

An Analysis of Usage Patterns in Utilization of Interaction Styles

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Abstract. This paper introduces particular results on analysis of usage patterns in contemporary word processing applications. We evaluate how interaction styles are used accordingly to frequency of usage of underlying user commands or semantical categories of user commands. We show that menus are used as a prevalent interaction style and report usage patterns on toolbars and keystrokes. Furthermore, the differences in usage of toolbars and keystrokes on frequently used commands are evaluated.

Keywords: user studies, interaction styles, usage patterns, word processing.

1 Introduction

This paper aims at analysis of usage patterns in utilization of interaction styles in word processing applications. Contemporary WIMP paradigm-based user interfaces make available pull down menus, toolbars, pop-up menus and keystrokes as interaction styles. Although the literature [2,5] or various human user interface guidelines define rules and guidelines for interaction styles, these are sometimes violated by user interface designers for a plenty of reasons. Furthermore, many users might not be acquainted about the proper utilization of particular interaction styles. It may put a doubt on whether interaction styles are actually used as user interface designers believe that users do. Although there is some work on usage of word processing applications [3,4,6], there has not been any recent study that paid a particular attention to utilization of interaction styles. Generally, pull-down menus are intended to invoke any of the user commands available in the application. Menus compromise between fastness and easiness of use. Toolbars and keystrokes are intended for direct activation of the most frequently used user commands. However, toolbars in modern office suites are often overloaded which might result in worsening usability. Pop-up menus are intended for providing a context-sensitive functionality dependent on the type of object at the cursor position. In this paper we report the usage of interaction styles in dependence on the frequency of usage or semantical categories of user commands in contemporary word processing applications. Word processing applications provided an opportunity to explore usage of interaction styles in WIMP paradigm-based applications since word processors represent one of the most widely used kind of applications.

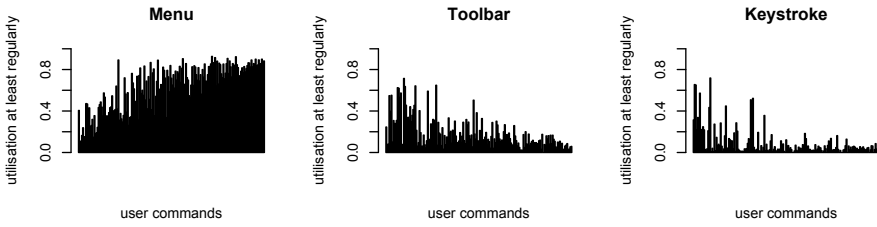


Fig. 1. Utilization of interaction styles on at least regularly used commands

2 Study Design

The utilization of interaction styles has been analyzed as a part of a study on user experience and usage habits in word processing applications. It has been studied using a questionnaire which surveyed computer skills and user experience, used functionality, interaction styles, users' opinions on word processing applications and opinions on the Microsoft Ribbon User Interface, see [1] for more details. The survey was not restricted to a particular word processing application since contemporary word processors provide more or less similar user interfaces. We studied the usage of selected ($N=179$) major user commands of the Microsoft Word and OpenOffice.org Writer that can be accessed using a menu, a keystroke, a toolbar or a pop-up menu. One-hundred-and-seventeen users (71 males and 46 females) participated in the survey. Although we were not able to achieve a representative sample, we paid a particular attention to achieve participants of various age, education and computer experience. The sample is somewhat biased to young ($M=22.79$, $Min=16$, $1st\ Qu.=19$, $Mdn=20$, $3rd\ Qu.=24$, $Max=54$, $Sd=6.51$), more than average experienced and educated users. The participants have long-term experience with computers ($M=11.29$ years, $Sd=4.71$) and quite high overall computing experience ($Mode=3$, $Mdn=4$, on the 5-point scale). Thirty-five percent of participants are able to type on a keyboard using all ten fingers. Participants have long term experience with word processing ($M=9.30$ years, $Sd=3.55$). There were 82 participants using Word 2003, 68 participants using Word 2007, 20 using Word 2000, 55 using WordPad, 51 using Writer in OpenOffice.org 3.x, 22 using Writer in OpenOffice.org 2.x and 27 participants using the TextEdit application in Mac OS X. Other word processing applications were used by less than twenty respondents and we do not report them here.

3 Utilization of User Commands and Interaction Styles

Users stated the frequency of usage of individual user commands on the following 7-point scale: *I do not use and do not know this command*, *I do not use, but aware of this command*, *I use this command rarely*, *I use this command routinely*, *I use this command regularly*, *I use this command frequently*, *I assume that this command is not provided by word processors I use*. Table 1 depicts the percentage of user command usage and usage of interaction styles. Note that only 14 user commands are user by more than 75 % of participants at least regularly.

Table 1. The most frequently used commands: command usage and interaction styles usage

| command | al_routinely | al_regularly | frequently | menu | toolbar | keystroke |
|-----------------------|--------------|--------------|------------|-------|---------|-----------|
| Bold | 98.29 | 90.60 | 44.44 | 16.44 | 54.79 | 21.92 |
| Save, Save As | 98.29 | 96.58 | 75.21 | 40.57 | 24.57 | 31.43 |
| Copy | 97.44 | 93.16 | 73.50 | 10.27 | 8.22 | 65.07 |
| Italic | 97.44 | 84.62 | 40.17 | 15.17 | 55.17 | 22.76 |
| Paste | 97.44 | 94.02 | 75.21 | 11.03 | 7.59 | 65.52 |
| Undo | 96.58 | 85.47 | 58.97 | 23.84 | 39.74 | 33.77 |
| Print | 95.73 | 83.76 | 49.57 | 46.78 | 28.07 | 22.22 |
| Character | 93.16 | 75.21 | 47.01 | 31.91 | 53.19 | 3.55 |
| Font Size | 93.16 | 80.34 | 45.30 | 25.00 | 62.50 | 2.94 |
| Underline | 92.31 | 74.36 | 33.33 | 14.69 | 57.34 | 20.98 |
| Font Name | 91.45 | 76.07 | 41.03 | 26.12 | 61.94 | 1.49 |
| New | 91.45 | 82.91 | 48.72 | 43.03 | 30.91 | 21.82 |
| Close | 90.60 | 82.91 | 56.41 | 42.64 | 27.91 | 24.81 |
| Cut | 90.60 | 83.76 | 58.97 | 15.22 | 10.14 | 57.25 |
| Open | 90.60 | 83.76 | 55.56 | 47.17 | 30.82 | 18.87 |
| Font Color | 88.89 | 69.23 | 29.91 | 19.05 | 71.43 | 0.79 |
| Bullets and Numbering | 87.18 | 61.54 | 25.64 | 43.38 | 45.59 | 0.74 |
| Insert Table | 82.05 | 54.70 | 20.51 | 53.33 | 35.83 | 6.67 |
| Select All | 81.20 | 71.79 | 38.46 | 18.18 | 0.91 | 71.82 |
| Select Text | 81.20 | 72.65 | 37.61 | 35.53 | 7.89 | 43.42 |

Participants were allowed to select any combination of the provided interaction styles, i.e., menu, toolbar, keystroke or pop-up menu, for each used command. The average utilization of interaction styles for individual levels of usage is depicted on Table 2. The utilization of individual interaction styles across *at least regularly used* commands is depicted on Fig. 1. User commands are ordered by usage decreasingly on the x axis. Table 3 depicts a detailed usage of interaction styles including all possible combinations across all available levels of usage. An interesting point is that usage of more than one interaction style at once on a particular user command is scarce and in total represent no more than 8.25 % of interaction styles utilization. Commands with the highest utilization of multiple interaction styles are following: “Save, Save As”, “Print”, “New”, “Open”, “Undo”, “Bold”, “Italic”, “Redo”, “Underline”. Note that most of these commands are used frequently.

Table 2. Utilization of interaction styles

| interaction style | rarely | routinely | regularly | frequently |
|-------------------|--------|-----------|-----------|------------|
| menu | 74.24 | 62.37 | 51.92 | 45.13 |
| toolbar | 16.75 | 24.65 | 32.58 | 37.33 |
| keystroke | 6.07 | 8.60 | 17.24 | 24.81 |
| pop-up menu | 9.63 | 14.27 | 13.77 | 14.59 |

Table 3. Overall utilization of interaction styles including its combinations

| | m | k | t | p | mt | mk | mp | tk | tp | kp | mtk | mtp | mkp | tkp | mktp |
|------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|------|
| mean | 61.79 | 6.93 | 14.81 | 8.22 | 3.48 | 1.42 | 0.85 | 0.68 | 0.89 | 0.26 | 0.33 | 0.20 | 0.06 | 0.05 | 0.04 |
| sd | 23.53 | 11.85 | 14.27 | 9.88 | 3.61 | 2.01 | 1.39 | 2.23 | 1.58 | 1.13 | 1.19 | 0.54 | 0.26 | 0.21 | 0.23 |

Table 4. User commands issued most frequently using a toolbar (left) and a keystroke (right)

| command | menu | toolbar | keystroke | command | menu | toolbar | keystroke |
|-------------------|-------|---------|-----------|-----------------------------|-------|---------|-----------|
| Font Color | 19.05 | 71.43 | 0.79 | Select All | 18.18 | 0.91 | 71.82 |
| Background Color | 26.13 | 64.86 | 0.90 | Paste | 11.03 | 7.59 | 65.52 |
| Text Highlighting | 26.32 | 64.21 | 1.05 | Copy | 10.27 | 8.22 | 65.07 |
| Text Alignment | 24.24 | 63.64 | 4.04 | Cut | 15.22 | 10.14 | 57.25 |
| Font Size | 25.00 | 62.50 | 2.94 | Copy To Scrapbook (Word) | 31.34 | 7.46 | 52.24 |
| Font Name | 26.12 | 61.94 | 1.49 | Paste From Scrapbook (Word) | 36.51 | 3.17 | 50.79 |
| Apply Style | 37.63 | 59.14 | 1.08 | Find | 43.97 | 9.48 | 44.83 |
| Underline | 14.69 | 57.34 | 20.98 | Select Text | 35.53 | 7.89 | 43.42 |
| Italic | 15.17 | 55.17 | 22.76 | Replace | 51.19 | 9.52 | 35.71 |
| Bold | 16.44 | 54.79 | 21.92 | Undo | 23.84 | 39.74 | 33.77 |

4 Usage Patterns

According to Table 2 we found menu as a prevalent interaction style since more than 60 % of at least routinely used functionality is issued using a menu. One important observation is that menus dominate to infrequently used user commands (such as “Bibliography Database”, “Document Permissions (Word)”, “Version”, “Protect Document” or “Options”). There is a high negative correlation between the usage at least routinely and utilization of menu $\rho(179) = -.83$, $p < .001$. Table 4 depicts user commands that are issued most frequently using a toolbar or a keystroke, respectively. Obviously, toolbars and keystrokes are used to quite frequently used commands. However, we observed one important difference; a toolbar is frequently used to commands related to document contents (i.e., a text formatting) whereas keystrokes are used to commands related to application control, such as clipboard operations, finding a text in a document or undoing/redoing changes. There was also found a moderate correlation between usage at least routinely and utilization of toolbar $\rho(179) = .59$, $p < .001$, and keystrokes $\rho(179) = -.46$, $p < .001$. Pop-up menus are intended for contextually dependent functionality, as it was recalled above. The data showed that pop-up menus are most widely used to manipulate tables in document. Fourteen of the sixteen most frequently issued user commands using a pop-up menu (“Table Properties”, “Picture Format”, “Select Rows”, “Select Cells”, “AutoFit Table”, “Select Columns”, “Object Format”, “Delete Row”, “Delete Columns”, “Insert Row”, “Insert Columns”, “Select Table”, “Merge Cells”, “Split Cells”, “Delete Table”, “Table Boundaries”) are related to tables. Furthermore, the data showed also that tables are quite frequently manipulated using a menu.

We used an ANOVA analysis with frequency of usage (*rarely*, *routinely*, *regularly* and *frequently*), a particular interaction style utilization and users treated as repeated measures to test a statistical significance. Mauchly's test showed that sphericity cannot be assumed neither for menu, toolbar or keystroke. We used a Greenhouse-Geisser correction by multiplying the degrees of freedom (3,348) by the ϵ . We obtained $\epsilon = .88$ for menu, $\epsilon = .91$ for toolbar and $\epsilon = .66$ for keystroke interaction style. An ANOVA analysis showed the main effect of frequency of usage was statistically significant for menu, toolbar and keystroke. For menu: $F(2.64, 306.24) = 55.39, p < .001, \text{partial } \eta^2 = .32$, for toolbar: $F(2.73, 316.68) = 25.68, p < .001, \text{partial } \eta^2 = .16$ and for keystroke $F(1.98, 229.68) = 58.40, p < .001, \text{partial } \eta^2 = .33$. The pop-up menu interaction style was not found significant for frequency of usage ($F(3, 348) = 1.34, p = .26$). It is a presumable result; only certain user commands are available through a pop-up menu. Pairwise t-tests with a Bonferroni adjustment on the individual interaction styles were used for post-hoc tests. For menu we revealed the significant differences between *rarely* and *frequently* ($p < .001$), *regularly* and *rarely* ($p < .001$), *routinely* and *frequently* ($p < .001$), and *routinely* and *rarely* ($p = .004$). For toolbar we revealed the significant differences between *rarely* and *frequently* ($p < .001$), *regularly* and *rarely* ($p < .001$), *routinely* and *frequently* ($p = .04$), and *routinely* and *rarely* ($p = .003$). For keystroke we revealed the significant differences between *rarely* and *frequently* ($p < .001$), *regularly* and *rarely* ($p < .001$), *routinely* and *frequently* ($p < .001$), and *routinely* and *regularly* ($p < .001$).

5 Summary

We reported usage patterns in utilization of interaction styles in word processing applications. We found that menu is a prevalent interaction style and toolbars and keystrokes as particularly used to frequently used user commands. Toolbars were found used to document-content related commands whereas keystrokes to application control related commands. The pop-up and pull-down menus were identified as particular methods to manipulate tables.

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