Transliterating Urdu for a Broad-Coverage Urdu/Hindi LFG Grammar

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LREC2010, Malta

Contents of the Talk:

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- Computational LFG grammar in development in Konstanz

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  $\longrightarrow$ smaller-scale (yet...): Welsh, Georgian, Hungarian, Turkish, Chinese, **Urdu** (among many others)

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```
"Nadya saw the book."

   PRED     'see<[1:Nadya] [113:book]>'
               PRED   'Nadya'
               CHECK  [_LEX-SOURCE morphology, _PROPER known-name]
   SUBJ        NTYPE  [NSEM [PROPER [NAME-TYPE first_name, PROPER-TYPE name]]]
                      [NSYN proper                                          ]
             1 CASE nom, GEND-SEM female, HUMAN +, NUM sg, PERS 3
               PRED   'book'
               CHECK  [_LEX-SOURCE countnoun-lex]
               NTYPE  [NSEM [COMMON count]]
   OBJ                [NSYN common        ]
               SPEC   [DET [PRED      'the']]
                      [    [DET-TYPE def  ]]
           113 CASE obl, NUM sg, PERS 3
   CHECK    [_SUBCAT-FRAME V-SUBJ-OBJ]
   TNS-ASP  [MOOD indicative, PERF -_, PROG -_, TENSE past]
57 CLAUSE-TYPE decl, PASSIVE -, VTYPE main
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   SUBJ     NTYPE     NSEM [PROPER [PROPER-TYPE name]]
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            SEM-PROP [SPECIFIC +]
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            PRED  'kitAb'
   OBJ      NTYPE NSEM [COMMON count]
                  NSYN common
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   CHECK    _VMORPH [_MTYPE infl]
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- together with Hindi the fourth most spoken language in the world ($\sim$ 250 million native speakers)

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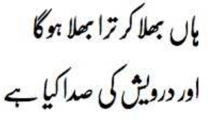
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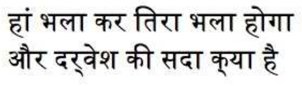
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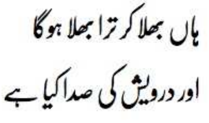
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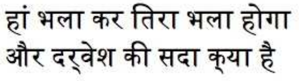
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- **Common transliteration in Latin alphabet:**

hAN	bHalA	kar	tirA	bHalA	hOgA
yes	good.M.Sg	do	then	good	be.Fut.M.Sg
Or	darvES	kI	sadA	kyA	he
and	dervish	Gen.F.Sg	call.F.Sg	what	be.Pres.3.Sg

‘Yes, do good then good will happen, what else is the call of the dervish.’

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- Use a common ASCII-based transliteration (A-Z, a-z, 0-9)
- Encode a *single grammar and lexicon* in ASCII-based transliteration

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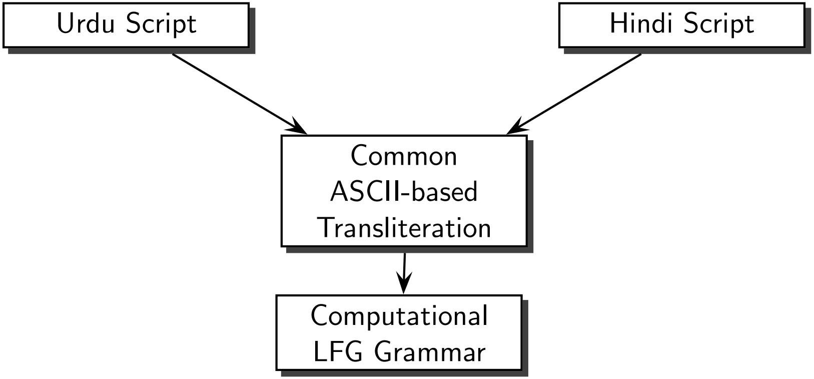

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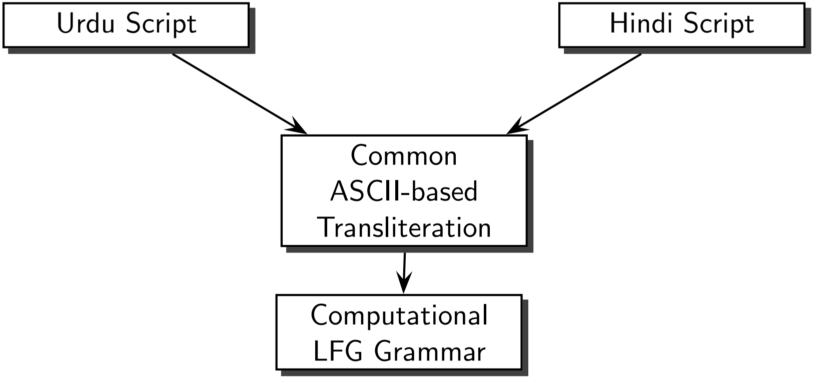

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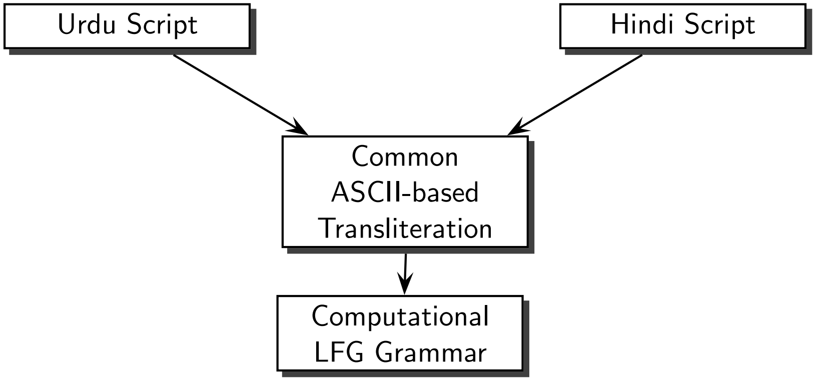

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→ **Grammar development effort is kept minimal**

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  - Arabic and Persian graphemes map onto a single Urdu phoneme

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- For class (2), context-sensitive rules were designed to account for the dual behavior

The Urdu Script: Some Peculiarities

An excerpt from our scheme table:

Unicode Urdu character	Latin letter in transliteration scheme	Phoneme
ب	b	/b/
پ	p	/p/
ت	t	/t/
ٹ	T	/ʈ/
ج	j	/ʤ/
چ	c	/t͡ʃ/

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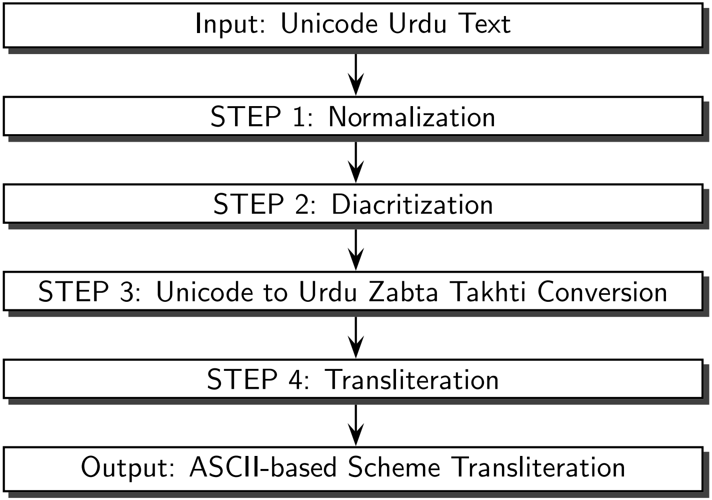
The Transliterator Pipeline



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→ The system works on composed characters only!

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$\longrightarrow$ Ambiguity created by absence of aerab diacritics is resolved

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Example:

Urdu Unicode text

چَابِی *čābī* ‘key’

UZT–converted text

898083120 *čābī* ‘key’

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`898083120`	*čābī* ‘key’

transliterated Latin letter-based notation

`cAbI`	*čābī* ‘key’

STEP 4 (cont.): Transliteration of Loan Graphemes

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→ Lexicon is kept simple to read in most of the cases

Evaluation of the Transliterator

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- Performance of the transliterator:

Test Corpus Size	$A = C_w / T_w$ (diacritized input)	$A = C_w / T_w$ (input without diacritics, with foreign words)
1000	0.995	0.925

Table: Accuracy Results for Transliterator

The Architecture of the Grammar

The transliterator is integrated into a parsing architecture using a Finite-State Morphological Transducer (FSMT) and the XLE Grammar Development Platform (XLE).

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Transliterator (Urdu & Hindi Unicode to ASCII-Based Transliteration)

↓

Tokenizer

↓

Morphology (FSMT)

↓

Syntax (C- and F-Structure) (XLE)

Integrating the Transliterator

$\longrightarrow$ **Transliterator applies first**

Integrating the Transliterator

→ **Transliterator applies first**

Example (*gARI calI* ‘The car worked/started.’)

transliterator input:

گاَڑِي چَلِي

gāṛī čālī

transliterator output:

`gARI calI` *gāṛī čalī*

Integrating the Transliterator (cont.)

→ **Transliterator output feeds in XLE tokenizer**

Integrating the Transliterator (cont.)

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Example (*gARI calI* 'The car worked/started.')

tokenizer input:

`gARI calI` *gāṛī čalī*

tokenizer output:

`gARI TB calI TB` *gāṛī čalī*

Integrating the Transliterator (cont.)

→ **Transliterator output feeds in XLE tokenizer**

Example (*gARI calI* 'The car worked/started.')

tokenizer input:

`gARI calI` *gāṛī čalī*

tokenizer output:

`gARI TB calI TB` *gāṛī čalī*

→ **Tokenizer output feeds in FST morphological transducer**

Integrating the Transliterator (cont.)

→ **Transliterator output feeds in XLE tokenizer**

Example (*gARI calI* ‘The car worked/started.’)

tokenizer input:

`gARI calI`	*gāṛī čalī*

tokenizer output:

`gARI TB calI TB`	*gāṛī čalī*

→ **Tokenizer output feeds in FST morphological transducer**

Example (*gARI calI* ‘The car worked/started.’)

morphology output:

`gARI+Noun+Fem+Sg`	*gāṛī*
`calI+Verb+Perf+Fem+Sg`	*čalī*

Integrating the Transliterator (cont.)

$\longrightarrow$ **Morphology output feeds in XLE syntactic rules**

Integrating the Transliterator (cont.)

→ **Morphology output feeds in XLE syntactic rules**

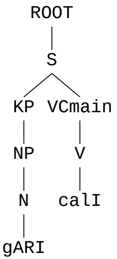
Example (*gARI calI* 'The car worked/started.')

Morphology Output/Syntax input:

gARI+Noun+Fem+Sg	*gāṛī*
calI+Verb+Perf+Fem+Sg	*čalī*

Syntax output (C-Structure and F-Structure):

CS 1:



```
"gARI calI"

   PRED     'cal<[1:gAR]>'
            PRED   'gAR'
   SUBJ     NTYPE  NSEM [COMMON count]
                   NSYN common
          1 CASE nom, GEND fem, NUM sg, PERS 3
   CHECK    _VMORPH [_MTYPE infl]
            _RESTRICTED -, _VFORM perf
   LEX-SEM  [AGENTIVE -]
   TNS-ASP  [ASPECT perf, MOOD indicative]
17 CLAUSE-TYPE decl, PASSIVE -, VTYPE main
```

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Thank you!

Are there questions?