

“Analysis of Telugu consonants features, elimination of their sideward, below base level and Head-top extensions including Head-✓stroke to bring them under “Perfect single consonant form”

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Abstract: Telugu script is written from left to right like other Indic scripts. The script consists of sequences of simple and / or complex characters and script has regular conjuncts, with trailing consonants taking a subjoined signs, often losing the v-shaped Head-✓stroke. 75% consonants are with Head-✓stroke. Out of 27 Head-✓stroke consonants 6 are with downward extension i.e. Base-↵ comma. Such extensions contribute uneven height levels in the script. Some are with sideward extension creating uneven width. Consonants with uniform height, base level and nearby width come under “Perfect single consonant form” and this would be an asset to Telugu script. Also more number of similar features matching and nearby tone harmony is good for easier learning and read write. This will also assist position placement of vowels signs for each consonant.

Key Words: Head-✓stroke, consonant base level, sideward extension, downward extension, base-comma.

1. INTRODUCTION:

In many Indic scripts, characters commonly have head stroke/character head-top joining line. These head-top joining shadow lines hide small portion of character features. A consonant can only support one vowel sign at a time. In general every consonant has inherent vowel and pronunciation is usually transcribed as “a”. Head stroke and top head line to the consonants is not a vowel sign. Telugu consonants height variation of Telugu consonants is mainly due to Head-✓stroke. Out of 36 Telugu consonants, 27 consonants have Head-✓stroke. Height of Head-✓stroke consonants is more than non-Head-✓stroke consonants. This means height of the consonants is not uniform. Consonant height level is also affected due to Head-✓stroke and Base-↵ comma. This creates further uneven levels in the script. Head-✓stroke has no special significance other than giving identity to the consonants. Telugu consonants have uniform size of Head-✓stroke. Kannada consonants Head-→stroke length varies according its position placement. Only one vowel – II – in both languages is with Head-✓stroke – Telugu and Head-→stroke – Kannada.

Guajarati, Tamil and Malayalam consonants do not have Head-✓stroke. Marathi, Devanagari, Hindi, Bengali and few other languages consonants have head-top joining line. Guajarati, Tamil, and Malayalam consonants are free from such extensions and these scripts look much simpler and consonant features are clear to look. Uniform height of all consonants is desirable to give a better look to the script.

In Telugu, Head-✓stroke may be to differentiate few similar features consonants. Position placement Head-✓stroke also differs according the form of consonant. If similar features consonants are slightly modified it may be possible to eliminate Head-✓stroke.

2. SCRIPT EXMPLES :

Gujrati script

મને વાગે છે કે હવે સમય આવી ગયો છે કે, આપણે જલ્દીથી હંસનાં બધા
જ સોનેરી પીંછા લઇ લેવા જોઈએ.

Fig. 1

Tamil

ஜப்பான்: டோக்கியோ ஒலிம்பிக் போட்டிகள் நடைபெறவுள்ள
கிராமத்தில் முதன் முதலாக ஒரு நபருக்கு கொரோனா தொற்று
உறுதி செய்யப்பட்டுள்ளது.

Fig. 2

Malayalam

എന്നാലും കിട്ടൂ എലിയുടെ ആത്മവിശ്വാസം കണ്ട് സിംഹം അവനെ
വെറുതെ വിട്ടു. തന്റെ ജീവൻ തിരിച്ചുകിട്ടിയ സന്തോഷത്തിൽ
കിട്ടൂ എലി അവിടെ നിന്നും ഓടിപ്പോയി.

Fig. 3

Marathi script - Font - Adobe Devanagari - 16 pt

झाडावर बसलेला माकड हे सगळं बघत असतो. तो विचार करतो की ही चांगली संधी आहे, मी आता
वाघाकडे जातो आणि या कुल्याची हुरारी उघडतो.

Fig. 4

- Marathi script is similar to Devanagari
- Each consonant is connected with head-top line – क – KA –
- Top line creates shadow covering part of the consonant features
- If top line is deleted it will depict each consonant feature similar to Gujarati

Kannada

ಬಳ್ಳಾರಿ ನಗರದ ಆದಿದೇವತೆ ಕನಕ ದುರ್ಗಮ್ಮ ದೇವಸ್ಥಾನ ಸಿಡಿ
ಬಂಡಿ ಉತ್ಸವ ಲಕ್ಷ್ಮಂತರ ಭಕ್ತರ ನಡುವೆ ನಡೆಯಿತು.

Fig. 5

- Kannada consonant with Head-→ stroke
- Height of Head-✓ stroke consonant is more than other consonants

Telugu

ఒక ఊరిచివర పచ్చని మైదానం లో నాలుగు ఆవులు ఎంతో
సఖ్యం గా , స్నేహంగా ఉండేవి. కలిసి గడ్డి మేయటం, కలిసి
తిరగడం చేసేవి.

Fig. 6

- Telugu consonant with Head-✓ stroke
- Height of Head-✓ stroke consonant is more than other consonants

Above illustrations are only for comparison with Telugu script.
Illustrations are with Microsoft Nirmala UI Semi Light Font 16 pt. unless specified
Hereinafter, focus will be mainly on Telugu script

Head-✓ stroke

- Head-✓ stroke is not a vowel nor a vowel sign
- Head-✓ stroke is not a Head-+ comma
- Head-✓ stroke is not – A – sign
- Head-✓ stroke is not like Halant sign
- Head-✓ stroke is replaced with vowels signs are placed
- Head-✓ stroke is replaced by Halant sign for semi-half-tone pronunciation
- Head-✓ stroke is not for short tone or long tone pronunciation
- Head-✓ stroke – to 27 out of 36 consonants
- Head-✓ stroke is given to Vowel –II –
- Head-✓ stroke is not given to Secondary form of consonants
- Head-✓ stroke has no special significance other than identification
- Short tone pronunciation of consonant with Head-✓ stroke may not be appropriate.
- Head-✓ stroke – no definition in Pedda Bala Siksha¹ nor in Telugu Unicode²

Disadvantages for the consonants with Head-✓ stroke

- Multi-level height of the consonants
- Position placement of Head-✓ stroke differs according to the features of the consonant
- Head-✓ stroke height level differs
- Head-✓ stroke base tip is merged with the head-bar in many consonants
- In Telugu script consonants with vowel sign, the form changes and becomes subjoined form, consonants often lose the Head-✓ stroke and height also differs

Advantages of eliminating Head-✓ stroke

- Main advantage of uniform height and base level
- This will give scope to modify/substitute consonants to eliminate other type of extension and bring all consonants with uniform base level and nearby width and save space
- Position and placement of consonant sub form below the base level of consonants can be more uniform keeping appropriate space between the consonants and sub forms
- This will also give further advantage with modified Halant- sign with minor modification of the symbol/sign position for uniformity with all consonants to depict clear features of the consonants.
- This will give further scope to uniform position placement of modified vowels signs to all consonants including non-vowel sign
- The script will look more clear and beautiful
- All put to gather will assist to standardize fonts and make efficient Optical Character Recognition (OCR) software
- It may also reduce number of strokes and assist in developing Telugu Keyboard and software

In this work Telugu consonants and their features are only considered to modify/substitute on the following basis

- Each consonant features should be clearly depicted
- Uniform height of consonants and nearby width
- Consonants should not have any sideward and downward extensions
- All consonants with uniform base level
- Maximum number of consonants pairs
- Consonants to match with their respective sub form
- Simple form/features of consonants for easier writing and learning

3. MATERIALS:

Consonants with Head-✓ stroke = 27

Consonant with Head-✓ stroke

Series –	Consonant	Consonant	Consonant	Consonant	Consonant
KA – క	KA – క	GA – గ	GHA – ఘ		
CH – చ	CH – చ	CHA – ఛ	JHA – ఝ		
TTA – ట	TTA – ట	TTHA – ఠ	DDA – డ	DDHA – ఢ	
TA – త	TA – త	THA – థ	DA – ద	DHA – ధ	NA – న
PA – ప	PA – ప	PHA – ఫ	BHA – భ	MA – మ	
YA – య	YA – య	RA – ర	VA – వ		
SA – శ	SHA – ష	SSA – ష	SA – స	HA – హ	
Others	LLA – ల్ల	KSHA – క్ష			Total - 27

Fig. 7

Consonants with Head-✓ stroke – are grouped as follow

1. Consonants with Head-✓ stroke
2. Consonants with Head-✓ stroke and -U- sign
3. Consonants with Head-✓ stroke and Base- comma
4. Consonants with Head-✓ stroke , -U- sign and Base- comma
5. Conjunct consonants with Head-✓ stroke

1. Consonants with Head-✓ stroke = 16

Consonant with Head-✓ stroke – no other extensions

Series –	Consonant	Consonant	Consonant	Consonant
KA – క	KA – క	GA – గ		
CH – చ	CH – చ			
TTA – ట	TTHA – ఠ	DDA – డ		
TA – త	TA – త	DA – ద	NA – న	
PA – ప	PA – ప			
YA – య	RA – ర	VA – వ		
SA – శ	SHA – శ	SSA – ష	SA – స	HA – హ
Others	LLA – ల్ల			

Fig. 8

2. Consonants with Head- stroke and Base- comma = 6

Consonant with Head-✓ stroke + Base- comma

Series –	Consonant	Consonant
CH – చ	CHA – ఛ	
TTA – ట	DDHA – ఢ	
TA – త	THA – ఠ	DHA – డ
PA – ప	PHA – ఫ	BHA – భ

Fig. 9

3. Head-✓ stroke and -U- = 2

Consonant with Head-✓ stroke + U

Series –	Consonant
PA – ప	MA – మ
YA – య	YA – య

Fig. 10

4. Consonants with Head-✓ stroke , - U – sign and Base- comma = 2

Consonant with Head-✓ stroke + U
 + Base- comma

Series –	Consonant
KA – ✗	GHA – ఘ
CH – చ	JHA – ఝ

Fig. 11

5. Conjunct consonants with Head-✓ stroke

Conjunct consonant with Head-✓ stroke

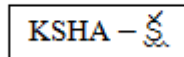


Fig. 12

Consonants

Out of 36 consonants

- 27 with Head-✓-stroke
 - 9 without Head-✓-stroke
 - 5 consonants pairs (10 consonants)
 - 1 consonant with Head-^–comma
 - 9 consonants with Base-^–comma and Head-✓–stroke
 - 1 consonant with Base-^–comma and without Head-✓–stroke
 - 6 consonants with sideward extension
 - 11 width groups
 - 1 Joint / Conjunct consonant with base Spur
 - 1 consonant NYA with extended leg below base level of consonants
 - 1 consonant with side bar (AA sign bar) and base ^ Spur
 - 14 “Single form consonants”
 - 6 “Perfect single form consonants”
6. Eliminating consonant Base- comma – consonant – KHA
7. Eliminating consonant Head-^ comma – consonant – TTA
8. Summary with consonant substitutes – Astavarga consonants – consonants pairs

4. METHODS :

1. Head-✓ stroke of consonants

Eliminated Head-✓ stroke – Modified consonants = 16

Eliminated Head-✓ stroke - modified consonants

KA GA CH TTHA DDA TA DA NA PA RA VA SHA SSA SA HA LLA
 క గ చ త డ త న ప ర వ శ ష స హ ల



Fig. 13

- Uniform top and base levels
- Modified consonants – DA – and – HA – with flat base
- Short length collar bar added to – KA –, – GA –, – TTHA – and – RA –
- Without collar bar GA will clash with Telugu numerical 1 and – RA – with Zero
- Modified – VA – will match to its sub form – va –

- Scope to substitute – TTHA –

Modified consonant – ఎ – PA – Advantages

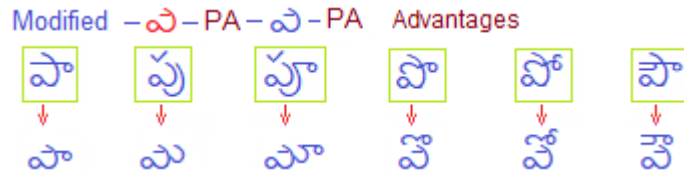


Fig. 14

- Extending bar of modified consonant – ఎ – PA – with give long tone – PA – with AA sign
- No need to increase height of the consonant with vowel signs
- Position placement of U and UU signs – advantages

Modified consonant – ఎ – SSA – Advantages

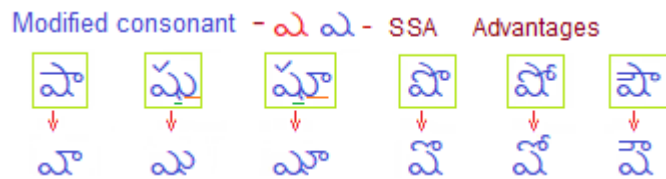


Fig. 15

Modified consonant – నె – SA – Advantages



Fig. 16

- The long tone – SA– will not conflict with long tone – ఱె –
- Modified consonant – SA – height need not be increased with few vowels signs and this will avoid ups and downs in the script

2. Consonants with Head-✓ stroke and Base-,- comma = 6



Fig. 17

- In order to avoid clash with other consonants, Dot-•-Bullet to be added to give unique identity to each consonant
- Scope to modify – DHA – consonant to avoid clash with modified – DA – consonant

Modified consonants – Dot-•-Bullet – added

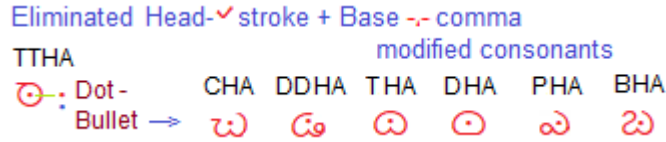


Fig. 18

- Dot-•-Bullet added to each consonants to give similar tone effect
- Modified consonant – DDHA – with Dot-•-Bullet
- Modified consonant – DHA – with flat base to avoid clash with modified consonant – THA –
- No further modification/substitute to these consonants
- Each modified consonant has unique features – Dot-•-Bullet

Modified consonant – •-PHA – Advantages

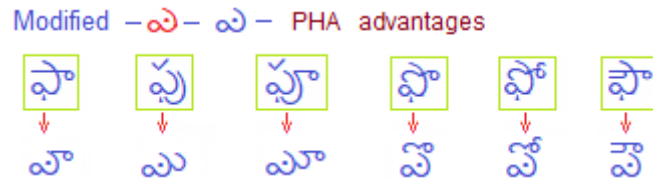


Fig. 19

- Position placement of U and UU signs appropriate and also other signs – advantages
3. Head-✓ stroke and - U = 2

Eliminated Head-✓ stroke and - U = 2 – Modified consonants = 2

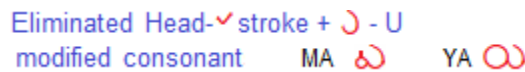


Fig. 20

- Consonant – MA – modified by adding bar, a unique feature
 - Scope to substitute modified – YA –
4. Consonants with Head-✓ stroke , - U – sign and Base -,- comma = 2

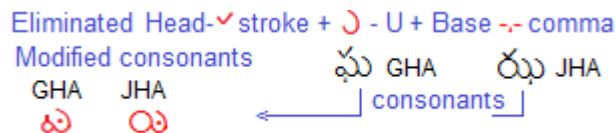


Fig. 21

- Scope to substitute modified – GHA – and – JHA – and create matching pairs
5. Conjunct consonants with Head-✓ stroke
 Modified conjunct consonant – KSHA –



Fig. 22

- Modified consonant – KSHA – easy to identify, read write
- Height on par with other modified consonants – an advantage

6. Eliminating consonant Base – comma

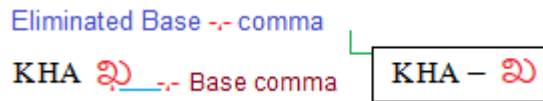


Fig. 23

- Modified consonant – KHA – looks good
- Scope to substitute modified consonant – KHA –

7. Eliminating consonant Head – comma

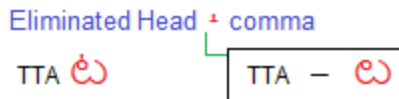


Fig. 24

- Modified consonant – TTA – will not clash with any other consonant/vowel

Substitute consonants

Substitute - KHA – to modified consonant – KHA

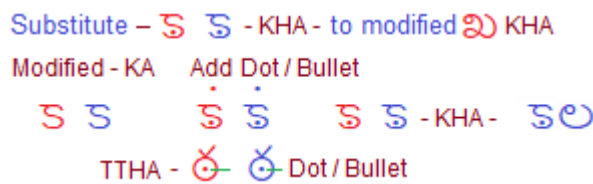


Fig. 25

- Modified consonant – KA – and substitute – KHA – with matching features and nearby tone pronunciation harmony form a good pair
- Modified consonant – KHA – with unique features – Dot/Bullet and collar bar

Compare

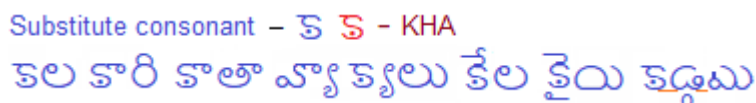


Fig. 26

- Substitute consonant – KHA – is easy to read write and good to adapt

Substitute - GHA – to modified consonant – GHA

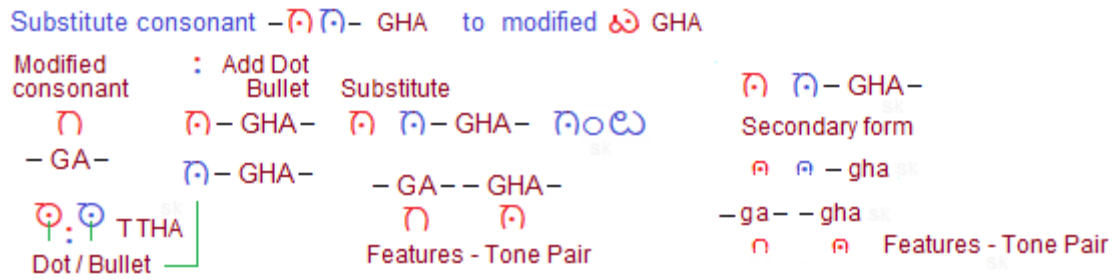


Fig. 27

- Substitute - GHA - is good matching pair to modified consonant - GA - and both fall under same class
- Modified - GA - and substitute - GHA - both with similar matching features and nearby tone harmony form a good pair

Compare

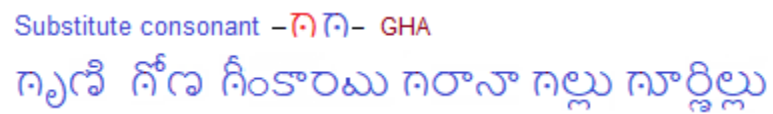


Fig. 28

- Substitute consonant - GHA - similar matching features and nearby tone harmony with modified consonant - GHA - and both come under same class and is preferred best substitute to adapt
- Substitute consonant - GHA - go well with other consonants, looks good and space saver

Substitute consonant - జ - JHA to modified consonant - య - JHA

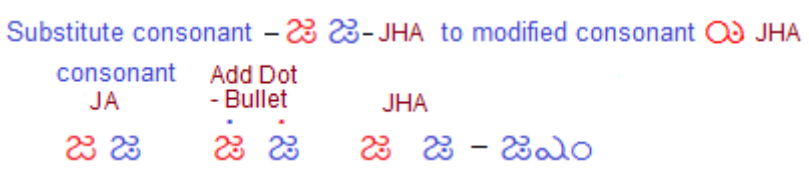


Fig. 29

- Substitute consonant - JHA - is an ideal substitute and good to adapt
- Both consonant - JA - and substitute - JHA - with matching features and nearby tone pronunciation harmony form a good pair

Compare

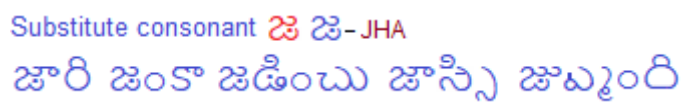


Fig. 30

- Substitute - JHA - space saving, easier to read write

Substitute consonant - ల - TTHA - to modified consonant - ఠ - TTHA

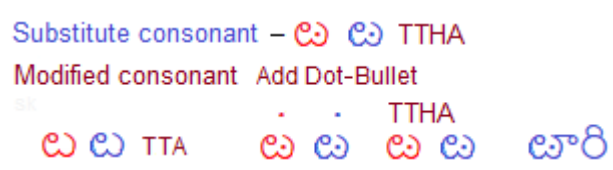


Fig. 31

- Modified - TTA - and substitute - TTHA - both with similar matching features and nearby tone harmony and form a good pair
- Substitute consonant - TTHA - looks clear, easy to read write

Compare

Substitute consonant – ಟ ಟ –TTHA
 ಪಾಟಶಾಲ ಕಟಾರಿ ಪಾಟಃ ಏಟಂ ಲಾಟಿ ವಿಟಾರು ಜಟರಮ

Fig. 32

- Substitute consonant – TTHA – is good to adapt as it pairs with consonant – TTA –

Substitute consonant – ೂ – YA – to modified consonant – ೃ – YA –

Substitute consonant – ೂ ೂ –YA to modified consonant ೃ YA

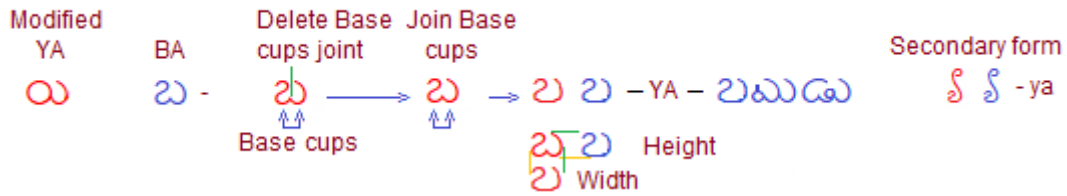


Fig. 33

- Substitute consonant – YA – with unique features perfectly matches with its secondary form – ya –
- Substitute consonant – YA – with its features will not clash with any consonant or vowel

Compare

Substitute consonant – ೂ ೂ –YA Secondary form ೃ ya
 Compare
 ಗಬ ಬುಡ್ಡಂ ಕೊಬ್ಯ ಬಂತ್ರ ಡೆಬ್ಯಾಲ ಕಾಬಮ ಬಜುರೈವೊಮ

Fig. 34

- Height of substitute consonant – YA – is same of– BA – and easy to identify and read write
- Substitute consonant – YA – matches its sub form and space saving

Substitute consonant – ೀ – RRA – to – consonant – ೀ – RRA

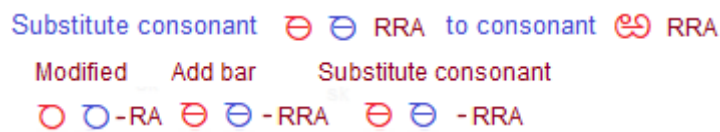


Fig. 35

- Substitute consonant – RRA – a good substitute, simple and easier to read write
- Substitute consonant – ೀ – RRA – and modified consonant – ೀ – RA – have similar matching features and nearby tone harmony and form a good pair

Substitute consonant – ೃ – NYA – to modified consonant – ೃ – NYA

- Substitute consonant – ೃ – NYA – a good substitute, simple and easier to read write

5. SUMMARY :

A brief summary of all levels – method followed –

Level – 1 – Consonants = 36

- Head-✓stroke eliminated – before 27
- 10 consonants pairs (24 consonants)
- All consonants are of almost same width
- Uniform base level – before varied
- 36 “Perfect single form consonants” – before 6
- 11 consonant forms eliminated
- 7 substitute consonants

Telugu consonants - extensions and combinations – levels

- Head –⁺–Comma eliminated
- Base –⁻–comma eliminated of all consonants and replaced by Dot Bullet
- No sideward extension to any consonant
- No extra-long tone [~] bar to any consonant

Consonants

Modified and substitute consonants

KA KHA GA GHA NGA CH CHA JA JHA NYA TTA TTHA DDA DDHA NNATA THA DA DHA NA
 క క గ గ ఙ చ చ జ జ ఙ ట ట డ డ న త త ద ద న
 PA PHA BA BHA MA YA RA RRALA VA SHA SSA SA HA LLA KSHA
 ప ప బ బ మ య ర ర ల ల వ వ శ ష ణ ణ డ డ

Fig. 36

- Uniform height and base levels and nearby width – “Perfect single consonant form”
- All look simple, nice and each consonant has unique features

Consonants – Similar matching features and nearby tone harmony pairs

Consonants - Pairs = 10

KA KHA GA GHA CH CHA JA JHA TTA TTHA DDA DDHA DA DHA PA PHA BA BHA RA RRA
 క క గ గ చ చ జ జ ట ట డ డ ద ద ప ప బ బ ర ర
 క క గ గ చ చ జ జ ట ట డ డ ద ద ప ప బ బ ర ర

Fig. 37

- Consonants – pair – same height and base level – before non
- More pairs than any other Indic script, an asset to Telugu - easier learning

Class wise – consonants – Astavarga

Consonants - Class wise - Summary – Astavarga

Class	KA KHA	GA GHA	NGA	Class	PA	PHA	BA	BHA	MA
క - KA -	క క	గ గ	ఙ	ప - PA -	ప	బ	బ	మ	
	CH CHA	JA JHA	NYA		YA	RA	RRA	LA	VA
చ - CH -	చ చ	జ జ	ఙ	ల - YA -	ల	ర	ర	ల	వ
	TTA TTHA	DDA DDHA	NNA		SHA	SSA	SA	HA	
ట - TTA -	ట ట	డ డ	న	శ - SA -	శ	ష	ష	హ	
	TA THA	DA DHA	NA		LLA	KSHA			
త - TA -	త త	ద ద	న		ళ	ష			

Fig. 38

Consonants – pairs – class wise – Similar features matching and nearby tone harmony

Consonants - Class wise - Pairs

KA	KHA	GA	GHA	CH	CHA	JA	JHA	TTA	TTHA	DDA	DDHA
క	క	గ	గ	చ	చ	జ	జ	ట	ట	డ	డ
DA	DHA	PA	PHA	BA	BHA	RA	RRA				
త	త	ప	ప	బ	బ	ర	ర				
అ	అ	ఎ	ఎ	ఇ	ఇ	ఓ	ఓ				
అ	అ	ఎ	ఎ	ఇ	ఇ	ఓ	ఓ				

Fig. 39

- More pairs easier to learn, read write

Non-pairing consonants – class wise

Non-pairing consonants - Class wise

NGA	NYA	NNA	TA	TTHA	NA		
క	క	చ	ట	ట	న		
MA	YA	LA	VA	SHA	SSA	SA	HA
మ	య	ల	వ	శ	ష	స	హ
అ	అ	ఎ	ఎ	ఇ	ఇ	ఓ	ఓ
అ	అ	ఎ	ఎ	ఇ	ఇ	ఓ	ఓ

Fig. 40

- Consonant – NGA – and – NYA – features match and have nearby tone harmony
- Consonant – NGA – and – NYA – a good pair although each comes under different class
- Consonant – VA – features match its sub form – va –

Eliminated consonants forms = 11

Eliminated consonants forms = 11

KHA	GHA	JHA	NYA	TTHA	NNA	MA	YA	HA	KSHA	RRA
ఖ	ఘ	ఙ	ఞ	ఠ	ణ	మ	య	హ	క్ష	ర

Fig. 41

Substitute - consonants

Consonant - substitute

KHA	GHA	JHA	NYA	TTHA	YA	RRA
క	గ	జ	ఞ	ట	య	ర

Fig. 42

- Substitute consonants – KHA. – GHA, – JHA, – TTHA and – RRA – form a good pair with respective modified consonant
- All with clear look, simple, easier to learn and read write

Consonants – word

Telugu consonants - Words

KA	KHA	GA	GHA	CH	CHA	JA	JHA
క	క	గ	గ	చ	చ	జ	జ
TTA	TTHA	DDA	DDHA	NNA	TA	THA	DA
ట	ట	డ	డ	ణ	త	థ	ద
DHA	NA	PA	PHA	BA	BHA	MA	YA
ధ	న	ప	ప	బ	బ	మ	య
RA	RRA	LA	VA	SHA	SSA	SA	HA
ర	ర	ల	వ	శ	ష	స	హ
LLA	KSHA	NGA	NYA				
ల	క్ష	ఙ	ఞ				

Fig. 43

- All consonants look clear and good
- Uniform top and base levels
- Much easier to learn and read write

Position placement of vowels – signs

Modified/substitute vowels – signs

Vowels and signs

Vowel	sign	Vowel	sign		
అ	AA	ఎ	E	ఐ	AU
ఇ	I	ఏ	EE		
ఊ	II	ఐ	AI		
ఉ	U	ఊ	O	ఱ	Halant
ఊ	UU	ఋ	OO	ఱ	Vocalic - R
				ఱ	Vocalic - RR

Fig. 44

Position and placement – U and – UU – signs³ – advantages

Consonants + U - U signs - Advantages

YA	VA	PA	PHA	SSA	KSHA
బుబూ	మమా	పపపా	పుపూ	షుషూ	క్షుక్షూ

Fig. 45

- Position placement of signs above the edge point of VA, PA, PHA and SSA consonants
- Such position placement of signs is also appropriate to – KSHA – and –YA also

Consonants – vowels – signs³ position placement – groups

Consonants - vowels - signs - position placement - Groups

	Collar-Head	Stem-Pin- Cups	Terminal Bar	Terminal tip	PA – PHA SA – HA							
KA	క	త	NGA	జ	TA	త	TTA	చ	CH	చ	PA	ప
KHA	క	ద	NYA	జ	VA	వ	TTHA	చ	CHA	చ	PHA	ప
GA	గ	ధ	JA	జ	SHA	శ	BA	బ	NA	న	SSA	ష
GHA	గ	ర	JHA	జ			BHA	బ	MA	మ	SA	స
DDA	డ	ర	NNA	న			YA	య	LA	ల	HA	హ
DDHA	డ	క్ష						LLA	ల	ల		

Fig. 46

PA – PHA – SSA – SA – HA – Group

Consonants - vowels - signs - PA - PHA - SSA - SA - HA - Group

PA	ಎ	ಪಾ	ವೆ	ವಿ	ಮ	ಮಾ	ವೆ	ವೆ	ವೆ	ವೊ	ವೊ	ಎಂ	ಎಃ	ವೆ
PHA	ಎ	ಪಾ	ಪೆ	ವಿ	ಮ	ಮಾ	ಪೆ	ಪೆ	ಪೆ	ವೊ	ವೊ	ಎಂ	ಎಃ	ಪೆ
SSA	ಎ	ಪಾ	ಷೆ	ವಿ	ಮ	ಮಾ	ಷೆ	ಷೆ	ಷೆ	ವೊ	ವೊ	ಎಂ	ಎಃ	ಷೆ
SA	ನ	ಸಾ	ನೆ	ವಿ	ಮ	ಮಾ	ನೆ	ನೆ	ನೆ	ನೊ	ನೊ	ನಂ	ನಃ	ನೆ
HA	ಎ	ಪಾ	ಹೆ	ವಿ	ಮ	ಮಾ	ಹೆ	ಹೆ	ಹೆ	ವೊ	ವೊ	ಎಂ	ಎಃ	ಹೆ

Fig. 47

Stem - Pin - cups - Group

Consonants - vowels - signs Stem-Pin-Cups - group

NGA	ಜ	ಜಾ	ಜೆ	ಜ್	ಜು	ಜು	ಜೆ	ಜೆ	ಜೆ	ಜ್ಜ	ಜ್ಜ	ಜ್ಜ	ಜಂ	ಜಃ	ಜ್
NYA	ಜ	ಜಾ	ಜೆ	ಜ್	ಜು	ಜು	ಜೆ	ಜೆ	ಜೆ	ಜ್ಜ	ಜ್ಜ	ಜ್ಜ	ಜಂ	ಜಃ	ಜ್
JA	ಜ	ಜಾ	ಜೆ	ಜ್	ಜು	ಜು	ಜೆ	ಜೆ	ಜೆ	ಜ್ಜ	ಜ್ಜ	ಜ್ಜ	ಜಂ	ಜಃ	ಜ್
JHA	ಜ	ಜಾ	ಜೆ	ಜ್	ಜು	ಜು	ಜೆ	ಜೆ	ಜೆ	ಜ್ಜ	ಜ್ಜ	ಜ್ಜ	ಜಂ	ಜಃ	ಜ್
NNA	ಣ	ಣಾ	ಣೆ	ಣ್	ಣು	ಣು	ಣೆ	ಣೆ	ಣೆ	ಣ್ಣ	ಣ್ಣ	ಣ್ಣ	ಣಂ	ಣಃ	ಣ್

Fig. 48

Terminal bar - Group

Consonants - vowels - signs - Terminal bar - group

TA	ಅ	ತಾ	ತೆ	ತ್	ತು	ತು	ತೆ	ತೆ	ತೆ	ತ್ತ	ತ್ತ	ತ್ತ	ತಂ	ತಃ	ತ್
VA	ಎ	ವಾ	ವೆ	ವ್	ವು	ವು	ವೆ	ವೆ	ವೆ	ವ್ವ	ವ್ವ	ವ್ವ	ವಂ	ವಃ	ವ್
SHA	ಶ	ಶಾ	ಶೆ	ಶ್	ಶು	ಶು	ಶೆ	ಶೆ	ಶೆ	ಶ್ಶ	ಶ್ಶ	ಶ್ಶ	ಶಂ	ಶಃ	ಶ್

Fig. 49

Collar-Head - Group

Consonants - vowels - signs - Collar - Head - Group - Consonants = 11

KA	ಕ	ಕಾ	ಕೆ	ಕ್	ಕು	ಕು	ಕೆ	ಕೆ	ಕೆ	ಕ್ಕ	ಕ್ಕ	ಕ್ಕ	ಕಂ	ಕಃ	ಕ್
KHA	ಕ	ಕಾ	ಕೆ	ಕ್	ಕು	ಕು	ಕೆ	ಕೆ	ಕೆ	ಕ್ಕ	ಕ್ಕ	ಕ್ಕ	ಕಂ	ಕಃ	ಕ್
GA	ಗ	ಗಾ	ಗೆ	ಗ್	ಗು	ಗು	ಗೆ	ಗೆ	ಗೆ	ಗ್ಗ	ಗ್ಗ	ಗ್ಗ	ಗಂ	ಗಃ	ಗ್
GHA	ಗ	ಗಾ	ಗೆ	ಗ್	ಗು	ಗು	ಗೆ	ಗೆ	ಗೆ	ಗ್ಗ	ಗ್ಗ	ಗ್ಗ	ಗಂ	ಗಃ	ಗ್
DDA	ಡ	ಡಾ	ಡೆ	ಡ್	ಡು	ಡು	ಡೆ	ಡೆ	ಡೆ	ಡ್ಡ	ಡ್ಡ	ಡ್ಡ	ಡಂ	ಡಃ	ಡ್
DDHA	ಡ	ಡಾ	ಡೆ	ಡ್	ಡು	ಡು	ಡೆ	ಡೆ	ಡೆ	ಡ್ಡ	ಡ್ಡ	ಡ್ಡ	ಡಂ	ಡಃ	ಡ್
THA	ಠ	ಠಾ	ಠೆ	ಠ್	ಠು	ಠು	ಠೆ	ಠೆ	ಠೆ	ಠ್ಠ	ಠ್ಠ	ಠ್ಠ	ಠಂ	ಠಃ	ಠ್
DA	ಠ	ಠಾ	ಠೆ	ಠ್	ಠು	ಠು	ಠೆ	ಠೆ	ಠೆ	ಠ್ಠ	ಠ್ಠ	ಠ್ಠ	ಠಂ	ಠಃ	ಠ್
DHA	ಠ	ಠಾ	ಠೆ	ಠ್	ಠು	ಠು	ಠೆ	ಠೆ	ಠೆ	ಠ್ಠ	ಠ್ಠ	ಠ್ಠ	ಠಂ	ಠಃ	ಠ್
RA	ರ	ರಾ	ರೆ	ರ್	ರು	ರು	ರೆ	ರೆ	ರೆ	ರ್ರ	ರ್ರ	ರ್ರ	ರಂ	ರಃ	ರ್
RRA	ರ	ರಾ	ರೆ	ರ್	ರು	ರು	ರೆ	ರೆ	ರೆ	ರ್ರ	ರ್ರ	ರ್ರ	ರಂ	ರಃ	ರ್
KSHA	ಷ	ಷಾ	ಷೆ	ಷ್	ಷು	ಷು	ಷೆ	ಷೆ	ಷೆ	ಷ್ಶ	ಷ್ಶ	ಷ್ಶ	ಷಂ	ಷಃ	ಷ್

Fig. 50

Consonants - vowels - signs - Terminal tip - Group

TTA	ట	టా	టే	ట్	టు	టూ	టే	ట్టే	టొ	టో	టౌ	టం	టః	ట్
TTHA	ట	టా	టే	ట్	టు	టూ	టే	ట్టే	టొ	టో	టౌ	టం	టః	ట్
NA	న	నా	నే	న్	ను	నూ	నే	న్నే	నొ	నో	నౌ	నం	నః	న్
CH	చ	చా	చే	చ్	చు	చూ	చే	చ్ఛే	చొ	చో	చౌ	చం	చః	చ్
CHA	చ	చా	చే	చ్	చు	చూ	చే	చ్ఛే	చొ	చో	చౌ	చం	చః	చ్
BA	బ	బా	బే	బ్	బు	బూ	బే	బ్బే	బొ	బో	బౌ	బం	బః	బ్
BHA	బ	బా	బే	బ్	బు	బూ	బే	బ్బే	బొ	బో	బౌ	బం	బః	బ్
MA	మ	మా	మే	మ్	ము	మూ	మే	మ్మే	మొ	మో	మౌ	మం	మః	మ్
YA	య	యా	యే	య్	యు	యా	యే	య్యే	యొ	యో	యౌ	యం	యః	య్
LA	ల	లా	లే	ల్	లు	లూ	లే	ల్లే	లొ	లో	లౌ	లం	లః	ల్
LLA	ల్ల	ల్లా	ల్లే	ల్ల	ల్లు	ల్లూ	ల్లే	ల్లల్లే	ల్లొ	ల్లో	ల్లౌ	ల్లం	ల్లః	ల్ల

Fig. 51

- Position placement of vowels signs is ideal to keep up uniform top and base level
- Position placement of sign – AA – to PA and SA is slightly different – for easier identification
- Position placement of U and UU signs for PA, PHA, YA, SSA, and KSHA look very good
- Sign – AA – suits to all consonants giving more open space and saving space
- Stem – Pin – cups – Group – signs position placement differs to give clear view of consonants features
- Consonant form/features look sharp and clear including base spur of consonant – SSA and – KSHA
- Consonants form/features not affected

6. RECOMMENDATIONS:

Consonant – (all including modified and substitute consonants)

- Uniform height, base level and nearby width consonants – “Perfect single consonant form”
- No sideward and downward extensions
- Eliminated Head-✓stroke
- Each consonant with its unique features
- More similar features matching and nearby tone harmony pairs
- Advantage – easier to read write and learning
- All worth to adapt

Consonant sub forms³

1. Above and below (ABL) level sub forms

- Uniform height and nearby width
- Height to be reduced
- Define position placement of each sub form

2. Below base level of consonants (BBL) sub forms

- Creating more symbolic sub forms
- Uniform height of other sub forms
- Define spacing between consonant and sub form
- Define position placement of each sub form below consonant

Vowels³

- Width difference may be minimized
- Sideward and downward extensions may be eliminated
- Modify vowels to bring maximum number under uniform height group
- Eliminate Head-✓ stroke vowel II and substitute to match vowel I
- Substitute vowels to bring to similar features and nearby tone harmony
- Maximum number of pairs ideal
- O of Um vowel should be smaller than the main vowel

Vowels – signs³

- Simplifying signs
- Elimination of Eye portion of AA sign bar
- Eliminating AI sign and substitute with simple sign
- Uniform height of short tone and long tone signs
- Position placement over the consonants uniform top level of signs desirable
- U and UU signs height to be reduced to match all consonant and edge position placement matching base level of consonants
- U and UU signs position placement above edge bar to top level of consonants PA, PHA, YA, SSA and KSHA is desirable
- Define position placement of vowel sign for each consonant

Halant – sign³

- Uniform – top – level with other signs when position placement over the consonants
- Define position placement of the sign for each consonant

7. CONCLUSION:

In this work, main focus was to analyse Telugu consonants features along with Head ✓ stroke consonants. 75% out of 36 consonants have Head-✓ stroke. Out of 27 consonants 8 consonants have Head ✓ stroke and Base-,- comma (below base level extension). These factors contribute uneven height levels of consonants. Consonants height levels have been brought down to one level from multi-level by eliminating Head-✓ stroke, Base-,- comma and sideward extensions. It is an appropriate step to bring all consonants come under the category of “Perfect single consonant form.” There is further scope to substitute few more consonants to bring them under matching pairs.

Procedure adopted to eliminate Head-✓ stroke, Base-,- comma and Head-+ comma to bring all consonants at uniform height and base level yielded desired results. Other types of sideward extension have been eliminated. Few consonants have been modified and provided substitute to 7 consonants. All these resulted more number of similar matching features and nearby tone harmony consonant pairs which is an asset to Telugu script. All consonants are now with nearby width. This will save space too. All consonants are worth to adapt. Apart from space saving equal height and uniform base level of consonants will enhance beauty of Telugu script. It would assist for easier learning, read write and print. It may also reduce number of strokes with new fonts. It will also assist in developing Telugu keyboard and software. It may also assist in developing efficient OCR software. Standardization of Telugu fonts is also equally important.

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