Tools to support research

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Index

Introduction

Currently, digital technologies such as computers, mobile devices, digital media creation and distribution tools, and social networking sites are transforming the way research is carried out, managed and communicated.

There are three traditional activities in particular that have benefited from technological advances: search and management of reliable information on the Internet and other web based sources; analysis of both quantitative and qualitative data; and the communication and presentation of the research work.

In this module, a varied range of tools that currently allow the effective use of technology to assist in research activities is presented. Choosing which one best fits the type of research, needs and tastes of the researcher is a personal matter. However, not using any of them is unthinkable in the global arena of research in the Information Society.

Objectives

The goals to be achieved by studying and working this module are the following:

1. To know the different research activities that benefit from technological support.

2. To know the varied range of tools to support research.

3. To understand the application of criteria to choosing the right tool to the researcher and her work.

4. To understand the relevance of tools to support research in the quality of every step of a research activity.

1. Management

1.1. Databases search engine

There are different types of search software, web search, full text search, and database or structured data search. The largest engines like Google search conduct thousands of searches per second using a great deal of computers and processing millions of web pages per second. Such a great volume of queries and word processing require software running in a highly distributed environment and, therefore, with a high degree of redundancy. Searching for text-based content in digital databases or other structured data formats (XML, CSV etc.) requires specialised search engines. Database search engines usually are included with major database software products; however, these search engines do not provide sophisticated data searching technology (string matching, boolean logic, algorithmic methods etc.).

There are a number of useful search engines that are freely available with no registration and can be used effectively to search for relevant citations and that are simple to use, even for beginners in the field of citation searching. The larger databases, with much more sophisticated search engines that can accomplish more complicated searches, are obviously more difficult to use.

Here are some of these search engines.

Google

Google is currently the most used search engine. It has one of the largest databases of web pages, including many other types of web documents (blog posts, wiki pages, group discussion threads) and document formats (PDFs, Word or Excel documents, PowerPoint documents, ODF documents, videos, multimedia etc.).

This search engine is often the first to be accessed because it is simple, fast and useful for practically any subject.

Not everything on the web is fully searchable in Google. However, studies show that more than 80% of the pages in a major search engine's database exist only in that database. Therefore a second search with similar software is recommended. For this purpose, **Yahoo! Search** is suggested. Using **meta-search engines** (i.e. Copernic) as the primary search tool is not recommended.

Many common features will work in any search engine. However, in this very competitive industry, search engines attempt to offer unique features.

Table 1. Comparison of characteristics of Google and Yahoo

Search Engine	Google	Yahoo! Search
Size	Immense. Probably the biggest.	Huge. Over 20 billion objects
Noteworthy features	Page rank system includes hundreds of factors, emphasising pages most heavily linked from other pages.	Shortcuts give quick access to dictionary, synonyms, patents, traffic, stocks, encyclopaedia, and more.
Phrase searching	Enclose phrase in double quotes ("").	Enclose phrase in double quotes ("").
Boolean logic	AND, OR. ( ) accepted but not required.	AND, OR, NOT or AND NOT. ( ) accepted but not required.
Language	Romanised and non-Romanised languages	Romanised and non-Romanised languages.
Translation	Yes, in "Translate this page". To and sometimes from English and major European languages and Chinese, Japanese, Korean.	Available as a separate service.

Google prioritises the most popular web sites, those with a greater number of links from other sites. In fact, Google is not well focused for searching scientific literature. Locating the specific needed reference, amidst the numerous pages of irrelevant material that it often generates, is very hard. However, (if you are lucky) it can give a few references (without abstracts) that will enable you to enter the field and you can then employ these in more selective search engines. Its major flaw is that it often generates too many links and after the first page they usually have less and less relevance.

Google Scholar

It is a search engine created by Google. It is a recent addition to searching the scholarly literature. It focuses on sites that have information or data which have been critically evaluated (peer-reviewed journals) or from university sources. Its strong point is simplicity of entry[1].

[1] Just a single box to type in authors or journal volume, date and pagination or subject and date.

Google Scholar searches for books and anything academic on scholarly sites (private or commercial). It also searches the *grey literature*. It has a *citation tracker* allowing a quick check on how many people have quoted the reference; as most items never get quoted, it is a very rough estimate of the relative value of an article in the field. However, there are reservations, because the citation tracker emphasises pages that are cited more often (like Google), it is biased to older literature and often misses the more up-to-date and most recent articles and hence its number of uses of the citation feature is not always reliable.

The *grey literature*

Open source written material that cannot be easily found through conventional sources: conference proceedings, dissertations, theses, preprints, clinical trials registries and technical reports.

Sometimes, it gives abstracts or a copy of the paper with the citation, but you usually have to look up the citation elsewhere for this. It also gives access to different versions of the citation and related articles. Its features make Google

scholar only useful as a supplementary search as you cannot rely on the thoroughness of its searches, but if you want a quick entry into the scientific literature of a subject or want to track a book (its searches take a few seconds) it is often quite useful.

Library search engine

This service is usual in digital libraries. Its strengths depend on the size of the database library. For members, it needs no registration and is completely free. A citation can often be located in a few seconds by entering even limited information on its search page. This page has a number of fields to search under: author's name, title words, journal title, date, volume number, issue number and first page. Obviously, the more fields you search under, the more likely you are to obtain your specific or wanted reference. However, if you are simply interested in exploring what is available for a specific subject, you can enter the general search box with a subject. To learn easily the use of the various searching methods and all its available options, there are many excellent, short tutorials with sound and animation.

Most recent articles have abstracts that can be freely downloaded, but many of the earlier ones do not have abstracts and you only get the title of the paper and journal, date of its publication, volume number, pagination and authors. If there is no free access, obtaining a copy of the article, either access to a digital library or a request to the journal's web site for a paying reprint will be needed. It is useful to use more than one search engine, since not all have the same links to other sites and free access copies.

A very useful feature of this kind of search engines is that each reference has a list of relevant papers assigned to the paper. Its major weaknesses are that it does not cover books significantly nor the *grey literature* and it is highly selective of the journals for inclusion in its database.

The case of the UOC Virtual Library

The UOC Virtual Library is the virtual library from the Universitat Oberta de Catalunya (Open University of Catalonia, UOC). The Library offers the University's different types of user access via the UOC portal. Given the virtual nature of the UOC, it is a key element of the e-learning model of the University. The following are some of its services.

1) The Catalogue

The Catalogue includes both physical documents: books, journals, videos, CD-ROM, CD-I etc., and electronic and digital documents, which can be accessed straight from the bibliographic record. It also provides access to other catalogues from around the world such as the CCUC (Catàleg Col·lectiu de les Universitat Catalanes - University Union Catalogue of Catalonia); the joint catalogue of the network of Spanish universities (REBIUN); catalogues of national libraries and to joint and specialist library catalogues in the rest of the world.

2) Electronic Resources

Among many other information resources, theElectronic Resources contains specialist full-text databases and electronic journals on a great range of subjects. You can directly access databases, e-journals, e-books and encyclopaedias.

A global search engine can be use to find the information in the entire library, regardless of where it is precisely. You need to enter the username and password you use to log in to the UOC Virtual Campus.

3) Services. As a complement to all of this information, the UOC Virtual Library offers you a lending service, own and external document supply service.

ISI Web of Science (WOK)

It is an online academic database provided by the Thomson Scientific's Institute for Scientific Information (ISI). This search engine is freely available if you belong to an organisation that subscribes and you only need to get authentication to register and create a password (it is now a database accessible from the UOC Virtual Library).

It provides access to many multidisciplinary databases and other resources:

• Web of Science
• ISI Proceedings
• Journal Citation Reports
• ISI Essential Science Indicators
• Derwent Innovations Index
• Current Contents Connect

1) The Web of Science database

In fact, it provides access to many different databases: Science Citation Index (SCI), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Biological Abstracts, Index Chemicus and Current Chemical Reactions, covering more than 11,000 leading journals in science, technology, social sciences, arts and humanities.

Figure 1. Web of Science Database

In particular, there are three citation databases in the Web of Science:

a) Science Citation Index Expanded. The **Science Citation Index (SCI)** is a citation index originally produced by the Institute for Scientific Information (ISI) in 1960, which is now owned by Thomson Reuters. The larger version is the **Science Citation Index Expanded**. It gathers references to published articles and, since 1991, it also includes a summary of approximately 70% of the articles. Its chronological scope is from 1945 to the present, with a weekly update. This database allows a researcher to identify which later articles have cited any particular earlier article, or cited the articles of any particular author, or determine which articles have been cited most frequently. This database has been criticised for its heavy bias in favour of English-language publications.

b) Social Sciences Citation Index (SSCI). It is an interdisciplinary citation index product of Thomson Reuters' Healthcare & Science division. It was developed by the Institute for Scientific Information (ISI) from the Science Citation Index. Since 1992, a summary in about 60% of the articles is included. Its chronological scope is from 1956 until today; there is a weekly update. It is made available online through the Web of Science service. This database provides information to identify the most frequently cited articles and by what publisher and author.

c) Arts & Humanities Citation Index (A&HCI). It is a citation index of over 1,100 of the world's leading arts and humanities journals. The A&HCI can be accessed online through the Web of Science. It provides access to current and retrospective bibliographic information and cited references. It also covers individually selected, relevant items from approximately 1,200 titles, mostly arts and humanities journals but with an unspecified number of titles from other disciplines. Its chronological scope is from 1975 to the present, with a weekly update.

There are free tutorials for search options in the Web of Science. The main search options are: general search cited reference search, structure search and advanced search. It is also possible to select which database(s) to search and the time span to search. The results summary shows the records retrieved by the search and it provides many features to aid research, like:

- searching within results to reduce the number of records retrieved by the search, by entering new topic terms in the text box;
- refining results by selecting only those records retrieved by the search that contain specific concepts, journals, authors, or years of publication;
- displaying records sorted by latest date, relevance, first author, source publication or publication year;
- sending the output to a file, e-mail or reference software; and
- drilling down and analysing records of interest to gain insight into hidden trends on a topic.

ISI Proceedings Database

It is a database of communications and presentations at the most prestigious conferences, congresses, seminars and conventions in the world and from all disciplines of the sciences, social sciences and humanities. Its chronological scope is from 1990 to the present.

There are free tutorials for search options in ISI Proceedings. Its search options are the following: quick search, general search and advanced search. The results summary shows the records retrieved by the search and also provides the same features to aid research as the Web of Science database:

- Searching within results to reduce the number of records retrieved by entering new topic terms in the text box.
- Listing only those records retrieved by your search that contain specific subjects, conferences, journals, document types or authors.
- Displaying records sorted by latest date, relevance, first author, source title, Publication year or conference title.
- Sending the output to a file, e-mail or reference software.
- Analysing records of interest to gain insight into hidden trends on a topic.

2) Journal Citation Reports (JCR)

It is a database that evaluates the science and technology journals on the one hand, and social sciences on the other depending on their **impact factor** (based on the analysis of published and citations received by publications), half-life and immediacy index. Its chronological scope is from 1997 to the present.

There are free tutorials for search options in the Journal Citation Reports (JCR) Search. Currently the selection page is based on what you select from the welcome page:

• To search for a specific journal, the options are the following: search for journals by full journal title, abbreviated journal title, title word and ISSN.

• Journal Summary List. This page displays a list of journals that match your selection options and search criteria. Up to 20 journals appear on the page.

Figure 2. Search options in the JCR Database

3) ISI Essential Science Indicators

It is a database of statistics on international search activity. It allows researchers to carry out analysis of research performance and to track trends in science. The source of the data includes the ISI databases, which includes some 8,500 journals in all disciplines. Its chronological scope is the past 10 years.

4) Derwent Innovations Index

It is a database of patents. It is divided into three categories: chemical, electronic and electrical engineering, and mechanical engineering. Its chronological scope is from 1963 to the present, with a weekly update.

5) Current Contents Connect

It is a database of summaries retrieved from more than 8,000 academic journals and over 2,000 books on science, social sciences and humanities. Its chronological scope is from 1997 to the present. It also offers links to over 4,300 academic sites that are evaluated by the ISI.

Citation alerts

A citation alert notifies you by email whenever a record you choose has been cited by a new record that has been added to the database. Sign in to your ISI Web of Science and click on the My Citation Alerts link at the top of the page.

Scopus

This search engine is only freely available to individual members of campus constituents or research institutes or organisations that have an organisational subscription to the database. It has a huge database. It will show you who is citing whom, with the number of citations per article.

Although institutional access is required to fully benefit from Scopus, you can still try it by testing the Author Preview link and search millions of available author details.

DBLP

The Digital Bibliography & Library Project (DBLP) is a free access computer science bibliography website hosted at Universität Trier, in Germany. It was originally a database and logic programming bibliography site and has existed at least since the 1980s. Journals tracked on this site include the VLDB Journal, a journal for very large databases, the IEEE Transactions and the ACM Transactions. Conference proceedings papers are also tracked. *DBLP* originally stood for *Database systems and Logic Programming* but is now taken to stand for *Digital Bibliography & Library Project*.

With the searching by author, the surname provides all the full names. Other search criteria are: article title, conference name, journal (abbreviated) and more.
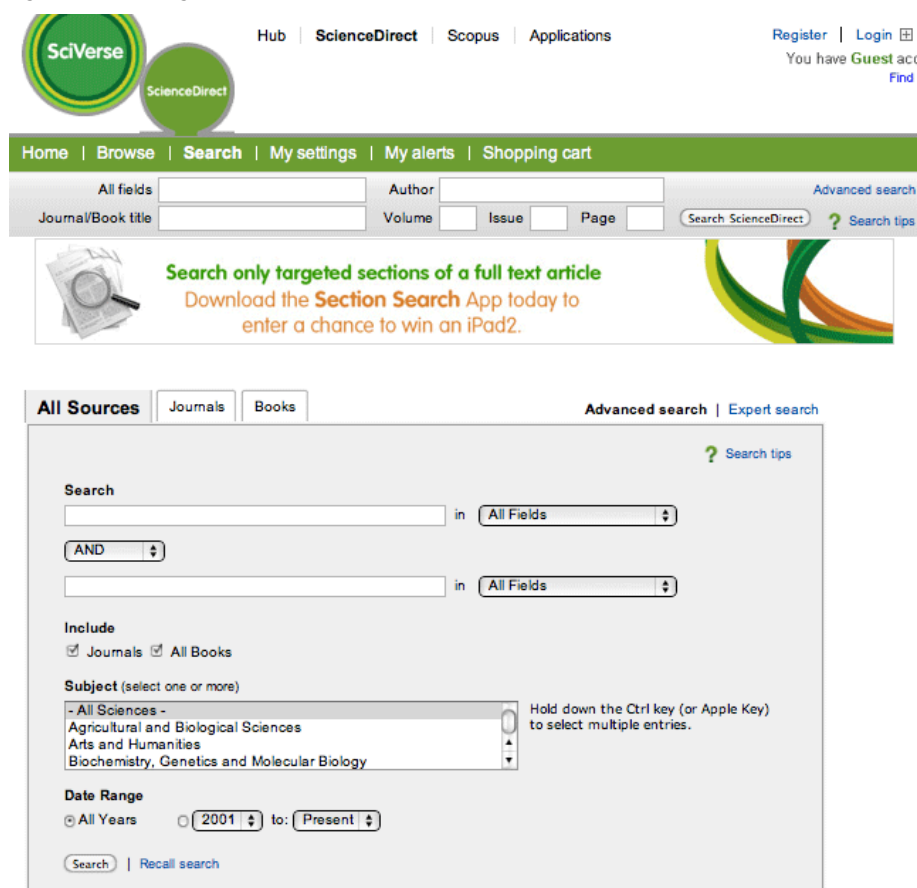
Science Direct

ScienceDirect is one of the largest online collections of published scientific research in the world. It is operated by the publisher Elsevier and contains articles from over 2,500 journals, e-books, reference works, book series and handbooks issued by Elsevier.

For most articles on the website, abstracts are freely available; but access to the full text of the article (in PDF, and also HTML for newer publications) requires a subscription or purchase payment. The UOC digital library provides an institutional access and, then, the full text of articles.

There are quick and advanced search options within text in: abstract, title, keywords, authors, ISSN or dull text; journals and books, on different subjects.

Figure 3. Searching in the Science Direct Database

SpringerLink

SpringerLink is one of the world's leading online scientific databases for scientific, technical and medical books and journals. It is hosted by Springer Science and Business Media or Springer, a global publishing company, which publishes books, e-books and peer-reviewed journals in science, technical and medical subjects. Springer is the second-largest journal publisher worldwide (the largest is Elsevier).

The Springer collection of online files is available via SpringerLink, which includes journals and series of books. The online archiving allows unrestricted electronic access to all journal articles published in English before 1997, from the first issue to the present. Researchers are able to electronically access a listing that can be traced back over 100 years. E-Journals, e-Books, e-Reference works and e-Book publisher Springer Series are available through SpringerLink.

There are local load options. Subscribers can access through IP verification for institutions (this is the case of the UOC digital library) and user names and passwords for individual users. Springer also offers customers the ability to purchase publications online directly or through other brokers.

It is free for the general search criteria (by using words in all text, title, summary, author, editor, ISSN). To use the personalised features (marked items or alerts) it is necessary to log in or register (free). Results are complete citations and abstracts. In particular, SpringerAlert is a free option practice that can be customised; it allows readers to receive instant alerts of publications based on criteria such as author, subject or keywords about specific research publications of a specific field of study.

Figure 4. Searching in SpringerLink

Other databases by knowledge area
Engineering databases

- Association for Computing Machinery (ACM)
- Computer Source
- ICYT - Ciencia y Tecnología (CSIC)

- IEEE Xplore
- Lecture Notes in Computer Science (LNCS)
- LISTA: Library, Information Science & Technology
- Wiley InterScience

RESH (humanities)

It is equivalent to JCR for Spanish journals in the humanities field. It provides the results of the analysis of the Spanish Journal of Social and Human Sciences from the standpoint of quality. It gives the Citation Index for the years 1999, 2000, 2001, 2002, 2003 and 2004 through which the use and influence of each of the journals listed above can be assessed. From those journals, with a simple click, you can access basic bibliographic information from journals as well as the levels of compliance with other key parameters of quality, both editorial and international visibility, thereby facilitating an overview on various aspects of the quality of each journal, basis of an integrated assessment.

LATINDEX (Iberoamerican)

It is a regional cooperative online bibliographical information system for scholarly journals from Latin America, the Caribbean, Spain and Portugal. It is available for free consultation. Established as a network in 1997, the project is based on the cooperation of 17 national resource centres that operate in a coordinated scheme for the gathering and dissemination of relevant information and data on the Iberoamerican journals. Latindex was created in 1997 in Mexico City with the commitment of four countries (Brazil, Cuba, Venezuela and Mexico). With the incorporation of Spain and Portugal in 1998, Latindex evolved towards an Iberoamerican system.

DIALNET (Hispanic)

It is a portal for dissemination of scientific Hispanic production. It was opened in 2001 and it is specialised in humanities and social sciences. Its free access database was established by the University of La Rioja (Spain) and is a virtual newspaper archive that contains the indices of scientific and humanistic journals from Spain, Portugal and Latin America, as well as books (monographs), PhD theses, tributes and other documents. Many documents are available online (full text). It also includes databases with documents in other languages and registration is free.

1.2. Reference and bibliography management tools

Reference management software, also known as citation management software or personal bibliographic management software, is intended for scholars and authors to use for recording and using bibliographic citations (references). Once a citation has been recorded, it can be used again and again in generating bibliographies and lists of references in scholarly books, articles and essays.

These tools usually consist of a database where full bibliographic references can be entered, plus a system for generating selective lists or articles in the different formats required by publishers and scholarly journals. They can not only store the exported citations from various databases, but automatically format and then reformat their punctuation accurately for various journals. They will also be able of importing the details of publications from bibliographic databases and online libraries. Some of these reference management packages can be integrated with text processors so that a reference list in the appropriate format is produced automatically as an article is written, reducing the risk that a cited source is not included in the reference list.

Reference management software does not do the same job as a bibliographic database, which tries to list all articles published in a particular discipline or group of disciplines. These databases are large and have to be hosted on main servers. Instead, reference management software collects a much smaller database of the publications that have been used or are likely to be used by a particular author or group, and such a database can easily be hosted on an individual's personal computer.

If you regularly write papers or surveys, then it may be worthwhile investing in those tools that can store, handle and format citations. There are numerous commercial ones available (Endnote and RefWorks are examples) and some non-commercial (Zotero and Mendeley) too. However, reference managers share a number of basic functions and features.

• Data entry can be done manually or automatically.

• Ability to store information in a structured format and easily retrieve it from any access point.

• From the search results, the program provides various output formats such as bibliographies, citations from texts, and also lets you shape and insert citations and bibliographies from the word processor in the main standard styles, in the styles of publication of the best known institutions and journals in each field of knowledge.

In addition to these common features, to evaluate reference managers and to know their potential and their ability to adapt to different research contexts, the following features are also important:

a) Web integration versus local version. The latest generation managers are integrated into the web, although that integration is performed in different ways. This fact has advantages (it can always be available from different terminals) and disadvantages (as the limitation of needing an Internet connection) which would prevent access to our literature and we have to rely on managers with local version.

b) Data import and compatibility. The compatibility of managers with databases depends on the commercial interests of each distribution company. When there is compatibility, the resources of the database can be imported automatically to the reference manager. For those databases that cannot directly export to the reference manager, the option is to export resources in RIS and to import them later from the manager.

c) Citation facilities. One of the basic functions of a reference manager is to facilitate the inclusion of citations in standard formats in the research. That can be done in two main ways: including citations in the text or generating a bibliography to add at the end of the document.

d) Sharing. Almost all reference managers provide the facility to share folders. This is an interesting feature when working in a group, as all members may have common references. To do this, researchers must use the same product.

e) Content syndication. RSS has become a key element for the dissemination of information in Web 2.0. Some managers have this facility, too.

f) Diversification of sources of information. Until recently, reference managers only worked with information from strictly scientific sources. Today there is a possibility to work with other sources of interest such as SlideShare presentations, video tutorials from YouTube or books emerging in commercial sources such as Amazon, which have not yet been collected by scientific research services.

Reference management software most commonly used for its quality, performance and the improvements made in recent years are **RefWorks, EndNoteWeb; Zotero and Mendeley**. They have similar functions but its performance level is different. These four reference management tools and a few others are presented in detail below.

RefWorks

It is a commercial tool. It requires subscription through an annual licence fee, although it is also available for an evaluation period of 30 days. Many universities hold an annual institutional subscription.

There are freely available tutorials (http://www.refworks.com/tutorial/):

There is only a web version, as RefWorks is integrated through a website that is accessed via password.

Refworks imports references automatically from multiple databases. Thus, search results from a wide variety of databases can be automatically exported into RefWorks with the simple click of a button; for instance from Science direct, Google Scholar or the ISI Web of Science.

All reference managers have many styles of citations, but an interesting question for researchers at European level is that RefWorks is able to automatically cite in ISO format. Another interesting feature is that RefWorks can integrate documents (Microsoft Word, PDF, Microsoft Power Point etc.) in the records themselves.

It has also interesting sharing facilities. As researchers must have an account on the system, according to the permissions granted by the RefWorks user, others can view, print, export or generate lists of shared references from RefShare. RefWorks support syndication (RSS). It also incorporates the possibility of syndication from the shared area, so that people who share folders know at all times when new references have been included.

RefWorks is accessible from the UOC Virtual Library by using a username and a password.

Web recommended

For more information about RefWorks, you can visit: http://www.refworks.com/

Figure 5. Access to RefWorks from the UOC Virtual Library
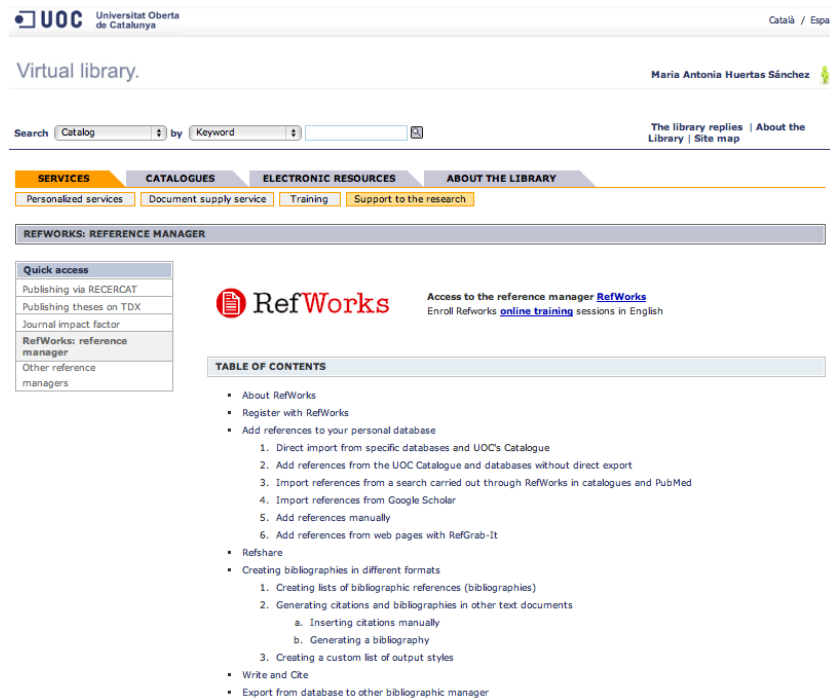
EndNoteweb

It is free, but with significant limitations on the availability of a maximum number of records or a limited number of folders to share. There are tutorials (http://www.endnote.com/training).

Figure 6. EndNote web information

Web recommended

For more information about EndNoteweb, you can visit: http://www.endnoteweb.com/
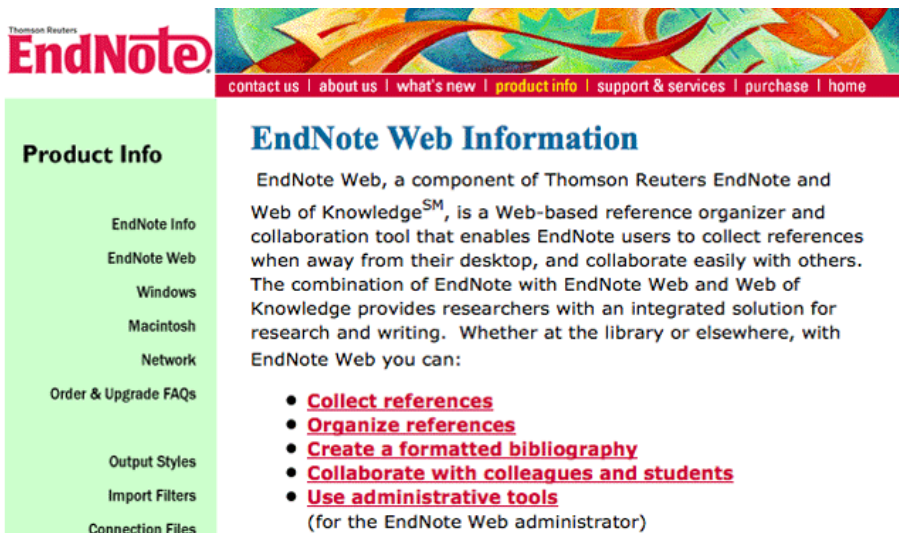
Like RefWorks, EndNote Web is also integrated through a website that is accessed via username and password. EndNote has a local version too (EndNoteX2), but with additional licence; this is a bidirectional communication interface between the local version and the web.

It can import references automatically from multiple databases, in particular from the Web of Science. Especially, Thomson provides direct export from this supplier information to its Reference Manager, EndNote in this case.

EndNote Web gives the option to import data from an existing bibliography in another document.

Like in Refworks, researchers must use the same product, i.e. they must have an account on the system to share content; but as EndNote Web is a free program, any user can have folders shared with another who has an account in the program. Content syndication it is not incorporated in EndNote Web.

Zotero

It is free software. It was developed for Mozilla Firefox, but the Zotero Standalone, first released in February 2011, allows Zotero to be run (using XULRunner) as an independent program outside Firefox. Zotero Standalone is available for Windows, Linux and Mac OS X. Connectors are available to integrate Zotero Standalone into the web browsers Safari and Chrome.

Once installed on your computer, it includes a button that allows the browser to import the data into Zotero. There are also tutorials.

Web recommended

For more information about Zotero, you can visit: http://www.zotero.org/

Figure 7. Zotero web page

Zotero is also integrated into the web, but in a different way as Refworks or EndNote are, because it is a small program that installs a kind of toolbar or extension on the web browser. Since the launch of version 2 of Zotero, this manager has been able to synchronise (update) automatically local versions on different computers with the web version. Zotero, being a browser extension,

shares some of the features, advantages and disadvantages of local and web versions, such as the inability to share data at a distance or the provision of a local system that can have a copy regardless of not having connection.

In general, Zotero is able to import references from most library catalogues and databases:

WorldCat, Amazon, Google Scholar, JSTOR, InfoTac online, Lexis Nexis, ISI, EBSCOhost, ProQuest, Web of Science and other digital media databases. Basically, the export can be done through the RIS format or automatically with the capture of a page or the information contained in a library catalogue. The import and export formats that Zotero can use are RDF, MODS, RIS, Refer/BibIx, Unqualified Dublin Core RDF, Wikipedia Citation, Templates and BibTex, among others.

Zotero, as a free software program can be integrated into Open Office manager. The program can generate complete bibliographies in different formats. It can also generate citations from Word and Open Office or it can include the citation in word processing online tools.

Zotero incorporates a shared space with all the possibilities of social networks, offering the opportunity to share references with others and generating RSS feeds in order to see the new references introduced by other users.

It has some interesting Web 2.0 features. When a bibliographic record with descriptors is imported, Zotero copies the descriptors. In addition, users can assign tags to the references.

Citeulike

It is a free proprietary application (Springer) and is web accessible.

Web recommended

For more information about Citeulike, you can visit: http://www.citeulike.org

Figure 8. Citeulike

The formats for import and export references are BibTeXt (the LaTeXt family) and RSI, which makes it compatible with other reference managers, so that you can transfer information from one to another. It also works with other formats like PDF, plain text and RTF. It also allows storing references of journal articles and web addresses. The references can be cited in many different formats (ACS, APA, CBE, Chicago, Elsevier, Harvard IEEE, JAMA, MLA, Nature Oxford Science and Turabian Vancouver).

It allows users to assign descriptors or tags to references and they can be used to search in the list of saved references. It is focused on sharing with other CiteULike users or a selected group of users. Besides, there is the possibility of creating a personal blog within the same CiteULike, sending messages to other users with an email account or knowing the internal references often introduced by the users of the program.

Connotea

It is free software application (Nature Publishing Group) and is web accessible.

The formats for import and export references are RIS, BibTeX, Endnote, MODS, RSS and RDF. You can add a button on the browser to be able to give references more easily. The RIS format offers the ability to export references that the user already has in another reference manager. It also allows capturing references from web pages. To facilitate this task, users can add a button to the browser that imports references directly to Connotea. However, this tool does not allow choosing different formats for rebuilding the bibliographic references.

Web recommended

For more information about Connotea, you can visit: http://www.connotea.org

Users can assign tags to the records and then it is possible to search records for the introduced tags, the document title, author or title of the publication. It also allows users to share references with any other user, with a group of users or to send a link to share references with non-Connotea users.

Mendeley

Mendeley is a freeware reference manager and academic social network for the desktop and the web. It can be used to organize research documents and to share and collaborate with others online. The desktop version runs on windows, Mac and Linux.

> **Web recommended**
>
> For more information about Mendeley, you can visit: http://www.mendeley.com/

Its main characteristics are the following: automatic generation of bibliographies, online collaboration with other researchers, discover and import papers from external web sites. It allows automatic extraction of metadata form PDF papers and exports citations and bibliographies in Microsoft Word, OpenOffice and BibTEX.

Figure 9. Mendeley Web Library
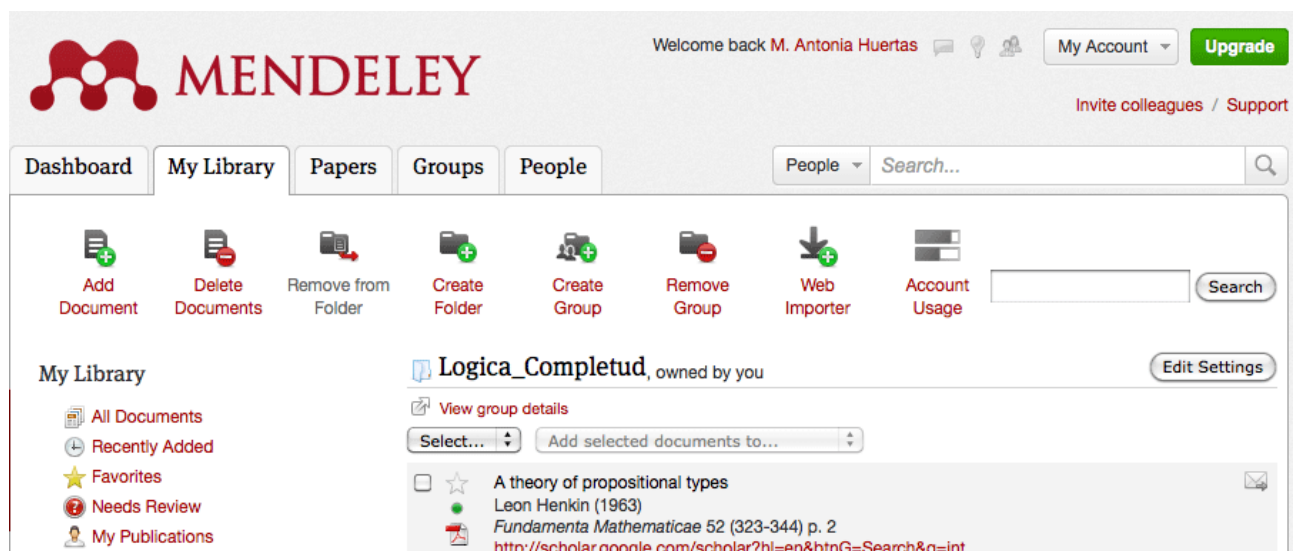
BibTeX

BibTeX is a reference management application for formatting lists of references. The BibTeX tool is typically used together with the LaTeX document preparation system. BibTeX makes it easy to cite sources in a consistent manner by separating bibliographic information from the presentation of this information. This same principle of separation of content and presentation/style is used by LaTeX itself.

> **Web recommended**
>
> For more information about BibTeX, you can visit: http://www.bibtex.org/

BibTeX uses a style-independent text based file format for lists of bibliography items, such as articles, books or theses. BibTeX uses a plain text format, which can be created and modified by the user using an arbitrary text editor.

Figure 10. BibTex Web page

Other reference management tools

- **BibDesk**. It is a free graphical bibliography manager for Mac OS X, providing powerful BibTeX file management for Mac users.

- **BibMe**. Free online bibliography maker generating MLA, APA, Chicago and Turabian citations.

- **Bookends**. Commercial reference manager for Mac OS X with support for retrieving bibliographic information and related files from the web, automatically generating bibliographies etc.

- **Heurist**. Free and web-based collaborative academic bookmarking, bibliographic and general database with rich data types, annotation, record interlinking and publication capabilities, including bibliography output and citation within Word. Reference import and bookmarker.

- **JabRef**. Free software application and cross-platform bibliography reference manager that generates BibTeX files.

- **Referencer**. Free software application for GNU/Linux to organise documents or references and ultimately generate a BibTeX bibliography file.

> **Web recommended**
>
> There is a comparison of reference management software in:
>
> http://en.wikipedia .org/wi-ki/Comparison _of_reference_ management_software

1.3. Tools for the management of research projects

Project management software is a concept that includes many kinds of software, including scheduling, resource allocation, collaboration software, communication and documentation systems, which are used to manage projects.

Regarding research project management, the most common type is planning and scheduling tools to organise a project in terms of work packages assigned to people and objectives to reach. These tools also include various monitoring tools like task lists or progress reporting. This can be combined with calendaring software, groupware applications that include task management tools or collaborative planning software. Depending on the mode matching between the design and management tool, there are two kinds:

1) Tools designed **to meet the specific needs of the project** on an individual basis. In this case, tools are designed and built to fit the management of a concrete research project.

2) Tools designed **to meet general different needs** in the management of business projects. They can easily be adapted to the needs of research project management.

Below, we will describe some tools of this second group, which are the most common ones.

First, we will describe **the proprietary tools**.

Microsoft Project

Microsoft Project (or MSP) is a project management software application developed by Microsoft that is designed to assist project managers in developing plans, assigning resources to tasks, tracking progress, managing budgets and analysing workloads. It is the most widely used and known among commercial project managers. There is also a free trial version.

The application creates path schedules visualised in a Gantt chart. It can recognize different classes of users with different access levels to projects, views and other data. Additionally, custom objects such as calendars are stored in a global mode that is shared by all users.

Web recommended

For more information about Microsoft Project you can visit: http://www.microsoft.com/project

Figure 11. Microsoft Project typical Gantt charts
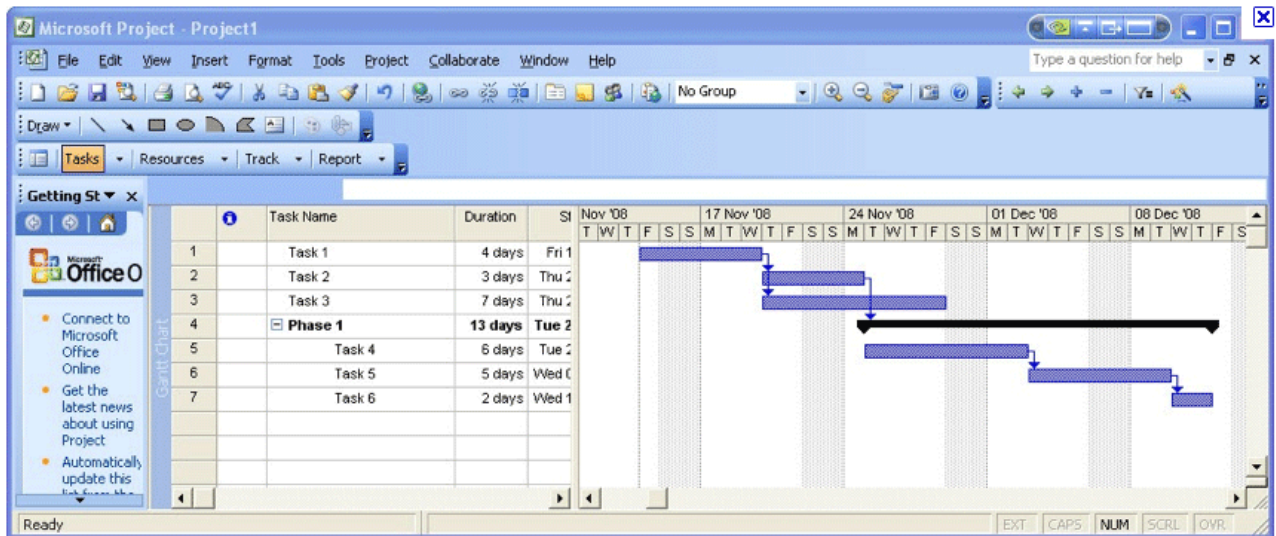
MSP also creates budgets based on resource rates. Resource definitions (people, equipment and materials) can be shared between projects using a shared resource pool. Each resource can be assigned to multiple tasks in multiple plans and each task can be assigned multiple resources.

In the Professional version, MSP connects to two servers to facilitate teams to collaborate. The first is in the connection to the SharePoint server tasks list, which allows project managers to publish their plans to where their project team lives and then automate status collection through the distributed task lists. The other server connection is Project Server 2010, which provides a unified project and portfolio management solution.

MSP's proprietary file extension is .mpp.

InLoox

InLoox is an application for project planning, resource management and project document management. It also uses Gantt planning charts and accounting functionalities. There is a free trial version.

InLoox is suitable for small and medium-sized projects. Its complete integration in Outlook can be seen as a specialty of InLoox, enabling the use of calendar, contact and email data for project management.

InLoox can be organised as required and project phases, work packages and milestones can be assigned to members of the project or other resources. Project members can see dates and milestones in their Outlook calendar or personal task list. It is simple to adapt to any requirements as new data fields and views can be easily integrated. InLoox is multilingual. Authorisation can be assigned to individual users or groups of users sharing a common role.

Web recommended

For more information about InLoox, you can visit: http://www.inloox.com/

Second, we will describe **the free software tools**.

OpenProj

OpenProj is a free desktop alternative to Microsoft Project. It has quickly become one of the most popular free software applications. It is available on Linux, Unix, Mac OS X or Windows. OpenProj is multilingual, as it has been translated into many languages, including Spanish.

> **Web recommended**
>
> For more information about OpenProj, you can visit: http://openproj.org/openproj

Figure 12. OpenProj typical Gantt charts
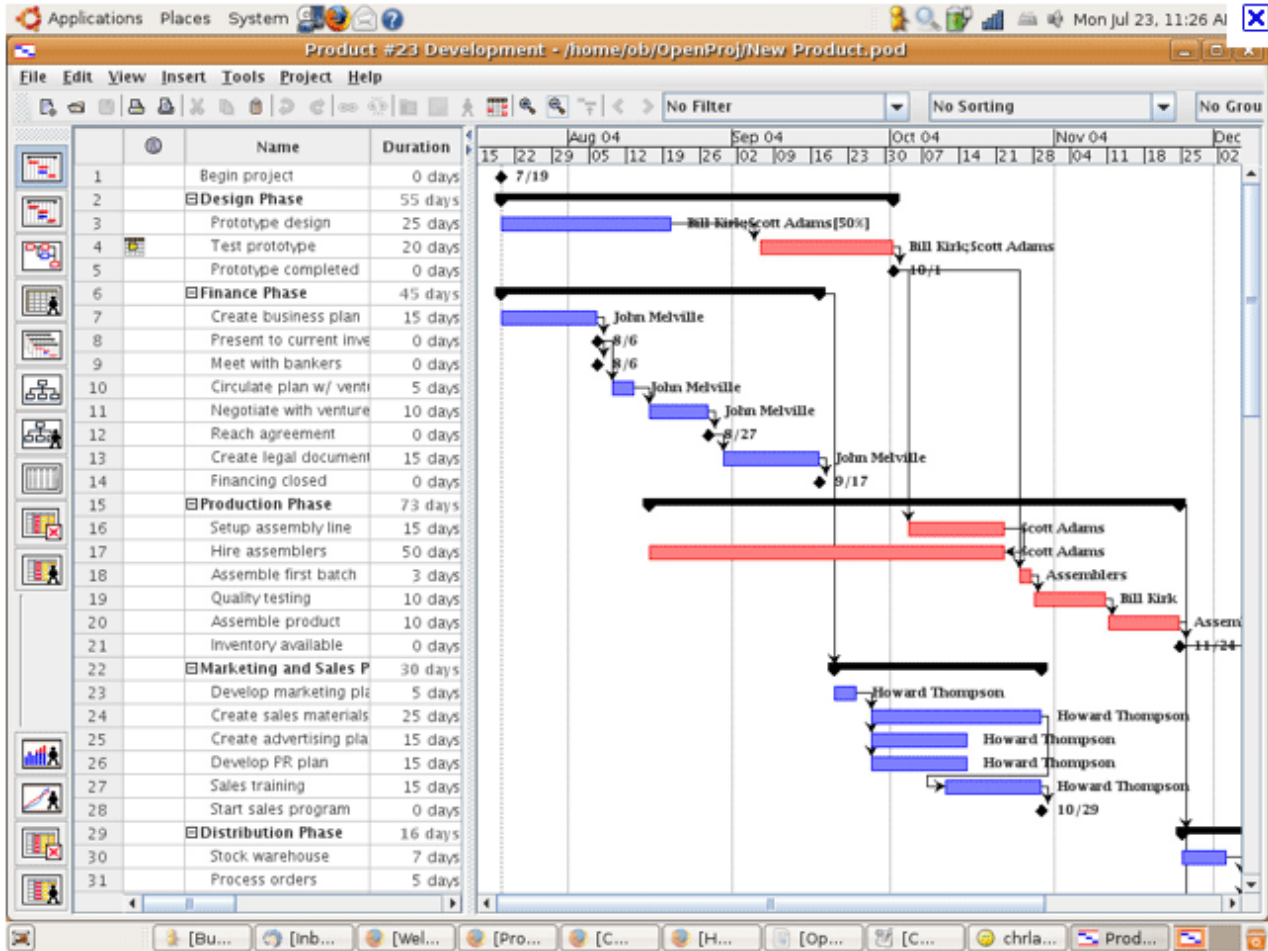
OpenProj shares the industry's most advanced scheduling engine with **Projects On Demand** (see below) and provides Gantt charts, network diagrams and other kind of charts.

> **For managing a group project**
>
> For managing a group project **Projects On Demand** is more suitable than OpenProj.

Projects On Demand is a hosted SaaS solution delivered on a monthly subscription. You do not install anything and simply manage projects in your browser. Projects On Demand has server-side functionalities not found in OpenProj, including multiprojecting, security, reporting, timesheets, notifications and more. It is best to think of OpenProj as a replacement of the desk-

top version of Microsoft Project. Projects On Demand has enterprise and multi-project features that cannot be implemented on a desktop. You can choose which is best for your projects.

GanttProject

GanttProject is a cross-platform desktop tool for project scheduling and management. It runs on Windows, GNU/Linux and Mac OS X, it is free and its code is open source. It uses Gantt charts and milestones and assigns members of the team to work on tasks. It generates PDF and HTML reports and can import projects from and export them to Microsoft Project formats.

Web recommended

For more information about GanttProject, you can visit: http://www.ganttproject.biz/

dotProject

Originally, dotProject was developed as a free software alternative to Microsoft products and other expensive commercial applications. Right from the start, it had a number of simple requirements, mainly a simple user interface, basic project management functionalities and open access and free usage.

Web recommended

For more information about dotProject, you can visit: http://dotproject.net/

It can be used to setup the tasks and dates to be performed; to assign members of the team to perform the tasks; to assign other resources to tasks; to set up project milestones; and to record basic project information such as requirements or budgets. Project members can use the system to update their progress on task, to advise other project members of the status of tasks and to manage their workload. They can also discuss issues with other project members via forums and manage diaries for tasks or events.

2. Data Analysis

2.1. Tools for quantitative analysis and statistics software packages

The quantitative analysis of data is essential in social sciences research and technical studies involving mathematical, numerical, statistical or data mining analysis. In this section, we will list the tools available to perform these analyses that have changed the research itself. These tools are supposed to be divided into two different groups, but they often overlap in many characteristics: the tools that use extensive mathematical capabilities (computer algebra systems) and those that focus on data analysis elements (statistics software packages).

2.1.1. Computer algebra system

A computer algebra system (CAS) is a software application that facilitates symbolic mathematics. The core functionality of a CAS is manipulation of mathematical expressions in symbolic form.

The symbolic manipulations supported typically include:

- Simplification to the smallest possible expression or some standard form.
- Calculation and change of mathematical expressions forms (algebraical, trigonometrical, exponential etc.)
- Differentiation and indefinite and definite integration.
- Symbolic optimisation.
- Solution of linear and non-linear equations.
- Solution of differential and difference equations.
- Calculation of limits.
- Series operations such as expansion, summation and products.
- Matrix operations including products, inverses etc.
- Statistical computation.
- Plotting graphs and parametric plots of functions in two and three dimensions, and animating them.
- Drawing charts and diagrams.

Many CAS also include:

- A programming language, allowing users to implement their own algorithms.
- Arbitrary-precision numeric operations.
- Editing of mathematical expressions in two-dimensional form.

- APIs for linking it on an external program such as a database or for using in a programming language to use the computer algebra system.

Some of them may also include:

- Graphic production and editing such as computer generated imagery and signal processing as image processing.
- Sound synthesis.

Below, we will describe some tools of this second group, which are the most common ones.

First we will describe the **proprietary tools**.

Maple

Maple is a general-purpose commercial computer algebra system. It was first developed in 1980 by the Symbolic Computation Group at the University of Waterloo, Canada. Since 1988, it has been developed and sold commercially by Waterloo Maple Inc. (also known as Maplesoft).

As an important feature, there is extensive support for numeric computations, to arbitrary precision, as well as symbolic computation and visualisation.

In addition, users can enter mathematics in traditional mathematical notation. Maple also incorporates a dynamically typed imperative-style programming language. There are also interfaces to other languages (C, Fortran, Java, MATLAB, and Visual Basic) and with Excel.

Web recommended
For more information about Maple, you can visit: http://www.maplesoft.com/products/maple/

Mathcad

Mathcad is an application primarily intended for engineering calculations. First introduced in 1986 on MS-DOS, it was the first application to introduce live editing of typeset mathematical notation combined with its automatic computation. It was also the first to automatically compute and check consistency of engineering units such as the International System of Units (SI). Mathcad includes some of the capabilities of a CAS but remains oriented towards ease of use and numerical engineering applications. Mathcad paved the way for a variety of desktop mathematical tools. It is oriented around a worksheet, in which equations and expressions are displayed graphically (WYSIWYG), as opposed to plain text, an approach later adopted by other systems such as Mathematica.

Web recommended
For more information about Mathcad, you can visit: http://www.ptc.com/products/mathcad

Figure 13. Mathcat typical worksheet

Mathematica

Mathematica is a CAS application used in scientific, engineering, and mathematical fields and others areas of technical computing. It was originally conceived by Stephen Wolfram and is developed by Wolfram Research of Champaign, Illinois.

Features of Mathematica include: mathematical functions, 2D and 3D data and function visualisation and animation tools, multivariate statistics, tools for image processing, data mining tools such as cluster analysis, sequence alignment and pattern matching, technical word processing including formula editing and automated report generating, tools for connecting to SQL, Java, .NET, C++, FORTRAN and HTTP based systems.

MATLAB

MATLAB stands for *MATrix LABoratory* and is a numerical computing environment and fourth-generation programming language. Developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, and Fortran.

Figure 14. MATLAB typical worksheet
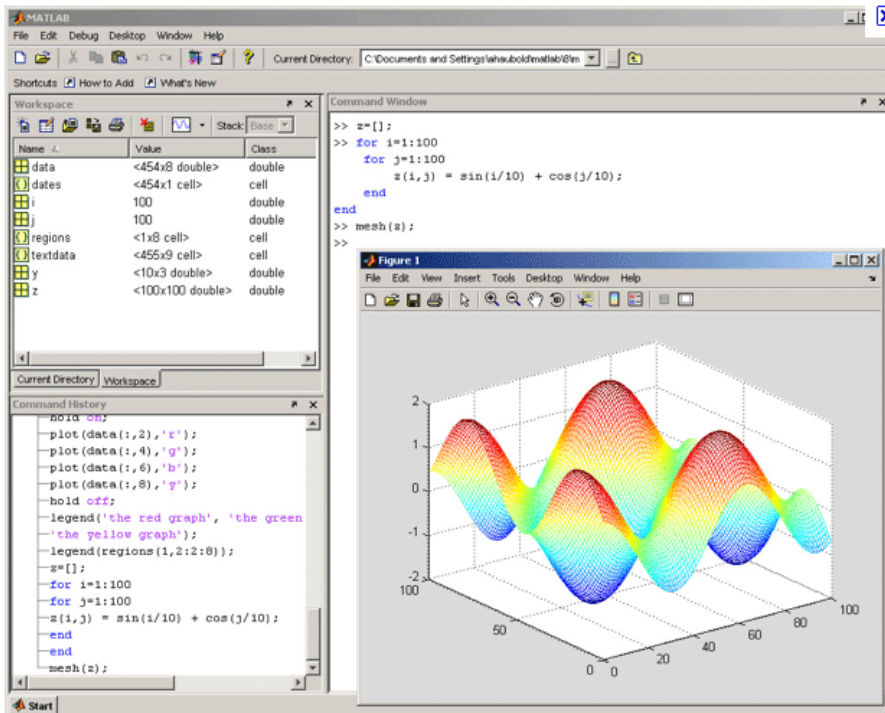
WIRIS

WIRIS is a software family of products for mathematical calculation, mostly used as education tools for learning mathematics. The WIRIS CAS is an online platform for mathematical calculations designed for education. Students and teachers have free access to WIRIS tools through public education portals (in particular at the UOC). Its main features include integral and limit calculation, function graphing in 2D or 3D and symbolic matrix manipulation. It covers all mathematical topics from secondary school to university level (calculus, algebra...). The WIRIS desktop is the offline version of WIRIS CAS.

Second, we will describe the **free software tools**.

GNU Octave

GNU Octave is a high-level language for numerical computations (it is very similar to MATLAB). It provides a convenient command line interface for solving linear and nonlinear problems numerically and for performing other numerical experiments using a language that is mostly compatible with MATLAB. As part of the GNU Project, it is free software under the terms of the GNU General Public License.

Web recommended

For more information about WIRIS, you can visit: http://www.wiris.com/

Comparison of computer algebra systems

In Wikipedia there are complete tables that compare a number of computer algebra systems.
http://en.wikipedia .org/wiki/List_of_ computer_algebra _systems

Web recommended

For more information about GNU Octave, you can visit: http://www.gnu.org/software/octave

Figure 15. Octave worksheet and outputs
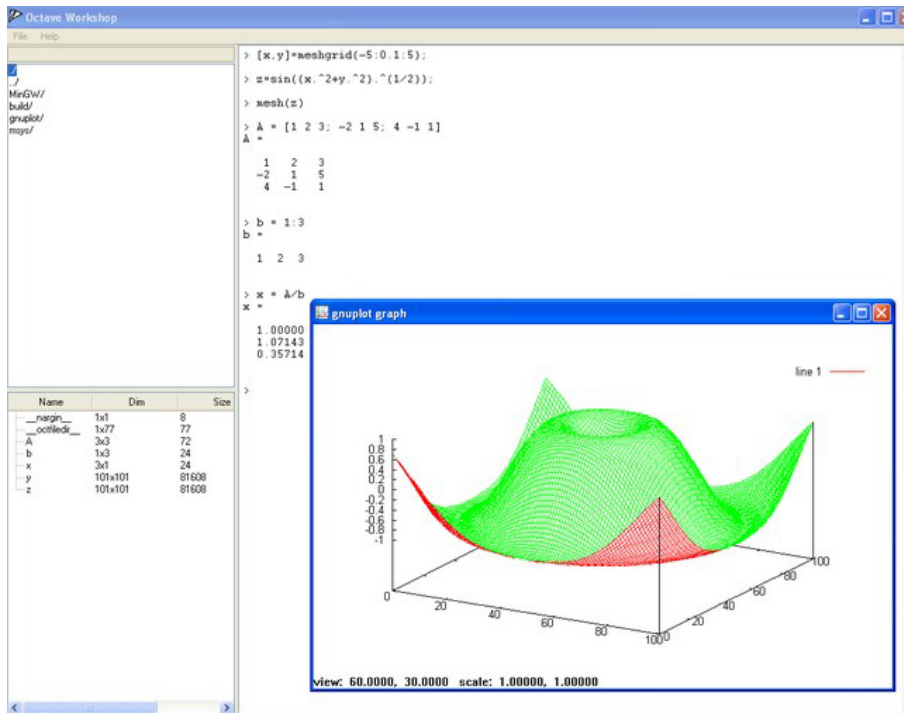
SciLab

Scilab is a free software application for numerical computation providing a computing environment for engineering and scientific applications. It is distributed under the CeCILL license (GPL compatible). The distribution mode of Scilab is particularly well suited for education where students can receive a free copy or as a tool for scientific cooperation without constraint.

SciLab includes hundreds of mathematical functions, access to advanced data structures and 2D and 3D graphical functions. It also includes specific functionalities such as: control, simulation, optimisation or signal processing. In addition, Xcos, the hybrid dynamic systems modeller and simulator, is provided with the platform.

Web recommended

For more information about SciLab, you can visit: http://www.scilab.org/

Figure 16. SciLab worksheet and outputs
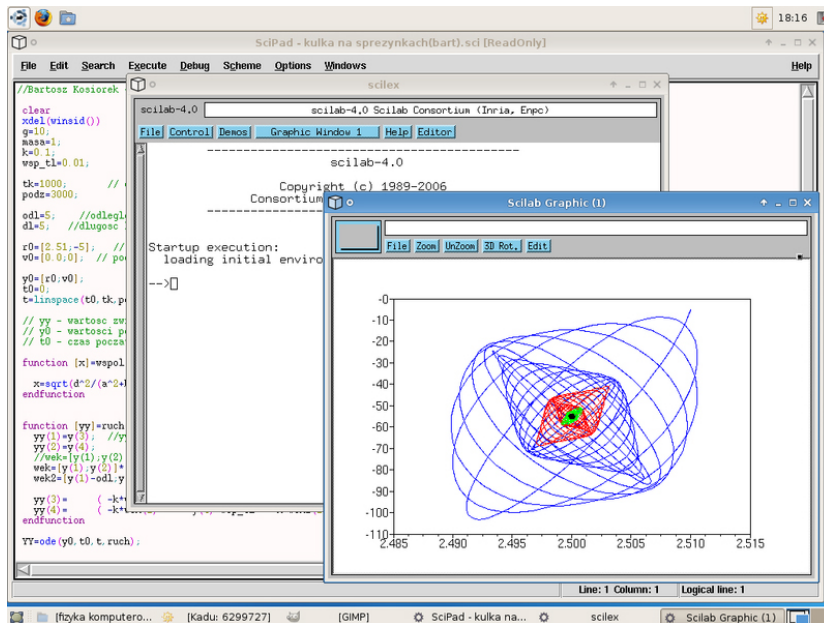
2.1.2. Statistics software packages

A statistical package is a suite of computer programs that are specialised for statistical analysis. It allows users to obtain the results of standard statistical procedures. Most statistical packages also provide facilities for data management.

Statistical software applications make it possible to examine data in multiple ways, to perform comparisons and to look for multivariate relations. Some of them allow for classification methods to find homogeneous subgroups that preserve the overall variability and cluster analysis to identify groupings of the most similar objects.

In the online publication *The 2011 Statistical Software Survey*, information provided by the vendors in response to a questionnaire can be found. This survey should not be considered as comprehensive, but rather as a representation of available statistical packages. The tools range from general tools that cover the standard techniques of inference and estimation, to specialised activities such as nonlinear regression, forecasting and design of experiments. The information contained in the survey is summarised in tables to highlight general features.

Some of the more popular and adapted tools to research are described below.

First, the **proprietary tools** are described.

JMP

JMP (pronounced *jump*) is a computer program that was first developed by John Sall and others (now by SAS Institute) to perform simple and complex statistical analyses. It is available for Windows, Macintosh and GNU/Linux. It dynamically links statistics with graphics to interactively explore, understand and visualise data. This allows you to click on any point in a graph and see the corresponding data point highlighted in the data table and other graphs.

Minitab

Minitab is a general statistics package. It is distributed by Minitab Inc, a privately owned company headquartered in State College, Pennsylvania. Today, Minitab is often used in conjunction with the implementation of Six Sigma, CMMI and other statistics-based process improvement methods. It is multilingual and has an intuitive, simple to learn design.

Figure 17. Minitab worksheet and outputs
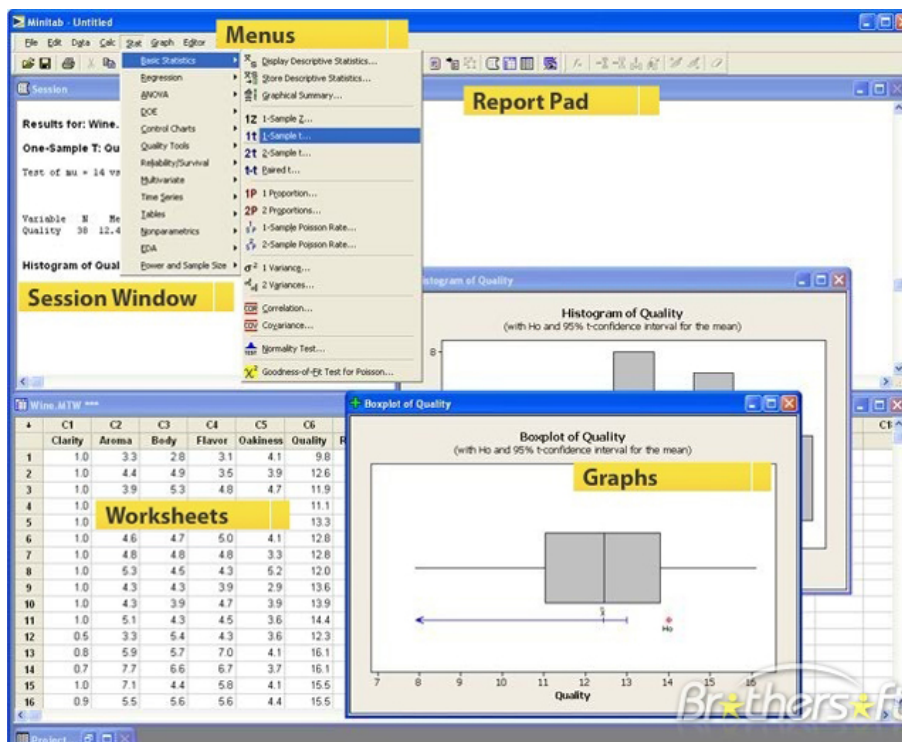
SAS

SAS (Statistical Analysis System) is an integrated system of software products provided by the SAS Institute Inc. that enables users to perform data management, report writing and graphics, statistical and numerical analysis. In addition, SAS has many business solutions that enable large-scale software solutions for areas such as IT management, human resource management, financial management, business intelligence, customer relationship management and more.

SPSS

SPSS (Statistical Package for the Social Sciences) was created and released in its first version in 1968. Today it is provided by SPSS Inc. SPSS is among the most widely used programs for statistical analysis in social science. In addition to statistical analysis, data management (case selection, file reshaping, creating derived data) and data documentation (a metadata dictionary is stored in the datafile) are features of the base software.

Stata

Stata is a general-purpose statistical software package created in 1985 by StataCorp for Windows, Mac OS X, Unix, GNU/Linux operating systems. It is used by many businesses and academic institutions around the world. Stata's full range of capabilities include: data management, Statistical analysis, graphics, simulations and custom programming.

Statgraphics

Statgraphics is a general statistics package that performs and explains basic and advanced statistical functions. It is distributed by StatPoint Technologies, Inc.

In September 2008, the Statgraphics Online version was released. Statgraphics Online is a statistical package that runs within a web browser. Users can enter data directly into the data editor or import data from text files, Excel files or other formats. The calculations are performed remotely on a web server and the results returned to the user's browser as HTML with embedded graphics images.

Now we will discuss the **free software statistical packages and tools**.

Dap

Dap is a statistics and graphics program (GNU Project) that performs data management, analysis and graphical visualisation tasks which are commonly required in statistical consulting practice. Dap was written to be a free replacement for SAS, but users are assumed to have a basic familiarity with the C programming language in order to allow for greater flexibility.

Dap is a command line driven program. Using its internal commands, one can perform tests on means and percentiles, correlation, ANOVA, categorical analysis, linear and logistic regression analysis and non parametric statistics. It can also be used to create scatterplots, line graphs and histograms of data. It has been designed so as to cope with very large data sets; even when the size of the data exceeds the size of the computer's memory.

Web recommended

For more information about SAS, you can visit: http://www.spss.com

Web recommended

For more information about Stata, you can visit: http://www.stata.com

Web recommended

For more information about Statgraphics, you can visit: http://statgraphics.com

Comparison of statistical packages

In Wikipedia there are complete tables comparing a number of statistical analysis packages.

http://en.wikipedia .org/wiki/Comparison _of_statistical_ packages

Web recommended

For more information about Dap, you can visit: http://www.gnu.org/software/dap

ELKI (Data Mining)

Environment for DeveLoping KDD-Applications Supported by Index-Structures (ELKI) is a Science Discovery in Databases (KDD, that is data mining) software application developed for use in research and teaching by Hans-Peter Kriegel at the Ludwig Maximilian University of Munich, Germany. It aims at allowing the development and evaluation of advanced data mining algorithms and their interaction with database index structures.

Most currently included algorithms belong to clustering, outlier detection and database indices. A key concept of ELKI is to allow the combination of arbitrary algorithms, data types, distance functions and indices and evaluate these combinations.

The source code is written with extensibility, readability and reusability in mind, but it is not extensively optimised for performance. The application of the algorithms requires knowledge about their use and study of documentation. The audience is students, researchers and software engineers. The visualisation modules use SVG for scalable graphics output and Apache Batik for rendering of the user interface as well as lossless export into PostScript and PDF for easy inclusion in scientific publications in LaTeX.

> **Web recommended**
>
> For more information about ELKI (Data Mining), you can visit: http://elki.dbs.lmu.de

Figure 18. ELKI screenshot

Gretl

Gretl is a free software statistical package, mainly for econometrics. The name is an acronym for GNU Regression, Econometrics and Time-series Library. It has a graphical user interface and can be used together with X-12-ARIMA, TRAMO/SEATS, R, Octave and Ox. It is written in C, uses GTK as widget toolkit for creating its GUI and gnuplot for generating graphs. As a complement to the GUI, it also has a command line interface.

> **Web recommended**
>
> For more information about Gretl, you can visit: http://gretl.sourceforge.net

Gretl includes the possibility to output models as LaTeX files. It is available in many different languages besides English.

Ploticus

It is a free, GPL, software package for producing plots, charts and graphics from data. It was developed in a Unix/C environment and runs on various Unix, GNU/Linux, and win32 systems. Ploticus is good for automated or just-in-time graph generation, handles date and time data nicely and has basic statistical capabilities. It allows significant user control over colours, styles, options and details. Ploticus is a mature package, it has been available since 1999 and version 2.40 has had more than 12,000 downloads to date.

Web recommended

For more information about Ploticus, you can visit: http://ploticus.sourceforge.net

PSPP

PSPP is a free software application for analysis of sampled data. It has a graphical user interface and conventional command line interface. It is written in C, uses GNU Scientific Library for its mathematical routines and plotutils for generating graphs. It is intended as a free replacement of the proprietary application SPSS. It provides a basic set of features: frequencies, cross-tabs comparison of means, linear regression, reliability and re-ordering data, non-parametric tests, factor analysis and more.

Web recommended

For more information about PSPP, you can visit: http://www.gnu.org/software/pspp

Statistical output and graphics are done in ASCII, PDF, Postscript or HTML formats. However, a limited range of statistical graphs can be produced, such as histograms, pie-charts and np-charts.

PSPP can import Gnumeric, OpenDocument and Excel spreadsheets, Postgres databases, comma-separated values and ASCII files. It can export files in the SPSS portable and systemfile formats and to ASCII files. Some of the libraries used by PSPP can be accessed programmatically; PSPP-Perl provides an interface to the libraries used by PSPP.

R

In computing, R is a programming language and software environment for statistical computing and graphics. R provides a wide variety of statistical (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering and others) and graphical techniques. R is designed to be a true computer language and it allows users to add additional functionality by defining new functions. For computationally-intensive tasks, C, C++ and Fortran code can be linked and called at run time. Another of R's strengths is its graphical facilities, which produce publication-quality graphs, which can include mathematical symbols. R has its own LaTeX-like documentation format.

Web recommended

For more information about R, you can visit: http://www.r-project.org

Although R is mostly used by statisticians and other practitioners requiring an environment for statistical computation and software development, it can also be used as a general matrix calculation toolbox with performance bench-

marks comparable to GNU Octave and its proprietary counterpart, MATLAB. An R interface has been added to the popular data mining application Weka, which allows for the usage of data mining capabilities in Weka and statistical analysis in R.

The R language has become a de facto standard among statisticians for the development of statistical software and is widely used for statistical software development and data analysis.

R is part of the GNU project. Its source code is freely available under the GNU General Public License and pre-compiled binary versions are provided for various operating systems. R uses a command line interface, though several graphical user interfaces are available.

Figure 19. R outputs
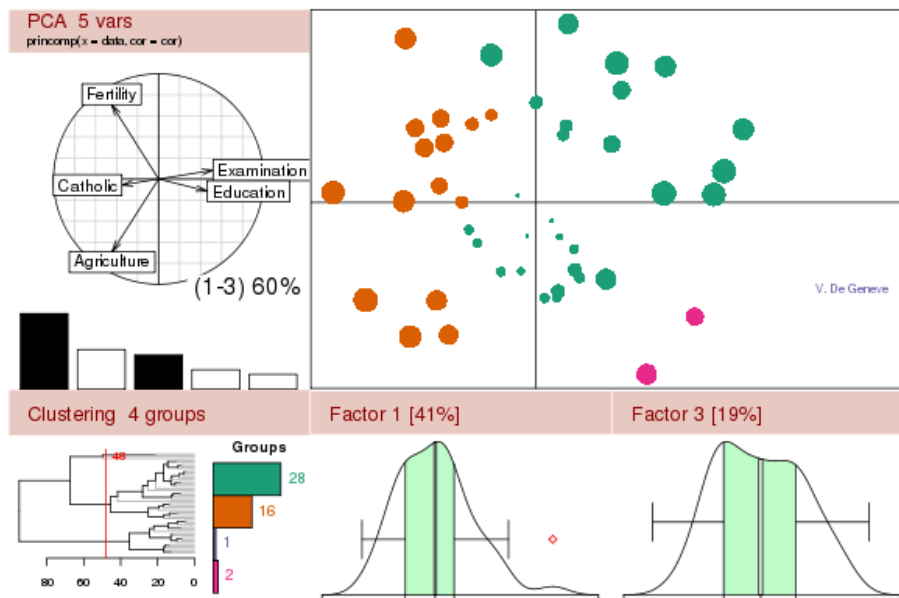
Weka (Data Mining)

Weka (Waikato Environment for Science Analysis) is a popular suite of machine learning software written in Java. Weka is free software available under the GNU General Public License. The Weka workbench contains a collection of visualisation tools and algorithms for data analysis and predictive modelling, together with graphical user interfaces for easy access to this functionality.

Web recommended

For more information about Weka (data mining), you can visit: http://www.cs.waikato.ac.nz/~ml/weka

Weka supports several standard data mining tasks, more specifically, data preprocessing, clustering, classification, regression, visualisation and feature selection. All of Weka's techniques are predicated on the assumption that data are available as a single flat file or relation, where each data point is described by a fixed number of attributes. Weka provides access to SQL databases using Java Database Connectivity and can process the result returned by a database

query. It is not capable of multi-relational data mining, but there is separate software for converting a collection of linked database tables into a single table that is suitable for processing using Weka.

2.2. Tools for qualitative data analysis

Qualitative data include text, visual and multimedia forms of non-numerical information. Computer Assisted Qualitative Data Analysis (CAQDAS) or Qualitative Software is a variety of tools and products. The first packages were generally concerned with the analysis of text. Current applications that are considered CAQDAS include a variety e of packages for taking a qualitative approach to qualitative data. A qualitative approach includes interpreting data through the identification and possibly coding of themes, concepts, processes, contexts etc. in order to build explanations or theories or to test a theory. Qualitative analytic techniques include in-depth interviews, focus groups, participant observation, grounded theory, action research and conversation and narrative analysis.

CAQDAS packages may also enable the incorporation of quantitative (numeric) data, include tools for taking quantitative approaches to qualitative data or both. However, they must directly handle at least one type of qualitative data and include some of the following tools for handling and analysing it:

- Content searching tools
- Linking tools
- Coding tools
- Query tools
- Writing and annotation tools
- Mapping or networking tools

Tools available may support certain tasks differently and there is some debate as to whether a particular package may steer the way you do the analysis. The researcher should remain in control of the interpretive process and decide which tool facilitates its approach most effectively.

Whilst there are many different packages, the key principles behind them are similar in many ways, such as:

- Instantaneous access to all sources of data files introduced into the project.

- Environment to explore the data: Many packages offer ways of exploring data without necessarily abstracting to the conceptual or coding level. **Annotations tools** may act like footnote tools in word processors applications enabling comments to be made about and anchored to specific pieces of data. **Linking tools** vary quite significantly between software applications but they can provide very flexible ways of manoeuvring

The CAQDAS Networking Project

The CAQDAS Networking Project was launched in the 1990s to provide information and training in the use of this kind of packages and to facilitate debate amongst users.

http://caqdas.soc.surrey.ac.uk

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S. Di Gregorio; J. Davidson (2008). *Qualitative Research for Software Users*. Open University Press, UK: McGraw Hill.

around data to follow processes. Alternatively **text search tools** offer ways to search for one word or phrase, or even a collection of words around the same topic area.

- Coding and retrieving functionality: All CAQDAS offer these functionalities. User-defined keywords or conceptual categories (codes) can be applied to selections of text and as many codes as required can be applied to the same selection. In all packages, coded textual data can be retrieved, re-coded and output with ease.

- Project management and data organisation: Any files that can be converted into the formats supported by the given software are data here. They can offer powerful means by which to organise data according to known facts, descriptive features and data types for later comparison and queries.

- Searching and interrogating the database: At any stage of the process all the packages offer means by which to interrogate the dataset. This includes searching the content of data or search relationships between codes. Searches may produce a secondary level of analytic coding. Search tools also allow you to combine the coding (interpretive or conceptual) and organisational (descriptive) dimensions of your work.

- Writing tools: The process of qualitative data analysis is rarely linear and the various writing tools (commenting, annotating, etc.) provide ways to increase the researcher's contact with thoughts and processes.

- Reports: All packages have a standard selection of reports that allow the user to view material in hard copy or integrate to other applications (Word, Excel, SPSS etc.).

It is necessary to choose the most appropriate package for your needs: free software, freeware or low-cost software.

CAT Coding Analysis toolkit

The Coding Analysis Toolkit (CAT) was developed in the summer of 2007. It is a web-based service suitable for Mac and PC platforms. The system facilitates the analysis of text datasets that have been coded using either an internal coding module or the commercial package ATLAS.ti (see below). There is a step-by-step tutorial.

Web recommended

For more information about CAT Coding Analysis toolkit, you can visit: http://cat.ucsur.pitt.edu

CAT uses keystrokes and automation to clarify and speed-up the coding, validation or consensus adjudication process.

ELAN

ELAN is a professional tool for the creation of complex annotations on video and audio resources. An annotation can be a sentence, word or gloss, a comment, translation or a description of any feature observed in the media. Annotations can be created on multiple layers, called tiers. Tiers can be hierarchically interconnected. An annotation can either be time-aligned to the media or it can refer to other existing annotations. The textual content of annotations is always in Unicode and the transcription is stored in an XML format. ELAN provides several views on the annotations and each view is connected and synchronised to the media playhead. ELAN delegates media playback to an existing media framework, like Windows Media Player, QuickTime or JMF (Java Media Framework). As a result, a wide variety of audio and video formats is supported and high performance media playback can be achieved.

ELAN is written in the Java programming language and the sources are available for non-commercial use. It runs on Windows, Mac OS X and GNU/Linux.

Web recommended

For more information about ELAN, you can visit: http://www.lat-mpi.eu/tools/elan

TAMS Analyser

TAMS is open source qualitative package for the analysis of textual themes, only available for MAC OS X and GNU/Linux. TAMS stands for Text Analysis Mark-up System. It is a convention for identifying themes in texts (web pages, interviews or field notes). It was designed for use in ethnographic and discourse research.

It lets you assign ethnographic codes to passages of a text just by selecting the relevant text and double clicking the name of the code on a list. It then allows you to extract, analyse and save coded information. The Macintosh version of the program also includes full support for transcription (back space, insert time code, jump to time code etc.) when working with data on sound files.

Web recommended

For more information about TAMS Analyser, you can visit: http://tamsys.sf.net/

Transana

Cross platform tool for transcription and qualitative analysis of audiovisual data supported by the Wisconsin Center for Education Research, Transana is part of the Digital Insight project (http://digitalinsight.wceruw.org/). There are versions for Windows and Mac OS X platforms.

It is not free but it is low-cost licence software. There is a free trial download.

Web recommended

For more information about Transana, you can visit: http://www.transana.org

Weft QDA

Free software tool for analysing textual data, developed by Alex Fenton to support his own MSc research. There are versions for Windows and GNU/Linux. It is an easy-to-use tool to assist in the analysis of textual data such as interview transcripts, written texts and field notes. It includes a number of fairly standard CAQDAS features.

Web recommended

For more information about Weft QDA, you can visit: http://www.pressure.to/qda/

Non free and non-cost free software:

ATLAS.ti

ATLAS.ti is a CAQDAS of a much extended use. It helps in qualitative analysis of text and multimedia data. A prototype of ATLAS.ti was developed by Thomas Muhr at Technical University in Berlin in the context of the project ATLAS (1989-1992). A first commercial version of ATLAS.ti was released in 1993 to the market.

Web recommended

For more information about ATLAS.ti, you can visit: http://www.atlasti.com/

Figure 20. ATLAS.ti worksheet
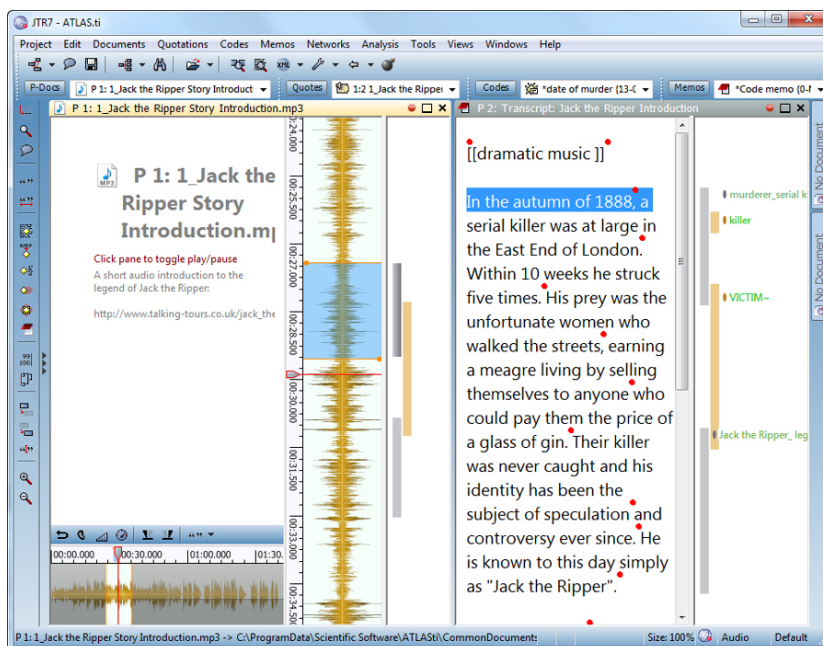
The program provides tools that let the user locate, code and annotate findings in primary data material, to weigh and evaluate their importance and to visualise complex relations between them. ATLAS.ti consolidates large volumes of documents and keeps track of all notes, annotations, codes and memos in all fields that require close study and analysis of primary material consisting of text, images, audio, video and geo data. In addition, it provides analytical and visualisation tools designed to open new interpretative views on the material. ATLAS.ti is used by researchers and practitioners in a wide variety of fields including anthropology, arts, architecture, communication, criminology, economics, educational sciences, engineering, ethnological studies, management studies and sociology. There is a free trial download.

HyperRESEARCH

Cross-Platform (Windows and Mac OS X) qualitative analysis software application for qualitative analysis of text, images, audio and video source material. Produced by Research Ware, Inc.

Web recommended

For more information about HyperRESEARCH, you can visit: http://www.researchware.com/

HyperRESEARCH enables you to code and retrieve, build theories and conduct analyses of your data. HyperRESEARCH is a solid code-and-retrieve data analysis program, with additional theory building features provided by the Hypothesis Tester. HyperRESEARCH has been in use by researchers in the social sciences and other fields since it was first introduced in 1991. There is a free limited edition available which has all features enabled except for a limitation in the number of codes and cases that can be used in a study.

MAXQDA

MAXQDA is one of the world's leading software applications for computer-assisted qualitative data, text and multimedia analysis, created and distributed by VERBI GmbH (only Windows version). VERBI designed the software for both qualitative and quantitative research (mixed methods research) in academic, scientific and business institutions. One distinguishing characteristic of the program is its intuitive four-window interface.

> **Web recommended**
>
> For more information about MAXQDA, you can visit: http://www.maxqda.com/

Figure 21. MAXQDA worksheet
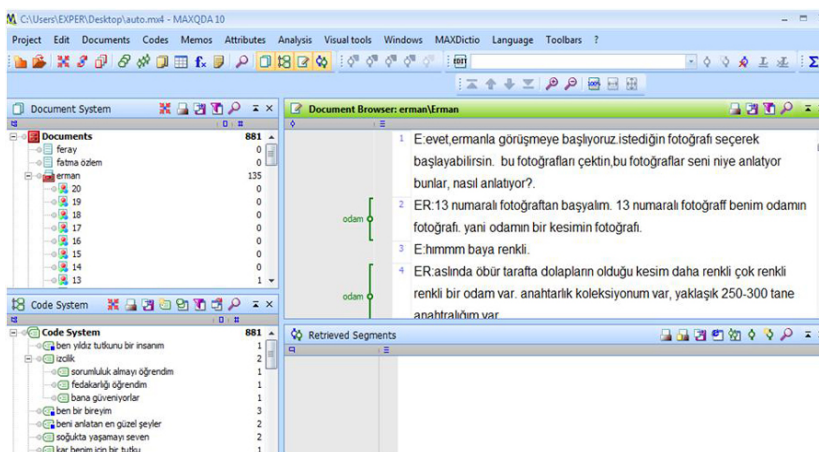
NVivo

NVivo is a qualitative data analysis computer software package. It has been designed for qualitative researchers working with very rich text-based or multimedia information, where deep levels of analysis on small or large volumes of data are required.

> **Web recommended**
>
> For more information about NVivo, you can visit: http://www.qsrinternational.com

NVivo is used predominantly by academic, government and commercial researchers across a diverse range of fields, including social sciences such as psychology, communication, sociology, as well as fields such as forensics, tourism and marketing.

NVivo helps researchers to organise and analyse complex non-numerical or unstructured data. The software allows users to examine complex relationships in the data; and combine subtle analysis with linking, searching and modelling.

Accommodates a wide range of research methods, including network and organisational analysis, action or evidence-based research, discourse analysis, grounded theory, conversation analysis, ethnography, literature reviews, phenomenology and mixed methods research. It supports documents in all languages. There is a free trial download.

QDA Miner

QDA Miner is a qualitative data analysis software package for coding, annotating, retrieving and analysing small and large collections of documents and images. QDA Miner may be used to analyse interview or focus-group transcripts, legal documents, journal articles, even entire books, as well as drawing, photographs, paintings and other types of visual documents. There is only a Windows version. It is also available in French and Spanish. There is a free trial download.

> **Web recommended**
>
> For more information about QDA Miner, you can visit: http://www.provalisresearch.com/QDAMiner/QDAMinerDesc.html

XSight

XSight is a program for qualitative data analysis. It provides a range of analysis frameworks for importing, classifying and arranging data; and the ability to visually map and report thoughts and findings.

XSight is used predominantly by commercial market researchers, but also by professionals and students in a diverse range of areas, from health and law to telecommunications and tourism. It is useful for evaluating a variety of information to review results and draw conclusions.

> **Web recommended**
>
> For more information about XSight, you can visit: http://www.qsrinternational.com/products_xsight.aspx

2.3. Data conversion and collection software

Some available software helps you to transcribe text-convert spoken or handwritten works to a typewritten, machine-readable format. Some other helps you to record interviews.

Some of these programs and resources are listed below:

- **Audacity** (http://audacity.sourceforge.net/) is an audio editor which will record sounds, play sounds, import, edit and export RIFFWAV, AIFF, Ogg Vorbis and MP3 files. Free licensed.

- **AudioTranskription** (http://www.audiotranskription.de/english/) is an information website on audio-recording and transcription, maintained by Thorsten Dresing & Thorsten Pehl.

- **f4** (http://www.audiotranskription.de/english/f4.htm) is a free transcription program for audio and video recordings (WMA, WAV, MP3 and Ogg formats) created by Dresing & Pehl GbR.

- **HyperTRANSCRIBE** (http://www.researchware.com/) helps to transcribe nearly any audio or video file, quickly and easily. You control the media with the keyboard for maximum efficiency (Mac OS X and Windows). Free trial download at http://www.researchware.com/ht/downloads.html

- **InqScribe** (http://www.inqscribe.com/) is a program that supports transcription, analysis and subtitling of digital audio and video. Mac OS X and Windows. Commercial licence.

- **Express Scribe Transcription Playback Software**
(http://www.nch.com.au) is a free audio player program designed to assist the transcription of audio recordings. Cross-platform.

- **MacSpeech Dictate** (http://www.macspeech.com): is a speech recognition software. Only for Mac OS X and proprietary.

- **Transcriber** (http://trans.sourceforge.net/en) is a free software, cross-platform tool for segmenting, labelling and transcribing speech (tested on GNU/Linux, Sun Solaris, Silicon Graphics and Windows NT).

- **Transcript** (http://www.jacobboerema.nl/en/Freeware.htm) is a desktop-based manuscript transcription tool. Supports word-processor-style formatting. The basic version is freeware, and Windows-only.

- **Transcriptions** (http://code.google.com/p/transcriptions/) is a text editor optimised for fast transcription of audio or video material. It is freeware and Mac OS X-only.

3. Presentation and writing tools

3.1. Scientific Word Processors

A **word processor** is a software application used for the composition, editing, formatting (and possibly printing) of any kind of digital printable material. Most are powerful systems consisting of one or more programs that can produce any arbitrary combination of images, graphics and text, the latter handled with type-setting capability.

Although early word processors used tag-based mark-up for document formatting, most modern word processors take advantage of a graphical user interface providing some form of WYSIWYG (what you see is what you get) editing. However, there are some very interesting processors (mostly in the category of scientific word processors) following the what-you-see-is-what-you-mean paradigm (WYSIWYM), as opposed to the WYSIWYG ideas used by common word processors. This means that the user only has to care about the structure of and information within the text, while the formatting is done by another advanced typesetting system (usually LaTeX).

Word processing typically implies the presence of text manipulation functions that extend beyond a basic ability to enter and change text, such as automatic generation of indices of keywords and their page numbers; tables of contents with section titles and their page numbers; tables of figures with caption titles and their page numbers; cross-referencing with section or page numbers and footnote numbering. Other common word processing functions include spell checking, grammar checking, and a thesaurus function (finds words with similar or opposite meanings). Other possible features include collaborative editing, comments and annotations, support for images and diagrams and internal cross-referencing.

Almost all word processors enable users to employ styles, which are used to automate consistent formatting of text body, titles, subtitles, highlighted text and so on. Styles greatly simplify managing the formatting of large documents, since changing a style automatically changes all text that the style has been applied to. Even in shorter documents styles can save a lot of time while formatting.

Word processors can be distinguished from **text editors** that can compose and edit text, but they do not format documents. Text editors are now used mainly by programmers, website designers, computer system administrators and, in the case of some LaTeX systems, by mathematicians and scientists (for com-

plex formulas and for citations in rare languages). They are also useful when fast start-up times, small file sizes, editing speed and simplicity of operation are preferred over formatting.

Among proprietary word processors, Microsoft Word is the leader.

Microsoft Word (proprietary software)

Microsoft Word is the most widely used computer word processing system (with its well-known .doc file extension). It was first released in 1983 and beginning with the 2003 version, the branding was revised to emphasise Word's identity as a component within the Office suite on Windows versions; Microsoft began calling it **Microsoft Office Word** instead of merely Microsoft Word. The 2010 version appears to be branded as Microsoft Word, once again. In 2011, the current versions are Microsoft Word 2010 for Windows and 2011 for Mac OS X.

Web recommended

For more information about Microsoft Word (proprietary software), you can visit: http://www.microsoft.com/

Since the release of 2007 it includes an XML-based file format (and new file extension .docx), a redesigned interface, an **integrated equation editor** and bibliographic management. Alternatively, it can save to the old format of Word 97-2003. Opening a Word document file in a version of Word other than the one with which it was created can cause incorrect display of the document. Rich Text Format (RTF), an early effort to create a format for interchanging formatted text between applications, is an optional format for Word that retains most formatting and all content of the original document. Later, after HTML appeared, Word supported an HTML derivative as an additional full-fidelity roundtrip format similar to RTF, with the additional capability that the file could be viewed in a web browser.

Word has a built-in spell checker, thesaurus, dictionary, Office Assistant and utilities for transferring, copying, pasting and editing text, such as PureText. WordArt enables drawing text in a Microsoft Word document such as a title, watermark or other text with graphical effects such as skewing, shadowing, rotating and stretching in a variety of shapes and colours and even including three-dimensional effects. Users can also spell-check text that uses visual effects and add text effects to paragraph styles. Microsoft Word supports the use of formulas.

Pages

Pages is a word processor developed by Apple. It is part of the **iWork** productivity suite and runs on the Mac OS X operating system. The current (2011) version is Pages 4, released in 2009. Pages is marketed by Apple as an easy-to-use application that allows users to create professional-quality documents on their home computer.

Web recommended

For more information about Pages, you can visit: http://www.apple.com/iwork/pages/

The Media Browser provides quick access to media in iTunes, iMovie, iPhoto and Aperture. Users can drag and drop music, movies and photos directly into Pages documents from the Media Browser window.

Pages can import some AppleWorks word processing documents and Microsoft Word documents, and can export documents to rich text, PDF and Microsoft Word formats.

Simple and complex mathematical equations can be written for a Pages document with Mac OS X's **Grapher**, offering similar capabilities to Microsoft Equation Editor (plus 2D and 3D rendering tools that only Grapher can use).

Free software applications are rapidly gaining in popularity. Among them, the most extended one is **OpenOffice.org Writer**.

OpenOffice.org Writer

OpenOffice.org Writer is the word processor component of the OpenOffice.org software package. Writer is a word processor similar to Microsoft Word. As with the entire OpenOffice.org suite, Writer can be used across a variety of platforms, including Mac OS X, Microsoft Windows, GNU/Linux, FreeBSD, Irix and Solaris. Released under the terms of the GNU Lesser General Public Licence, Writer is free software.

> **Web recommended**
>
> For more information about OpenOffice.org Write, you can visit: http://www.openoffice.org/product/writer.html

Writer is capable of opening and saving documents in a number of formats, including the OASIS Open Document Format 1.1 (its default format), Microsoft Word's Office Open XML, RTF and XHTML. It has ability to export to the PDF format natively.

Features include an Equation editor (**OpenOffice.org Math**).

LyX

LyX is a document processor following the WYSIWYM paradigm. Here, the user only has to think about the structure and the content of the document, while the formatting is done by LaTeX, an advanced typesetting system. LyX is designed for authors who want professional output with a minimum of effort and without becoming specialists in typesetting. The job of typesetting is done mostly by the computer, following a predefined set of rules called a style, not by the author. Specific knowledge of the LaTeX document processing system is not necessary but may significantly improve editing with LyX for specialist purposes.

> **Web recommended**
>
> For more information about LyX, you can visit: http://www.lyx.org/

Since LyX largely functions as a front-end to the **LaTeX** (see below) typesetting system, it can handle documents ranging from books, notes and theses, to articles in refereed journals, letters and anything else LaTeX can handle.

LyX also supports right-to-left languages like Arabic, Persian, and Hebrew, and it has substantial support for bidirectional writing. LyX also supports Chinese, Japanese and Korean languages.

Although LyX is popular among technical authors and scientists for its advanced mathematical modes, it is increasingly used by social scientists and humanists for its bibliographic database integration and ability to manage multiple files.

The LyX document processor is available for various operating systems, including UNIX, Mac OS X, OS/2, Windows, and GNU/Linux. LyX can be redistributed and modified under the terms of the GNU General Public License and is thus Free Software.

Some features: Automatically-numbered headings, titles and paragraphs, with table of contents; Text is laid out according to standard typographic rules, including indents, spacing and hyphenation; standard operations like cut/paste and spell-checking; notes; BibTeX support; table editor (WYSIWYG); **math editor (WYSIWYG)** and ability to import various common text formats.

Online word processors such as Google Docs are a new category.

Google Docs

Google Docs is a free, web-based word processor, spreadsheet, presentation and data storage service offered by Google. It allows users to create and edit documents online while collaborating in real-time with other users.

> **Web recommended**
>
> For more information about Google Docs, you can visit: http://googledocs.blogspot.com/

Documents, spreadsheets, forms and presentations can be created within the application itself, imported through the web interface or sent via email. They can also be saved to the user's computer in a variety of formats (Open document, HTML, PDF, RTF, Plain Text and Mixrosoft Word). By default, they are saved to the Google servers. Open documents are automatically saved to prevent data loss and a revision history is automatically kept. Documents can be tagged and archived for organisational purposes. The service is officially supported on recent versions of the Firefox, Internet Explorer, Safari and Chrome browsers running on Microsoft Windows, Mac OS X and GNU/Linux operating systems.

In September 2009, **an equation editor** that allows rendering in **LaTeX format** was added.

Google Docs serves as a collaborative tool for editing amongst users and non-users in real time. Documents can be shared, opened and edited by multiple users at the same time. In the case of spreadsheets, users can be notified of changes to any specified regions by e-mail. The application supports the ISO standard OpenDocument format. It also includes support for proprietary for-

mats (such as Microsoft Word Document and Microsoft Excel spreadsheet file formats). However, there are no tracked changes, so it is impossible to determine which editors made which changes to the document.

Google Docs is amongst many cloud computing document-sharing services. The majority of document-sharing services require user fees, whereas **Google Docs is free**. Its popularity amongst businesses is growing due to enhanced sharing features and accessibility. In addition, Google Docs has enjoyed a rapid rise in popularity among students and educational institutions.

Mobile Google Docs allows mobile phone users to browse their Google Docs documents in a mobile browser. Users can view documents and view and edit spreadsheets. Neither presentations nor PDF files can be viewed, although websites other than Google can be used for this purpose. Versions of Google Docs for the iPhone and Android include functionality for editing spreadsheets and viewing presentations, along with an interface designed specifically for the device.

3.2. LaTeX

LaTeX is a free document processor following the WYSIWYM paradigm, specifically oriented for technicians and scientists. LaTeX was originally written in the early 1980s by Leslie Lamport.

LaTeX is based on the idea that authors should be able to focus on the content of what they are writing without being distracted by its visual presentation. In a LaTeX document, the author specifies the logical structure using familiar concepts such as chapter, section, table, figure etc. and lets the LaTeX system worry about the presentation of these structures. It therefore encourages the separation of layout from content while still allowing manual typesetting adjustments where needed.

LaTeX can be arbitrarily extended by using the underlying macro language to develop custom formats. Such macros are often collected into packages, which are available to address special formatting issues such as complicated mathematical content or graphics.

Unlike other word processing systems, you do not obtain the final result as you type; it first creates a source document that is processed to get the printable document. It is based on a low level composition language called TeX and it mainly consists of a collection of macros that facilitate the use of this powerful language. The LaTeX project site is: http://www.latex-project.org/

TeX is a typesetting system designed and mostly written by Donald Knuth. It was designed to allow anybody to produce high-quality books and to provide a system that would give the exact same results on all computers. TeX is popular to typeset complex mathematical formulae. TeX is popular in academia, especially in mathematics, computer science, engineering and physics.

TeX is usually provided in the form of an easy-to-install bundle of TeX itself along with METAFONT and all the necessary fonts, documents formats and utilities needed to use the typesetting system. On UNIX-compatible systems, including GNU/Linux and Mac OS X, TeX is distributed in the form of the TeX distribution and more recently the TeX Live distribution. On Microsoft Windows, there is the MiKTeX distribution and the Windows version of TeX Live.

Several document processing systems are based on TeX, notably **Texinfo**, the GNU documentation processing system. TeX has been the official typesetting package for the GNU operating system since 1984.

Numerous extensions and companion programs for TeX exist, among them **BibTeX** for bibliographies (distributed with **LaTeX**), **pdfTeX**, which bypasses DVI and produces output in Adobe Systems' Portable Document Format and **Omega**, which allows TeX to use the Unicode character set. Most TeX extensions are available for free from **CTAN** (http://www.ctan.org/), the Comprehensive TeX Archive Network.

LaTeX has become the dominant method for using TeX and relatively few people write in plain TeX anymore. The current version is LaTeX2e. As it is distributed under the terms of the LaTeX Project Public License (LPPL), LaTeX is free software.

If you need quality scientific papers, there is no other more comprehensive system of scientific editing. In practice, the LaTeX system has been the standard scientific word processor for many years (LaTeX is most widely used by mathematicians, scientists and engineers). There is one drawback: you have to learn LaTeX, it is difficult but not impossible with proper guidance and some patience. If instead you just want to make simple summaries and small jobs you can still use most common (non scientific) word processors, like Microsoft Word.

LaTeX is used because of the high quality of typesetting: publishing features and extensive facilities for automating most aspects of typesetting and desktop publishing, including numbering and cross-referencing, tables and figures, page layout and bibliographies.

How to install and use LaTeX.

Distribution for LaTeX (TeX)

First, you have to install a current distribution for LaTeX (TeX), depending on the platform you are using. We suggest the following three among others:

- **Windows**
  - **MiKTeX** (http://miktex.org/). It is the most common LaTeX system for Windows. It remains a free program but now it has the option of email support after paying a small fee. This option is not required but serves to maintain program activities and is recommended for the continuation of the project. The MiKTeX distribution uses a viewer named YAP.

  - **proTeXt** (http://www.tug.org/protext/). proTeXt aims to be an easy-to-install TeX distribution for Windows, based on MiKTeX. After downloading, a short PDF document can be used as a guide for the installation (available in English, French, German, and Italian); it provides clickable links to install the various components, along with explanations.. proTeXt adds a few independent tools to MiKTeX, notably **TeXnicCenter** and **Ghostscript**

- **Mac OS X**
  - **MacTeX** (www.tug.org/mactex). It is an easy to install distribution of TeX for Mac OS X, prepared by the MacTeX TeXnical Working Group of the TeX Users Group (TUG).

- **GNU/Linux**
  - **TeX Live** (http://www.tug.org/texlive/). Your system distribution or vendor has probably provided a TeX system including LaTeX. Otherwise install TeX Live directly.

LaTeX editors

Second, in order to create a document in LaTeX, a TeX file must be created using some form of text editor (as LaTeX refers only to the language in which documents are written, not to the editor used to write those documents). In fact TeX files are simple ASCII text files. While most text editors can be used to create a LaTeX document, a number of freeware and shareware editors have been created specifically for working with LaTeX. On the other hand, the .dvi file extension can be viewed with a suitable program for it, usually provided by the TeX distribution software.

a) TeXniCenter (http://www.texniccenter.org/). A free editor that runs on the Windows platform. It is fully functional with a solid interface, configurable and able to integrate with the major distributions of LaTeX for Windows (including MiKTeX).

Highlight features are: the simple insertion of LaTeX constructs via toolbars and menus, and the possibility to open as many files as needed, where each open file is represented by a tab; and it is multilingual out of the box; support for English and German; other translations can be provided by users.

Figure 22. TeXniCenter LaTeX editor
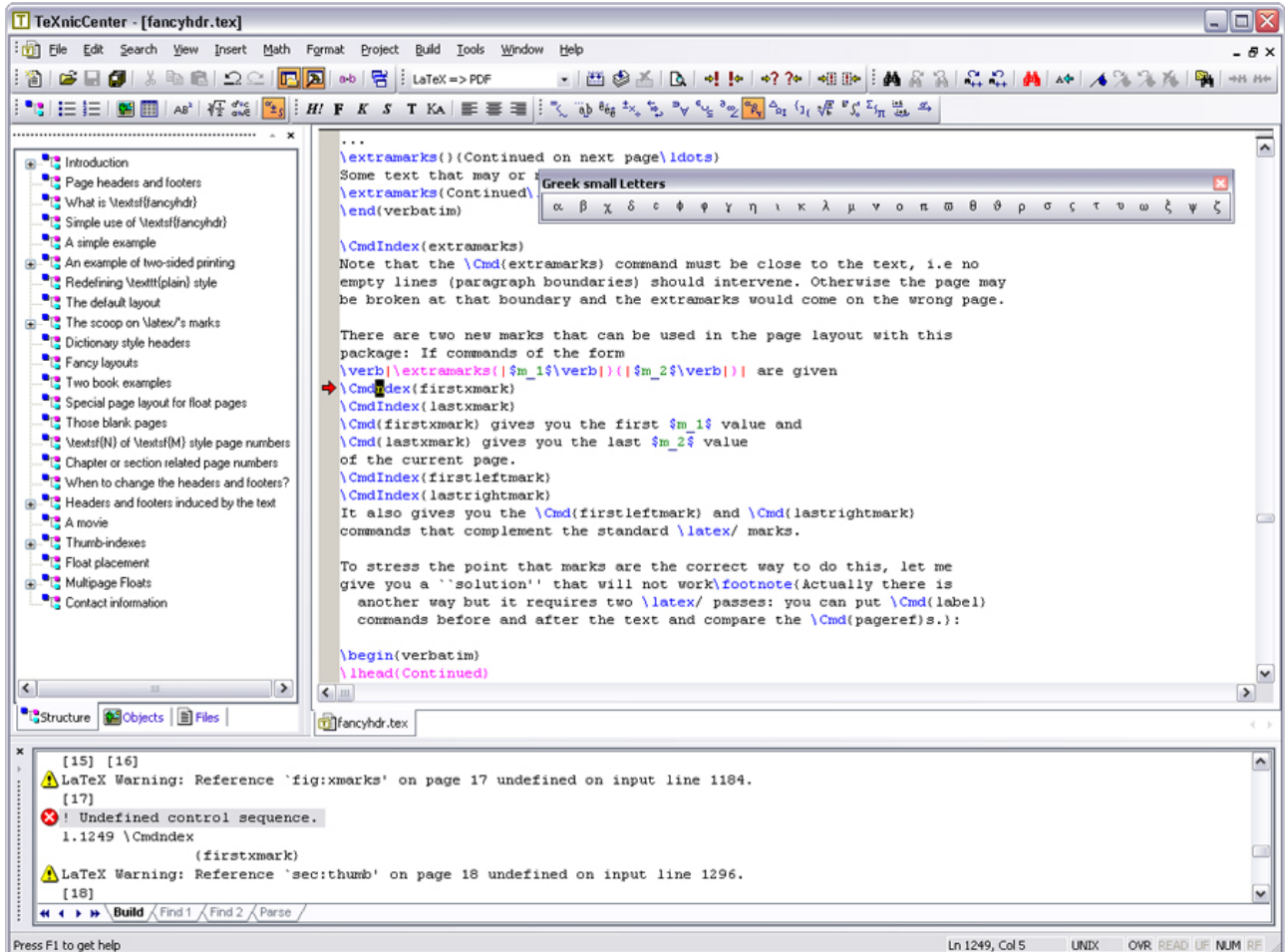
Output profiles define the steps to be executed to compile your LaTeX files to the resulting output file (e.g. DVI, PDF) and how to view it. There is flexible viewer integration: it supports the integration of nearly every viewer including **Adobe Reader** and **GhostView**, thus, building or viewing your document's output requires just one key press or menu selection. Nearly all LaTeX editors, errors, warnings and box errors in LaTeX's log output are highlighted and you can simply jump to the relevant text location.

TeXnicCenter comes with a standard Windows installer providing useful default settings and it allows sharing your output profiles with other TeXnic-Center users.

b) Winedt (http://www.winedt.com/). A quality shareware editor working on Windows. It has great potential and it is low-cost. It integrates perfectly with the MiKTeX system and can be supplemented with some extra help to perform tasks such as editing or correcting tables.

Figure 23. Winedt LaTex Editor
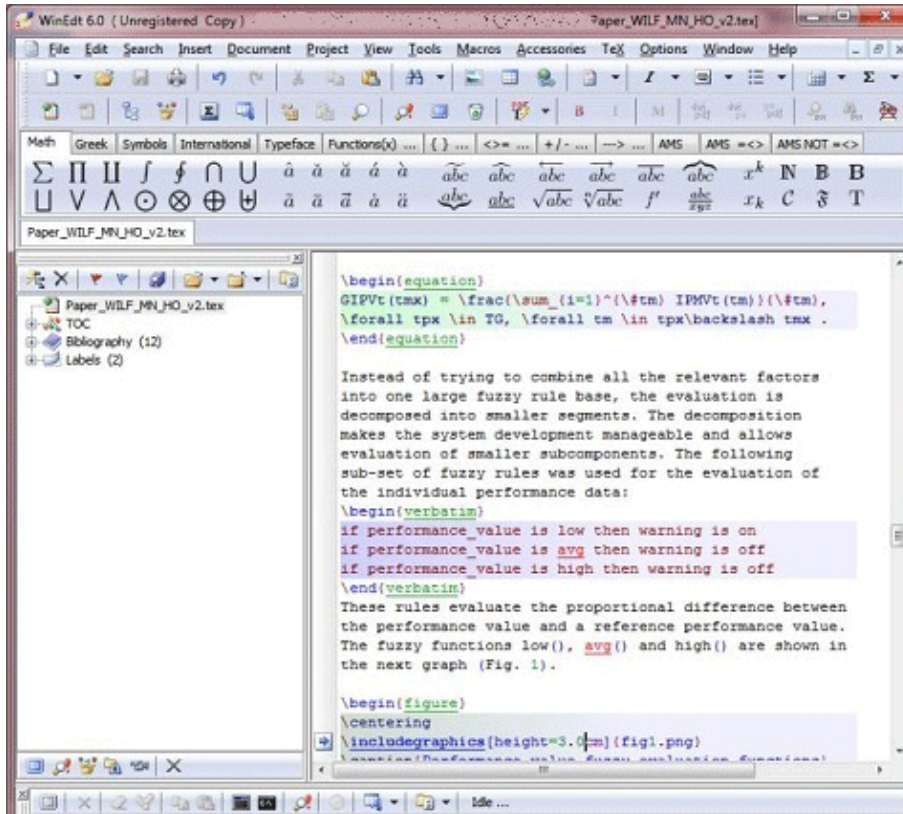
Its main features are: multiple document interface, including management of included files in a WinEdt, management of bibliographic entries and labels, access to common mathematical symbols and text formatting via GUI buttons.

c) GNU Emacs (http://www.gnu.org/software/emacs/emacs.html). GNU Emacs is a highly customisable text editor. Its main features content-editing modes, full Unicode support for nearly all human languages and their scripts and a large number of extensions that add other functionality, including packages with support for LaTeX.

d) LyX (http://www.lyx.org/). LyX is not only a LaTeX editor, but a WYSIWYG document processor which runs on GNU/Linux/Unix, Windows, and Mac OS X. It is released under a Free Software license.

LyX combines the power and flexibility of TeX/LaTeX with the ease of use of a graphical interface. It supports easy creation of mathematical content (via a fully integrated equation editor) and structured documents like academic articles, theses and books (it facilitates reference list and index creation). Equations can be entered via a point-and-click interface or via keyboard with La-

> **See also**
>
> For more information about WYSIWYG document processors, you can see section 3.1.

TeX commands (optionally via auto-completion). It can import and export to many formats (LaTeX, PDF, Postscript, DVI, ASCII, HTML, OpenDocument, RTF, Microsoft Word and others) and it uses source code viewer for instant LaTeX and DocBook view.

e) GNU TeXmacs (http://www.texmacs.org/). It is a free WYSIWYG scientific text editor that is inspired by both TeX and Emacs. TeXmacs runs on all major Unix platforms and Windows. Documents can be saved in TeXmacs, XML or Scheme format and printed as Postscript or PDF files. Converters exist for TeX/LaTeX and HTML/MathML.

Figure 24. GNU TeXmacs editor
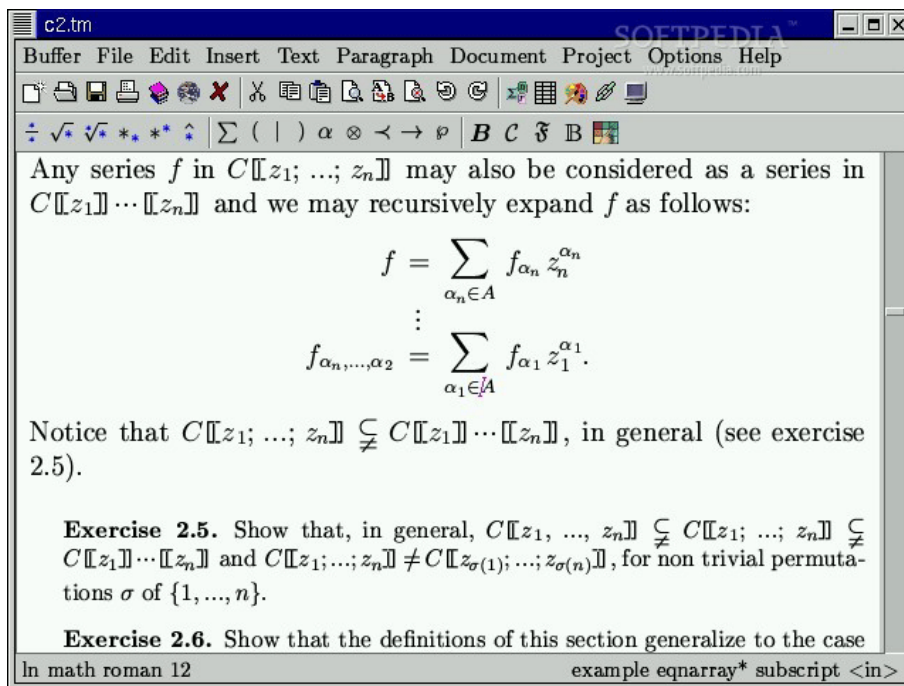
It provides a unified and user-friendly framework for editing structured documents with different types of content (text, graphics, mathematics, interactive content etc.). The software includes a text editor with support for mathematical formulae, a small technical picture editor and a tool for making presentations from a laptop. Moreover, TeXmacs can be used as an interface for many external systems for computer algebra, numerical analysis, statistics etc. New presentation styles can be written by the user and new features can be added to the editor using the Scheme extension language.

f) TeXShop (http://www.uoregon.edu/~koch/texshop/). TeXShop is a free editor and previewer for Mac OS X to display scientific and technical documents created in TeX format. It is licensed under the GNU GPL. It was developed by Richard Koch and enhanced by Mitsuhiro Shishikura, who added the ability to transfer mathematical expressions directly into Keynote presentations. TeXShop requires an existing TeX installation and is currently bundled with the **MacTeX** distribution.

Figure 25. GNU TeXShop editor
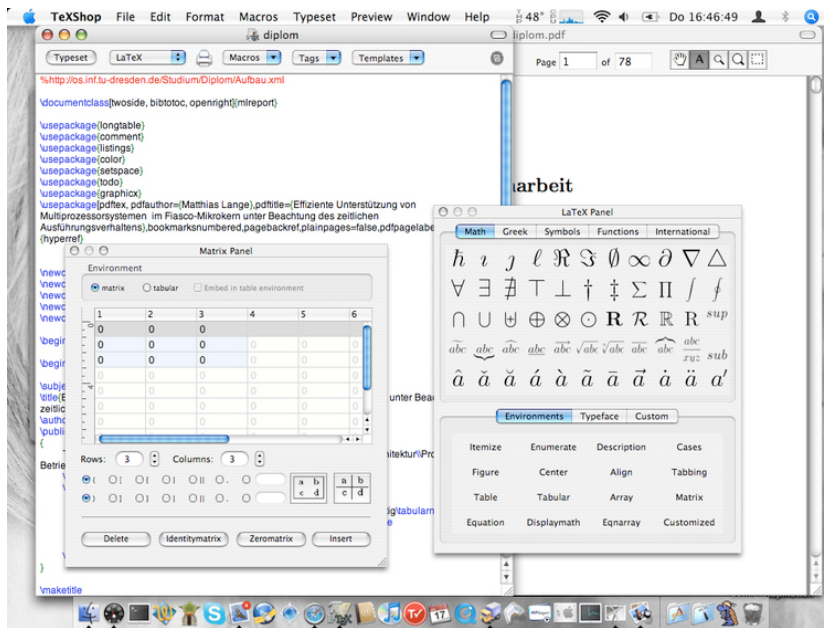
TeXShop is capable of jumping from preview to code and vice versa. Since PDF is a native file format on OS X, TeXShop uses pdfTeX and pdfLaTeX rather than TeX and LaTeX to typeset in its default configuration.

There is a support forum, which is administered by the German project ApfelWiki.de.

g) WinShell (http://www.winshell.de/). WinShell is a free multilingual integrated development environment (IDE) for LaTeX and TeX, running for Windows. The program includes a text editor, code syntax highlighting, project management (table of contents, figures, tables and bibliography), spell checking, BibTeX support, Unicode support, different toolbars and user configuration options. It is not a LaTeX system; an additional LaTeX package is required.

f) Scientific WorkPlace

Scientific WorkPlace (SWP) is a proprietary software package for scientific word processing on Microsoft Windows. It is shipped as a WYSIWYG LaTeX-based word processor, together with the LaTeX document preparation system and an optional computer algebra system.

Scientific WorkPlace allows editing and typesetting mathematical and scientific text using the WYSIWYM paradigm. All formula layout and entering of special characters can be done by either mouse or via keyboard shortcuts. As users edit, they see the document presented in a formatted and typeset form. Documents are stored in LaTeX format and can be typeset using any LaTeX processor to obtain typeset pages. Scientific Workplace comes with the True-

Comparison of TeX (LaTeX) editors (From Wikipedia)

The following page shows a table contrasting the features of the text editors that interface to TeX (or LaTeX).

http://en.wikipedia.org/wiki/Comparison_of_TeX_editors

Web recommended

For more information about Scientific WorkPlace, you can visit: http://www.mackichan.com/

Tex implementation of LaTeX and pdfTeX. This way, Scientific WorkPlace provides the high quality of LaTeX typesetting without requiring users to learn the LaTeX language.

Figure 26. SWP editor
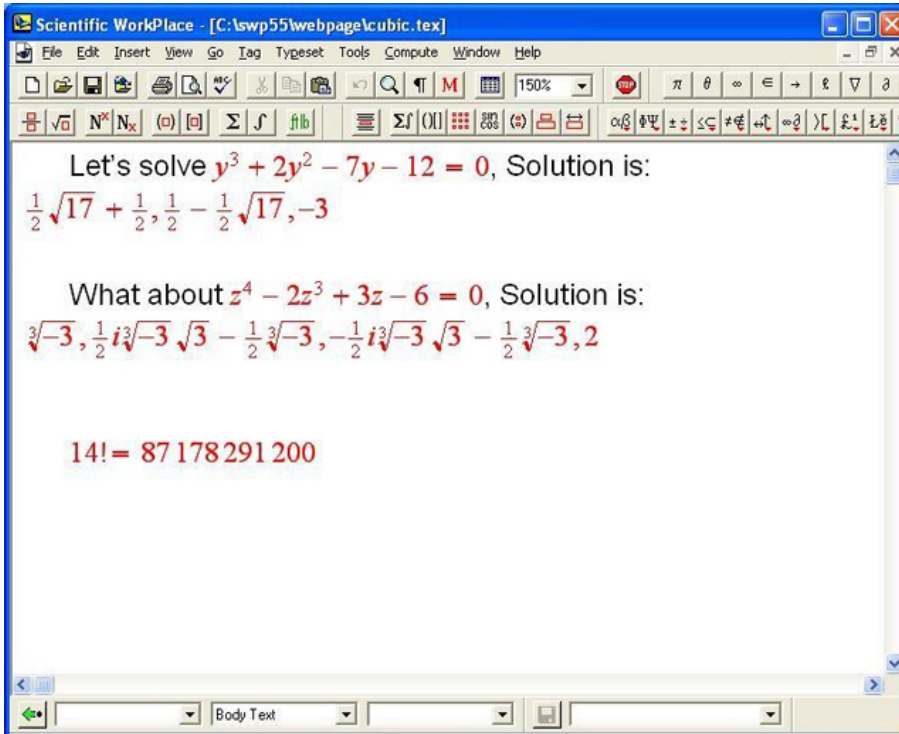
Scientific WorkPlace includes a built-in computer algebra system (Maple in earlier versions and MuPAD in later versions) with which one can perform computations and generate plots from inside the editor.

Subsets of these capabilities are available as **Scientific Word** (no computer algebra) and **Scientific Notebook** (limited LaTeX import/export, no LaTeX typesetter included).

Scientific WorkPlace combines the ease of entering and editing mathematics in mathematical notation with the ability to compute and plot with the built-in computer algebra engine. In this integrated working environment, the user can enter mathematics and perform computations without having to think or work in a programming language.

LaTeX Guides in Intenet (English)

To learn TeX or LaTeX the following books are recommended. The first, by the author of LaTeX, is short, and the other three are detailed and comprehensive.

• *LaTeX, A Document Preparation System (Second Edition)* by Leslie Lamport, Addison-Wesley, 1994.

- *More Math Into LaTeX (Fourth Edition)* by George Gratzer, Springer, 2007.

- *Guide to LaTeX, Tools and Techniques for Computer Typesetting (Fourth Edition)* by Helmut Kopka and Patrick W. Daly, Addison-Wesley, 2003.

- *The LaTeX Companion (Second Edition)* by Michel Goossens, Frank Mittelbach, Johannes Braams, David Carlisle, and Chris Rowley, Addison-Wesley, 2004.

A number of free guides to LaTeX are available. Two of the most useful are the following:

- *The Not So Short Introduction to LaTeX2e* Version, by Tobias Oetiker, 2010. http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf

- LaTeX Tutorials, from Andy Roberts. http://www.andy-roberts.net/misc/latex/index.html

- *Short LaTeX files*, by Will Robertson. http://www.andy-roberts.net/misc/latex/index.html

3.3. Tools for presentations

There are many different types of presentations including professional (work-related), education, research and for general communication. Presentation software is a tool to help both presenters with an easier access to their ideas and participants with visual information. Usually, text, graphics, movies, and other objects are positioned on individual pages or slides. The slide analogy is a reference to the slide projector, a device now obsolete due to the use of presentation software. Slides can be displayed on-screen and navigated through at the command of the presenter. Transitions between slides can be animated in a variety of ways, as can the appearance of elements on a slide itself. Typically a presentation has many constraints and the most important is the limited time to present information.

Many presentation applications come with pre designed images and have the ability to import graphic images, previously created in other programs such as Adobe Photoshop or Adobe Illustrator. Besides, with the growth of digital photography and video, many programs that handle these types of media also include presentation functions for displaying them in a similar slide show format. For example, Apple's iPhoto allows groups of digital photos to be displayed in a slide show with options such as selecting transitions, choosing whether or not the show stops at the end or continues to loop and including music to accompany the photos.

Add-ons for presentation programs can also be used to enhance their capabilities. For example, it would be useful to export a PowerPoint presentation as a Flash animation or PDF document. This would make delivery through removable media or sharing over the Internet easier. Since PDF files are designed to be shared regardless of platform and most web browsers already have a plug-in to view Flash files, these formats would allow presentations to be more widely accessible.

Certain presentation tools also offer an interactive integrated hardware elements designed to engage an audience or facilitate presentations across different geographical locations. Other integrated hardware devices ease the job of a live presenter such as laser pointers and interactive whiteboards.

3.3.1. Microsoft PowerPoint and similar programs

Microsoft PowerPoint

Microsoft PowerPoint is a presentation application by Microsoft. It is part of the Microsoft Office suite and runs on Microsoft Windows and the Apple's Mac OS X operating system.

Web recommended
For more information about Microsoft Power-Point, you can visit: http://www.microsoft.com

PowerPoint has become the most used solution for professional presentations. Since its creation and although purely digital, PowerPoint has followed the logic of its predecessor, the overhead projector. In both scenarios, the presenter follows the sequential flow of the presentation slides.

In modern environments, the audience is often likely to ask questions out of sequence and for a PowerPoint presenter; sometimes presenter has to press the Escape key, which exists the slide show mode in PowerPoint, and manually locate the slide in question followed by a restart.

ActivePrez

It is a software presentation program developed by GMARK. It is an extension to the Microsoft Office PowerPoint software and runs on the Microsoft Windows operating system. The primary objective of ActivePrez is to provide a web like, hierarchical and interactive interface within a PowerPoint slide show.

Web recommended
For more information about ActivePrez, you can visit: http://www.activepresentation.com/modules/movie/scenes/home/

Each objective should be addressed at least by one WP. Otherwise, it is no possible to carry out the objective.

Since ActivePrez content is stored as extension objects within the existing PowerPoint file formats, there are no specific file format associated and the formats supported are therefore a subset of those provided in PowerPoint.

PowerPoint Viewer

The Microsoft Office PowerPoint Viewer is a program used to run presentations on computers that do not have Microsoft PowerPoint installed. The Office PowerPoint Viewer is added by default to the same disk or network location that contains one or more presentations you packaged by using the Package for CD feature.

The PowerPoint Viewer is installed by default with Microsoft Office. The PowerPoint Viewer file is also available for download from the Microsoft Office online website.

Password-protected presentations for opening or modifying can be opened by the PowerPoint Viewer. The Package for CD feature allows you to package any password-protected file or set a new password for all packaged presentations. The PowerPoint Viewer prompts you for a password if the file is password-protected.

Keynote

Keynote is a presentation software application developed as a part of the iWork productivity suite by Apple Inc. It adds the ability to control the slideshow with an iPhone or iPod touch through the Keynote Remote application. It exports to PDF, QuickTime, Flash, JPEG, TIFF, PNG, HTML (with JPEG images) and PowerPoint. Keynote also uses .key (presentation files) and .kth (theme files) bundles based on XML. Besides, it supports QuickTime video formats in slideshows.

Web recommended

For more information about Keynote, you can visit: http://www.apple.com/iwork/keynote

OpenOffice.org Impress

OpenOffice.org Impress is a part of the OpenOffice.org office suite developed by Sun Microsystems. It is distributed under a free software licence and, hence, is freely available for download.

Web recommended

For more information about OpenOffice.org Impress, you can visit: http://www.openoffice.org/product/impress.html

It is a presentation software application similar to Microsoft PowerPoint. It is able to view, edit and save files in several file formats, including the Microsoft Power Point format. It is also able to create PDF files from presentations and to export presentations to ShockWave Flash files allowing them to be played on any computer with a Flash player installed.

OpenOffice.org Impress users can install the Open Clip Art Library, which adds a large gallery of images for general presentation and drawing projects.

3.3.2. LaTeX programs

Beamer

Beamer is a LaTeX class for creating slides for presentations. It supports both pdfLaTeX and LaTeX dvips. It runs in Unix-like and Windows platforms under LaTeX Project Public License and GNU General Public License. It is available in English, German, Croatian and Serbian. The name Beamer is taken from the German word Beamer, a pseudo-Anglicism for video projector.

The beamer class has special syntax for defining slides (known in Beamer as frames). Slides can be built up on-screen in stages. The output is handled in a PDF file by creating successive pages that preserve the layout but add new elements, so that advancing to the next page in the PDF file appears to add something to the displayed page, when in fact it has redrawn the page.

Beamer provides the ability to make handouts, that is a version of the output suitable for printing, without the dynamic features, so that the printed version of a slide shows the final version that will appear during the presentation.

Source code for beamer presentations, like any other LaTeX file, can be created using any text editor, but there is specific support for beamer syntax in **AUC-TEX** and **LyX** (AUCTEX is an extensible package for writing and formatting TeX files in Emacs and XEmacs, distributed under the GNU General Public License).

3.3.3. Zoom user interface programs

Recently, a new presentation paradigm has emerged: zooming presentation programs. Instead of serial slides, ZUIs (zoom user interface) are based on one infinite space on which all content is presented. This format allows for non-linear presentations, richer detail of content, and more complex visual messages and relations.

Prezi

Prezi is a web-based presentation application that uses a single canvas instead of traditional slides. Text, images, videos and other presentation objects are placed on this infinite space and grouped together in frames. It allows users to create non-linear presentations where they can zoom in and out of a visual map. A path through different objects and frames can be defined, representing the order of the information to be presented. The presentation can be developed in a browser window and then downloaded so that an Internet connection is not needed when showing the presentation.

Web recommended

For more information about Prezi, you can visit: http://prezi.com/

Prezi has different license models. Customers who use the free Prezi Public license must publish their work on the Prezi site. Customers who pay for a Prezi Enjoy or Prezi Pro licence can create and share private Prezis. Prezi also offers a special education licence for students and educators.

3.3.4. Online Presentation

Online presentation allows accessing, importing, editing and sharing presentations from anywhere and anytime. Presentation files can be shared, viewed with just a browser and embedded into a blog or website.

In the following, some of the tools providing online presentations are presented.

280 Slides

280 Slides is a freeware web application for creating online slide presentations. The layout is similar to PowerPoint, and offers a variety of the same easy to use features. 280 Slides has a built-in media search that allows for easy insertion of video, audio, and images from popular places like YouTube and Flicker. Presentations can be downloaded and saved in the PowerPoint format, shared via email, or embed in websites.

> **Web recommended**
>
> For more information about 280 Slides, you can visit: http://280slides.com/

AuthorSTREAM

AuthorSTREAM is a web based Microsoft PowerPoint presentation platform.

After creating a multimedia presentation in PowerPoint, users can upload presentations to authorSTREAM, which get converted to Flash format, shows up on a unique URL and is available in a Flash player. Users can get a unique code of the Flash presentation to embed it into blogs and websites. Every presentation provides users with the option to share the presentation through e-mail. AuthorSTREAM also allows its users to share their presentations on Apple iPod or iPhone or on equivalent devices, and to upload it on YouTube. AuthorSTREAM supports sounds, GIF animations, and narrations within a PowerPoint presentation. Flash is a prerequisite for accessing presentations from authorSTREAM.

> **Web recommended**
>
> For more information about AuthorSTREAM, you can visit: http://www.authorstream.com/

Empressr

Empressr is a web-based application similar to Microsoft PowerPoint. It is free-ware application and allows its users to create and upload slideshows online, incorporating media (e.g. video, images and audio) into their presentations. Empressr uses Flash to stream videos to make slideshows more dynamic.

> **Web recommended**
>
> For more information about Empressr, you can visit: http://www.empressr.com/

iWork.com

iWork.com is an online service by Apple Inc. complementing their iWork suite of office productivity software. The iWork.com service provides a web interface for viewing, downloading, and commenting uploaded documents. In contrast to cloud-based office applications such as Google Docs, it does not offer editing.

> **Web recommended**
>
> For more information about iWork.com, you can visit: https://www.iwork.com/signin/

PreZentit

PreZentit is a freeware presentation application to work on presentations on-line. All work is saved on the Internet and users can access their presentations from anywhere, at anytime. Besides, an unlimited number of collaborators can work on the presentation and leave comments.

> **Web recommended**
>
> For more information about PreZentit, you can visit: http://prezentit.com/

Slideboom

SlideBoom can be used to create and share online presentations. Users can create a PowerPoint presentation using the Microsoft application and then upload it.

> **Web recommended**
>
> For more information about Slideboom, you can visit: http://www.slideboom.com/

SlideServe

SlideServe allows uploading and sharing PowerPoint presentations publicly or privately. It can be used in conjunction with many other applications including Microsoft PowerPoint, Twitter and MySpace.

> **Web recommended**
>
> For more information about SlideServe, you can visit: https://wiki.itap.purdue.edu/display/INSITE/SlideServe

Slideshare

Slideshare is a popular online presentation tool. It allows uploading and shar-ing PowerPoint and Keynote presentations, Microsoft Word and PDF docu-ments, and professional videos. It also allows adding audio to make a seminar.

> **Web recommended**
>
> For more information about Slideshare, you can visit: http://www.slideshare.net/

Activities

1. Practice with different search engines presented in section 1.1:

- Search for 3 relevant articles about the subject "collaboration tools to support research". Specify databases in which you have found them, and with which search engine. Write a brief summary of the results.
- Search for articles of a lead author in the field of knowledge of your expertise. Have you obtained different results with different search engines?

2. Choose a reference and bibliography management tool for use in your research activity. Explain the reasons for your choice. Use it to produce a brief bibliography on "tools to support research" or on another subject's choice.

3. Choose a tool for the management of research projects. Explain the reasons for your choice. Use it to produce a brief general project on your bachelor or thesis project or another subject's choice.

4. Imagine you need to do a quantitative study. Write a design (with the different stages of data collection, analysis and results). Choose a tool for the quantitative analysis. Explain your choice. Explain the main uses in the analysis and production of results.

5. Write a brief article about LaTeX by using LaTeX.

6. Choose a presentation tool. Explain the reasons for your choice. Use it to produce a brief presentation on your bachelor or thesis project or another subject's choice.