Arrow Key Configurations on Laptop Keyboards: Performance and User Preference of the Inverted-T and Modified-T Layouts

Eric Thomas , Ruben DeLeon , Nicholas J. Kelling and Christy Harper
University of Houston-Clear Lake Hewlett-Packard

Abstract

As laptops have become smaller, keyboard sizes have followed suit. Consequently, arrow key configurations have been looked at to help free up real estate on the keyboard. The most common configuration is the Inverted-T, however the Modified-T is a configuration that is being considered due to its size and scalability. This study sought to understand how the Inverted-T and the Modified-T compare to each other in terms of performance and user preference. Results showed that user performance and preference did not differ significantly between the two keyboard designs.

Introduction

- To help make laptops smaller, arrow keys have shrunk in size.
- The Inverted-T configuration is more traditional and commonly used. In this configuration, the size of the arrow keys are the same size as the letter keys.
- The Modified-T configuration maintains the shape of the standard Inverted-T but reduces the overall size to fit in one keyboard line rather than two.
- The smaller size of the Modified-T represents a more difficult target that may hinder performance (Fitts and Peterson, 1964).
- Previous research has demonstrated that differences can be found between various keyboard layouts (Nery, Harper & Bartha, 2013). That study compared the Inverted-T to the Modified Cross.
- A direct comparison between the Inverted-T and Modified-T is required to better understand the effects of a compressed layout on performance and preference.

Inverted-T Configuration

Modified-T Configuration

Method

Participants

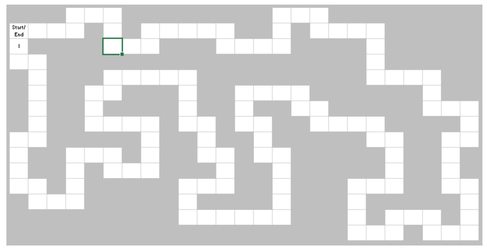
20 undergraduate students ranging from 24 - 40 years of age (*M* = 28.25; *SD* = 5.76) were recruited from the University of Houston-Clear Lake.

Equipment

- Mini USB keyboard (Inverted-T)
- Small Apple keyboard (Modified-T)
- Morae, a usability testing software, was used to capture keystrokes, screen images, and completion time.

Procedure

- Task 1: Participants completed a maze using only the arrow keys. Completion time and the number of errors were recorded to assess performance.
- Task 2: Participants navigated a "realistic use" maze by moving from one red cell to another, typing answers to questions in the cells. Again, completion time and the number of errors were recorded to assess performance. This task was designed to mimic realistic use of the arrow keys.
- Participants completed both tasks with one keyboard and were given the System Usability Scale (SUS) Assessment. They then repeated different mazes on the other keyboard and were given the SUS for that keyboard. Keyboard order was counterbalanced between participants.



Maze Task

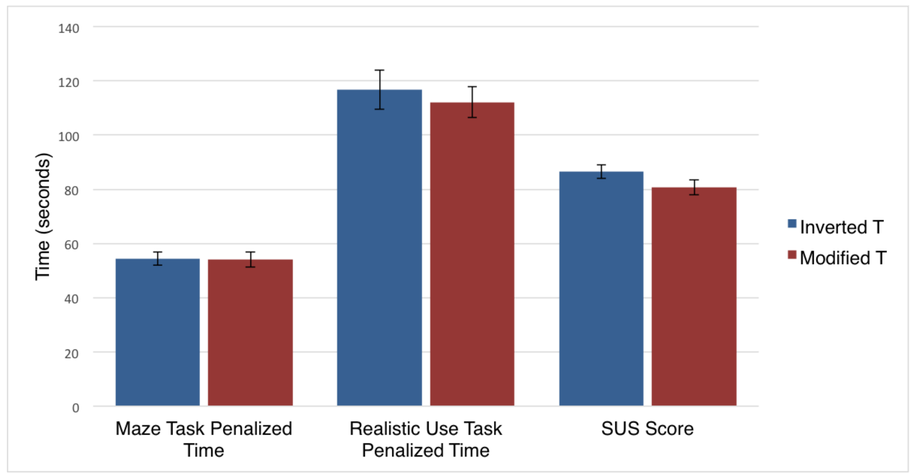
Realistic Use Task

Statistics

A combined speed accuracy measure was created for each task by adding a penalty onto the participant's time for each error they made. For each task, the penalty equaled 10% of the average time across all of the conditions. Paired t-tests were used to analyze all relationships between arrow key configurations. These relationships included Maze Task Time, Maze Task Errors, Realistic Use Task Time, Realistic Use Task Errors, Maze Task Penalized Time, Realistic Use Task Penalized Time, and SUS Score.

Results

No significant differences were found between any keyboard comparison regardless of task. Also, no significant difference was found between the SUS scores of each keyboard.



Task	Keyboard				Test Statistics	
	Inverted-T		Modified-T			
	M	SD	M	SD	t	p
Maze Time	43.45	13.60	46.24	9.31	-1.05	0.306
Maze Errors	1.93	1.34	1.70	1.56	0.68	0.508
Realistic Use Time	102.81	25.71	102.07	24.85	0.32	0.756
Realistic Use Errors	1.35	1.32	0.98	0.72	1.26	0.221
Maze Pen. Time	54.44	10.94	54.04	12.31	0.16	0.871
Realistic Use Pen. Time	116.64	32.40	112.06	25.48	1.18	0.251
SUS Score	86.50	11.54	80.75	12.44	1.76	0.095

Discussion

- These results demonstrate that the Inverted-T and Modified-T arrow key configurations do not differ in their efficiencies, including speed of use and number of errors. Additionally, no preferential evidence was found between layout types.
- This suggests that arrow keys can be made smaller without decrement to user performance.
- Non-significant SUS scores suggest that users do not prefer or rely on one configuration over another.
- Although no significant difference was found, larger variability in performance was found in the realistic use task suggesting a possible improved methodology for assessing arrow key configurations.

Selected References

- Fitts, P. M., & Peterson, J. R. (1964). Information capacity of discrete motor responses. *Journal of experimental psychology*, *67*(2), 103.
- Nery, A., Harper, C., & Bartha, M. (2013). *Arrow Key Configuration on Laptops: Performance and User Preference of the Inverted-T and Modified Cross.* Paper presented at the Proceedings of the Human Factors and Ergonomics Society 57th Annual Meeting - 2013. doi: 10.1177/1541931213571294