HCI CASE 04

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Experiment

- The experiment investigates the efficiency of text entry based on the WPM metric using a specially developed virtual keyboard for mobile devices
- Participants – 30
- Type of experiment – repeated mesaures
- Counterbalanced

Independent and dependent variables

Type of experiment: Repeated measure

Independent variable:

- Keyboard layout- Alphabetical layout and Specific layout
- Typing method- One-thumb, Two thumbs, Cradling

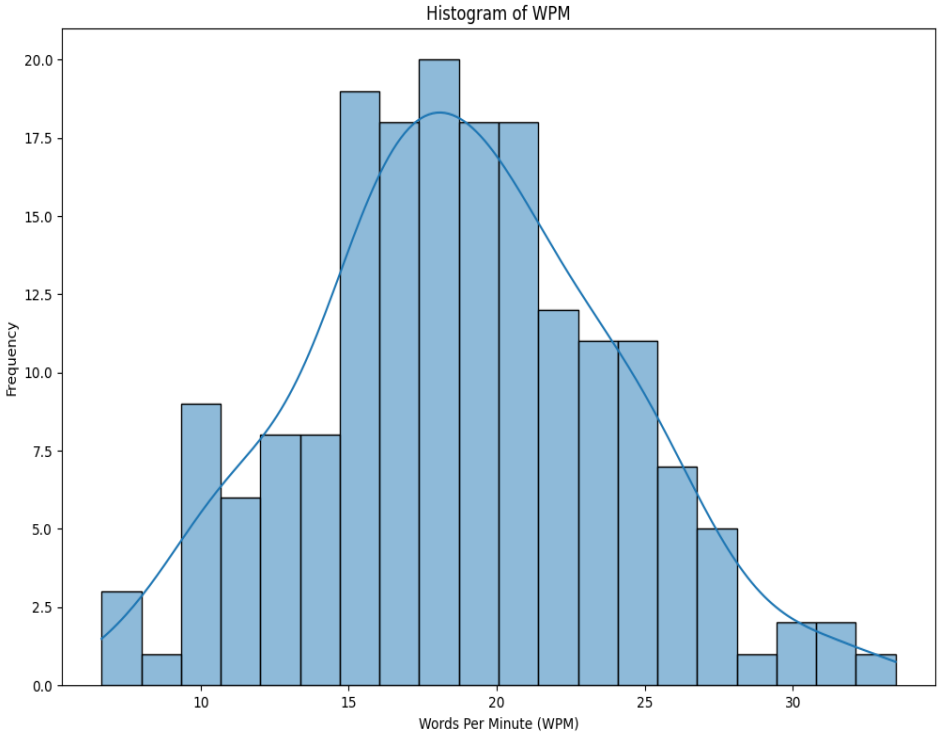
Dependent variable:

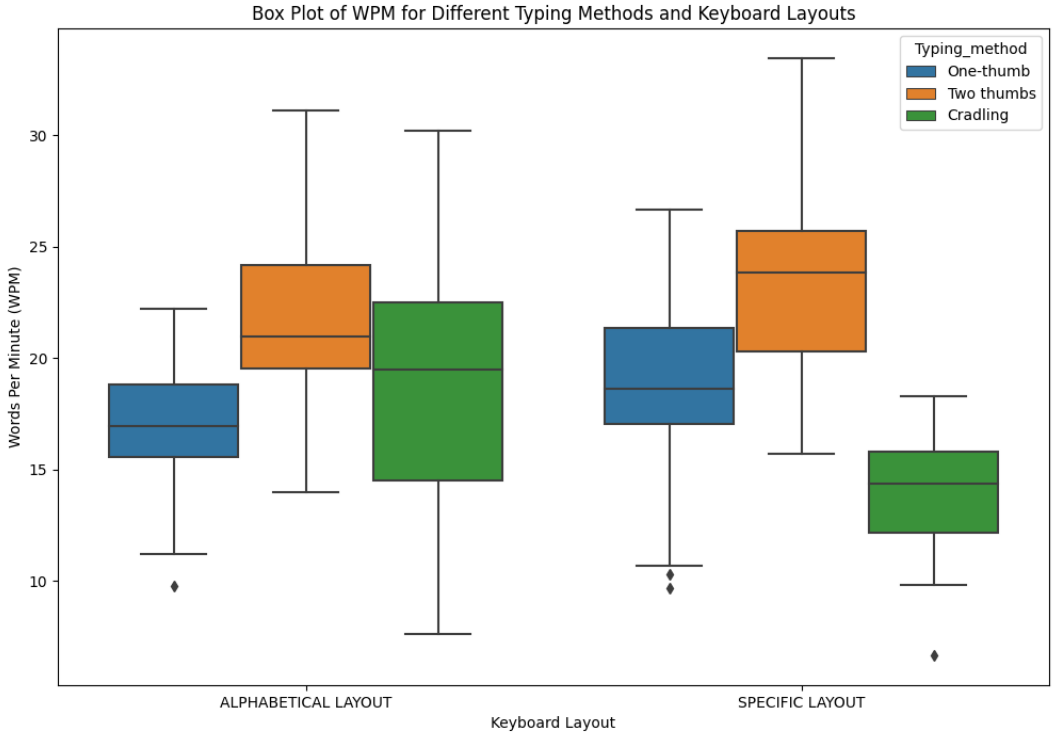
- WPM – Words per minute

Data

	ALPHABETICAL LAYOUT			SPECIFIC LAYOUT		
	One-thumb	Two thumbs	Cradling	One-thumb	Two thumbs	Cradling
	Average WPM					
Participant 01	18,22	23,63	19,66	17,87	26,39	11,79
Participant 02	15,81	23,66	26,95	18,76	16,26	10,44
Participant 03	20,99	24,36	26,95	21,37	28,16	15,61
Participant 04	16,96	21,59	12,50	18,61	18,17	15,74
Participant 05	18,21	22,07	22,65	23,24	25,70	14,01
Participant 06	9,78	15,62	24,61	19,01	21,84	12,07
Participant 07	17,45	27,71	25,06	9,66	16,92	12,43
Participant 08	22,21	20,20	15,39	23,07	30,30	11,85
Participant 09	13,53	15,23	16,51	21,25	23,63	15,06
Participant 10	14,94	20,35	14,27	17,06	15,70	14,94
Participant 11	21,34	20,46	7,59	18,37	25,79	18,29
Participant 12	18,53	25,13	21,26	16,06	17,54	10,44
Participant 13	19,48	22,70	10,62	18,63	21,86	11,23
Participant 14	19,66	19,89	22,15	19,90	23,99	17,44
Participant 15	12,86	20,10	9,68	20,28	24,60	13,30
Participant 16	19,55	25,89	28,02	17,01	21,21	17,54
Participant 17	17,16	18,15	20,69	22,08	25,66	15,84
Participant 18	16,96	13,99	20,04	17,80	23,33	17,07
Participant 19	11,18	23,01	7,77	26,65	23,74	16,57
Participant 20	18,91	26,00	20,88	10,31	25,10	9,83
Participant 21	19,23	25	18,17	14,36	24,63	16,77
Participant 22	15,95	20,66	19,32	17,85	20,68	14,38
Participant 23	16,98	18,54	15,3	16,88	25,13	16,08
Participant 24	15,55	19,29	8,6	17,73	19	12,53
Participant 25	14,38	21,28	21,94	23,25	33,47	12,95
Participant 26	16,5	31,12	23,2	22,71	24,36	12,5
Participant 27	15,06	18,61	17,11	19,06	20,2	15,61
Participant 28	15,56	19,41	19,12	21,9	19,87	6,65
Participant 29	15,86	24,8	10,77	11,48	28,09	14,91
Participant 30	16,65	20,22	30,21	10,67	31,74	14,3

Descriptive statistics





Tools for analysis and statistical test

- Python – libraries used: pandas, statsmodels, pingouin, seaborn, matplotlib
- Data visualization: seaborn and matplotlib were used to create a box plot and a histogram
- Statistical test: Two way repeated measures Anova (statsmodels' AnovaRM function)
- Post-hoc tests: Tukey's HSD (statsmodels' pairwise_tukeyhsd) and Pair Wise T-tests (pingouin's pairwise_ttests)
- Sphericity check: Mauchly's test using pingouin's sphericity function

Statistical test report (1)

- Mauchly's test of sphericity: W = 0.948962 chi2 = 1.46682 p = 0.48027
- Keyboard layout: F(1,29) = 0.2858, p = 0.5970
- Typing method: F(2,58) = 47.4047, p < 0.0001
- Interaction effect: F(2, 58) = 12.5877, p < 0.0001

Anova

	F Value	Num DF	Den DF	Pr > F
Keyboard_layout	0.2858	1.0000	29.0000	0.5970
Typing_method	47.4047	2.0000	58.0000	0.0000
Keyboard_layout:Typing_method	12.5877	2.0000	58.0000	0.0000

Statistical test report (2) Tukey HSD

- Cradling vs One-thumb: (mean diff = 1.3862, p = .202, CI = [-0.5231, 3.2954])
- Cradling vs Two thumbs: (mean diff = 6.2762, p < .001, CI = [4.3669, 8.1854])
- One-thumb vs Two thumbs: (mean diff = 4.89, p < .001, CI = [2.9808, 6.7992])

Multiple Comparison of Means - Tukey HSD, FWER=0.05

group1	group2	meandiff	p-adj	lower	upper	reject
Cradling	One-thumb	1.3862	0.202	-0.5231	3.2954	False
Cradling	Two thumbs	6.2762	0.0	4.3669	8.1854	True
One-thumb	Two thumbs	4.89	0.0	2.9808	6.7992	True

Statistical test report (3) Pair Wise T-tests

- Alphabetical Cradling vs One-thumb: (t(58) = 1.362, p = .178, Hedges' g = 0.347)
- Alphabetical Cradling vs Two thumbs: (t(58) = -2.285, p = .026, Hedges' g = -0.582)
- Alphabetical One-thumb vs Two thumbs: (t(58) = -5.565, p < .001, Hedges' g = -1.418)
- Specific Cradling vs One-thumb: (t(58) = -5.024, p < .001, Hedges' g = -1.280)
- Specific Cradling vs Two thumbs: (t(58) = -10.010, p < .001, Hedges' g = -2.551)
- Specific One-thumb vs Two thumbs: (t(58) = -4.546, p < .001, Hedges' g = -1.158)

Contrast	Keyboard_layout	A	B	Paired	Parametric	T	dof	Alternative	p-unc
Keyboard_layout	-	ALPHABETICAL LAYOUT	SPECIFIC LAYOUT	FALSE	TRUE	0.533212211	178	two-sided	0.594551814
Typing_method	-	Cradling	One-thumb	FALSE	TRUE	-1.670656421	118	two-sided	0.097439916
Typing_method	-	Cradling	Two thumbs	FALSE	TRUE	-7.173069058	118	two-sided	6.96787E-11
Typing_method	-	One-thumb	Two thumbs	FALSE	TRUE	-6.891587941	118	two-sided	2.88711E-10
Keyboard_layout * Typing_method	ALPHABETICAL LAYOUT	Cradling	One-thumb	FALSE	TRUE	1.362494777	58	two-sided	0.178309253
Keyboard_layout * Typing_method	ALPHABETICAL LAYOUT	Cradling	Two thumbs	FALSE	TRUE	-2.284690711	58	two-sided	0.026007158
Keyboard_layout * Typing_method	ALPHABETICAL LAYOUT	One-thumb	Two thumbs	FALSE	TRUE	-5.564582734	58	two-sided	7.03043E-07
Keyboard_layout * Typing_method	SPECIFIC LAYOUT	Cradling	One-thumb	FALSE	TRUE	-5.023547171	58	two-sided	5.15894E-06
Keyboard_layout * Typing_method	SPECIFIC LAYOUT	Cradling	Two thumbs	FALSE	TRUE	-10.00992593	58	two-sided	2.992E-14
Keyboard_layout * Typing_method	SPECIFIC LAYOUT	One-thumb	Two thumbs	FALSE	TRUE	-4.545608899	58	two-sided	2.8338E-05