

#### Please cite the Published Version

Paxton-Fear, Katie (2018) A Computational Decipherment of Linear B. In: Computer Applications and Quantitative Methods in Archaeology Conference (CAA 2018), 19 March 2018 - 23 March 2018, Tübingen, Germany.

Version: Presentation

Downloaded from: https://e-space.mmu.ac.uk/627538/

Usage rights: O In Copyright

#### **Enquiries:**

If you have questions about this document, contact openresearch@mmu.ac.uk. Please include the URL of the record in e-space. If you believe that your, or a third party's rights have been compromised through this document please see our Take Down policy (available from https://www.mmu.ac.uk/library/using-the-library/policies-and-guidelines)



# Lessons of the Past, Tools of the Future A Computational Decipherment of Linear B

Katie Paxton-Fear PhD student in Defence and Security Cranfield University <u>K.Paxton-Fear@cranfield.ac.uk</u>

#### Creativity is Limitation



- Limitation: Follow the steps of the original decipherment
  - "Standing on the Shoulders of Giants"
- A different approach to a interdisciplinary project

## Background

- Linear B was found on Crete and at select places on the mainland
- It is a syllabic language
- The language was used administratively
- Related languages
  - Linear A, Cypro-Minoan, Cretan Hieroglyphs, Classical Cypriot



## A Recipe for Decipherment



1) Correctly classify and transcribe tablets Completed by Emmett L. Bennett Jr.



2) Find evidence of inflection Completed by Alice Kober



3) Create a	grid o	f characters
-------------	--------	--------------

**Completed by Michael Ventris** 



4) Begin assigning likely values to the grid Completed by John Chadwick & Ventris

	Α	E	I	0	U
VOWEL	Ч	A	¥	Ľ	۴
D	F	₩	Π	f	Ж
J	8	×		2	Juu
К	Ð	×	Ŷ	P	e);
М	M	मुख	V	۴	Ч
N	Ŧ	뿌	Ϋ́	₩s	
Р	ŧ	ē	Â	ቫ	У
Q	Ŷ	0	<del>ا</del>	Ť	
R	2	Ψ	¥	+	Ч
S	Ý	٣	本	۴	E
т	E	: :	M	Ŧ	Ф
w	Π	S	Æ	$\Pi^3$	
Z	f	ē.		\$	

#### System flow





## Finding Inflection: Original Work

- Kober originally found evidence that Linear B was inflected
- Kober's algorithm
  - Select words which are followed by ideograms and numerals
  - Find the same **word in different contexts**
  - Find **predictable patterns** where the word endings change

	Туре А		Туре В				
Case I	ፕ <u>ኦ</u> ለ 🛛	‡¥∩[]	Ф Ҟ ҄ ҄ Ѩ 目	₽₩#目	Ϋ́ Ѵ̈́ Ҵ		
Case II	Υ <sup>™</sup> ሺ ሺ ፻	‡¥ጠጚ	Φ ᢜ ፟ Ѩ โ	ዋ ነ ለ 7	Ϋ V ϔ Ţ		
Case III	ቸ ፻ ቸ	‡Ψ <b>Ŧ</b>	Φ ቶ የ	ዋ፝፝፝፝፝	ቸ <sup>ሆ</sup> ϔ ϔ		
	Туре С	г	ype D	Туре Е			
Case I	Ҟ҄ѷҏ҃	(	₽₩目	+ ∦ 目			
Case II	<u>ቶ</u> ፻ ዦ ፻	(	$\mathcal{D}$	ት Æ ፻			
Case III	ት 7 የ	(	¢۲	+ <i>Π</i> <sup>3</sup>			

#### Finding Inflection: Computational Approach

- A visual representation
- Loop through each word
  - Loop through each word
    - If the word is exactly the same ignore
    - Else
      - Loop through the characters in word 1
        - Does this character match the character in word 2
          - Increase the similarity
        - Else stop, these words are dissimilar

wal talk wal war wal	[w,a,l,k] [t,a,l,k,i,n, [w,a,l,k,i,n, [w,a,n,t,i,n [w,a,l,k,e,c	g] ,g] ,g] ]]	
Loop	Word 1	Word 2	Similarity
1	walk	walk	0
2	walk	talking	0
3	walk	walking	4
4	4 walk		2
Loop	walk	wanting	Similarity
1	W	W	1
2	а	а	2
2			2

n

Z

#### Finding Inflection: The Results





#### Creating the Connections: Original Work

- Kober showed how characters are connected
  - Computerise this process
- Predictable patterns, evidence of inflection
- Then this is plot on a graph



Ser-vu- <mark>s(a) -&gt;</mark> Servus Ser <mark>-vu-m(a)</mark> -> Servum Ser-vi -> Servi							
Same word - Einstacterastens asente, the mexpext different case character likely shares a consenant							
	Type A		Туре В				
Case I	ዮ <b>የ</b> ጽ 🖻	‡ ¥ ∩ 目	Ф 兆 舟 目	₽₩ѧ目	サレヤ目		
Case II	ዣ <b>१</b> ∕ ∩ ፻	‡ ₩ Λ ኛ	Φ <u>ቶ</u> μ ?	₽₩47	<u></u> የ እ አ ይ		
Case III	ዋ ช ₹	‡Ψ₹	ቀ ቶ የ	ዋ 🐺 የ	¥ V ጞ የ		

#### Creating the Connections: Results



#### • Graph

- Node -> A Linear B character
- Edge -> A shared vowel or consonant
- Weight -> How often it appears
- Seed the graph with likely values
  - da, ma, mi, ni, so, do, su, du
- Plot onto a table

#### Final Grid

	а	е	i	Ο	u
М	ma	me	mi	mo	mu
Ν	na	ne	null	no	nu
D	da	de	di	do	du
J	ја	je	ni	јо	ju
К	ka	ke	ki	ko	ku
Р	ра	ре	рі	ро	ри
Q	qa	qe	qi	qo	qu
R	ra	re	ri	ro	ru
S	sa	se	si	SO	su
Т	ta	te	ti	to	tu
Z	za	ze	zi	ZO	zu
W	wa	we	wi	WO	null

#### Conclusion

- It is possible to replicate the decipherment of Linear B computationally
  - Different approach that typical Machine Learning decipherments
- Working with limitations can encourage creative solutions
- Interdisciplinary projects are great sources of personal growth

### Thank you for listening

#### Any Questions?

@InsiderPhD

☑ K.Paxton-Fear@cranfield.ac.uk

www.somewebpage.com

https://github.com/greenpencil

My Linear B datasets are available and free for use <u>https://github.com/InsiderPhD/Linear-B-Dataset</u> My inflection algorithm is available and free for use <u>https://github.com/greenpencil/Java-Inflection-Algorithm</u>