### **Dynamic Correspondences:**

An Object-Oriented Approach to Tracking Sound Reconstructions

Tyler Peterson – University of British Columbia (Canada) Gessiane Picanço – Universidade Federal do Pará (Brazil)

### Introduction:

- Databases: have transitioned from searchable repositories of tokens, to a tool that can organize vast amounts of data, and execute complex statistical functions and queries on the data it stores.
- Many options: commercial databases (MS Access/Excel, Filemaker Pro; OpenOffice Calc and Base); Academic/Research databases: ShoeBox, various applications from the MPI.
- How can we put these innovations to work on Comparative/Historical linguistics?

### The BDEC-T Database

- Base de Dados para Estudos Comparativos Tupí (Database for Comparative Studies – Tupí)
- Implemented within MS Access 2003, providing the user an interface for entering language data, which is then externally linked to tab-delimited text files.
- Provides a visual interface for entering segmented data which can then be cross-tabulated in the form of *pivot tables --* a recent innovation in the implementation SQL queries.
- Why? We believe cross-tabulation and pivot tables are an effective tool for tracking several one-to-one and one-to-many correspondences simultaneously across several languages; the ability to dynamically survey the languageinternal distribution of segments and their features.
- What are cross-tabulations? They track the joint distribution of two variables for our purposes, these variables will be phonemes.

# The Data: The Tupí langauges

- The Tupí stock of language families is concentrated in the Amazon river basin of Brazil, comprising of 10 language families totaling approximately 64 languages.
- At present, the BDEC-T for the Tupí stock contains a glossary of 813 words and up to 3,785 entries distributed across 15 Tupían languages.
- Approximately 18% of this 813-word list appear to have cognates in the majority of languages entered so far, and which can be used as reference for a reliable set of robust cognates across the entire Tupí stock.

### **Promising results**

- BDEC-T has predicted larger sets of correspondences than those posited by previous, manual methods.
- BDEC-T has challenged previous claims: A previous analysis mistakenly posited the correspondence set \*Ø/? for both Mundurukú and Mekéns. The segmentation function in BDECT-T tracked a more suitable
   correspondence \*Ø/? for Mekéns but \*(C)VPV/(C)V for Mundurukú.

Rodrigues	BDEC-	Т	Rodi	rigues	BD	EC-T	
P-T Mund.	P-T M	und.	P-T	Mund.	P-7	Г M	lund.
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	ø			ťſ		ťſ	
	ps			ф.		¢	
	p/t						
*p <sup>?</sup> b	*p² b		*fl <sub>3</sub>	t	*fl <sub>3</sub>	t	
	р			d		d	
		<b>C</b> 1	62	62	64	C.5	66
		51	52	33	54	30	20
Proto-Tupí:	*upi?a	Ø	u	р	i	?	а
Mundurukú:	topsa	t	0	ps	Ø	Ø	a
Mekéns: upi	a	Ø	u	р	i	Ø	a

Table 5: \*(C)V?V corresponding with (C)V

*k k	*k k	*k <sup>7</sup> ?	*k <sup>7</sup> ?
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Table 4: The correspondence sets as proposed by Rodrigues (1995) compared with those generated by the BDEC-T.

## **Objectives and Plan**

- To demonstrate the core functions of BDEC-T: segmentation and correspondence analysis utilizing cross-tabulation and pivot tables.
- To present a powerful yet practical use of an 'off-the-shelf' database application that can be implemented with little or no previous programming experience.

### Procedure:

- I. Data entry
- II. Segmentation
- III. Queries
- IV. Analysis

### **Master Switchboard:**

🕖 Programma de Fonologia Experimental e Histórica - [Base de Dados para Estudos Comparativos - Tupí (BDEC-T)]

Laboratório de Fonologia Experimental e Histórica

Base de Dados para Estudos Comparativos - Tupí (BDEC-T)



Coordinação: Gessiane Picanço (picanco.g@hotmail.com), Universidade Federal do Pará © 2006 Designed and implemented: Tyler Peterson (tylerrp@interchange.ubc.ca), University of British Columbia

### Data Entry Form:

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### Data Entry Form:

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### Forms and Data storage

- Each of the 64 languages and 4 proto-languages in BDEC-T is associated with its own data entry form.
- The data entered in these forms is stored in a master table where all of the languages are represented as columns.
- Glosses are the rows, where each gloss is assigned a unique, autogenerated number in the master record when it is entered into the database.
- This serves as the primary key for all the translations of that gloss across all of the languages.

### Segmentation:



### Segmentation and comparison:

#### 🖉 Programma de Fonologia Experimental e Histórica - [Mundurukú Data Entry Form]

rikem	Tupari	Mondé	Mundurukú
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Awetí	Tuparí kopkap	Salamãy (Mondé)	Jurúna
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uruborá	Ramarama		
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upí-Guarani			
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Guaraní Antigo	Kokama	Asuriní do Xingú	Kamayurá tata
Guaraní Paraguaio	Tupinambá	Araweté tatã	
Chiriguano	Nhe'engatú	Anambé do Cairarí ratã	
Mbyá <mark>r-atá, tatá</mark>		Amanajé Amanajé	Anambé de Ehrenreich
Guayaki (Axé)	Subgroup IV		Awree Awra
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Nhandeva (Txiripá)	Guajajára	Kayabí	Guaja tata
Xetá		Apiaká	
Tapieté tata		Tupi-Kawahib dialects	
Izoceño (Chané)		Tenharim	Takunhapé
		Uru-eu-uau-uau	
Guaravu	Asuriní do	Amondava	
Sirionói	Avá-Canoeiro tata	Júma tat	a
	Mujetire	Karipuna	
	Parakanã	Parintintin	
	Tapirapé		
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## Aligning correspondences:

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palatalization

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	,	1	1	1	1	1
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	1	1	\$	1	1	1
Sakirabiá	0	t	а	t	Ø	Ø

Segmentation slot	<b>S1</b>	<b>S2</b>	<b>S</b> 3	<b>S</b> 4	<b>S</b> 5
Avá-Canoeiro	ø	i	ø	a	р
Guajá	ø	u	2	i	ø
Mbyá	h –	u	?	i	ø
Kamayurá	h	i	?	i	р

Table 2: Segmentation of 'arrow'

Segmentation slot	<b>S1</b>	S2	<b>S</b> 3	<b>S4</b>	S5
Avá-Canoeiro	ø	ø	i	t	i
Guajá	ø	w	i	t	i
Araweté	i	W	i	t	i

Table 1: Segmentation of 'wind'

## What can be done with this data?

- Cross-tabulations of the segment data recorded in each column can be used to:
  - 1) monitor the language-internal distribution of segments; and
  - 2) track correspondences between languages for a particular cognate or segment slot.
- This is visually implemented through *pivot* tables.

### **Cross-tabulation and Pivot tables**

- Cross-tabulation: displays the joint distribution of two or more variables, usually
  presented as a contingency table which plots the distribution of two or more
  variables simultaneously.
- This allows us to examine frequencies of observations that belong to specific categories on more than one variable. By examining these frequencies, we can identify relations between crosstabulated variables.
- Access 2003 includes a graphical implementation of SQL statements in the form of cross tabulations, or pivot tables.
- Pivot tables can be described as an 'object-oriented' representation of SQL statements: columns of data are treated as objects, which allow the user to create multidimensional views of the data by 'dragging and dropping' columns into various sorting arrangements.
- Different levels of detail or organize data can be used by dragging the fields and items or by showing and hiding items in the drop-down lists for the fields.

# I. Language-internal distributions

- Phonotactic restrictions may, in many cases, be gaps left behind by historical changes.
- Pivot tables allow the analyst is able to easily monitor and track distributional gaps or contrasts and so provide a more systematic diachronic analysis.

#### Sample Case study: Mundurukú

- i. Root-initial distribution of phonemes.
- ii. Distribution of root-intial labials.
- iii. Root-initial consonants and their following vowels.
- iv. Root-initial distribution of creaky and nasal vowels.
- v. Root-initial syllables: vowels and what consonants precede them.

### 

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36	rede	ərə́, ərə̃	-	-	Ø	ə/ə	r	ő/õ	-	-
37	í mãe	ر) از (7)	-	-	ſ	í/i	-	-	-	-
38	mosquito, carapanã	ſík	-	-	ſ	í	k	-	-	-
39	) batata	wejîk	-	-	w	е	Ø	ſ	í	k
40	) tapiri, tenda, abrigo	ſidʒáp	ſ	i	ব্দ্র	á	р	Ø	-	-
43	} banhar-se	aðdsók	-	-	Ø	â	dz	ó	k	-
51	anzol	piŋá	-	-	р	i	ŋ	á	Ø	-
54	l pescoço	ąŋóbə	-	-	-	-	-	-	-	-
57	irmão	waŋó, kít-pit, kipít	-	-	k	i	р	í	t	-
61	ir (ir embora)	dʒə́, ʧə́	-	-	tj/dz	á	Ø	Ø	-	-
62	pre <u>quica (an</u> imal)	ai	-	а	Ø	i	-	-	-	-
Record:		∗ of 96	( <u> </u>							

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i 📑 Eile	<u>E</u> dit	<u>V</u> iew <u>P</u> ivotTable <u>T</u> ools <u>W</u> ind	low <u>F</u>	<u>i</u> elp 4	Ado <u>b</u> e P	DF				
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Ø/t/d	-	op, top, dop	0	ø	ø	р	13	flecha		
b	Ē	ábə, abə	ə	Ø	-	-	83	quem		
	-	ąbík	Í	k	-	-	115	sentar-se, sentado		
d	=	dądzé	â	Ø	ďЗ	é	3	queixada		
		dąjdó	ą	j	d	ó	4	tatu		
		dajá	а	ſ	Ø	á	7	fogo		
		dajéw, dajé	а	ſ	é	Ø	68	traíra (peixe, sp.)		
		dot	0	t	-	-	127	vir		
		dadzek-tjó	а	dz	е	k	496	caititu, catitu, porco-do-mato		
		idį-bí	j∕i	-	-	-	555	rio		
वउ	+	o-dzodít	0	d	í	t	16	tio		
		ſidʒáp	á	р	ø	-	40	tapiri, tenda, abrigo		
		dzat	а	t	ø	-	409	pegar, segurar, agarrar (set II)		
		âqzəj	ş	ø	j	-	640	cobrir		
d/n	+ -	da?ó-rḗk	а	7	ó	-	21	calango		
ſ	+ -	(7)〕〔	í/i	-	-	-	37	mãe		
ľ		ſík	í	k	-	-	38	mosquito, carapană		
		ſét	é	t	-	-	90	dormir		
		jíbə, ilibənế	í	b	ə	-	503	cipó		
k	+	waŋó, kít-pit, kipít	i	р	í	t	57	irmão		
		kip	i	р	ø	-	98	piolho		
		káli	á	ſ	i	-	212	lua		
		káli, koató/koato, kadzépí	0	ø	a-a	ø	246	sol		
		kít	í	t	-	-	508	verde, não-maduro		
		kibit, ə̃ilít	i	b	i	ø	514	irmã		
		ikopí	0	p	í	-	580	caba		
m	+	məsə, məsák-ta	ə	s	á	ø	75	mandioca		
PivotTable '	View		-	-	-	-				

Pivot tables can be converted into Pivot charts, which can perform basic statistical procedures, in this case, counting the distribution of root-initial consonants:



**PivotChart View** 

🔎 Programma de Fonologia Experimental e Histórica - [Lg internal dist Mu : Select Query]

B

📴 File Edit Yiew PivotTable Tools Window Help Adobe PDF

Boolean searches are replaced by a filtering function.

Rather than specifying segments/phonemes, they are 'filtered' out by deselecting them from a pull down box attached to the sorting column.

For example, if we are interested in tracking the distribution of labials, we simply delesect all non-labial phonemes.

Drop Filter Fields Here											
S3	•	Word -	S4 🗸	S5 🗸	S6 🗸	S7 🗸	Number 🗸	Gloss 🗸			
(AII)			0	ø	ø	р	13	flecha			
<b>□</b> -			ə	ø	-	-	83	quem			
⊡ø ⊽ø/t/d			í	k	-	-	115	sentar-se, sentado			
₽b			ą	ø	dз	é	3	queixada			
vd vdx			ą	j	d	ó	4	tatu			
∎d/n			а	ſ	ø	á	7	fogo			
<b>⊘</b> ∫ ⊒k		-	а	ſ	é	ø	68	traíra (peixe, sp.)			
	ĸ	Cancel	0	t	-	-	127	vir			
			а	dz	е	k	496	caititu, catitu, porco-do-mato			
		idį-bi	j/i	-	-	-	555	rio			
dz	+	o-dzodít	0	d	í	t	16	tio			
		ſidzáp	á	р	ø	-	40	tapiri, tenda, abrigo			
		dzat	а	t	ø	-	409	pegar, segurar, agarrar (set II)			
		ਭੁਖਤਭੁ	ð	ø	j	-	640	cobrir			
d/n	+-	da?ó-rḗk	а	?	ó	-	21	calango			
ſ	+	آر (7) آر (7)	í/i	-	-	-	37	mãe			
		ſſĸ	í	k	-	-	38	mosquito, carapanã			
		<u>jét</u>	é	t	-	-	90	dormir			
		jjíbə, ijibənế	í	b	ə	-	503	cipó			
k	+	waŋó, kít-pit, kipít	i	р	í	t	57	irmão			
		kip	i	р	ø	-	98	piolho			
		káji	á	ſ	i	-	212	lua			
		káji, koạtó/koato, kạợzépi	0	ø	ą-a	ø	246	sol			
		kít	í	t	-	-	508	verde, não-maduro			
		kibjt, ə̃jjít	i	b	Į	ø	514	irmã			
		ikopí	0	р	í	-	580	caba			
m	+	məsə, məsək-ta	ə	s	á	Ø	75	mandioca			

The sort function reapplies, with only the labial phonemes left, along with all the words root-initial labials are found in.

We believe this has an advantage over standard string queries: rather than spend time searching for phonemes that might not be there, you select what's available and filter out the rest.

		adit View PivotTable	<u>T</u> oo	ls <u>W</u> ir	ndow	Help	Ado <u>b</u> e PDF	
		i		Ŧ		B	IU	E = =   🆄 •   A •   🚣
Drop Filt	er	Fields Here						
		Drop Column Fields I	lere					
S3	•	Word 👻	S4 🗸	S5 🗸	S6 🗸	S7 👻	Number 👻	Gloss 👻
b	+	ábə, abé	ə	Ø	-	-	83	quem
		ąbík	í	k	-	-	115	sentar-se, sentado
m	+	məsə, məsək-ta	ə	s	á	Ø	75	mandioca
p .	+	piŋá	i	ŋ	á	Ø	51	anzol
		pạj-bá, paj-ba	ə	j	-	-	76	cobra (gen.)
		ројі	0	ſ	í	Ø	133	pesado
		pəw	ə	w	-	-	247	soprar, assoprar
		pósắŋ	ó	s	ő	ŋ	369	remédio
		pəkasó, tjoót	ə	k	а	s	502	pombo, rolinha
W	+	wejîk	е	ø	ſ	í	39	batata
		wjją	Į	ſ	ø	ø	91	saúva, formiga (sp.)
		witő	i	t	ő	-	219	mutum
		witá-7a	i	t	á	-	265	pedra
		waʔíʔa	а	7	í	7	489	cabaça

The drop field can accommodate more than one column. We can use this to track what kind of vowel follows the root-initial onsets.

Because S4 will typically contain these vowels, it is dragged over to the drop area and placed to the right of S3

Program : 🔄 🖘	mma c.Ja	r de Fonologia Experimental e His	corica	- (Lĝ i Jole	nterna Adaba (	ndist M	iu:Select Qi	ueryj
: En Ene	Eald			<u>i</u> eip == =	нао <u>р</u> ен ≡   &			
Prop Bilto	w Eig	lde Here			=			
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S3	-	Word 🗸	S4 🗸	S5 🗸	S6 🗸	S7 🗸	Number 👻	Gloss
Ø/t/d	+	op, top, dop	0	ø	ø	р	13	flecha
b	+	ábə, abə́	ə	ø	-	-	83	quem
		ąbík	í	k	-	-	115	sentar-se, sentado
d	+	dądzé	ą	ø	dz	é	3	queixada
		dajdó	ą	j	d	ó	4	tatu
		dajá	а	ſ	Ø	á	7	fogo
		dajéw, dajé	а	ſ	é	Ø	68	traíra (peixe, sp.)
		dot	0	t	-	-	127	vir
		dadzek-tjó	а	dz	е	k	496	caititu, catitu, porco-do-ma
		idį-bí	j/i	-	-	-	555	rio
dz	+	o-dzodít	0	d	í	t	16	tio
		ſidʒáp	á	р	Ø	-	40	tapiri, tenda, abrigo
		dzat	а	t	Ø	-	409	pegar, segurar, agarrar (se
		āqzēj	ð	ø	j	-	640	cobrir
d/n	+	da?ó-rếk	а	7	ó	-	21	calango
-	+	(7)ʃi, Jí	í/i	-	-	-	37	mãe
		<u></u> ſĺk	í	k	-	-	38	mosquito, carapanã
		∫ét	é	t	-	-	90	dormir
		jjíbə, ilibəné	í	b	ə	-	503	cipó
k	+	waŋó, kít-pit, kipít	i	р	í	t	57	irmão
		kip	i	р	Ø	-	98	piolho
		káſi	á	ſ	i	-	212	lua
		káji, koạtó/koato, kạœép	0	ø	ą-a	Ø	246	sol
		kít	í	t	-	-	508	verde, não-maduro
		kibjt, əjjít	i	b	į	Ø	514	irmã
		ikopí	0	р	í	-	580	caba
m	+	məsə, məsək-ta	ə	s	á	Ø	75	mandioca

The effect is one of hierarchical sorting: S3 sorts the vowels in S4, the join of which sorts the words that are associated with the combinations:

S3	•	S4	•	Word	S5 🗸	S6 🗸	S7 🗸	Number 👻	Gloss 🗸
Ø/t/d		0	+	op, top, dop	Ø	Ø	р	13	flecha
		Total	+-						
b		ə	-	ábə, abə́	Ø	-	-	83	quem
		í	+	ąbík	k	-	-	115	sentar-se, sentado
		Total	+ - +					-	-
d		а	Ē	dajá	ſ	Ø	á	1	fogo
				daſéw, daſé	ſ	é	Ø	68	traira (peixe, sp.)
				dadzek-tjó	ďZ	е	k	496	caititu, catitu, porco-do-mato
		ą	=	dądzé	Ø	dЗ	é	3	queixada
				dąjdó	j	d	6	4	tatu
		j/i	+	idį-bí	-	-	-	555	rio
		0	+	dot	t	-	-	127	vir
		Total	+-						
dz		а	-	dzat	t	Ø	-	409	pegar, segurar, agarrar (set II)
		á	+	ſidzáp	р	Ø	-	40	tapiri, tenda, abrigo
		ð	+	<u></u> ਬੁਖਤ ਦੁj	Ø	j	-	640	cobrir
		0	+	o-dzodít	d	í	t	16	tio
		Total	+ -						
d/n		а	-	da?ó-rḗk	7	ó	-	21	calango
		Total	+ - +						
l		é	=	ʃét	t	-	-	90	dormir
		Í	Ē	jîk	k	-	-	38	mosquito, carapanã
				jjîbə, ijibənế	b	ə	-	503	cipó
		í/i	-	(7)ʃi, ʃí	-	-	-	37	mãe
		Total	+ - +					0.40	
k		á	-	káji	ſ	i	-	212	lua
		i	=	waŋó, kít-pit, kipít	р	í	t	57	irmão
				kip	р	Ø	-	98	piolho
				kibjt, əjjít	b	į	Ø	514	irmã
		í	+	kít	t	-	-	508	verde. não-maduro

Filtering can again be applied, but this time, to select only creaky and nasal vowels which follow the S3 consonants:

S3 •	<b>S</b> 4	-	Word	•	S5 🗸	S6 🗸	S7 🗸	Number 👻	Gloss
Ø/t/d	✓(AI)			1	ø	Ø	р	13	flecha
	<b>⊻</b> -								
b			_	J	Ø	-	-	83	quem
	₹á				k	-	-	115	sentar-se, sentado
	In Index al a seconda de la compacta de la compact							-	-
d	iv a/a				ſ	Ø	á	(	fogo
	ve				ſ	é	Ø	68	traíra (peixe, sp.)
	<b>▼</b> é				dz	е	k	496	caititu, catitu, porco-do-mato
		ЭK	Cancel	1.	Ø	dz	é	3	queixada
			dąjdó		j	d	ó	4	tatu
	į/i	+-	idį-bí		-	-	-	555	rio
	0	+-	dot		t	-	-	127	vir
	Total	+							
dz	а	+	dzat		t	Ø	-	409	pegar, segurar, agarrar (set l.
	á	+	∫idzáp		р	ø	-	40	tapiri, tenda, abrigo
	ð	+-	aq2ði		ø	j	-	640	cobrir
	0	+-	o-dzodít		d	í	t	16	tio
	Total	+							
d/n	а	+	da?ó-rếk		7	ó	-	21	calango
	Total	+-							
ſ	é	+	∫ét		t	-	-	90	dormir
	í	+	<u></u> ſĺk		k	-	-	38	mosquito, carapanã
			jjíbə, ijibənế		b	ə	-	503	cipó
	í/i	+	رر)) الالله		-	-	-	37	mãe
	Total	+							
k	á	+	káĵi		ſ	i	-	212	lua
	i	+	waŋó, kít-pit, kip	oít	р	í	t	57	irmão
			kip		р	ø	-	98	piolho
			kibjt, ә̃j∫ít		b	Į	Ø	514	irmã
	í	+	kít		t	-	-	508	verde, não-maduro

Filtering is not hierarchical: any filters applied will eliminate the values in any other sort column.

S3 🔹	S4	•	Word 🗸	S6 🗸	S6 🗸	S7 👻	Number 👻	Gloss 👻
d	ą	+	dądzé	Ø	dЗ	é	3	queixada
			dąjdó	j	d	ó	4	tatu
	j/i	=	idį-bí	-	-	-	555	rio
	Total	+						
dz	ð	+	<u> </u>	Ø	j	-	640	cobrir
	Total	+						
n	ő/ð	=	ta/da, tá/dá, we-nắj	Ø	Ø	j	28	semente, caroço
	õ	+	nőŋ-?á	ŋ	-	-	20	pulga, bicho-de-pé
	Total	+						
s	ð	+	səsə́n (sə́t)	t	-	-	410	ter vergonha, envergonhar-se
	Total	+						
t/d	ą	+	tạjįt, dạjįt	ſ	į	t	97	filha (do homem)
			kpot, 7ít⁄7it, t/dajpá	Ø	j	Ø	278	filho
	Total	+						
tj/dz	é	+	ඇඳ්m, tjếm	m	-	-	500	sair
	ð	+	ťf⊋k	Ø	Ø	k	82	frio
	Total	+						
ťn	ą	+	nąbḗ, tąbḗ	b	ð	Ø	221	nariz (set I)
			tąbá, ka-nąbá	b	á	Ø	240	raiz
	ő/ő	+	tấj, nấj, tấj, nấj	j	Ø	-	25	dente
	õ	+	∫ĩn-tốm, tõౖm, nõౖm	Ø	Ø	m	31	pó, massa de mingau
	Total	+						
W	į	+ -	wjją	ſ	Ø	Ø	91	saúva, formiga (sp.)
	Total	+						
Grand Tota	al	+						

S4 can be dragged over to precede S3. In effect, we can observe the distribution of which consonants serve as onsets to which vowels, as sorted by those vowels.

S4 🔹	S3	-	Word 👻	S5 🗸	S6 🗸	S7 👻	Number 👻	Gloss
а	d	+	da∫á	ſ	Ø	á	7	fogo
			daſéw, daſé	ſ	é	ø	68	traíra (peixe, sp.)
			dadzek-tjó	dz	е	k	496	caititu, catitu, porco-do-mato
	dz	+-	dzat	t	ø	-	409	pegar, segurar, agarrar (set l
	d/n	+-	da?ó-rḗk	7	ó	-	21	calango
	t	+	tajjî	ø	j	ſ	34	esposa (set II)
			i-pí, tajípí	ſ	í	-	104	dor, doer
	t/d	+	dajíp, tajíp	ſ	í	р	94	quente
			tarêm, darêm, erep	r	ẽ	m	523	podre, estragado
	ťn	+	takə́/nakə́, pəné	k	ő/õ	-	32	galho, ramo
	w	+	wa?í?a	7	í	7	489	cabaça
	Total	+						-
á	dz	+	ſidzáp	р	Ø	-	40	tapiri, tenda, abrigo
	k	+	káji	ſ	i	-	212	lua
	t	+	tádo	d	0	-	18	uxi, oxi (fruta, sp.)
	Total	+ -						
ą	d	=	dądzé	Ø	dЗ	é	3	queixada
			dąjdó	j	d	ó	4	tatu
	t/d	+	tajįt, dajįt	ſ	Į	t	97	filha (do homem)
			kpot, 7ít/7it, t/dajpá	Ø	j	Ø	278	filho
	ťn	+	ngbə, tgbə	b	ő	ø	221	nariz (set l)
			tąbá, ka-nąbá	b	á	ø	240	raiz
	Total	+						
á/a	t/d	+	táp, dáp, tap, dap	р	-	-	29	cabelo
	7	+	7át, 7at	t	-	-	122	cair
			7á	-	-	-	202	fruta
	Total	+						
е	W	-	wejîk	Ø	ſ	í	39	batata
	Total	+ -					~~~	
á –	11	H	I fát	+			<u>un</u>	aarmir

PivotTable View

### In sum so far:

- Flexibility: This methodology of 'dragging and dropping', swapping, filtering and pivot charting can be applied to all the S1-S10 segment columns.
- Intervocalic consonants, root-final segments etc. can all be tracked.
- Corrections can be monitored for and made: all modifications made in the language data entry forms is automatically updated in the pivot tables.

### II. Mundurukú and Kuruáya: Comparing S3 onsets

- Because of the relational capabilities of Access, we can join the S1-S10 data from several languages and track their correspondences.
- All of the same functions demonstrated above can be applied, and this will be an effective tool in working out phonemic reconstruction.

A SQL query is generated that joins the S3 data from both Mundurukú (S3-M) and Kuruáya (S3-K).

By dragging S3-M over to the drop area, the correspond ing S3-K and their words are sorted to S3-M.

S3-M	-	S3-K 🔹	Mundurukú 🗸 🗸	Kuruáya 👻	Número 🔻	Gloss 👻
ps-ks	+	b	o-psą, -ksą	ó-bią	87	fígado
s	+		səsən (sət)		410	ter vergonha, envergonhar-se
t	+	t	tádo	taló	18	uxí, oxí (fruta, sp.)
		t	tajji	ó-taitſi	34	esposa (set II)
		t	pə-tét, bə-tét	o-b <del>i</del> -tet	81	nome
			i-pí, tají-pí		104	dor, doer
Å	+	Ą	ʧókṓn	t∫okãn	64	tucano
t/d	+	Øltl	təp, dəp, tə́p, də́p	t <del>i</del> p, l <del>i</del> p, <del>i</del> p	27	folha
		t/l	táp, dáp, tap, dap	tap, lap	29	cabelo
		t/l	ti/di, tí/dí, idi	títi, ti, li	30	água, líquido
		t	dajíp, tajíp	tákip	94	quente
			tạjit, dạjit		97	filha (do homem)
		t-l	toj, doj, tój, dój	loj, toj	101	sangue
		t-l	tiŋ, diŋ	tin, Iin	116	fumaça
			topsą, dopsą	tóbią, lóbią	229	070
		t	toąj-bé /doąj-bé	táj-b <del>i</del>	239	rabo
			kpot, 7ít/7it, t/dạj-pə́		278	filho
			tarêm, darêm, erep	í-patek	523	podre, estragado
t∫/d5	ŧ	d	ਕਤੁਰੰ, ਧੁੱਰੰ	o-d <del>i</del>	61	ír (ír embora)
		t∫-d	tj≘k, ka-dʒ⊋k	í-tʃɨk, ká-dɨk	82	frío
			చ్రర, గ్రర	o-dódó	103	ver
			கூḗm, ʧḗm		500	sair
t/n	ŧ	ťl	tấj, nấj, tãj, nãj	tãj, lãj	25	dente
		t/l	Jĩn-tốm, tõm, nõm	tốm, lốm	31	pó, massa
			takə́/nakə́, pənē		32	galho, ramo
		t-l	ngbə, tgbə	lomĩ, tomĩ, lõb <del>i</del>	221	naríz (set l)
			tąbá, ka-nąbá		240	raiz
w	+	w	wejîk	wedík	39	batata
		w	wija	wí[a-laj	91	saúva, formiga (sp.)
PivotTable V	'iew					

This correspond ence can be easily switched by simply swapping S3-M for S3-K:

By inserting S4-M after S3-M, we can observe the corresponde nce between Mundurukú root-intial CV sequences with those in Kuruáya:

S3-K	•	S3-M 🔻	Mundurukú 🗸 🗸	Kuruáya 🔹 🔻	Número 🔻	Gloss 🔹
b	+	ps-ks	o-psą, -ksą	ó-big	87	figado
d	+	ſ	(7)所	i-di	37	mãe
		ſ	ſſĸ	dik	38	mosquito, carapanã
		dз	Jidzáp	kidap	40	tapiri, tenda, abrigo
		tf/dg	ਕਤੁਰੰ, ਸੁੱਰੰ	o-d <del>i</del>	61	ír (ír embora)
		ſ	jjíbə, ijibənế	ídi-b <del>i</del> , i-b <del>i</del> , kóro-b <del>i</del>	503	cípó
k	+	k	kip	kip	98	piolho
I .	+	d	dajá	lája	7	fogo
		n	nõŋ-?á	lõŋ	20	pulga, bicho-de-pé
		d/n	da?ó-rḗk, na?ó-rḗk	lá?o	21	calango
		n	ta/da, tá/dá, we-nḗj	ta, la, we-lắ-ĩ	28	semente, caroço
		d	dajé-w, dajé	láĵoj	68	traíra (peixe, sp.)
m	+	m	məsə, məsək-ta	másik	75	mandioca
р	+	р	piŋá	pinã	51	anzol
		р	pạj-bá, paj-ba	píli	76	cobra (gen.)
t	+	t	tádo	taló	18	uxi, oxi (fruta, sp.)
		t	tajji	ó-taitʃi	34	esposa (set II)
		t	pə-tét, bə-tét	o-bi-tet	81	nome
		t/d	dajíp, tajíp	tákip	94	quente
		t/d	togj-bə́ /dogj-bə́	táj-b <del>i</del>	239	rabo
ţſ	+	ţſ	tſókőn	t∫okãn	64	tucano
ťl	+	t/n	tấj, nấj, tãj, nãj	tãj, lãj	25	dente
		t/d	táp, dáp, tap, dap	tap, lap	29	cabelo
		t/d	ti/di, tí/dí, idi	títi, ti, li	30	água, líquido
		ťn	Jĩn-tốm, tõm, nõm	tõm, lõm	31	pó, massa
t∫-d	+	tʃ/ʤ	tj̃⊋k, ka-dʒ⊋k	í-tfik, ká-d <del>i</del> k	82	frío
t-l	+	t/d	toj, doj, tój, dój	loj, toj	101	sangue
		t/d	tiŋ, diŋ	tĩŋ, lĩŋ	116	fumaça
		t/n	nabắ, tabắ	lomĩ. tomĩ. lõb <del>i</del>	221	naríz (set l)

S3-M	S4-M	•	S3-K 🔻	S4-K 🔹	Mundurukú 🔹 👻	Kuruáya 🔹 🔻	Número 🔻	Gloss 🔹
⊟t	а	+	t	а	tajſi	ó-taitʃi	34	esposa (set II)
	á	+	t	а	tádo	taló	18	uxi, oxi (fruta, sp.)
	é	+	t	е	pə-tét, bə-tét	o-b <del>i</del> -tet	81	nome
	Total	+						
⊟fl	ó	+	Ą	0	ʧókőn	tjokãn	64	tucano
	Total	+ - +						
l⊟t/d	а	Ē	t	á	dajîp, tajîp	tákip	94	quente
	ą	Ē						
	á/a	-	t/l	а	táp, dáp, tap, dap	tap, lap	29	cabelo
	ə/ə́	-	Ø/t/I	i	təp, dəp, táp, dáp	t <del>i</del> p, l <del>i</del> p, <del>i</del> p	27	folha
	i	+	t-l	ī	tiŋ, diŋ	tĩŋ, lĩŋ	116	fumaça
	í/i	+	t/l	i	ti/di, tí/dí, idi	títi, ti, li	30	água, líquido
	o	+	t	Ø	toąj-bé /doąj-bé	táj-b <del>i</del>	239	rabo
	ó-o	+	t-l	0	toj, doj, tój, dój	loj, toj	101	sangue
	Total	+-						
⊟tʃ/dʒ	é	-						
	ə́	+	d	ŧ	dਤੁਰੰ, ਧੁੰਰ <u>ੰ</u>	o-d <del>i</del>	61	ír (ir embora)
	ē	+	t∫-d	i	fj⊋k, ka-dʒ⊋k	í-tjik, ká-dik	82	frío
	ó	+						
	Total	+						
l⊟t/n	а	=						
	ą	-	t-l	o-ō	ngbə, tạbə	lomĩ, tomĩ, lõb <del>i</del>	221	naríz (set l)
	อ์/อั	+	t/l	ā	tắj, nắj, tãj, nãj	tãj, lãj	25	dente
	õ	+	t/l	õ	Jĩn-tốm, tốm, nộm	tỗm, lỗm	31	pó, massa
	Total	+						
l□w	а	-						
	е	-	w	e	wejîk	wedík	39	batata
	i	=						
	<u>i</u>	+	w	í	wjją	wíĵa-laj	91	saúva, formiga (sp.)
	Total	+						
PivotTable Vie	eiai							

## III. S3 across several languages

- There is no inherent limit to the number of segments or languages.
- Five languages: Mundurukú, Tapieté, Wayampi, Avá-Canoeiro, Kamayurá.
- i. Test S3 correspondences across all of these languages simultaneously.
- ii. Test CV correspondences.

#### S3-T (Tapieté) corresponding with the other four languages:

S3-T	•	S3-M 🔻	S3-W 🔻	S3-A 🔻	S3-K 🔻	Mundurukú 💦 💌	Tapieté 🔹 🔻	Wayampi 🔹 🔻	Avá-Canoeiro 🔻	Kamayurá 💦 🔻	Gloss
k	+		k	k	k	kisé	kise	k <del>i</del> se (empr.)	k <del>i</del> e	k <del>i</del> e-7i	faca
			k	k	k	taó, daó, tao, dao	tì-kãwế	kaŋ‴e / kaŋ‴er	kaŋ	kaŋ	0550
					k	pariwát	karai		maira	kara?ip	homem branco, civ
				k	k	ikopí	kaw-apua, kaw-usu,		kaw	kap	caba
m	+		m	m		-ktop, i-top	∫e-me	mẽ / men	men	i-7irű	marido
				ø		7ît, jo-pît	mĩJi		at <del>i</del>		pequeno
mb	+				р		mb <del>i</del> te			-piter-ip	meio
p	+		р	р	р	ŋeba	ti-pepo	pepű-kã	і-реро	і-реро	asa
		р	р	р	р	poJí	poh <del>i</del>	połj / po(w)łj (WA)	po <del>l</del> j	i-pow <del>i</del> j	pesado
			р	р	р	kabi-ók	pitu	p <del>i</del> a, p <del>i</del> sajé, p <del>i</del> tű	ipiaj, pitun	ipitun	noite, escuridão
			р	р	р	ajpãn, ísá	taʔɨ, pɨʔahu	p <del>i</del> au	i-p <del>i</del> au	i-p <del>i</del> au	novo, jovem
		ø	р	р	m/p	i, í	te-p <del>i</del>	pi	piŋ	mi, i-pi	pé
		7p/b	р	р	р	(7)pə, pá, bə, bá	po, te-po	ро	k‴ã, i-po	h‴ã, po	mão
			р	р		-opsą, -ksą	pi7a	pia-k‴e / pia-k‴er	p <del>i</del> a	i-pere	figado
r/h	+			ø	ø	tópa, dópa	rowa, howa		owa	owa	face, rosto
		t/n	Ø	Ø/r	ø	tấj, nấj, tãj, nãj	rãĩ, hãĩ	ãj	i-ãj, ni-rãj	aĩ	dente
		t/d	Ø	ø	7	táp, dáp, tap, dap	ha, ra	ap-ira	ар	7ар	cabelo
s	+		s	ţſ	ø	á, idé	su?u, hemo	รนใน	ţи	ne-u?u	morder, picar
		7ſ	Ø	ø	Ø	(7)ʃ, ʃí	si	ŧ	ŧ	ij-ŧ	mäe
síhi	• ±		Ø	ØІв	h	- en	so?o, ho?o, ro?o	070	о, -во	ha?o	came
t	+	ťſ		t	t	tjókốn	tűka		tukan	tukan	tucano
					t	tajįt, dajįt	tadzi			taj <del>i</del> t	filha
ţ٢	+		k	k	k	ſét	o-tje	a-ke	ker/k <del>i</del> r	e-ket	dormir
tr	+		Ø	ø	t/r	baj	tu, ru	u	papaj, uw	apa, tup, je=rup	pai
w	+		s	w		wá?odá	wasu-wasu	so?o	watju		veado
			<b>w/</b> β	w	w	įpí	iwi	<del>i</del> wi / iβi (WA)	iwi, ij-a	iwi	terra, solo, chão
				ø	Ø	-JíJí, -Jírí	-k∾e, wasu		-иви, -и	-u	AUMentativo
						<u>a</u> dzém	wãhe		ik	o- <del>i</del> k	chegar
							cules.	ulies.	ulico miel ulico	udeo.	naccarinha náccar

PivotTable View

#### S3-M (Mundurukú) corresponding with the other four languages:

S3-M	•	S3-T 🔻	S3-W 🔻	S3-A 🔻	S3-K 🔻	Mundurukú 💎 🔻	Tapieté 🔹 🔻	Wayampi 🔹 🔻	Avá-Canoeiro 🔻	Kamayurá 🔹 🔻	Gloss
р	+	р	р	р	р	poJí	poh <del>i</del>	połj / po(w)łj (WA)	ројј	i-pow <del>i</del> j	pesado
						pəw	pedzu	peju	o-peju, p <del>i</del>	ja-p <del>i</del>	soprar, assoprar
						pósຈຶ່ກ	mõha			moaŋ, i-hoaŋ	remédio
s	+ -					səsən (sət)	mãrã, p <del>i</del> hu			otsĩ	ter vergonha, enverg
t	+	h		ø	ø	i-pí, tají-pí	has <del>i</del>		a <del>i</del> , i-a <del>i</del>	-a <del>i</del>	dor, doer
ţ	+ -	t		t	t	tjókốn	tűka		tukan	tukan	tucano
t/d	+					topsą, dopsą	pi?a	upi?a	upia, supia	-rupi?a, upi?a	070
		r/h	ø	ø	7	táp, dáp, tap, dap	ha, ra	ap-ira	ар	7ap	cabelo
						ti, di, tí, dí	ŧ	ŧ	ŧ	7 <del>i</del>	água, líquido
		h	Ø	ø	h	dajíp, tajíp	haku	aku	akup, i-akup	hakup	quente
			s	t		tiŋ, diŋ		tata-sĩ	tata-tiŋ		fumaça
tſ/ʤ	+ -	h	Ø		r	क्दर्ठ, मुर्ठ	heja	esa	a-mae	ne=re <b>t</b> sak	ver
t/n	+	r/h	Ø	Ø/r	ø	tấj, nấj, tấj, nấj	rãĩ, hãĩ	ãj	i-ãj, ni-rãj	aĩ	dente
w	+	ዋ		ø	ø	witá-?a	dzita-ki		ita	ita	pedra
						witő		mitű	mitű	m <del>i</del> tű	mutum
						wejîk	∫ure, dzet <del>i</del>		jit <del>i</del> ka	jet <del>i</del> k	batata
						wa?í?a	ti?iwa		ia	i7a	cabaça
7	+ -					7á, 7a	i7a	7a	а	i-7a	fruta
		ŧ	ŧ	( <del>i</del> )	i	7ip, 7íp	iwira	?i, iwira / iβira (WA)	<del>i</del> w <del>i</del> ra, w <del>i</del> ra	iwira	árvore, madeira, pau
		Ø	7	ø	7	7át, 7at	а	7a	о- <del>і</del> в, о-j <del>i</del> pira	o-kuj, 7at	cair
		h				7ó/7o, kốn	karu, ho?u		u, o-u	o-?u, a-karu	comer
						7ot-pə́					larva, bicho-de-pau,
						7é	mbe?u		е	ja-7e	dizer
٦٢	+	S	Ø	ø	Ø	(7)斤 斤	si	ŧ	ŧ	ij-i	mäe
7p/b	+	р	р	р	р	(7)pə, pá, bə, bá	po, te-po	ро	k‴ã, i-po	h‴ã, po	mão
						(7)pído, bído	tűtűhẽ	<del>i</del> witu / iβitu (WA)		m <del>i</del> tu, i-p <del>i</del> tu	ar, respiração, respi
Grand	T ±										

PivotTable View

#### S3-W (Wayampi) corresponding with the other four languages:

S3-M 🔻	S3-T 🔻	S3-A 🔻	S3-K 🔻	Mundurukú 💦 💌 🔻	Tapieté 🔹 🔻	Wayampi 🔹 🔻	Avá-Canoeiro 🔻	Kamayurá 🔹 🔻	Gloss
		k	k	ſep		ka	i-kaw	i-kap	banha, gordura
	k	k	k	kisé	kise	k <del>i</del> se (empr.)	k <del>i</del> e	k <del>i</del> e-?i	faca
	k	k	k	taó, daó, tao, dao	tì-kãwê	kaŋ‴e / kaŋ‴er	kaŋ	kaŋ	0550
	Ą	k	k	∫ét	о-ђе	a-ke	ker/k <del>i</del> r	e-ket	dormir
Count of S	з-т з								
	m	m		-ktop, i-top	∫e-me	mẽ / men	men	i-7irũ	marido
Count of S	3-T 1								
	р	р	р	ŋeba	ti-pepo	pepű-kã	i-pepo	i-pepo	asa
р	р	р	р	polí	poh <del>i</del>	po <del>i</del> j / po(w) <del>i</del> j (WA)	po <del>i</del> j	i-pow <del>i</del> j	pesado
	р	р	р	kabi-ók	pitu	p <del>i</del> a, p <del>i</del> sajé, p <del>i</del> tű	ipiaj, pitun	ipitun	noite, escuridão
	р	р	р	ajpãn, ísé	taʔɨ, pɨʔahu	p <del>i</del> au	i-p <del>i</del> au	i-p <del>i</del> au	novo, jovem
ø	р	р	m/p	i, í	te-p <del>i</del>	pi	p <del>i</del> ŋ	mi, i-pi	pé
	ø	р	р		hũwa, hũ	piũ, pijũ	pitun	pitsun	preto
?p/b         p         p         p         (?)pə, pá, bə, bá         po, te           p         p         -opsą, -ksą         pi?a		po, te-po	ро	k‴ã, i-po	h‴ã, po	mão			
		pi7a	pia-k‴e / pia-k″er	p <del>i</del> a	i-pere	figado			
		р	р	tit, tít, dit, dít		poti / potir	pot <del>i</del> s	i-pot <del>i</del> r-a	flor
Count of S	3-T 8								
	w	w		wá?odá	wasu-wasu	so7o	watju		veado
	s	ţſ	ø	á, idé	su?u, hemo	su?u	ťји	ne-u?u	morder, picar
t/d		t		tiŋ, diŋ		tata-sĩ	tata-tiŋ		fumaça
Count of S	3-T 2								
	w	w	w	wásễ	w <del>i</del> ra	w <del>i</del> ra	wira-miri, wira	w <del>i</del> ra	passarinho, pássaro
Count of S	3-T 1								
	w	w	w	jpí	łwi	<del>i</del> wi / iβi (WA)	<del>i</del> w <del>i</del> , <del>i</del> j-a	łwi	terra, solo, chão
Count of S	3-T 1								
7	Ø	ø	7	7át, 7at	а	7a	о- <del>і</del> в, о-j <del>i</del> p <del>i</del> ra	o-kuj, 7at	cair
Count of S	3-T 1								
	S3-M • Count of S Count of S P Ø 7p/b Count of S Count of S Count of S Count of S	S3-MS3-TKkkkkfCount of S3-TAPPP	S3-M     S3-T     S3-A       k     k       k     k       t     k       t     k       t     k       t     k       t     k       t     k       t     k       t     k       t     t       Count of S3-T     1       Count of S3-T     1       P     P       P     P       P     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       Ø     P       P     P       Ø     P       Ø     P       Ø     P       Ø     P       P     P       Ø     P       Ø     P       Ø     P       Ø     K       Ø     K       Ø     K       Count of S3-T     1       Y     Ø       Ø     Ø    <	S3-M       S3-T       S3-A       S3-K         k       k       k         k       k       k         k       k       k         k       k       k         tf       k       k         Count of S3-T       3       3         Count of S3-T       1       3         Count of S3-T       1       3         P       P       P         P       P       P         P       P       P         P       P       P         Ø       P       P         Ø       P       P         Ø       P       P         Ø       P       P         Ø       P       P         Ø       P       P         Ø       P       P         Ø       P       P         Count of S3-T       8       S         Yd       Y       Y         V       W       W         Count of S3-T       1       S         Y       Ø       Y       Y         Count of S3-T       1       S         Y <td>S3-MS3-TS3-AS3-KMundurukú<math>\bullet</math>kkkjepkkkkisékkkjepkkkjeptimekkjeptimemmkCount of S3-T3-ktop, i-topCount of S3-T1-ktop, i-topCount of S3-T19pppolípppolípppolípppolíjppppjpán, ísáØppjppjjjjjjjØjjØjjØjjj</td> <td>S3-MS3-AS3-KMundurukúTapietéTapietékkkfepkkkkisékkkkisékkkkisékkkfétcount of S3-T3mm-ktop, i-topfe-meCount of S3-T1ppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíjppppppppipppppppppppppppijpppijpjititititiititijidijidiiidiiidiiidiiidiiidiiidijidii&lt;</td> <td>S3-T       S3-A       S3-K       Mundurukú       Tapieté       Wayampi         k       k       k       fep       ka         k       k       k       kisé       kise         k       k       k       kisé       kise         k       k       k       kisé       kise         k       k       k       fét       o-tje       a-ke         Count of S3-T       3      </td> <td>S3-T       S3-A       S3-K       Mundurukú       Tapieté       Wayampi       Avá-Canceiro *         k       k       k       jep       ka       H-kaw         k       k       k       kisé       kise       kise (empr.)       kie         k       k       k       k       kisé       kise       kise (empr.)       kie         k       k       k       k       ka       fét       o-tje       a-ke       kar/*e / kar/*er       kan         Count of S3-T       3       -       -       men       men       men       men         Count of S3-T       1       -       -       pepů-kå       i-pepo       pepů-kå       i-pepo         p       p       p       p       políf       pohi       poij / po(W)ij (WA)       poij         p       p       p       políf       pohi       poij / po(W)ij (WA)       poij         Ø       p       p       políf       pohi       pia, ipiun       ipia, pisaje, pitů       ipia, pitun         Ø       p       p       m/p       j, í       te-pi       pi       pin         Ø       p       p       (?), po, pá, bə, bá</td> <td>S3:M       S3:T       S3:A       S3:K       Mundurukú       Tapieté       Wayampi       Axá-Canoeiro       Kamayurá       *         k</td>	S3-MS3-TS3-AS3-KMundurukú $\bullet$ kkkjepkkkkisékkkjepkkkjeptimekkjeptimemmkCount of S3-T3-ktop, i-topCount of S3-T1-ktop, i-topCount of S3-T19pppolípppolípppolípppolíjppppjpán, ísáØppjppjjjjjjjØjjØjjØjjj	S3-MS3-AS3-KMundurukúTapietéTapietékkkfepkkkkisékkkkisékkkkisékkkfétcount of S3-T3mm-ktop, i-topfe-meCount of S3-T1ppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíppppolíjppppppppipppppppppppppppijpppijpjititititiititijidijidiiidiiidiiidiiidiiidiiidijidii<	S3-T       S3-A       S3-K       Mundurukú       Tapieté       Wayampi         k       k       k       fep       ka         k       k       k       kisé       kise         k       k       k       kisé       kise         k       k       k       kisé       kise         k       k       k       fét       o-tje       a-ke         Count of S3-T       3	S3-T       S3-A       S3-K       Mundurukú       Tapieté       Wayampi       Avá-Canceiro *         k       k       k       jep       ka       H-kaw         k       k       k       kisé       kise       kise (empr.)       kie         k       k       k       k       kisé       kise       kise (empr.)       kie         k       k       k       k       ka       fét       o-tje       a-ke       kar/*e / kar/*er       kan         Count of S3-T       3       -       -       men       men       men       men         Count of S3-T       1       -       -       pepů-kå       i-pepo       pepů-kå       i-pepo         p       p       p       p       políf       pohi       poij / po(W)ij (WA)       poij         p       p       p       políf       pohi       poij / po(W)ij (WA)       poij         Ø       p       p       políf       pohi       pia, ipiun       ipia, pisaje, pitů       ipia, pitun         Ø       p       p       m/p       j, í       te-pi       pi       pin         Ø       p       p       (?), po, pá, bə, bá	S3:M       S3:T       S3:A       S3:K       Mundurukú       Tapieté       Wayampi       Axá-Canoeiro       Kamayurá       *         k

#### S3-A (Avá-Canoeiro) corresponding with the other four languages:

S3-A	•	S3-M 🔻	S3-T 🔻	S3-W 🔻	S3-K 🔻	Mundurukú 💦 🔻	Tapieté 🔹 🔻	Wayampi 🔹 🔻	Avá-Canoeiro 💌	Kamayurá 🔹 💌	Gloss
k	+ -			k	k	ſep		ka	i-kaw	i-kap	banha, gordura
			k	k	k	kisé	kise	k <del>i</del> se (empr.)	k <del>i</del> e	k <del>i</del> e-?i	faca
			k	k	k	taó, daó, tao, dao	ŧ-kãwẽ	kaŋ‴e / kaŋ‴er	kaŋ	kaŋ	0550
			Ą	k	k	∫ét	o-tje	a-ke	ker / k <del>i</del> r	e-ket	dormir
			k k ikopí				kaw-apua, kaw-usu,		kaw	kap	caba
		Count of S	S3-T 4								
m	+		m	m		-ktop, i-top	∫e-me	mẽ / men	men	i-7irũ	marido
		Count of S	S3-T 1								
р	+		р	р	р	ŋeba	ti-pepo	pepű-kã	i-pepo	і-реро	asa
		р	р	р	р	poJí	poh <del>i</del>	połj / po(w)łj (WA)	po <del>i</del> j	i-pow <del>i</del> j	pesado
			р	р	р	kabi-ók	piłtu	p <del>i</del> a, p <del>i</del> sajé, p <del>i</del> tű	ipiaj, pitun	ipitun	noite, escuridão
			р	р	р	ajpãn, ísé	ta?i, pi?ahu	p <del>i</del> au	<del>i</del> au <mark>i-p<del>i</del>au</mark>		novo, jovem
		Ø p p		р	m/p	i, í	te-p <del>i</del>	pi	piŋ	mi, i-pi	pé
		Ø p p			р		hũwa, hũ	piũ, pijũ	pitun	pitsun	preto
		p     p     p     nuwa,       p/b     p     p     p     (?)pa, pá, ba, bá     po, te-p				(7)pə, pá, bə, bá	po, te-po	ро	h‴ã, po	mão	
		p p - opsą, -ksą					pi7a	pia-k‴e / pia-k″er	<mark>p<del>i</del>a </mark> i-pere		figado
				р	р	tit, tít, dit, dít		poti / potir	роt <del>і</del> в	i-pot <del>i</del> r-a	flor
		Count of S	63-T 8								
r	+		ø		ø		ti-reko		tfi-remireko	emireko	esposa (set l)
		Count of S	S3-T 1								
t	+	ų	t		t	tjókốn	tűka		tukan	tukan	tucano
		t/d		s		tiŋ, diŋ		tata-sĩ	tata-tiŋ		fumaça
		Count of S	S3-T 1								
ţ	+		s	s	ø	á, idé	su?u, hemo	su?u	ťји	ne-u?u	morder, picar
		Count of S	S3-T 1								
w	+ -		w	s		wá?odá	wasu-wasu	so7o	watju		veado
			w	w/β	w	įpí	iwi	<del>i</del> wi / iβi (WA)	<del>i</del> w <del>i</del> , <del>i</del> j-a	łwi	terra, solo, chão
, PivotT	able	View									

#### S3-K (Kamayurá) corresponding with the other four languages:

S3-K	•	S3-M 🔻	S3-T 🔻	S3-W 🕶	S3-A 🔻	Mundurukú 💎 🔻	Tapieté 🔹 🔻	Wayampi 🔹 🔻	Avá-Canoeiro 🔻	Kamayurá 💦 💌	Gloss
k	+			k	k	jep		ka	i-kaw	i-kap	banha, gordura
			k	k	k	kisé	k <del>i</del> se	k <del>i</del> se (empr.)	k <del>i</del> e	k <del>i</del> e-7i	faca
			k	k	k	taó, daó, tao, dao	ŧ-kãwẽ	kaŋ‴e / kaŋ‴er	kaŋ	kaŋ	0550
			Ą	k	k	∫ét	o-tje	a-ke	ker / k <del>i</del> r	e-ket	dormir
			k			pariwát	karai		maira	kara?ip	homem branco, civ
	k k ikopí ka					ikopí	kaw-apua, kaw-usu,		kaw	kap	caba
		Count of S	3-T 5								
m/p	+	Ø	р	р	р	i, í	te-p <del>i</del>	pi	piŋ	mi, i-pi	pé
		Count of S	3-T 1								
р	=		р	р	р	ŋebạ	ti-pepo	pepű-kã	i-pepo	i-pepo	asa
		р	р	р	р	poJí	poh <del>i</del>	po <del>i</del> j / po(w)ij (WA)	po <del>i</del> j	i-pow <del>i</del> j	pesado
			р	р	р	kabi-ók	pitu	p <del>i</del> a, p <del>i</del> sajé, p <del>i</del> tű	ipiaj, pitun	ipitun	noite, escuridão
			р	р	р	ajpãn, ísé	taʔɨ, pɨʔahu	p <del>i</del> au	i-p <del>i</del> au	i-p <del>i</del> au	novo, jovem
		Ø p p hũwa, h					hũwa, hũ	piũ, pijũ	pitun	pitsun	preto
		<b>?p/b p p p</b> (?)pə, pá, bə, bá po, tr					po, te-po	ро	k‴ã, i-po	h‴ã, po	mão
				р	р	tit, tít, dit, dít		poti / potir	bot <del>i</del> R	i-pot <del>i</del> r-a	flor
			mb				mb <del>i</del> te			-p <del>i</del> ter- <del>i</del> p	meio
		Count of S	3-T 7								
r	=	ʧ/ୟ	h	Ø		අපුර, ජූර	heja	esa	a-mae	ne=retsak	ver
		Count of S	3-T 1								
t	=	Ø	h/r	Ø	ø	é	hape, rape	pee ~ ape	ape	tape	caminho
		Ą	t		t	ʧókốn	tűka		tukan	tukan	tucano
			h/r	Ø	ø	pətét, bətét	he, ti-re-7e	e / er	er-a	tet	nome
			t			tajįt, dajįt	tadz <del>i</del>			taj <del>i</del> t	filha
		Count of S	3-T 4								
t/r	=		t/r	Ø	ø	baj	tu, ru	u	papaj, uw	apa, tup, je=rup	pai
		Count of S	3-T 1								
PivotT	able	View									

These correspondences can be pivot charted: S3-T (Tapieté) corresponding with the other four languages, along with their counts:



#### CV correspondences across all of the languages can be achieved: S3-M and S4-M is sorts all potential correspondences in the other four languages:

S3-M 🔻	S4-M	•	Mundurukú 🔹 🔻	S3-T 🔻	S4-T 🔻	Tapieté 🔹	S3-W 🕶	S4-W -	Wayampi	• S3-K •	S4-K▼	Kamayurá 🔻	S3-A 🔻	S4-A 🕶	Avá-Canoeiro
р	ə	+													
	o	+	poJí	р	0	poh <del>i</del>	р	0	połj / po(w)łj (WA	V P	0	i-pow <del>i</del> j	р	0	po <del>i</del> j
	ó	+													
	Total	+-													
s	อ้	+													
	Total	+													
t	а	-													
	Total	+ - +	<i></i>		-	<i></i>	_								
ţ	Ó	-	tjókön	t	ū	tüka				t	u	tukan	t	u	tukan
t d	Total	-	tán dán tan dan	- ih	-	he re	a	-	an ira	2	-	2-5	a	-	
ua -	а	-	tap, dap, tap, dap	m	a	na, ra	Ø	a	ap-ira	( L	a	rap	Ø	a	ap alwar i alwar
		+	dajip, tajip	n	а	паки	Ø	а	аки	n	а	пакир	Ø	а	акир, гакир
	1	-+													
	í/i	-													
	0	Ē													
H(1-	lotai ∡	-+		-	-	le e Ce	a	-	1121	_		and a more that a la			
l d'urag	O Total	-+	व्ह०, पु०	n	e	neja	Ø	е	esa	r	е	ne-reisak			a-mae
t/n	5/5	+													
	Total	+													
7	á/a	+	7át. 7at	ø	а	а	7	а	7a	7	а	o-kui. ?at	ø	ŧ	о- <del>і</del> к. о-і <del>і</del> ріга
	é	+										, <b>,</b> ,			
	íli	+													
	0	+													
	ólo	+													
	Total	+													
7p/b	á/ə	+	(7)pə, pá, bə, bá	p	0	po, te-po	p	0	ро	p	0	h‴ã, po	p	0	k‴ã, i-po
	í	+	(VE -) E -) = -/ = -												···
	Total	+													
Grand Tot	al	+													

# IV. Approaching phonemic reconstruction

- With this methodology, we have a set of useful tools that are particularly applicable to tracking sound changes.
- Once the analyst works out a phonemic reconstruction based on the results obtained from the methods demonstrated above, they can be entered in their own proto-language data entry form.

### **Proto-language Data Entry Form:**

🔎 Programma de Fonologia Experimental e Histórica - [Mundurukú Data Entry Form]											
Eile Edit View Insert Format Records Tools Window	Help Adobe PDF			Type a question f							
: 🔽 •   🛃   🛃 💁 🗳   ≵ 🗈 🛍   ୭   ≙↓ ≾↓   🍞 🛅 🍸	'   🏦   🕨 🗰   🚰   📑 🐂 🛛 😦 📜	→ Arial Unicode M	5 - 8 - <b>B</b> <u>I</u> <u>U</u>	≣≣≣  <u>♪</u> •  <u>4</u> •  <u>4</u> •							
Proto-Tupí-Guaraní Entry		Switchboard	Open Master Cognate S	ets Semantic Shift							
Master Gloss Entry	Proto-Tupí-Guaraní Data Entry		Proto-Language	s							
Number: 7	Word: *tata	Morph. Gl.:	Proto-Tupi	atia							
Port. Gloss: fogo	Morph. Cat.:	Entered by: GP	Proto-Tupari								
Eng. Gloss: fire	Notes:	Date:	3/21/2007 Proto-Munduru	cú 🛛							
Notes: see also "lenha"	Open Proto-Tupí-Guaraní Data Entry Table	Open Proto-Tupí-Guaraní Seg	mentation Proto-Tupi-Guar	aní <sup>*</sup> tata							
Segmentation of Proto-Tupí-Guaraní Entry:		Proto-Tupí-G	uaraní Notes:								
<u></u>	<u>S6 S7 S8 S9</u>	S10 (AutoNu mber)		×							
- 🎽 - 🗾 t 🎽 a 🗹 t 🗹	a 🔟 - 🔟 - 🔟 - 🔟	. •									
F1: - F1: - F1: - F1: - F1: - F1	l: - F1: - F1: - F1: -	F1: -									
F2: - F2: - F2: - F2: - F2: - F2	2: - F2: - F2: - F2: -	F2:									
Tupí											
Arikem	Mondé	Mundurukú									
Karitiana Akunsu Malawén	Arua	Mundu	iruku daja								
Awetí Sakirabiá (Mekens)	o-tat Gavião										
Awetí Tuparí	kopkap Salamãy (Mondé)	Jurúna									
Ayuru	Suruí	Jurú	na								
Sateré-Mawé aria	Zoró	Xipa	ya								
Puruborá											
Puruborá	can										
				<b>   </b>							
		iis		-							
Guaraní Antigo Kokama	Asuriní do Xingú		Kamayurá tata								
Record: 14 7 > > > > > 6 819											
Form View											

A pivot table and chart can be constructed in the same way as shown above:

We can track the progress of our reconstruction, and check the languageinternal distribution of the (proto-) segments which will aid in preventing possible cases of skewed occurrences.



# V. An experiment: Features

- Each segment has two fields associated with it (F1 and F2) that can store any type of feature the user finds relevant.
- This has been used to generate syllable templates and track the distribution of nasality.

🔎 Programma de Fonologia Experimental e Histórica - [Mundurukú Data Entry Form]											
Eile Edit View Insert Format Records Tools Window	v <u>H</u> elp Ado <u>b</u> e PDF				Type a question						
Ĩ 🔽 • I 🛃 🖪 🔍 🂝 I X 🗈 🛍 I "୨ I ᢓ↓ X↓ Tỹ 🏹 🦷	7   🏦   🕨 🙌   🚰   🧾 🏪 +   🎯 💂 📒	→ Arial Unicode N	45 🝷 8	• B I <u>U</u>   = =	E =   b +   <u>A</u> +   🚄						
Mundurukú Data Entry		Switchboard	Open Master	Cognate Sets	Semantic Shift						
Master Gloss Entry	Mundurukú Data Entry		Proto-Language								
Number: 7	Word: daʃá	Morph. Gl.:		Proto-Tupi	atia						
Port. Gloss: fogo	Morph. Cat.:	Entered by: GP		Proto-Tupari							
Eng. Gloss: fire	Notes:	Date:	3/21/2007	Proto-Mundurukú							
Notes: see also "lenha"	Open Munduruku Data Entry Table	Open Munduruku Segmenta	tion Table	Proto-Tupi-Guaraní	tata						
Segmentation of Mundurukú Entry:		Mundurukú N	lotes:								
S1 S2 S3 S4 S5	S6 S7 S8 S9	S10 1 The p	honeme /ŋ/ is phonet	ically [ɲ] syllable-initially.	×						
d - a - j -	á 🖬 - 🛨 - 🛨 - 🛨	- •									
F1: -	F1: - F1: - F1: - F1: -	F1: - (AutoNu mber)			<b>X</b>						
F2: - F2: - F2: O F2: N F2: O F	F2: N F2: - F2: - F2: -	F2: -									
Тирі											
Arikem	Mondé	Munduruki	í								
Karitiana Akunsu Matumán	Aruá	Mund	urukú dajá								
Awetí Mekens)	otat Gavião		laya								
Awetí Tuparí	kopkap Salamãy (Mondé)	Jurúna									
Sateré-Mawé Ayuru	Suruí	Jun	úna								
Sateré-Mawé	Zoró	Xipa	aya								
Pumborá Bamarama											
Puruborá Karo	l can										
Tupí-Guarani											
Subgroup      Subgroup	Subgroup V		Subgroup VII	hata							
Record: III III 7 DINE Kokama	Asurini do Xingú		Kamayura	tata							
Form View											

🔎 Progra	nma de Fono	ologia Exp	erimenta	al e Histó	rica - [M	unduru	ku pros	ody (exp	erimen	t) : Sele	ct Quer	y]				
i 📑 🛛 Eile	<u>E</u> dit <u>V</u> iew	PivotTab	le <u>T</u> ools	<u>W</u> indow	v <u>H</u> elp	Ado <u>b</u> e	PDF								Тур	
1		*	- B	ΙU	≣≣	≡   ≤	≥ -   A	-   🧾		🗹 -   🖁	1 🖏	<b>a</b> 🖪		$\begin{smallmatrix} \mathbf{A} \\ \mathbf{Z} \\ \mathbf{Z} \\ \mathbf{A} \\ \mathbf{A} \\ \mathbf{\Sigma} $	🎰 🔍 🏷   🗄 🌿 🎁 🖬   📍   🎐   🔳   🖀   🧰	
3: σ	▼ 4: σ ▼	5: σ 🕶	6: σ 🕶	7:σ•	· 8: σ	• S1	▼ S2	▼ S3 ▼	s4 •	S5 🗸	S6 🕶	S7 🕶	S8 🕶	Mundurukú 🚽 🔻	Número 🕶 Gloss 🔹 👻	
80	ΘN	Ξ.	Ξ.	Ξ.	-	+ -	-	t/d	í/i	-	-	-	-	ti, di, tí, dí	<sup>30</sup> água, líquido	
						-	-	7ſ	í/i	-	-	-	-	(7)ji, jí	<sup>37</sup> mãe	
						-	-	7p/b	á/ə	-	-	-	-	(7)pə, pá, bə, bá	<sup>84</sup> mão	
						-	-	7	é	-	-	-	-	7é	518 dizer	
						Co	unt of M	lunduruk	ú					4	4	
					Total	± Co	unt of M	lunduruk	ú					4	4	
				Total		± Co	unt of M	lunduruk	Ú					4	4	
			Total			± Co	unt of M	lunduruk	Ú					4	4	
		¤ø	Ξ.	Ξ.	-	+ -	-	tj∕dz	ó	Ø	-	-	-	<b>கு</b> ó, ʧó	103 <sub>VØ</sub> r	
						Co	unt of M	lunduruk	ú					1	1	
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			Total				Count of Mundurukú 1									
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						-	-	ť/d	а	р	-	-	-	táp, dáp, tap, dap	<sup>29</sup> cabelo	
						ſ	i	ďZ	á	р	-	-	-	∫idzáp	<sup>40</sup> tapiri, tenda, abrigo	
						-	ą	ďZ	ó	k	-	-	-	ąфók	<sup>43</sup> banhar-se	
						-	-	7	í/i	р	-	-	-	7ip, 7íp	<sup>113</sup> árvore, madeira, pau	
						-	â	b	í	k	-	-	-	ąbík	<sup>115</sup> sentar-se, sentado	
						-	-	t/d	i	ŋ	-	-	-	tiŋ, diŋ	116 fumaça	
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- Difficult to track the overall distribution of segments. For example, to check the distribution or environment of all the vowels in a language, there is at present to straightforward way to collect all of the vowels across any and all Segment fields.
- Sometimes querying an environment is necessary (i.e. Boolean): it is tedious to find all the occurrences of, for example, CVC, or anything more specific.
- Some management/stability/memory issues.
- Sometimes difficult to interpret results.
- Although all of the language data itself is stored in text files to preserve its declarative format, MS Access itself is not cheap.

### Conclusion

- BDEC-T presents a practical methodology that is easily and quickly implementable, and that makes use of a function that many people already have with their database or spreadsheet.
- i. Efficient: data analysis is quick pivot table and chart queries can be stored and easily printed.
- ii. **Precise:** the user ultimately has control over the correspondences through the segmentation interface. Potential mergers and splits can be tracked.
- iii. **Functional/Flexible:** any arrangement of Segment columns, features, glosses, words etc. can be related simultaneously across any number of languages.
- iv. Expandable: new features can be added or old ones rearranged to suit evolving needs. Can be mounted on the internet and accommodate several different users.

### Thank you!

Tyler Peterson tylerrp@interchange.ubc.ca

Gessiane Picanço picanco.g@hotmail.com