

White Paper Report

Report ID: 100485

Application Number: HG-50022-10

Project Director: Peter Scharf (peter.scharf@univ-paris-diderot.fr)

Institution: Maharishi University of Management Research Institute

Reporting Period: 7/1/2010-6/30/2014

Report Due: 9/30/2014

Date Submitted: 9/29/2014

White Paper
HG-50022-10
Sanskrit Lexical Sources
Digital Synthesis and Revision

Dr. Peter M. Scharf
Maharishi University of Management Research Institute

29 September 2014

Contents

1	Narrative	1
1	Introduction	1
1.1	Personnel	1
1.1.1	Blaise Pascal research chair and IIT Bombay visiting professorship	1
2	Project activities	2
2.1	Data-entry	2
2.2	Lexical source integration	4
2.2.1	Data-cleansing, markup, and interface development	4
2.2.2	Catalogue	5
3	Accomplishments	6
4	Audiences	8
5	Evaluation	9
6	Continuation of the project	9
7	Long term impact	9
8	Grant products	10
	Appendices	11
A	Presentations	12
B	Publications	15
C	Screen shots	16

List of Tables

1.1	Sanskrit-English Dictionaries	7
1.2	English-Sanskrit Dictionaries	7
1.3	Sanskrit-French Dictionaries	8
1.4	Sanskrit-German Dictionaries	8
1.5	Sanskrit-Latin Dictionaries	8
1.6	Sanskrit-Sanskrit Dictionaries	8
1.7	Specialized Dictionaries	8

List of Figures

C.1	The Sanskrit Library integrated dictionary interface	16
C.2	Cologne Digital Sanskrit Lexicon project home page	17

Narrative

1 Introduction

The stated aim of the project was to synthesize, extend, revise, and improve the principal lexical reference works of Sanskrit, the primary culture-bearing language of India, and one of the world's richest, and to provide access to them at the University of Cologne and in the Sanskrit Library. The project integrated existing digitized major Sanskrit lexical reference works and extended them by digitizing and integrating subsequently published additions and corrections, specialized dictionaries, indigenous Indian monolingual dictionaries, and traditional linguistic analyses. Furthermore, the project improved the utility and accessibility of the lexical resources by linking them with digitized Sanskrit texts.

1.1 Personnel

The collaborative German/U.S. project was managed by Dr. Peter Scharf, a Sanskrit scholar at Maharishi University of Management Research Institute (MUMRI) and Thomas Malten, the director of the Cologne Digital Sanskrit Lexicon project (CDSL) at the University of Cologne. The U.S. team included Ralph Bunker, a software engineer at MUMRI and Jim Funderburk, a retired mathematician and amateur Sanskritist who had worked with Scharf previously. He volunteered considerable time to the project including the development and management of the CDSL website.

1.1.1 Blaise Pascal research chair and IIT Bombay visiting professorship

During the period 1 February 2012 – 31 July 2013, Scharf spent a year as laureate of a prestigious Chaire Internationale de Recherche Blaise Pascal funded by the State of France and the Ile de France region. The award involved a year of research housed in the History of Linguistics laboratory at the Université Paris Diderot and provided a handsome research account. He was invited as a visiting professor to the Indian Institute of Technology Bombay (IIT Bombay) for a semester December 2012 – April 2013. While the award and invitation drew Scharf away from

MUMRI, they permitted him to engage unforeseen resources in the project. He negotiated an agreement with the Indian Institute of Technology Bombay to hire two Sanskrit post-doctoral research associates for the year and one computer science post-doctoral research associate for a few months to assist in the Sanskrit lexical sources project. The computer scientist, Pawan Goyal, was also engaged for three months at the French national computer science research center (INRIA) during October–November 2012 and May 2013 directly in France. A second post-doctoral associate in Sanskrit was hired in Europe for a month.

2 Project activities

2.1 Data-entry

The project activities were divided between the German and U.S. partners as follows: the German partner digitized the lexical sources; the U.S. team converted character data-entry to XML and produced HTML displays. Digitization of the lexical sources began with the production of digital images of the dictionaries. The images were sent to Auroracana Exports for double-keyed data-entry and double-blind error correction. Character markup was supplied for visually distinct textual properties such as boldface headwords, and italicized citations. Remaining doubts, where the scanned images or the printed text itself were unclear, and where headwords between dictionaries do not correspond, were examined and resolved by the U.S. team and its Sanskrit assistants at IIT Bombay. Funderburk, Goyal, and Scharf wrote computer programs that made rich use of regular expressions to identify headwords and their definitions, and to determine their corresponding positions in the digital images of the sources. From this information, Funderburk and Goyal constructed simple XML structures for each lexical source, with one record per headword. This XML form was read into a simple SQLite database table. Web displays were constructed as PHP programs to query the SQLite database by headword and to link entry displays to the scanned images.

Dr. Thomas Malten, our collaborator at the University of Cologne, was in charge of data-entry for the project. As stated in the proposal section IIB describing the scope of the project (p. 10), the German partner would complete the data-entry for the bilingual dictionaries for which only digital images are available listed in section IIA1 (p. 7) and provided with full bibliographic details and extents in Appendix B (pp. 59–60). The German partner would also produce digital images and machine-readable data files of the lexical sources listed in Appendix C (pp. 61–70).

Data-entry proceeded in two stages: (1) double-keying the text, (2) a repeated cycle of comparing the two versions, marking differences and returning the marked

version, with no indication of what the other version produced, to each data-entry clerk for correction. This double-blind error correction process adopted for the second stage is a revision over the previous error-correction process which allowed the data-entry clerk to see both versions of the text, her own and the one produced by the other clerk. The previous process resulted in each clerk repeatedly favoring her own error. The new process forced each clerk to reexamine the source independently to attempt to correct her error. Although the new process took longer, it produced cleaner, more certain results.

Data entry for the six volumes of Ghatage et al. included in the project was completed early in 2011. In the meantime two additional volumes of the work not originally included in the project were published. Data-entry of these works was completed by the end of October 2011. The Sanskrit Library contracted an agreement with the University of Hyderabad to share digital resources and thereby obtained a copy of the *Amarakoṣa*. Likewise, the Sanskrit Library contracted an agreement with Osmania University's Sanskrit Academy to obtain a copy of the *Vācaspatya*. While obtention of the latter lexical source allowed the project to integrate the dictionary, the copy was found to include systematic errors, so the project directors decided to proceed with data-entry anew, and an independent digital edition was produced.

Due to the extra time required to include the additional new volumes of the major lexicon Ghatage et al., the project was unable to digitize eight of the specialized sources listed in Appendix C, section IA2 (pp. 62–64). These consist of the following works:

1. Acharya, Prasanna Kumar. 1946. *An encyclopaedia of Hindu architecture*. Revised, enlarged edition. Manasara series 7. London; New York: Oxford University Press. [Br] Has later, 2nd edition. Rock NA1502 .A25x 1981. [H] Loeb Design NA1502 .A25 1979. [Br] Description: xx, 861 p.; 25 cm. est. 1.72MB
2. Cowen, D. V. 1950. *Flowering trees and shrubs in India*. Bombay: Thacker & Co. [Br] ROCK QK490.I4 C6 1950. [Br] Description xvi, 137 p. illus. (part col.) 29 cm. est. 274K
3. Cowen, D. V. 1970. *Flowering trees and shrubs in India*. Bombay: Thacker & Co. Botany Arnold (Cambr.) F1 55 C83.5 1970. Description: xviii, 159 p., [28] leaves of plates: ill. (some col.); 29 cm. 318K
4. Dharmadhikari, T. N. 1989. *Yajñāyudhāni: An Album of Sacrificial Utensils with Descriptive Notes*. 1 vol. Pune: Vaidika Saṁśodhana Maṇḍala. [Br] Annex BL1236.76.S23 V34 1989. [H] Harvard Depository FA6625.604.1 [Br] Description: 88 p.: ill.; 23 x 29 cm. 57 chars/line x 24 lines/page x 56 pp. = 77K

5. Lin, Zhongyi. 1971. *A Glossary of Buddhist terms in four languages (English, Chinese, Pali & Sanskrit): Compiled by Lim Teong Aik = Fo xue ming ci si zhong yu yan hui ji (Ying Zhong Pali Fan wen)*. Taipei Shi: Hui ju chu ban she. [OCLC] In 6 locations USA: Yale Univ Libr, East Asian Libr at Princeton Univ, Univ of Illinois, Univ of the West, Oakland Pub Libr. Description: 120, xvi, [6] p.: ill. (1 color), maps, port.; 19 cm. 250K
6. Raghavan, V. 1952. *Yantras or Mechanical Contrivances in Ancient India*. Indian Institute of Culture, Trans. No. 10. Bangalore: Indian Institute of Culture. [Br] ROCK TJ103 .R293 1952. [H] Widener LSoc 2443.5 no.10. [Br] Description: 31 p.; 25 cm. 62K
7. Renou, Louis. 1942. *Terminologie grammaticale du sanskrit*. Bibliothèque de l'École des hautes études, IVe Section des Sciences historiques et philologiques. 280-282 fasc. Paris: É. Champion. [Br] ROCK PK654 .R4 v.1 [H] Widener 3244.110 Vol I: 50 chars/line x 37 lines/page x 196 pp. = 363K; Vol II: 50 chars/line x 37 lines/page x 166 pp. = 307K; Vol III: 50 chars/line x 37 lines/page x 188 pp. = 348K
8. Tewari, S. P. 1987. *Contributions of Sanskrit inscriptions to lexicography*. Delhi: Agam Kala Prakashan. [H] Harvard Depository PK923 .T49 1987. [H] Description: xii, 247 p.; 23 cm. 60 chars/line x 40 lines/page x 256 pp. = 614 K

We hope to digitize these in a future project.

2.2 Lexical source integration

2.2.1 Data-cleansing, markup, and interface development

Bunker, the principal computer scientist engaged in the project located at MUMRI, created a local version of the Sanskrit Library website and developed an interactive HTML interface that allowed assistants, wherever they were located and whatever was the quality of their internet connection, to access dictionary images and write files from the HTML interface on their private computers. We created local workstations that provided all the facilities of the Sanskrit Library web server. Utilizing the environment created by Bunker, Goyal developed HTML pages to validate headword coordination between newly digitized dictionaries with the headwords in MW.

During 2012-2014, the Sanskrit post-doctoral associates at IIT Bombay utilized local workstations to integrate the supplement to Monier Williams' *A Sanskrit-English Dictionary* (MW) with the main body of the text, and create an index of the headwords in the *Vācaspatya* to digital images of the work. During the past

year, one corrected some two thousand errors in headwords in Ghatage et al. and mapped them to headwords in MW. A post-doctoral assistant at IIT Bombay examined 785 unclear printed characters and corrected them in the digital edition. Funderburk created similar displays for the correction of doubts in other dictionaries using which a post-doctoral assistant similarly corrected 500 unclear printed characters in Apte's *English-Sanskrit dictionary*, 700 in Apte's *Sanskrit-English dictionary*, and 200 in Rādhākāntadeva's *Śabdakalpadruma*. The other Sanskrit assistant mapped headwords in Bhaṭṭācārya's *Vācaspatya* to headwords in Monier-Williams's *Sanskrit-English dictionary*.

Funderburk and Scharf developed the list display under the current project in 2012. Funderburk and Bunker also developed displays for mobile devices.

In addition to developing HTML interfaces for the Sanskrit assistants to carry out the above tasks, Goyal completed a mapping of Huet's Sanskrit-French dictionary with the MW headwords and created initial HTML displays of several dictionaries. These include the following:

1. Huet, Gérard. 1994-2013. *The Sanskrit Heritage Dictionary*.
2. Monier-Williams, M. 1899. *A Sanskrit-English dictionary*.
3. Scharf, Peter M. 2002. *Rāmopākhyāna: the story of Rāma in the Mahābhārata*.
4. *Bhūtasāṅkhyā: A dictionary of terms designating numerical values*. 2003.
5. Subodh Kulam. 2013. *Sanskrit-Nepali-English dictionary*.
6. Rādhākāntadeva Bāhādura. 1821-1851. *Śabdakalpadruma*.
7. Ghatage, A. M. et al. 1976-. *An encyclopaedic dictionary of Sanskrit on historical principles*.
8. Bhaṭṭācārya, Tārānātha Tarkavācaspati. 1873. *Vācaspatya*.
9. Bhattacharya, Pushpak and Irawati Kulkarni. 2013. *Sanskrit Wordnet*.

Scharf and Goyal designed the integrated dictionary interface webpage and revised the list display, and Goyal incorporated the new displays with the old in this interface. Part of the revision of the list display included refining the designation of homophonous headwords in MW to capture homophones that resulted from the addition of feminine suffixes to adjectives and to nouns that occur in all three genders. Bunker incorporated the new developments into the Sanskrit Library's development server at <http://sanskrit1d.ccv.brown.edu> under Reference, Integrated Sanskrit dictionary, and its new server at <http://sanskritlibrary.com>.

2.2.2 Catalogue

A principle of the current project is to allow access to original sources rather than to merge diverse sources in a reedited synthesis. In line with this principle, proper

identification of lexical sources is necessary. Scharf developed a TEI-conformant XML template for cataloguing the digital lexical sources developed in the project and created catalogue entries for the dictionaries currently available on the Sanskrit Library website. Funderburk provides access to digitizations of the title pages and front matter under documentation at the Cologne site.

3 Accomplishments

The project now incorporates digitizations of the following classes of lexical resources:

- 11 bilingual Sanskrit-English dictionaries
- 3 English-Sanskrit dictionaries
- 2 Sanskrit-French dictionaries
- 5 Sanskrit-German dictionaries
- 1 Sanskrit-Latin dictionary
- 2 Sanskrit-Sanskrit dictionaries
- 10 specialized dictionaries.

These resources are listed in tables 1.1–1.7.

Each of these resources has four displays on the University of Cologne website: basic, list, advanced, and mobile friendly, each with a choice of input and display options. Input can be entered in one of three Romanizations: Sanskrit Library phonetic, Kyoto-Harvard, and ITrans. One can choose to display output in Devanagari or Roman Unicode as well as in one of these three. The basic display presents the headword and its definition alone. The list display presents a list of headwords at the left which shows the headword in context. For dictionaries such as MW which present headwords in a hierarchy under their derivational root, one can choose between a hierarchical list and an alphabetical list. The advanced display permits searching for words that begin with, end with, or contain a string as well as match it exactly. The advanced display also permits one to search the body of the text and thus serves as a reverse dictionary, permitting one to find all the Sanskrit headwords that contain an English word, for example. Finally the Cologne site offers a display amenable to mobile devices. The Cologne site also makes a collection of materials available for download. These materials include the original data-entry files, their transcoding to UTF8, a corrected text file, scanned images of the work, an XML conversion of the corrected data-entry with its document type definition (DTD), software to create the XML file from the corrected text, and materials to construct an offline version.

Lexical resources are also incorporated into the integrated display on the Sanskrit Library website. Here one can enter the headword once and look it up in any lexical resource just by clicking the resource in the list. Pressing the carriage return looks it up in the dictionary selected to serve as the default. One can also select from a broader range of input options, including several Romanizations as well as Roman and Devanagari Unicode, and display options including seven major Indic scripts. Lexical resources are presented in the list display. The list of headwords can be browsed in either direction. Clicking another headword in the list fills that word in the entry field and looks it up in the last used dictionary. At the Sanskrit Library, the integrated dictionary is linked to a morphological analyzer linked to more than a hundred Sanskrit texts. When one clicks a word in texts that have analyzed interword phonetic changes, the analyzer presents possible stems and corresponding grammatical identifications of the form. Clicking the stem, opens the integrated dictionary page, fills the stem in the integrated dictionary entry field and looks it up in the default dictionary.

Table 1.1: Sanskrit-English Dictionaries

ID	date	Dictionary
WIL	1832	Wilson Sanskrit-English Dictionary
YAT	1846	Yates Sanskrit-English Dictionary
GST	1856	Goldstücker Sanskrit-English Dictionary
BEN	1866	Benfey Sanskrit-English Dictionary
MW72	1872	Monier-Williams Sanskrit-English Dictionary
AP90	1890	Apte Practical Sanskrit-English Dictionary
CAE	1891	Cappeller Sanskrit-English Dictionary
MD	1893	Macdonell Sanskrit-English Dictionary
MW	1899	Monier-Williams Sanskrit-English Dictionary
SHS	1900	Shabda-Sagara Sanskrit-English Dictionary
BHS	1953	Edgerton Buddhist Hybrid Sanskrit Dictionary

Table 1.2: English-Sanskrit Dictionaries

MWE	1851	Monier-Williams English-Sanskrit Dictionary
BOR	1877	Borooah English-Sanskrit Dictionary
AE	1884	Apte Student's English-Sanskrit Dictionary

Table 1.3: Sanskrit-French Dictionaries

BUR	1866	Burnouf Dictionnaire Sanscrit-Français
STC	1932	Stchoupak Dictionnaire Sanscrit-Français

Table 1.4: Sanskrit-German Dictionaries

PWG	1855	Böhtlingk and Roth Grosses Petersburger Wörterbuch
GRA	1873	Grassman Wörterbuch zum Rig Veda
PW	1879	Böhtlingk Sanskrit-Wörterbuch in kürzerer Fassung
CCS	1887	Cappeller Sanskrit Wörterbuch
SCH	1928	Schmidt Nachträge zum Sanskrit-Wörterbuch

Table 1.5: Sanskrit-Latin Dictionaries

BOP	1847	Bopp Glossarium Sanscritum
-----	------	----------------------------

Table 1.6: Sanskrit-Sanskrit Dictionaries

SKD	1822	Sabda-kalpadruma
VCP	1873	Vacaspatyam

Table 1.7: Specialized Dictionaries

INM	1904	Index to the Names in the Mahabharata
VEI	1912	The Vedic Index of Names and Subjects
PUI	1951	The Purana Index
ACC	1962	Aufrecht's Catalogus Catalogorum
KRM	1965	Kṛdantarūpamālā
IEG	1966	Indian Epigraphical Glossary
SNP	1974	Sanskrit Names of Plants
PE	1975	Puranic Encyclopedia
PGN	1978	Personal and Geographical Names in the Gupta Inscriptions
MCI	1993	Mahabharata Cultural Index

4 Audiences

Sanskrit texts constitute an enormous body of knowledge in diverse domains that is grossly underrepresented in the Western academic community. Access to this body of knowledge, which is currently accessible only to highly-trained specialists, will

be profoundly valuable to students, scholars, and the wider public concerned with such fields as historical and general linguistics, philosophy and religious studies, history of science and mathematics, pharmacology and medicine, and general history and literature of South Asia.

5 Evaluation

Each of the webpages that displays the digital dictionaries contains a link to a form that permits users to submit corrections. Corrections are vetted by Funderburk, Scharf, and other volunteers and incorporated into data-revisions. Comments by users regarding presentation are accepted by Funderburk and Scharf and incorporated into design revisions. Such comments on early versions of the sites already led to the development of the various displays, and input and display options.

6 Continuation of the project

The Sanskrit Library plans to continue the project to complete the digitization of the specialized dictionaries that were not able to be included in the present project listed above in §2.1 and to include traditional thesauri. These plans were included in a proposal to digitize Sanskrit lexical and grammatical sources just submitted to the NEH and DFG.

The same software at the Sanskrit Library website that allows access to lexical resources from texts simultaneously provides the tools and environment for incremental production of a comprehensive digital Sanskrit lexicon linked to textual instances. While morphological and prosodic variants of headwords in existing lexical sources are identified in texts, linguistic software can flag word forms missing from existing lexical resources, suggest parses, and compile lists of suggested lexical bases linked to their contexts. These lists will allow researchers subsequently to locate terms to be defined in their contexts easily. In the future, qualified scholars will be invited to compose and submit lexical entries via a wiki to the Sanskrit Library board of editors for publication in the gradually expanding lexicon.

7 Long term impact

We expect that the website will provide the most current and most comprehensive lexical information about Sanskrit in the world to enrich knowledge and understanding of the many fields to which Sanskrit scholarship has contributed over several millennia.

8 Grant products

The principal products of the project are the lexical resources listed in tables 1.1–1.7 in §3 on the websites of the CDSL at the University of Cologne shown in Figure C.2 (<http://www.sanskrit-lexicon.uni-koeln.de>) and of the Sanskrit Library shown in Figure C.1 (sanskritlibrary.org). The project is described on the Sanskrit Library website in a page linked to the project title, ‘Sanskrit lexical sources: digital synthesis and revision,’ under ‘Projects’. The Cologne CDSL home page provides documentation under the link so named. In addition Scharf delivered the project-related invited lectures and conference presentations listed in Appendix A and produced the project-related publications listed in Appendix B.

Appendices

Presentations

1. "Preserving knowledge through media transitions: ushering the heritage of India into the digital age." Year of India series, Brown University, 11 November 2009.
2. "Preserving knowledge through media transitions: ushering the heritage of India into the digital age." National Workshop on Sanskrit and Computers: getting equipped to face new challenges, University of Hyderabad, 19-24 December 2009.
3. "Sanskrit linguistic processing: character-encoding, morphology, lexicography." Workshop on Sanskrit and Computers: getting equipped to face new challenges, University of Hyderabad, 19-24 December 2009.
4. "The canonical form of roots in Pāṇinian Dhātupāṭha." Department of Sanskrit Studies, University of Hyderabad, 22 January 2010.
5. "Developing computational resources to conduct linguistic research on Sanskrit and provide digital access to Sanskrit texts and manuscripts." Joint seminar with Amba Kulkarni, Śrī Śaṅkarācārya University of Sanskrit, Kalady, Kerala, 27 January 2010.
6. "Preserving knowledge through media transitions: ushering the heritage of India into the digital age." University of Madras, 1 February 2010.
7. "Preserving knowledge through media transitions: ushering the heritage of India into the digital age." Institute Français, Pondichery, 2 February 2010.
8. "Preserving knowledge through media transitions: ushering the heritage of India into the digital age." Rashtriya Sanskrit Sansthan, New Delhi, 13 February 2010.
9. "Sanskrit linguistic processing: character-encoding, morphology, lexicography." Department of Linguistics, IIT Bombay, Friday, 19 February 2010.
10. "Sanskrit linguistic processing: character-encoding, morphology, and lexicography." Malcolm Hyman Memorial Workshop, on the theme, "The Challenges of Electronic Tools for Working with Textual Sources." Max Planck Institute für Wissenschaftsgeschichte, Berlin, 31 May - 2 June 2010.
11. "Encoding Sanskrit for linguistic processing, data-entry, and display." Paper presented at the Nineteenth International Congress of Vedanta, 28-31 July

- 2010, University of Massachusetts, Dartmouth, Mass.
12. “Plenary talk 5.” Fourth International Sanskrit Computational Linguistics Symposium, Jawaharlal Nehru University, New Delhi, 10-12 December 2010.
 13. “Digital Sanskrit library integration.” École Française d’Extrême Orient, Pondichéry, 3 January 2011.
 14. “Sanskrit computational linguistics.” Center for Advanced Study in Sanskrit (CASS), Pune University, Pune, 15 January 2011.
 15. “Sanskrit lexical sources: digital synthesis and revision.” Department of Sanskrit and Lexicography, Deccan College Research Institute, Pune, 17 January 2011.
 16. “Sanskrit linguistic processing: character-encoding, morphology, and lexicography.” Workshop on Sanskrit Computational Tools to Understand Sanskrit Texts, 22-27 December 2011, Chinmaya International Foundation Shodha Sansthan, Adi Sankara Nilayam, Veliyanad, Kerala.
 17. “E-text markup: an introduction to XML and the Text Encoding Initiative.” Workshop on Sanskrit Computational Tools to Understand Sanskrit Texts, 22-27 December 2011, Chinmaya International Foundation Shodha Sansthan, Adi Sankara Nilayam, Veliyanad, Kerala.
 18. “Sanskrit lexical sources: digital synthesis and revision.” Wörterbuchkolloquium, 1–2 March 2012, Akademie der Wissenschaften und der Literatur, Mainz, 1 March 2012
 19. “The Sanskrit Library: integrating lexical resources, linguistic tools, text, and images in a distributed web-based library,” International Blaise Pascal Research Chair, lecture 1. Université Paris Diderot, 5 April 2012
 20. “Linguistic issues in encoding Sanskrit: clarifying the axes of information encoding: graphic—phonetic, sequential—featural, and contrastive—non-contrastive.” International Blaise Pascal Research Chair, lecture 3. Université Paris Diderot, 7 June 2012
 21. “Indic lexical resources: the historical evolution of root lists (*dhātupāṭha*) and their relation to rules in Indian grammars.” International Blaise Pascal Research Chair, lecture 5. Université Paris Diderot, 13 Sept. 2012
 22. “Building a morphologically and syntactically tagged Sanskrit database.” Workshop TITUS 25, Historical Corpora 2012, 6–9 December 2012, Goethe University, Frankfurt, 8 December 2012
 23. “Sanskrit lexical sources: digital synthesis and revision.” National Seminar on the Recent Trends in Vedic Studies and Lexicography, 7-9 March 2013, Deccan College Post-graduate and Research Institute, Pune, 8 March 2013
 24. “Linguistic issues and intelligent technological solutions in coding Sanskrit.” Gestion informatisée des écritures anciennes: état des lieux et perspectives,

- 21–22 mai 2013, Centre d'Études Supérieures de la Renaissance (CESR),
Université François-Rabelais, Tours, 21 May 2013
25. “Non-arbitrary lexical tagging.” International Blaise Pascal Research Chair,
lecture 8. Université Paris Diderot, 30 May 2013
26. “Présentation du site The Sanskrit library.” Septième rencontre du réseau
DocAsie, 26–28 juin, Bibliothèque nationale de France et Bibliothèque uni-
versitaire des langues et civilisations (Bulac), Paris, 28 June 2013

Publications

1. and Malcolm Hyman. *Linguistic issues in encoding Sanskrit*. Providence: The Sanskrit Library; Delhi: Motilal Banarsidass, 2011.
2. and Pawan Goyal, Gérard Huet, Amba Kulkarni, and Ralph Bunker. “A distributed platform for Sanskrit processing.” In *Proceedings of the 24th International Conference on Computational Linguistics, IIT Bombay, Mumbai, 8–15 December 2012*. International Committee on Computational Linguistics, 2012. <http://aclweb.org/anthology-new>
3. “Linguistic issues and intelligent technological solutions in encoding Sanskrit.” *Document numérique* 16.3 (2014): 15–29. (Paper presented at Gestions informatisée des écritures anciennes: État des lieux & perspectives, 21–22 May 2013, Centre d’Études Supérieures de la Renaissance (CESR), Université François-Rabelais, Tours.)

Screen shots

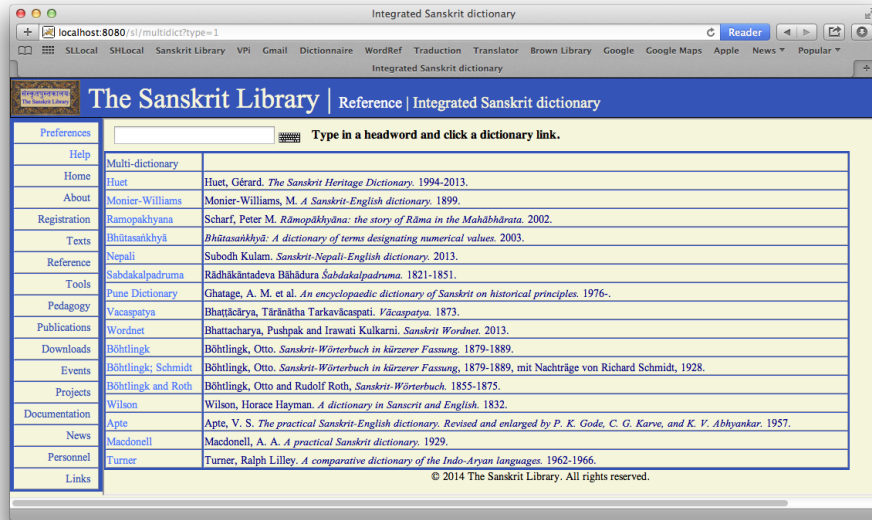



Figure C.1: The Sanskrit Library integrated dictionary interface

www.sanskrit-lexicon.uni-koeln.de

IITS Koeln

SLocal SHLocal Sanskrit Library VPI Gmail Dictionnaire WordRef Traduction Translator Brown Library Google Google Maps Apple News

IITS Koeln



Cologne Digital Sanskrit Dictionaries

UNIVERSITÄT ZU KÖLN

This web page provides access to many of the Sanskrit lexicons prepared by the Institute of Indology and Tamil Studies, Cologne University. The dictionaries are organized primarily by the secondary language (English, German, etc.), and then by date of publication. Each dictionary has several types of display, as well as a comprehensive selection of materials for download.

[Documentation](#) (Previous Cologne Sanskrit-Lexicon [Home Page](#))

Sanskrit-English Dictionaries

ID	date	Dictionary	Displays and Downloads
WIL	1832	Wilson Sanskrit-English Dictionary	B L A M D S Deprecated
YAT	1846	Yates Sanskrit-English Dictionary	B L A M D
GST	1856	Goldstücker Sanskrit-English Dictionary	B L A M D
BEN	1866	Benfey Sanskrit-English Dictionary	B L A M D
MW72	1872	Monier-Williams Sanskrit-English Dictionary	B L A M D
AP90	1890	Apte Practical Sanskrit-English Dictionary	B L A M D
CAE	1891	Cappeller Sanskrit-English Dictionary	B L A M D S
MD	1893	Macdonell Sanskrit-English Dictionary	B L A M D S
MW	1899	Monier-Williams Sanskrit-English Dictionary	B L A M D S1 S2 Markup Deprecated
SHS	1900	Shabda-Sagara Sanskrit-English Dictionary	B L A M D
BHS	1953	Edgerton Buddhist Hybrid Sanskrit Dictionary	B L A M D

English-Sanskrit Dictionaries

MWE	1851	Monier-Williams English-Sanskrit Dictionary	B L A M D
BOR	1877	Borooah English-Sanskrit Dictionary	B L A M D
AE	1884	Apte Student's English-Sanskrit Dictionary	B L A M D S1 S2 Deprecated

Sanskrit-French Dictionaries

BUR	1866	Burnouf Dictionnaire Sanscrit-Français	B L A M D
STC	1932	Stchoupak Dictionnaire Sanscrit-Français	B L A M D S SD

Sanskrit-German Dictionaries

PWG	1855	Böhtlingk and Roth Grosses Petersburger Wörterbuch	B L A M D S Deprecated
GRA	1873	Grassman Wörterbuch zum Rig Veda	B L A M D
PW	1879	Böhtlingk Sanskrit-Wörterbuch in kürzerer Fassung	B L A M D S Deprecated
CCS	1887	Cappeller Sanskrit Wörterbuch	B L A M D S
SCH	1928	Schmidt Nachträge zum Sanskrit-Wörterbuch	B L A M D S

Sanskrit-Latin Dictionaries

BOP	1847	Bopp Glossarium Sanscritum	B L A M D
-----	------	--	-----------

Sanskrit-Sanskrit Dictionaries

Figure C.2: Cologne Digital Sanskrit Lexicon project home page