



# Introducing XAIRA...

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An XML-aware tool for corpus indexing and searching

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# What is XAIRA?

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- XML Aware Indexing and Retrieval Architecture
  - Developed from the British National Corpus SARA program
  - Components include an Index Toolkit and a Windows Client
  - Open Source: available from <http://xaira.sf.org>
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# Historical Background (c.1994)

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- Original design goals
    - robust searching of very large (c. 1 Gb) amount of SGML data
    - re-use available indexing tools
    - usable by researchers in CL, NLP, lexicography
  - Original assumptions
    - client/server architecture
    - index build once only
    - one specific corpus (the BNC) only
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# Historical Background (c.2004)

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- Design goals
    - robust searching of any amount of XML data
    - offload processing to other components wherever possible
    - assume nothing about input DTD/Schema
  - Architecture
    - client/server still valid
    - expect to re-index often
    - expect multiple interfaces
-

# Why another search engine?

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- Can't you do all this with Google?
    - Digital texts are not just for discovery and display
    - The methods of corpus linguistics have a wider relevance
  - Can't you do all this with eXist?
    - Probably, but only if you have a team of programmers at your disposal!
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# Xaira: the key features

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- ❑ Indexes the PCDATA
  - ❑ Supports word search, concordance generation and manipulation, collocation, lexical analysis
  - ❑ Uses XML annotation to the max
  - ❑ Supports XML-aware complex queries
  - ❑ Leverages existing standards
    - TEI/XCES; Unicode; CSS and XML; SOAP
  - ❑ Uses efficient and compact indexing appropriate to small or huge corpora
-

# First catch your corpus...

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- any collection of well-formed XML documents
    - if a DTD is supplied, the corpus must be valid
    - if no TEI header is present, one will be created
  - the more you put in, the more you get out
  - "texts" are defined independently of file structure, as are the relevant units within them
  - all indexing information is stored in the corpus header
-

# Loading a corpus into Xaira

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- i. Put the corpus into XML
  - convert it to Unicode
  - index tools can help
    - Adding minimal tagging
    - Converting existing tagging
- ii. Use the Index Tools wizard

The more markup you put in, the more Xaira can do with it.

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# Hoorah for Unicode

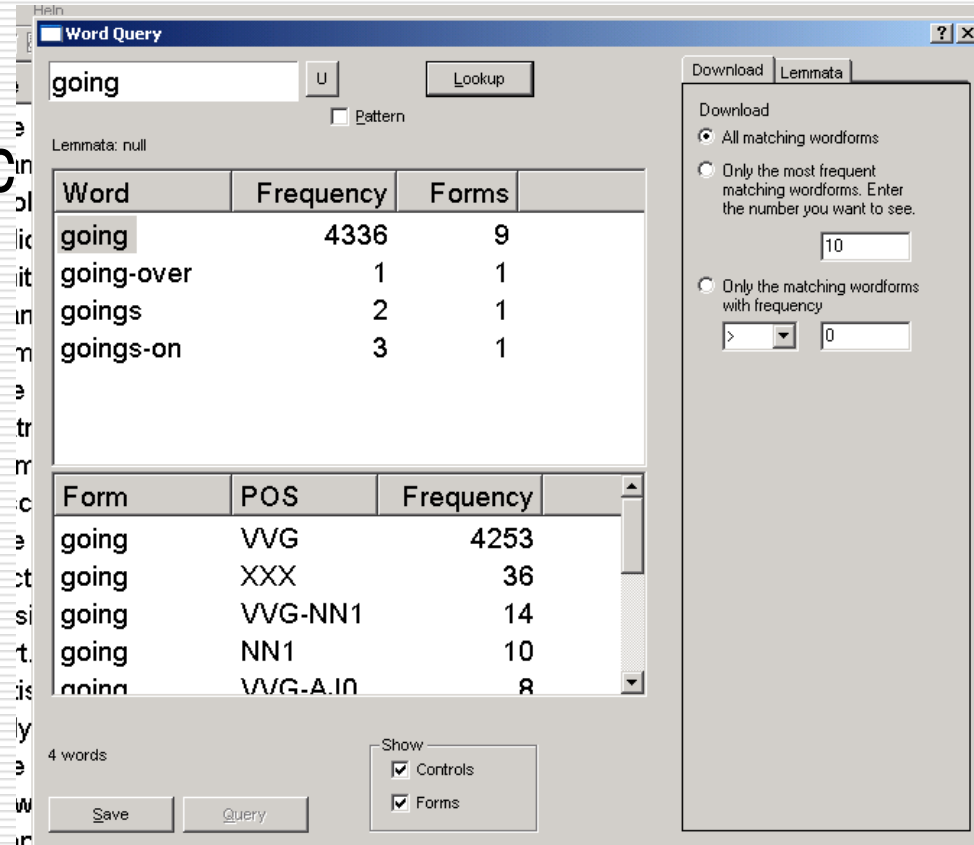
---

- All data is held internally as Unicode
    - this allows us to defer most problems (e.g. tokenization, case-folding, line-breaking, character normalization, glyph composition) to someone else!
  - User interface issues
    - For output, use one or more appropriate fonts
    - For input, we provide a keyboard definition utility
-

# A word query



- ❑ Enter a stem or pattern
- ❑ See forms and frequency
- ❑ See selected variants
- ❑ Look up hits
- ❑ Save wordlists



The screenshot shows the 'Word Query' window with the search term 'going' entered. The 'Pattern' checkbox is unchecked. The 'Lemmata' field is null. The 'Download' tab is selected, showing options for downloading matching wordforms. The 'All matching wordforms' option is selected, and the number of wordforms to display is set to 10. The 'Only the most frequent matching wordforms' option is also visible, with a frequency threshold of 0. The 'Only the matching wordforms with frequency' option is also visible, with a frequency threshold of 0. The 'Show' checkbox is checked, and the 'Controls' and 'Forms' checkboxes are also checked. The 'Save' and 'Query' buttons are visible at the bottom.

Word	Frequency	Forms
going	4336	9
going-over	1	1
goings	2	1
goings-on	3	1

Form	POS	Frequency
going	VVG	4253
going	XXX	36
going	VVG-NN1	14
going	NN1	10
going	VVG-A.IN	8

4 words

Show  
☒ Controls  
☒ Forms

British English. Contains about 27078 words from

# A collocation list

- ❑ After any query...
- ❑ See word forms that collocate with it
- ❑ Adjust window, filter by frequency, select score
- ❑ Look up collocates
- ❑ Save wordlists

The screenshot shows the 'Collocations' software window. The 'Focus' tab is active, displaying a query for '<phrase>going</phrase>' with 126 hits. The 'Calculate' button is visible. Below the query, a table lists collocates with their frequency (Fr...) and MI score. The table has three columns: 'Word', 'Fr...', and 'MI'. The data is as follows:

Word	Fr...	MI
coming	5	22.4
prevent	6	22.2
stars	2	21.4
scotland	2	20.9
saw	2	20.8
abroad	2	20.7
keep	3	20.7
wife	1	20.7
daily	1	20.6
charity	1	20.6

At the bottom of the window, there are buttons for 'Save' and 'Query', and a 'Show' section with checkboxes for 'Controls' (checked) and 'Forms' (unchecked). On the right side, there are tabs for 'Download', 'Lemmata', 'Window', 'Score', and 'Colligation'. The 'Download' tab is active, showing options to download matching wordforms, with a filter for 'Only the highest scoring matching wordforms' and a threshold of 10.0.

# A Keyword in Context

**XAIRA - [Query1]**  
File Edit Query View Window Help

all

υππον λέγων, Ἀνάστηθι καὶ πορεύου κατὰ μ...

ὁ δὲ κύριος πρὸς αὐτόν, Ἀναστὰς  
ναζάμενος τὰ ἱμάτια εἶπεν πρὸς αὐτούς, Τὸ  
καθεζόμενος δέ τις νεανίας ὀνόματι  
ὅς τι ὡς ὀθόνην μεγάλην τέσσαρσιν ἀρχαῖς  
πτὰ πλήρεις πνεύματος καὶ σοφίας, οὓς κατὰ  
καὶ δώσω τέρατα ἐν τῷ οὐρανῷ ἄνω  
ὁμοθυμαδὸν οἱ Ἰουδαῖοι τῷ Παύλῳ καὶ ἤγαγον  
ὁ δὲ κύριος προσετίθει τοὺς σωζομένους καὶ  
πάντες δὲ οἱ πιστεύσαντες  
ὄσθαι τὴν ἡμέραν τῆς πεντηκοστῆς ἦσαν πρὸς  
ὅς ἐν μέσῳ τῶν ἀδελφῶν εἶπεν [ἦν τε ὄχλος  
οὐκ ὀνομαζόμενων ἐκείνων καὶ τῇ πόλει ἐγγιζόντων ἀντιόχειας  
Ἡμεῖς δὲ πρὸς αὐτούς, Ἄνδρες Ἰσραηλῖται, προσέχετε  
ἐπιλαβόμενοι τὴν λέξιν τοῦ κυρίου  
καὶ τοὺς πρώτους τῆς πόλεως καὶ ἐπήγειραν  
αὐτοὺς διερρωτήσαντες τὴν οἰκίαν τοῦ Σίμωνος  
τοικοῦντες Λύδδα καὶ τὸν Σαρῶνα, οἵτινες ἐ...

For Help, press F1

Start | EL... | xair... | Mar... | htt... | newt | goi...

**Collocations**

Focus  
Query: Query1  
Hits: 858

☐ Downloads only

<lemma>ἐπὶ</lemma>

Calculate

☐ Pattern

Window L4 R4  
No colligation  
Lemmata: null

Score MI  
DL top 10

Word	Fr...	MI
γῆσ	71	25.7
τῆσ	136	23.4
δύο	11	23.1
τοὺσ	63	23.1
ἀνθρώπου	11	23.1
ἐγένετο	16	23.0
τῆν	116	22.9
πάντων	10	22.9
θεῶι	11	22.8
ἔσται	8	22.8

10 collocates

Save Query

Show  
☒ Controls  
☐ Forms

Download Lemmata Window Score Colligation

Download

☐ All matching wordforms

☒ Only the highest scoring matching wordforms. Enter the number you want to see.

10

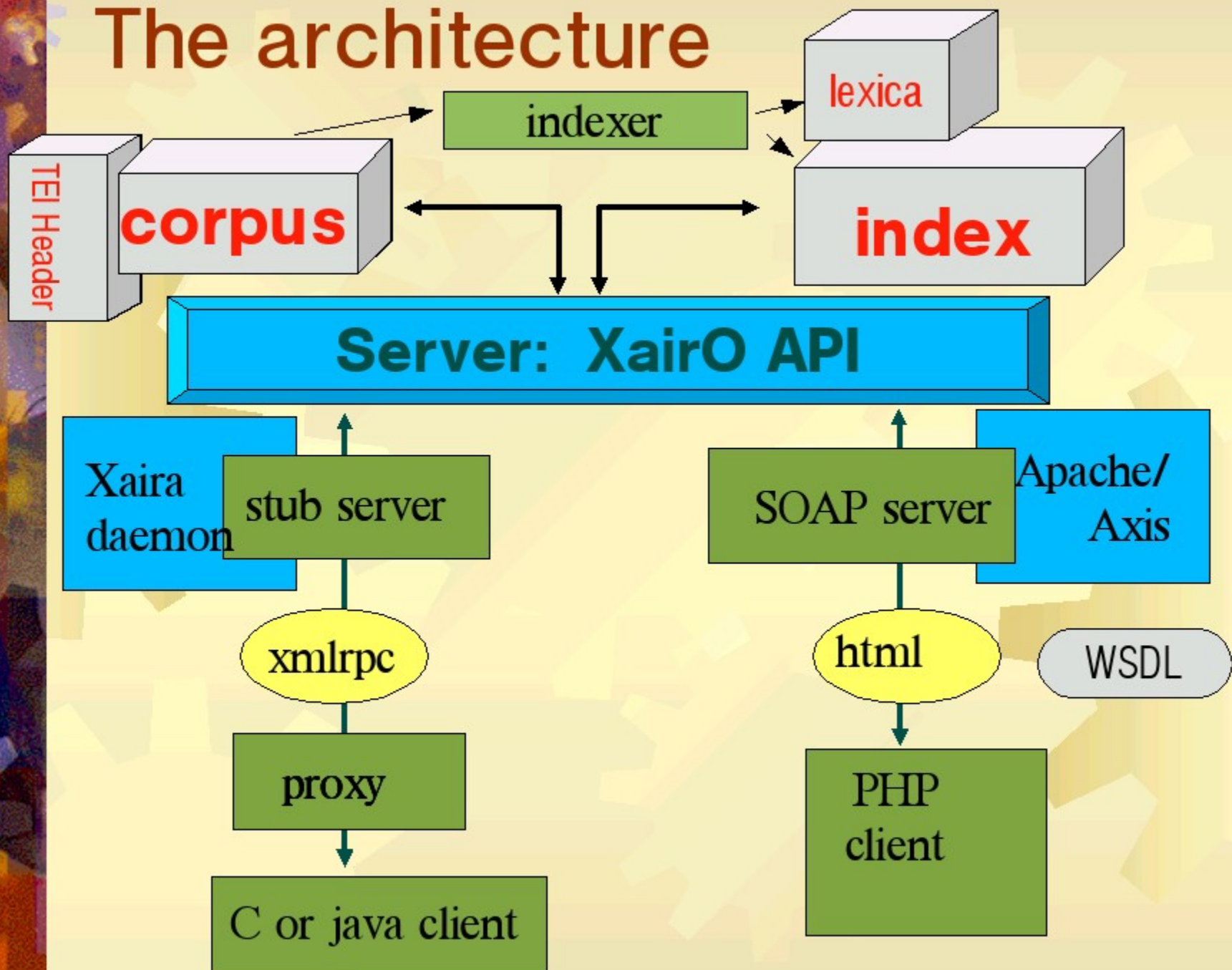
☐ Only the matching wordforms with score

> 10.0

Only include collocates which appear at least this number of times:

100

# The architecture



# XXQ: the Xaira XML Query Language

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- Simple XML vocabulary for searching
    - word, punctuation mark, substring
    - word + secondary keys (e.g. POS)
    - XML start- or end-tag, plus attributes
    - Unicode-compliant regular expressions
  - Facilities include
    - usual Boolean operations
    - sequence, disjunction, join
    - scoped searching, gaps
  - Special lexical features
-

# XXQ more formally

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- XXQ is a pattern matching language
  - Returns manipulable streams of matching *locations* in a corpus
  - XXQ query components
    - simple: <form>, <addKey>, <lemma>, <element>, <pattern>
    - complex: <seq>, <and>, <or>
  - matching may be literal or regexp
-

# XXQ examples

---

```
<form>fish</form>
```

returns locations of the form *fish*

```
<lemma scheme="x">fish</lemma>
```

returns locations of forms which have  
the lemma *fish* in scheme *x*

```
<addKey name="POS">VB</addKey>
```

returns locations of forms which have an  
additional key of type *POS* with the value *VB*

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# Element vs pattern queries -1

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- element query

- Finds XML elements

- Independent of their location

- Restriction by attribute value

- pattern query

- Restricts locations in terms of their XML context (by using Xpath)

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# Element vs pattern queries -2

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```
<element name="book">  
  <attribute name="n">acts</attribute>  
</element>
```

```
<pattern match="book[@n=Acts]">  
  <form>Paul</form>  
</pattern>
```

---

# combinations -1

---

- <seq>: ordered sequence (possibly containing <gap>s)

```
<seq>  
  <form>fish</form>  
  <gap max="2"/>  
  <form>chips</form>  
</seq>
```

---

# combinations -2

---

- <and>: union operator

```
<and>  
  <form>fish</form>  
  <addkey name="pos">VERB</addkey>  
</and>
```

- <or>: disjunction operator

```
<or>  
  <seq><gap/><form>fish</form></seq>  
  <seq><gap/><form>chips</form></seq>  
</or>
```

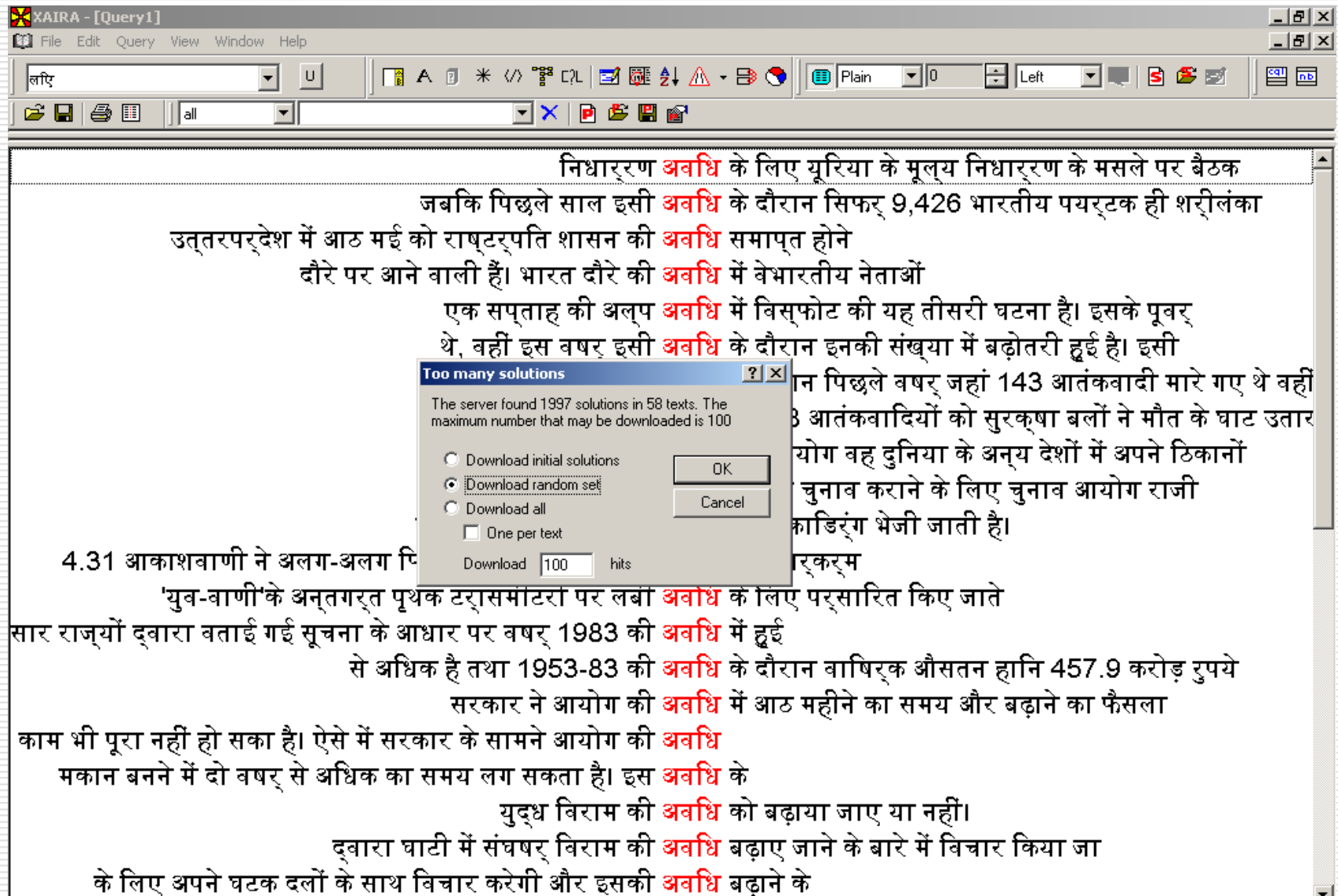
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# This is all hidden behind the GUI, of course

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- Word and lemma query
  - User-configurable display
    - plain, XML, user-defined stylesheets
  - Texts, Results, Browse windows
  - Results can be exported in XML
  - “visual interface” for complex queries
-

# Exploring a text



The screenshot shows the XAIRA - [Query1] application window. The main text area displays a snippet of text in Hindi, which is partially obscured by a dialog box. The dialog box, titled "Too many solutions", informs the user that the server found 1997 solutions in 58 texts, exceeding the maximum download limit of 100. It offers three options: "Download initial solutions", "Download random set" (which is selected), and "Download all". There is also a checkbox for "One per text" and a "Download" field set to "100 hits".

निधारण अवधि के लिए यूरिया के मूल्य निधारण के मसले पर बैठक जबकि पिछले साल इसी अवधि के दौरान सिर्फ 9,426 भारतीय पयर्टक ही श्रीलंका उत्तरप्रदेश में आठ मई को राष्ट्रपति शासन की अवधि समाप्त होने दौरे पर आने वाली है। भारत दौरे की अवधि में वेभारतीय नेताओं एक सप्ताह की अल्प अवधि में विस्फोट की यह तीसरी घटना है। इसके पूर्व थे, वहीं इस वर्ष इसी अवधि के दौरान इनकी संख्या में बढ़ोतरी हुई है। इसी पिछले वर्ष जहां 143 आतंकवादी मारे गए थे वहीं 3 आतंकवादियों को सुरक्षा बलों ने मौत के घाट उतार योग वह दुनिया के अन्य देशों में अपने ठिकानों चुनाव कराने के लिए चुनाव आयोग राजी काडिरंग भेजी जाती है।

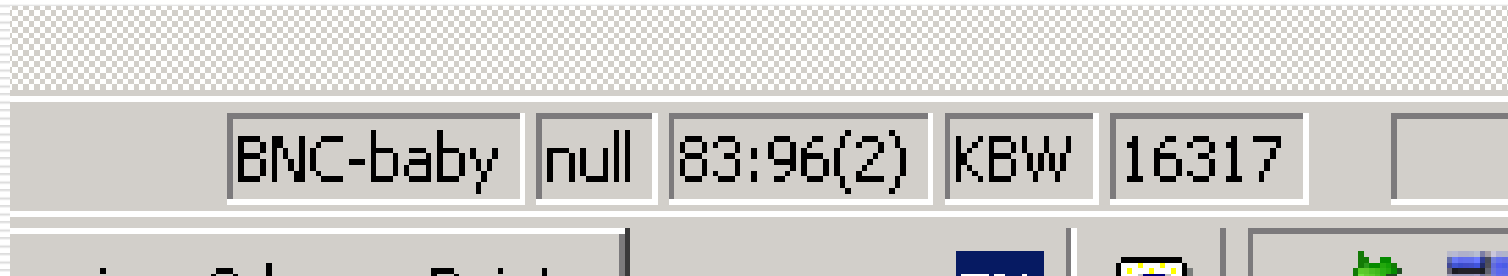
4.31 आकाशवाणी ने अलग-अलग पि र्कर्म

'युव-वाणी'के अन्तर्गत पृथक ट्रांसमिटर्स पर लंबा अवधि के लिए प्रसारित किए जाते सार राज्यों द्वारा बताई गई सूचना के आधार पर वर्ष 1983 की अवधि में हुई से अधिक है तथा 1953-83 की अवधि के दौरान वाषिर्क औसतन हानि 457.9 करोड़ रुपये सरकार ने आयोग की अवधि में आठ महीने का समय और बढ़ाने का फैसला काम भी पूरा नहीं हो सका है। ऐसे में सरकार के सामने आयोग की अवधि मकान बनने में दो वर्ष से अधिक का समय लग सकता है। इस अवधि के युद्ध विराम की अवधि को बढ़ाया जाए या नहीं। द्वारा घाटी में संघर्ष विराम की अवधि बढ़ाए जाने के बारे में विचार किया जा के लिए अपने घटक दलों के साथ विचार करेगी और इसकी अवधि बढ़ाने के

# Referencing system

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- ❑ Corpus
- ❑ Subcorpus
- ❑ Hit number : total hits (texts)
- ❑ Text identifier
- ❑ Context identifier



A screenshot of a software interface showing a table of corpus data. The table has five columns with the following values: 'BNC-baby', 'null', '83:96(2)', 'KBW', and '16317'. The interface includes a checkered pattern at the top, a table with a grey header, and a bottom bar with various icons and a search field.

BNC-baby	null	83:96(2)	KBW	16317
----------	------	----------	-----	-------

# Additional keys (e.g. POS codes)

- “find a POS code, whatever word it’s attached to”

Additional key query

Word:

☒ Any

Key value: 

- AJ0
- AJ0-AV0
- AJ0-NN1
- AJ0-WVD
- AJ0-WVG
- AJ0-WVN
- AJC
- ΔIS

Key:

- “find a POS code only when it’s attached to ‘going’”

Additional key query

Word:

☐ Any

Key value: 

- AJ0
- AJ0-WVG
- NN1
- NN1-AJ0
- NN1-WVG
- WVG
- WVG-AJ0
- WVG-NN1

Key:



# Multi-part lemmatization

- DOG (verb)
  - Dog VVB
  - Dogged VVN
  - Dogs VVZ
  - Dogging VVI
- DOG (substantive)
  - Dog NN1
  - Dogs NN2
  - Dog NP1

Word Query

dog U Lookup

☐ Pattern

Lemmata: lancaster

lemma	lemmapos	Frequency	Forms
dog	SUBST	500	3
dog	VERB	11	4
dog-collar	SUBST	2	2
dog-eared	ADJ	1	1
dog-eat-dog	SUBST	1	1
dog-fouling	SUBST	1	1
dog-legged	ADJ	1	1
dog-like	ADJ	1	1
dog-meat	SUBST	1	1
dog-owner	SUBST	1	1
dog-straying	ADJ	1	1

Form	POS	Frequency
dog	VVB-NN1	1
dogged	VVN	8
dogged	VVN-AJ0	1
dogs	VVZ-NN2	1

29 words

Show  
☐ Controls  
☒ Forms

Save Query

# Building complex queries

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- visual interface
  - *scope node* defines where to look
    - an XML element
    - by span
  - *query nodes* define what to look for
    - word, phrase, addkey, pattern, XML
  - *link types* define sequence in which query node targets should occur
    - next, one-way, two-way
-

# Sentences beginning with conjunctions

The screenshot displays the XAIRA software interface, specifically the Query Builder dialog box. The dialog box is titled "Query Builder" and contains a tree structure representing a query. The tree has a root node labeled "<element name='bncDoc'/>". This node has two children: a node labeled "<element name='s' end='yes'/>" and a node labeled "<pos><word>\_</word><poscode key='POS'>CJC</poscode></pos>". The dialog box also includes "OK" and "Cancel" buttons, and a status bar at the bottom indicating "Query is OK".

The background text, which is partially obscured by the dialog box, appears to be a document discussing American art and language. Visible fragments include:

- ...the sa...
- off.
- in resista...
- time o...
- of ange...
- function...
- iple — i...
- nse col...
- isation...
- You tak...

Below the dialog box, more text is visible:

se experience has been continuous over at least four centuries. And Glauber also implies that the forms and images in which t...

n American art is itself testimony to the success of such efforts. But new categories can in turn prove to be exclusive.

sed in subsequent renderings — the massive wig, for example. And in the second version he introduces a three-dimensional h...

ther more strongly than in English, unlucky, wretched, doomed. But conversely, in Latin America, negra or neqrita are often us...

ature of the period is also very preoccupied with food and drink. But it is not just the strong smells of food, but the metaphorical...

which are suggested by the inclusion of such items in his work. And where the tins of fish are juxtaposed with fragments of Ma...

ueen of the American Empire, is devoured by her own hounds. But no simple anti-colonial reading of Gironella's work is possi...

nblem of the yoke has strong resonances in Spain and Mexico. But it is important that here the yokes are inverted: Mariana an...

e bourgeoisie in respect of its structured 'overconsumptionism'. And secondly, the defeat of the last major challenge to the sys...

minates everything this oxymoronic 'radical orthodoxy' touches. And it touches a lot.

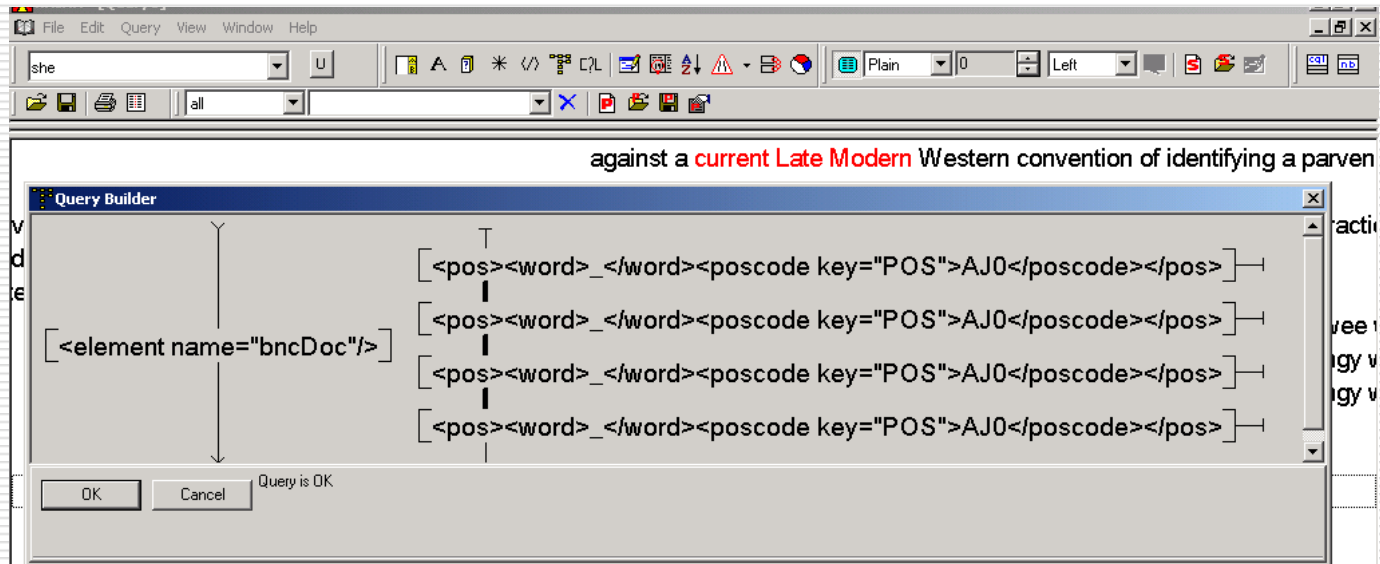
n (if not the evidence of late capitalism's corruption and decay). But this is not the argument's main thrust; and it is this rather e...

quite another also to offer a wholesale refutation of Modernism. And Callinicos is aware of this: 'Is not the general tendency of...

rather at the first frosts anyway, if they come; and if they don't... But with his placement of Modernism in the lineage of Nietzsc...

as a coach and horses through postmodernism: well and good. But the roads on which he drives it also go through most of the...

# Sequences of four adjectives



Old good old Stubby.

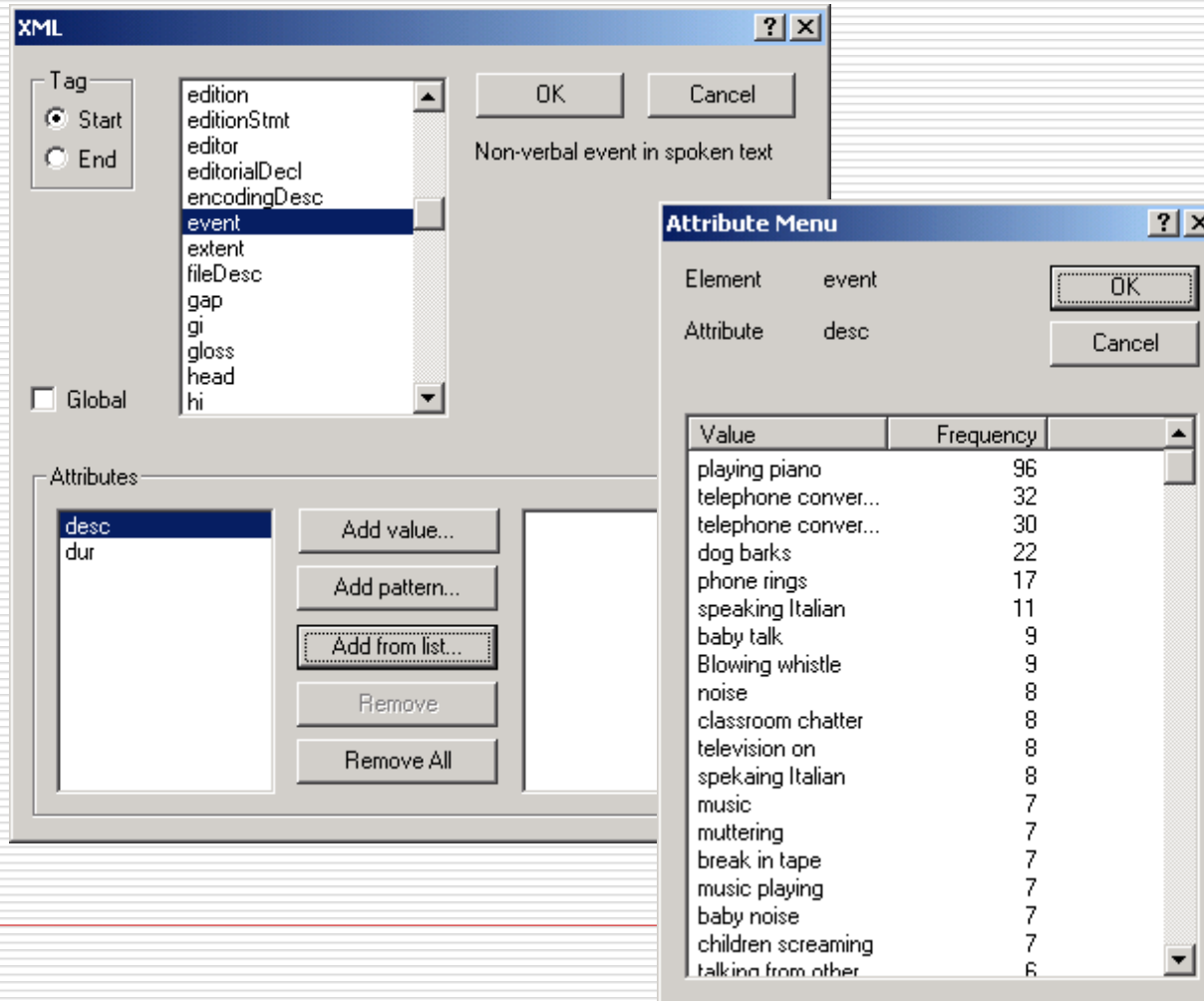
and a policeman was supposed to be on duty because it was this **great big wide** Upper Parliament Street, and going across it, if I had  
pulled back on the stick, and our plane was screaming up into the **wide blue lovely** bullet-free sky and the Maggot was laughing and  
the huge romantic canvas showing the same spot, painted by the **early nineteenth-century British** Romantic artist James Ward and

Lynch, who fell at the first fence on his **only other Grand** National ride in 1981, had looked likely to miss

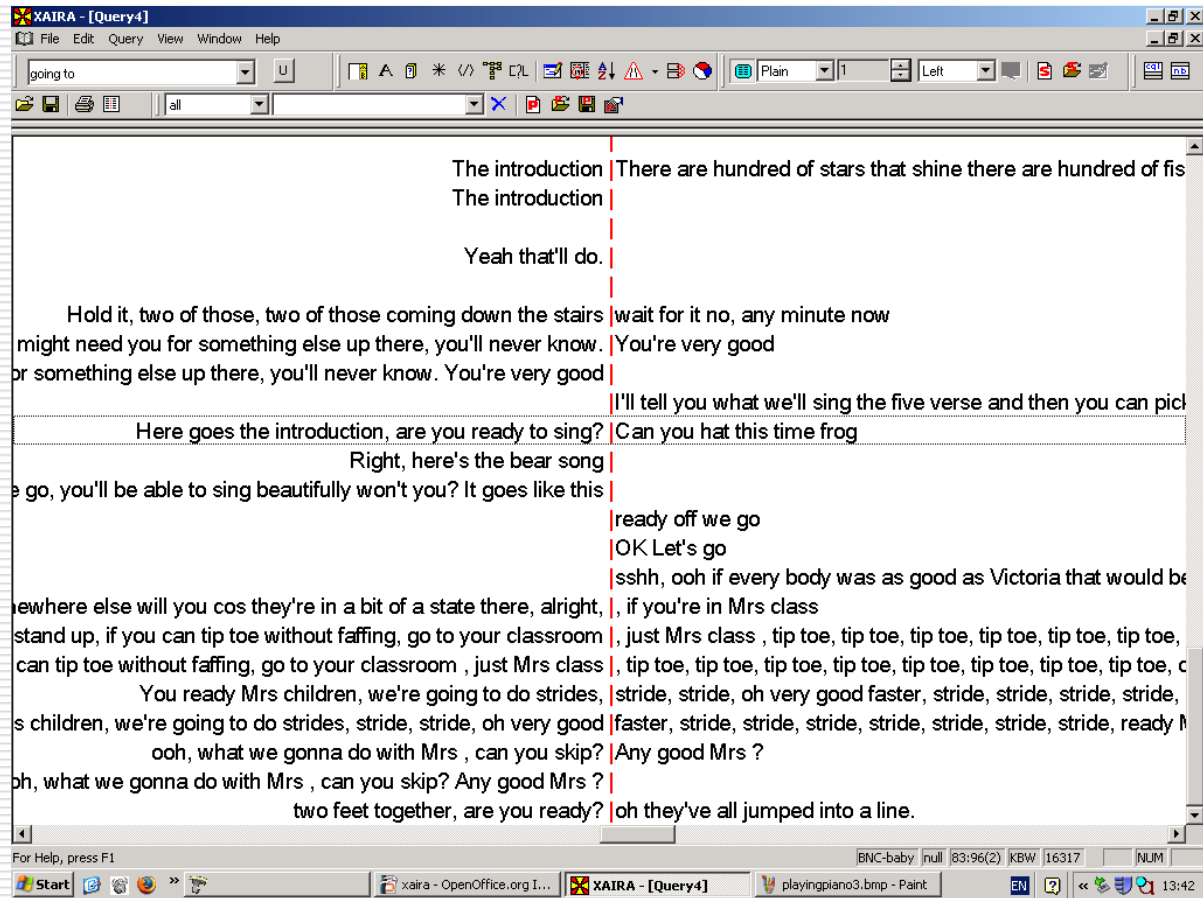
The **jubilant 46-year-old Argentinian** celebrated landing the £91,660 for  
after St George's finished on 175-7, despite a 2-55 return from **16-year old slow** left arm bowler Howard Jones on his debut.

The Orange Beast, recalcitrant hero/heroine (politically **correct transsexual eastern** European motorcycle and sidecar) c

# XML Queries

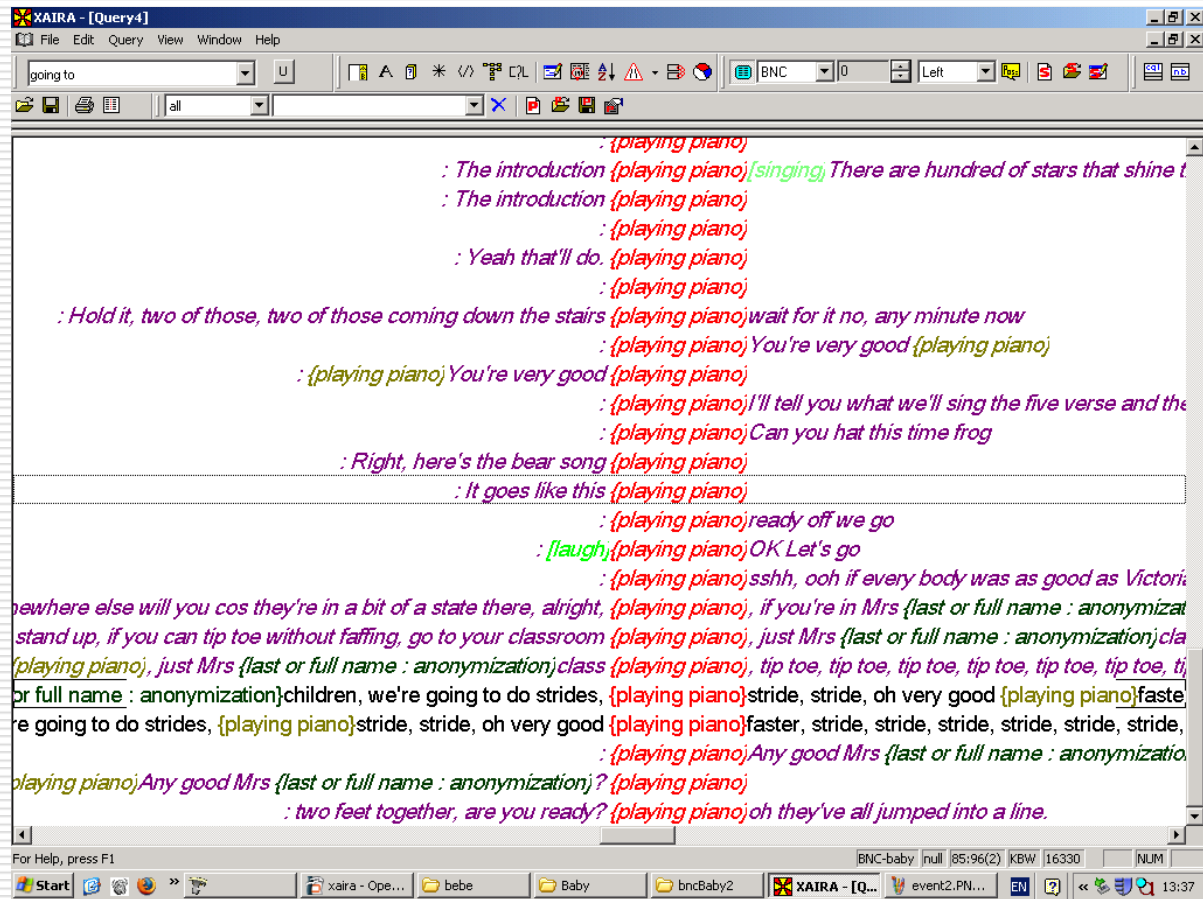


# “playing piano” – plain view



[illegible]

# “playing piano” – custom view



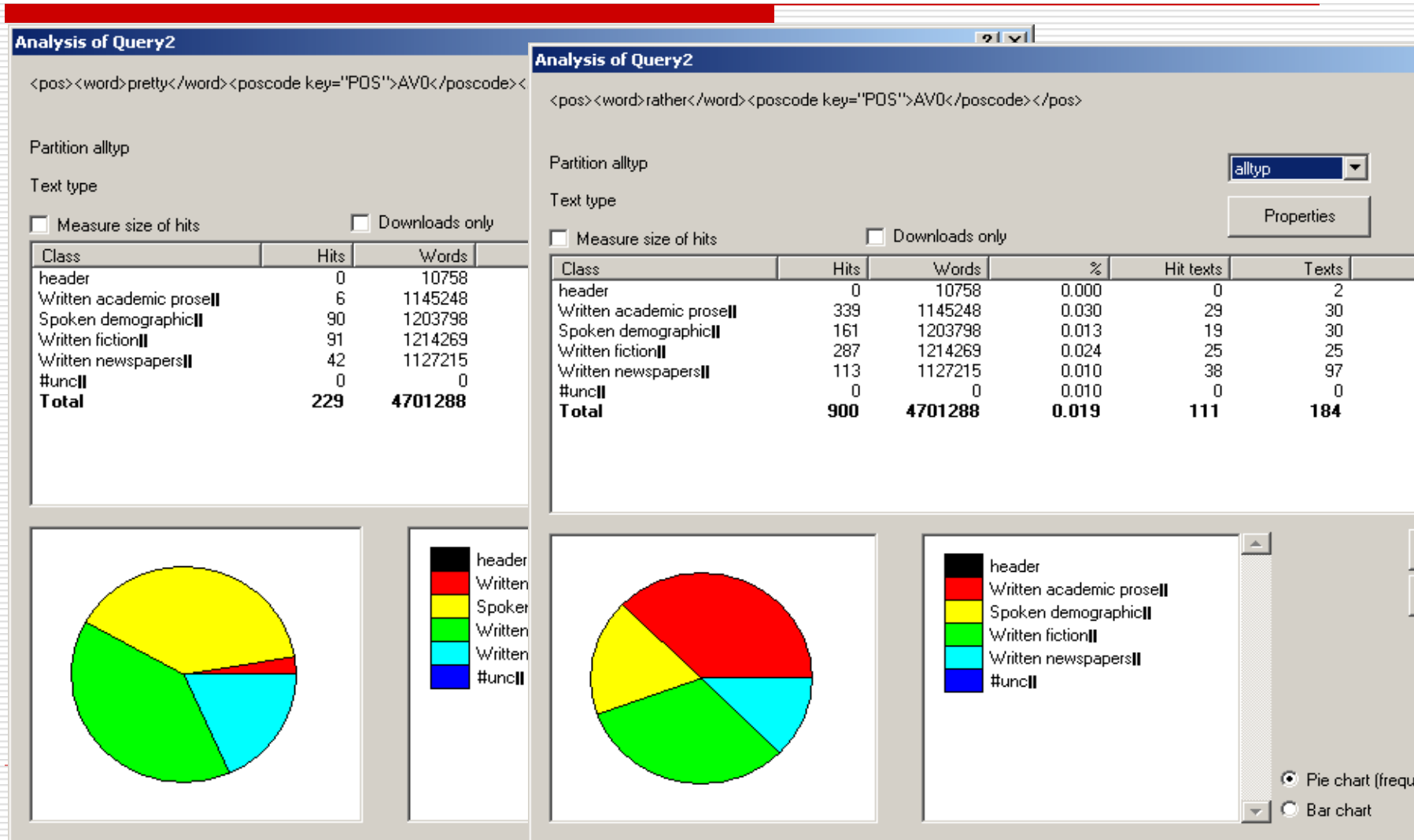


# Categorizing texts in a corpus

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- A corpus can be *partitioned* in many ways
    - By pre-assigned category, domain, text-type, topic etc. specified in the markup
    - Manually or by running a query
  - Searches can be restricted to texts of a given classification (subcorpora)
  - Or results compared across the partition
-

# “pretty” vs “rather” in BNC Baby



# What is XAIRA's niche?

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- Web search engines
    - patchy and unknowable coverage
    - designed to recover content, not word forms
    - hard to cite, harder to process
  - XML display engines
    - expensive, geared to reader not searcher
    - focus on presentation rather than content
  - As a back end for your next generation web application
-

# Interfaces available now

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- Full-featured Windows client
    - can be run standalone or as interface to Windows, Unix, or Mac OSX server
    - includes simple corpus building utility
  - Cross-platform
    - SOAP interface
    - Simple PHP and Java clients
    - Server and indexer
  - Xpath engine
-

# Using Xaira as a back end

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- PHP interface

- supports all calls to the Xaira object model
- suitable for any web programmer
- platform independent

- For example...

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## Results for dharma (धर्म): 101 hits

View: ☐ E ☐ S ☐ S ☐ S ☐ S

Hit: << 10 >>

Context: - 6 +

Sort: ☐ L ☐ N ☐ R

Script: ☐ IAST ☐ DEVANAGARI

[New search](#)

10	tebhyas tan na tad ākhyeyaṃ sa dharma iti niścayaḥ akūjanena ceṇ mokṣo nātra	mahabarata 7955
11	duḥkhataram jīvitād viprayojanam ayaṃ vo rocatām dharma iti vācyaḥ prayatnataḥ na kaś cid	mahabarata 7976
12	sanātanaḥ vyavahāraś ca yo drṣṭaḥ sa dharma iti naḥ śrutaḥ yaś ca vedah	mahabarata 8808
13	na ca mādṛisutāv ubhau bhavān dharmo dharma iti satataṃ vratakarśitaḥ kaccid rājan na	mahabarata 2471
14	pratyāsannasya tasyarśe kiṃ syāt pāpaprāṇāśanam adharma dharma iti ha yo ' jñānād ācared	mahabarata 8957
15	grhasthasya tu gacchati nānyas tasmāt paro dharma iti prāhur manīṣinaḥ prāṇā hi mama	mahabarata 296
16	mahān doṣo vadhena saha kalpate ahimsālakṣaṇo dharma iti vedavido viduḥ yad ahimsraṃ bhavet	mahabarata 10699
17	sūkṣmatvād gatim vidmaḥ katham cana adharma dharma iti vā vyavasāyo na śakyate kartum	mahabarata 13046
18	bhaviṣyati duṣkaram paramajñānam tarkeṇātra vyavasyati śrutir dharma iti hy eke vadanti bahavo janāḥ	mahabarata 5918
19	dhārayati prajāḥ yaḥ syād dhāranasamyuktah sa dharma iti niścayaḥ ye ' nyāyena jihīrsanto	mahabarata 5922
20	loke vigarhitam kṛtapūrvīṇas tu tyajato mahān dharma iti śrutih samsiddhaḥ puruṣo loke yad	mahabarata 20793
21	prakalpayet yam ete ' bhyanuḥjānīyuh sa dharma iti niścayaḥ eta eva trayo lokā	mahabarata 7874
22	kurupravīraṃ parivārya tasthuḥ hā nātha hā dharma iti bruvanto ; hriyā ca sarve	mahabarata 1734
23	dhanam deyaṃ sūdrāputrāya bhārata ānṛśaṃsyaṃ paro dharma iti tasmai pradīyate yatra tatra samutpanno	mahabarata 4527
24	strīpumsos tulya eva saḥ ratiḥ sādharmaṇo dharma iti cāha sa pāṛthivaḥ atha kena	mahabarata 4427
25	vidhrtāḥ prajāḥ yat syād dhāranasamyuktam sa dharma iti niścayaḥ śrutidharma iti hy eke	mahabarata 7951

Printed Notes





## Results for dharma (धर्म): 101 hits

View:



Hit: &lt;&lt;&lt; 10 &gt;&gt;&gt;

Context: - 6 +

Sort:



Script:

[New search](#)

10	तेभ्यस्तन्नतदाख्येयंस धर्म इतिनिश्चयःअकूजेनेनचेन्मोक्षोनात्	mahabharata 7955
11	दुःखतरंजीवितोद्विपरियोजनमयंयोरोचतां धर्म इतिवाच्यःप्रयत्नतःनक्षचिदि	mahabharata 7976
12	सनातनःव्यवहारश्चयोदृष्टःस धर्म इतिनिःश्रुतःयश्चवेदः	mahabharata 8808
13	नचमाद्रीसुतावुभौभवान्धर्मो धर्म इतिसिततंवरतकर्त्तृकचक्षिराजन्	mahabharata 2471
14	प्रत्यासन्नस्यतस्यरषेकस्यात्पापप्रणाशनमधर्मो धर्म इतिहियोज्ञानादाचरेद्	mahabharata 8957
15	गृहस्थस्यतुगच्छतनिन्यस्तस्मात्परो धर्म इतिप्राद्वर्तनीषणिःप्राणाहमिम	mahabharata 296
16	महान्दोषोवधेनसहकल्पतेअहसिलक्षणो धर्म इतिवेदवदिविदुःयदहसिरंभवेत्	mahabharata 10899
17	सूक्ष्मत्वाद्गतविदिमःकथंचनअधर्मो धर्म इतिवाव्यवसायोनक्षक्यतेकरतुम्	mahabharata 13046
18	भवषियतद्विष्करंपरमज्ञानंतरकेणात्प्रव्यवस्यतश्चिरतरि धर्म इतिहियेकेवदन्तबिह्वोजनाः	mahabharata 5918
19	धारयतपिरजाःयःस्याद्धारणसंयुक्तःस धर्म इतिनिश्चयःयेन्यायेनजहिर्षन्तो	mahabharata 5922
20	लोकेवगिरहतिमृकत्प्रवणिस्तुत्यजतोमहान् धर्म इतिश्रुतिःसंसदिधःपुरषोलोकेयद्	mahabharata 20783
21	प्रकल्पयेत्यमेतेभ्यनुजानीयुःस धर्म इतिनिश्चयःएतएवत्रयोलोका	mahabharata 7874
22	कुरुप्रवीरंपरिवारयतस्थुःहानाथहा धर्म इतिबिरुवन्तोऽद्वयिचसरवे	mahabharata 1734
23	धनैर्यशूद्रापुत्रायभारतआनुशंस्यंपरो धर्म इतितिसमैप्रदीयतेयत्रतस्समुत्पन्नो	mahabharata 4527
24	स्त्रीपुंसोस्तुत्यएवसःरतःसाधारणो धर्म इतिचाहसपार्थविःअथकेन	mahabharata 4427
25	वधिताःप्रजाःयत्स्याद्धारणसंयुक्तंस धर्म इतिनिश्चयःश्रुतधर्मइतिहियेके	mahabharata 7951

## Printed Notes

# Frequently Asked Questions

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- ❑ Does it work on a Mac?
  - ❑ Does it work with non-XML text?
  - ❑ How much does it cost?
  - ❑ How do I make it do xxxx?
  - ❑ Where's the documentation?
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