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An optimal keyboard layout for the Greek Language Using Evolutionarily Algorithms

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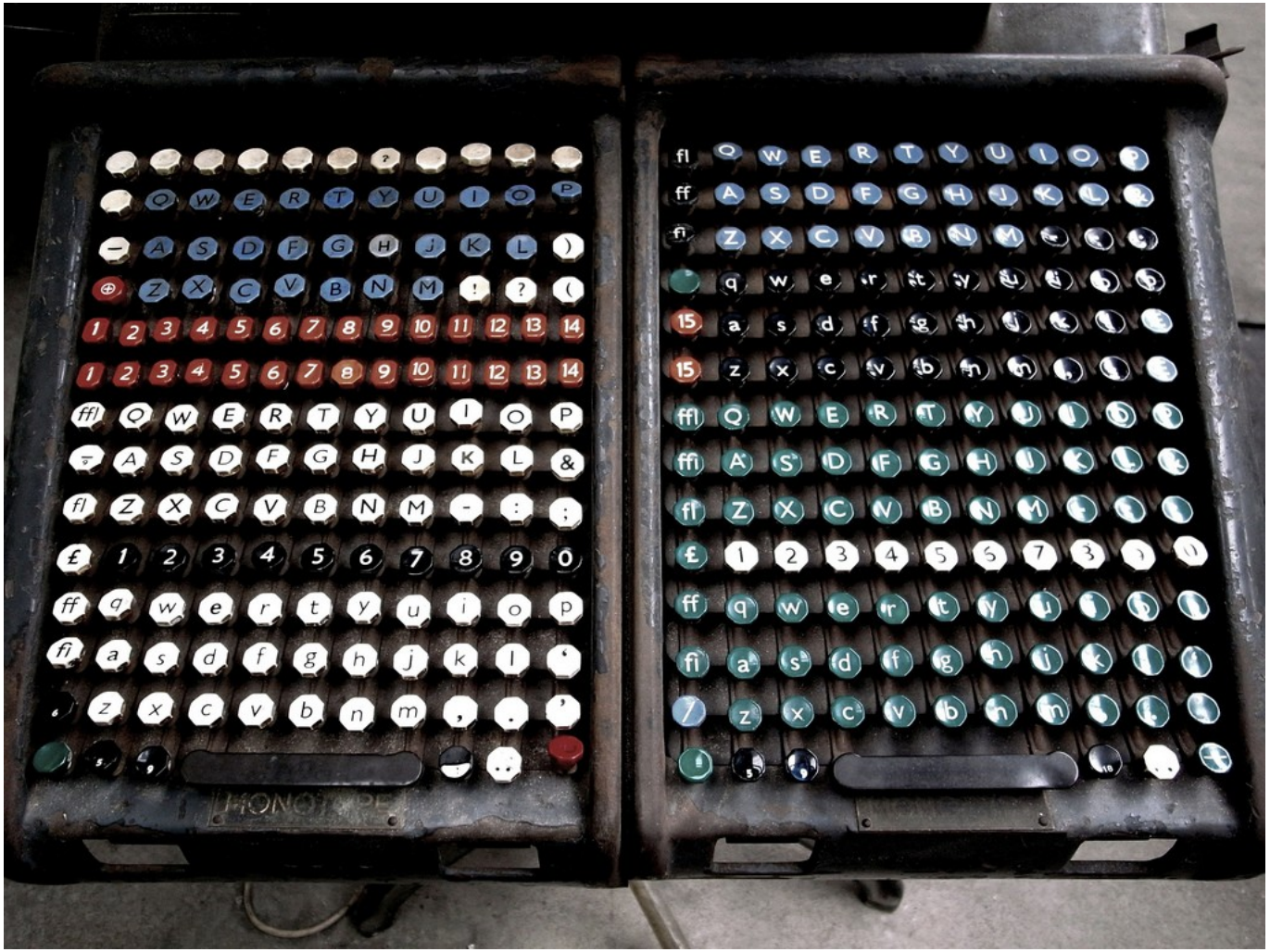
Origins



- Linotype
  1970 -1980

The Origins QUERTY

The 1873 prototype used to demonstrate the technology to Remington (original image: The World of Typewriters)

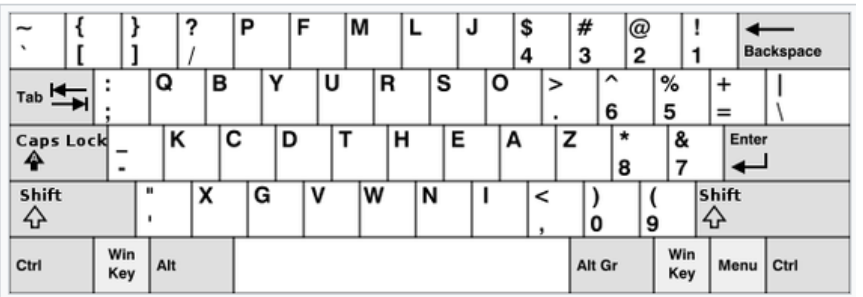
- Sholes and Gliden typewriter
- Remington in 1873
- Remington 2 1878

A better Way Dvorak Simplified

~ `	! 1	@ 2	# 3	$ 4	% 5	^ 6	& 7	* 8	(9	) 0	{ [	}]	Backspace	
Tab	" '	< ,	> .	P	Y	F	G	C	R	L	? /	+ =	| \	
Caps Lock	A	O	E	U	I	D	H	T	N	S	_ -	Enter		
Shift	: ;	Q	J	K	X	B	M	W	V	Z	Shift			
Ctrl	Win Key	Alt								Alt Gr	Win Key	Menu	Ctrl	

- August Dvorak 1932
- ANSI 1991

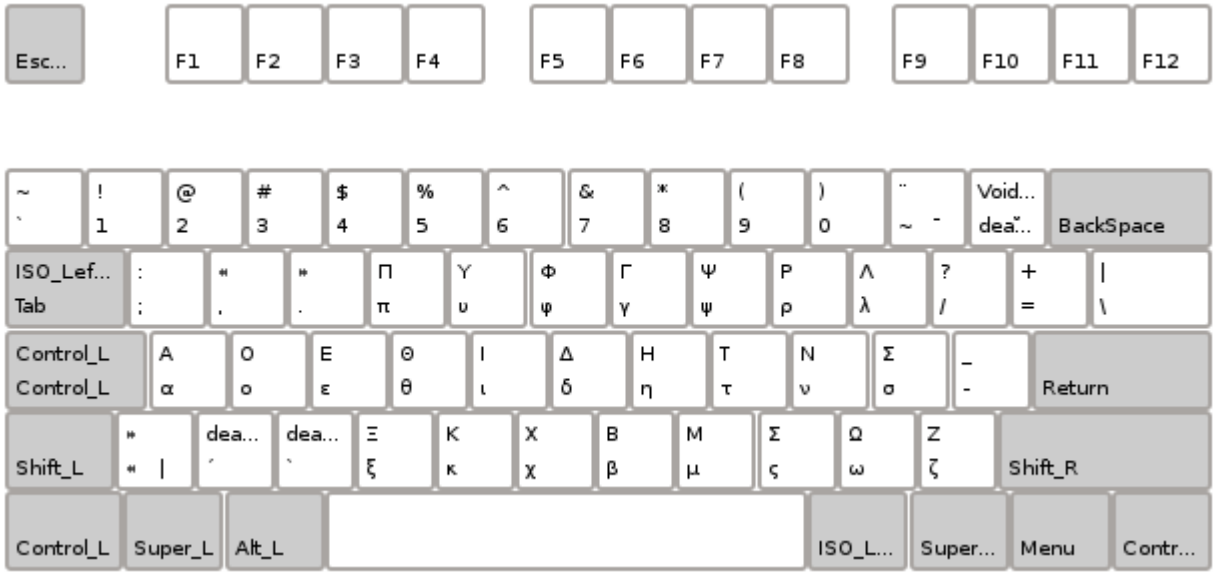
One-handed versions



Left-handed Dvorak layout

Greek Dvorak ?

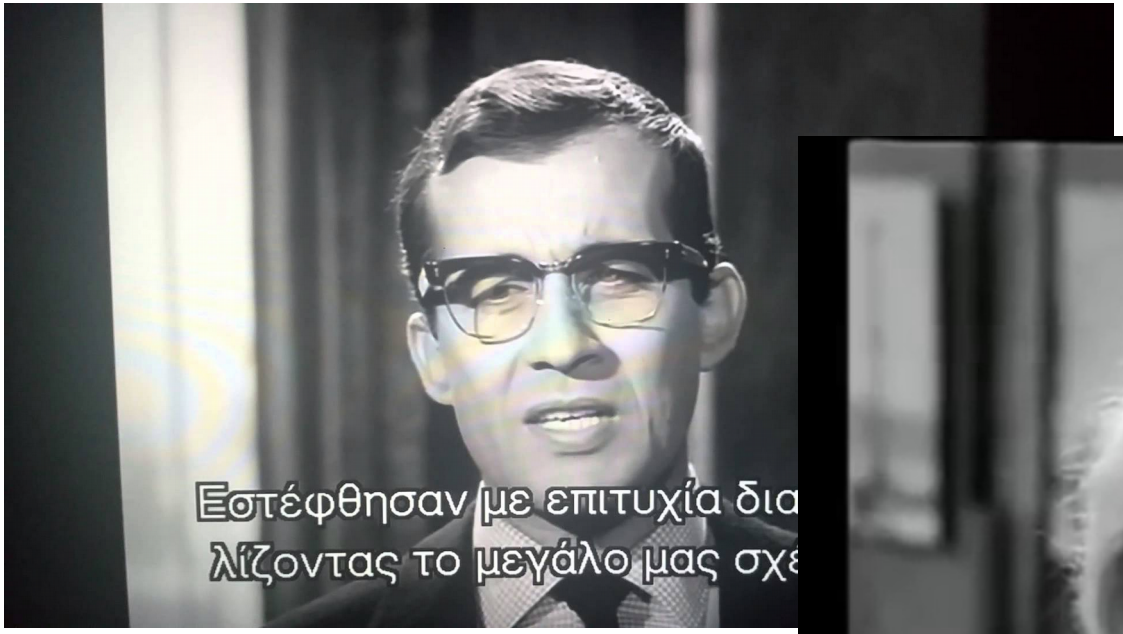
What Did the Dvorak ever done to us ?



- No Greek layout based on Dvorak exists (afaik)
- Based on scientific work
- Greek QUERTY layout is even worst
  - Accent characters
  - Polytonic

http://thelibrarybasement.com/2012/02/18/polytonic-greek-in-dvorak-layout-for-linux/

Resistance



Κυρ Στέφανε, Βάλε και Antivirus, Τρέχω Windows, Και Windows 10 Βάλε και μνήμες Κυρ Στέφανε

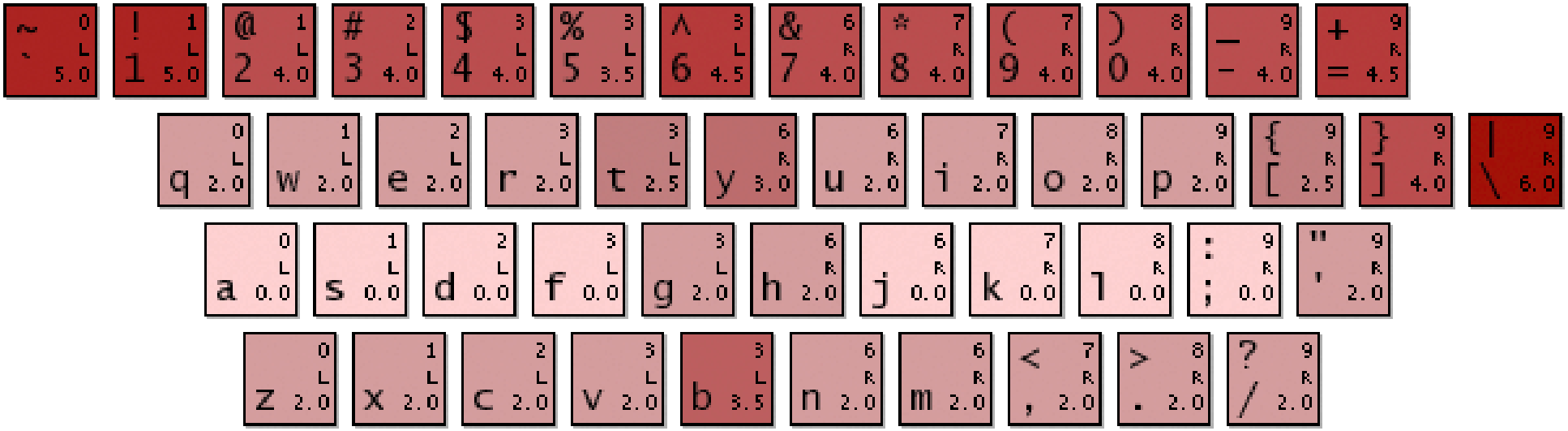
Seeking a better Keyboard Layout for The Greek Language

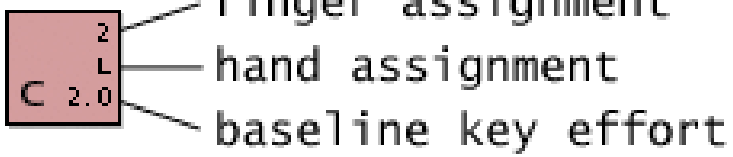
Typing Effort

- Limited use of bottom row
- Increase use of home row
- Limited same finger typing
- Balanced use of of both hands (debate «ui» vs «ts»)
- Limited use of weak fingers (debate pinky and ring)
- (Stroke path) Triads 3-key effort

Base Effort

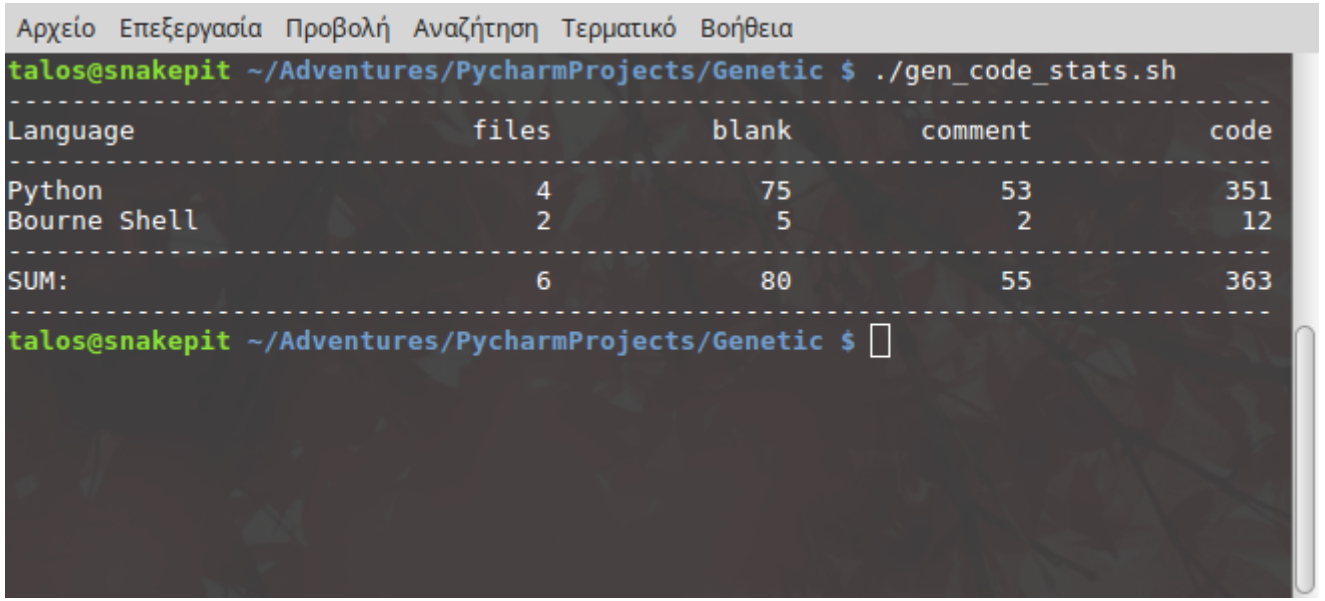
total distance traveled by fingers during typing





Initial Implementation

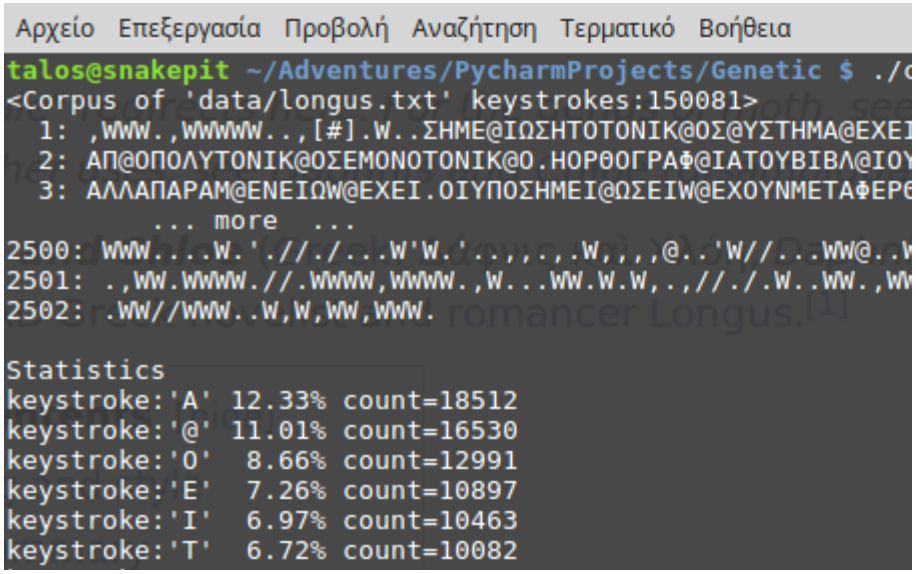
https://github.com/jtsagata/keyboard-monkey



- In Python
- From Scratch
- 351 LOC Working
- Need more work

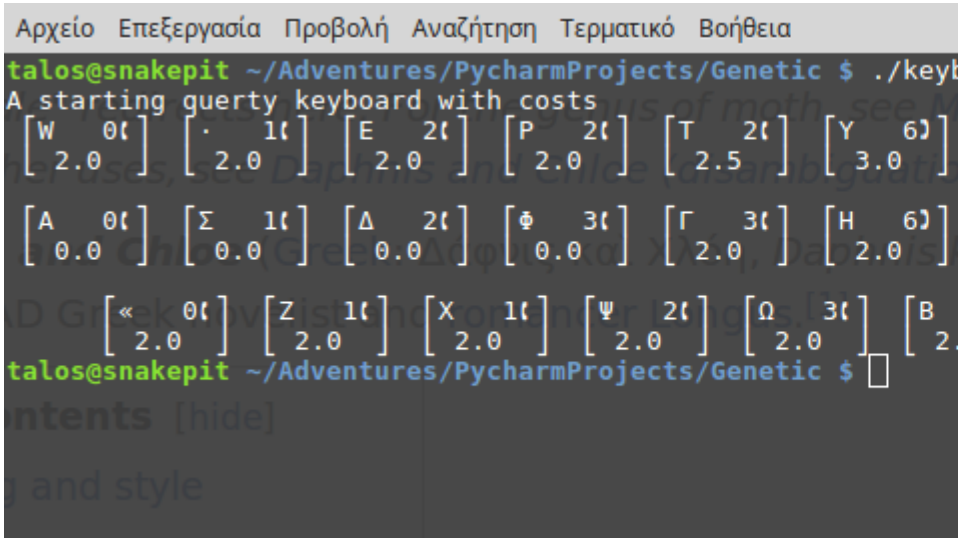
Implementation Details :1

- The Corpus Class



- Convert a corpus text to keystrokes
  Using ‘greek tonos’
  Removes other characters noise
- Daphnis and Chloe by Longus (2 century AD)

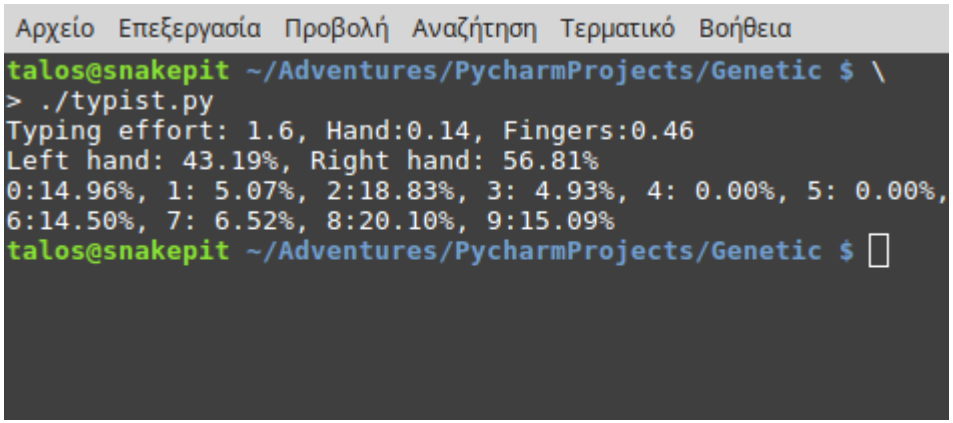
- The Keyboard Class



Hardware details
Mutation / crossover operations
Export as png/pdf
Generate layout for X11
‘Levenstein’ distance

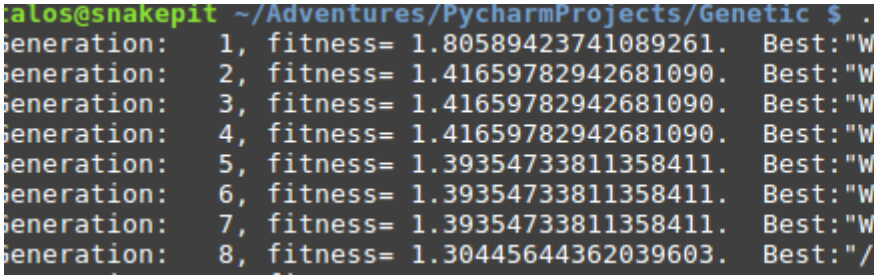
Implementation Details :2

- The Typist Class



- Types a Corpus Text on a Keyboard
- Statistics
- Typing Effort

- The Algorithm



- Evolutionary (NO DNA)
- Multicore Evaluation
- Still needs tuning
- Lots to be done
- Working

A First “Good” Layout

```
talos@snakepit ~/Adventures/PycharmProjects/Genetic $ ./genetic.py
Generation:   1, fitness= 1.80589423741089261.  Best:"W#EΨΣΥΔΞΒΠΛ]ΑΤθ.ΓΗΙΚ[N;@«ΖΧΡΩΟ'Μ,Φ/" (16).
Generation:   2, fitness= 1.41659782942681090.  Best:"WΔΗΡΤΥΜΒ.Π[]ΑΟΝΦΓΚ#Ε@';Λ/Ζ0ΨΩΙΞΧ,Σ«" (19).
Generation:   3, fitness= 1.41659782942681090.  Best:"WΔΗΡΤΥΜΒ.Π[]ΑΟΝΦΓΚ#Ε@';Λ/Ζ0ΨΩΙΞΧ,Σ«" (19).
Generation:   4, fitness= 1.41659782942681090.  Best:"WΔΗΡΤΥΜΒ.Π[]ΑΟΝΦΓΚ#Ε@';Λ/Ζ0ΨΩΙΞΧ,Σ«" (19).
Generation:   5, fitness= 1.39354733811358411.  Best:"WΔΕ[ΩΥ;ΞΒΠΨ]ΑΤ#Ι0ΗΟΚΛΝΓ@«ΖΧΡΣ.'Μ,Φ/" (19).
Generation:   6, fitness= 1.39354733811358411.  Best:"WΔΕ[ΩΥ;ΞΒΠΨ]ΑΤ#Ι0ΗΟΚΛΝΓ@«ΖΧΡΣ.'Μ,Φ/" (19).
Generation:   7, fitness= 1.39354733811358411.  Best:"WΔΕ[ΩΥ;ΞΒΠΨ]ΑΤ#Ι0ΗΟΚΛΝΓ@«ΖΧΡΣ.'Μ,Φ/" (19).
Generation:   8, fitness= 1.30445644362039603.  Best:"/B;ΡΚ]ΛΔ.ΞΦΥΑΟΝΠ0ΨΕΙ@'ΗΜΤΖ,[Ω«WΧ#ΣΓ" (30).
```

```
Generation: 132, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 133, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 134, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 135, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 136, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 137, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 138, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 139, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).
Generation: 140, fitness= 0.76259971929474812.  Best:".ΦΧΗ[#«ΓΖΛΔ]Α@ΙΤ;ΩΕΟΝΥΚ,0'ΒΞΡΜΣΠΨW/" (32).

Best Keyboard:
 [.]  [Φ]  [X]  [H]  [[]  [·]  [«]  [Γ]  [Z]  [Λ]  [Δ]  []]
 [A]  [ά]  [I]  [T]  [;]  [Ω]  [E]  [O]  [N]  [Y]  [K]  [,]
   [θ]  ['']  [B]  [Ξ]  [P]  [M]  [Σ]  [Π]  [Ψ]  [W]  [/]

Statistics:
Typing effort: 0.69, Hand:0.01, Fingers:0.062
Left hand: 49.50%, Right hand: 50.50%
0:14.06%, 1:13.40%, 2:12.09%, 3:12.67%, 4: 0.00%, 5: 0.00%, 6:12.32%, 7:11.80%, 8:11.83%, 9:11.82%
talos@snakepit ~/Adventures/PycharmProjects/Genetic $
```

- TODO: Show and calculate population stats
- TODO: Graph and reports module
- TODO: Parameters Class
- TODO: History Object

Deliverables (TODO)

X11 Keyboards for evaluation and testing

Produce windows .klc files ?

Group 1
Layout: pc+gr+inet(evdev)+group(alt_shift_toggle)+compose(rctrl)+terminate(ctrl_alt_bksp)
IBM ThinkPad 560Z/600/600E/A22E, Intl

If there is time to implement

Future Project Ideas :1

- **A Keyboard Layout for the C++/Java crowd.**
- **Alternative Physical keyboards Layouts (see next slide)**
- **A Greek/English Keyboard Multi-Layout**
  - What English keyboard ? (Qwerty, Dvorak, Colemak, custom)
  - Same location of Letters
    - Good Idea? ('cross scripting' font rendering)
    - Adoption Strategy ?
- **A Custom hardware one handed implementation**

Future Project Ideas :2

- **Design a totally custom keyboard**
  - Hardware implementation
  - One handed
  - Based on FrogPad
  - Engelbart NLS idea

NLS, or the "oN-Line System"
The Mother of All Demos
Douglas Engelbart
9 December, 1968

Keyboards

Maltron Dual Hand with Malt Key distribution

The Velotype

Optimus Maximus

The Kinesis Advantage keyboard

Implementations

- The Carplax Project
  http://mkweb.bcgsc.ca/carpalx/ (Perl)
- https://github.com/wincent/yak-layout (Racket)
- https://github.com/ajnirp/keyboard-layout (LISP)
- http://mtgap.bilfo.com/keyboard.html (Ruby)
- https://bitbucket.org/ArneBab/evolve-keyboard-layout (Python)
- Many good implementations of genetic algorithms in Python and other languages

Literature

- Toward Optimal Arabic Keyboard Layout Using Genetic Algorithm, Malas et all, MESM 2008, Amman, Jordan
- The Standard and Dvorak Keyboards Revisited: Direct Measures of Speed, Leonard, J. West, SFI Working Paper 1998
- Fact or Fiction? The Legend of the QUERTY Keyboard, Jimmy Stamp, Smithonian Magazine 2013 (available online)

Happy Hacking