Understanding the Harappan Script: going beyond grammar and

UPPER CITY

(前) (前) 大平 炎 次介 介 ⊗
 1. Main Gate
 2. Main Street
 3. Cattle Bazaar
 4. Market Square
 5. Granary Square
 6. Shrine Forest
 7. Entry to Shrine
 8. Arena
 9. Upper City Gate
 10. Maham's House
 11. Great Bath
 12. Senate
 13. River Gate
 14. North Gate

Dr Mayank Vahia THE MAP OF MOHENJO DARO



LOWER CITY

My respects to the Legend





Preamble

- The Harappan Script has not been deciphered.
- There are primarily two approaches:
 - Search for the rules of writing (grammar) that is driven by a computational approach
 - Search for meaning through the association of signs to physical entities.
- We know a large part of the grammar. We know:
 - Relative ordering and sequencing of signs
 - Signs begin a string.
 - Signs that end a string
 - Signs that come in the middle.
 - Clustering of sign groups.
- All known attempts to interpret the writing have been demonstrably unsatisfactory they are often internally inconsistent or inconsistent with the grammar.
- We now need to think afresh about the Harappan writing. That is the emphasis of this • talk.

The Harappans

- Harappan cities from the largest urban complex that flourished in the Western Part of the Indian Subcontinent between 7000 and 1700 BC.
- Their urban phase goes from 2500 BC to 1700 BC.
- They disappeared in a non-violent manner.
- It was larger than all other cultures of that period *put together*.
- It was spread over a million square kilometres and traded with West Asia.
- It was highly standardised across this entire region with
 - 1. Characteristic written materials and seals
 - 2. Beads and other jewellery
 - 3. **Standardised architecture** and brick sizes in the ratio of 1 x 2 x 4 and cross brick building style.
 - 4. **Indoor** water closets and water management system
 - 5. **Planned towns with citadels, platforms and podiums, specific burial patterns**
 - 6. **Standardised Weights**, parallel-sided blades
 - 7. Copper and bronze articles

The Miniatures

- The medium of choice for expressions is miniatures about 1.5 to 15 cm i size.
- The miniatures seem to have been used for a large variety of purposes.
- Several interesting themes on the objects.
- Almost all the written material is on the miniatures.
- Many seals have a holder at the back suggesting that it could have been used as a rubber stamp or tied up in strings.
- But duplicates are rare.



Wheeler on Harappan Miniatures

"... IT WOULD BE NO EXAGGERATION TO DESCRIBE THEM AS LITTLE MASTERPIECES OF CONTROLLED REALISM, WITH A MONUMENTAL STRENGTH; IN ONE SENSE OUT OF ALL PROPORTIONS TO THEIR SIZE AND IN ANOTHER ENTIRELY RELATED TO IT..."

Wheeler, 1931



But their love for miniature was far wider















-1037 A

Complex designs



Sitabra Sinha et al.





Pieces that don't fit – 2: Unusual animals **Composite Bovid** Bovid Tiger Water Buffalo Human Elephant

Seals with writing















Why seals?

- These miniatures have several advantages
 - They are easy to carry
 - They are easy to make under expert training.
 - They are largely tamper-proof.
 - They are difficult to recreate or replicate except with extensive training.
- THEY ARE EXPLICIT PROOF OF CENTRALISED TRAINING AND ADMINISTRATION.
- But in the absence of evidence of standing armies, such a course must have been developed by consensus.
- That itself speaks a lot about the Harappan Civilisation.

About the written material

- The seals are a masterful combination of:
 - Artistic imagination
 - High degree of precision
 - Creative technology
 - Objective clarity
 - A fascinating ability to express themselves almost exclusively on this medium.
 - Nowhere in the entire human race do you find this obsession with miniatures.
- Mesopotamia has circular miniature seals that predate the Harappan Seals but the two seem to be independent developments.

Writing and language

- A formal Script formally encodes information.
- We encounter Writing as a method of coding information.
- Harappan writing was probably invented to aid memory, mark ownership etc.
- The Harappan writing was not invented to express ideas in and thereby not bound to a specific form of language.
- Language and scripts have complex relations. The two can be independent of each other. You can write Hindi in Devnagari, Roman or Urdu scripts.
- A writing system can code multiple languages in the same script.
- Its use to express ideas is a later and important evolution, just as commercial arithmetic precedes mathematics.
- Writing evolves.

•

 THE FIRST MISTAKE WE MAKE IN INTERPRETING THE WRITING IS TO ASSUME A RELATION BETWEEN SCRIPT AND LANGUAGE AND ASSUME THAT IT REPRESENTS INFORMATION IN A SINGLE LANGUAGE.

PREHISTORIC LANGUAGES OF SOUTH ASIA



Gadgil, M., Joshi, N.V., Shambu Prasad, U.V., Manoharan, S. and Suresh Patil

1997. pp.100-129. In: The Indian Human Heritage, Eds. D. Balasubramanian and N. Appaji Rao. Universities Press, Hyderabad, India.

Why write?

"The practice of writing and the development of a coherent system of signs, a script, is something which is seen only in complex societies...
 Writing ... is a feature of civilisations." - Colin Renfrew (Archaeology and Language, 1857)

Speculations on the Harappan writing

- In the context of the Harappan, it could have served the following purpose:
 - Tags for securing goods/storage rooms in trade
 - Identification mechanism for material/ manufacturers/ individuals/ quantity.
 - Tokens as primitive coinage for the exchange of goods and administration of labour a more sophisticated barter but pre-currency system.
 - Religious purposes such as amulets for protection
- The medium they used was temper-proof and durable.
- Harappan clearly did not have a monolithic usage.

We do know a lot about Harappan writing

- The writing is highly ordered with flexibility similar to that of the linguistic scripts.
- They wrote from right to left, which may be due to the ease of reading what was written if you were marking using your left hand and putting pressure with your right hand.
- It is always in small strings of an average of **5** signs.
- We know that the transition from potters' marks to the complete script was rather swift.
- It disappeared as swiftly as it appeared.
- The writing was highly standardised across the entire region of Harappan Civilisation. This is true in the following aspects
 - The sign designs are very similar.
 - The medium of writing is very similar.
 - The sequencing of texts is very similar.
 - The signs that seem to have been used only locally are few and rare.



Stage 1 and 2

7000 to 3200 BC

Possehl (2002)

Writing and Civilisation

- Writing is a hallmark of Civilisation.
- It requires several changes in the very nature of civilisation.
- Cultures, precursors to civilisations receive information from many experiences.
- These are often organised randomly to store information.
- The associations are not linear and are often comparative.
- This gives to what is called the Inductive logic.
- As cultures become civilisations, they become more linear in thinking and deductive in organising information.



Stage 3

Early Harappan (Ravi phase) 3200 to 2800 BC

Pot marks

HARAPPA Period 1: Ravi Phase

Post-firing graffiti

Writing of a culture – non-linear and symbol selection in a disordered manner.

Note: some symbols may also have been mistaken for random scratches

NA ⊕ V M X */ ||

Pre-firing potter's marks

+ ||

Possehl (2002) & Kenoyer (2006)



Possehl (2002) & Kenoyer (2006)

Stage 3

Early Harappan (Kot Diji phase) 2800 to 2500 BC

Harappan script appears for the first time ...

Writing at the beginning of the
phase of civilisation, Ordered with evolved symbols with variants for more subtle ideas

HARAPPA, Period 2, Kot Diji Phase Script Post-firing graffiti

♥ ♥ (V) V /N + */ || くで、 シミュ 井 町 こ と ×, 'BB 'INN "V' \bowtie ۱۸۸۸ ۱0 |||W|1日#茶 ♪

Pre-firing potter's marks

 $\square (X \times X \parallel \parallel \parallel)$ 18 K. ्रेड्र



Stage 4

Peak of Harappan Urban 2500 to 1900 BC

ᢧ᠕᠁ᡩ᠓᠐ ⑧《目目.Ⅲ次○○)UK @ ||) ※ Ć ୰୷ୢଽଢ଼ଢ଼ୢଢ଼ୄ୵୷୰ HD II @ ◇ ℧⊞ℷ⊪⊍≬ ∪⊗∭.**∞⊕Ω⊞⊞ ↑ II U Q \ @ \$'20\$\$\$#U 成のA・ひ令Ⅱ ひ》 U\$\$X\$\$ ℧ℳ╢╢⋓℗"&฿シ ୰୷\\\\" ү/目∞ && 🖓 🖓 "♦ ひ) 川谷の 「、三川

Formal, well defined writing system of a civilisation.

Formally identifiable grammar

Unsupervised computer learning can identify the patterns in the

Kot Diji phase 2800 to 2500 BC

HARAPPA, Period 2, Kot Diji Phase Script Post-firing graffiti

Pre-firing potter's marks



Kenoyer (2006)

Harappan Script 2600-1900BC

ᢧ᠓ᡙ᠓ᡚ ❸《首月 Ⅲ次 ♡ ♡)UK @ ||) % € ℧℁୵ጀ⊕ୡՋୡ"⊘ ୰⊞ℷ⊪⊍≬ **ひゑ∭.*&⊥∝⊕Ω⊞囲** ᅀ║Ѡ҄҄҄҄Ҳ҄Ҭ҄Ѡ ℧℁ዿℷΩℂℹℬ 歳�♪↓↓�∥ ひ》 ୰⋧፠୵ጀ&∥ୖଡ଼ "⋈ ℧ⅆℍℍ℗⅌ℷ℞⅀ ୰୷╢╢⊎"�' ү/目∞ && 🖓 🖓 "♦ ひ) 出 & の " 『 帰

Mahadevan (1977)



				() 63	2) (Ç	6 4	65		¥ 67†	1221 68†	XX 69†	Q 70†	
20			A 72†	73†	74) †	2 75	76†	77	9 78†	7 9	¥ 80)
			82 82	≈ € 83	۶۵ م 84-	t	/R 85	86† .	 87†	' 88	 89†	₩ 90†	k
/æ 40†		Ⅲ ₩ 91†	92	93	94	//	95	96†	 97	 98†	 99	100	
50†		 101	 102†	 103†	 104	 + 1	 105	 106†	 107†	108	 109† -	110	11
	L		шш 171†	нн 172	173†	174	₩ 0 175†	E 176†	‡ 177†	A. 178†	"A" "A" 179	180†	
			181†) 182†		184 †	185	186†	187	188	ШШ 189	₩₩ 190†	
200				M 192	193†		↑ 195	196	197†	198†	199	200	
A 210†			201†	202†	A 203	A 204†	205†	206†			209	A 210†	
219†			A 211	ل ب 212	¥ 213†	214†	215	1 × 216†	217†		JX 18	219†	
Ŧ			3 70	₩ 371†	4 372	O 373†	0 374†	() 375†	0) 376	377	() 378	(I) 379†	
339 HY Y			80 380	000 381†	382	10 383	884†	385		W 387†	388	() 389†	
I ∪ 349 P 跚				391†	392	393†	8 394†	395†	() 396	0 397	398	399	
359†			& 400†	401	402†	() 403†	404	405	406	907 407		0 <u></u> 	
\bigcup_{369}			8	8	8 412	H8 413	8 414	8 415	416	8 417†			

1			↓ ₂†	\$ 3			5	A	The second		\mathbf{X}_{7}	1	¥ 8†)次) ^{9†}		内 10
		6	12†		б		Б, 1	5†	T 16	*	17†				1 9†		20 ****
2:	یکل ا	1 22		23		% ↓≫ ∧ 24	1	1	¦大 26	1	★) 27		10 28†		977 29†		★ 30
	1 0	۲ 3	U 2†	0 33	U	₩ 34	₹ 35	₩ †	36	C	九		*		大 39		107
\$	^	42		<u>}</u>	į		4	€U 5	**	IJ	2 47		AF 48†		X 49†	1	50†
51	t	5		€ 53†		K 54†	55.)) †	56†		漫 57†		¥ 58		A 59†	1	6 0†
	Щ 171	ש ו†	н 172	1	73†	111 174		₩ 0 175†	176	t	‡ 177†		A. 178†		"A" 179		180†
	18	7 0 1†) 182†	ł	H 183			185	186	1			188		Ш 189		190†
	19	ſ	192		93†			↑ 195		₹ 96	1 97†		198†		199	[⊒ 200
	20] 1†	202†		H ₂₀₃	A 204†		A 205†	Z_{20}	2 6†		N 1 N 1	A 208		209	4	210†
	1 21	1	لم 212	2	¥ 13†	214†	1	215		¢ 16†	\sum_{21}	X 7†			K.		219†
	Ű 331†		332†	ļ	ل نام	ہ¥۔ 334∙	t	Щ 335		336) †	337	\ †	338) 31	1	J 39
	341†		U 342†	: :	U 343†	۲ 34	י ד 4	1 345	F	34	46	¥ 34) 7†	¥ 34	₩ 48†	H 3	Ú 49

355

V

365†

356

366

357

499 367† **U** 358†

> **Ü** 368

() 111†	 112†	() 113	 114	115	 116	1111 1111 117	 118	// }}}	/// 120†
1111 121†)	J 123†	<u>ہ</u> 124†	K 125†	<u>к</u> 126	ח 127†	\ 128†	129	∫ 130†
V 131	132†	133	A 134	A 135	136†	X 137†	X 138	139	140
Ж 141†	X 142†	" " 143†		145	2 146†	147		X 149†	XX 150†
151	X 152	^ 153	9 154	† 155†)^(157	X 158†	* 159†	4 160
Y 161	Ч 162†	¥ 163	"Ψ" "" 164	165	166	¥ 167†	基 168	۲ 169†	170
Γ									
	280	281	282 2	283 2	84† 2	285 28) 6† 287†) 288	289†
) 290†	3 291	292† 2	93 29) 29)) 5† 290)) 5† 297†	298)))) (8† 299

¢ 300

B 310

() 320

281	282 282	283	284†	285	286†) 287†) 288	")" 289†	U	Ŵ	Ж	ų	Ŷ
291	292†) 293)) 294†)) 295†) 296†) 297†)))))) 298†	(299	330†	331†	332†	333 7'F	334† 7"F
6 301	X 302†)(^{303†}	D 304	D 305†	306	D 307†	"B" 308	309	340† ¥ ¥	341† ¥ 9	342† Я ¥	343† µUfy	344
311	312†	313	314	315	(H) 316	317	A 318	G) 319	350	351	352	353	354
O 321	322†	323	324†	325	326†	327†	U 328†	329	HO 360	361	100 362	363	364

Mahadevan's list of signs

Relative use of symbols with place



What this tells

- It is clear that the Harappan Civilisation developed in isolated groups and isolated development of the residential clusters.
- But these were clearly in close contact with each other.
- Yet the writing and other cultural parameters are highly standard with only a small variation from region to region.
- This indicates a high level of standardisation that demands standardised administration.
- The culture was spread over greater than a million square kilometres and also traded with West Asia.
- This is not easy to achieve. How they achieved this is a dilemma.

The difficulties

- The problems with decipherment are manyfold
 - 1. Writing is cryptic there are no longer text and surprisingly few cases of the same writing.
 - 2. We don't even know if it is linguistic and the underlying language if any, is unknown.
 - 3. But syntax has the same flexibility as language.
 - 4. The writing is highly standardised.
 - 5. No bilingual text has been found.
 - 6. We have no literary data (even from later memory) of the culture, its rulers etc.
 - 7. There is no clear evidence of continuity between the Harappan and later cultures.
 - 8. More than 100 attempts to assign 'instinctive' meaning to some signs as a starting point have all ended up with an internal contradiction.

Harappan script is mathematically shown to be highly structured and similar to be at least a formal language, if not a natural language!

We know how to write in Harappan script, even if we do not know how to read it!

So what is it?

- The interpretations have varied from:
 - 1. Dravidian I Mahadevan, A Parpola, B Wells and several others
 - Labels tags, item or people identifiers, promissory notes or religious tokens
 - 3. Numeric B V Subbarayappa
 - 4. Random Farmer
 - 5. Sanskrit S Kalyanaraman
 - NONE OF THESE ARE CONSISTENT WITH THE SYNTACTIC ANALYSIS.

The story so far

- The writing was a highly coordinated activity suggesting centralised teaching centres.
- **Flexibility** in writing is similar to that of linguistic writing.
- Long distance trade would be one obvious purpose this would explain the need for near linguistic writing that is understood by all – "Sending rice to Mohenjo Daro" – kind of sentences.
- This would explain the need for near linguistic flexibility.
- It is unlikely that the writing includes literary works.
- The relation between the motifs and the written material is unclear.
- The script was used for expressing **heterogeneous information** but using highly standardised grammar across space and time.
- The Harappan script had multiple uses and conveyed fairly sophisticated information cryptically across vast regions through specialised writers.

Possible Usage

Commerce

✓ Mercantile
 ✓ Monetary
 ✓ long distance trade
 ✓ Accounting
 ✓ Stock keeping
 ✓ Taxation

Religion

Worship or homageFolklore

Administration

✓ Royalty and royal decree ✓ Geography or geography ✓ Land record
 Personal identity

✓ Identity ✓ Names and visiting cards ✓ Memory aid

1

Understanding writing

- Writing involves cognitive and physical processes to translate information (or thoughts) into symbols for reference over space and time.
- It is highly sensitive to the information it wishes to convey. Why would Indian languages need a word for Snow?
- A system of writing relies on many of the same structures as the knowledge it represents, with the added dependency of a system of symbols.
- A written language may take on characteristics distinctive from the spoken language.
- Writing is a series of physically inscribed symbols. The interpreter or activator of a text is critical to this coding.
- Writing systems do not themselves constitute languages; but a convention that is meant to inform other humans separated by time and/or space. A commonly agreed convention is central to this.
- WE NEED TO GET A BETTER HOLD ON THE WAY HARAPPANS WERE THINKING RATHER THAN BEHAVING. AND THIS IS EASIER SAID THAN DONE.

Path to decipherment?

- Archaeologists have given us data to work on but not enough to decipher it easily.
- We now have some idea of its syntax.
- We need to understand the context of sign modifications.
- We need to understand the context of the signs with respect to other entities on written material.
- It will have to be put in the context of other cultural aspects of the Harappan Civilisation.
- MOST IMPORTANTLY WE NEED TO UNDERSTAND THEIR MINDSET AND THE NATURE OF THE CIVILISATION.
- We have not approached the problem from this angle.

Some paths to moving forward

- By now it is clear that
 - The writing is grammatically precise and versatile.
 - The signs seem to be a mix of individual and compounded signs.
 - It has the flexibility of linguistic writing.
 - We know the grammar or syntax but not the meaning.
 - But we do not know if the writing is non-linguistic, linguistic or multi-linguistic!
- No current model comes even close to an answer to what they wrote.

The writing

ned to be numerical

heir appearance, the

en the writing and

86† . 149	87† <u>365</u>	88 1	89† 314	90† 2	91† 2	92 1	93 11	94† 11	95 <u>64</u>	96† 22	
1	I	11	_ 11	1	[]]	[]	1111	11			
97 <u>91</u>	98† 88	99 <u>649</u>	100 29	101	102† 161	103† 30	104† 70	105	106† 38	107† 6	
108	109†	110	() 111†	1111 112†	() 113]]] 114	115			1111 1118	ır
3	38	•	4	70	17	7	1	2	1	1	I

ncy of occurrence of signs with different stroke



	"Number"	Sign no	Occurrence
	1	86	149
	1a	97	91
	1b	98	88
	2	87	365
	2a	99	649
	2b	100	29
	2c	101	1
	3	89	314
	3a	102	16
ρ	3b	103	30
	4	-	0
t	4a	104	70
	4b	105	2
ľ	5	0	0
	5a	106	38
)	5b	107	6
	6	-	0
	6a	108	3
n	6b	109	38
	7	-	0
	7a	110	6
	7b	112	70
	8	-	0
	8a	114	7
	9	-	0

Correcting a bias in the design of the corpus

- Researchers have been biased by the way in which the corpora are made – keeping "similar looking" and not by frequency.
- We instinctively assume in general that the sign n is more important than sign n+x.
- As can be seen from the figure on the right the usage is very different.

Signs used more than 75 times (38 signs) Rank by Overall Ranked Group Most fre sign Used Ratio Number by total usage of signs no of in group signs 5 Fish 7, 9, 14, 18, 31 18 0.278 5 2 Stroke 2,6,8, 22, 23, 36 47 0.128 2 2 6 7 3Diamond 3, 15, 21, 25 0.120 3 4 44 1 Jar 1, 4, 13, 20, 30 0.114 4 5 16, 24, 33, 34 38 0.105 5 6Curve 4 17, 32, 38 Open 3 38 0.079 6 6 8 curve 5, 10, 11, 12, 27, 4Lambda 52 0.077 37 7 4 19.25.32 46 0.065 8 7 Man



40

Frequency of different Harappan symbol sets



Numerical symbols frequency distribution





U-shape symbols frequency distribution



The Synonyms path

• Synonyms can be:

- Linguistic synonyms (words with similar meanings).
- Grammatical synonyms words that mean completely different things but are grammatically identical.
- Synonyms that look different because they may refer to tense past present future.
- For example:
 - I have food (to eat) or I have chocolate (to eat) the difference is that the entity is different but in the context of eating.
 - I have clothes (to wear) I have no clothes (to wear!) grammatical synonyms
 - I have food (to eat) and I had food the difference in tense.
- Within this lies a pattern that can reveal some of the patterns in writing and GIVE MORE CONSTRAINTS ON FUTURE DECIPHERMENTS.
- It should also be noted that the writing was almost certainly not for a single purpose only.
- HOWEVER NO TWO SYNONYMS ARE IDENTICAL it would be a waste or resources

248	347	¥∧s
5	× 11 7 99 6	A 35
<	\$ Q	
¥ 347	358)*))
****	Ŭ 348	244
	بلم 194	7
99	402	J 342
102		65
	267	8 391
A 211	U 342	500

Repeating and complex signs and signs with add ons 歳 歳 歳 歳 ST.

- Repeating signs •
 - In many cases we have seen that the same sign repeats itself as a pair ar \$\$ \$\$ \$\$ locations within a text. 愁 ※ 前 肺 肺
 - Which are the signs that show these characteristics and why? •
- Complex signs ٠
 - While some signs are roots, many signs seem to be an addition of two or more other signs.
 - This is not short-handing and the composites appear in different environments.
 - These need to be isolated and studies
- Sign add-ons
 - There are several elements that are clearly not signs but value additions to the signs.
 - They also appear on a few signs and these need to be identified.

成员

* *

嫩 �� �

ままやが

ð,

ent

						Design	Sign(s) in which it appears
C	iar	morai	na	an	d cian additiv		2 291 401 416
5	igi	mergn	IY I	an	u sign additi		★ 5 ★ 20 393
	Design	Sign(s) in which it appears				1	6 39 67 68 128 187 226 263
	5	和	-		A 00	`	[↑] ¹
	N			1	275 407	1	18 212 329 330 343 344 345 346
	A	45 46			"), 289		
	A	"A" A 🗞				1 1	¹ A ¹ ,
	Π	П П П П П П		$\overline{}$	*)*)	^	
	V	195 196 199 200		ð	(a))) C 111 (1)		☆ ☆ ↓ ↓ ↓ ↓ ↓ ↓ 65 66 75 92 138 153 159 163 318 334 398 W 0 0 0 0 0 0 0
		278 279			62 295 300 370 376 1 '1' '1' '1' '1' '1' '1' '1' '1' '1' '		55 70 71 406
	M	131		1	∧I I I I I I I 25 26 52 183 246 248 269 349 I F HO	1 \	/【 85
	\wedge			1		<u> </u>	
		316 317 318 393 395		30	69 272 399		117 131 139 142 206 208 234 339
	A	316				8	42 136 193 210 232 262 297 326 327
	X	X 75		7775	332 337		380 398 "X" "X" "Y" "A" "A" "P"
	Ŷ	₩ ₩ ₩ ₩ ₩					
						(196 203 207 411

Clusters of data

- Computationally we know that the Indus writing can be separated into 9 different clusters.
- The sign frequency distribution is different in different sets.
- This is a major clue to identify different types of information that is currently grouped as single information.

S. No.	EBUDS	C1	C2	C3	C4	C5	Ce	С7	C8	С9
1	ग 342	۳ 169	245	A 211	99 11	र्ग 342	Ч 162	.391.	1 76	 87
2	1 99	6	U 342	♦ 59	ل 342) 123			У 342	У 342
3	267	J 123	25	89	267)) 671	₹ 342	89	A 59	A 59
4	69 59	102	 .99	1 1 .99	Х 67	Â 85	 .99	U 328	₩ 15	 .99
5	 87	A 254	A 204	336	391	ٿ 343	ٿ 343	₩ 336)) 67	
6	176	86) 97	¥ 67	♦ 59	₽₩	J 123	X 17	86	₿ 391
7	Д 67	U 343	75			<u>)</u>		86		U 343
SIGN	EBUDS	C1	C2	СЗ	C4	C5	C6	С7	C8	C9
U 342	1	<mark>36</mark>	2	<mark>6</mark> 3	2	1	2	41	2	2
U 342	1 2	36 -	2 3	63 3	2	1	2 4	41 12	2 16	2
↓ 342 Ⅱ 99 267	1 2 3	36 - 60	2 3 30	63 3 8	2 1 3	1 - 39	2 4 41	41 12 41	2 16 46	2 4 52
↓ 342 Ⅱ 99 ↓ 267 ↓ 59	1 2 3 4	36 - 60 60	2 3 30 18	63 3 8 2	2 1 3 6	1 - 39 8	2 4 41 9	41 12 41 32	2 16 46 3	2 4 52 3
Juine Juine 342 Juine 99 267 267 267 59 11 87 87	1 2 3 4 5	36 - 60 60 -	2 3 30 18 7	63 3 8 2 18	2 1 3 6 16	1 - 39 8 131	2 4 41 9 16	41 12 41 32 -	2 16 46 3 35	2 4 52 3 1
→ 342 II 99 267 59 ==== 87 178	1 2 3 4 5 6	36 - 60 - -	2 3 30 18 7 18	63 3 8 2 18 36	2 1 3 6 16 76	1 - 39 8 131 -	2 4 41 9 16 22	41 12 41 32 - -	2 16 46 3 35 1	2 4 52 3 1 38
→ 342 II 99 267 59 II 99 267 59 II 87 II 87 59 67	1 2 3 4 5 6 7	36 - 60 - - 25	2 30 18 7 18 18	63 3 8 2 18 36 6	2 1 3 6 16 76 4	1 - 39 8 131 - 3	2 4 41 9 16 22 31	41 12 41 32 - - 16	2 16 46 3 35 1 4	2 4 52 3 1 38 21
→ 342 II 99 267 267 59 178 1778 1778 477 477 211 211	1 2 3 4 5 6 7 8	36 - 60 - - 25 -	2 3 30 18 7 18 18 30	63 3 8 2 18 36 6 1	2 1 3 6 16 76 4 32	1 - 39 8 131 - 3 131	2 4 41 9 16 22 31 -	41 12 41 32 - - 16 -	2 16 46 3 35 1 4 4 15	2 4 52 3 1 38 21 52

One possible way forward

- Take signs and their additive components.
- Take a look at signs that are conjunctions of signs.
- Make a master list of original signs that appear with additives and in conjunctions.
- Study the sign sets that the computer identifies as synonyms. These are grammatical synonyms. In "I eat" and "I drink" are grammatical synonyms but their meanings are different.
- Look at the environment in which different variants appear.
- Look for the environment of signs and repeated sign patterns.
- List signs and sign pairs that appear in the 9 different groups.
- Look for possible models where information is stored for any of the possible uses.
- Look for possible methods of centralising the writing.

Conclusion

- We have a limited amount of data and no bilingual text, we cannot use brute force methods to decipher the script.
- We will have to understand the wider context of the writing rather than look at each symbol as a singular representation of information.
- Currently our ignorance of a lot of subtle aspects exceeds our broad understanding.
- These subtleties include understanding of:
 - Clustering sign
 - Sign merger
 - Sign additives
 - Relation to the animal motif
- We need to understand the Harappan people better before we can address the question of what they wrote.

At this stage, our ignorance exceeds our understanding.

We just do not understand the Harappan People.

We are very biased by our present perspective, which assumes that they were socially similar to us.

That seems to be a poor assumption.

Welcome to a problem.

Thank you for listening.



The End!