

Chapter 7 Electronic Theses and Dissertations: Progress, Issues, and Prospects

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Introduction

ETDs form an important component of global scholarship (Fox, 1997) and research output. Many universities around the world require, accept, or at least encourage students to submit their theses and dissertations electronically. The Networked Digital Library of Theses and Dissertations (NDLTD, 2009b), which promotes ETD activities worldwide, now has over 779,000 ETDs accessible through its Union Catalog, run by Online Computer Library Center (OCLC). Other NDLTD partners provide powerful tools for searching, browsing, and visualization (Scirus/NDLTD, 2009; VTLS, 2009).

The global move toward ETDs is a “win-win” situation. Everyone saves money and receives benefits. New opportunities and possibilities abound: open access (Fox, McMillan, Suleman, Gonçalves & Luo, 2004; Fox, 2005; Fox, Yang, & Kim, 2006); better preparation for the up-and-coming community of young researchers (Fox, Hall, & Kipp, 1997); increased visibility of individual as well as university research (Fox et al., 1996); and broader collaboration inside and among universities (and other interested institutions) (Fox, Hall, Kipp, Eaton, et al., 1997). Students are improving their skills and universities are improving their infrastructures to work with online information, applying key library and information science concepts, and advancing scholarship.

While ETDs can result from the works of students at all levels (bachelors, masters, doctoral), most emphasis has been on graduate students (Eaton, Fox, & McMillan, 1997). Those who engage in research and prepare a thesis or dissertation should be empowered to propose and report on other investigations using the modern tools of scholars living in the Information Age (Fox, Hall & Kipp, 1997).

Since its inception, ETD activities have been tied in with efforts to apply technological developments to enhance education. Some efforts have related to curricular development (Fox, Yang, Wildemuth, & Pomerantz, 2006; Yang, Oh, Pomerantz, Wildemuth, & Fox, 2007). Others have been connected with work to make reports and educational resources available online (Fox 1998b; Fox, 1999a; Fox, 2002).

History

The move toward ETDs began with discussions in a 1987 workshop in Ann Arbor, Michigan, led by Nick Altair of University Microfilms International (UMI), who was involved in the Electronic Manuscript Project. The idea of marking up dissertations according to an Standard Generalized Markup Language Document Type Definition (SGML DTD) was pursued by Virginia Tech working with SoftQuad, and led to perhaps the first ETD in 1988. Extending Virginia Tech’s demonstration effort was initially funded

Chapter 7

by Gary Hooper of the Research Division. But making ETDs common practice had to wait for improved technology support, among other things.

By 1992, before the release of the first version of PDF and Adobe's Acrobat tool in 1993, a Virginia Tech team composed of John Eaton (Graduate School), Edward Fox (Computer Science, Computing Center), and Gail McMillan (University Libraries) began discussions about ETDs with Adobe and worked with a pre-release version of their software. The Coalition for Networked Information (CNI) launched a discovery project guided by the Council of Graduate Schools, UMI, and Virginia Tech to explore ETDs. Ten universities in the United States and Canada sent representatives from their graduate programs, libraries, and computing/IT groups to an October 11, 1992, Design Meeting in Washington, D.C. This group agreed that working toward ETDs would be a reasonable initiative, so discussions continued at sessions of the CNI 1993 Spring Meeting held the following March in San Francisco. At the July 1993 meeting of the Monticello Electronic Library Project in Atlanta, participants from the southeastern United States also discussed the role of ETDs in education and libraries.

Subsequently, the Virginia Tech library drafted a workflow description, developed and tested ETD submission scripts, and prepared a demonstration website in 1995. Following the faculty's recommendation from the Degree Requirements, Standards, Criteria, and Academic Policies Committee in 1996, graduate students were given the option to submit their theses and dissertations online. The library added incentives by waiving the Archiving Fee (previously the Binding Fee) for all who would submit ETDs in 1996. On January 1, 1997, ETDs became a requirement at Virginia Tech; West Virginia University followed in 1998 with its own requirement.

ETD initiatives have benefited from several funding sources. When the Southeastern University Research Association (SURA) sold SURAnet, some of the funds went to support a 1996-1997 project led by Eaton, Fox, and McMillan to launch ETD activities throughout the southeastern United States (SURA 1997). Then the US Department of Education funded a 1996-1999 project led by these investigators to extend ETD efforts more broadly (Fox et al., 1996; Kipp, Fox, McMillan, & Eaton, 1999). The resulting National Digital Library of Theses and Dissertations (Fox et al., 1996) quickly expanded into an international initiative, and was renamed the Networked Digital Library of Theses and Dissertations (Fox, Eaton, et al., 1997).

An ongoing series of ETD conferences have helped to disseminate ideas and best practices. In 1998, 20 participants in a Memphis, Tennessee meeting constituted the first ETD symposium (MECCA, 1998). Virginia Tech hosted the second ETD symposium in 1999, including 70 participants. Annual conferences (<http://www.ndltd.org/community/conferences>) have subsequently been held throughout the United States and, since 2003, at international venues. The 2010 conference will be at the University of Texas at Austin, while the 2011 conference is planned for Cape Town, South Africa (<http://scholar.lib.vt.edu/theses/NDLTD/conferences.html>).

Chapter 7

International Growth

In addition to the spread of ETD activities in the United States, there was early interest internationally (Fox et al., 1997). In 1997, Fred Friend in the United Kingdom helped lead a thesis online group, while a team at Humboldt University in Berlin began building consensus toward supporting German ETD initiatives. Interest grew elsewhere as well, so the United Nations Educational, Scientific and Cultural Organization (UNESCO) convened a workshop in Paris on September 27-28, 1999, and then launched a multi-year initiative to assist with ETD activities. Much of the funding went to aid activities in Latin America, Africa, and Eastern Europe, and included support for travel to attend the International ETD Symposia, such as the 2003 meeting in Berlin. Several groups, ultimately coordinated by a team that chose Joseph Moxley as editor, leveraged UNESCO support to create an online ETD Guide, available in multiple languages. An updated version is available both from a site at Virginia Tech (*Guide*, 2008), and through WikiBooks (Moxley et al., 2008). Though the *Guide* moved, with some updates incorporated, to the wiki format in 2007, it is getting its first substantial rewrite in 2009 led by Canadians Sharon Reeves and Max Read.

Many presentations have been given around the world to help introduce the ETD concept. Some of the early talks include those in Hong Kong (Fox, 1998c), Japan (Fox, 1999b), Korea (Fox, 2000a), Mexico (Fox, 1998a), Poland (Fox, 2000b), Russia (Fox, 1998b), Spain (Canos, Fox, Gonçalves, & France, 2000), Switzerland (McMillan, 1998), and Taiwan (Fox, 1999c). The members of the NDLTD Board of Directors have been particularly active in promoting ETD initiatives and disseminating information and best practices around the globe. In August 2009 the representation of countries on the Board of 27 included Australia, Brazil, Canada, China, Denmark, Germany, India, South Africa, Sweden, the United Kingdom, and the United States. The NDLTD membership (<http://www.ndltd.org/about/members/ndltd-members>) includes other countries as well, including Latvia, Lithuania, Malaysia, Mexico, Spain, Switzerland, West Indies, and Zimbabwe. Regional conferences and consortia have been highly effective in facilitating broad involvement from academia, such as the Australasian Digital Theses Program (ADTP), which involves over 40 universities.

Universities

The cornerstone of ETD activities is the university. Any institution where students participate in research engages those students in preparing documents to describe their research. This both ensures that they learn how to write in a way that effectively describes their work, and helps disseminate their findings. Since students prepare practically all such documents electronically, and since the Internet and World-Wide Web provide universal support for document dissemination, it is clear that electronic theses and dissertations are invariably being created. Since universities are obliged to collect theses and dissertations, and in many cases have rules for archiving those documents, and since carrying out these processes is less expensive when done

Chapter 7

electronically, moving to ETDs is an obvious solution. At a time when universities face serious budgetary challenges, such a change is, indeed, warranted (Fox et al., 2002).

One side benefit of this approach is that if students create born-digital works, there is no cost to the university. On the other hand, if someone has to scan a paper document or digitize a video or audio file, there is the additional expense of digitizing, after the original costs to print, bind, and shelve the paper document. Yet, Virginia Tech and other institutions, in the interest of supporting research, are scanning old theses and dissertations, developing an electronic back-file so that eventually all of its theses and dissertations will be available electronically. Clearly, if the ultimate aim is to have a complete collection of ETDs, the sooner a university requires ETD submission the lower the total cost will be.

Training and Educating Graduate Students

Increasingly students arrive at university with digital skills, i.e., skills required to use new technologies for personal, professional, and organizational advancement. Many universities also offer their students face-to-face and online assistance to help them develop skills with word processing, scholarly communication, use of the Internet and WWW, and processing of multimedia content, with additional library instruction in information literacy. ETDs provide graduate students with incentives to develop these skills. As future professionals, publication is often expected or required, and ETDs provide experience preparing a work for publication. These publications are increasingly electronic, and ETDs provide students with experience preparing and submitting works electronically.

Training programs for ETD authors can be very short, minimally leading students to the resources that document the requirement, guidelines, and examples from their committee, department, and graduate school. Others include short courses, even online tutorials, for various commercial software products that help students prepare their works as well as others that help them keep track of their reference works and format their citations properly (e.g., EndNote).

Another important lesson that often accompanies ETD training is about intellectual property. Students frequently seek guidance about using copyrighted texts, tables, charts, illustrations, surveys, etc., (DLA, 2009a) and how to cite them correctly (McMillan, 2009). In addition, ETD education needs to help graduate students understand when copyright begins, and about their rights as creators of new works.

Training is more often lacking in preparing documents that are preservation and reader friendly. For example, students need to be reminded to link only to resources that are stable and likely to persist for the long term, such as from government and educational institutions, and to carefully consider the durability of links to personal and commercial websites. File names, file sizes, and file types also should be carefully considered for reader-friendliness as well as preservation readiness. Universities are beginning to recommend that students use PDF/A—the international standard for archival files (DLA,

Chapter 7

2009a) available in Adobe Acrobat 5 and later, rather than the generic PDF in order to limit potential problems with links to external resources.

Preservation of ETDs

The most tenuous and highly emotional service libraries provide within ETD initiatives is archiving and preservation. Partially because not enough time has elapsed to prove that digital documents can live for decades in publicly accessible digital libraries and institutional repositories, the uncertainty of online archives causes great unease to many. Few universities have the history with ETDs that Virginia Tech (required since 1997) and West Virginia University (required since 1998) do. ETD initiatives include a variety of activities but often long-term custodianship is neglected.

Though there is not a one-size-fits-all solution, the NDLTD is collaborating with the MetaArchive Cooperative to establish a distributed preservation network, which uses modified Lots of Copies Keeps Stuff Safe (LOCKSS) software from Stanford University. The security of the MetaArchive method lies in both its cooperative nature and its being a dark archive (i.e., with contents limited to specific partners in the preservation archive and not accessible for searching or browsing) so that it can host all ETDs no matter their level of public accessibility.

LOCKSS is an open source preservation system for libraries that makes use of an innovative peer-to-peer system of distributed content caches. It operates within the Open Archival Information System (OAIS) framework and functions well with off-the-shelf equipment and open source software. In the ETD arena, the LOCKSS software architecture ingests the digital works and stores them across the Cooperative's secure server nodes. The ETD Preservation Network is a private, dark archive so it is accessible only by designated partners' servers. If any server node fails, it can be restored from any of the other server nodes.

Prior to the MetaArchive Cooperative, universities did not respond to the call for formal ETD preservation strategies nor were the previous LOCKSS-based preservation prototypes formally implemented (McMillan, 2003; McMillan, 2004; McMillan, Jannik, & McDonald, 2005). However, two popular digital preservation workshops at the ETD conferences held in Scotland (McMillan & Halbert, 2008) and Pittsburgh (McMillan, Halbert, & Donovan, 2009) led to the initiation of the ETD Preservation Network (MetaArchive, 2009). The work of the MetaArchive Cooperative also has led to recommended best-practices for preservation-readiness for both new ETD initiatives and remediation guidance for existing ETD collections (Halbert & McMillan, 2009; Halbert, McMillan, & Skinner, 2009).

Library Instruction and Information Science Curriculum

It is important that ETD authors appreciate the full cycle of information from creation to dissemination and preservation (*DL4U*, 1999) and how their use of word processing software, for example, will directly affect the long-term access to and preservation of their ETDs and other digital works. The next generation of scholars, if involved in ETD

Chapter 7

activities, would be better prepared having some knowledge and skills from the fields of library and information science (LIS). Key parts of LIS that relate to ETDs have been identified and described in curricular modules (Fox, Yang, Wildemuth, & Pomerantz, 2006; Yang et al., 2007). For earlier ETD activities that specifically address a LIS audience, see Fox (1998e).

For example, recently developed curricula addresses digital preservation, including methods to ensure that there are a sufficient number of copies distributed geographically to avoid catastrophic loss because of events at a single site. Fortunately, demonstrations of this approach, such as the LOCKSS project (Santhanagopalan, McMillan, & Fox, 2006), have developed into full scale ETD preservation initiatives such as the MetaArchive Cooperative's ETD Network (MetaArchive, 2009), discussed above.

Graduate students need to master the tools of ETD creation, not only so they can adequately convey their research, but also so their ETDs will be broadly accessible now and for the long term (McMillan, 1999). For example, digital library curriculum helps students see their role in promoting the full cycle of information from creation to dissemination and preservation (*DL4U*, 1999). Library instruction as well as Library and Information Science courses help graduate students appreciate how their works, created with word processing software, will directly effect their long-term preservation and access.

Digital Libraries and Institutional Repositories

Historically, publishers (as aggregators and distributors) and academic libraries (as managers and preservers) have served complementary roles: disseminating and preserving the intellectual output of their faculty, students, and staff. Academic institutions with established technological infrastructure are increasingly interested in capturing, preserving, and disseminating the primary research of their communities as it documents the institution's intellectual legacy. Whether it is called a digital library or an institutional repository, universities are beginning to archive and provide open access to a broad range of scholarly output. But the available materials are heavily dominated by ETDs, largely because graduate students are much more amenable to these efforts than are faculty.

Table 1 shows the most popular repository software used by institutions with ETDs according to a 2008 survey (DLA, 2008; McMillan, 2008).

Chapter 7

Table 1. Survey Results of Repository Software in Use in 2008

Repository Software	Used by Reporting Institutions
DSpace	20%
ETD-db	10%
Eprints	2%
Fedora	2%
In-house Solution	22%
Other	44%

Open Access

As universities and libraries face budgetary challenges, they turn more and more toward open access mechanisms such as the above. Considering the imbalance in access to scholarly information resources around the globe, and the fact that open access resources can be available worldwide, there is particular interest from developing nations.

It is relatively simple for a university to provide open access to its ETDs. Usually the university libraries host the ETDs and support the full information cycle including prolonged open access. Many universities have broad digital library efforts, or specialized institutional repositories (often using systems like EPrints, DSpace, or Fedora). ETDs are among the most common works one can find in a university institutional repository. Support is sometimes centralized for sustainability purposes; thus, EThOS (www.ethos.ac.uk/), the United Kingdom's repository program for ETDs, is now managed by the British Library after being thoroughly vetted for education and research by the UK's Joint Information Systems Committee.

An important effect of open access is the increased availability of scholarly works. A paper thesis or dissertation, after being processed following a successful defense and review by a faculty committee, rarely has more than 10 accesses, while ETDs typically have hundreds or thousands of downloads if made openly accessible (DLA, 2009b). If there are goals of widely disseminating research results, of promoting interest in the work of students, and of increasing the visibility of university research, open access can lead to dramatic benefits.

An oft-voiced concern is whether access to ETDs should be restricted. Many specifics should be considered in this regard:

1. Requiring ETD submission, and having a university archive the works, will have no harmful effect on the student authors.
2. Typically, students will own the copyright to their ETDs.

Chapter 7

3. If a student plans to file a patent related to their ETD, they should do that within a year.
4. If a university wants to provide access to ETDs, it can do so in many different ways. Getting authorization follows naturally if copyright is transferred. But that is not necessary; it suffices for the student to agree that the university, alone or through agents, may store and disseminate the work (i.e., to agree to a non-exclusive license).
5. Providing access can be done for a whole work, or for parts of the work; there are many mechanisms to allow such control.
6. Most publishers consider ETDs to be a different genre (Fox, McMillan, & Eaton, 1999). There have been several surveys of publishers' attitudes towards ETDs (Dalton, 2000; Seamans, 2001; McMillan, 2001; Holt, 2002). Rarely will a publisher allow an ETD without substantial improvement to appear in book or article form, and often publishers will consider the popularity of an ETD to be a convincing argument to invest in editorial assistance leading to a quality commercial product.
7. Providing access can be delayed (e.g., embargoed) when issues arise because of patent or publication plans, but usually 1-3 years is the most that is needed. After that point, there rarely is any serious need to continue to restrict or withhold access.

Related to open access is the Open Archives Initiative (OAI) and its support of metadata access, explained in the next section.

Metadata and the Open Archives Initiative

Supporting access to books is a traditional role of a library catalog. These bibliographic records describing books and other works also can be known as metadata descriptions in the context of the World-Wide Web. The metadata standard known as the Dublin Core (DCMI, 2009) has been extended to specifically address access to ETDs on the Web through application of ETD-MS, a standard developed by the NDLTD (<http://www.ndltd.org/standards/metadata/>). See Table 2 for details on what additions to the Dublin Core are deemed most important, so as to precisely describe ETDs.

Chapter 7

Table 2. ETD-specific and Dublin Core Metadata Elements

	ETD-MS	Dublin Core
1.	title	title
	title.alternative	
2.	creator	creator
3.	subject	subject
4.	description	description
	description.abstract	
	description.note	
	description.release	
5.	publisher	publisher
6.	contributor	contributor
	contributor.role	
7.	date	date
8.	type	type
9.	format	format
10.	identifier	identifier
11.	language	language
12.	coverage	coverage
13.	rights	rights
14.	thesis.degree	[n.a.]
	thesis.degree.name	
	thesis.degree.level	
	thesis.degree.discipline	
	thesis.degree.grantor	
15.		Relation
16.		Source

A collection of metadata records for an ETD collection can be shared automatically and without any additional resources when universities use software like ETD-db, which incorporates ETD-MS and in 2001 was updated to support OAI-PMH (see below). Open access to ETD metadata is common practice and rarely leads to concerns like those that may relate to the ETD itself.

The Open Archives Initiative (<http://www.openarchives.org/>), originating from a Santa Fe meeting in 1999, easily supports the worldwide move toward ETDs (Suleman & Fox, 2002). OAI-PMH, the Open Archives Initiative Protocol for Metadata Harvesting, allows

Chapter 7

automatic harvesting of ETD metadata records, and making them available at various sites (e.g., regional collections), as well as at a central global site like the NDLTD Union Catalog (NDLTD, 2009c), originally run by Virginia Tech but long ago taken over as a support service provided by OCLC.

NDLTD Union Catalog

One major access point for ETDs from around the world is the NDLTD Union Catalog where ETDs are linked to their home institutions as a result of their metadata. See Figure 1 for a sample record selected from the Union Catalog.

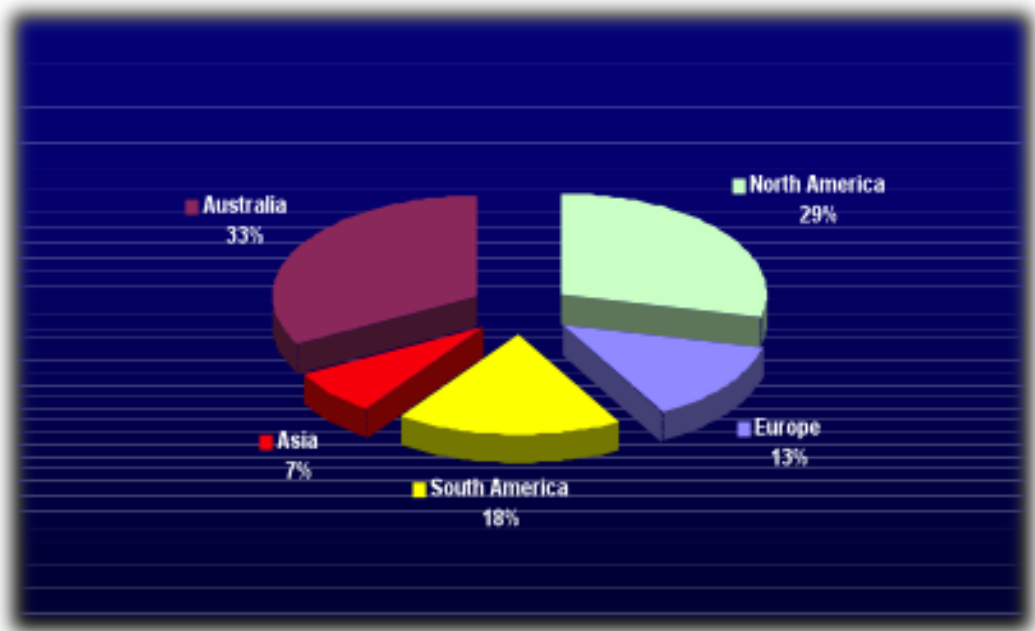
Figure 1. Sample Metadata Entry for a Dissertation in the NDLTD Union Catalog

identifier	oai:VTETD:etd-05042009-152934
datestamp	6/2/2009
All	VTETD
dc:title	Max-Plus Algebra
dc:creator	Farlow, Kasie Geralyn
dc:subject	Mathematics
dc:description	In max-plus algebra we work with the max-plus semi-ring which is the set $R_{\max} = [-\infty, \infty)$ together with operations " $a+b = \max(a,b)$ " and " $ab = a + b$ ". The additive and multiplicative identities are taken to be $\epsilon = -\infty$ and $e = 0$ respectively. Max-plus algebra is one of many idempotent semi-rings which have been considered in various fields of mathematics. Max-plus algebra is becoming more popular not only because its operations are associative, commutative and distributive as in conventional algebra but because it takes systems that are non-linear in conventional algebra and makes them linear. Max-plus algebra also arises as the algebra of asymptotic growth rates of functions in conventional algebra which will play a significant role in several aspects of this thesis. This thesis is a survey of max-plus algebra that will concentrate on max-plus linear algebra results. We will then consider from a max-plus perspective several results by Wentzell and Freidlin for finite state Markov chains with an asymptotic dependence.
dc:contributor	Martin Day
dc:contributor	Peter Haskell
dc:contributor	Robert Wheeler
dc:publisher	VT
dc:date	5/26/2009
dc:type	text
dc:format	application/pdf
dc:identifier	http://scholar.lib.vt.edu/theses/available/etd-05042009-152934/
dc:source	http://scholar.lib.vt.edu/theses/available/etd-05042009-152934/
dc:language	en
dc:rights	unrestricted
dc:rights	I hereby certify that, if appropriate, I have obtained and attached hereto a written permission statement from the owner(s) of each third party copyrighted matter to be included in my thesis, dissertation, or project report, allowing distribution as specified below. I certify that the version I submitted is the same as that approved by my advisory committee. I hereby grant to Virginia Tech or its agents the non-exclusive license to archive and make accessible, under the conditions specified below, my thesis, dissertation, or project report in whole or in part in all forms of media, now or hereafter known. I retain all other ownership rights to the copyright of the thesis, dissertation or project report. I also retain the right to use in future works (such as articles or books) all or part of this thesis, dissertation, or project report.

Chapter 7

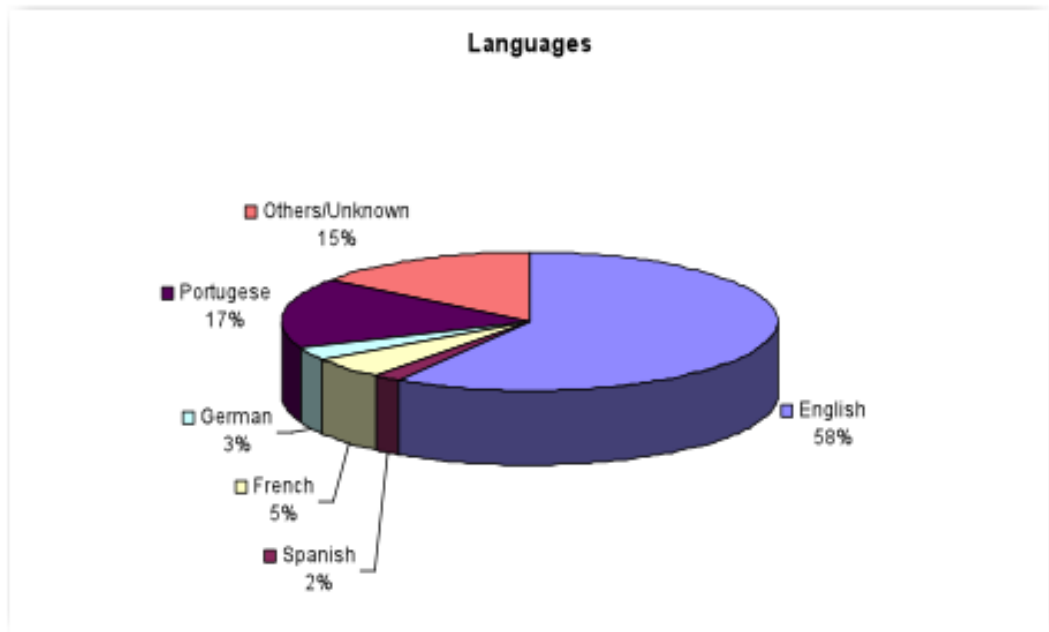
Contributors to the Union Catalog are universities from around the world (see Figure 2). Currently, the Union Catalog has metadata descriptions for 779,197 ETDs from various universities. The statistics that we present below, though, are only for 478,617 ETDs for various reasons (like missing or noisy metadata). The ETDs accessible through the Union Catalog are in multiple languages shown in the illustration of languages areas in Figure 3.

Figure 2. Metadata Reveals Worldwide Distribution of ETDs in the NDLTD Union Catalog (for 478,167 ETDs)



Chapter 7

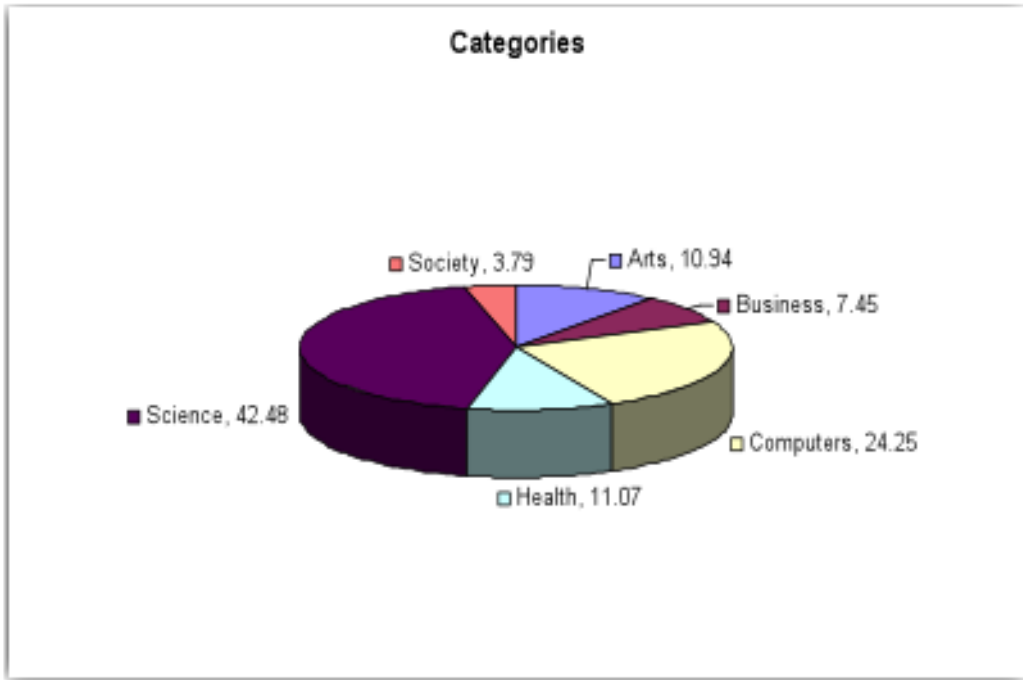
Figure 3. Languages of the ETDs in the NDLTD Union Catalog (for 478,167 ETDs)



Techniques have been developed for identifying the principal topic of many ETDs in the NDLTD Union Catalog. The details of these techniques are available in recent publications (Srinivasan & Fox, 2009a; Srinivasan & Fox, 2009b). Figure 4 illustrates the major categories, based on the Open Directory Project (ODP, 2009), also known as Mozilla Directory, under which the English language ETDs

Chapter 7

Figure 4. Topical Areas of English language ETDs in the NDLTD Union Catalog
(total 478,167 ETDs)



Additional Services Based on ETD Metadata

Building upon the NDLTD Union Catalog, there are various services freely available to the global community. OCLC provides Search & Retrieve URL Service / Search & Retrieve Web Service (OCLC, 2009). VTLS, Inc. provides browsing, searching, and visualizing services based on the metadata in the Union Catalog (Suleman et al., 2001a; Suleman et al., 2001b; VTLS, 2009). Scirus provides browsing and searching support utilizing metadata as well as full-text ETDs.

Software to support submission and collection management began with ETD-db, developed for open access by the Digital Library and Archives at Virginia Tech. Many ETD initiatives have been started by adapting this freely available software (<http://scholar.lib.vt.edu/ETD-db/>) and it supports various ongoing initiatives such as those at Georgia Tech, which also uses DSpace for its ETD repository; University of Pittsburgh; and internationally at the University of the Free State. Enhancements are in the works (Volpe, McMillan, & Fox, 2008).

Virginia Tech has engaged in a number of research studies aimed at providing extended support to those interested in ETDs (Gonçalves, Zhou, & Fox, 2002). Some work relates to improved classification (Koller & Sahami, 1997; Sebastiani & Ricerche, 2002;

Chapter 7

Srinivasan & Fox, 2009a; Srinivasan & Fox, 2009b; ODP, 2009). Filtering is another important service (Zhang, Gonçalves, & Fox, 2003). Analyzing trends in topic shift and the rise and fall of groups interested in specialty areas is another goal (Kim, Yang, & Fox, 2006). Document summarization (such as into one or more concept maps) and support of cross-language discovery and retrieval also is of interest (Richardson, Fox, & Woods, 2005; Richardson & Fox, 2007; Richardson, Srinivasan, & Fox, 2008).

Quality control is, of course, important for a large distributed enterprise. As a suitable ecology emerges, measurement can be critical (Fox, 1998d). A toolkit to measure the quality with regard to a variety of measures related to digital libraries (Moreira, Gonçalves, Leander, & Fox, 2007) has been applied to help point out weaknesses (such as missing metadata fields) in various ETD metadata collections.

Summary and Conclusion

ETDs are an important component of scholarship and research. Many collections are freely accessible directly from the institutions that host them. However, over 779,000 ETDs also are available through the notable efforts of organizations like the NDLTD. The NDLTD began in the 1990s to foster ETD initiatives, and to facilitate their dissemination. Its membership comprises many universities from around the world, and it is the largest service of its kind.

Work toward global support for ETDs has progressed well since the first discussions in 1987. For more information about ETD activities up through 2003, please see the edited collection by Fox, Feizbadi, Moxley, and Weisser (2004). Many goals and activities fit into our future vision (Fox, 2000c). We will continue to build upon an effective foundation coordinated by NDLTD (NDLTD, 2009b) and documented through its web site (NDLTD, 2009a).

Chapter 7 References

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Chapter 7

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Putting Knowledge to Work & Letting Information Play:

The Center for Digital Discourse and Culture



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Table of Contents:

Introduction	6
<i>Timothy W. Luke and Jeremy Hunsinger</i>	
The Book Unbound: Reconsidering One-Dimensionality in the Internet Age	24
<i>Ben Agger</i>	
Fluid Notes on Liquid Books	33
<i>Gary Hall</i>	
What Can Technology Teach Us about Texts? (and Texts about Technology?)	54
<i>Jean-Claude Guédon</i>	
Open Works, Open Cultures, and Open Learning Systems	76
<i>Michael A. Peters</i>	
Textscapes and Landscapes: A Settler Poet Goes On-Line	99
<i>Brian Opie</i>	
Reweaving the World:	
The Web as Digital Discourse and Culture	116
<i>Timothy W. Luke</i>	
Electronic Theses and Dissertations: Progress, Issues, and Prospects	126
<i>Edward A. Fox, Gail McMillan, and Venkat Srinivasan</i>	
From gunny sacks to mattress vine: notes on Douglas Engelbart, Tim O'Reilly, and the natural world	149
<i>Sue Thomas</i>	
The Pleasures of Collaboration	158
<i>Thom Swiss</i>	
Info-Citizens: Democracy, Expertise and Ownership in European Research Funding	160
<i>Timothy W. Luke and Jeremy Hunsinger</i>	
<i>The New River: Collected Editors' Notes</i>	177
<i>Ed Falco, et. al.</i>	

On the Origins of the Cute as a Dominant Aesthetic	
Category in Digital Culture.	212
<i>Dylan E. Wittkower</i>	
Culture, Media, Globalization	230
<i>Mark Poster</i>	
Barack Obama and Celebrity Spectacle	232
<i>Douglas Kellner</i>	
A Short History of the Center for Digital Discourse and Culture	262
<i>Jeremy Hunsinger</i>	
Digital Research and Tenure & Promotion in Colleges of	
Arts and Sciences: A Thought Piece	271
<i>Theodore R. Schatzki</i>	