

New uses for old books: Description of digitised corpora-based on the Setswana language collection in the WITS Cullen Africana Collection

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Abstract

This paper described a Corpus of 104 books. The books were catalogued into a standard library and archival metadata: Dublin core. A subset was digitised and cleaned. The books were then divided into five subsets and compared against each other and the entire Corpus. We speculated that the Corpus as a whole could be used as a general language register. Some examples are also given of the characteristics of the genre subsets. The paper aims to introduce the Corpus to natural language processing (NLP) researchers and offer it for further research.

1 Introduction

“The inability to communicate with human beings in their own language may be one of the most significant barriers to adopting information and communication technology in the third world and bridging the digital divide” (Getao & Evans, 2000: 128).

At the same time, NLP is one of the most complex computational problems that have faced computer scientists. The calls for actions to develop resources for these languages, preferably in a coordinated and systematic manner, has been responded to in this paper. NLP researchers in English have had the advantage of many Corpora for research and testing. In this paper, we present the collection of the African language: Setswana sub-collection, for African Language NLP

researchers in the [2nd Workshop on Resources for African Indigenous Languages](#).

1.1 Background

This project has a long history, from preserving books that would have been thrown out as outdated to creating a Corpus. We see it as unlocking the resources that many generations of archivists, librarians, researchers, authors, and translators have preserved in the belief that the books had value. Although, the individuals involved could not have imagined the computational uses in 1980. The William Cullen library: Africana Collection holds a subcollection of rare African language books dating from the 1800s in a locked area without researcher access. These books were originally the private collections of lecturers in the department. They were added to and carefully chosen by the African languages department as an internal library which was then given the Africana Library¹. These books provide a history of the development of various languages and varied orthography.

2 Collection Preparations

The first step was to catalogue the collection. There was an existing catalogue, but it was on physical cards and, we discovered, incomplete. We removed the books from the shelves and did a basic catalogue. We focused on creating a complete catalogue of books in Southern African languages. There is still an extensive collection in a variety of other African languages awaiting further research. The complete collection in Southern African languages is described elsewhere. We then compiled a metadata in Dublin core (and included some archival elements) of the Setswana books containing language varieties from Botswana and South Africa. The original catalogue designated these books as common readers. This paper describes the sub-collection of 104 Setswana books. These include Bibles, New and Old testaments, hymn books, prayer books, children's stories, grammar books, school books and novels.

¹ Margaret Atsango private correspondence 29-30/09/2021



3 Digitisation Methodology

The Avison book edge scanner in the Wits University Library Digitisation Centre converted all the materials into tiffs at high resolution. We used the international standards techniques and workflows adapted by the centre for the scanning of local content. After that, all the collected tiffs were cropped into Microsoft office 2010 documents. All scanned and cropped tiffs were then transferred into Abby FineReader 12 software. This software managed to split combined tiffs, skewed tiffs were deskewed, blank pages were removed, the pre-processing was applied, and lastly, they were saved in PDF format. The next step was to use the language recognition embedded in Abby FineReader 12 software to all the unrecognised PDFs by applying optical character recognition (OCR). This tool allowed the computer to recognise Setswana texts, moving from physical documents to text interpreted as data. This proves that the ground-breaking work of Otlogetswe in Setswana over many years (Otlogetswe, 2020, 2016, 2015, 2013, 2011a, 2011b, 2010, 2009a, 2009b, 2008; Otlogetswe and Chebanne, 2018; Otlogetswe and Ramaeba, 2014) which powered these recognition features is substantially effective. The recognition was challenging because the text was, like all older print, difficult, containing nonstandard fonts. Following the OCR process, we edited texts from the scanned documents as the OCR was approximately 80% effective in Setswana, with some unrecognised words. Such words were turned into different signs or symbols. Certain letters were misrecognised as other letters. We then cleaned the data by eliminating those signs and letters, replacing them with the correct Setswana letters manually. Pictures, text lines, and artefacts from the scanning process also had to be eliminated. The final product was then put into standard word documents.

4 Description of Corpora

The Corpus was created in Voyant (Sinclair & Rockwell, 2016). Basic descriptive tables as well as a Cirrus word cloud (see the appendices) were created. We created trends, collocations and correlation tables of the entire Corpus. To explore the linguistic varieties of the Corpus, we create five subsets: Bibles, Fairy tales, Grammar, Novels, and Poetry based on

Genre.

The entire Corpus has 367149 total words and 23686 tokens. The appendices show a (10-line) sample of each.

Table 1: Example of Corpus Frequencies

Title	Words	Types	Ratio	Words/ Sentence
Bibles	57965	5164	0.089	17.984
Fairy tales	18980	2685	0.141	16.561
Grammar	9218	1774	0.192	10.030
Novels	34207	5799	0.169	19.435
Poetry	11550	3289	0.284	24.732

The average words per sentence in these subsets showcase Poetry as the highest (24.7) followed by Novels (19.4), Bibles (18.0), and Fairy tales (16.6), with Grammar (10.0) as the lowest. There is a case to made that the Corpus average of 19.3 could potentially be used as a language average, but this would require further research.

We also looked at the major terms

Table 2: Example of major terms

<u>Term</u>	<u>RawFrequency</u>	<u>RelativeFrequency</u>
batho	1305	3554.4153
kgosi	1169	3183.9934
modimo	967	2633.808
motho	764	2080.899
dira	690	1879.346
ja	618	1683.2402
bana	602	1639.6613
monna	579	1577.0165
utlwa	567	1544.3322
letsatsi	558	1519.8188
mosadi	502	1367.2922
bua	499	1359.1212
feta	475	1293.7527
tsaya	450	1225.6604
tloga	446	1214.7657
tsamaya	435	1184.805
ngwana	414	1127.6075
dikgomo	394	1073.1338
morafe	367	999.59424
motse	361	983.2521
lefatshe	354	964.1862



banna	315	857.9623
metsi	308	838.8965
tau	299	814.38324
baiseraela	276	751.7384
mokgwa	276	751.7384
lencwe	267	727.2252
mosimane	251	683.6461
nako	239	650.96185
ntlo	238	648.23816

4.1 Some features of the Corpus

The Corpus is able to support multiple types of research. The following were some initial features of interest that we found on an initial examination. The Corpus is still being annotated.

Orthography

This subset gives us information on how speech sounds form patterns. We were able to track changes because of the date range that our corpora spans. All our Bibles were written in an older orthography of the Serolong & Setlhaping dialect on a phonological level. Our data also shows that most of our Bibles from the 1800s were written in the Serolong & Setlhaping dialect, known as the early orthographies of Setswana. Thus, early orthographies were based in Serolong & Setlhaping as the missionaries first created sttlements among the Barolong & Batlhaping in Kudumane in 1821. In the older orthography, the letter [y] was used with the same pronunciation as the letter [j] used in the current orthography. For example, the words Yosefe (Joseph), Yehofa (Jehova) and Yoshue (Joshua) are currently written as Josefa Jehofa and Jošua.

In the Serolong & Setlhaping dialect, people pronounce the phonemes / f / as [h] and / tsh / as [tšh]. For example, they pronounce the words 'world' and 'resemblance' as lehatshe and tšhobotsi, instead of lefatshe and tshobotsi.

Fairy Tales

Fairy tales are often intended for children, features fanciful and wondrous characters such as elves, goblins, wizards, and fairies. The term "fairy" tale refers more to the fantastic and magical setting or magical influences within a story rather than the presence of the character of

a fairy within that story. The language register is simple because the writer speaks to children warning them in a casual and relaxed tone about a cannibal that

eats children, for example. The vocabulary of the story is also easy for children to understand.

Characters in fairy tales may be fairy folk or even talking animals, believable characters that children will care about such as a good-hearted hero, a scheming villain dimo (cannibal), in our example above), a wise helper, as so forth.

The word dimo (cannibal), is one of the highest frequencies (88) in the genre. Cannibals are often used in Setswana children's stories to scare them and warn them about the scheming villain that eats children. Many animals appear often in the genre. Setswana children's stories frequently consist of speaking animals that live with people. In most cases, an animal like nonyane (bird) is there to protect children from danger by keeping them under their wings while flying. Other examples of talking animals are phuduhudu (deer), phokojwe (jackal), and phiri (wolf). There are also human protagonists or participants in children's stories like Ntswakae, Ntitiagatsana, and Tsetsenyane.

The word ja (eat) appears 43 times in the genre as children are often eaten in these stories.

It is clear that the register of the Corpus is mostly formal. In particular, the register used in the grammatical genre. It is academic in the sense that the grammatical textbook shows the writing style of the Setswana language.

We were keen to work on this Corpus especially because many other language collections depend on written speech such as newspapers, radio, or tweets that are relatively informal in register.

It would be interesting to compare this to (Marivate et al., 2020) newspaper Corpus.

5 Conclusion

This collection sat, from approximately the mid-1970s, on dusty shelves in a closed room. It was not used because the library did not have the language skills to catalogue it, and it was a fragile collection. This collection was nevertheless chosen by linguists because of its high value across a range of African languages. The language resources often available to NLP researchers are newspapers and social media forms that contain informal speech. This collection has well-described genres of formal writing. It is often asserted that there are



insufficient African language texts available for research. However, as this work shows, the resources do exist but require work to convert into digital format.

The tables attached are samples to encourage an NLP researcher to explore the Corpus. We believe that our data (comparisons, collocations, and trends) can serve as a resource to pick tones. There is further work to be done because many of the books of the Corpus are translations. This means that the collection can also, with some work, provide line by line translations for test datasets.

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Stéfan Sinclair

We would like to recognise the memory of Stéfan Sinclair, McGill University, who imagined, designed, and programmed much of Voyant Tools until 2020, when he passed away. See [obituary](#).

Peter Duncan

Special Collections Librarian

William Cullen Library (retired)

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Peter curated and advocated for the collection to be catalogued and used throughout his career. The collection came to the library from the private collections of lecturers and departmental collections of the African Languages at WITS.

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Appendices – These are sample tables meant to introduce the types of data created from the Corpus.

Appendix 1 - Trends

Doc Index	Term	Raw Frequency	Relative Frequency	Z-Score	Z-Score Ratio	TF-IDF	Distributions		
0	ba	3647	62917.277	33.157654	-1017.6505	0.0	0.003450358	0.005520573	0.0055723283
4	ba	16906	45898.81	55.502193	-1703.4329	0.0	0.0065837344	0.005714953	0.00538373
2	ba	1471	43002.89	25.90773	-795.1412	0.0	0.00324495	0.0023679363	0.0019294296
0	le	2391	41249.03	21.703148	-666.09717	0.0	0.0059346156	0.0043819547	0.0039506597
1	go	378	41006.727	14.760752	-453.0262	0.0	0.004664786	0.0030375354	0.0042308527
2	go	1393	40722.66	24.528439	-752.80896	0.0	0.0038880932	0.004063496	0.003215716
4	le	14310	38850.816	46.971714	-1441.6216	0.0	0.0044199256	0.003885082	0.0037954887
5	ba	730	38461.54	13.78445	-423.06226	0.0	0.004056902	0.0072181243	0.0052687037
4	go	14079	38223.668	46.212646	-1418.3248	0.0	0.0031248983	0.0028588339	0.003700466
1	ba	344	37318.29	13.414559	-411.70987	0.0	0.004664786	0.0027120851	0.0018442179

Appendix 1 is a sample of Bible trends. There are ten distribution points. Three are presented here.

Appendix 2 – Collocated (example from Novels)

Term	Frequency	Context	Contextual Frequency
ba	1471	ba	1790
go	1393	go	736
le	1262	le	557
le	1262	go	502
go	1393	ba	497
ba	1471	go	486
ba	1471	le	480
go	1393	le	465
le	1262	ba	457
ke	802	ke	373



