

CS449 - Human Computer Interaction

Assignment-2 Fitts' Law Analysis

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I have selected the calendar application within Microsoft Outlook as the subject of my analysis for this assignment. As a user, my primary task within this interactive application is to efficiently manage my schedules by navigating through different days and months. To do so, I need to switch between the current month, previous month, and next month to view and create events, tasks, and appointments. In Outlook's calendar application, this seemingly simple task carries a design problem that becomes evident when viewed through the perspective of Fitts' Law. Before going into the problem, to better visualize this design issue, please check the [figure1](#) added below, which shows the application's layout and the placement of the navigation buttons.

The critical design problem in the calendar view is about the positioning and usability of the navigation buttons, specifically the "previous" and "next" month buttons located at the top left corner of the calendar panel. While these buttons are expected to facilitate user interaction, they introduce a significant challenge related to Fitts' Law, impacting the efficiency and usability of the application. To explain the problem in more detail, while users navigate through days in calendar panel, when they want to switch between months, they need to use the previous/next month buttons which are in shape of up/down arrows and positioned at the very top left corner of the calendar panel. Although at first glance, moving the mouse pointer all the way to the top left to switch between months may not seem too problematic, but as user wants to switch between months and quickly check some events in different days of different months rapidly, the positioning of these buttons, along with their small size, renders this interaction process between the application and the user very frustrating. An example worst case scenario is as follows: A user check events for all days, starting from the 1st day of the month, and when he/she is at the last day of the month, for moving on to the next month, user needs to click on the next month button. However, as obviously user's focus, as well as the mouse cursor, is on the bottom-right (last day on month) of the calendar panel, moving the cursor a considerable distance with a need of precise movement disrupts user's experience. This design problem is inherently related to Fitts' Law, which is one of the fundamental principles in HCI. Fitt's Law establishes a relationship between the time required to move to a target, the size of the target, and the

distance to the target. In the context of Outlook's calendar application, the design issue is in direct conflict with these principles. At first, Fitts' Law emphasizes that the time needed to reach a target is inversely proportional to the size of the target and directly proportional to the distance to the target (Yablonski, 2020). In this case, the "previous" and "next" month buttons, due to their small size and significant distance from the user's current position, represent a substantial challenge for efficient interaction, and contradicts Fitts' Law which suggests that design should facilitate quicker and more accurate interactions by providing larger and more accessible targets (Yablonski, 2020).

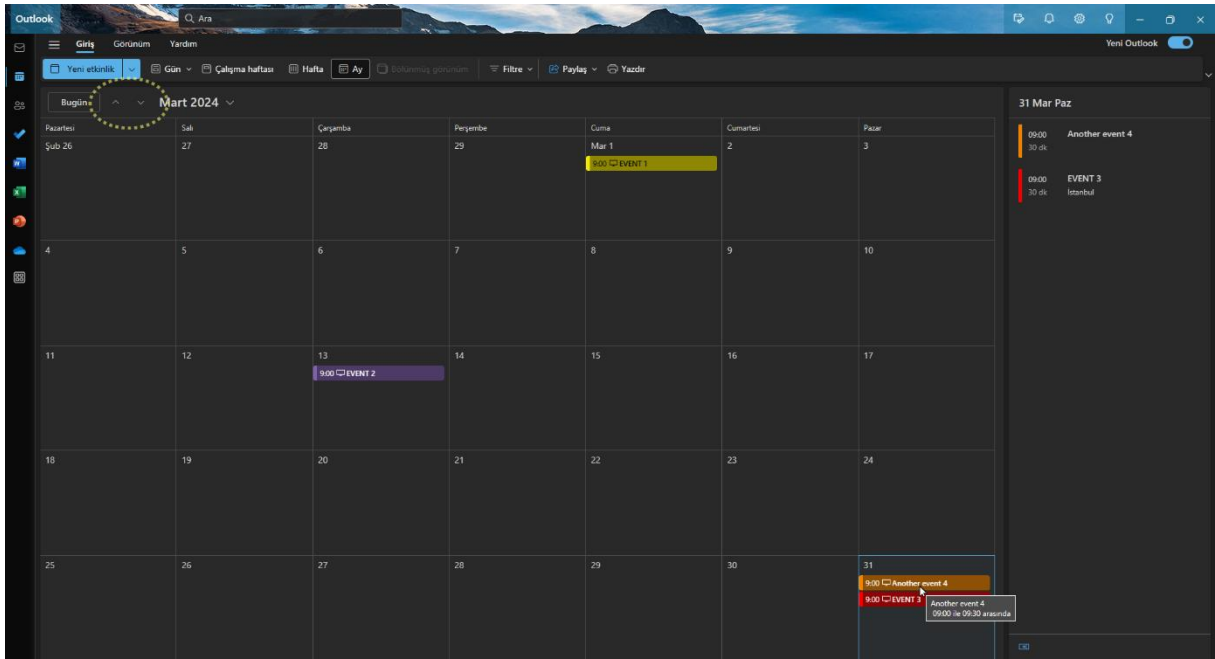


Figure 1: Outlook's Calendar Application (Previous and Next month buttons are circled)

Moreover, the lack of keyboard shortcuts or mouse wheel support further makes the problem worse. Schneiderman's (2016) "Eight Golden Rules of Interface Design" underscores the need for "universal usability" by recognizing the requirements of diverse users, including novices and experts. The absence of keyboard shortcuts, a feature often preferred by more experienced users, neglects the expert segment of the user base. According to Schneiderman, enriching the interface design with features for both novices and experts enhances the overall user experience.

Another related study is the academic work named "Understanding user preferences based on usability and aesthetics before and after actual use" (Lee, 2010), emphasizes the importance of both usability and aesthetics in user satisfaction. This study demonstrates a strong interrelationship between perceived usability, aesthetics, and user preference. Findings mirrors the calendar application's issue: While the placement of the buttons on the top left corner may

seem aesthetically pleasing initially for a new user, the usability problem becomes dominant after actual use.

In conclusion, the design problem in Outlook's calendar application presents a clear HCI issue related to Fitts' Law. The position and size of the navigation buttons hinder efficient interaction, violating the principles of Fitts' Law by increasing the time and effort required to complete the task. Furthermore, the absence of keyboard shortcuts neglects the diversity of users, contradicting Schneiderman's principle of universal usability. This design issue's impact on user preference aligns with the findings of Koubek's study, highlighting the need for effective and user-centred interface design.

Analysis with Fitts' Law metric:

As for the practical application of Fitts' Law to quantify the design problem that I have identified in the Outlook's calendar application, I will examine two real-world scenarios specifically by calculating Difficulty Index values of them. In the first case, user is looking at the first day of the month and wants to switch to the previous month; while for the second case, the user is looking at the last day of the month and wants to switch to the next month. I have chosen these two scenarios because it is highly expected for a user to use 'next month' button after looking at the last day, as well as to use 'previous month' button after looking at the first day. Additionally, examining specifically these two cases will give us a general idea about the Difficulty Index value, although not as much as creating an accessibility heatmap of the entire calendar panel, which is something that currently I am not able to do. To better visualize these scenarios, check the [figure 2.1](#) and [figure 2.2](#) below, illustrating the layout of the application, the positioning and width of the 'next month' button, the cursor's location, and the distance from the cursor to the center of the button. These metrics will serve as the basis for our Difficulty Index calculation. Here are the calculations based on the Fitts' Law formula, where 'D' represents the distance from cursor to the center of the target and 'W' represents the width of the target:

$$\text{Difficulty Index} = \log_2 \left(\frac{2D}{W} \right)$$

For Case 1:

$$W = 45px \quad D = 860px$$

$$DI = \log_2 \left(\frac{2 * 860}{45} \right) = \log_2(38.22) \cong 5.25$$

For Case 2:

$$W = 45px \quad D = 1450px$$

$$DI = \log_2 \left(\frac{2 * 1450}{45} \right) = \log_2(64.44) \cong 6$$

Average Difficulty Index of two scenarios: 5.625

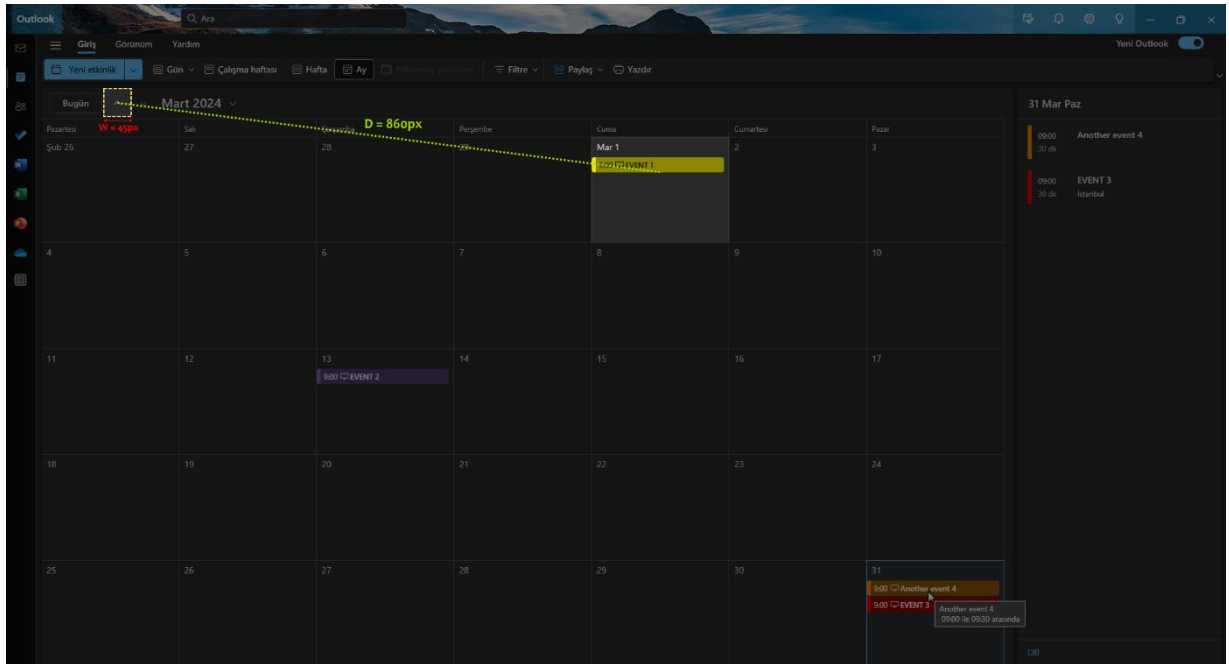


Figure 2.1: Depiction of Fitts' Law Metrics for Case #1

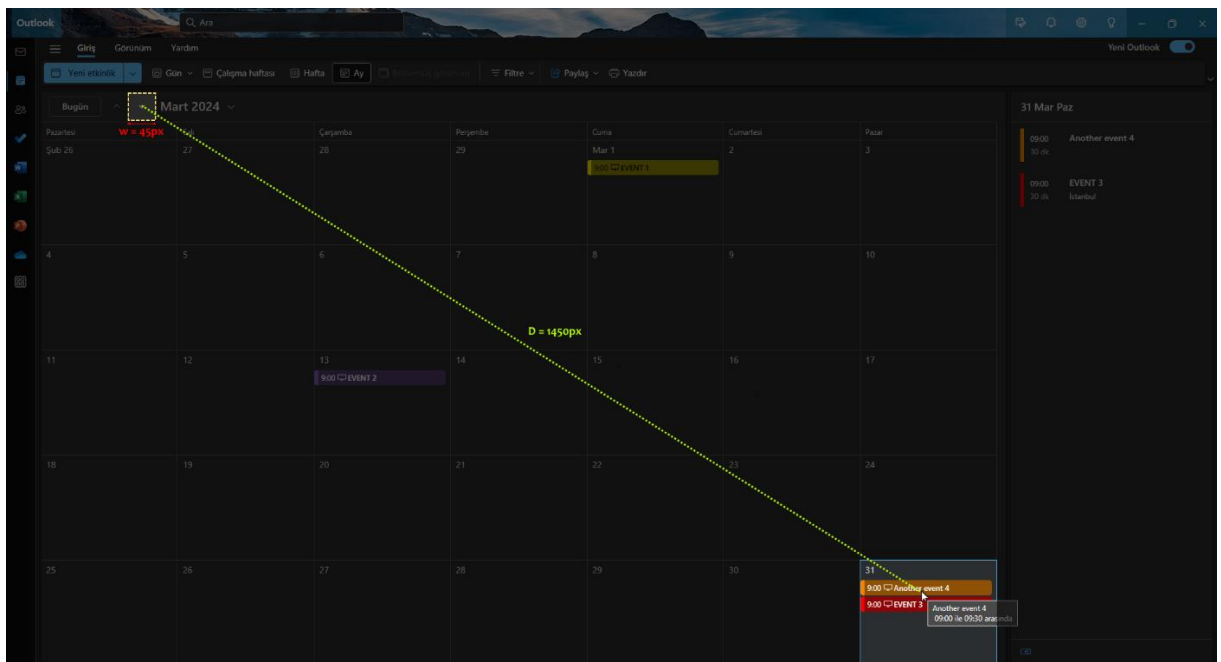


Figure 3.2: Depiction of Fitts' Law Metrics for Case #2

Proposed Solution:

To address the identified HCI problem within the Outlook's calendar application, I have developed a design improvement that enhances user interaction while preserving the existing layout. In this proposed solution, I have introduced a more user-centric approach to the placement of the navigation buttons. The core idea behind this redesign is to maintain the current button positions while adding duplicate buttons to the right side of the calendar panel. The 'previous month' button now also resides at the top right, and a new 'next month' is added to the bottom right of the calendar panel. Before the details of this design improvement, please take a closer look at the enhanced design via the provided [Figma link below](#), as familiarizing yourself with this visual representation will facilitate a better understanding of the changes and their implications, as I proceed to explain the rationale behind this solution.

In this design, the 'previous month' button has been added to the top right corner of the calendar panel. This strategic placement is aimed at aligning with user expectations. When a user's focus is around the upper half of the calendar panel, which often occurs when viewing the first few days of the month, they are more likely to want to switch to the previous month. Therefore, the placement of the 'previous month' button at the top right offers a more intuitive and accessible location, addresses to the user's natural interaction tendencies. Similarly, for users navigating the days located in the lower half of the calendar, it is more common for them to switch to the next month. The new 'next month' button is situated at the bottom right corner of the calendar, aligning with the user's inherent expectation to find it in this area. This positioning of new buttons minimizes the cognitive load placed on users, making it easier for them to locate and access the buttons seamlessly. For a quantitative analysis of the enhanced design, I have calculated the Difficulty Indexes (DI) for the same scenarios as in the previous part, comparing the new design to the original one. Here are the calculations of two cases on the new design that is shown in [figure 3](#):

For Case 1:

$$W = 45px \quad D = 860px$$

$$DI = \log_2 \left(\frac{2 * 590}{32} \right) = \log_2(36.875) \cong 5.2$$

For Case 2:

$$W = 45px \quad D = 1450px$$

$$DI = \log_2 \left(\frac{2 * 180}{32} \right) = \log_2(11.25) \cong 3.5$$

Average Difficulty Index of two scenarios: 4.35

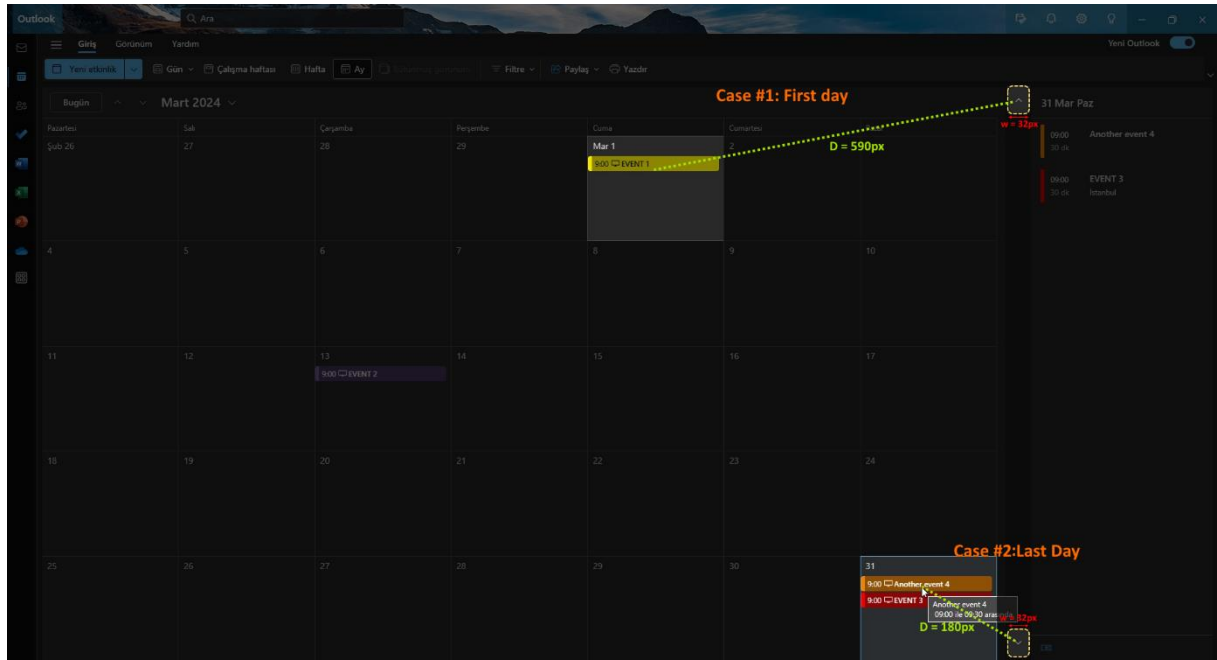


Figure 3: Depiction of Fitts' Law Metrics for two scenarios on enhanced design

As demonstrated by the calculations, the average Difficulty Index for the improved design is approximately 4.35, while in the original interface of the application, the average DI was calculated 5.625. This notable reduction in DI indicates a significant improvement in user's interaction efficiency for these two common scenarios. It is worth noting that these cases are highly expected to be encountered by users in their daily interactions, making the results particularly relevant.

The proposed solution not only aligns with the principles of Fitts' Law but also, takes into account the principles of both usability and aesthetics, as highlighted in the study by Lee and Koubek (2010). By making navigation more intuitive and efficient, the design promotes usability while maintaining a visually appealing interface. Furthermore, the implementation of keyboard hotkeys and mouse wheel support for navigating on calendar would further enhance the user experience, in line with Shneiderman's (2016) "Eight Golden Rules of Interface Design.". These features will enrich the interface, satisfies both novices and experts, thereby improving the overall usability of the Outlook calendar application. Ultimately, the proposed solution deals with the HCI design problem identified in the original Outlook calendar application by offering a more user-friendly and efficient design. The alignment with Fitts' Law principles and the positive impact on Difficulty Indexes underscore the improved usability of the enhanced design. By combining the proposed solution with additional features like keyboard hotkeys and mouse wheel support, the Outlook calendar application can undergo a transformative change, delivering a more effective and user-centered experience.

Figma Link for Enhanced Design:

https://www.figma.com/proto/YfBq3L15w79h3zs9r8Vh6Y/CS449_Fitts'LawAssignment_Solution?type=design&node-id=3-3&t=svTWNqYDV7xjgmke-0&scaling=min-zoom&page-id=0%3A1

References

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