Windows' Ergonomics: Experts Health Point of View

Michel Plaisent, Prosper Bernard, Auguste Degila, and Sopit Norpanya

***Abstract*—**This paper reports the results of a work on progress aimed at assessing the users' perception of the several uses of mouse, which could have been avoided with a better conception of Windows interface. A group of 13 expert in Work Health and Security evaluated 5 screens, representative of difficulties caused by the windows interface before and after a certain acknowledgment. Results show a relative negative evaluation from experts.

***Keywords*—**Ergonomics User-friendliness, Usability, Repetitive Strain Injury, Windows Conception, Interface.

I. Introduction

"WORKING SHOULDN'T HURT!" (Ontario Ministry of Labor, 2013). But the widespread use of mouse interface that forces users to repetitive mouse manipulations could result in significant challenges to the health of users, including pain and injury (Hoe et al, 2012). These are globally named Computer-Related Disorders (CRD) but also designated by various names including : Cumulative Trauma Disorders(CTD), Repetitive stress injury (RSI), Repetitive stress disorder (RSD), Repetitive strain injury (RSI),Repetitive strain disorder (RSD), Repetitive motion injury (RMI), Repetitive motion disorder (RMD), Musculoskeletal disorder (MSD), musculoskeletal injuries of the upper limbs (Albionstopitnow,2013).

They are an important part of work-related musculoskeletal disorders (WMSDs) according to the Canadian Centre for Occupational Health and Safety (2005). The estimated costs of these diseases are the United States of the order of several billion in lost productivity, medical costs, loss of time and training replacements for the cases (Reeves,2005; Shikdar & Sawaqed,2003). Though some treatments as acupuncture can bring some relief (Khosrawi et al, 2012), clearly a better comprehension of the source of these problems is still needed.

At the center of these interfaces based on Windows and despite all the advantages of functionality that this approach brings over the old interface in command mode, ergonomic flaws persist as it is no more enough for a product to meet the needs of users, it must also meet the standards for the ISO 9241-11 usability of products, namely (Hilbert & Redmiles, 2000) and successful testing of cognitive ergonomics "usability testing".

This paper presents an ongoing research to determine the perceptions of experts about the relevance of certain uses of the mouse, that a better design of Windows could have avoid. More specifically it is assumes that the design of mouse usage in several tasks related to finding files in the browser interface of Windows increases the number and duration of manipulations of the mouse as a result of poor design of the GUI yet appreciated by users.

II. Issues Arising From Working With The Mouse In Windows

Several studies report an inappropriate or improper use and the mouse may lead to musculoskeletal injuries (Delisle et al, 2004; Délisle et al.,2002; Hvikkos & Laippalap, 2003; Lalumière & Collinge,1999; Laursen,2000; Ortiz-Hernandez et al, 2003), they involve several body parts: hands, the back and upper limbs, the latter comprising areas at risk, the fingers, thumb, handful, forearm, elbow, upper arms (including the clavicle and scapula) and neck (Cook et al, 2000). Early after the introduction of mouse as a main interface to input, experiments with tasks "drag and drop" and "point-and-click" led to recommendations on minimizing the number of extended dredging of wrist extension and other tasks that require maintaining hand on the mouse Karlqvist et al (1994).

The main causes of musculoskeletal trauma are static body postures, repetitive movements, prolonged muscle contractions, and the use of force (Kotani, 2001; Ortiz-Hernandez, et al, 2003). The absence of a break aggravate the problem according to Colombini, D. (1998). Some (Jensen et al, 2002) indicate that it is mainly the duration of use that causes musculoskeletal trauma thus fatigue plays a major role in the performance of the hand (Fleming et al, 1997).

Psychological factors also play a role in the development of musculoskeletal injuries (Jensen et al, 2002), including quantitative demands (pace of work, deadlines, etc.), sensory demands (visual stress, accuracy, etc..) and, cognitive demands (memory, decision making, etc.).

Cognitive overload held in the effort (Conklin, 1987; Ritter

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et al, 2000) and the additional concentration necessary to maintain several tasks simultaneously. For example, a task of navigating through hypertext links in which the user must keep his conscience on the link while at the same time creating a mental map to navigate between links results in cognitive overload so that a text reader can instead devote his cognitive ability to understand the content. The reader of an hypertext will take several decisions to navigation which are also likely to contribute to cognitive overload. The same goes for reading a single text from multiple pages on the screen. A part of the consciousness is directed towards understanding the content, another to handling the scroll bar.

The human would have difficulty concentrating on more than one subject at a given time (Baars,1992), yet the Windows interface often results not only in an increase of the workload, but also a regular shift of attention the work to the handling system, so the loss of the conductive wire. So this would be a design flaw, according to Yu & Roh (2002). However, the design of an interface should be a central objective of concentration all the attention of the user on the task by reducing the number of manipulation tasks [20]. So when designing it would be important to discern the characteristics of tasks with respect to their handling requirements (Hilbert & Redmiles, 2000; Howard, 2003). This is even more important for new users.

III. METHODOLOGY

A study was conducted among 13 experts in health and safety at work to determine their perception of the relevance of the design elements of Windows. Five screens were selected carefully by researchers as representative of difficulties caused by the windows interface. These screens are presented in the appendix. The selection was made taking into account the following:

The screen should be familiar to respondents. This constraint meant to choose situations that arise for most users, regardless of their level of expertise with software:

- There should be frequent occurrence of situation with most software of the Office suite.
- The need to use the mouse should be obvious
- Improved interface design should have allowed to avoid the use of the mouse

After an overview of the impact of the movement of the mouse (at a conference on health and safety at work), these experts were invited to view each of the selected screens and give their assessment of the usability of these screen on a Likert scale numbered from 1 to 5 (1 = very dissatisfied, 5 = very satisfied). The researcher then explained how the design of the screen forced the user to use the mouse. Participants were then asked to correct their appreciation of the usability of the screen to eventually take into account these explanations.

Prior to viewing screens and subsequently thereto, participants were asked to rate the Windows interface "in general". The screens contain the following situations:

1. File explorer (icons): the text under the icons, referred to the names of files that start similarly, making it impossible to choose the “good” icon. This situation often occurs when the user saves successive version of a same documents by changing only the end of the name of the latter versions; in the example presented to experts, the three icons began with "projet_de_rec”, Windows masking “hercheUN”, “herche DEUX” and “herche TROIS” and this has the effect of forcing the user to open with the mouse each of the three icons to see which contains the desired information.
2. File Explorer (list) : the size of all the columns display is determined by the wider name column and this has the effect of limiting the number of displayed files and columns; this force the user to use the scroll bar to show alternative documents, while the screen is large enough to display all files, a large proportion of if empty, which could be used to display more files or all files an reducing the number of uses of the mouse.
3. File Attributes : This screen shows the default window that appears in detail mode; it partially shows the file name and the date when " Microsoft Word Document " occupies most of the space. Expand a column has no effect on the width of the window and therefore is done at the expense of other information. One needs to increase the window size and then the column size in order to get access to hidden information. The system will remember only the extension of a column but not the expansion of the window, forcing the user to unnecessarily redefine its size every time he opens a file.
4. Number of titles per window: the same window size problem arises on the vertical plane , that the window size limits the amount of information available, the user must scroll the window (" scroll ") is extend the size of the window, a fleeting operation that could be avoid with appropriate control on the windows size , that could be facilitated by an adequate design of windows, opening as long as needed to accommodate easy choice of files.
5. Specification file : selecting a document is accomplished through the selection of the folder containing it. But the folder view is done in a small box, despite the availability of space; if the user does not know the full name of the current folder, but only 34 characters whereas Windows allows names to 100 characters, the user must undergo many trials and fails before he can get into the good directory. Yet next to the "tool" command, Windows had a lot of free space. The user must use the mouse to determine the full name of the file, and in doing so he must make many unnecessary manipulations.

Although arbitrarily determined, the five situations presented to the experts therefore referred to situations probably already experienced, mutatis mutandis. After each screen capture shown to the experts, the researcher informed participants of the main ergonomic flaw in the window and offered opportunities for experts to modify their assessment in an additional box.

IV. RESULTS

Table I presents key statistics obtained. One can observe that the average rating is generally low, the rating 3 representing the neutral point. Interestingly, evaluation of Windows generally falls 3.46 to 2.71 due to the awareness of the gaps as and when lights are put in the gaps of the interface. The overall assessment is based on the five partial judgments made initially before explanations while Table II presents the corrected appreciation once informed by the researcher. Upon reflection, respondents have adjusted downward their assessment but not in a very statistically significant level

TABLE I
EVALUATION OF SCREENS BEFORE

	N	Min	max	Mean	Err std	St. Dev.
Explorer (icôns)	13	1	5	2.85	0.337	1.214
Explorer (list)	13	1	5	3.15	0.355	1.281
Files attributes	13	1	5	3.46	0.351	1.266
Word open (horizontal)	3	1	5	3.00	1.155	2.000
Word open (vertical)	2	1	5	3.00	2.000	2.828

TABLE II
EVALUATION OF SCREENS BEFORE – AFTER

Statistic	Before Mean	After Mean	t-test	Sig.	correlation	sig
Explorer (icôns)	2.8462	2.3636	1.399	0.192	0.500	0.117
Explorer (list)	3.1538	2.4000	2.077	0.068	0.314	0.377
Files attributes	3.4615	2.2857	2.390	0.038	0.058	0.867

V. CONCLUSION

In this ongoing study, the researchers wanted to take the pulse of experts in health and safety as a pre-test. Based on the results, it appears that respondents' perceptions before and after reflection is not too negative to the Windows interface. Note that subjects were selected from a wide area and do not represent the views of specialist ergonomists work with mouse and interfaces. This perception is changing somewhat after facing confrontation with a biased assessment of the conceptions of the screens interface, but not in an extreme way.

This study suffers from several drawbacks, including the selection of situations and subjects, the number of subjects and the quality of responses. However, it indicates the relevance to conduct similar studies in order to get software design substantially improved.

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APPENDIX: FIVE SCREENS USED

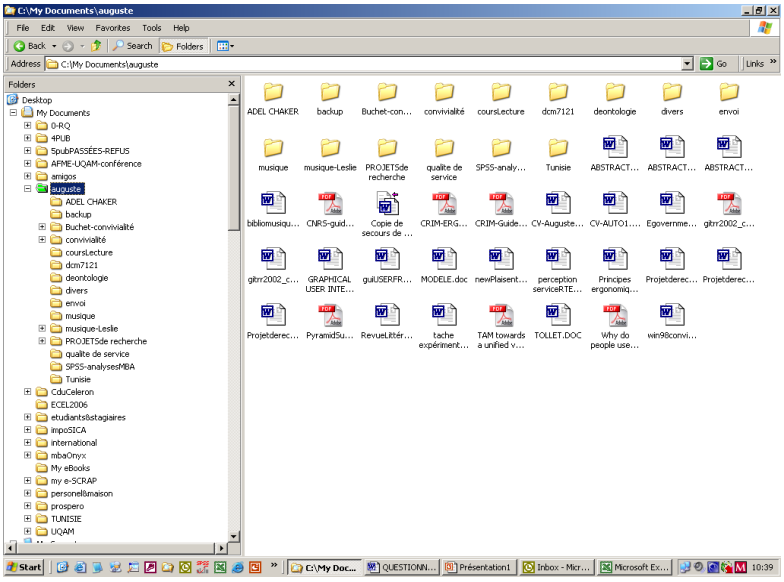

Fig. 1 Windows Explorer (icons)

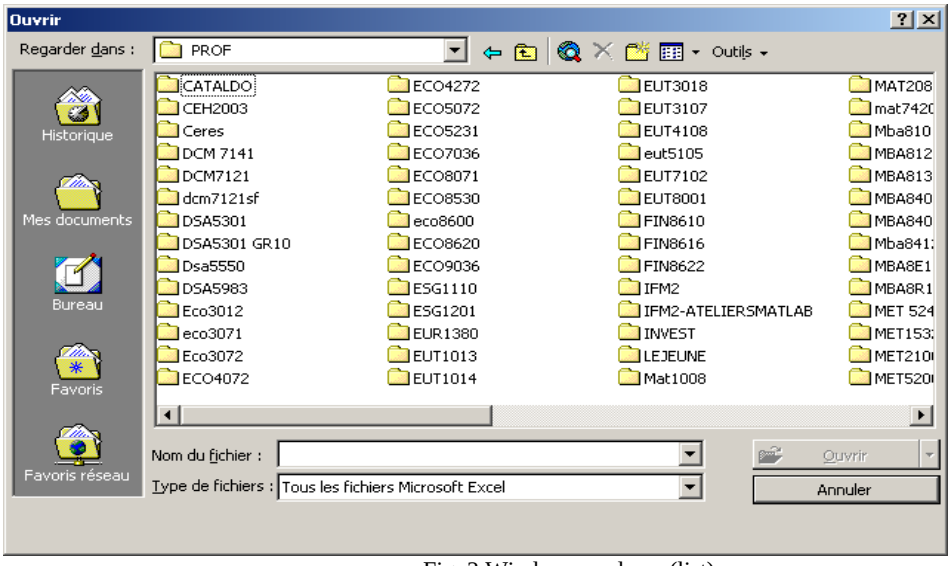

Fig. 2 Windows explorer (list)

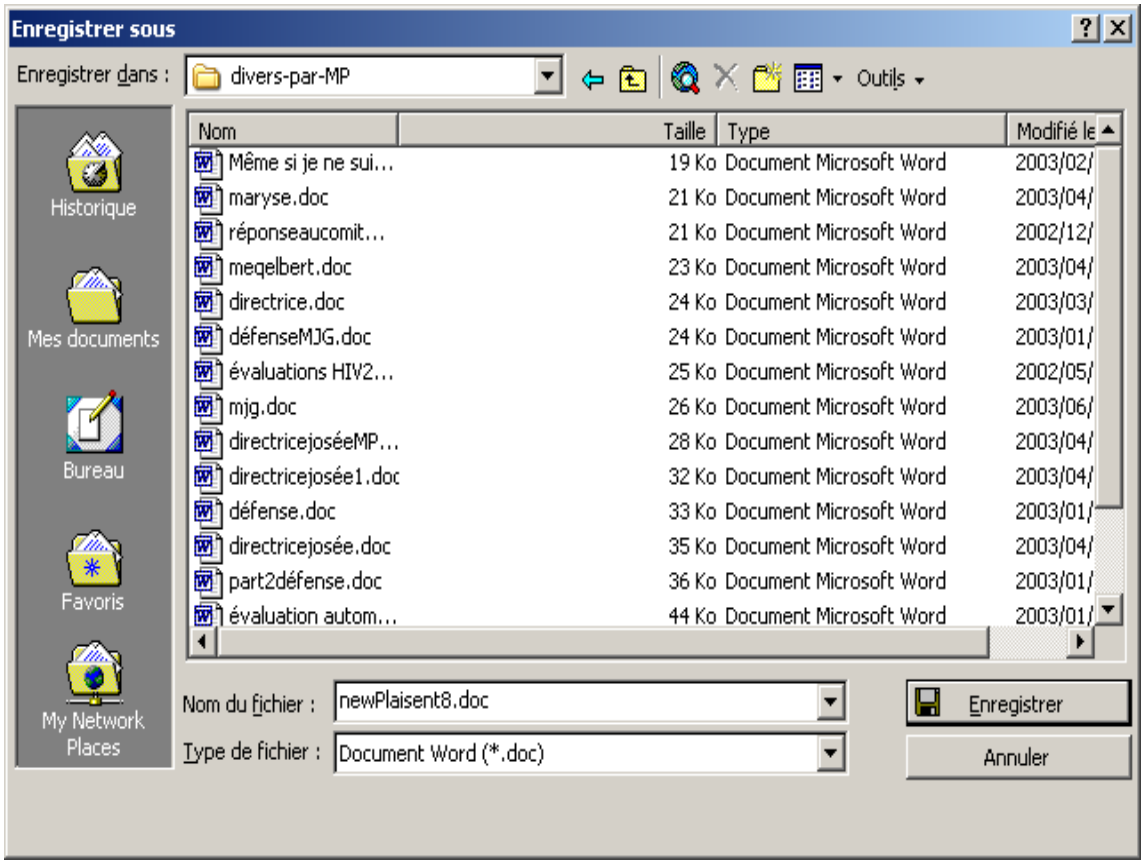

Fig. 3 Files Attributes

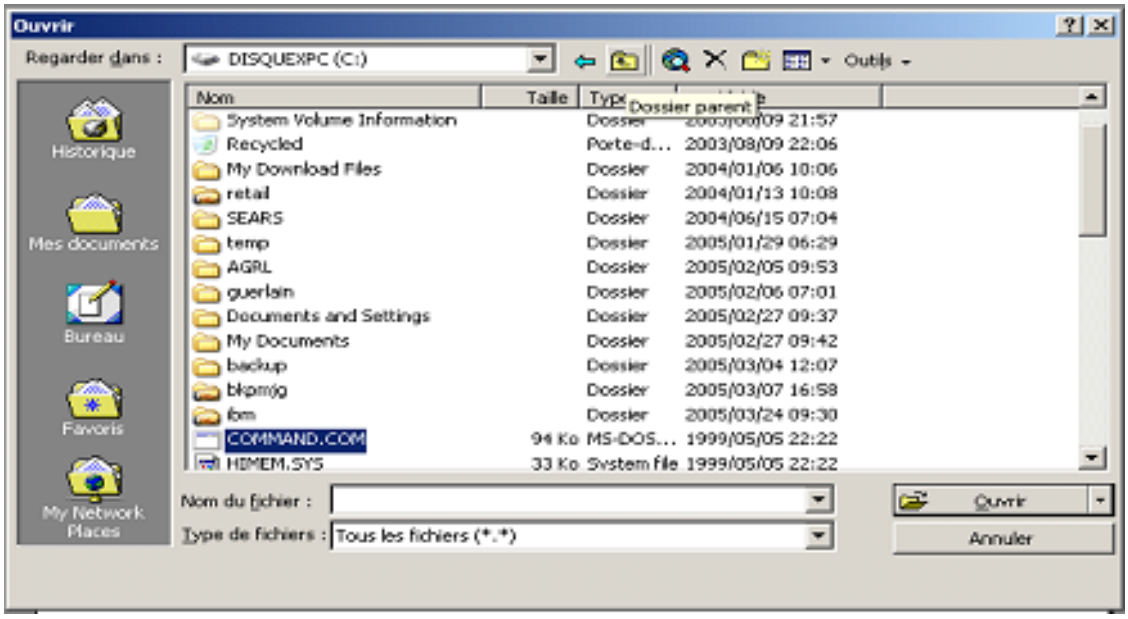

Fig. 4 Word Open a document (15 titles)

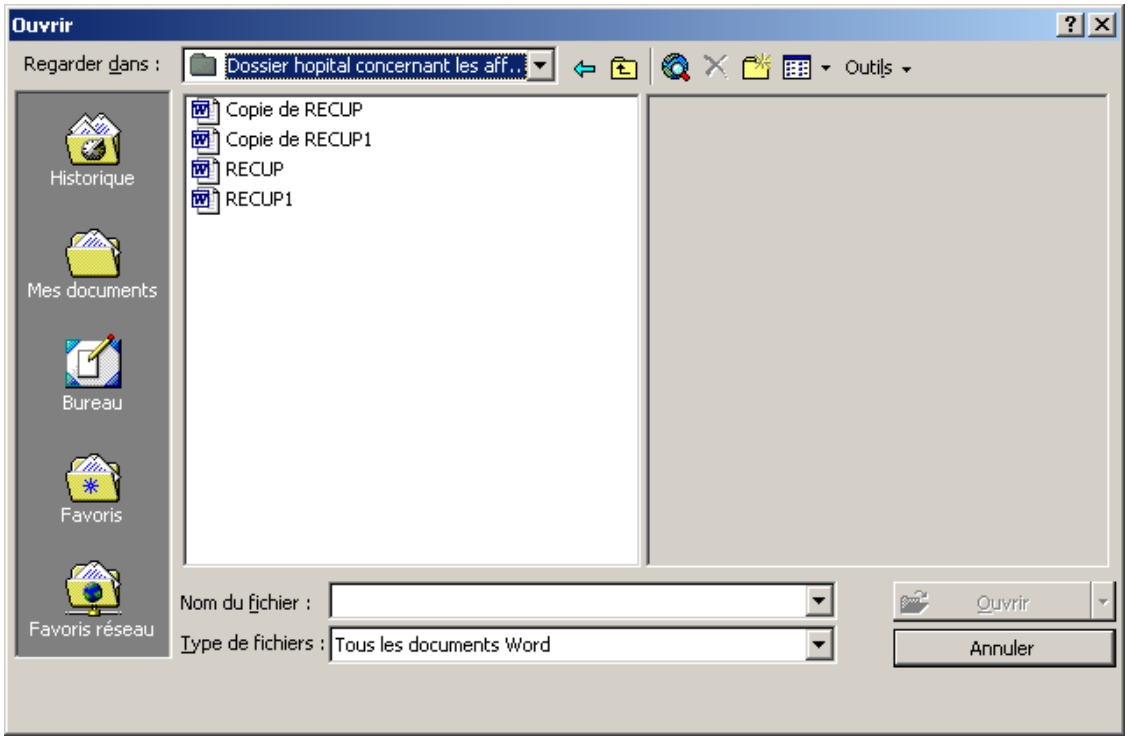

Fig. 5 Word open a document (directory specified)