Transliteration on the Internet: The Case of Ethiopic

ዳንኤል ያዕቆብ መኰንን
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Introduction

In the later half of this century we are experiencing what has already for some time been dubbed the "Information Age". For many of us in this era the ability to exchange electronic text shapes the way we live, work, and even recreate. Unlike the printed mediums the information we receive electronically we can easily manipulate and repropogate. The variable of physical distance is all but eliminated to users in the electronic communication formula.

But this is only readily done for scripts of the developed world. In the developing world where the indigenous writing systems did not play a part in the computer revolution, societies and developers are now scrambling to cope with script interchange issues as the information age advances upon them. As if it were an elemental force in nature, two people at any distance apart in a common medium will be drawn towards each other to communicate with whatever means the medium allows. The "communicational potential" between them will be too strong for exchange not to happen; they will communicate, information will propagate.

In this article we will look at what happened when the information revolution began to subsume Ethiopic[1] script -the writing system used in present day Ethiopia and Eritrea. We will look briefly at the issues for why Ethiopic was caught unprepared as the Information Age dawned and what happened when the forces of communication were greater than the resistance of the medium to Ethiopic information interchange.

[1] "Ethiopic" is an ISO term to be certain, native users prefer the terms "Ge'ez" (ግዕዝ) or "Fidel" (ፊደል).

Background

The modern Ethiopic writing system is now roughly 500 years old. The origins of the script trace back through the Mino-Sabæan and ultimately lead to the Phoenician. The precursors to the modern script are found in Eritrea and Ethiopia as early as 1,000 BC. The script did not begin to resemble its modern form until the mid 4th century AD following the arrival of Syrian missionaries who would translate The Bible into the then dominant language Ge'ez. The writing direction would be reversed from right-to-left plow style to left-to-right regular style. The script would also become a syllabary.

The modern day script contains writing elements for twenty numerals, ten unique punctuation marks, and a syllabic domain of, to this day, uncertain size. Also noteworthy is that the script has only a single case and a cursive form is not used.

Syllabaries are generally of a known and manageable size, so it may come as some surprise the discovery that Ethiopic's full extent is still veiled in mystery. To be sure, few would argue over the elements of the stable syllabary of the last 5 centuries. This is often referred to as the "Amharic Syllabary", for the extensions upon the Ge'ez syllabary made for the literal practices in the language Amharic. The overwhelming mass of Ethiopic literature is in the languages Amharic, Tigrigna, Ge'ez, and lesser so in Oromigna, whose speakers have long literal traditions. The combined syllabary for these languages holds 36 consonant series in 7 syllables each. Most consonant series also have an 8th form and 6 series have a complete set of 12 forms for a total of 307 syllabic letters.

Of the no fewer than 82 languages spoken in the combined Ethiopia and Eritrea, many societies have only in this century entered into a literal tradition from an oral one. In so doing they would encounter that the Amharic syllabary would not be sufficient for representing all of their spoken sounds. New letters would then be introduced following the syllabary's intrinsic convention for the introduction of new syllables.

Writing extensions however were usually devised and offered to these peoples. Establishing that they have accepted the characters and made them a part of their present day writing practices is a major barrier to current standardization efforts (i.e. ISO-10646).

Foreground

When Ethiopic script first ventured onto the personal computer is uncertain but is likely to have occurred in late 1985. The Ethiopian Science and Technology Commission was behind early breakthroughs and soon formed the National Computer Center to lead computerization efforts. At the center's peak DOS 3.2 was disassembled and made completely Ethiopic. The same approach was repeated for at least ten popular softwares as work on new offerings developed by the center began to move forward.

Tragically, given the volatile political climate of the day, the Ethiopian Science and Technology Commission would not be in a position to standardize and direct the migration of Ethiopic script into the computer world. Most of the notable work that would follow the initial triumphs would happen outside of Ethiopia. Ethiopians in dispora, driven my hobbyist or commercial interest would repeat the first accomplishments and move forward with each new wave of progress by the computer industry. They would offer new software and adapted existing software to support Ethiopic. The ESTC would not keep pace with the industry and the pioneering work was soon antiquated[2].

[2] *The truly interested can still purchase from the ESTC "Agafari" the Ethiopic DOS operating system*

Without a central body at the core of this new industry progress made by individuals went on in isolation and in varied directions. There would be little, if any, communication between these pioneers who were now becoming market competitors. The field would grow and each new vendor would use his own character coding systems for Ethiopic. Different solutions would be applied to manage the more than 320 Ethiopic elements into the confines of the less generous ANSI. Some would apply multiple font systems, others would break Ethiopic into base forms and a series of diacritic marks in order to use a single font. The lesser used characters might be dropped from the syllabary, the lesser responsible developers would try to introduce completely new writing elements. In the more than 25 coding systems in use today; the range of characters available goes from a paltry 200 to an unlikely and bloated 480. None of the solutions would be satisfactory, and none of the solutions would be compatible.

This chaos of ever increasing character coding systems, exploding computer proliferation and numbers of computer users, would be the setting for the head-on collision that would happen next: The Internet.

The Need To Communicate

In the early 1990's Ethiopian (and now Eritrean) users of popular Internet communication services, such as email and network news, grew in number until in December of 1991 the first email list server was established for group communication within this community.

The problem of communication between varied computer systems, softwares, file and text formats was never more apparent. Users would go to the extremes of mailing uuencoded images of documents in desperate attempts to communicate in Ethiopic. Ultimately the community would have to work with what was available to everyone: Qwerty array keyboards with only Roman script to read and type.

The complications of communication in

Ethiopian languages with a foreign script would become apparent, and dynamically so. With each consecutive email posting, and even within the body of the same message, new renderings of Amharic words could be found. Without reservations authors would mix different rules from English's confusing orthography and sometimes with the Ethiopic keyboard mappings that their favorite software applied.

Subscribers began to copy one another's conventions and before long in this interface between a natural language and a foreign script there was a gradual convergence upon a transliteration creole of sorts. There would be less variance in word renderings but absolute consistency escaped, the arrival of new subscribers would also perturb the creole's convergence.

There was an underlying regularity that was invariant, particularly concerning the use of consonants. Truly, there was not an overwhelming concern for the issue among the regular subscribers, members were more or less content to make cognitive inferences to reconcile the lax writing practices.

A few developers however saw the potential for what a regular and consistent system would offer. With a regular system these ASCII email files could easily be translated by computer software. The possibility was at hand for users to use their Ethiopic software to import and export email messages. While it would be inconvenient to have to use two software package to read Ethiopic email, it would be a first step. More importantly a common ground would be introduced for Ethiopic text interchange, a system that was not tied to any one vendor, a system that was human readable and did not require special software to compose, an intuitive system that people were more or less using already.

Transliteration

Work began on a formal and rigorous transliteration system that would later become "The System for Ethiopic Representation in ASCII", or SERA. The issue of representing Ethiopic text in a conversion alphabet was nothing new. The application and constraints of the problem in electronic media however, were probably being faced for the first time.

Before going further it is useful now to address exactly what transliteration is and what it is not. It has been the author's experience that some amount of confusion surrounds the use of the two terms "transliteration" and "transcription" -related but critically different practices in the conversion of a system of writing.

The best way to clarify the difference is with an example; lets illustrate the two with the salutation "ሰላም ጓደኞቼ" for "Greetings my friends". In a transliteration system our goal is simply to map character for character the Ethiopic script to a target syllabary or alphabet such as Latin. The result in SERA would surface as "selam gWadeNocE", or in the working ISO/TC46/SC2 standard which applies only the single case "selam gwade'noche'". If we are careful to restrain our mappings to being 1-to-1 we also create a reversible system and can retransliterate the Latin back into Ethiopic without loss of content. Both SERA and the ISO standard are reversible transliteration systems.

It is not of necessity that a transliteration system attempt to preserve the spoken level of the text elements but it is usually practical to do so. For instance, were we to consider only the transfer of text elements we could apply a transliteration system that marked syllables by their numeric order and render "s1l2m6 g8d1N8c5". The numbers however are considerably less natural to read than a system applying vowels. At the other extreme is "sälam g^{w}adäñočē" under a phonetic system. The phonetic alphabet goes further to preserve the spoken level (minus gemination) but would also be unnatural to the average user.

Transcription goes a step further and considers not just the target script but the writing practices of a target language that uses the target script. A transcription system will apply capitalization to proper nouns, doubling of geminated words, and inflict the "norms of irregularity" upon the transcribed words in the orthographic conventions of the target writing system. For instance our

example phrase in American or British English might render as "selam gwaddegnochay" there would be little debate concerning the transcription of "selam" which happens to also match its transliteration. "ኝ" however may take the forms "ng", "gn", and "ny" probably without doubling of one of the two radicals -though transliterated into Spanish as "ñ" would certainly be doubled. "ቼ" could transfer as "chay", "chei", "chie", "chae", "che", "chai", and perhaps even "cheigh" with more or less mutual acceptance.

It is important to point now out that a transcription system is also *not* necessarily a 1-to-1 mapping as the above example helps illustrate. Rather, such a transcription system would be an exceptional (or trivial) case. Other complications have crept into Ethiopic. In Amharic, the largest spoken language using Ethiopic script, there are 4 syllabic series in the phoneme base of "he" (ሀ, ሐ, ኀ, and ኸ) that would all map onto the English "h" plus a vowel. In Tigrigna, another language using Ethiopic, there are only two series in "he" (ሀ, ኀ) that map onto "h". In Ge'ez, the language for which the script has its namesake, only ሀ would map onto "h".

Again we see transcription will fail to be reversible but it is not applied for that purpose. At the time the need was found to devise SERA a nearly 30 year old system for the transcription of Ethiopic text was in use by the Institute of Ethiopian Studies in Addis Abeba (though applying doubling the system is erroneously referred to a "transliteration"). The IES system is used largely for bibliographic purposes and cataloging of the library's collection and less frequently for the transcription of a complete manuscript.

The IES transcription system would not be able to solve the problem of electronic text interchange for Ethiopic. In addition to the reversibility problems discussed; the IES system is not typographically possible with a standard PC keyboard. Further, many elements would require 8 bits for interchange or are not found in the IS0-8859-1 or ISO-8859-2 sets. The last failing of a transcription system for the average Ethiopian user was that it would require a very strong command of English. Transcription of many words would be a challenge even to native speakers!

SERA would have to be simpler for the average user to learn and apply, it would have to be a transliteration system. Initial considerations were also that SERA be easy to type and read as well as implement readily in transliteration and retransliteration algorithms with the basic "macro" languages used by software of the day. Since text had to be transferred through all existing Email gateways it was also a requirement that the system apply only 7 bit characters. Finally, as it was also the prevalent practice in email exchanges to mix English with Ethiopian languages SERA would also have to provide a mechanism to indicate a change of scripts.

Of Utility and Things To Come

In the experience of the application of SERA over the last 4 years it has been the exception rather than the norm that it be used in the email exchanges for which it was devised. Except for the occasional exchange of sizeable length, users generally do not make the effort to write in the more rigorous manner that SERA demands.

The mechanism of transliteration to escape the volatile character code realities of Ethiopic has in several instances been realized. Users of Multilingal Emacs' (Mule's) "Ethiopic Mode", which applies SERA, will not notice that the Ethiopic font has changed to the working Unicode/ISO-10646 specification. No documents will be effected. Mule also applies SERA based escape sequences for Ethiopic TEX support. This is of some very high practical value when considering the migration of the TEX community to Unicode. Before then, Ethiopic TEX users may wish to start using the newly released `ethiop` package for Ethiopic support in `Babel`. The `ethiop` package applies a secondary transliteration system as well as a new character coded font. Again, the qualitative Ethiopic text for Mule users remains impervious to these changes.

The need to handle Ethiopic in 7 bit environments has given SERA additional application areas that were never expected. As an input method for Ethiopic text SERA (and a modified version

known as SERA-IM) have been applied in Ethiopic versions of UNIX "talk", IRC-Chat, a web based "Chat Room" interface, text editors including Mule, and one commercial product.

Finally, and most unexpectedly, for Ethiopic document Optical Character Recognition (OCR) by one researcher in Czechoslovakia. When his Macintosh operating system could not provide a way to store the addresses of Ethiopic character glyphs, SERA mapping were used instead. This growing collection of work has been online as the "Library of Ethiopian Text". Browsing world wide web with the Mule editor this collection is transliterated automatically for the viewer. A Java plug-in for Netscape 4.0 will do the same for PC users and transliterate the SERA web pages into the character codes of the users's favorite font package.

In the reverse direction the current text only Lynx browser will convert UTF-8 encoded text into SERA for those who are not able to display UTF-8 Ethiopic text in their terminals. On the horizon in 1997 is a "DLL" for Ethiopic information processing to assist vendors in applying SERA. A Java "Beans" implementation of a SERA lexer should also be seen shortly.

While promising efforts seem to be underway for SERA support in more and more applications, new solutions for Ethiopic text transfer may be coming forth that would eliminate the need for a transliteration system altogether. Almost all major operating systems will begin to support Unicode and UTF-8 encoding by the end of 1997. UTF-7 support should become more prevalent in software as well, allowing for the transfer of Ethiopic text across the same mediums that SERA was designed for.

The text world will not be viewed through UTF-7 and 8 lenses overnight of course. But lets consider a time, however distant, when this might be true. The cost of using Unicode in UTF-8 is an expensive one to the Ethiopic users. It is true that the Unicode/ISO-10646 specification remains tentative, the basic domain however is unlikely to change when it has passed its last stage of officiation. The working specification for Ethiopic puts it in the range where it requires 3 bytes per character under UTF-8 encoding. File sizes are then 150% larger than that of most European scripts and 300% more than that of the 7 bit range.

In an analysis of a document containing more than 10,000 Ethiopic characters we find that to store the file with SERA text requires roughly 79% of the bytes of a 2 byte per character system, and 53% of the bytes needed by UTF-8 encoding. SERA may remain then a preferred medium for storage and transfer, it is only more computationally expensive to convert to and from character addresses during file input-output.

The ISO and the Place of Transliteration

In the case of Ethiopic a transliteration convention emerged in part from the absence of a universally recognized character code system to exchange electronic text. In the cases of other writing systems that have had recognized character code systems for some time -Greek, Cyrillic, Arabic, Hebrew, and Asian scripts to name a few, electronic communities developed transliteration systems dispite.

Ultimately software, computer systems, and the communications infrastructure are expected to catch up to the needs of the multilingual community. Until then, the need to communicate between people remains too strong a force to wait for evolution. Communities will continue to communicate over electronic mediums with what ever the lowest common denominator provides.

This does not mean chaos reins in the interim. Rather, members of the virtual villages are facing this reality head-on and coming to terms with it. The International Standards Organization plays host to parties interested in forming transliteration standards. Working groups have been formed to set standards for the transliteration of ten scripts under the ISO technical subcommittee on the "Conversion of Written Languages". More working groups will be formed as 1997 progresses.

Internationally recognized standards will provide the green light the software houses need to add support for transliteration systems. Software support for a transliteration standard will be vital to the success of the standard.

At this stage transliteration has reached its primary electronic potential: the ability to bridge communication in a system of writing between the software "haves" and "have-nots". The paramount point then that the ISO working groups are well advised to let govern the design of new standards is that the ultimate success of introduced standards will lie in the finger tips and keystrokes of the users when they elect to apply the standard when, returning to the origins, no specialized software is available to automate the transliteration.

References

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	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1200	ሀ	ሁ	ሂ	ሃ	ሄ	ህ	ሆ		ለ	ሉ	ሊ	ላ	ሌ	ል	ሎ	ሏ
1210	ሐ	ሑ	ሒ	ሓ	ሔ	ሕ	ሖ	ሗ	መ	ሙ	ሚ	ማ	ሜ	ም	ሞ	ሟ
1220	ሠ	ሡ	ሢ	ሣ	ሤ	ሥ	ሦ	ሧ	ረ	ሩ	ሪ	ራ	ሬ	ር	ሮ	ሯ
1230	ሰ	ሱ	ሲ	ሳ	ሴ	ስ	ሶ	ሷ	ሸ	ሹ	ሺ	ሻ	ሼ	ሽ	ሾ	ሿ
1240	ቀ	ቁ	ቂ	ቃ	ቄ	ቅ	ቆ		ቈ		ቊ	ቋ	ቌ	ቍ		
1250	ቐ	ቑ	ቒ	ቓ	ቔ	ቕ	ቖ		ቘ		ቚ	ቛ	ቜ	ቝ		
1260	በ	ቡ	ቢ	ባ	ቤ	ብ	ቦ	ቧ	ቨ	ቩ	ቪ	ቫ	ቬ	ቭ	ቮ	ቯ
1270	ተ	ቱ	ቲ	ታ	ቴ	ት	ቶ	ቷ	ቸ	ቹ	ቺ	ቻ	ቼ	ች	ቾ	ቿ
1280	ኀ	ኁ	ኂ	ኃ	ኄ	ኅ	ኆ		ኈ		ኊ	ኋ	ኌ	ኍ		
1290	ነ	ኑ	ኒ	ና	ኔ	ን	ኖ	ኗ	ኘ	ኙ	ኚ	ኛ	ኜ	ኝ	ኞ	ኟ
12A0	አ	ኡ	ኢ	ኣ	ኤ	እ	ኦ	ኧ	ከ	ኩ	ኪ	ካ	ኬ	ክ	ኮ	
12B0	ኰ		ኲ	ኳ	ኴ	ኵ			ኸ	ኹ	ኺ	ኻ	ኼ	ኽ	ኾ	
12C0	ዀ		ዂ	ዃ	ዄ	ዅ			ወ	ዉ	ዊ	ዋ	ዌ	ው	ዎ	
12D0	ዐ	ዑ	ዒ	ዓ	ዔ	ዕ	ዖ		ዘ	ዙ	ዚ	ዛ	ዜ	ዝ	ዞ	ዟ
12E0	ዠ	ዡ	ዢ	ዣ	ዤ	ዥ	ዦ	ዧ	የ	ዩ	ዪ	ያ	ዬ	ይ	ዮ	ዯ
12F0	ደ	ዱ	ዲ	ዳ	ዴ	ድ	ዶ	ዷ	ዸ	ዹ	ዺ	ዻ	ዼ	ዽ	ዾ	ዿ
1300	ጀ	ጁ	ጂ	ጃ	ጄ	ጅ	ጆ	ጇ	ገ	ጉ	ጊ	ጋ	ጌ	ግ	ጎ	
1310	ጐ		ጒ	ጓ	ጔ	ጕ			ጘ	ጙ	ጚ	ጛ	ጜ	ጝ	ጞ	ጟ
1320	ጠ	ጡ	ጢ	ጣ	ጤ	ጥ	ጦ	ጧ	ጨ	ጩ	ጪ	ጫ	ጬ	ጭ	ጮ	ጯ
1330	ጰ	ጱ	ጲ	ጳ	ጴ	ጵ	ጶ	ጷ	ጸ	ጹ	ጺ	ጻ	ጼ	ጽ	ጾ	ጿ
1340	ፀ	ፁ	ፂ	ፃ	ፄ	ፅ	ፆ		ፈ	ፉ	ፊ	ፋ	ፌ	ፍ	ፎ	ፏ
1350	ፐ	ፑ	ፒ	ፓ	ፔ	ፕ	ፖ	ፗ	ፘ	ፙ	ፚ					
1360		፡	።	፣	፤	፥	፦	፧	፨	፩	፪	፫	፬	፭	፮	፯
1370	፰	፱	፲	፳	፴	፵	፶	፷	፸	፹	፺	፻	፼			

Proposed Extensions

1380	ᎀ	ᎁ	ᎂ	ᎃ	ᎄ	ᎅ	ᎆ		መᎀ	በᎁ	ᎂᎀ	ᎃᎀ	ᎄᎀ			
1390	ᎇ	ᎈ	ᎉ	ᎊ	ᎋ	ᎌ	ᎍ		ምᎁ	በᎁ	ᎂᎁ	ᎃᎁ	ᎄᎁ			
13A0	ᎎ	ᎏ	᎐	᎑	᎒	᎓	᎔		ሟ	ቧ	ኗ	ቇ	ፗ			
13B0	᎕	᎖	᎗	᎘	᎙	᎚	᎛		ምᎁ	በᎁ	ᎂᎁ	ᎃᎁ	ᎄᎁ			
13C0	ለ	ሉ	ሊ	ላ	ሌ	ል	ሎ		መ	ሙ	ሚ	ማ	ሜ	ም	ሞ	
13D0	ረ	ሩ	ሪ	ራ	ሬ	ር	ሮ		ነ	ኑ	ኒ	ና	ኔ	ን	ኖ	

Private Use

FDF0	※	◊	♦	▽	▼	◘	◙	◚	◛	◙	··	¡	«	»	.	?

Table 1: The Ethiopic Unicode Definition in Ethiopic

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
1200	he	hu	hi	ha	hE	h	ho		le	lu	li	la	lE	l	lo	lWa
1210	He	Hu	Hi	Ha	HE	H	Ho	HWa	me	mu	mi	ma	mE	m	mo	mWa
1220	`se	`su	`si	`sa	`sE	`s	`so	`sWa	re	ru	ri	ra	rE	r	ro	rWa
1230	se	su	si	sa	sE	s	so	sWa	xe	xu	xi	xa	xE	x	xo	xWa
1240	qe	qu	qi	qa	qE	q	qo		qWe		qWi	qWa	qWE	qW		
1250	Qe	Qu	Qi	Qa	QE	Q	Qo		QWe		QWi	QWa	QWE	QW		
1260	be	bu	bi	ba	bE	b	bo	bWa	ve	vu	vi	va	vE	v	vo	vWa
1270	te	tu	ti	ta	tE	t	to	tWa	ce	cu	ci	ca	cE	c	co	cWa
1280	`he	`hu	`hi	`ha	`hE	`h	`ho		`hWe		hWi	hWa	hWE	hW		
1290	ne	nu	ni	na	nE	n	no	nWa	Ne	Nu	Ni	Na	NE	N	No	NWa
12A0	e/a*	u/U	i	A/a	E	I	o/O	ea	ke	ku	ki	ka	kE	k	ko	
12B0	kWe		kWi	kWa	kWE	kW			Ke	Ku	Ki	Ka	KE	K	Ko	
12C0	KWe		KWi	KWa	KWE	KW			we	wu	wi	wa	wE	w	wo	
12D0	`e	`u/`U	`i	`A/`a	`E	`I	`o/`O		ze	zu	zi	za	zE	z	zo	zWa
12E0	Ze	Zu	Zi	Za	ZE	Z	Zo	ZWa	ye	yu	yi	ya	yE	y	yo	yWa
12F0	de	du	di	da	dE	d	do	dWa	De	Du	Di	Da	DE	D	Do	DWa
1300	je	ju	ji	ja	jE	j	jo	jWa	ge	gu	gi	ga	gE	g	go	
1310	gWe		gWi	gWa	gWE	gW			Ge	Gu	Gi	Ga	GE	G	Go	GWa
1320	Te	Tu	Ti	Ta	TE	T	To	TWa	Ce	Cu	Ci	Ca	CE	C	Co	CWa
1330	Pe	Pu	Pi	Pa	PE	P	Po	PWa	Se	Su	Si	Sa	SE	S	So	SWa
1340	`Se	`Su	`Si	`Sa	`SE	`S	`So		fe	fu	fi	fa	fE	f	fo	fWa
1350	pe	pu	pi	pa	pE	p	po	pWa	mYa	rYa	fYa					
1360		:	::	,	;	:-	-:	`?	:|:	`1	`2	`3	`4	`5	`6	`7
1370	`8	`9	`10	`20	`30	`40	`50	`60	`70	`80	`90	`100	`10000			

Proposed Extensions

1380	`qe	`qu	`qi	`qa	`qE	`q	`qo		mWe	bWe	GWe	fWe	pWe			
1390	`ke	`ku	`ki	`ka	`kE	`k	`ko		mWi	bWi	GWi	fWi	pWi			
13A0	Xe	Xu	Xi	Xa	XE	X	Xo		mWE	bWE	GWE	fWE	pWE			
13B0	`ge	`gu	`gi	`ga	`gE	`gG	`go		mW	bW	GW	fW	pW			
13C0	`le	`lu	`li	`la	`lE	`lG	`lo		`me	`mu	`mi	`ma	`mE	`m	`mo	
13D0	`re	`ru	`ri	`ra	`rE	`r	`ro		`ne	`nu	`ni	`na	`nE	`n	`no	

Private Use

FDF0	\~X	\~e	\~E	\~a	\~A	We	Wi	Wa	WE	W	''	`!	<<	>>	.	?

Table 2: The Ethiopic Unicode Definition in SERA