended learning and other modes of use

During the first year of using the *EAP Toolkit* to support the pre-sessional course course tutors began blending parts of LOs with their classroom teaching, linking to *Blackboard* through computer and/or SMART board technology in their own classrooms. This suggested to us that LOs could offer a new and potentially powerful type of classroom teaching resource. Teachers also began prescribing particular LOs to students for class preparation and consolidation; creating programmes of selected LOs for students to complement the course syllabus; adapting or adding to LO activities to create offline writing tasks which students could submit for tutor feedback. In other words, they began to embed LOs much more with their teaching, making them more integral to the course syllabus. This practice grew in subsequent years and a number of distinct ways of using and blending the toolkit with the pre-sessional and other tutor-led courses emerged. The different modes of use for the toolkit that have been identified to date are:

- as a stand-alone resource for students to use for independent study;
- as a remedial resource for tutors to direct individual students to;
- blended with face-to-face teaching and / or a specific programme of study such as the pre-sessional course
- *through student use outside the classroom for lesson preparation/consolidation*
- *through adaptation into hybrid online/offline tasks*
- *and through tutor use in the classroom*

The LOs have therefore proved to be flexible in ways we had not foreseen at the outset. Although their effectiveness as classroom teaching resources has not yet been formally investigated, observations of their use in classroom teaching suggest that both students and teachers readily adapt to them for this purpose. LOs collected into toolkits such as the *EAP Toolkit* and those forming a

growing resource bank continue to offer new possibilities for repurposing and re-use. Some of these possibilities have already been realised in further projects which are now being evaluated such as the HUMLO Project: repurposing learning objects to meet discipline-specific needs in Humanities (Watson, 2009) and the development of an open set of web-hosted LOs forming part of *Prepare for Success,* (www.prepareforsuccess.org.uk)*,* a web learning resource for international students coming to study in the UK funded through the Prime Minister's Initiative for International Education and the UK Council for International Student Affairs (UKCISA).

4.2 User evaluation of LOs

Since their introduction in the summer of 2004, a variety of data capture methods have been used to help evaluate the use of LOs in blended learning contexts. This has so far mainly focussed on use of the *EAP Toolkit* on pre-sessional courses and data has been gathered at regular intervals. Data format has included student questionnaires (800 gathered in total); observations of students using LOs during independent study sessions (70); tutor questionnaires (150); student learning log entries (120).

Figure 4 below presents a brief comparison of students' responses in 2004, 2005 and 2008 in relation to frequency of use; ease of use; and perception of the usefulness of LOs in the *EAP Toolkit* for independent learning purposes.

LOs	2004	2005	2008
Frequency of use	78% (once a day to once or twice a week)	74% (once a day to once or twice a week)	73% (once a day to once or twice a week)
Ease of use	90% (very easy/easy)	83% (very easy/ easy)	76% (very easy/ easy)
Usefulness	88% (very useful/useful)	92% (very useful/ useful)	93% (very useful/ useful)

Figure 4: A comparison of student responses concerning frequency of use, ease of use and usefulness of LOs over 3 pre-sessional courses

Since 2005, in order to embed the LOs more effectively in the presessional courses, pre-sessional tutors have been inducted in use of the LOs before the course begins and, subsequently, each class of students has been guided through self-enrolment to the toolkit and received a hands-on induction with the LOs. Use of LOs has continued particularly through increased blending by tutors with their classroom teaching and through their directing students to LOs that consolidate classroom learning, although there has been a slight fall in frequency of student use. In 2008 a particularly large cohort of students (c. 700) passed through the summer pre-sessional on five or ten week courses. The challenge of inducting so many students and a range of other practical, contributory factors may explain why a drop in frequency of use was reflected in the responses of students surveyed that year, despite the fact that they also rated LO usefulness more highly than in previous years.

LOs in the EAP Toolkit…	Student % agreeing or strongly agreeing	
are enjoyable to use	63% (2005)	62% (2008)
help me to understand a learning point	70% (2005)	71% (2008)
provide good feedback	66% (2005)	49% (2008)
support my classroom learning	62% (2005)	64% (2008)

Figure 5: Student evaluation of particular points concerning LO effectiveness in 2005 and 2008

In 2005 and 2008 the sample groups (312 respondents in 2008 compared with 260 in 2005) also rated the particular points concerning LO effectiveness. Their responses, summarised in Figure 5, reflect remarkable consistency with the exception of their perception of the quality of the feedback. One explanation for the decrease in student satisfaction with feedback (despite an increase in perception that the LOs help them understand the learning point) may lie in higher student expectations regarding the capacity of learning software to provide personalised feedback in every case.

Forty three pre-sessional tutors also completed a tutor questionnaire relating to the use of LOs in 2008. 90% felt that the LOs were 'useful in terms of supporting students' independent study on the course', compared with 81% in 2005 when tutors' views were also sampled. 65% felt that they 'supported students' classroom learning', compared with 57% in 2005 . In 2008, 79% indicated that they directed their students to LOs 'regularly' or 'sometimes' and 25% indicated that they felt the LOs had a role in their own classroom teaching as well.

Overall, students and tutors perceptions are that the LOs have a positive role in helping students learn and usage levels among students and tutors are high. The LOs (aimed at students with IELTS scores between 5.5 and 7.0 or equivalent) can present challenges to students at the lower end of this spectrum and lower satisfaction levels with activity feedback may point both to this and to the fact that online learning materials used for independent study can rarely measure up to the best feedback from a real tutor either face-to-face or online, when delivered as part of an iterative framework for learning as described by Laurillard (Ibid). Nevertheless, it is gratifying that in the opinion of the students and their class tutors, the LOs do help them understand and learn.

The precise role that the LO pedagogic model plays in this still needs much deeper investigation and a comparison with students' use of more traditional materials for independent learning could also be undertaken. Clearly, there is much that needs to be examined but the results so far encourage us to continue with the development of learning objects following this pedagogic model.

5. Conclusion and further development

This case study has strived to show that, among the many other web-based possibilities for enhancing education in the twenty first century,   pedagogically-designed LOs can provide a particularly versatile resource offering scope for sharing, blending, re-use and repurposing. However, in addition to the use of an effective pedagogic model for LO design, classroom teachers need to be enabled to create effective, versatile and reusable teaching and learning materials for their students' online use without reliance on technologists to support their technical realisation. To this end, the pedagogic approach described above has been embedded in a simple LO authoring tool for teachers, the LOC Tool (Watson et al. 2008) which, despite being still in the process of undergoing further enhancement, is already being used by c.100 teachers. This software guides teachers through the creation of pedagogically effective LOs without the need for technical support. If classroom teachers can be thus equipped, LOs can play a significant role in helping realise a shift in the kinds of resources that underpin much of the learning and teaching in the twenty first century.

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