Learning Technologies that Are Not Meant for Learning
A Critical Discussion of Learning Objects[1]

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So-called "learning technologies" often build on traditions that presuppose ideas of learning that are quite contrary to modern educational ideas. The example discussed here is the notion of "learning objects". These are built on ideals of structuring and reusing educational content according to the object-oriented tradition within computer science. It is argued that this tradition, together with the established practices of producing instructional materials within Instructional design, have developed a series of top-down standardisation projects that are out of tune with modern pedagogy. It is also maintained that these projects have failed to connect with the opportunities created through social tagging. Furthermore, the key technology of XML, so crucial for advanced web applications, can be seen as constituted by a number of ideological layers. It is argued that part of the failure of learning objects lies in the reproduction of key ideological layers, rather than adapting XML to the actual needs of professional practice, in this case teaching/learning.

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Information and communication technologies designed for learning are seldom what they seem. Although information technologies may be de-

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signed with learning in mind, they build on earlier artefacts produced with a technological mindset. Typically, information technologies are not constructed with complex, domain specific, future usages in mind. However, engineers will sometimes design technologies that unintentionally restrict possible future usages. On the one hand, usages in different circumstances are seldom contemplated. On the other hand, specific ideas, of relevance for a wide array of different circumstances, become inscribed into the technology. Typically, technologies, once implemented, take on a life of their own. The user of learning technologies may seldom realise that there were choices to be made when designing the initial technology and that the decisions involved were definitely not made with learning in mind.

Does it matter? What consequences can there be that conceptions of learning were not considered from the start? These are difficult questions to answer. It is not possible to go back in time and back engineer what could have been. However, I will do my best to analytically travel in time. I will in this article go back to the original ideas of a particular learning technology, that of *learning objects*, and attempt to track the various ideas that were formative for earlier technologies. I will argue that these technologies have been restrictive in certain ways and have then continuously adapted along the same trajectory in forming learning technology. My choice of learning objects as a case for this kind of investigation is based on it being the most heavily invested and debated digital learning technology in recent decades.

Learning objects can be described as systematically marked-up educational material intended for reuse in different contexts. This definition can cover a great number of different types of objects. Actually, as will be discussed further on, there is substantial disagreement on how to define this key concept. Large-scale projects involved with the development of depositories for learning objects have been concerned with digital technologies for encoding, finding, sorting, standardising and utilising different kinds of educational materials. The most central idea is that of *reuse*, to

produce an educational text for one purpose and then reuse it in a number of substantially different contexts. The focus of this article is on the formalised and standardised technologies involved. Educational material is processed for reuse with the help of certain technologies. These instruments, in combination with the idea of reuse, I argue, will implicitly contain certain ideals concerning information, knowledge and learning.

The question that this article is concerned with is then: *how are the embedded ideals of reusing information and knowledge transformed when applied to the domain of learning?*

The Object-Oriented Tradition

The artefacts of digital learning are often construed on the basis of certain strands of thought emanating from the object-oriented research tradition. In this perspective, which is situated within computer sciences as far back as the 1960s, the creation of reusable components or objects is highly valued (Wiley 2000a). It has produced mainstream coding such as SIMULA-67, C++ and Java (Friesen 2004). The object-oriented tradition holds no specific idea on knowledge and learning, but eventually an interest in reuse was connected to pedagogical projects with XML as the key mediating technology. Within the object-oriented tradition, reuse is afforded by an emphasis on descriptive techniques. As a result, techniques for crystallising out the most important information are favoured. Structural clarity is sought in the way information is coded and given specific positions in a larger framework. From the start, these dominating ideas had little in common with pedagogy or other strands of research within the social sciences or humanities.

The idea that had been "cooking" in this tradition for decades was to reuse objects for various purposes. Teaching/learning was one obvious possibility. However, in order for learning technologies to be successfully adapted, the object-oriented tradition had to be connected to pedagogical thinking. This connection could be made in two different ways.

First, researchers could broaden their area of competence from object-oriented research to subject/user oriented research. There are obvious difficulties involved with this strategy. Researchers that are used to solely investigating objects will largely have made their mark through the use of mathematical methods and logic. An entirely different set of methods are required for connecting to human subjects and learning situations.

The second possible strategy would be to have the object-oriented researchers pass on the problem to colleagues specialised in pedagogy, with the risk of severe communication problems between the two groups.

What eventually developed was a third alternative: development was driven by object-oriented colleagues, that is, researchers within Instructional design who were specialised in a narrow tradition of educational research. As I will argue later in this text, this tradition was concerned with objects (texts), rather than with the processes of learning. The transition from an object-oriented to a pedagogical perspective was therefore less of a cultural clash than one would expect. The downside was a lack of adaption to mainstream educational thinking, i.e. domain specific contexts and requirements. This lack of adaptation constitutes the analytical focus in this text.

eLearning and Reuse

eLearning had its breakthrough in the 1990s and has expanded vastly since then (Zhang & Nunamaker 2003). A marked trend at the time was the commercialisation of learning, specifically through distance education. Digital and online tools would, many speculated, enable effective mass education for profit.

In this process, learning seemed to be objectified in a number of different ways. Most importantly, the human teacher was to some extent exchanged for digital resources. A teacher working with reusable learning objects could effectively, or so it seemed, educate large numbers of students. To enable such effects, learning goals had to be formalised to suit the limited flexibility of the computer. The time seemed ripe to apply the

object-oriented perspective to learning. The ideas associated with eLearning (mass education, standardisation of learning procedures, distance learning, blended learning, flexible learning situations, fixed learning outcomes), all seemed to connect well with the object-oriented tradition.

As education became an investment object, new ideals were promoted based more on mainstream management literature than on pedagogic ideals. Considerable pedagogical research has been devoted to the global, structural transformation of education that emerged in the 1990s (Beck & Young 2005; Lawn 1996; Woods & Jeffrey 2002). The main thrust of this research has been to explore the transition of education from a public good to commercial goods. In library and information science, this shift has also been analysed from an information policy perspective by Johansson (2004) with focus on consequences for power relations, information access and learning on a more general social level. Learning objects also seemed to fit into this new economic context, as they would apparently support an efficient and rational process of learning.

In addition, the technological timing was right. For many years, the object-oriented tradition had striven to reinvent the document into something that could be effectively computer processed. Ironically, they were pursuing problems that traditionally had been dealt with within the humanities and textual studies (Renear 1997). In addition, the publishing business had also been concerned, from a more practical vantage point, with issues of "what is a text?" and "how should texts be structured?" With the evolution of digital publishing, textual processing had been placed within the domain of the object-oriented tradition. Furthermore, when Tim Berners-Lee in 1991 launched the World Wide Web, it included a new and very simple markup language, HTML. From this point, markup languages became one of the fundamental technologies of the Internet. Moving into the mid-90s, the future standard for markup languages, XML (Extensible Markup Language), was constructed as an artefact with great versatility. XML became the basis for all kinds of applications and learning was definitely an important target.

While the timing for learning objects in many ways was optimal in the 1990s, there were also distinct disadvantages connected to the timing.

First, learning objects were clearly linked to a commercial perspective. Consequently, learning objects were seen as vehicles for driving students towards standardised learning objectives efficiently and at low cost. This in turn led to the standardisation and marking up of reusable learning objects according to a number of fixed rules. As we shall see, this became one of the most problematic aspects of learning objects.

Second, the basic paradigm within many schools of pedagogy was transformed during the late 1990s. The traditional cognitive perspective, with its focus on the individual learner was somewhat congruent with the ideals of the object-oriented tradition. The new socio-cultural paradigm, however, moved modern pedagogical ideals toward the *contexts* of learning. While learning objects were developed to support fixed learning objectives, socio-cultural perspectives viewed the process of learning as open-ended. Learning objects were taken to be instruments of control, facilitating teaching efficiency in administering doses of learning, examination and re-examination. The new pedagogy suggests, instead, that students should gain control over digital tools.

Third, Google, launched in 1998, successfully favoured a different model than searching metadata. Essentially, ranking was based on patterns of linking, in turn reflecting actual social usage on the World Wide Web. The flexibility of the Google search engine made it a superior vehicle for finding relevant data, outclassing traditional metadata-based searching. Google also created competition with other projects that were built on top-down models in which experts prescribed, formalised and restricted the reusability of documents. Clearly this was the case with learning objects.

Markup Technology and Learning: A Move into Pedagogy

As the object-oriented tradition sought tools for developing learning objects and reuse, web-based markup technology quickly caught on as the most

favoured tool. Markup languages, connected to learning objects, can support learning in several ways. I will here mention a few possibilities.

As XML functions as a set of rules valid for various types of markup approaches, compatibility is created. Given a sophisticated setup, this would enable students to move freely between various types of digital systems. A formative idea in the design of XML is to distinguish between content-descriptive encoding and presentational encoding. This makes it possible to shift presentation, or media, while retaining the same content. In theory, the student would therefore be able to develop a more flexible style of learning, consuming educational material through a number of different devices, switching, for instance, between the computer and the mobile phone.

Markup language also opens possibilities for adapting the learning object to the preferences of different users. If a number of documents are systematically coded according to the same procedure, it becomes possible to custom-make educational packages for different groups with various needs.

A main idea in the development of learning objects has been that teachers can become more effective as they are able to utilise sophisticated learning objects produced by other teachers. This is, however, a somewhat troubling idea. The technology is often portrayed as affording teachers more quality time in their professional practice. However, the systematic reuse of learning objects can also underpin a move to downsize teaching staff.

The objects that are marked up are, of course, traditional textual documents. Obviously, it is possible to apply this coding procedure to other forms of media. However, these will invariably be treated as if they were textual documents. To talk about learning objects is therefore, in a way, to disguise that the concept refers to a bunch of systematically marked up textual documents.

A systematic processing of documents in order to convert them into learning objects is only possible through the prior establishment of markup standards. Different documents must be marked up with the same procedure (standards) in order to create a repository of learning objects. This

evidently excludes documents with proprietary encoding, those that are marked up according to their own unique characteristics. Rather, all documents are seen to be able to be processed with a uniform set of standards. As a consequence, in order to actually produce learning objects, there must be an agreement on standards in place. Furthermore, once this structure has been fixed, it tends to be difficult to renegotiate.

As I shall discuss later in this article, the all important discussion on standards tends to open up all of the complex pedagogical and epistemological questions that had been avoided in the initial linkage between reuse and learning. The process of standardisation must deal with questions such as:

- What parts of the document should be marked up?
- How should they be marked up?
- How much information is necessary?
- How sensitive to different types of information should the standards be?
- What distinguishes various types of educational documents (social science, humanities, natural sciences etc.)?
- What are the differences between educational levels?
- How can a distinction be made between various educational situations and programs?
- In which ways should the markup be connected to learning objectives?
- How could the markup attain a level of incompleteness so that it remains flexible in relation to future revisions of learning objectives? Etc.

These are quite challenging issues for standardisation efforts. Nevertheless, a robust and standardised framework was promoted as the foundation for the success of the learning objects project. The discussion during the late 1990s and at the start of the new millennium clearly focused on the problems of

coding and standards. Consequently, problems concerning the interaction between teachers and students, as well as issues concerning educational context, were mostly avoided.

The Key Markup Technology: XML

Markup is originally connected to the organisation of texts in order to print them. Markup is historically both a practice and a set of theoretical ideas, developed somewhat differently in two communities. On the one hand, the concern of structuring texts is an explicit humanistic practice and the experts are literary intellectuals (Langerth Zetterman 2008). On the other hand, it has been equally important to work technically with the concrete act of printing. Traditionally, this has been a kind of factory work with many of the tell-tale signs of mass production. A number of professions dealing with the selection, editing and distribution of books have also been involved. However, when we look at XML today, it is quite clear that it is basically a mathematical/logical product in the object-oriented tradition. Today, all actors relate to this new fundamental principle of publishing and connect to it in different ways.

With the development of XML we have an extremely versatile product that can be used for a wide range of different purposes. Learning objects is only one of many practical applications coming out of this technology. As we move onto investigating the specific application of learning objects, we find that the strengths and weaknesses of XML extend to any learning technology that builds upon it.

I will argue that XML construction is based on the systematic favouring of a certain mindset when deciding on a series of very complicated problems. My argument is that the technology of XML therefore builds on a system of ideas that can be called an ideology. The ideology of XML is that of the universal master code, open for all applications. It can be compared to a kind of pure mathematics, which is not applied in itself, but instead serves as a backdrop for specific applications. Quite intentionally, important decisions on constructing a real-life functioning markup language have

been postponed. The implication is that those producing artefacts within specific domains should make such decisions. Indeed, a great number of tools have been developed in order to be able to adapt XML to specific domains.

I will argue, below, that as learning objects develop to meet the requirements of a domain specific application, a basic misunderstanding troubles implementation. The ideology of XML is reproduced rather than adapted to specific needs.

The Ideology of XML

What, then, is the ideology of XML? What follows, consists of my reading of the construction of XML. I have attempted to identify the main foundational ideas in their relation to each other in ideological layers. I will focus on a series of basic concepts or ideas/ideals in several layers around a core idea. Each layer serves to turn the ideology of XML in a particular direction. The resulting ideology is tightly knitted together, with ideas linking and reinforcing each other. After years of use, it can be perceived as an optimal and unproblematic tool. The task of the critical researcher is to peel back the layers and discuss it as an ideology where certain choices have been made and show how these have restricted certain usages and emphasised others.

XML is an exceptionally complex technology and the main point of an ideological analysis of XML is to visualise the wealth of ideas and values that in different ways have been associated with it. XML has been developed into something far beyond that of being a mere standard for textual markup. It has developed into one of the foundational features of the World Wide Web. As such, it contains a multitude of values and some of these tend to pull in different directions, creating tensions.

The core idea is the *content-based strategy* (Renear 1997), that markup languages should be built on content related tags, rather than fixed formats. Content is king and can take many different forms. This is actually a reversal of an older practice in which the content had to adapt to the rigid form of paper, WYSIWYG (What You See Is What You Get). De-

spite digital versatility, early practices were aimed at imitating the restrictions of paper on the computer screen. A new theoretical platform was suggested in the article "What is text, really?" by DeRose *et al.* (1990) in connection with a long-standing discussion on the complex forerunner to XML, SGML (Standard Generalized Markup Language). The content-based strategy built on the insight that documents carried some uniform structural characteristics: headings, paragraphs, quotes, figures etc. Editing could therefore be focused on the manipulation and standardisation of these fixed objects. The content-based strategy has ever since been a dominating paradigm in publishing and an idea with many merits. This supplies a core for any modern markup standard, such as XML. Several layers can be identified around this core idea.

First, a choice of a structural ideal of the content was needed. DeRose *et al.* (1990) chose *hierarchy*, the idea that all information can be structured according to an inverted tree model, a root element at its top. The title of the document was positioned above headings, which in turn was seen as positioned above subheadings and so on. Different documents could be layered according to the same hierarchical notion. However, much is implied by the adaption of this layer. The technologies that build on XML will also have to recognise that a hierarchical principle is the best way to structure information, that it works in all contexts and that there is no viable alternative.

The hierarchical idea was not only seen as valid for structural elements such as chapters and headings. The hierarchical principle was in textual theory given the name Ordered Hierarchy of Content Objects (OHCO) and it was argued that everything in the text could be organised hierarchically. Following this, XML was designed to pursue hierarchical structures with an extensive scope. The content of a document could be structured hierarchically in order to facilitate information retrieval and computer-based learning on the World Wide Web. For instance, a text about animals could use mammals and non-mammals as categories below the root element. There would then be various subclasses below these, etc.

It is important to scrutinise the implications of the hierarchical standard. This is a strategy that is radically different than organisation by hyperlinks. Even though different web pages are structured according to the hierarchical principle, the prime usage is to enable the user to skip between various hierarchies, i.e. liberating the reader from the preconceived hierarchies of those producing documents. Nelson, the originator of the hyperlink concept has for several decades, through his Project Xanadu, continuously proposed ideas to undermine the hierarchical principle of the World Wide Web (Nelson 2009). However, as XML is designed in this way, applications dependent on XML tend to mirror hierarchical structure.

The second layer is *sequential processing*. The primary problem that XML was designed to deal with was the processing of texts, not databases. While databases are explicitly hierarchical in nature, traditional texts are structured to follow a sequential order. "Because XML was defined as a textual language rather than a data model, an XML document always has implicit order – order that may or may not be relevant but is nonetheless unavoidable in a textual presentation" (Goldman, McHugh & Widom 2000, 154).

The sequential structure also constitutes a restriction that Nelson (2009) intended to challenge through the construction of hyperlinks. Sequential processing both complements and challenges the hierarchical principle as it supplies a realistic strategy for dealing with text that, nevertheless, becomes an obstacle for other usages of XML (such as learning objects). One problem within textual theory that was quickly identified was that of overlapping hierarchies (Barnard *et al*. 1988). The same text could contain different sequences that utilised the same textual objects in different ways. Some of the researchers that had authored "What is text, really?" acknowledged that this was a problem but saw no solution (Renear, Mylonas & Durand 1996). They argued that overlapping hierarchies were to be dealt with as unavoidable exceptions and that the OHCO-model still supplied the best methodology. Caton (2001) argued that such a perspective ignored the communicative functions of text and that the OHCO-model was too rigid

to adapt to this aspect. The model has been extensively analysed and criticised in recent years (DeRose 2004).

Summing this up, there seems to be a conflict between the first and second ideological layer (hierarchy and sequential processing) in the development of XML-based attempts at textual theory. As I will soon discuss, major difficulties may be created when XML is adapted to a wide range of other functions.

A third layer is *standardisation*. This is the idea that it is possible to establish certain standards and systems of classification that will work well for most user groups and needs. Due to the corporate conflicts that existed between Microsoft and Sun Microsystems, XML was developed as a universal, multi-purpose tool. One purpose was to solve one of the most basic problems on the Internet, that of communication between different platforms. The continued success of the World Wide Web itself hinged on the possibility of building a congruent digital architecture that could handle information from a wide array of different sources (Robie *et al.* 2001).

As XML was to solve problems concerning platform interoperability, the ideal of standardisation was over layered (the fourth layer) with another ideal: *compatibility*. It is important to point out that this is another type of idea than standardisation. It is the notion that XML will be compatible with all platforms and all applications. In this way XML optimises the exchange of data.

The introduction of compatibility as an ideological layer led inevitably to the ideals of flexibility and neutrality as a fifth layer. *Flexibility* can be said to be the idea that the technology can be used for just about every possible situation and need. XML contains instruments (schemas) for extending standards to fit specific needs. However, such adaptions can counteract the ideals of standardisation and compatibility. Therefore, schema can sometimes be the fault line where different layers of the ideology come in conflict with each other. When the standardisation schema is too strict, it can lead to a so-called "schema lock-in" (Vorthmann & Robie 2001).

Neutrality is the idea that the technology should not in any way favour a particular user group, user need, practice or set of ideas. In fact, ideals of flexibility and neutrality could serve to make the work of producing standards a lot more difficult since a multitude of local adaptions could serve to undermine respective standards.

In the development of the ideals of compatibility, flexibility and neutrality, a new ideal of great significance is added to the "ideology of XML". Actually, this sixth layer consists of two ideas that are bonded together to assure an extraordinarily powerful artefact: *multitasking* and *integration*. *Multitasking* is simply the idea to utilise XML in a wide range of different Web applications. XML is *not* specialised into an instrument that would universally support the work of structuring and marking text. Instead, it is designed to serve as a multitool. The consequences are immense. Internet workers become specialists on various dimensions of XML, not the whole thing. Indeed, the very concept of "XML" becomes difficult to understand. There are whole families of specifications such as XSLT, XPath, XML Base etc. There are also a number of XML related technologies such as RSS, WAP, SVG etc. We can also identify discrete domains of XML work such as XML JavaScript or XML Basic.

As the development of the multitasking instrument proceeds, XML becomes *integrated* into a series of core technologies that constitute the modern web. I therefore identify *integration* as the seventh layer. XML becomes a kind of "obligatory passage point", since it is the key to many different applications and documentation practices. Among other things, XML becomes a key element in the so-called "Semantic Web layer cake" (Hendler 2001). In practice, there is a risk of compromising the quality of XML since it has to serve many masters. Actually, many of the problems that emerge are a consequence of the strategy of turning XML into something much more than a standard for marking up texts.

While the layers, so far, are directed toward other applications, the ideology of XML can be said to have both an eighth and a ninth layer of

ideas, which are directed toward users. I would like to identify two main ideas here.

The eighth layer can be described as *simplicity/complexity,* this is the idea that it is both possible and desirable to create intuitive and powerful functions through complex coding. Powerful functions create shortcuts and aggregate a number of routines to cater for user convenience. The ideal of "intuitive interfaces" adds layers of design. Taken to an extreme, such ideals lead to "smart technology" which processes a number of decisions that otherwise would be made by the user. Therefore, the user and those responsible for designing the system will live in very different worlds, and where demands on the information literacy of the user would be rather low. This state of affairs is enabled through an extremely complex practice on the part of system designers. It also builds on the basic XML idea of *separation*, that it is not only possible but also efficient to separate content from presentation.

The ninth layer contains *reusability*, an idea that has consistently been built into markup languages ever since SGML (Lubell 2001). This is a basic idea that I would say has two tenets. On the one hand, there is the doctrine of one input-many output, that the same content will be distributed in several different forms. On the other hand, there is the notion that we make too much effort in our production of documents. Rather than producing a fresh document, we can reuse the work somebody else has done. Therefore, the idea of reusability is connected to an ideal of rationalisation and efficiency. It also builds on a naive realism, underestimating the way that different epistemologies and styles of presentations are anchored within specific contexts.

The tenth and final layer concerns the overall use of XML. This is the final idea, which wraps the whole system into a gift package. It is a magical idea that few artefacts can aspire to: *universality*. This is an artefact that is designed to be used in all possible platforms, situations and contexts.

Reviewing these various layers, there are some obvious tensions. It would seem that XML-values can be grouped according to the rough categories

of "soft" and "hard". *Soft XML* highlights *flexibility* and creates an image of a technology that fluently adapts to domain specific needs, allowing users to shape something according to their unique needs. *Hard XML* emphasises standards, distanced neutrality and rigid hierarchies. It is possible to find examples where either one of these interpretations is the best choice. However, domain specific projects such as learning objects would seem to require a combination of hard and soft values where the latter is in the driver seat. In other words, *universality* should be balanced by and, indeed, secondary to *flexibility*. The idea of universality should be read: "since XML is universal, it is so flexible that it can take any specific form and therefore adapt to specific needs." However, if the values of hard XML are given precedence, the project would be underpinned by another interpretation: "universality is a cornerstone of XML, allowing compatibility between projects, all specific applications of XML must therefore be strictly standardised to retain this universality and compatibility." As we shall see, this kind of *hard XML* interpretation has guided the project of "learning objects".

XML and the Revolution in Social Tagging

XML can be adapted to exciting and user-friendly applications when universality is used as a resource for creating flexibility rather than as a standard setter. This has been most obvious within the revolution in social tagging during the recent decade. This entails the adaption of XML in a direction opposite to that of learning objects projects.

In order to understand the recent and dynamic transformation of classification, it is fruitful to distinguish between classification or "ordering" of the first, second and third order (Weinberger 2007).

The first order of classification entails a classical hierarchical structure where every entity has its place. This has been humankind's favourite working mode ever since Aristotle devised the basic principles. These ideas have both structured the sciences into disciplines and libraries into the Dewey decimal system. Therefore, there has always been a problem of overlapping

hierarchies i.e. that different sciences deal with the same phenomenon from different perspectives or that libraries sometimes need to place some books in several places. The same problem is evident in the routine organisation of personal computers, as the individual file can only have one place.

XML can (but should not!) be seen as a sophisticated product of the same kind of thinking. From the hard XML mindset, classification and usage is fundamentally regulated by the process of building strong hierarchies top-down. This, in turn, creates constant struggles with the problem of overlapping hierarchies. Any hierarchical system is based on a series of key choices where there always are alternative choices to be made and these will then have a formatting as well as an ever increasing restrictive influence on the choices to be made at the lower levels. As classification work in this tradition can only give credence to one interpretation, other possibilities are hidden from sight. Hierarchies provide knowledge organisation where the chosen mode of ordering becomes standardised. Once again, *soft XML* is an exceedingly flexible tool that need not be used as a strict hierarchical instrument.

The second order of classification entails the posting of metadata onto the elements of the hierarchical system. This alleviates some of the difficulties of the first order ordering. Some of the hidden hierarchies can now become visible and we can connect overlapping hierarchies. As long as we utilise keywords, i.e. controlled vocabularies, that serve as standards for all of the relevant hierarchies we, as users, can construct other hierarchies as we start from a given keyword, rather than from the conventions of first order classification. Such possibilities can be enabled when adapting XML. As has been discussed, soft XML highlights the idea of separation, sometimes termed *modulation*; it is possible to tag each unit separately using the overreaching hierarchical structure. It is also possible to tag beyond the controlled vocabularies and allow users to create their own tags.

Historically, the first and second orders of ordering have been restricted by, what we now can see as, a lack of sophisticated search technology. Put in another way, classifying systems have been limited to the artefact of

paper. Granted, the library index card has enabled some cross-referencing but this is a relatively weak effect compared to what can be done in a digital environment. Today, it is considerably more doable to more fundamentally break the hegemony of first order hierarchical structures.

The third order of classification builds on new ways of tagging individual elements based on the individual needs of the user. Such tagging does not have to adhere to existing hierarchies or controlled vocabularies. In essence, this means that any element can be surrounded by a large number of keywords that are directed toward competing hierarchies, so-called "tag clouds" (Sinclair & Cardew-Hall 2008). Furthermore, large populations of users can share their individual tagging efforts.

This phenomenon has been termed user-contribution tags, collaborative tagging, collective tagging, folksonomy or social tagging and it has revolutionised the business of categorisation, as well as search and information retrieval. Shirky (2009) goes so far as to argue that "... the Web is actually a radical break with previous categorisation strategies, rather than an extension of them" (1). Similarly, Weinberger (2007) argues that this mode of user generated tagging holds many advantages over the expert driven categorisation work of the first and second order. The user is no longer dependent on an understanding and acceptance of the established hierarchical structure of a given data set. Instead, it becomes possible to introduce alternative meanings and hierarchies. In essence, this disempowers traditional standardisation efforts. While these traditionally fixate objects of knowledge into one position, one form, with a clear hierarchical heritage all the way up to the root, social tagging tends instead to suggest that knowledge has many forms.

Social tagging is not a revolution in technology or systems design, but rather in functionality (Panke & Gaiser 2009). As such, it challenges the traditional strategies of metadata hierarchies constructed by professionals, but social collaborative technologies of this sort are naturally not without problems on their own (c.f. e.g. Johansson 2004, 228–244). A key characteristic concerns the way personal information resources are transformed

into collective and collaborative information systems. This creates a number of interesting tension points between tagging for personal or social use, idiosyncratic tagging or standard-setting, freedom or control as well as amateur or expert driven tagging (Smith 2008). If the project of learning objects had been conceived a few years into the new millennium, this exciting discussion would have been a viable starting point. However, by then, learning objects was a project deeply implicated in the standard setting of hierarchies and controlled vocabularies.

The third order of ordering is in many ways reliant on ideas and technologies based on XML. Indeed, XML must be seen as fundamentally flexible and a resource for solving problems within all three of these systems of ordering. However, the third order actually breaks with some of the ideological layers discussed previously and presupposes that the ideals of soft XML dominate Web design. While social tagging still is a content-based strategy with a fundamental separation between content and structure, the values of hard XML (sequential processing, standardisation and hierarchy) are secondary to those of soft XML. Translated into the issue of learning, social tagging seems to enable, and justify, the creation of learning materials from the bottom rather than from the top.

The project of learning objects was, however, fundamentally positioned within the object-oriented tradition where sequential processing, standardisation and hierarchy were core ideas.

The Ideas of Instructional Design

From a modest beginning in the early 90s, learning objects were soon to become big business. Friesen (2004), reflecting on a number of projects ranging from $30 to $500 million, noted that to his knowledge there had been no "in-depth studies of the pedagogical consequences of these systems and ways of thinking, and no examinations of their epistemological and ideological implications" (1).

Work with markup and learning objects has been dominated by a pedagogical tradition closely tied to computer science called Instructional

design. This is a field that developed core procedures during World War II when the US military faced the task of mass education relating to a variety of tasks (Dick 1987). Standard works within this tradition were established during the 1960s and 1970s, such as *The Conditions of Learning* (Gagné 1965) and *Principles of Instructional Design* (Gagné & Briggs 1974). In order to understand the ideas that went into learning objects, we need to understand Instructional design.

In the introduction, I mentioned the alternatives for object-oriented researchers when constructing learning technologies. Researchers can either move into pedagogy or leave the artefacts to somebody with the relevant knowledge. Instructional design would, at first glance, seem to be an ideal solution to the problem. It is actually a pedagogical subject with object-oriented roots; as such, it has a long tradition of collaborating with computer science. However, my argument is that they are far from ideal in this situation.

Let us investigate the basic ideas that underpin Instructional design and the kind of perspectives they applied to learning objects.

First, the major pedagogical practice promoted is the design of instructional material, in most cases manuals. In a sense, this practice is more related to the object-oriented tradition than to modern pedagogical thought. Obviously, systematic focus on instructional materials and learning has led to a specialisation in understanding and servicing formal learning situations.

In particular, Instructional design has been very successful in designing instructive products for the American military. When it comes to learning objects, involvement with the American military is not a closed chapter. The US Department of Defense has been so active in the issue of learning objects that Friesen (2004) discusses it as a kind of education in a militarised zone. Indeed, Friesen (2004) argues that military ideals are visible in certain learning objects projects.

A typical strategy has been to break down educational material in pieces and to codify in step-by-step instructions. Arguably, this has also led to an atomistic view of knowledge. It is seen as doable and constructive to break

down knowledge into smaller pieces. This is an idea that in some ways is congruent with the idea of *separation* within the ideology of XML. This has never been clearer than in the work on learning objects. An early metaphor, which would remain vital, was that of seeing learning objects as LEGO pieces (Wiley 2000a). This implied that learning materials could be broken down into smaller pieces and then they were to be marked up. Following this, the objects could be accessed according to different criteria and then rearranged in a new order.

On the face of it, this idea seems similar to that of the third order of ordering, discussed above. However, the starting point of tagging at the level of individual units, is taken in another direction, more congruent with the first and second order of ordering. Sites such as Flickr utilise social tagging so that the user can create their own hierarchical structures for searching and browsing procedures. Contrary to this, learning objects proceed from controlled vocabularies and standards. This, in turn, creates fixed hierarchies, forcing the user to adapt.

Another vital difference lies in the character of the unit that is marked up. There is a profound difference in the social tagging of individual bookmarks (think delicious.com) and pictures (as in Flickr) compared to tagging textual content within a document. The LEGO-metaphor clearly implies a separation of different units of learning. It is also something made possible through the hierarchical design of XML markup. Since the hierarchical coding of the content clearly creates different branches of code to be kept apart, it is inviting to pick them apart and rearrange them in a new order. However, many educational texts are written in such a way that different sections subtly connect to each other. Once again, XML is a highly flexible tool that is both linear and hierarchical at the same time. If XML is utilised to emphasise hierarchical dimensions – so the textual units can be rearranged - then some of the finer points of the holistic text tend to be lost.

Once the emphasis on sequencing and rearranging sequencing that traditionally has been so important in Instructional design has been grasped

the thinking on learning objects becomes more comprehensible. When we have broken down a complex task into its components, it is argued, it is vital to present them to students in the "right order", so that different sets of skills can build upon each other.

Instructional Design as Teacher Support

I have earlier pointed to XML as constructed at the opportune time for the evolution of learning objects. Despite this, from a pedagogical perspective, the timing was poor. The development of thinking on learning objects was parallel to an interesting development within pedagogical thinking. In the 1990s, constructivist approaches came to replace instructional methods in many countries, including the US (Tavangarian *et al.* 2004). This meant a shift from a focus on the teacher to the individual learner. Learning was reconceived to be something self-regulated, always situated and constructed in a socially dynamic context. For eLearning, this created three challenges: to support the teacher, the individual learner and the social process of learning. Instructional design was traditionally geared toward supporting the teacher and was challenged by this new paradigm. The strategy that evolved was for Instructional design to continue to build on their own tradition while developing an overreaching concept of neutrality. The gist of this approach was to view the current socio-cultural paradigm merely as a temporary trend where Instructional design should position itself above all schools of thought and all trends.

David Merrill, the most influential researcher in the field, explicitly stated that Instructional design should be neutral in relation to pedagogical theories. This influential idea was at one time formulated as follows:

> *Too much of the structure of educational technology is built upon the sand of relativism, rather than the rock of science. When winds of new paradigms blow and the sands of old paradigms shift; then the structure of educational technology slides toward the sea of pseudo-science and mythology. We stand firm against the shifting sands of new paradigms*

> *and "realities." We have drawn a line in the sand. We boldly reclaim the technology of Instructional design that is built upon a rock of instructional science.* (Merrill *et al*. 1996, 3)

In fact, the whole strategy of assuming the possibility of a neutral technology bears not only the mark of *hard XML*, but of the object-oriented tradition. The practical consequence is a production process in which the complexity of practice can be ignored. If we construct a technology based on the concept of *universality*, assuming that it will work anywhere and anytime, then we need not bother to find out about the diversity of real learning situations. In his experience of constructing Norwegian standards, Hoel (2005) found this idea of *neutrality* to be dysfunctional. Invariably, he argued, different national, political and cultural contexts require different standards and technologies.

For Instructional design, with its focus on the teacher-perspective, an important issue to address was: how do teachers universally work with educational material? Here Reigeluth and Nelson (1997) were very influential in their suggestion that teachers work by breaking down material into parts and thereafter reassembling these parts in a way that suited their instructional goals. Of course, this description was congruent with the ideals and practices of Instructional design. The focus is on the educational material, not the process of teaching or on interacting with a group of real-life students. In any case, it was thought that teachers could be supported by learning objects that already were disassembled and the traditional step of breaking down material could simply be bypassed. In my mind, this assumption misses the point of the breakdown process also being a learning process for the teacher, and quite necessary for the planning process. An additional problem is that the breakdown model actually presupposes a universal teacher practice.

Ideas in the Development of Learning Objects

The concept of learning objects seems to go back to Wayne Hodgins who in 1994 named a working group "Learning Architectures, APIs and Learning objects" (Wiley 2000a). Quite soon, the metaphor of LEGO pieces was in use and learning objects became standardised pieces of learning materials. Ideas of standardisation and reusability are, as I see it, core layers in the "ideology of XML".

While the concept of learning object is young, the very idea of reusing digital learning material has a longer history (Collis & Strijker 2004). The general idea was probably given life in the 1970s by David Merrill and colleagues at Brigham Young University. This work was done within Component Display Theory, which would later evolve into Instructional Transactional Theory within Instructional design.

Several attempts were made to reuse educational software beyond its original market, with very slight success. Various problems appeared such as incompatibility, lack of knowledge/awareness among users and difficulties concerning management of access. It was recognised that reusability depended on matching the educational product with the context of the end user, such as language, culture and pedagogical approaches.

With such experiences in mind, it would be reasonable to assume that there are two possible ways to proceed. They could apply the ideals of soft XML, attempting to create locally compatible, flexible and specialised products or attempt to further standardise and generalise the products. As I have earlier discussed, following the hard XML interpretation, the latter trajectory was pursued. As we move into the second half of the 1990s, it is difficult to talk about learning objects and strategies of standardisation apart from each other. In time, this may lead to an increasing tension between standardisation and efforts to produce material that matches the context of the end user.

Devising Standards

In order to implement learning objects as a project according to the ideals of hard XML, international standards had to be researched, negotiated and

given legitimacy by some kind of formal institution. As learning objects were not as successful commercially as expected at the end of the 1990s, the problem was seen to be due to the lack of standards (Wiley 2000a). If this project advanced so that any institution could create their own taxonomies, then reusability would suffer.

Without standards, there would be great difficulties in global communication between various types of organisations. A series of standardisation projects had been initiated in the latter half of the 1990s, and their results were pending. One of the most important actors involved was the Institute of Electrical and Electronics Engineers (IEEE). In 1996, it formed *The Learning Technology Standards Committee* with the task of promoting and developing instructional technology standards. The committee would eventually form an influential working group called the Learning Objects Metadata Working Group (LOM).

The European Union supported a similar body in a project called the Alliance of Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE). The US Department of Defense took an influential initiative as well; the Advanced Distributed Learning Initiative (ADL). Another important standardising project was the Instructional Management Systems Project (IMS) established in 1997 and actually funded solely by membership fees. Members included a number of very powerful organisations and corporations relating to software development and utilisation, such as Microsoft, IBM and the US Department of Defence. ADL worked actively to take standards from IMS and test them in various practical contexts through the Shareable Content Object Reference Model (SCORM).

It is impossible to review all these initiatives within the scope of a single article. Instead, I will focus on two of the most influential standardisation projects: SCORM and LOM. My aim in discussing these two is to identify weak points, arguing that these are the results of:

- the object-oriented foundation,
- the reproduction of hard XML values, and

- a systematic lack of engagement with modern pedagogy.

SCORM and the Ideology of XML

As one of the core concepts within the ideology of XML was "separation", it is perhaps not surprising that this idea is reproduced in the construction of learning objects. Separation is crucial in SCORM, which consists of a manifest describing the resources to be used for a particular learning material and stipulating the order in which these resources were to be presented or sequenced. Therefore, content and presentation are kept apart. Following this division, SCORM courseware could then be packaged in a PIF (Package Interchange File) for easy communication across different Learning Management Systems (LMSs).

SCORM has been continuously updated. The first version came in January 2000 and was updated twice in the following two years. SCORM 2004 was released in January 2004 and was, again, updated twice over the two following years. A fourth edition with a radical rethink, adaptable to Web 2.0 ideas, was released in March 2009.

The traditional Instructional design practice of sequencing the resources in a certain order has here been institutionalised as a universal principle. The same kind of sequence is seen to be appropriate for all contexts and this sequence has been standardised rather than left in the hands of users.

SCORM worked with an explicit idea of neutral pedagogy. Therefore, the aim is not to generate standards of its own, but rather to connect existing standards with each other. I would agree with Friesen (2004) who states that the active engagement that teaching implies is contrary to the ideals of non-involvement, neutrality and impartiality. Furthermore, pedagogic work is always a contextual practice, aimed at a specific audience, with certain types of learning achievements in mind. In other words, what is pedagogically neutral cannot be pedagogically relevant.

Hoel (2003) has scrutinised many of the key standardisation documents available at the time of his study. His conclusion is that these ideas failed to deliver on the goal of being pedagogically neutral. SCORM also fails to

give the student and the teacher an active role in the building blocks, called Shareable Content Objects (SCOs). These are stipulated to be very small, stand-alone lessons. These small learning objects can actually be problematic for teachers working with a more holistic learning style. As SCOs are small, this has implications for learning goals, which cannot be too ambitious. Hoel finds version 1.2 of SCORM to have a linear logic of presentation, a problem that is somewhat addressed in version 1.3.

Bohl *et al.*, in analysing SCORM, argued that the model showed general deficiencies: "From a learner's point of view, the SCO presents itself as a hotchpotch of ill-matched content. The learner has to work out contextual relations for himself because SCO comprehensive contexts are explained only partially" (2002, 2).

The criticism against SCOs also demonstrates the practical problems of upholding neutrality in the construction of standards. The decisions to work with small lessons and to make them stand-alone are based on specific ideas on knowledge and learning. While this approach may work well when teaching certain skills, they may be problematic for situations of advanced learning.

LOM and the Ideology of XML

The Learning Object Metadata (LOM) is a data model coded in XML that describes the system of tagging the learning object in order to create re-usability and interoperability. It is not as pedagogically relevant or inflected as SCORM, but suitable for the construction of repositories of learning objects. A key idea underpinning this project is that once tagged, the sequencing and packaging can be automated.

The IEEE (2002) Standard for Learning Object Metadata proposed that the author of the learning object should tag it according to nine categories: General, lifestyle, meta-metadata, technical, educational, rights, relation, annotation and classification. Each category contains a number of elements or subcategories. For instance, in the educational category there are eleven elements:

- interactivity type,
- learning resource type,
- interactivity level,
- semantic density,
- intended end user role,
- context,
- typical age range,
- difficulty,
- typical learning time,
- description and
- language.

Despite the fact that this system of categories forces the author of the learning object into a demanding documentation work process, it can still be criticised for being too restricted. For instance, Foroughi (2004) discussed the obvious problem that this markup structure gives no information on intellectual tradition. It is, of course, no coincidence that this kind of metadata is missing as this would clash with the idea of neutrality. Including such tags would seem to suggest that learning objects were not actually neutral and would generate different usages depending on the intellectual tradition. In any case, Foroughi (2004) suggests the tagging of subcategories such as:

- School of philosophy,
- concept,
- theory and
- keywords.

This kind of response is therefore to suggest more of the same, more categories and more detail. In other words, this is the idea of increasing the

level of standardisation and complexity in order to gain advantages in usability and flexibility.

Evaluating LOM, Hoel (2003) finds its high level of abstraction too high and that it has too many complicated categories of classification (over 90). As was the case with SCORM, LOM does not identify any active role for the student.

Starting in 1999, one of the key researchers on learning objects, David Wiley, published a series of informal papers, often on his own site, reusability.org, that focused the problem of context. In Wiley, Recker and Gibbons (2000) it is argued that the use of a learning object can be seen as a process of contextualisation. As a consequence, the automatic assembly of learning objects according to standardised routines, is seen to be flawed. Wiley (2001) developed this argument for the concept "The Reusability Paradox", which builds on the distinction between small and large (automatically assembled) learning objects. Wiley maintained that only small learning objects were reusable. Any large, aggregated learning object had to be assembled according to an individual context and it would therefore be of little relevance for other contexts.

> *It would appear that the least desirable relationship possible exists between the potential for learning object reuse and the ease with which that reuse can in fact be automated: the more reusable a learning object is, the harder its use is to automate. Identically, the less reusable a learning object is, the easier its use is to automate. This discovery is depressing, indeed.* (Wiley 2001, 9)

Wiley argued for the adoption of a constructivist view of learning.

A Divided Research Field

Even though the neutral perspective has been instrumental in the development of learning objects, it is clear that researchers within the broad field

of learning objects research implicitly position themselves within different epistemological and pedagogical perspectives.

One way of characterising the division of the research field is to focus on what kind of standards researchers favour. There are, as I see it, three possible alternatives:

- standard-setting by the students themselves (inspired by socio-cultural pedagogy)
- standard-setting by teachers
- standard-setting by the developers of learning objects (object-oriented tradition)

I will below give an example for each of these perspectives.

Standard-setting by the students themselves is a quite radical idea compared to the main trend in learning objects development. As this would build on social tagging, it would obviously turn the foundational ideas of learning objects on its head. As a consequence, gigantic projects such as SCORM and LOM would have served little purpose. In recent years, some researchers have abandoned the values of hard XML and instead attempted to develop learning objects from the socio-cultural perspective. Dutch researcher Koper (2000) attempted to establish open and flexible learning environments where students could define their own learning objectives and pursue their own methods. Inspired by the socio-cultural perspective, Koper criticised traditional work with learning objects, arguing that the strategy of devising superstructures tended to make students passive. Similar rethinking on learning objects have also been pursued by Koper (2004) and Langerth Zetterman (2008). In addition to the socio-cultural perspective, researchers have also been inspired by the interactive trend on the World Wide Web often characterised as Web 2.0.

The idea to allow standard-setting by the teachers is also radical compared to the mainstream development of learning objects. However, it is also more in line with the traditions within Instructional design which have

always had a focus on the teacher. Some researchers within this tradition tend to reject superstructure standardisation projects as being too simplistic for advanced learning tasks. They could be suitable for simpler educational tasks, for instance training programs within the military. For instance, two researchers from Israel argue as follows:

> *The advantage of our approach is that the metadata tags, which is the principal concept of XML, evolve from the teacher's conceptions, as opposed to metadata tags defined, and so forced on, by external experts. This methodology enables the teachers to develop a course according to their own conceptions, expressed by their choice of metadata tags, for their further reuse.* (Kanovsky & Or-Bach 2004)

The mainstream approach to learning objects is still standard-setting as a neutral superstructure devised by the developers of learning objects. Researchers with this perspective still have faith in the established path. They may perceive those on the other side as being deluded. For instance, when Ally and Cleveland-Innes reflect on those critical to the function of learning objects they say:

> *There has been criticism that the use of learning objects make learning fragmented and does not give students the big picture. This criticism is due to the inability to comprehend how learning objects can be implemented. A learning object does not exist in isolation but is combined with other learning objects and appropriate instructional strategies for learning to occur and to allow students to achieve the course learning outcomes.* (Ally & Cleveland-Innes 2004, 2)

These researchers tend to see learning as being personal and something that is an effect of the external pedagogic initiative. The "learning is personal" argument can build on the idea that ICT has changed the

phenomenon of learning. The implication is that we cannot build on nondigital based theories on learning.

The Crisis in Learning Objects Research

The harsh criticism and the obvious division of the research field also led to a certain abandonment. At the start of the millennium, it was sometimes said that the whole project was dead. This was not a debate visible in research articles, but it became obvious that this had been a somewhat lively debate when David Wiley made a sensational entry in his blog in January 2000. Wiley, who wrote his PhD thesis on learning objects and sequential theory (Wiley 2000b), had long been one of the most prolific researchers in the field. He commented the frequent and recent "ringing the death bell for learning objects" in the following way:

> *I've been doing a lot of thinking about these declarations since they started appearing, and I've come to the somewhat troubling conclusion that I don't think I care if learning objects are dead or not... I've been saying that the idea of LEGO-like assembly of resources simply will not work from a learning perspective. The role of context is simply too great in learning, and the expectation that any educational resource could be reused without some contextual tweaking was either naive or stupid. I will here attribute learning objects' inability to live up to the incredible hype and investment they received to the fact that the premise of the possibility of simple reuse was simply wrong.* (Wiley 2001, 1)

Wiley sees the idea of reusability as the major flaw in the project. Other major figures in the field pointed to other kinds of mistakes. In an article in *Online Learning Magazine* from 2002, Thor Anderson, a major contributor to SCORM argued that the wrong kind of competence had been utilised at an early stage of the project. He argued that research now needed to turn away from the focus on infrastructure toward pedagogical soundness (Welsch 2002, 14). David Merrill speculated that the successful

LEGO-metaphor had been taken a bit too far. "You can't chop things up and expect them to make sense..." (quoted from Welsch 2002, 16).

Collis and Strijker (2004) suggest that the major problem is that learning objects have a complicated life cycle that takes different forms in various contexts. However, they see researchers as only discussing two of the six life cycle stages (selecting and labelling). In other words, researchers are stuck in the most concrete practices of markup. Their inability to see the larger picture will of course make it impossible to take the necessary step of applying XML to the specific practice of pedagogical work.

Tore Hoel, who has probably produced the most sophisticated criticism of SCORM and similar standardisation projects, sees a major problem in the way that work became geared toward the single user, a lone learner who only interacts with content in the course (Hoel 2003). This is very different from modern pedagogical theories and the socio-cultural view of learning.

There are, however, researchers that are more optimistic about the future. Dutch researcher Rob Koper, who has been critical of learning technology standards such as SCORM and LOM, points to three basic flaws in these attempts (Koper 2004). First, they ignored that Internet technologies can today support more types of learning than they could a decade ago. Second, the knowledge-based society created a demand for a different attitude towards learning that is more integrated into work and other life contexts and combining formal and informal learning. Third, it has not taken into account social constructivist principles of learning, which leads to new approaches such as collaborative learning and learning communities.

From this kind of discussion, it has been possible to talk about "second-order learning objects" (Allert, Richter & Nejdl 2004). These learning objects do not contain knowledge, but rather study tasks and learning stages that focus on the process of learning. However, while Koper and his colleagues may seem very close to modern pedagogical methods, they are still talking about learning objects and reuse. Koper (2004) preferred to talk about "units of learning" in a way that is similar to references to learning objects: "A unit of learning can be all kinds of learning opportunities,

not only formal structures such as courses and lessons, but also various informal learning events" (675).

Has Technological Development Made Learning Objects Obsolete?

Learning objects were solidified as a viable project in the 1980s and 1990s. As I have argued earlier, the ideas on learning and knowledge were poorly adapted for the new millennium. This was also the case for the basic ideas on classification, which were built on the first and second orders of ordering. Moving into the new millennium, the costly and complex expert driven classification and standardisation projects started to look like dinosaurs when compared to del.icio.us.com, Slideshare and Wikipedia.

Furthermore, learning objects also tended to become sidetracked by the evolution of learning platforms connected to both lower and higher education. The need for such technologies was urgent, particularly within the expanding market of distance education. These were designed and solidified without waiting for learning objects projects to get their stuff in order. During this establishment phase, there was also an increased demand for features that supported social activities such as networking, chat, collaboration, group work, etc. Such functions were beyond the ambitions of learning objects projects.

Learning objects were also designed in a context where the crawlers of search engines focused on metadata. The dominating search engine of the 1990s, Yahoo, worked with a strategy similar to that of the ideas driving the learning objects project. Yahoo constructed a gigantic directory with hierarchies, top level categories, subcategories and so on. This professional structure was built to stand against the test of time. For any new document there was a pre-existing virtual library shelf where it could be placed. This system tended to mimic the real library, but did not make optimal use of the digital resources which allowed the same document to be positioned on many shelves at the same time. As Google came to dominate the market, metadata, while still important, became less vital when compared to systematic linking. Google highlighted the feature of the same homepage

being linked to a diverse amount of networks, placing the same content in different information domains. As Shirky (2009) puts it: "...Google understood there is no shelf, and that there is no file system. Google can decide what goes with what after hearing from the user, rather than trying to predict in advance what it is you need to know" (8). Increasingly, it was the external tagging, linking, that provided ranking and custom-made hierarchies based on search, and not on the content-based strategy inscribed in metadata.

The technological innovations of the web that are sometimes roughly characterised as "Web 2.0", also emphasised the social character of the Internet. The concept of "social media" refers to a number of commercial applications that can be tools for more user-driven and socially-embedded learning processes compared to that of older pedagogical projects, such as learning objects.

Beyond Learning Objects: AI and Personalisation

In the late 1990s, Tim Berners-Lee launched the idea of the semantic web (Berners-Lee, Hendler & Lassila 2001). The semantic web would serve as a controlling layer on the Internet. This would be populated by artificial intelligence in the form of personal semantic agents that surveyed the Internet. The semantic agents would act as servants to humans, facilitating our experience of interacting with technology. There would be no frustration of interacting with the huge amounts of technologies available, understanding their diverse programming and user interface. Instead, the personal semantic agent would fluently serve as our mediator to technology. This vision emphasises two main features: Artificial Intelligence (AI) and personalisation. In the context of learning, these ideas generate alternate ideals and approaches compared to that of learning objects.

One ambitious attempt to further the ideas of AI and personalisation in the context of learning is the Educational Modeling Language (Koper & Manderveld 2004), a semantic notation system for units of learning.

The aim is to counter the rigid structure of traditional learning object-projects and create tools that allow flexible modes of learning.

Another approach is the so-called "ubiquitous web" (Billsus *et al.* 2002). Learning is here connected to the problem of information overload. Automated, adaptive and intelligent personalisation is emphasised. Essentially, the users are seen here as flawed in creating effective and sophisticated filters for their own information needs. Users would generally have too little understanding of the available resources to be able to evaluate them. The alternative can then be personalised adaptive system, trained to become familiar with user interests and quickly adapt to changes (Light & Maybury 2002). This entails a kind of personal servant which has such intimate knowledge of the user that it can search and filter in her stead. This is a powerful and potentially dangerous idea with resonance in many fields such as Information Retrieval, Text Retrieval Evaluation and Machine Learning. It is also the basic ideology and goal underpinning the search engine of Google. While these technologies show great promise, there are also problems. Roughly four fundamental problems with automatic personalisation can be identified (Pariser 2011; Sunstein 2007).

First, building on the historical interests of a person may constrict future personal development. Personalisation may simply disallow personal growth as our personal artificial intelligence constructs filters based on who we were.

Second, personalisation tends to assume that each user only holds one identity, while in reality people assume different roles over the course of each day.

Third, information needs are situated, varying according to specific and unique situations in daily life. Personalisation systems will have difficulties in recognising these differences since they would have limited access to that situational data.

Fourth, personalisation works at the individual level although, in real life, people develop their interests in social contexts. This is a major drawback. Primitive ideas of personalisation have an affinity with behaviourism.

Successful personalisation projects need to recognise that information is useful and given specific meanings in distinct social settings.

What Did We Learn of Learning Objects?

The starting point of this article was to raise questions concerning learning technologies and the ideas that were inscribed in them during their conception and development. My aim has been to discuss the way that alternative contexts seldom are aboard from the start and that this has implications for any kind of specific application, such as learning technologies. Furthermore, I have attempted to show how a simple idea of reuse is transformed into a one-dimensional view of teaching and learning. The development of the project of learning objects follows a trajectory stipulated by core ideas on reusability within object-oriented research and guided into the realm of pedagogy through Instruction design. The project has also been determined by a series of decisions made in the development of XML and, as I have argued, a misinterpretation of the ideas of flexibility and standardisation within the hard interpretation of XML.

While this trajectory developed amidst huge corporate and government funding, modern pedagogy turned away from it. The new paradigm honoured ideas such as "social context" and "situatedness".

Despite this, the trajectory continued, underpinned by the idea that there were no preconceptions, pedagogical or epistemological ideas inscribed into the project. As the project was seen as neutral in all these accounts, it could stay aloof from these fickle pedagogical trends.

The project of learning objects is an interesting example of a process in which the complexity of translation and implementation is vastly underestimated. The heavy intellectual and economic investments in the ideas of neutrality and standardisation led to wasted resources. As Koper (2004) reasoned, the whole project evidences an inability to follow and respond to changing trends in society. When the World Wide Web was launched in 1991, this initiated a dramatic restructuring of human communication.

This process had only started when the formative ideas of learning objects were set in stone.

Learning objects were quite clearly developed with the help of pedagogical ideas that were easily accepted and digested by researchers within an object-oriented tradition. Just as formative were the basic instruments and perspectives within Instructional design, being quite comfortable with concepts such as separation, sequencing and instruction. The starting point seems to have been an image of a pedagogical landscape built on an atomistic image of knowledge where all educational needs are well structured and possible to describe in formal terms.

It is important to emphasise that the explicit needs of the "knowledge society" have moved in another direction. Increasingly, societal, technical and natural phenomena are both by politicians and researchers seen as interrelated. Decision-makers require specialised knowledge to be refined by other perspectives in order to supply a necessary overview.

Furthermore, postmodern and social constructivist criticism has established that there is an element of power involved in all knowledge claims. While the project of learning objects supplies objects/instructions that make "learning occur", any post-Kuhnian understanding of knowledge would portray sophisticated learning as a critical enterprise.

The idea of "reuse" has also aged poorly in recent years as the pace of knowledge production is furious. Demands within educational institutions are often directed toward the most current literature available. Usage of old textbooks is often conceived, rightly or not, as an indicator of a lazy teaching staff that has not bothered to update their competence. In this context, reuse of old texts must also be critically evaluated. Why reuse the older text when there are so many new ones produced?

The educational model that places the teacher in the centre can also be seen as outdated. The work on learning objects performed by instructional design pursued a tradition of clarifying and formalising the educational process by strengthening the boundaries between teacher and student

and also between formal and informal learning. Modern pedagogy has tended to move in the opposite direction.

The project took for granted that the work teachers spend on disassembling and reassembling educational material was largely a mechanical process. The teacher could therefore be supported by being relieved of this routine task. One could, instead, argue that this actually disempowers the teacher, stripping her of the mandate to assemble educational material to the best of her ability.

The standardisation projects tend to view students as objects of instructions/learning rather than as active, critically evaluating citizens in a complex society. Contrary to modern socio-cultural thinking, they are all expected to learn the given material in the same way regardless of topic, educational level or context.

The project has been pursued with an image of a teacher that already has finished educating herself. She knows all there is to know about the given topic and she would therefore not gain any further wisdom by the process of putting together educational material. In addition, she would not require any feedback from the students. In fact, such feedback could even be seen as destructive to the whole system as the learning objects are centralised products that are intended to function in the same way in many different educational programs. Furthermore, if some student groups were powerful enough to produce feedback that could influence learning objects, this could create a democratic problem as only the strongest educational centres would be able to further their perspectives.

With today's technical instruments it would seem quite obvious that learning technologies start with social communication and social tagging. Focus is not on devices for educational instruction, but rather on connecting students and their ideas. Technology for facilitating social tagging can afford students power and control over the educational process. This could also stimulate students in becoming self-reflective on their own learning and to critically reflect on the educational process. While learning objects

directed the students toward solitary studies, modern learning technology can create more interaction.

In closing, it is reasonable to assume that we will see a dramatic expansion of instruments for online learning. It is important that various user groups recognise that learning technologies always include implicit perspectives on what constitutes learning. Ideally, end-users could be involved at an early stage, influencing the development of technologies meant for learning.

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Notes

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