

## Understanding the Usability of Calendars on Transactional Interfaces

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### Abstract:

*Date field is appearing in all web forms. The users usually find difficulty while they are filling the fields. The aim of this research is to examine the user behavior while they are filling dates fields, and propose design guidelines based on the results. The investigation was conducted in two eye tracking experiments and the guidelines were proposed base on the model of interaction in web transactional tasks.*

**Keywords:** *web form, eye tracking, web usability, web calendars, transactional tasks, Arabic web form*

### I. INTRODUCTION

Transactional activities are essential for facilitating services, particularly web-based transactions such as e-gov, e-learning, and e-commerce services. Activities conducted on the web have been classified as transactional when the user reaches the site and interaction will happen; for example, completing a shopping transaction or filling out a form [1]. Filling forms is an essential part of tasks on the web; it reflects the real world process that we want to produce through the web sites such as shopping, membership, etc. Because of this, designing web forms is an increasingly developing area of research in the Human Computer Interaction field, and many guidelines have been suggested based on anecdotal and usability evidence for designers to achieve effective designs that support users in accurately and efficiently completing web forms.

The research on Web form design can be classified into two categories: research studies that focus on how the users interact with the web forms and modeling this interaction. The first model proposed in transactional tasks was the modal theory byargas-Avila et al. [2]. The modal theory assumes that the filling form process is done in two stages: form completion in which the user fill out the form fields, and revision stage in which the user reviews the form after submission and exploring the feedback. The second model was proposed by Al-Wabil and Al-Saleh [3]. It assumes that the users conduct the Web Transactional tasks in six stages: form a goal, determine strategy, act, perceive system state, evaluate field, and evaluate form. Each main stage may contain sub stages. The second category of research focuses on providing design guidelines. These guidelines have been proposed either by web design practitioners or in user-research contexts by involving users in usability testing experiments [4]. These guidelines often focus on specific components, features or elements in the web form such as: label placement in forms [5], layout optimization on web forms [6], types of input methods (i.e. form controls) [7], and form submission methods [8].

Dates are often a key element in interactive web forms. During most of transactional tasks the users need to enter dates such as DOB, departure date, and arrival date. Most of the web sites show the date field as an interactive calendar where the user can select the chosen date. These interactive calendars are basically visual

representation of the day, month, and year. This visual representation varies in interfaces and the interaction modalities often differ (e.g. pull-down menus, tabular format, data entry fields). Prior research has suggested that users often face difficulties in understanding the strategy of the calendar field [14]. Recent studies that we have conducted have also suggested that a key difficulty users experience is understanding the interaction method in first exposure to interfaces which have interactive calendars to facilitate the selection of the day that users want to enter in a web form [3][9].

This study examines the usability of calendars on transactional interfaces in supporting users in transactional tasks by considering visual patterns exhibited by users when they fill the calendar field on web form. The method of investigation is eye tracking users in their interaction with web forms in the context of Arabic interfaces. The objectives of this study are to examine user behavior on 3 different designs of web forms, compare their strategy of using calendar with the strategy proposed by the model of interaction in transactional tasks[1], find difficulties the users may face while using these date entry and propose design guidelines base on these findings. The paper is organized as follows: Section 2 provides a background on date field on web form design. Section 3 provides an overview about the usability of date fields on web form. Section 4 describes an exploratory study examining interaction strategy of calendars that users are often expected to figure out on their own on web forms. Section 5 describes two eye tracking studies investigating how the users interact with dates fields on Arabic web forms. We conclude with design implications in Section 6 and future work.

## II. DATE FIELD ON WEB FORMS

Date field on web forms may take one of three designs: as textbox to allow the user to enter the required date as shown in figure 1, as dropdown lists to allow the user to choose the required date as shown in figure 2, and as an interactive tabular form for a calendar where the users can select the date as in figure 3.

Figure 1. Date field where the users have to enter the date

Figure 2. Date field where the users have to select the date from the lists

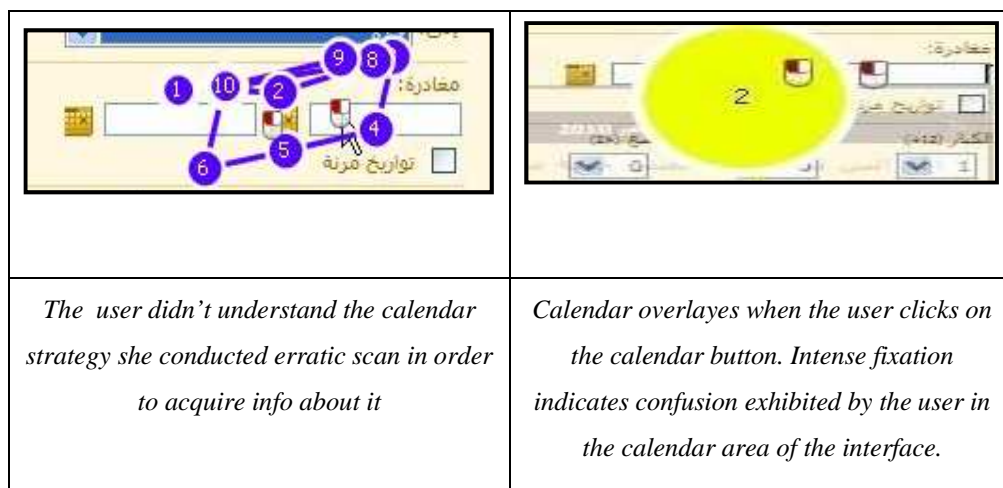
Figure 3. Date field where the users have to press the calendar button and select the date from the calendar



Calendars vary from any other form control in their design considerations which involve the visual appearance of values, their level of interactivity (e.g. overlay in the interface), and the constraints in the design (e.g. restricting values relevant to months, year, ranges and days). Examples of guidelines for calendar designs include: using calendars to provide additional options with the drop down list fields [7] (page. 97), how the user can access calendars [10] (page 166), and guidelines that focus on the design of the calendar itself (provide good values, show only valid dates values, minimize clicks, and consider whether you really need customers to specify dates) as described in [13].

*c. Understanding the strategy of the calendar field*

Each field has its own strategy that the user is expected to understand intuitively to facilitate uninterrupted interaction in the web form. The user often visually examines each web form control, and can collect information about the field strategy from field instructions, label and user experience in completing calendar s. The user understanding of calendar strategies was studied as a part of the validating the model of users in transactional tasks in an eye tracking exploratory experiment described in [2] and [9]. The study showed that 60% of the participants had difficulties while they fill the calendar field. These have been shown as erratic scan or long scan on the field as depicted in figure 5.



*Figure 5. The users didn't understand the strategy of the calendar fields*

The rest of the participants had prior experience in using calendars. This had been shown as regular scanning of the calendar field as shown in figure 6. Their scan path was systematic in the sense that they often started by scanning the field labels, followed by scanning the textbox and finally visually scanning the calendar button and recognizing the point of interaction.

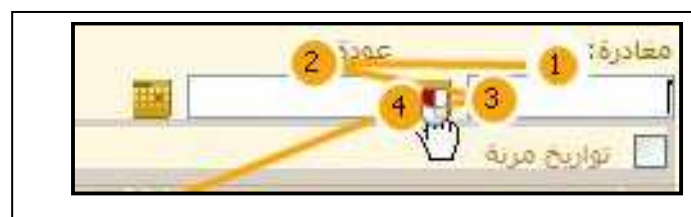


Figure 6. The users understood the strategy of the calendar fields

## IV. EYE TRACKING EXPERIMENTS TO EXAMINE DATE FIELDS ARABIC WEB FORM

Two eye tracking experiments were conducted in 2010-2011 to examine user behavior in Arabic web forms in order to model their interaction with the web forms. The key strokes, scan path, and mouse movements were logged and analyzed as part of the creation and validation of a user model of interaction with web forms. This study is based on the data obtained from these two experiments with a particular focus on the interaction with calendars and an in-depth analysis of patterns of interactions. A sample of 10 different participants using three date fields on three different web forms have been used in the analysis of this study.


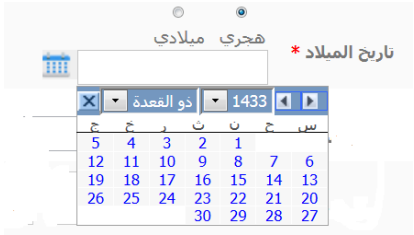
## a. Overview of Experiments

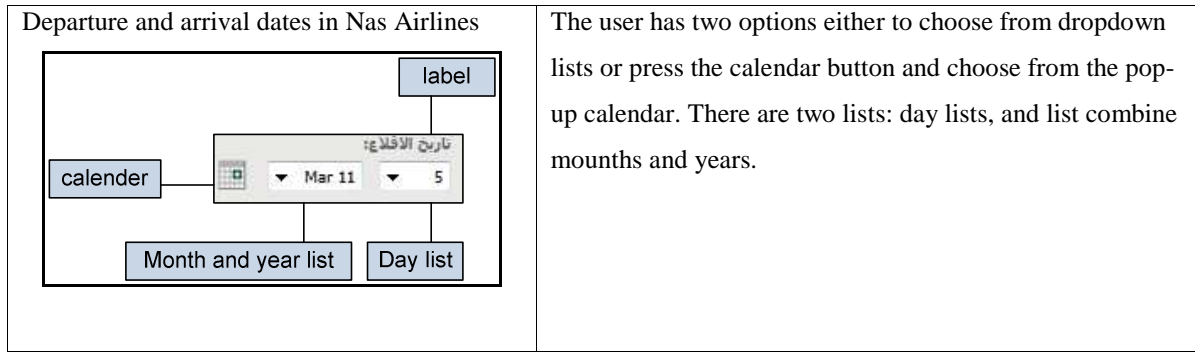
10 participants took part in the study for each date field on three different forms. Participants ranged in age from 14 to 42 years. Participants had a range of computer experience from 4 to 15 years, and their experience in using the Internet was between 4 to 15 years. All of the participants had prior experience in interacting with web forms. In the two experiments, each participant was tested individually in sessions ranging between 20-40 minutes with an average duration of 30minutes.

## b. Stimuli

Calendars with date fields in three web forms: The Yahoo sign up page, the users are asked to enter their DOB. Mawhiba (Saudi academic portal) sign up page, the DOB is one of the requirements in completing the registration process and shows immediate feedback on some of its fields. Nas Airlines the users are asked to specify the departure and arrival dates. Table 1 shows the studied fields and their strategies that the user has to understand in order to complete the field.

TABLE I. THE STUDIED STIMULI AND THEIR STRATEGIES

Stimuli	Field strategy
DOB field in Yahoo sign up page 	The user should select the month (Gorgian calendar), write the day( as number), and write the year.
DOB field in Mawhiba sign up page 	The user should select the calendar she wants (Gorgian or, Hijri), press the calendar button, select the year and month from the drop down lists or use the arrows to navigate between months, and choose the day from the calendar.



c. Analysis

The analysis was conducted to examine how the user understands the strategy of each field and what are the difficulties they face during the interaction with calendar's controls for filling out the data for the field's value.

For the Yahoo date field, 9 participants were able to fill the field normally without any difficulties; one participant entered the name of day instead of number. Inline immediate feedback facilitated recognition of this error as depicted in Figure 7 which shows the embedded error message which appeared to the participant on the form when she entered wrong value.

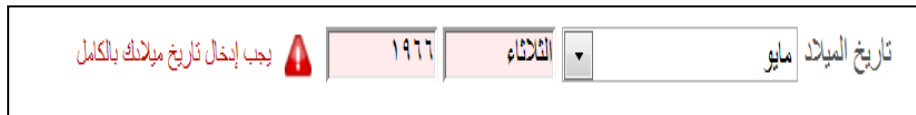


Figure 7. The users entered the name of the day instead of the date

For the Mawhiba portal, the analysis was divided in to three parts according to the strategies in the Mawhiba date field. First, we examined if the participant understood the calendar strategy directly by pressing the calendar button. Second, we checked if the user used the list or arrows to navigate and select the year and month. Third, we examined how the user tried to select the day. For the first part the viewing patterns are show in table 2.

TABLE II. VISUAL PATTERNS OF PARTICIPANTS' UNDERSTANDING OF THE CALENDAR FIELD

Pattern	# of participants
Normal : The participant press the calendar button directly	5
abnormal: The participant tried to write in the textbox	4
abnormal: The participant conducted erratic scan and long fixation before understnading the calendar stategy	1

After the users pressed the calendar button they should select the month and year either from the dropdown lists or navigate by using the arrows. Two participants have used the arrows to select the day, but they found that using the list was much easier; it was observed that they switched to use the lists after this recognition of an alternate form of interaction. In the final step, the user is expected to select the day from the opened calendar. In this study, one participant was observed trying to find a list for days to follow the same strategy of months and years which sheds some light on the importance of considering familiarity of design elements for users in the overall design of web form controls. For Nas airlines web form, the analysis was divided in to two parts

according to the strategy the participant use in filling the date field. Two participants have used the calendar to fill out the date. The rest of the participants have used dropdown lists to fill out the field. Table 3 shows how the participants cognitively determined the strategy of the calendar's interaction prior to initiating the interaction itself for entering the date values.

TABLE III. VISUAL PATTERNS OF PARTICIPANTS USING CALENDAR

Pattern	# of participants
Normal: press on the calendar button, chose the month and year, then chose the day.	1
Abnormal: Try to type on the calendar.	1

Table 4 shows the visual patterns of the participants who used the lists to choose the dates.

TABLE IV. VISUAL PATTERNS OF PARTICIPANTS USED DROPDOWN LISTS

Pattern	# of participants
Normal : Open the list, chose the day from the day list, and month and year from month and year list by one fixation or regular mouse movement(e.g. the mouse moved on the lists' items one by one).	4
Abnormal : Long fixation with systematic revisit with limited mouse movements.	1
Abnormal: using two strategies (list and calendar)	1
Abnormal: Long fixation with erratic eye gaze and mouse scans outside the list.	2

For the participants who used the dropdown lists, the expected problems were: the participant didn't understand the strategy of how the month and year were written. They are written in the same list as abbreviation in English language. The participant didn't understand that one of the two strategies (calendar/lists) can be used to choose the day. For the participants who used the calendar, the expected problem was the user didn't understand that the textbox shows the chosen dates only and it doesn't use to write on it. Figure 8 and Figure 9 show gaze plots of two participants the first one didn't understand the data in list where month and year written in the same field. This was clear from the number of fixations which was more than the other participant and the number of clicks while the participant revisited the list multiple times.



Figure 9: Gaze palots of participant confused between two strategies



Figure 8: Gaze plots of participant not confused between two strategies



## V. CONCLUSION

The focus of this research was to examine the user behavior on web form while users interact with calendars and filling out date field. The study was designed to examine how the determine strategy stage was conducted based on the model of interaction of web transactional tasks. The investigation was conduct by two eye tracking experiments where three different designs of date fields were examined. The results give indication that the problems the users face are two types: the strategy of the field is not clear. This was evident in the interactions observed in the yahoo DOB field. There was no clear instruction that the user should enter the day not the name of the day. In the Nas airlines site, the list of months and year were combined in the same list in English language. The second problem was when the user was confused between two strategies. This was clear when the user try to write on the textbox of calendar field. Based on the findings the proposed guidelines are: *Avoid combining more than one strategy in the same field*: Combinations of strategies in form elements can confuse users when the case of unfamiliar controls is presented in the transactional interface. In general forms, familiarity of general user population is essential to ensure the form's usability. Combinations often confuse the users and this consequently leads to them attempting to complete the field in a familiar but inconcistent method with the form's design. While it this may be perceived as trivial with one form element, it is confounded when the transactional tasks are comprised of several fields of this type. *The options in the field should be clear (in the label or list)*, and *the form shouldn't allow the users to use the field in wrong strategy. It should give an alert or clear error message*. The future work of this research is to examine transactional interfaces with calendar's adhering to the proposed design guidelines and comparing that to forms that control for these specific form elements, and examine the validity of these proposed guidelines.

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