relevantive

user experience architecture

Linux Usability Study Report

Version 1.01

August 13, 2003

0. Executive Summary

This report presents the results of a large scale Usability Study which was conducted in the summer of 2003 by the Berlin based firm relevantive AG.

The study investigates the question of how usable desktop applications are on Linux, with a strong focus on usage in companies and public administrations. Due to the fact that there are no publicly available studies on this subject, the intention is to provide an additional basis of information for decision-makers who plan, intend or are in the process of migrating to Linux on desktop.

The study is centered on a task based set of usability tests, where 60 test participants performed typical office tasks on a Linux system. A further group of 20 users performed the identical tasks on a Windows XP system. The participants had no prior experience with the tested systems.

The test system was based on SuSE 8.2 and KDE 3.1.2 and was configured in close cooperation with basysKom, a Darmstadt based Linux consulting company. The configurations followed basic usability guidelines. All results and statements in this study are related to this preconfigured system.

The main results:
The usability of Linux as a desktop system was judged to be nearly equal to Windows XP. The performance (time required to complete a task) was in average only slightly behind Windows XP. A couple of tasks were, in fact, easier and faster to solve on Linux. Some applications were judged by the participants as better than their equivalents on Windows XP.

The majority of the test participants enjoyed working with the Linux system and estimated that they would need a maximum of one week to acquire their previous level of competence on this system. It can therefore be concluded that a migration to Linux would be positively accepted by users / employees. Thanks to the strong configurability of Linux / KDE a tailor-made system can be designed which adapts to the requirements of the users in companies and public administrations.

The study also reveals significant problems that are connected with Linux as a desktop system. This mainly consists of the poor wording of programs and interfaces, the lack, at times, of clarity and structure of the desktop interface as well as the menus, and poor system feedback.

These problems are identified, documented by examples, and their effects are analyzed in respect of the user performance and experience.

In addition, the report gives recommendations and suggestions for all who consider, plan or are in the process of a migration to Linux

1. Contents

In order to provide a clearer orientation, a short description of the chapters will be given in the following paragraphs.

Aims:
The central questions of the survey shall be described, as well as whom it is aimed at and what we have tried to achieve.

Test design:
After a short introduction of the methods employed for the usability tests, we shall describe the scenario of computer users which constitutes this survey's background. Apart from describing the tasks which test subjects had to perform, we will explain how test results were recorded and evaluated.

Technical Setting: Configuration of the Linux desktop and Windows XP:
The hardware and software used for the test systems will be described here. After presenting the usability guidelines that the configuration was based on, the adjustments we made will be explained in detail and with examples.

Results:
After summarizing the main results of the survey, the subchapters „Wording" and „Information Architecture" will expand on the general requirements of an interactive system, and we will explain a way in which the results could be interpreted. After this, the results of the separate tasks will be discussed in detail. The way in which the test subjects dealt with the programs used will also be described and analyzed. Using the results, the test subjects will be classified into different user types. The test tasks were followed by an interview, which investigated the users' impressions of the tested system from different perspectives. The last paragraph summarizes these results and compares the answers of the Linux test subjects to those of the XP test subjects.

Recommendations:
The different elements of the presented results apply to the following target groups: decision makers in administration and business, developers of Open Source software, and also those administrators implementing the migration and configuration of Linux. On the basis of the results, those groups shall be presented with recommendations for specific training, migration possibilities, configuration and software development.

2. Aims

Many companies and authorities are currently considering migration towards Linux on Desktop. The basis of their evaluations is mostly financial and technical, but there are also political factors (amongst others independency). Because of the lack of freely available surveys, it has hardly been possible, up until now, to consider user-friendliness (usability) in decision making at all.

The success of a newly introduced desktop system and total costs of migration depend mostly on the usability of the systems. A system which can be used easily and intuitively and on which users (employees) can reach their accustomed level of competence and feel at ease quickly with, will be accepted more readily. Therefore, costs of training decrease whilst willingness to learn increases.

There are many vague rumors and prejudices about Linux on Desktop. The aim of this survey was, therefore, to revisit them and establish a well-founded basis of evaluation in their place.

Finally, this survey aims to make decision makers and developers aware of the issue of usability. Linux on Desktop does have the potential to be a real alternative on the desktop. However, this potential can only be realized if usability can be integrated more fully into development and decision and migration processes.

3. Test Design

Our test was designed so that we could acquire results which were as realistic as possible through the immediate use of the desktop systems. The usage tests, which focus on specific tasks and have been established successfully by usability research, are therefore central to the design of the test. They enable the observation and analysis of strategies and usage problems in accordance with the different types of users.

3.1 Methods

For each test subject, the test consisted of three parts:

- the pretest questionnaire regarding background experience and demographical data.
- the usage test: the performance of typical office tasks
- the posttest questionnaire regarding preference, problems, changes of opinion, and also considering the ease of learning and estimation of competence

In total, we tested 80 participants, 60 of those on Linux and 20 on Windows XP. The usual and sufficient number for a usability test is 10 to 20 people. We chose this unusually high number of test participants so as to differentiate between user types.

The tests took place between June 26 and July 16, 2003, in Berlin. 60% of them were conducted in the *relevantive AG* test lab, 40% of them in specially equipped rooms in the Wissenschaftszentrum für Sozialforschung Berlin (WZB, Social Science Centre Berlin).

All tests were conducted as moderated one-on-one interviews. A moderator introduced the tests and sat beside the test participant during the test. The moderator was only offering help if it was necessary in order to continue with the current task or if anything about the task was unclear. In total, 4 different moderators took part. During the test, the moderator recorded on about two pages the problems concerning operating and understanding, as well as the test participant's approach, mistakes, and uncompleted tasks.

In the moderator's introduction, the situation which the test was supposed to mirror was described. Roughly the following wording was used:
"Imagine that new computers with a new operating system were introduced to your company. It is your first day of work with the system."
The test subjects received a one page handout on the system's specific properties. It mainly consisted of:

- user name and password
- path of the personal folder
- the fact that the applications and settings can be found using the "K" or "Start" button in the left bottom corner
- the indication of a CD-R/RW drive
- the names of most programs used during the test

This overview aimed to give a basic introduction to the system and would probably have been far more detailed if a migration were actually to be carried out.

All tasks were presented on a notebook computer next to the test participants. After each task, they had to use the notebook computer to record how easily they rated this task. It was optional to enter the issues that they liked or disliked and which problems arose. As far as we are aware, the second computer did not influence the results. The input was given on a full screen browser which did not make an operating system apparent. All test subjects were able to clearly distinguish between the computer with the questionnaire, and the test computer.

All input as well as the time at which a task was presented and at which the task was completed, was recorded directly into a database.

All tests were transmitted to another computer using VNC (Virtual Network Computing) and were recorded there with sound (ScreenCam). Therefore all tests could be revisited and were available for additional analysis.

3.2 Usage scenario

Our test series could only cover a small sector of all the usage scenarios possible "in the real world". It was, therefore, conceived in such a way as to enable general conclusions to be drawn regarding different scenarios. This applied to the range of test subjects, as well as to the range of applications. Since this survey is chiefly aimed at businesses and authorities who consider, plan or carry out a migration towards Linux on Desktop, we created a situation as similar as possible to that situation.
This means, amongst other things:

- Users have a general competence in the daily use of Windows at work
- Users have no administrative rights or root privileges, they are, therefore, unable to install applications or change central settings.
- The computer is largely preconfigured.
- Use of the computer is mostly restricted to specific applications in a practically homogenous surrounding
- Users have an administrator or members of support staff at hand in case they face any technical problems
- If any system changes are implemented, users will be trained accordingly

3.3 Test subjects

Our screening (filter of choice) of test subjects depended on the following criteria:

- aged between 25 and 55
- daily use of a computer at work
- employed
- no experience of Linux and Windows XP
- no computer experts or absolute beginners

In total, sex and age were equally distributed. The distribution of test subjects was arranged so that the two test groups Linux and Windows XP could be compared.

Recruiting was undertaken using four different means:

- Advertisements in daily newspapers and local magazines in Berlin
- Advertisements in public institutions

- A marketing agency
- Internal mail to employees of the Wissenschaftszentrum Berlin (WZB, Social Science Center Berlin) from the computing department.

All test subjects were paid with a two figure Euro sum.

3.4 Tasks

Tasks were chosen to cover typical office exercises as well as operating system and desktop functions. The latter apply mainly to starting applications, system dialogs, settings, and also media and printer access.

As far as this was possible, problems were phrased in such a way as to avoid terms from either Windows XP or Linux.

The number of tasks and the time estimated to complete them were arranged so that the total time to complete the test was about one hour. This duration had been established in pre-tests, and there were no tests which took significantly more or less time. Had the test been longer, this would have lead to a decrease in the test participants' concentration which in return would have produced distorted results.

The tasks were:

1. Configure the screensaver so that it comes on after 20 minutes.

2. Please use a word processing program of your own choice to write the following lines:
   Harry Potter
   In the latest Harry Potter novel, an important person will lose his or her life.
   Format the first line as a centered heading.
   Add page numbers on right hand upper margin of the page.
   Print the document.
   Save the document as "Potter.doc" in WORD format in your personal folder.
   Close the program.

3. Play the third title of the music CD placed next to you and listen to it briefly.
   Change the program's volume control to a comfortable level.
   Close the application and remove the CD from the drive.

4. In your personal folder, create a new folder of any name.
   On a computer (called “henriette") connected via network, look for the document "Besprechung.doc" in the folder "Unterlagen".
   Please copy this document to the previously created local folder.

5. List all files from your personal folder which have been created on 06/25/2003 and start with the letters “Vorschlag".

6. Save (burn) the previously copied document "Besprechung.doc" (in your created folder) onto a CD (which you will find beside you).
   Afterwards, remove the CD from the drive.

7. Open the email application. You have received a new mail which mentions the date of an appointment. Have a look at the organizer and see whether you are still free on that date.
   If that date is still available, please enter the appointment.

8. Write an email to Michael Meier, the contact details of whom you will find in the address book. As a “subject" please enter “Anfahrt" and in the main text area "Anbei die Anfahrtsskizze".
   Please enclose a document called "Anfahrtsskizze.gif" as an attachment. This can be found amongst your personal documents in the picture folder. Send the mail.

9. Look for a program which can display .pdf files.
   Place an icon/symbol of that program in the bottom bar so that you can start the program with a single click.

10. Please open a Web Browser and load the web page that is listed in the bookmark folder „Pictures“ („Bilder“). Set the picture shown on this web page as the desktop background of your computer.

At first glance, this choice of tasks seems to contain ones which are not conventional work related office applications, like playing a music CD or changing the background image. Nevertheless, those tasks were useful in categorizing the test subjects into different user types and in discovering usage patterns on the basis of certain behavior patterns.

The choice of tasks was “neutral" on purpose. This means that the problems were decided upon during the test design phase, before their complexity had been assessed on either system.

3.5 Evaluation

The evaluation was based on quantitative data (times and questionnaires), flexible entries in questionnaires, video recordings as well as the notes which the moderators recorded during the tests.

The flexible entries in the questionnaires were categorized and then coded. The moderators’ notes were another basis for categorization which meant that the number of typical mistakes, procedures and events could be recorded. If it had turned out that a category had not been covered by the test report, this would have been made up by consulting the records.

As well as establishing the frequency distribution of answers and their relation to occurrences during the experiment, the focus of the evaluation was to identify patterns of use, which meant that we could categorize user types. On account of the choice of tasks, we were able to recognize factors influencing certain patterns of behavior / use which recurred in other tasks.

The statistical evaluation was purposefully limited to frequency distribution. There was far more emphasis laid on investigating the causes and factors of certain user

behavior and on the question of which steps are, in the end, necessary and possible to increase the user-friendliness of Linux on Desktop.

4. Technical Setting

4.1 Basic Configuration of the Linux Desktop

This chapter will in detail describe the adaptations which were made regarding the desktop environment (KDE) and the applications in order to provide a usable test system.

What is easier to use than a computer system with a user interface and logic, tailor-made for the person working at that computer?

Linux applications show an outstanding configurability and can be adapted according to the taste and experience of the user. Hence, it was the aim in configuring the system to make the most of every possibility offered by KDE and the applications in order to make the test system as usable as possible.

The testing scenario tries to recreate the following situation: A company or a public office is migrating to Linux on desktop. The employees are using computers for their daily office routines, i.e. they are experienced in using the applications and the Windows operating system.

The tested configuration tries to deal with this procedural knowledge. Nevertheless, even the named user group is heterogeneous in terms of not only their knowledge of information technology but also in terms of their strategies for using software. This is why the configuration tries to offer many alternative ways to solve a task.

This means that there could not be tailor-made solutions for the individual user. However, the test results will show how to categorize user groups, user habits and user expectations. Based on this, the personalization of the desktop configuration mechanisms can be further differentiated. Furthermore, companies will be able to adapt their desktop configurations according to an analysis of the user structure of their employees, which will decrease the need for training programs and increase the employees' acceptance of the new system.

4.1.1 Installation and applications

The tested system is a SuSE Professional 8.2 distribution. The desktop environment is KDE version 3.1.2 (bugfix release) with German localization. The computer is a Compaq Celeron 2GHz, 348MB RAM, graphic on board, which is also sold in Germany with pre-installed Linux (Mandrake). A 17 inch Sony CRT monitor was used. The CD-ROM drive was replaced by an LG-R/W/RW drive. In addition, a network printer (Samsung) was integrated into the configuration plus a remote Windows directory (via Samba).

The user has no administrative rights as the test does not feature tasks requiring root access. This is in order to make the presented scenario of an administrated working environment in a company authentic.

The test analyzes the usability of GUI applications. Therefore, no shell is used. The tested configuration features a shell in a submenu “Systemprogramme" (system applications), but no test participant used this option anyway.

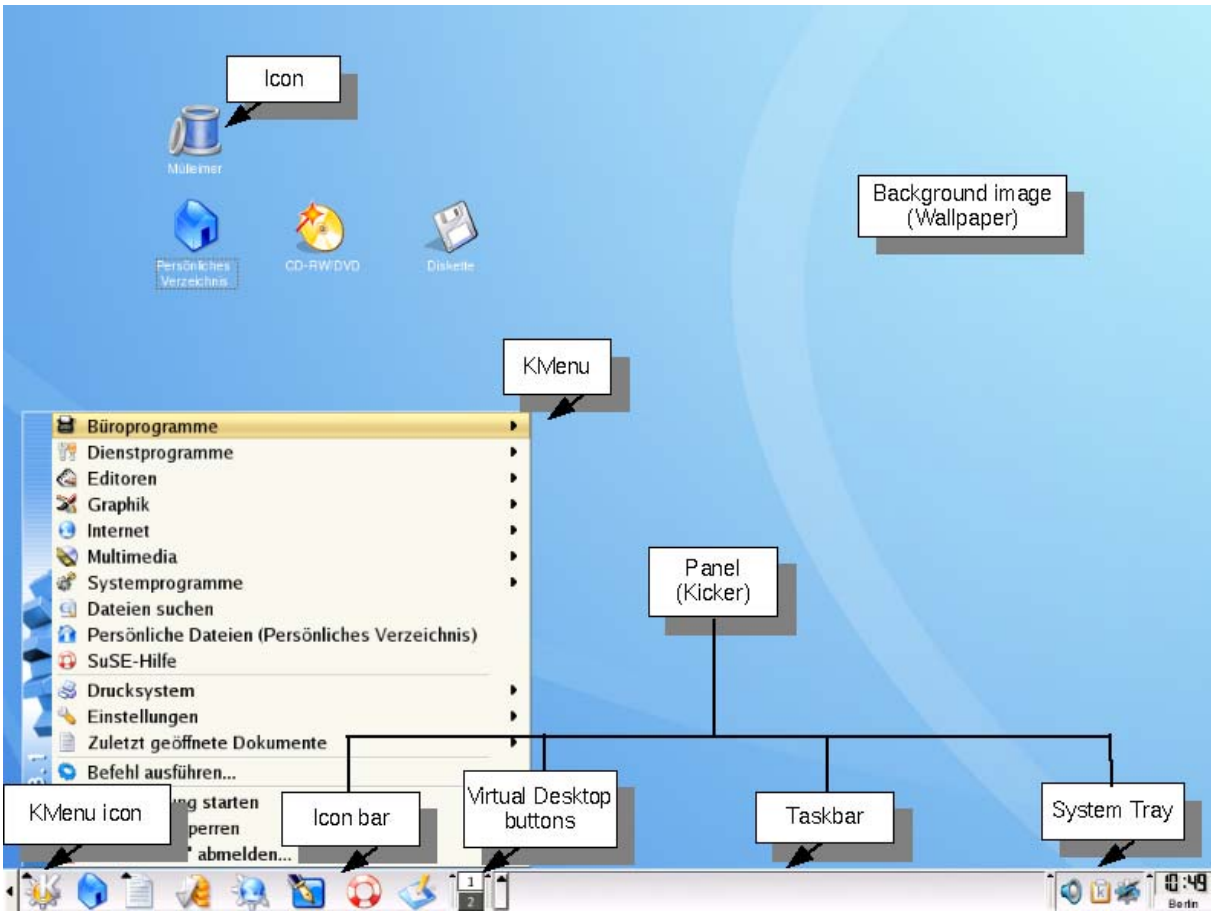
The following applications were tested:

- Desktop: KDE
- Word processing: OpenOffice.org Writer
- File Manager: Konqueror
- CD Player: KsCD
- Mail Client: KMail
- Web Browser: Konqueror
- Settings: KControl
- CD Writer: K3b
- Organizer: KOrganizer
- Address book: KAddressbook
- Pdf viewer: acroread (Acrobat Reader)

Additionally, the OpenOffice.org Quickstarter was installed. Other than that, several applications of the SuSE standard installation were kept even if they were not relevant to the tested tasks.

4.1.2 Names of the KDE Desktop Components

The screenshot shows the names of the KDE Desktop Components which will be used in the rest of this report.



Names of the KDE desktop components

4.1.3 Usability Principles Guiding The Configuration

4.1.3.1 Clarity

If you have to deal with a previously unknown system, clarity is one of the most important requirements. This refers to the choice and the arrangement of the icons on the desktop and in the panel, the logical organization of the choices in the menus and the limiting of the options relevant to our scenario and user group.

4.1.3.2 Naming

The naming of buttons, icons, menu items etc. determines if using the system depends on procedural knowledge ("...and then I'll always click on this button on the right-hand side...") or if the functions and their usage are self explanatory. To comply with this, applications are assigned their name and their function („CD Burning (K3b)"). These assignments have to be logical and take into account the keywords the users are expecting (e.g. in Germany most people use the expression „to burn a CD" („CD brennen") instead of „to write a CD" („CD schreiben") and will scan for the keyword „burn").
The assigned names have to be used consistently throughout all applications.

4.1.3.3 Icons

What has been said in terms of the naming also applies to the icons. Many users use icons as their main means of navigating the applications. That is why the same concept always have to be illustrated by the same icons. Expectations of the users have to be taken into account (e.g. the symbol of a globe is associated with the Internet and not with a local network environment).

4.1.3.4 There's more than one way to do it

The way one person uses an application depends on many factors. Even a single user chooses different strategies for different tasks (e.g. RMB/context menus, drag&drop, mouse vs. keyboard). To take this heterogeneity of strategies into account, the user has to be given more than one way to do it.

4.1.3.5 Modeling on Windows

The tested configuration was modeled partly on Windows, not because Windows features the better usability, but to accord with the knowledge of the users at the time of the migration. Their procedural knowledge, through years of using Windows, must not be underestimated.
The tested configuration deals with this by using the shortcuts „Ctrl-C, Ctrl-V" for copy&paste and produces a process listing for the „Ctrl-Alt-Del" shortcut. To use the Windows key as a single key (not only in combination with others) was not possible. This feature will be implemented in KDE 3.2. In addition, the applications were started via desktop icons by double-clicking.

Apart from the previously stated adaptations, we refrained from explicitly modeling the Windows GUI. Instead, we aimed at analyzing special Linux concepts in terms of their usability.

4.1.4 Configuration: Examples

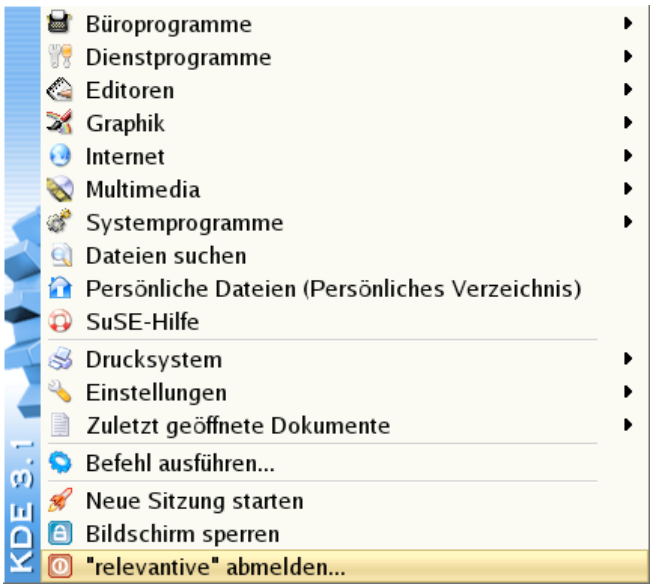
The configuration is aimed at former Windows users, so, first of all, we used the application KPersonalizer to adapt the basic settings for this target group. The most important adaptations will be described in the following paragraphs. Apart from these, there were changes to several minor details. For example, all start-up wizards were deactivated (Kandalf etc.), KPrinter was configured as printer dialog in OpenOffice.org and Acrobat Reader (acroread), and the mimetype links were changed for the tested applications (particularly pdf and ps). Additionally, some pre-configuration of the tested applications was carried out.

4.1.4.1 Structure of the main menu (KMenu)

In General
The menu should be as clearly structured as possible. This was ensured by the following adaptations:

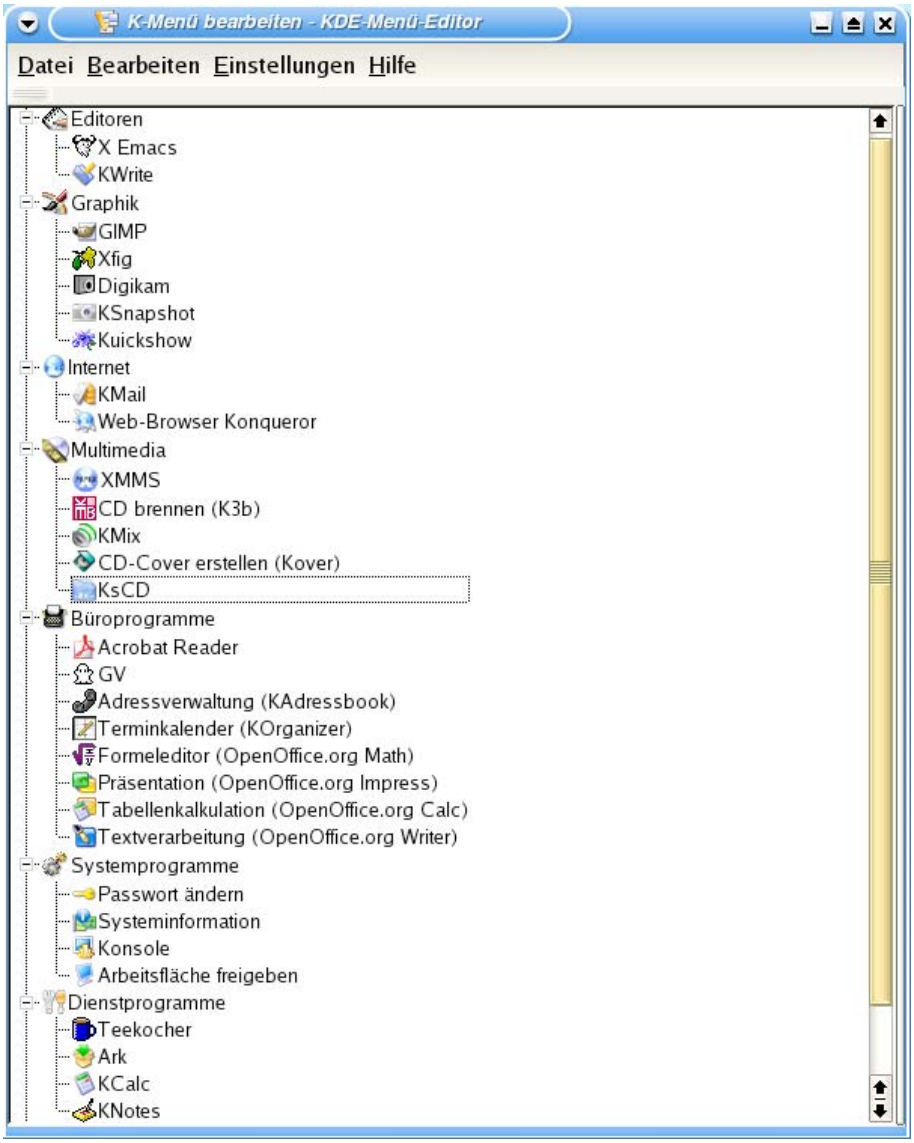
- limited choice of applications
- deactivation of submenus, concentration on KDE's menu structure with regard to office users. We deactivated the SuSE-menus as well as the following: development, education, games, hardware.
- condensation of settings menus
- sound and uniform names for applications

The following screenshot shows the resulting menu structure (from top to bottom): office applications; utilities; editors; graphics; internet; multimedia; system applications; find files; personal folder; SuSE help; print system; settings; recent documents; run command; new session; lock screen; logout "relevantive". The submenus are ordered alphabetically. It is possible to configure the order of the submenus, but this was not necessary for the tested configuration.



KMenu: First level

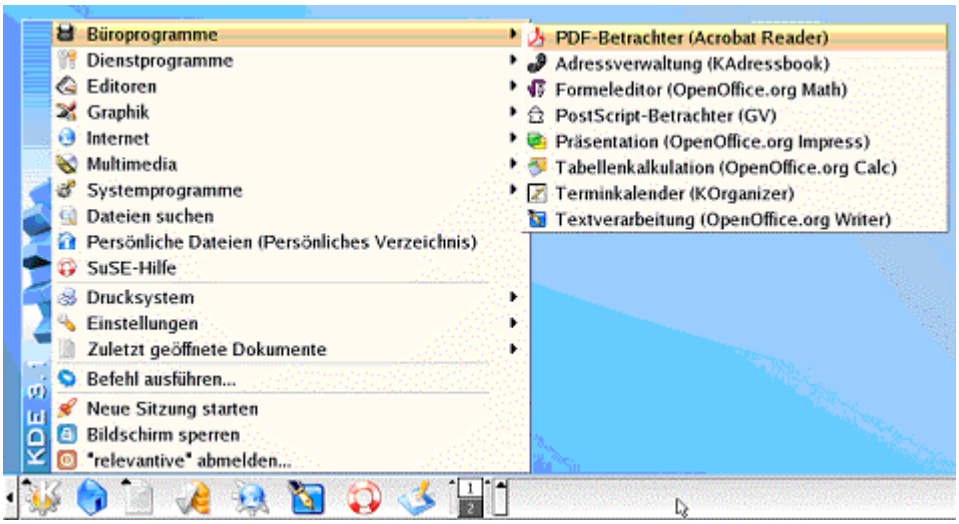
The next screenshot shows a listing of the applications of the tested configuration with their respective categories.



Applications shown in KMenu and their categorization

The categories from the default KDE set up were kept even when some of the assignments were changed (e.g. KOrganizer in office applications instead of utilities). Each KMenu application item has a distinct icon and a name consisting of the application's name and the function of the application (this is the default for KDE applications, but not for non-KDE applications. We filled in the missing information).

The screenshot shows the naming style of the KMenu application items: Pdf viewer (Acrobat Reader), Address book (KAddressbook), ...



KMenu: Naming style of the applications

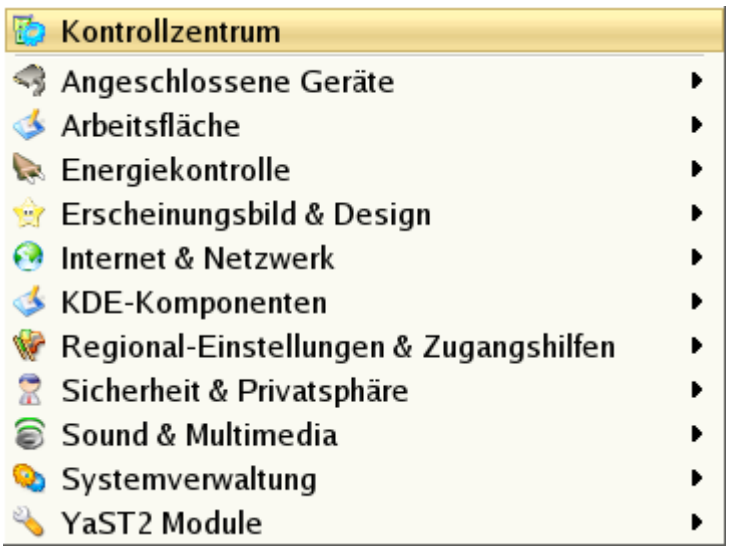
The "Recent applications" part was deactivated. It was confusing to the test participants since the distinction is not clear between this part of KMenu and the following submenus.
In addition, some items appeared several times in the "recent" list, which added to the confusion.

Centralizing the Administration
The test design included only administrative tasks at the level of the user: screensaver and wallpaper (background picture). The YaST system administration was not necessary. The SuSE menus together with lots of administration tools were deactivated, as were many of the administrative tools featured in the KMenu. The YaST modules remained as submenu of the KDE Control Center (KControl).

The default KMenu featured two submenus containing different options for changing settings: "Settings" and „System". SuSE solved this problem by offering, on the one hand, KControl as a menu icon (opens the KControl dialog window) and, on the other hand, one submenu „System" with further submenus.
For the tested configuration, we chose a third way. To make the many administrative applications less complicated, they were put together into the submenu „Systemprogramme" („System Applications"), and several applications were removed. As the main settings menu we activated the KMenu extension „Settings". Extensions are optional submenus of KDE, and can be configured via KControl by using „Desktop" → „Panel" → „Menu". The order of the extensions in KMenu is determined by the order in the kickerrc configuration file (Extensions =printmenu.desktop, prefmenu.desktop, recentdocs.desktop).

As well as offering the view of a tree with submenus, the new settings menu „Settings" offers the Control Center as dialogue. The advantage of the tree structure is that it does not overwhelm the user by a mass of settings options in the dialogue window. Instead s/he may navigate easily to the chosen option by using the submenu structure of the menu tree. The following screenshot shows the contents of the

"Setting" menu: control center; peripherals; desktop; power control; look & feel; internet & network; KDE components; localization and accessibility; security & privacy; sound & multimedia; system administration; YaST2 modules.



Control Center

4.1.4.2 Desktop

Icons

Icons for the main applications and removable media were put on the desktop. As the Linux file system is unknown to the test participants, the icons helped them in navigating the system.
The icon size was chosen to be rather large to help the users to recognize them. A good example for a helpful icon configuration is the CD symbol which links to the mount point of the CD-RW drive. If the CD in the drive contains data, Konqueror can be started by clicking on the CD icon. If it is a music CD, KsCD starts (the CD player). If the CD is an empty blank CD, the writer application (K3b) starts up.

It should be noted that we, firstly tried to use a mechanism which dynamically created desktop icons for removable media (configurable in the KControl module „Desktop"). Unfortunately, in this variant the icons are not correct in that the link between the icon and the application gets mixed up.
Furthermore, the labeling was not very clear, so, in the end, this potentially useful option was rejected in favor of the tested configuration.

Panel

As was the case for the menu and the desktop icons, we tried to structure the panel as clearly as possible. Only the icons for the most important applications as well as access to the help manuals were placed in the panel. We also offered SuSE's document menu as one quick browser button. This feature has the drawback of offering access to the terminal for all directories. Therefore, the document directory causes confusion and the standard user cannot profit from it.

We removed all mini applets from the system tray except the clipboard applet named Klipper and the audio mixer KMix to adjust the volume. The OpenOffice.org

Quickstarter was added. The number of virtual desktops remained at two, during the test with the users only using the first one.

Window Size
All the KDE applications employed launch the first time with a window size covering a quarter of the screen size (1024x768 pixel). In most cases, the application starts, subsequently, with the window size that was used the last time. For this reason we increased the window sizes to cover two thirds of the screen size.

Problem: Tooltips
Tooltips are very important whenever the user is not familiar with the symbols used. Most widgets and control elements feature tooltips and sometimes they are even editable (e.g. menu entries). In a fundamental way, though, they cannot be changed, i.e. for the K symbol of the Kmenu, which has the German tooltip „Programm starten", the original text is „Start Applications". The word „Programm" is singular and not plural which might be a typo in the translation. Without prior knowledge, the users could not understand the K symbol. After seeing the tooltip information, they still did not expect to find a menu with all applications and settings behind it. However, the tooltip cannot be changed in this place.

Another problem emerged regarding the tooltips of applications in the panel. During the first mouse-over we noticed a significant delay which we could not change in the configuration.

4.1.4.3 Applications
OpenOffice.org (Version 1.0.2)
OpenOffice.org (OOo) distinctly separates itself from the other applications. OOo applications are found in their own individual submenu and they do not save newly created documents into the given structure in the document folder, saving them instead into the home directory.

We changed these two irregularities in the test configuration: The OOo applications are now found in the submenu named „Büroprogramme" (office applications) and the default directory for saving OOo documents is the document folder. Additionally, we added a dot to the name of the configuration directory so that it was a hidden directory as it is usually in Unix.

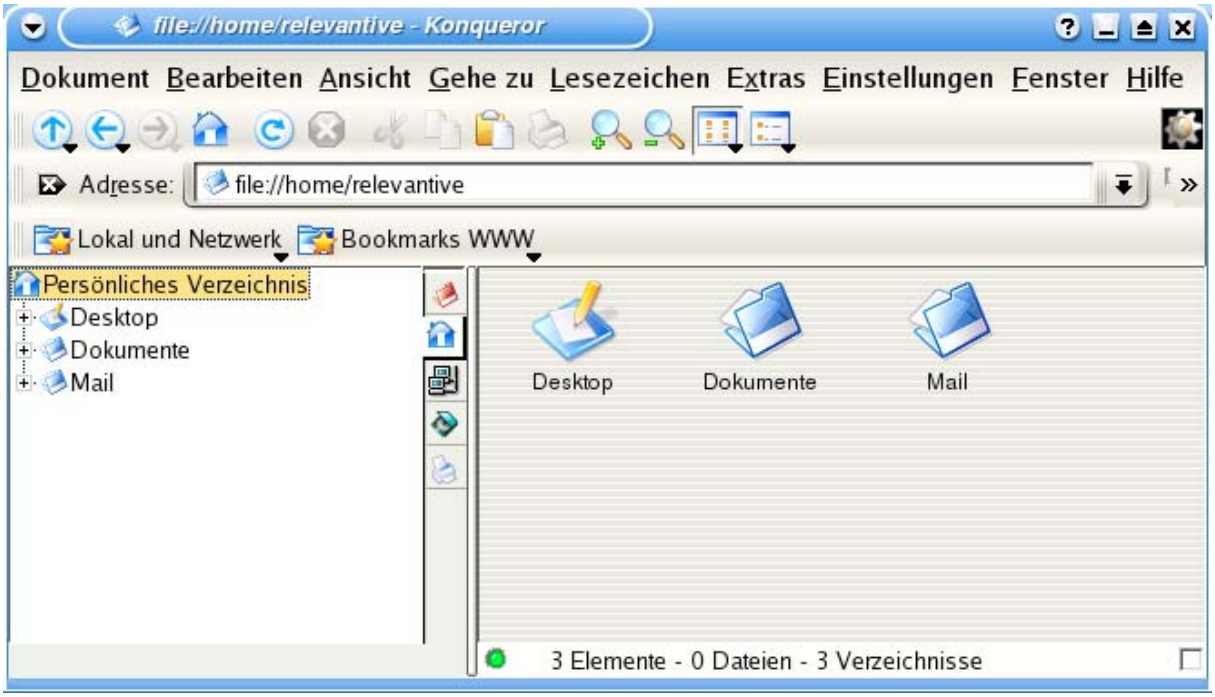
Further problems with OpenOffice.org consisted of naming and icons. All names of OpenOffice.org programs had „.org" in their names (OOo, OpenOffice.org). This is quite confusing since users interpret it as a domain ending and not as a local application. As far as possible, we therefore avoided this sort of naming in the test configuration (e.g. desktop icons).

The font and icon sizes are very small in the default configuration of the OOo Writer. We therefore changed the options and chose a scaling of 110%.

The OOo program icons depict documents (written sheets) so that users easily recognize the programs as being for documents. For this reason we exchanged all OOo icons for those of the KDE Office Suite.

Konqueror

Because many users do not know the Linux file system, the handling of file management should be done within a well-known environment, similar to Windows Explorer. As profile we chose the icon view because the built-in file preview is a basic feature of Konqueror. The screenshot shows the startup view of Konqueror as file manager.



Konqueror as file manager

In order to be able to navigate within the file system, two alternatives were configured: by bookmarks or by using the sidebar (konqsidebartng). In this way, the user can reach the following resources: After launching, the user's home directory is shown.
Also available is an overview of the whole file system, a network device reachable using samba, removable devices as well as the printer queue. In order to distinguish the file navigation using bookmarks from web bookmarks, we created two bookmark folders in the toolbar: „Lokal und Netzwerk" (local and network) and „WWW-Bookmarks" (web bookmarks).

The navigation bar (between the two areas) enabled the creation of a similar appearance to Windows Explorer, with a tree view on the left and a viewing of the current directory on the right. (This view can also be accessed using the option „Split View Left/Right." The sidebar offers extensive navigation alternatives using symbols).

We encountered the following problems when configuring the sidebar: Firstly, the sidebar uses only tiny icons in the navigation bar to switch between the file system parts (/, /home/user, /dev, smb://...). We could, at least, edit the tooltips, but we could not change icon size. Secondly, by default, the navigation icons place themselves next to the left border and users do not notice them. We were able to place them between the left and right view though and did this in the test configuration. Thirdly, the order of the icons adapts according to the alphabetical order of the configuration file names which are found in the directory

„konqsidebartng" (~/.kde/share/apps/konqsidebartng/entries). We renamed them so that the icons were in the following order: Root directory, home directory, network, devices, printers.

The tests were done with unlinked views. Konqueror offers the option „link views" So that the user navigation of the right view can be linked to the focus in the left view and vice versa. This option functions incorrectly in the following situation: If one does not use the menu entry „View" → „Link View" but instead the checkbox in the lower right hand corner of konqueror, a symbol blinks for a short time, but disappears immediately after (there is no explaining tooltip here). The linkage does not get activated.

There is only a workaround for linking the views. If the menu item „Window" → „Split view left/right" is chosen, the checkbox lets itself be activated and the views including the sidebar are linked.

The linkage only works within one file system view of the sidebar (root directory, home directory, network environment, ...). When changing the view in the sidebar, e.g. from home directory to network environment, the right view does not automatically follow the sidebar: In the sidebar, the network directory is shown, but the right view still contains the home directory. When changing the right view using bookmarks or the URL bar from home directory to network environment, the right view contains subdirectories of the network folder, while the sidebar still shows the directory tree of the home.

Problem: K3b (CD Writing)
Naming is a large problem in K3b. The application embeds itself as a service menu entry into the context menu of Konqueror. In this way, a very fast method is provided to burn a file on CD. Unfortunately, the entry in the context menu is „Daten-CD mit K3b erstellen" (Create data CD with K3b) which most users ignored, since the entry contained neither the keyword „brennen" (burn) nor a functional description („Brennprogramm", burn program) of the program name „K3b". The same problem arose in Kmenu. The original entry was „CD-Schreibprogramm" (CD writer). We modified the name to be the following: „CD brennen (K3b)" (burn CD (K3b)).

In the application itself there were also naming and icon problems. K3b uses no wizard when launching the application in order to let the user choose between data and audio CD. The user has to start a project using the menu („Datei" (file)-→"Neues Projekt" (new project)→"Neues Datenprojekt" (new data project), where neither „Datei" → "Neues Projekt" (file → new project) nor the expression „Neues Datenprojekt" (new data project) let the user think that s/he is on the right track.

Alternatively, the user can make use of the icons, but they are not very descriptive (CDs of various colors, sizes and numbers). Additionally, the icons were drawn very small in the default setup and it was very hard to interpret them. Using the K3b configuration file we increased the icon size. Unfortunately it was not possible to display text, as well as tooltips, next to the icons (IconText obviously is not implemented).

Even when the user manages to create a data project, a „burn" icon is still missing at a prominent place. Through experience it is assumed by the user that the icon is in the lower right hand part of the window. However, it is located unobtrusively between the other icons below the menu bar. We were not able to reconfigure this layout (though increasing the icon size helped somewhat).

4.1.5 Summary of the Configuration

The Linux desktop is highly configurable and can be adapted to suit the needs of special user groups. Many of these options, though, are hidden in configuration files and could, therefore, be more easily reachable. A possible solution would be to make a Desktop-HOWTO (using a standardized help format), that would be made up of all configuration options whether they be GUI-based or in files.

The way in which the KPersonalizer could be differentiated so as to take more utilization features into account would be an even greater step in the right direction.

We would advise against using a default KDE „out of the box". The solutions described above are not part of the default configuration, but they contributed considerably to the usability of the test system.

4.2 Configuration of Windows XP

The Windows system used in the test setup was the operation system „Windows XP Pro“ and corresponded greatly to the originally delivered system. We also made the following changes:

- Users did not have administrative rights
- We chose a similar background image motive to the one we chose for the Linux system.
- Application icons on the desktop and in the quicklaunch bar were put in a similarly place.
- The Windows Explorer contained an additional drive letter for the network directory.
- Numerous requests for registrations were deactivated.
- We installed Microsoft Office 2000 Small Business as well as Microsoft Word 2002.
- We installed Acrobat Reader 5.
- A network printer server was added.
- We deactivated the Windows system service „Nachrichtendienst“ (news service). During the pretests, many test participants were confronted with advertising popups and were distracted by them.

The Windows XP Desktop of the tested configuration

5. Results

This chapter will present and analyze the results of this test series from different perspectives. After summarizing the main results of the study, each task will be discussed in detail, and we will analyze the interactions of the test participants and the corresponding applications. After this, a categorization of the test participants into user types will be described.
The actual usage test was followed by a posttest questionnaire, which investigated the test participants' impressions of the test systems from different perspectives. These results are summarized and compared to those of Windows XP.

5.1 Summary

The analysis of the test results shows the strengths and weaknesses of the Linux desktop. However, the impressions of the test participants were predominantly positive.

Firstly it can be said that the use of the Linux desktop had no significant effect on the performance of the users. On average, they needed only a little more time to solve the tasks than the Windows XP test participants.

The Linux system had some strengths in terms of the multimedia applications (write and play CDs) and in the combination of mail application, address book and organizer. The latter combination was able to successfully compete with Microsoft Outlook.

The test participants had large problems with the file system. In this area, the file manager „Konqueror" provides only little help. In addition, the word processor „Open Office.org Writer" made it difficult for users to solve simple tasks.

A detailed description of the ratings can be found in the chapters on the individual tasks.

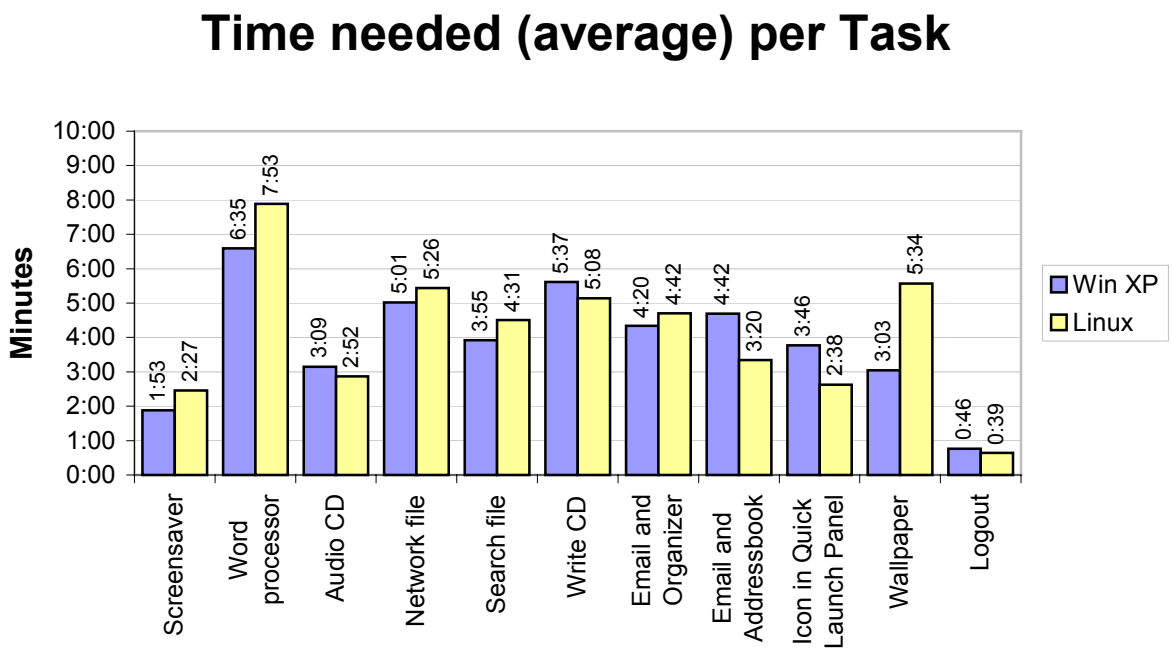
The posttest questionnaire revealed the following results:

- 87% of the Linux test participants enjoyed working with the test system (XP: 90%)
- 78% of the Linux test participants believed they would be able to deal with the new system quickly (XP: 80%).
- 80% of the Linux test participants said that they would need a maximum of one week to achieve the same competency as on their current system (XP: 85%).
- 92% of the Linux test participants rated the use of the computers as easy (XP: 95%).
- 83% of the Linux test participants liked the design of the desktop and the applications (XP:100%).
- 83% of the Linux test participants rated the desktop and the applications as clearly laid out (XP:100%).
- 66% of the Linux test participants considered the application icons to be clear and understandable (XP:75%).
- 73% of the Linux test participants rated the labels of buttons and application as clear and understandable (XP: 100%).

- 61% of the Linux test participants had a better opinion of the operation system than before the test (XP: 55%).

5.2 Performance

In this chapter, performance means the speed in which the test participants completed the tasks. All in all, the Linux test participants needed, on average, 44:49 minutes to complete all the tasks. The Windows XP test participants needed, on average, 41:21 minutes and where, thus, only a little faster.
The following chart shows the time needed per task, ordered in the sequence tested.

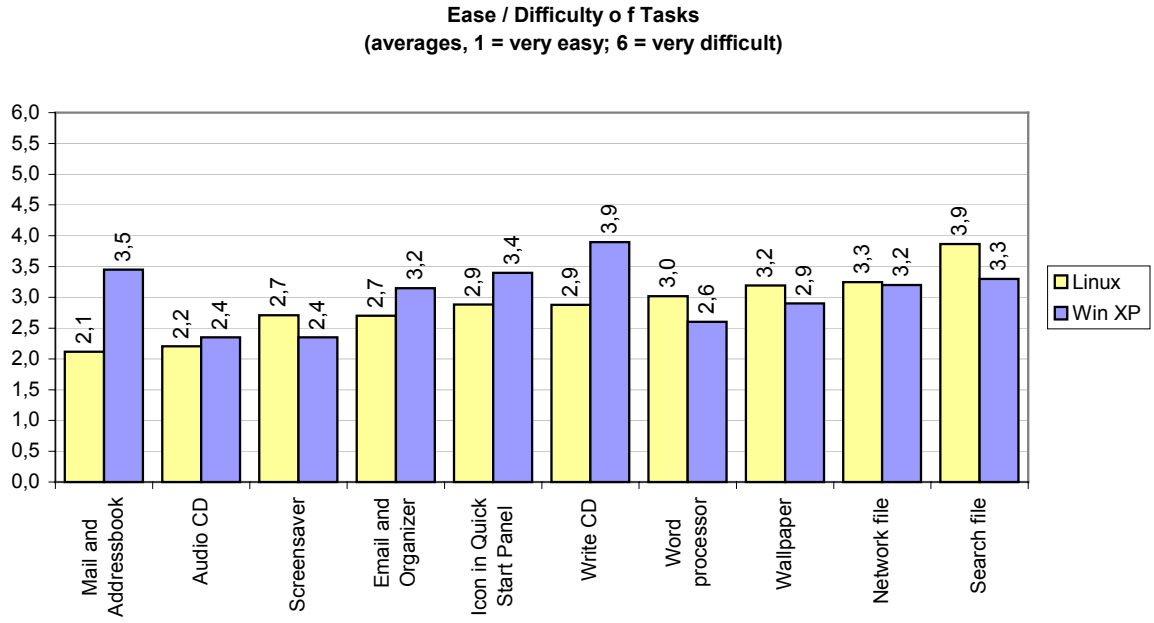


The average time needed to complete the tasks on Linux were not significantly higher than on Windows XP.

The Linux users needed more time to set the screen saver, to use the word processor, to copy and to find a file, to enter an event in a calendar and to set the wallpaper from a web page (6 tasks). They needed less time for the playing and writing of a CD, for the use of the mail application in connection with the address book, and for placing an application icon on the quick launch bar. (4 Tasks).

5.3 Ease / Difficulty of the tasks

After each task, the participants were asked to rate how easy / difficult the task was, on a scale of 1 (very easy) to 6 (very difficult). The chart shows the average score of the Linux results in ascending order.



Interestingly, the largest differences, in comparison to Windows XP, were those applications that are highly integrated in Windows XP (writing a CD on Windows XP is not a stand-alone application, but integrated into the Windows Explorer; mail and calendar / address book are integrated into Outlook. It seems that this strong integration is not necessarily welcomed by the users.

5.4 Wording

As was discovered, one of the central weaknesses of the Linux desktop is its wording, in particular the naming of menu items. Whilst „naming“ refers to specific terms, wording covers the relation between terms, their consistency and recognizability. Generally speaking, Windows XP was in an advantageous position as all the test participants had prior experience with Windows, and Windows XP's wording does not differ much from previous versions of Windows. Therefore, the experience and knowledge of the test participants had been conditioned by these Windows terms, which could, in part, not be found in the Linux GUIs.

Wording is a fundamental challenge for those designing interactive applications. It is one of the greatest influences governing the possibility of using a system intuitively, governing whether there is a short adjustment time to the system and whether the possibilities and the horizon of a system or an application can be explained . Fundamental aspects of good wording are:

- Acquaintance / recognizability: Am I acquainted with the term, and do I know what it has previously effectuated?
- Expectations: Am I acquainted with the term in the given context, am I expecting it to be there, do I know what it effectuates in this context?
- Distinctiveness: How does the term differ from those with a meaning which I find similar?

In the planning of an action, users try to design a strategy which orientates itself on clearly defined terms which they know and expect. The more the wording corresponds to the users' mental namespace, the easier it is for them to use the system. Therefore, the terms „disappear“ and their aims become prominent.

Two different classes of wording problems could be identified for the Linux desktop. These involved, firstly, those terms directly associated with system concepts, and, secondly, those which are on the whole freely able to be defined within applications

For the first category of terms, it was, at times, impossible and unreasonable to use those terms whose usage has been established by Windows. For example, user specific settings could be found under the menu item „Einstellungen“ (settings), programs which allow system configuration could be found under „Systemprogramme“ (system applications) (this includes shell, change password, system information, remote desktop connection). This last category could not be deactivated. In the tests, this meant that about half of all users were looking for the screen saver settings in „Systemprogramme“ (system applications) since the term „Systemsteuerung“ (control panel) is known and its usage has been established through Windows. This shows that wording problems, in particular, have been created by the translators. While an English speaking user will not get confused by having to switch from Windows’ „control panel“ to KDE’s „control center“, the German user will always scan for the term „System“ as in Windows’ „Systemsteuerung“, neglecting KDE’s „Kontrollzentrum“. Only after the test participants realized that this would not lead to completion of the task did they start looking for other possibilities which they found in „Einstellungen“ (settings) with the corresponding submenu.

In terms of the second category, it is comparatively simple to use terms known and established through Windows and so we did this in the configuration. However, this possibility was not always available or was simply too complex for our test. For example, it became apparent that the biggest problem in inserting page numbers with the OOo Writer was that the appropriate command was filed under „Insert“ → „Fields“ („Einstellungen“ → „Feldbefehl“). „Feldbefehl“ („field command / order“) was a fairly meaningless term to almost all of the test participants which lead to the fact that this menu item was always ignored at first. It was also expected that a significant and frequently used function, such as page numbering, would be found on a higher level than the third submenu.

In addition, difficulties in terms of terminology were not all predictable. After all, a reasonable wording requires usage tests. Even though we had enough experience to be able to anticipate and avoid many pitfalls in the wording, several did not emerge until the tests. The most striking example of this is the term „Verzeichnis“ (directory). To 46% of all test subjects it was unclear whether „Ordner“ (folder) and „Verzeichnis“ (directory) were synonymous. Consequently, they had problems with the task which asked them to create a new folder. It should also be known that their handout explicitly mentioned the „persönliche Ordner/Verzeichnis“ (personal folder / directory). In terms of our results, this means that the Linux system would have increased its rating and performance with optimal wording.

Further details on wording can be found in the results to the individual tasks.

In the course of translating this report, it came clear that many of the problems we mentioned as naming/wording problems on behalf of the developers, were in fact related to the translation of some GUI items. Translation within the KDE project (and in most other (open source) software projects as well) works like this:

The developer of the application provides one standard template file containing the necessary text strings (in ASCII format). Translation teams then add their translations of those strings. At this stage, they may have not even looked at the GUI itself. KDE's translation HOWTO (http://i18n.kde.org/translation-howto) however requests the translators to check the context of their translations: “After this it should be possible to choose your language and to see your translation in the program interface (assuming you compiled the program also). Now you can start your context checks: Go through all menus and dialogs and check if all your translations make sense in their real environment. “
However they are aware that this is not always done: “These context checks are often neglected due to tight release schedules.”

On the Linux test systems, the following problems were closely related to the translation:

"Control Center"
People migrating from Windows to Linux are used to change their system's settings using an application called the "Control Panel". On KDE's English version they will have no problem adjusting to the only slightly different "Control Center".
The German Windows GUI calls the same application "Systemsteuerung" while the German KDE uses "Kontrollzentrum", which is the exact and correct translation of "Control Center", but which confuses the migrating users as they expect their setting to be found somewhere with the string "System" in it.

"Browse"
If a KDE application offers the possibility to browse the file system for some item (e.g. a wallpaper), a button called "Browse..." is provided.
The German translation is "Auswählen..." which means "choose" or "select", but also "commit" or "apply". That is why the users did not get the notion that they could use this button for browsing, but for applying selections they had done in some different place.

"Tools"
The menu "Tools" is used in many KDE and non-KDE applications. The term describes its contents quite clearly. If you are looking for the "Search files" tool in Konqueror, you will check the "Tools" menu.
In the German applications, the term "Extras" is used instead, meaning "supplements", along the line of "miscellaneous" or even "advanced". So especially inexperienced users are not likely to look there for one often-used tool.

"Fields" and "applications"
If you have some experience in using word processors, you will also in Germany encounter the term of "Felder" ("fields") and even probably think of looking for page numbering at this submenu. Nevertheless the German translation in OpenOffice.org Writer was "Feldbefehl" meaning "field command" or "field order", a term that does not exist in the German language (only probably in some military context). Furthermore it is a word in the singular, which does not hint to a list of contents of this submenu.
We encountered the singular/plural problem also at the tooltip of the KMenu button, reading "Programm starten" (launch application) instead of "applications".

5.5 Information Architecture

Any complex computer system offers a large number of possibilities and a lot of information on how to interact with that system. The way in which these possibilities and this information are structured, i.e. how they can be accessed, is the most influential aspect governing how easily and intuitively a user can handle them.

Information Architecture (IA) is closely related to wording since it is mostly recognized by the user through its terminology. In this context, an IA is characterized by hierarchies, inventories („what there is“) and groups („what belongs with what“).

To the user, the introduction of hierarchies is necessary since it is impossible to display everything at the same time and on the same level – the flood of information would be too great. Accordingly, the introduction of hierarchies means reducing visible information whose removal should, logically, depend on how relevant they are to the user. Amongst other things, this means that items which are important and frequently used should be found amongst the higher levels of the hierarchy.

The introduction of inventories is governed by the possibilities that the system can offer and the choice which should be presented to the user. It also has to depend on the relevance to the user or groups of users.
In terms of the Window XP tests, problems occurred, in some cases, with the arrangement of the „Start“ menu which differs from previous Windows versions. Especially inexperienced users needed some time to discover the visually highlighted „programs“. Further, the „personalized“ menu, which is activated by default in Windows XP, caused problems several times. It displays only the supposedly most important and most recently used menu entries, all the others only after a second click on an arrow. Here, the attempt to reduce information leads to the fact that browsing becomes more complicated.

The grouping together is closely related to the hierarchies. In terms of menus, the grouping together of terms has to accord with their relation to the user. In turn, every term must clearly refer to the corresponding generic term. Since menus work top-down the generic term has to clearly suggest the sub terms. The differentiation between the terms featuring in one generic term category and another is, therefore, of great importance.

The main problem in the Linux tests was frequently a combination of wording problems and the fact that the grouping of terms could not be intuitively grasped. Those users looking for the file search within Konqueror needed a lot of time to browse through the different menus (the required function can be found in „Extras“ (tools)). The examples of „System applications“ vs. „Settings“ and OpenOffice.org Writer as specified in the last chapter are also worth noting in this context.

Other parts of information architecture are the file system and the directory hierarchy. Some test participants, who were used to the Windows practice of finding the CD drive at the top level of hierarchy in the Windows Explorer, tried to browse to the top level of hierarchy in Linux / Konqueror (i.e. „/“) but did not succeed in finding a suitable term. This is ultimately due to the Linux File Hierarchy System (FHS) which does not allow the mounting of devices on the top file system level. In the SuSE distribution, the CD drive is mounted under „/media“.

5.6 Tasks

This chapter presents, on the one hand, the possible problems that users might encounter during the course of a migration and, on the other, the areas that prove to be no problem at all.

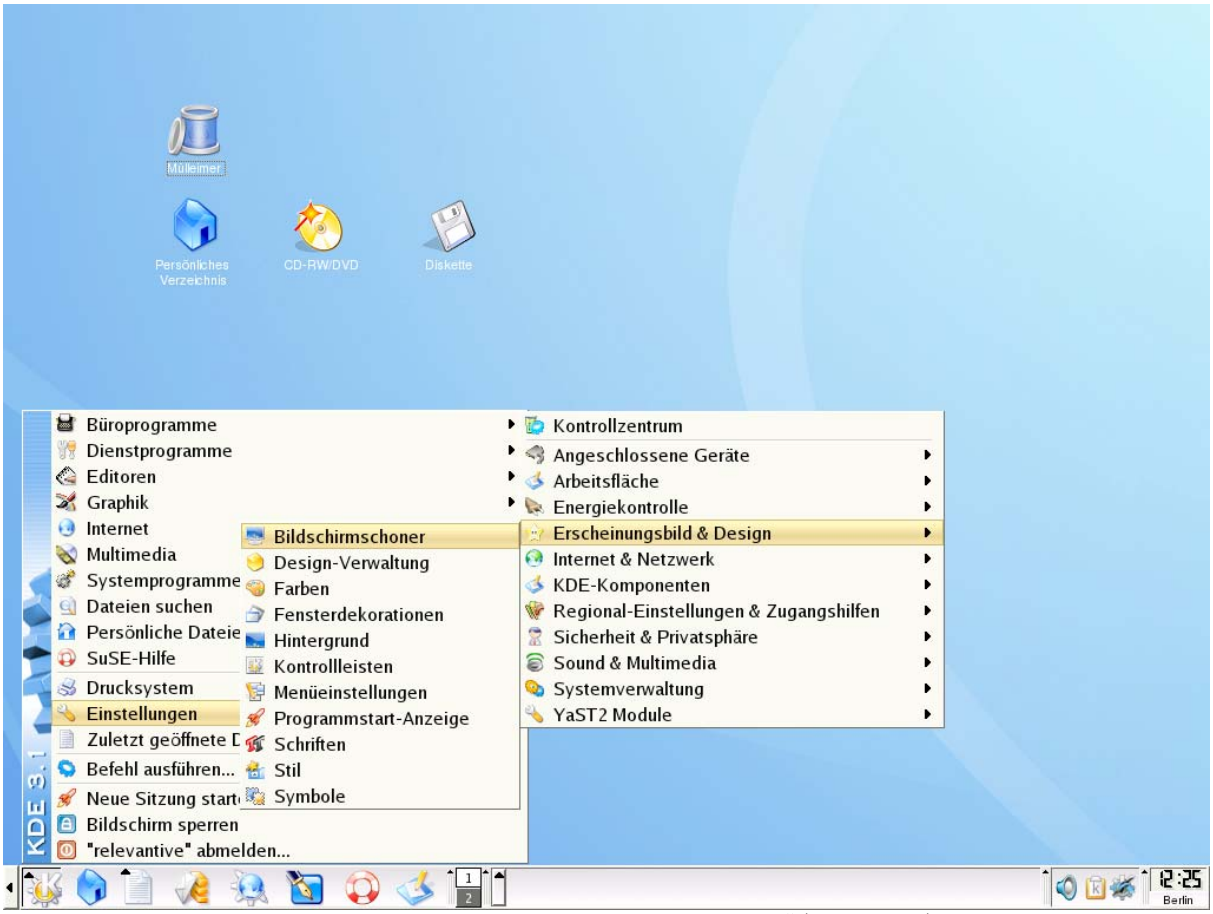
The detailed descriptions of the tasks' results in most cases only cover the Linux system. We only refer to Windows XP when unexpected results or mentionable usability flaws occur

5.6.1 Screensaver

Task: „ Configure the screensaver so that it comes on after 20 minutes."

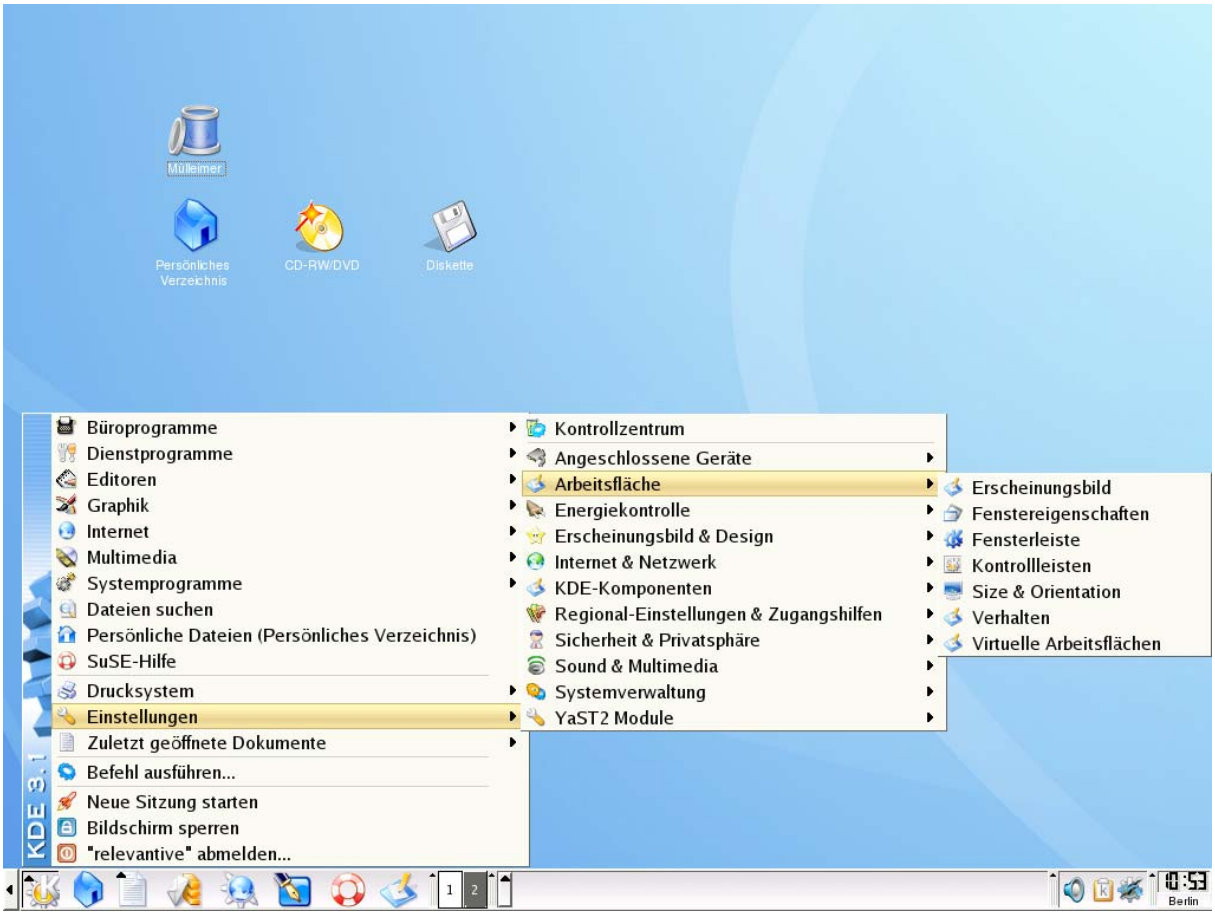
The test participant is asked to adapt the desktop environment to his/her needs. This requires locating the right settings option. The aim of this task is to find out what the test participant's expectations are in terms of the location of settings as well as their naming. Additionally, this task was used as an indicator to monitor the participant's use of the KMenu vs. the desktop's RMB/context menu. This indicator served later in the classification of the test participants into user types (see chapter 5.7).

The tested Linux system features settings options in KMenu's submenu „Settings". This means that the KControl can be used as a dialog window (no test participant chose this option) and can be split into a collection of submenus. The screensaver settings are located at „Look & Feel" → „Screensaver".
The following screenshot shows the unfolded submenu „Erscheinungsbild & Design" („Look & Feel") of the settings-menu („Einstellungen"). The entry „Bildschirmschoner" („Screensaver") is highlighted.



Screensaver settings in the submenu „Erscheinungsbild & Design“ (look&feel)

Some test participants did not expect to find the settings under „Look & Feel“ as their associative chain linked „screensaver“ with „screen“ and „hardware/monitor“. They chose „Settings“ → „Yast2 Module“ → „Hardware“ → „Video card and monitor“. They did not get any further, as these settings can only be accessed by administrators.
Those who associated „desktop“ with the term „screensaver“ and tried this settings submenu were equally mislead. Unfortunately, this featured only a hotchpotch of fonts, windows options and monitor settings (resolution, refresh rate etc.).
The screenshot shows the entries of KControl's submenu „Arbeitsfläche“ („Desktop“): appearance; window behavior; taskbar panel; size & orientation; behavior; multiple desktops.

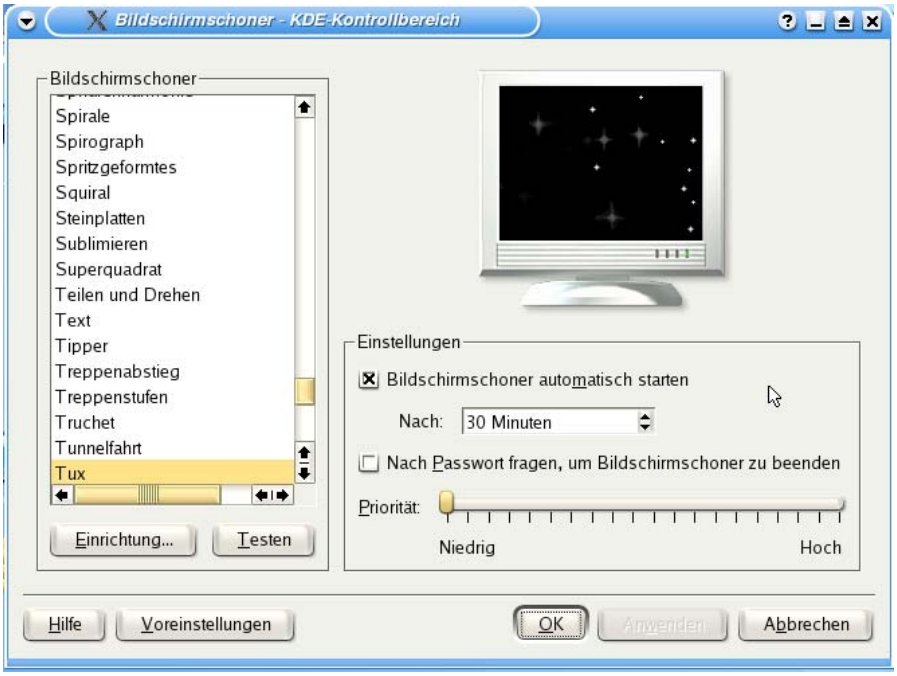


KControl submenu: „Arbeitsfläche“ (desktop)

This is another significant naming problem since the desktop's RMB/context menu has its screensaver settings in a submenu called „Desktop“.

Another group of test participants associated screensaver with „power control“ and found the option „Display Power Control“. However, they could only configure the standby mode there, not the screensaver.

As soon as the test participants found the right menu, the settings themselves posed no problem. The screenshot shows the Control Center's screensaver dialog.



Screensaver

The participants testing Windows XP rated this task as slightly easier than the Linux users did (average 2.4 vs. 2.7 Linux). This clearly came about because the fitting settings option was found faster even when the tabs of the dialog window were not discovered at once.

5.6.2 Word Processing

Task: „ Please use a word processing program of your own choice to write the following lines

Harry Potter

In the latest Harry Potter novel, an important person will lose his or her life.

Format the first line as a centered heading.
Add page numbers on right hand upper margin of the page.
Print the document.
Save the document as "Potter.doc" in WORD format in your personal folder.
Close the program.“

This tasks had several aims. The first thing we wanted to find out was if and how easily the Linux test participants would recognize OpenOffice.org (OOo) Writer as a word processing application. Secondly, word processing including, the printing and saving of a file, is a typical office task and, as such, is essential to our usage scenario. Thirdly, the question regarding the saving of the file in a different format was very interesting, as compatibility in document sharing is an important criterion in terms of migration to Linux.

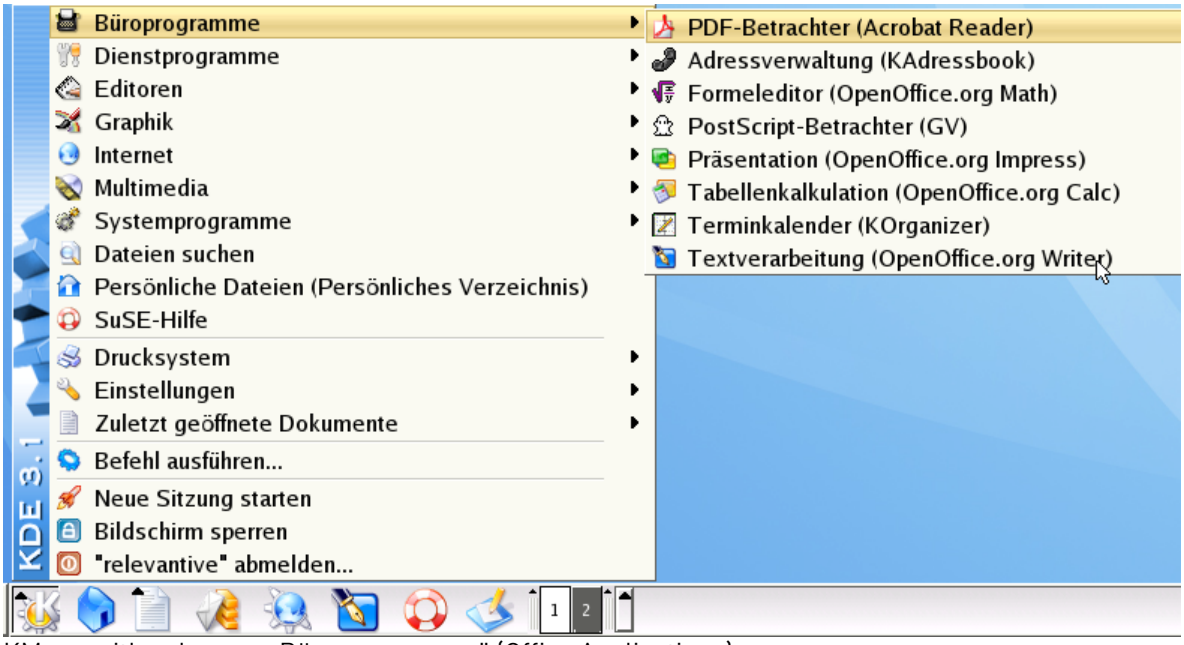
The results are unambiguous. The test participants using OOo Writer on Linux needed significantly more time than those testing Microsoft Word on Windows XP and rated the task as more difficult. The reasons for this were weak wording and a complicated concept for adding page numbers.
The following paragraphs describe these problems in detail.

Starting the Application

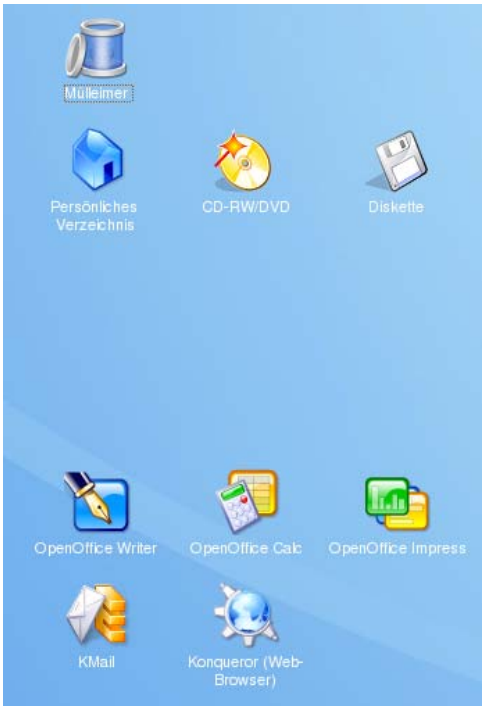
All test participants identified OOo Writer as being a word processing application without any problem. This does not exactly go without saying as former Windows tests showed test participants only looking for the term „Word“ and the matching icon. StarOffice was not recognized as equivalent to Microsoft Office.

There were two main reasons why this posed no difficulty for the Linux test participants. Firstly, the application could be easily found in the KMenu → „Office Applications“ → „Word Processing (OpenOffice.org Writer)“. And secondly, the icon on the desktop was expressive.

The screenshots show the entry „Büroprogramme“ („Office Applications“) in the submenu, as well as the desktop icon used for OOo Writer.



KMenu with submenu „Büroprogramme" (Office Applications)

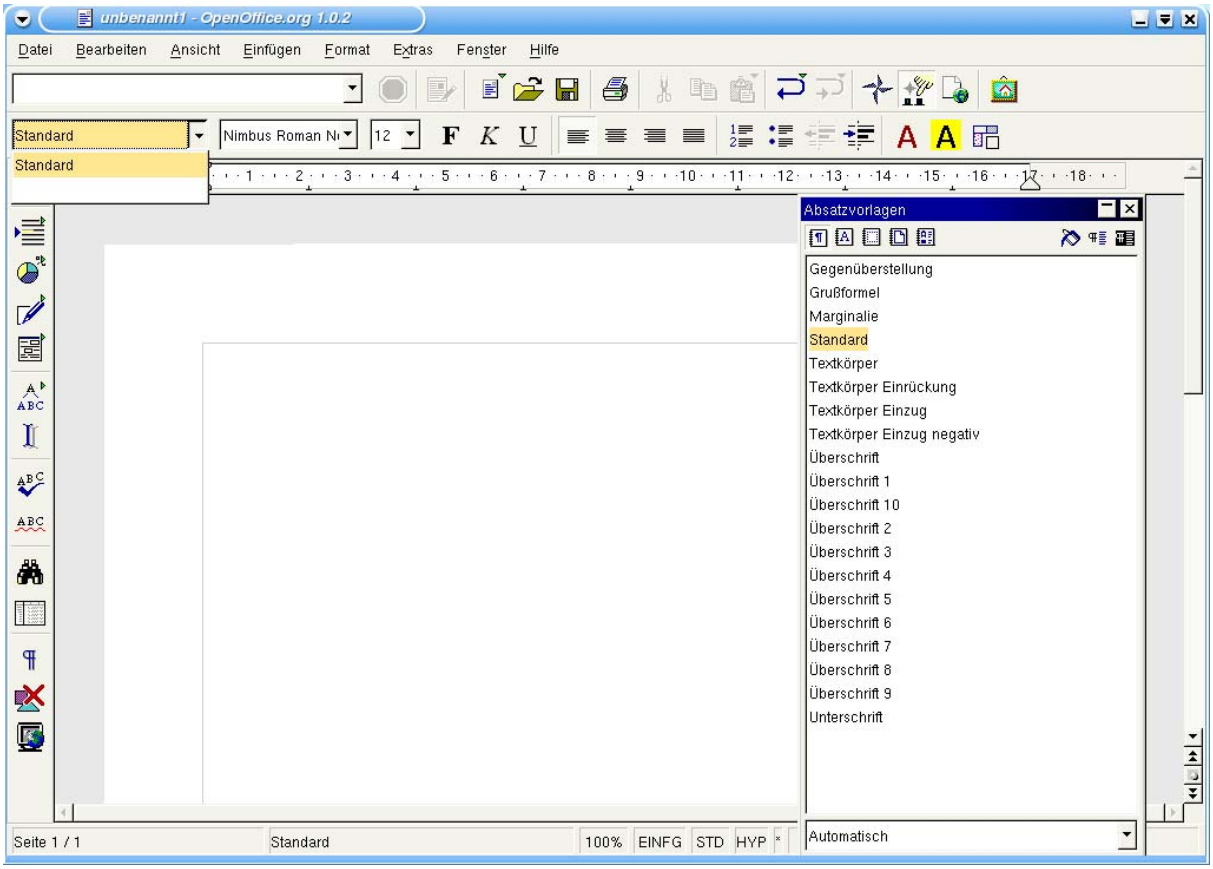


Part of the desktop : Icons

About a third of the test participants firstly checked out the desktop icons. However, these did not aid them so they then successfully tried the KMenu entry for OOo Writer.

Text formatting

After starting the OOo Writer, the so-called Stylist is activated, which offers different paragraph styles (e.g. to set some of text as a heading). The majority of the test participants did not understand this concept at first. Often the Stylist's window was moved or deactivated, because it partly obscured the written lines.
Most of the test participants used the application menus to set the first line as a heading, even if the Stylist was activated. This was because of their experience using Microsoft Word, as this does not feature anything comparable to the Stylist, instead offering a drop-down menu in its object bar.
The screenshot shows OOo Writer with the Stylist („Absatzvorlagen"/Paragraph Styles") as well as Writer's drop-down menu (upper left side), which unfortunately offers only the „Standard" („Default") style.



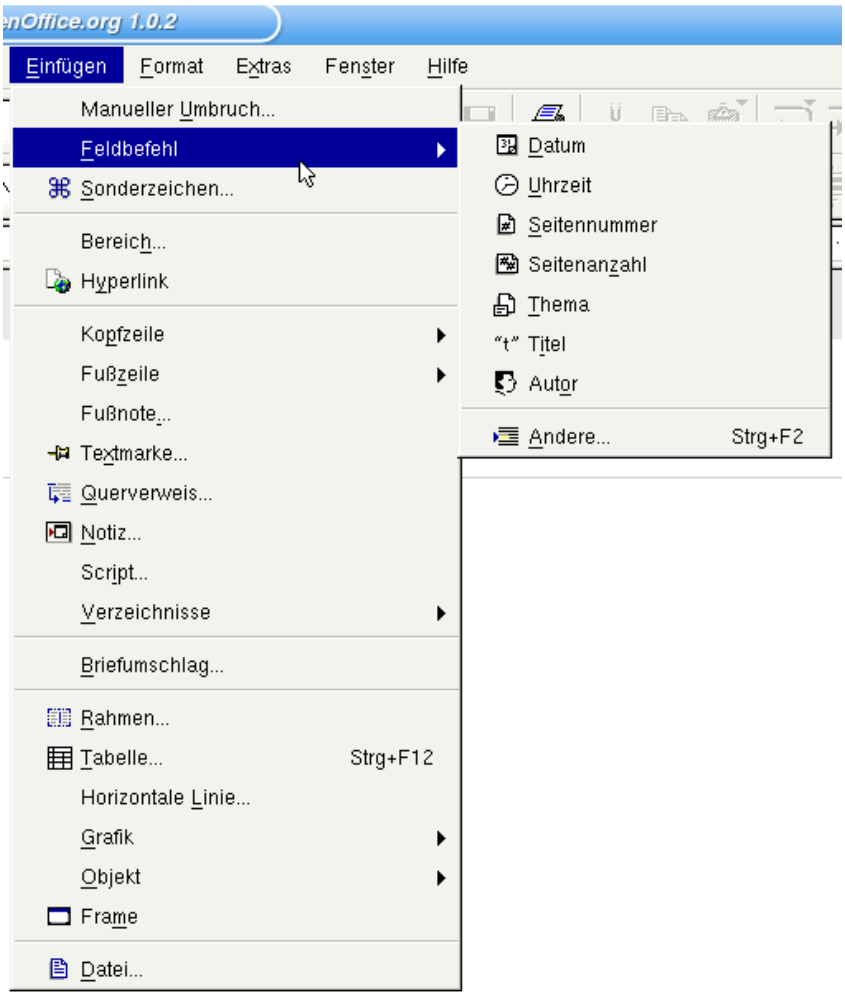
OpenOffice.org Writer: Stylist with paragraph

If test participants used the Stylist (e.g. because they did not find a useful entry in the menus), they encountered the following problem: The choice of a style has to be confirmed by double clicking the item in the list. Since most test participants tried single clicks to no avail, they did not use this formatting option any further and set the heading manually by changing the font size etc.

Page numbering

Adding page numbers turned out to be the largest problem. Firstly, test participants were not able to locate the function „insert page number“ as it is hidden in „Insert“'s submenu „Fields“ which was translated into the - in German non-existent - word „Feldbefehl“ (field order/command).
This submenu features a choice between „page number“ and „total of pages“ (in German „Seitennummer“ and „Seitenanzahl“). Whilst the test participants were scanning for the term „Zahl“ („number“) as in „Seitenzahl“ (which is a synonym of but more commonly used than „Seitennummer“) many chose the wrong option „Seitenanzahl“ (meaning „page count“).

The screenshot shows the menu „Einfügen“ („Insert“) with its submenu „Feldbefehl“ („Fields“). The entries are: „Datum“ (date), „Zeit“ (time), „Seitennummer“ (page number), „Seitenanzahl“ (page count), „Thema“ (subject), „Titel“ (title), „Autor“ (author), „Andere...“ (other).

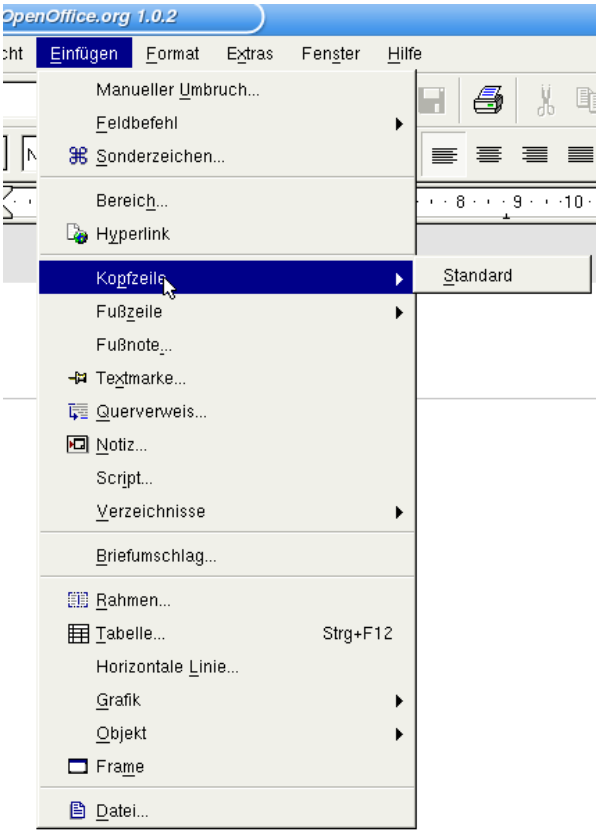


OpenOffice.org Writer: Insert page number

Using the „Insert“ → „Field“ → „Page number“ option, however, did not result in any dialog regarding the choosing of the insert location (e.g. „upper right hand corner“). Instead, the page number was inserted at the current location of the cursor in the middle of the written text. In about half of the tests, the heading was still highlighted at this moment, resulting in the replacement of the heading by the page number.

The required placing of the page numbers can only be accomplished by choosing a header or footer and aligning it on the right or left.
The fact that this is a very complex sequence for the everyday task of page numbering does not really need to be discussed further.

The insertion of a heading can not really be intuitively implemented. This was responsible for the fact that this task's average duration was more than one minute longer than that of Windows XP (Word). Using the menu „Insert", the test participants found the submenu „Header" which had one single entry „Standard". Many participants either thought that this was the wrong option or did not take the entry „Standard" as the appropriate option for their task, but rather as a description of the current setting relating headings. Only after all other possibilities had been tried out and the participants had returned to this option, did they try it out and were astonished by how bad the implementation was.
The following screenshot shows the contents of the submenu „Kopfzeile" (header): only „Standard" (default).



OOo Writer: „Field" → „Page number"

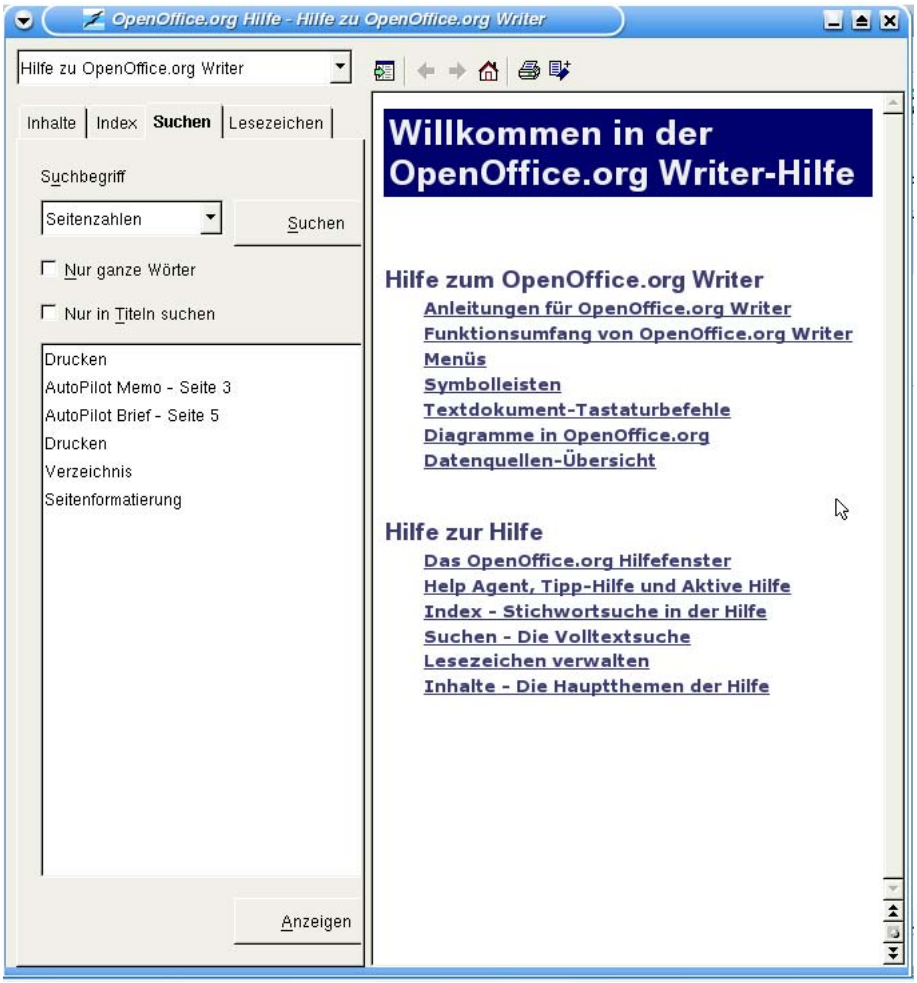
The OOo Writer would have gotten better ratings, had the function of inserting page numbers been located on the top level of the „Insert" menu. This is the case with Microsoft Word, which is why there were hardly any problems at all with this task. Nevertheless, the inserting of headers in Word is not very easy either as there is no possibility of really inserting a header, only of viewing them using the appropriate option in the „View" menu.

It must be added, however, that OpenOffice.org's menu structuring is very customizable (via „Tools" → „Configure"). You can not change the naming of the menu entries there, but you can adapt the menus' hierarchies to your own needs.

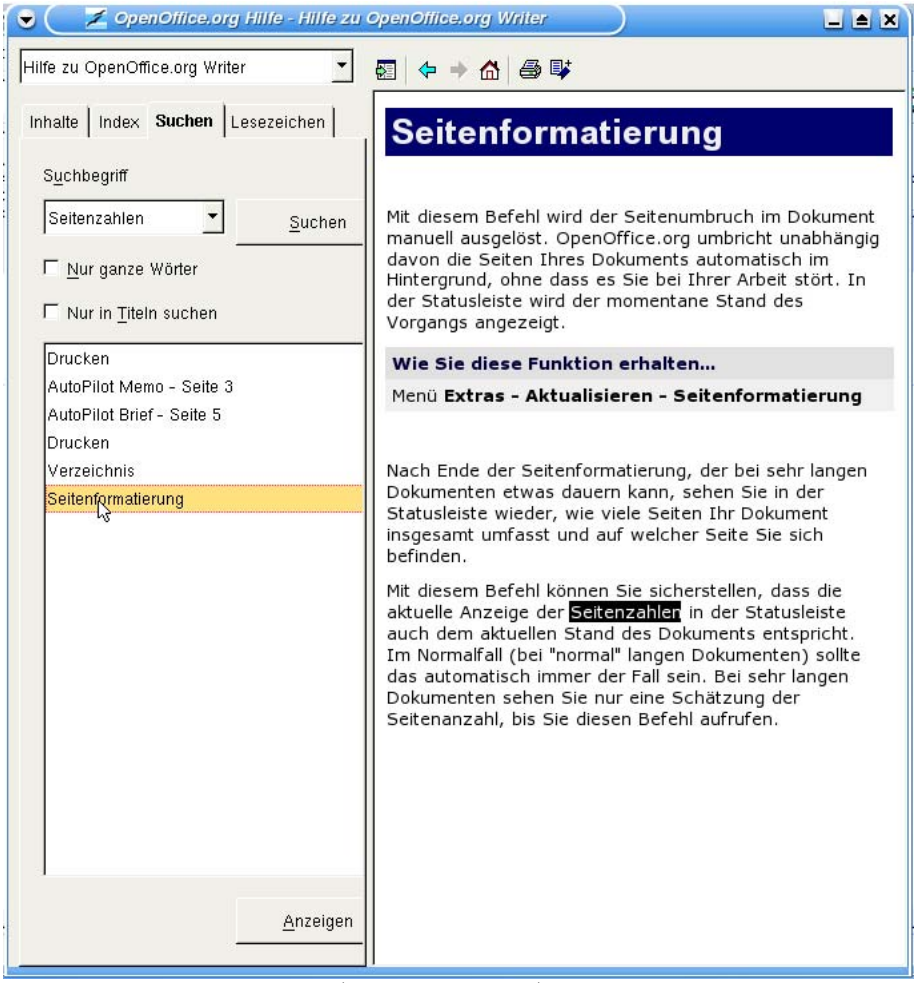
Therefore, it would be possible to raise the entry „Page number“ to the menu's first level. In spite of this, the tested configuration features the OOo Writer default menus.

Last but not least, it should be stated that OOo Writer's Help manuals provided no help at all for the mentioned problems. 11 of the test participants tried it for instructions, mostly looking for the term „Seitenzahlen“ (page numbers). The search results featured only one plausible term (see first screenshot): „Seitenformatierung“ (page formatting), the others being „Drucken“ (printing), „AutoPilot Memo - Seite 3“ (AutoPilot Memo – page 3), „AutoPilot Brief - Seite 5“ (AutoPilot Letter – page 5), „Drucken“ (printing) – again –, and „Verzeichnis“ (directory). To get the help text displayed, you must double-click the list entry (which was not something intuitive for the test participants) or use the „Anzeigen“ (display) button. Unfortunately, the help text was not helpful at all (it is concerned with updating the page formats in the document and recalculating the total number of pages that are displayed on the status bar).

The first screenshot shows the search results for the term „Seitenzahlen“ (page numbers), the second one the help text to the subject „Seitenformatierung“ (page formatting) with the highlighted search term „Seitenzahlen“ (page numbers) – referring there to „number of pages“ instead of page numbers.



OpenOffice.org Writer: Help (page numbers)



OpenOffice.org Writer: Help (page formatting)

The next version 1.1 of OpenOffice.org Writer has dealt with the problems regarding the help manuals. Navigating them has improved very much as well as getting to-the-point, and comprehensible help has been included regarding the previously stated problems.

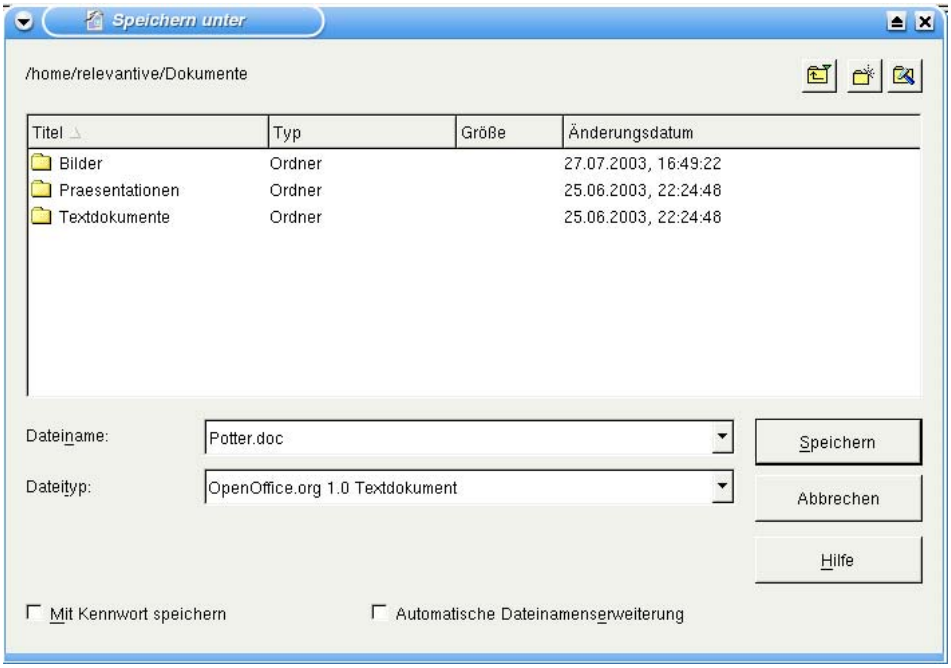
Printing

Printing was problem for neither the Linux nor the Windows XP test participants, even though the Linux user had to confirm two dialog boxes.

Saving

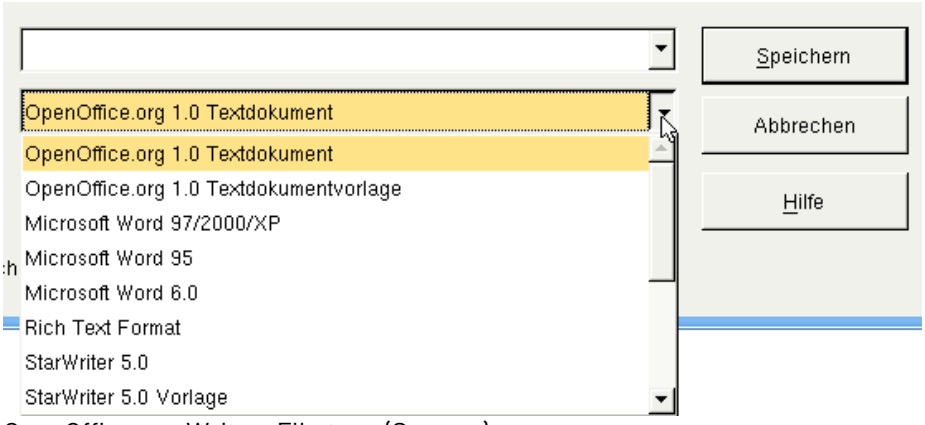
As the OpenOffice.org Writer file type is not yet widespread, Microsoft Word being the de facto standard, the test participants were to save their document in the Word file type, in their personal folder.
Approx. 30% of the test participants had problems dealing with the file system. Their personal folder was not recognized for what it was, even when being displayed per default in the file dialog and being mentioned in the explanatory test handout. In spite of this, the test participants were not sure if they happened to be in the right directory. Many of the test participants clicked their way up through the file system hierarchy, then starting from root down to their personal folder. More distinct wording and visualization could prove helpful in these cases.

The screenshot shows the dialog box „Speichern unter“ (save as) which offers as default the „Dokumente“ (documents) directory within the personal folder.



OOo Writer: Save-dialog

OpenOffice.org Writer offers a comfortable export function to save a document as a Microsoft Word file type by using the „Save as"-dialog.
The screenshot shows the file type options.



OpenOffice.org Writer: File type (Save as)

However, the vast majority of the test participants thought that simply adding the extension „.doc" to the file name would suffice in saving it as a MS Word document, even if the file type „OpenOffice.org 1.0 Textdokument" (OpenOffice.org 1.0 Text Document) was set in the drop-down menu.
In the tested configuration, the option „Automatische Dateinamenserweiterung" (automatic file name extension) was used. Therefore the Writer extension „.sxw" got appended to the file name „Potter.doc". As the test participants did not notice this, the document was saved under the name of „Potter.doc.sxw" in about 70% of the tests.

Deactivating the „automatic file name extension" option would have led to an even worse outcome, as then the file would have been saved by the name of „Potter.doc," and Konqueror as well as Writer would display it because of its extension as a MS Word document. This is wrong! As only the file name, not the file type, got changed

while saving, the document is still of the OOo Writer file type, which would show up, at the latest, when a Windows user wanted to open the file with MS Word (s/he will be confronted by a dialog box asking for the file type s/he wants to import from. Choosing the OOo Writer file type is impossible as there is no possibility of importing .sxw-files into Word).

Windows XP

Windows XP's Word posed fewer problems in this part of the task. Certainly, Word had a clear advantage as the file type did not have to be changed.
Nevertheless, Word's high automatization led, in many cases, to the problem that the document was not saved by the name of „Potter.doc“, as was required, but as „Harry Potter.doc“, because Word sets the first line of the file by default as a file name.

5.6.3 Audio CD

Task: „ Play the third title of the music CD placed next to you and listen to it briefly.
Change the program's volume control to a comfortable level.
Close the application and remove the CD from the drive.”

The main aim was to investigate what the test participants expect of an icon depicting a CD and whether they expect the audio CD to start playing without any action required on their side.

As a result of their Windows background, most of the test participants actually expected the CD to start playing after being inserted into the drive, but the Linux system does not carry out this function. All participants quickly grasped that they „had to do something“.
There were two possibilities of starting the CD player (KsCD): By using the KMenu entry („Multimedia“ → „CD-Spieler (KsCD)“) or by using the desktop icon „CD-RW/DVD“. As the icon unambiguously depicted a CD, most of the test participants used it to start the CD player (although the naming of the icon did not hint at this, nor did the tooltip information categorized as „desktop config file“)(„Einrichtungsdatei“) and also categorized as a device („Gerät“) and offering the comment „mount and open CD-R“).
The screenshot shows the described tooltip relating to the „CD-RW/DVD“ icon on the desktop.

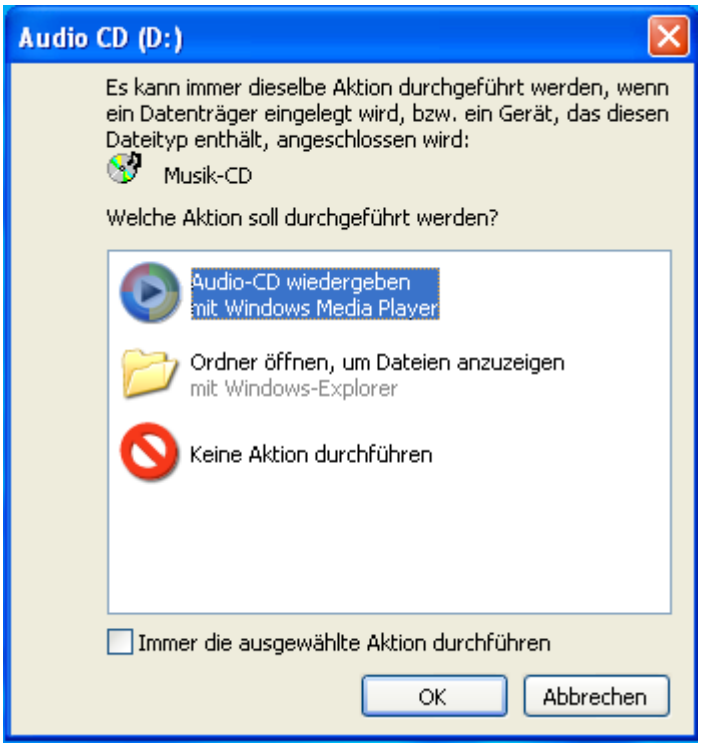
Desktop icon CD-RW/DVD with tooltip

Using the CD player, KsCD posed no big problems as the GUI parts were labeled with descriptive tooltips. However, it took some time before the lowest field was understood as being the track display. This is why some test participants, at first, were not sure if they had found the required third track of the CD. The track numbers are almost unable to be seen at all on the display.

The volume control slide was, in most cases, not recognized until very much later (even though it had a descriptive tooltip). The reason for this is that the slide was understood as depicting the current position of the track as the visualization did not suggest that it was a volume control slide. Because of the tooltip it got recognized after a while.
The screenshot shows KsCD. The display shows the track's current playing time, the total playing time of the CD, the volume (in percent), the track number („03/10“) as well as the CD's and the track's name. Below the display the yellow volume control slide can be seen.

KsCD

It took the test participants using Windows XP longer, on average, to complete this task, and they also rated it as more difficult.
In inserting an audio CD in the drive, they are confronted with a dialog box for the choosing of an application (this happens every time an audio CD is inserted): Play it using Windows Media Player, open a folder in Windows Explorer to show the data, or do nothing (see screenshot).



Windows XP: Pop-up dialog box when inserting an audio CD

When choosing Windows Media Player, the test participants got confused by the displayed animation. In addition, no track numbering gets displayed (see screenshot).

Windows MediaPlayer

5.6.4 Copy file

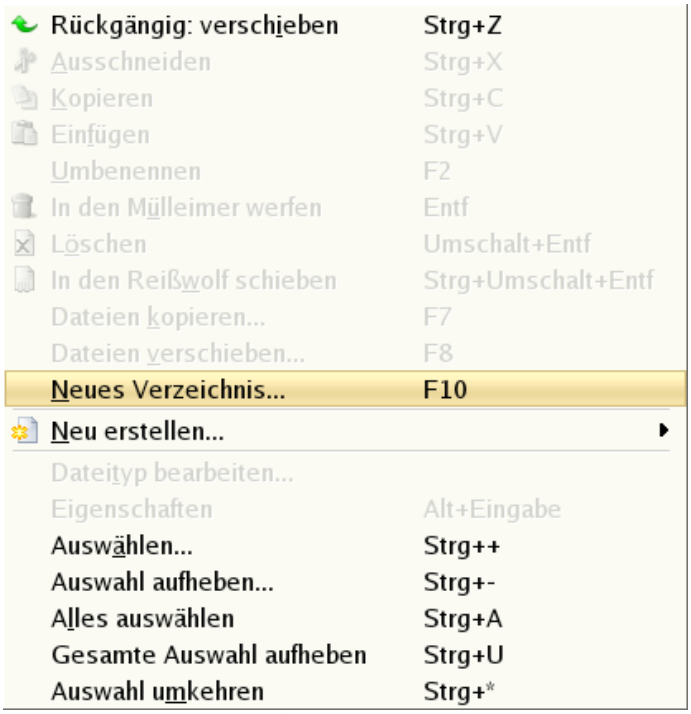
Task: „ In your personal folder, create a new folder of any name.
On a computer (called 'henriette') connected via network, look for the document 'Besprechung.doc' in the folder 'Unterlagen'.
Please copy this document to the previously created local folder."

This task should provide insight into the problems arising by an unknown file system as well as into how using a remote drive is supported. These file operations were undertaken on Linux using Konqueror in file manager mode. The remote drive was accessed using Samba.

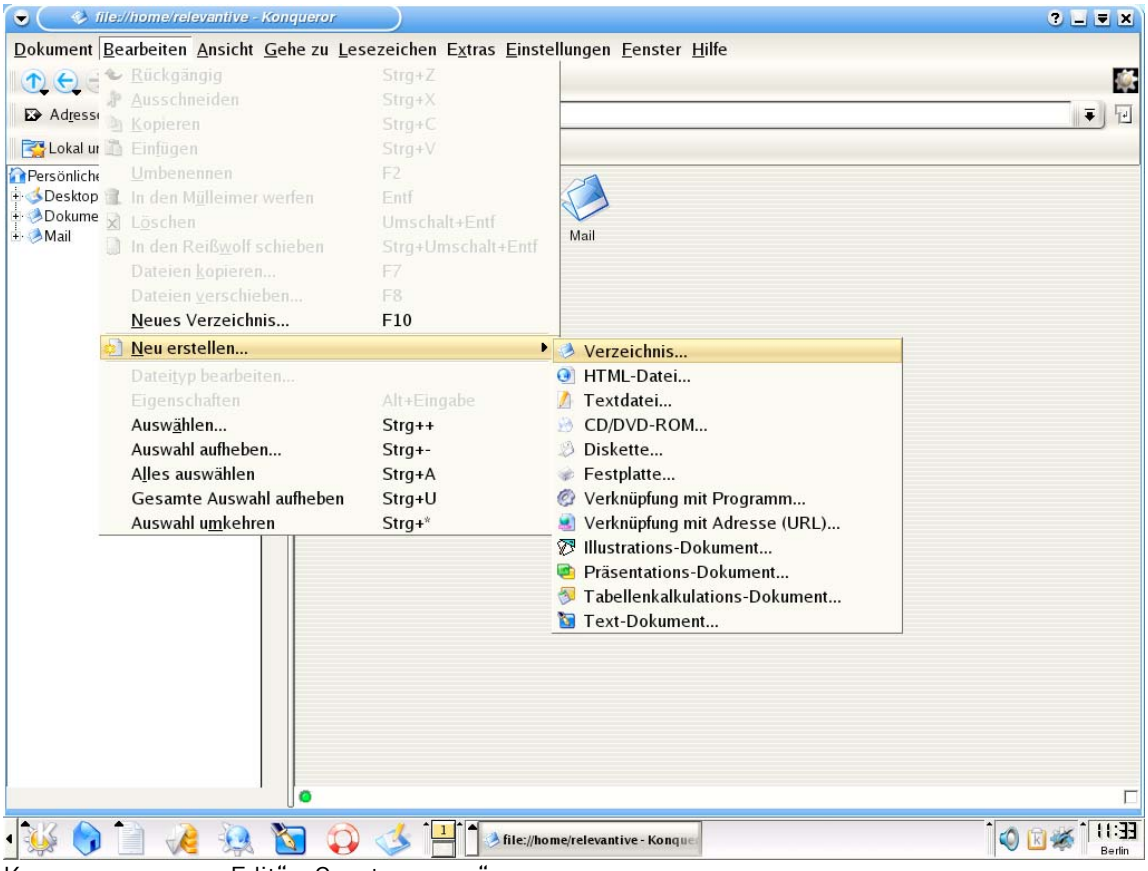
Altogether, this task took a relatively large amount of time (on average 5:01 minutes on Windows XP, 5:26 minutes on Linux) even though the task was completed by the fastest Windows XP user, taking 1:10 minutes, and the fastest Linux, user taking 1:14 minutes. The slowest times were those of two Linux test participants who needed 18:08 and 18:48 minutes. The slowest user on Windows XP needed 10:35 minutes.

On Linux, the creation of a new folder posed large problems to many of the test participants as the term „folder" (German „Ordner") was not understood to be synonymous with the term „directory" („Verzeichnis"), used by Konqueror. Unfortunately, there is also no consistent naming within Konqueror: The menus use the term „directory" while the tooltip and the lower status panel provide the term „folder" for the type of directory.

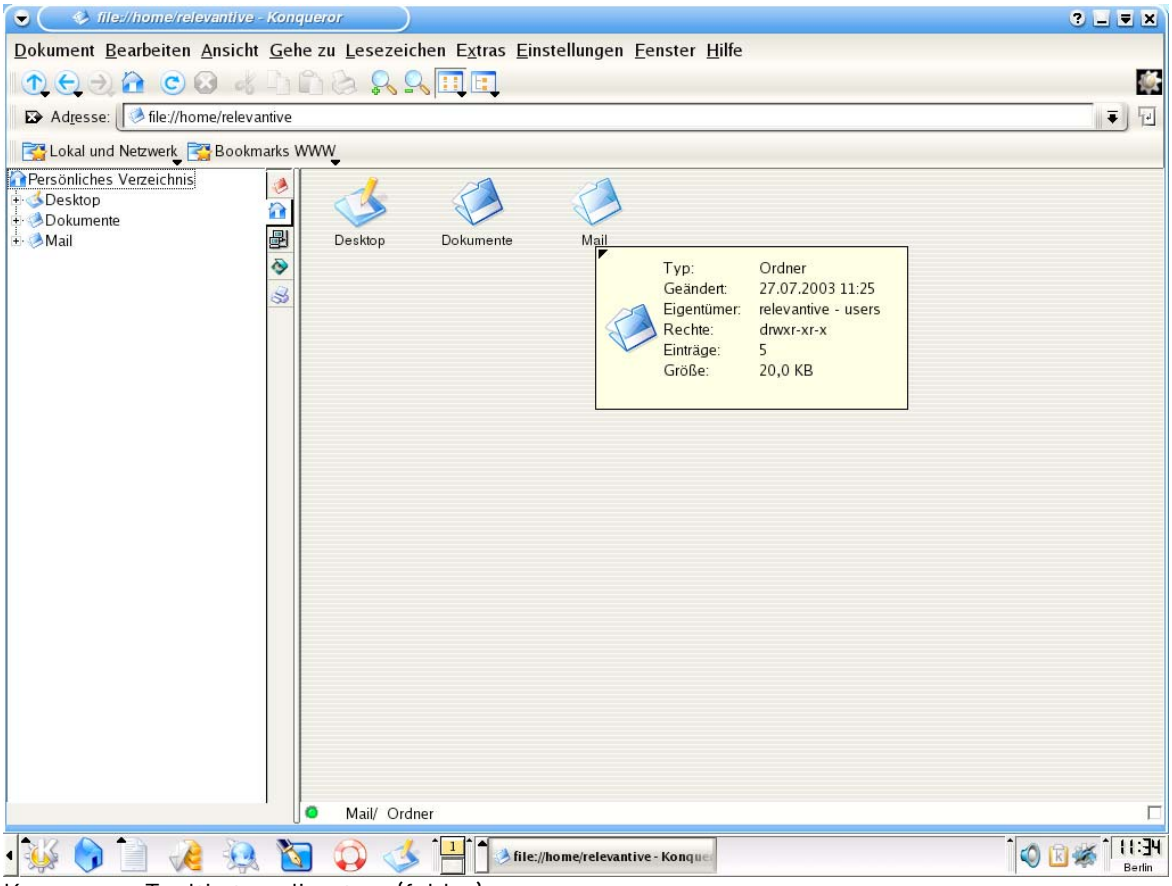
The first screenshot shows the „Edit"-menu („Bearbeiten") of the file manager Konqueror, the entry „Neues Verzeichnis" (new directory) is highlighted. The second screenshot shows the unfolded submenu „Neu erstellen..." (create new) with the entries „Verzeichnis" (directory), „HTML-Datei" (HTML file), „Textdatei" (text file) and so on. The third screenshot shows the tooltip of a directory with the entry „Typ: Ordner" (type: folder).



Konqueror: Menu „Edit“: New directory



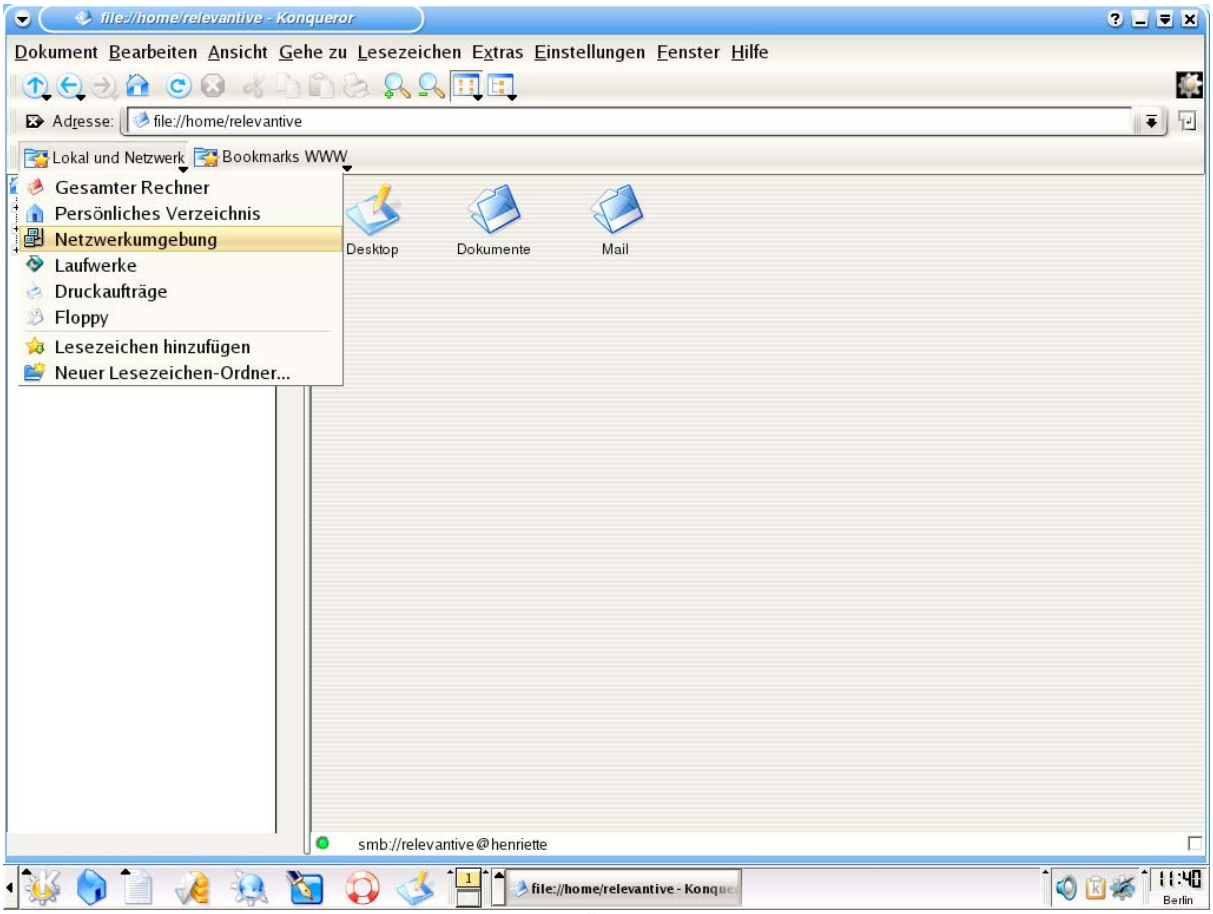
Konqueror, menu „Edit“: „Create new ...“



Konqueror: Tooltip to a directory (folder)

While only the term „folder“ was used in the task description, the handouts provided to the test participants used the terms synonymously, as in „Ordner/Verzeichnis“ (folder/directory). However, most of the test participants were not aware of this correspondence (see also chapter 5.4 Wording).

As for the problems mentioned in the chapter „Technical Setting – Applications“ (4.1.4.3) which concern Konqueror's navigation sidebar (icons too small and not labeled), most of the test participants used the bookmark menu „Lokal und Netzwerk“ (local and network). The screenshot shows the contents: „Gesamter Rechner“ (entire computer), „Netzwerkumgebung“ (network environment), „Laufwerke“ (drives/devices), „Druckaufträge“ (printer queue), „Floppy“.



Konqueror: Bookmark folder „Local und network“

It took several seconds to connect to the network, with those using the bookmark navigation getting no feedback at all; when using the sidebar, a tiny cog wheel animation appeared on top of the network icon which was noticed by only very few of the participants. As a result, this appeared to be a dead end to most of the test participants and they started looking elsewhere for access to the remote drive. This is one of the worst cases of user guidance, as users who erroneously assume that a certain way is not leading to the aim of their task will not try until much later to use this option again, if at all.

Furthermore, the problem of unlinked views in Konqueror's right and left window (changes in the navigation sidebar are not linked to changes in the right window half and vice versa, see chapter 4.1.4.3 of the „Technical Settings“ for details) added to the complexity of this task.

If the file was eventually found, 40% of the test participants copied it by using Konqueror's menu options „Edit“ → „Copy“ followed by „Edit“ → „Paste“ („Bearbeiten“ → „Kopieren“, „Bearbeiten“ → „Einfügen“), 20% used the RMB/context menu with the same entries, about 30% used the keyboard shortcuts „Ctrl-C Ctrl-V“. Four of the test participants discovered and used the context menu's „Copy to“ („Kopieren nach“) option, which directly shows the way to the desired directory using submenus.
Copying on Windows XP involved roughly the same distribution. However, two participants used drag&drop, which only one of the Linux users tried.

5.6.5 Locate files

Task: „List all files from your personal folder which have been created on 06/25/2003 and start with the letters 'Vorschlag'."

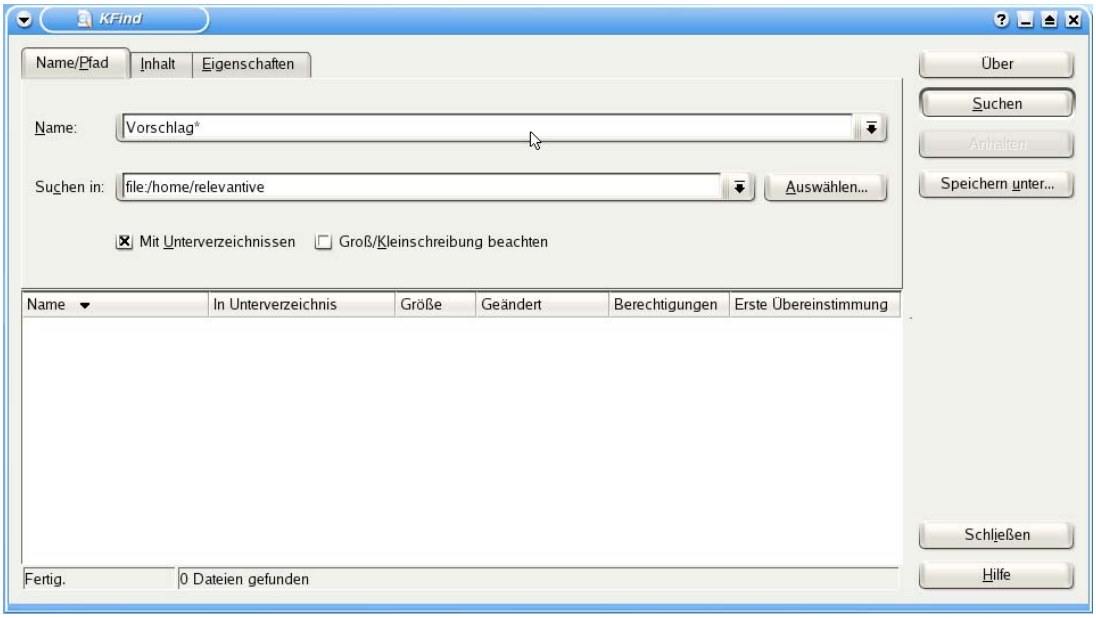
This task was rated, with an average of 3.9, to be the most complicated of all on Linux. However, it was also one of the three most difficult tasks for the Windows test participants.

About half of the test participants found the searching tool (KFind) in KMenu, the others in Konqueror's menu „Extras" (tools) → „Dateien suchen..." (find files). The last group took a little longer as Konqueror's menus are hard to scan quickly (because of deficient structuring/grouping).

The search itself showed up two central problems: the wildcard (*) and limiting the search to the creation date. The latter lead to the fact that not one (!) of the test participants was able to solve this task correctly as no search result was displayed (even if there existed two files created on the mentioned date).

The first difficulty arose from the wildcard whose function was common to only about half of the test participants. In actual fact, it was the default entry in the search term filed, but got overwritten in most cases. So the search could only be for exact results („Vorschlag") with the test results being correspondingly empty. No clue hinted at the use of wildcards.
If the search term field is left empty (not even a wildcard) all files are searched.

The following screenshot shows KFind with the truncated search term „Vorschlag*".



KFind with truncated search term

The Windows XP file search is designed differently. You do not have to use truncation as the search is always for file names *containing* the search term, not just for the search term itself. This is why the problem did not show up in these tests.

The second problem with the KFind file search was its calendaring/date function. Firstly, the simple choosing of dates posed large problems which led to much frustration on the test participants' side. Secondly, the date range logic is neither explained nor plausible.

Selecting the proper dates is not logically structured and mixes two concepts: Clicking the chosen item and typing the date directly into an appropriate field.
The screenshot shows the calendaring box that opens on selecting the drop-down arrow at the right of the date.

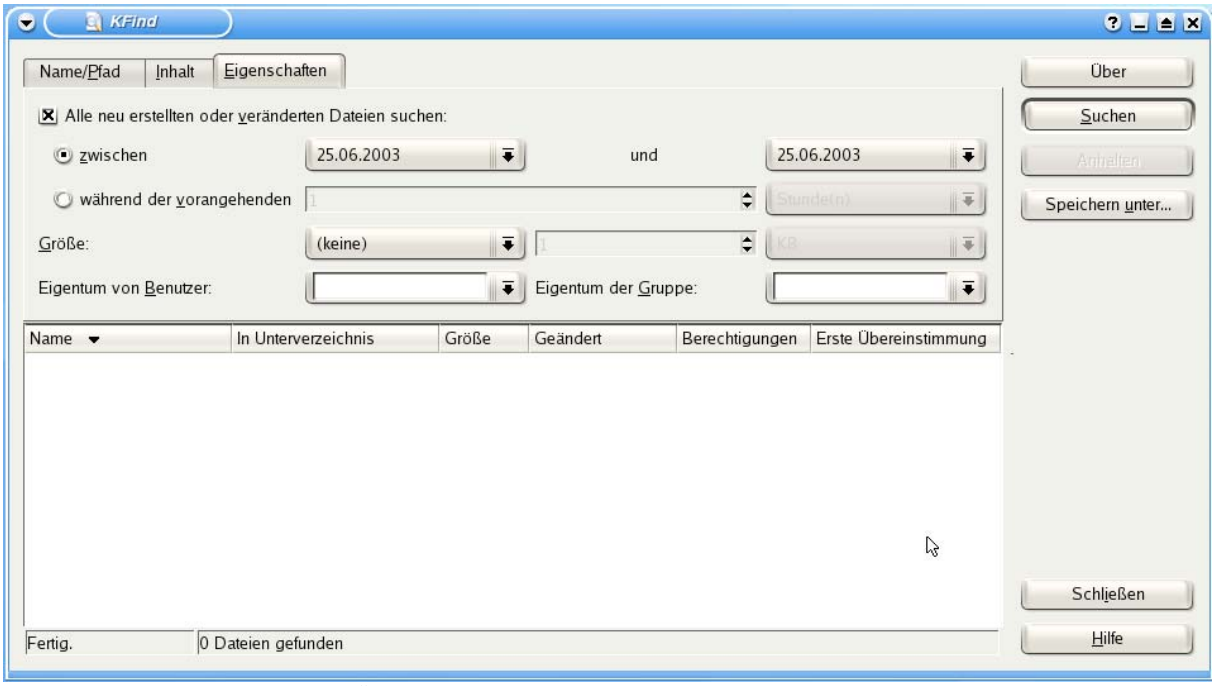
Kfind with calendaring function for choosing a date range

If you enter the date by keyboard into the input field on the lower left hand side, and confirm it using the „Enter“ key, only the yellow mark switches to the selected day while the date is not really confirmed.
Nearly all of the 13 test participants who entered the date directly, clicked after entering it on the upper date display (showing 01.01.2000), on which the entered date vanished instead of changing the displayed date. The only possibility to confirm the selection is to click on the yellow marked day. To check this out, the users always had to try this several times.
The test participants who used the arrow buttons or who clicked directly on the button showing the month's name („Juni“) completed this task faster. But also, by using this strategy they had to confirm the selected day by clicking the yellow marked day, not by using the „Enter“ key.

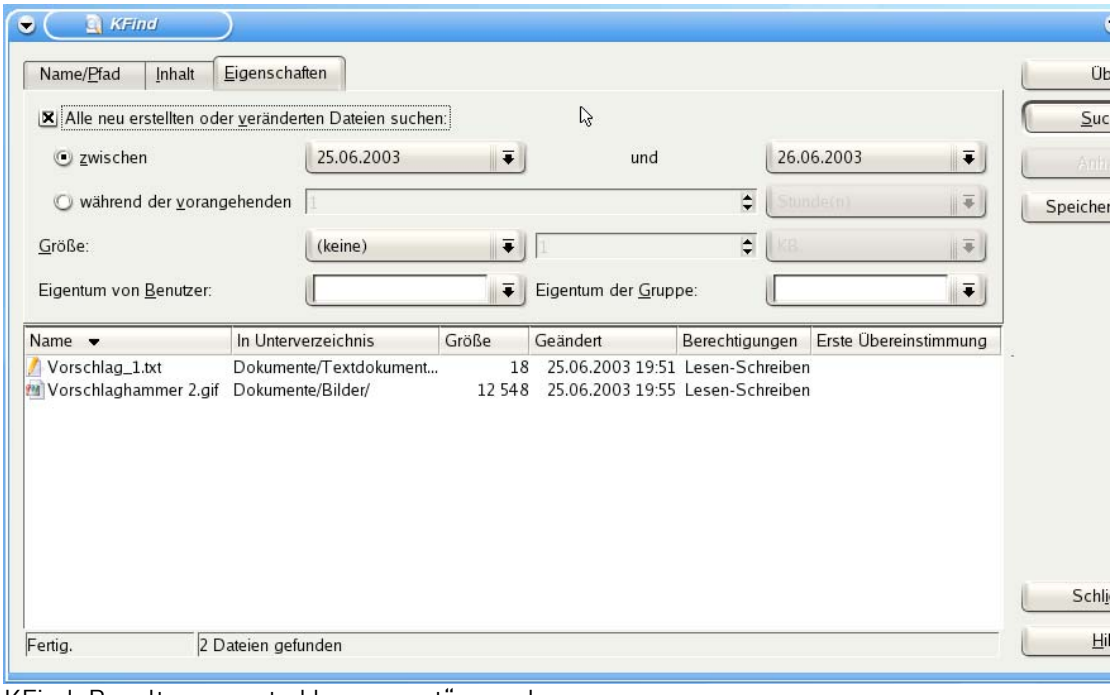
The next problem proved to be even more serious. All of the test participants entered the date of „06/25/03“ as the starting *and* ending date of the search, as they looked for files created on this day and there was no special option for entering only one date. The search result was empty so the participants asked if there were any matching files at all.
The reason why no files were found is that the application requires a date *range* to be entered, starting on the 06/25/03, 0:00h and ending on the 06/26/03, 0:00h, in order to be able to find the required files. If the same date is entered twice, the application searches for files created between 06/25/03, 0:00h and 06/25/03, 0:00h, which naturally produces an empty result set.
The fact that the users did not see this logic does not really need discussing further.

The first screenshot shows the empty result set from the users' intuitive approach to the date range, the second one the files found through using the „correct“ approach.
Activated: „Find every file created or changed between [date1] and [date2]“. („Alle neu erstellten oder veränderten Dateien suchen zwischen [...] und [...]“).

(The deactivated option offers the possibility of looking for files created or changed within the last x hours/days/weeks etc.). The status bar says: „Ready. [...] files found." („Fertig. [...] Dateien gefunden.").

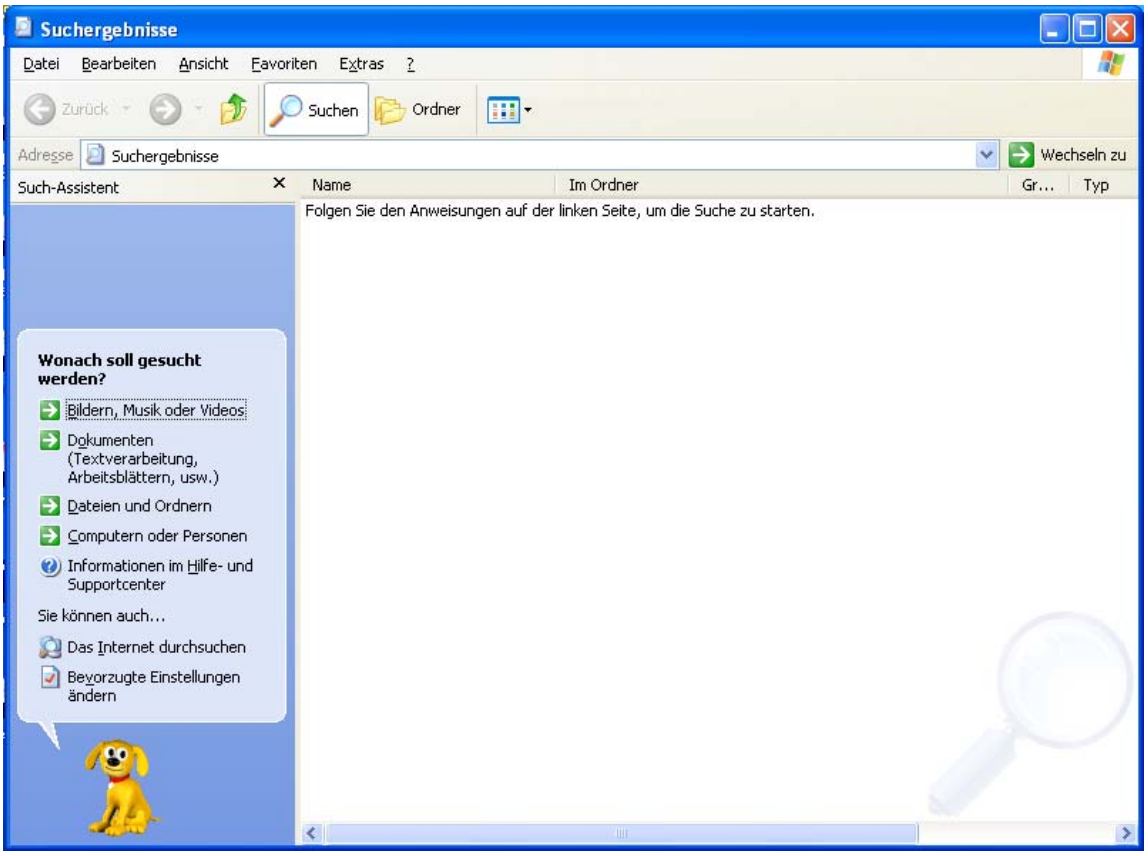


KFind: No results by „intuitive" search



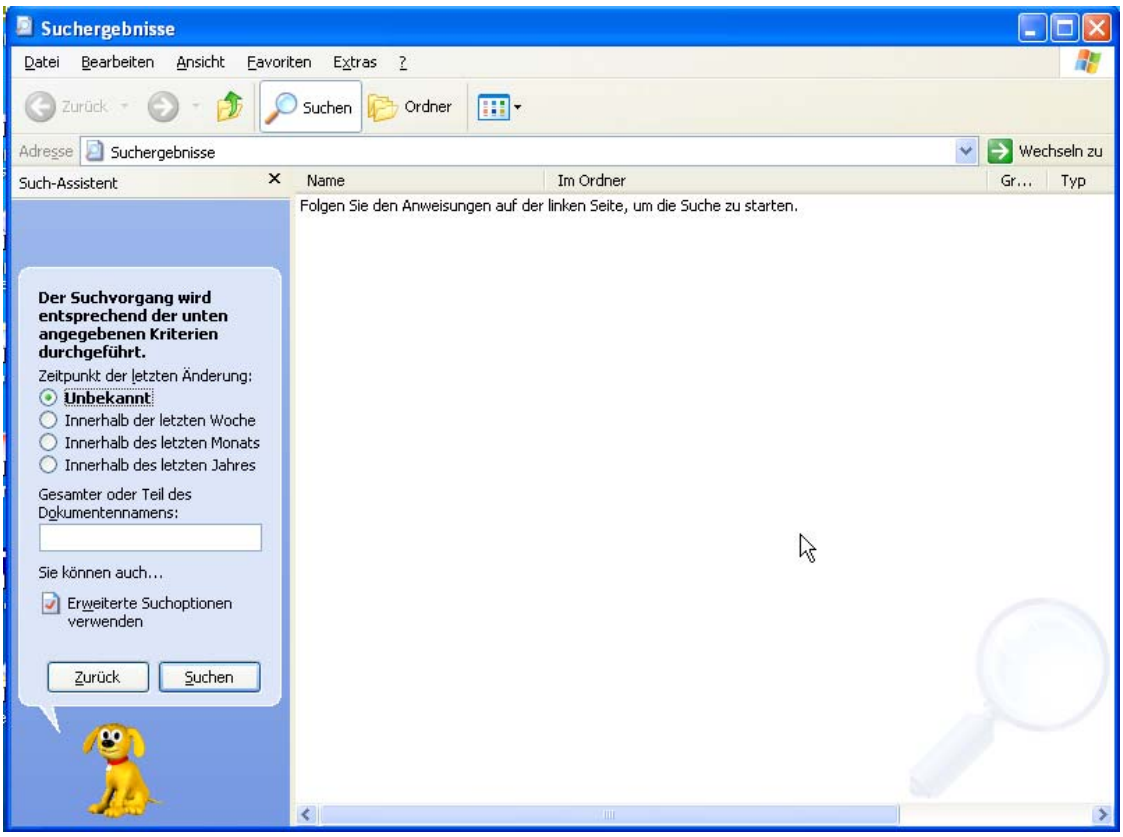
KFind: Results generated by „correct" search

This task also took a surprisingly long amount of time on Windows XP, also because of usability problems: The startup window of the searching tool offers two options: Looking for documents (word processing, spreadsheets etc.) („Dokumenten (Textverarbeitung, Arbeitsblättern, usw.)") or for files and folders („Dateien und Ordnern"). The screenshot shows these options and, in addition, the search for multimedia files („Bildern, Musik oder Videos") and computers or people („Computer oder Personen").



File search on XP: No selection of creation date

As the majority of users selected documents („Dokumenten...“), the next window offered them only the following limited set of search options (see screenshot): „Zeitpunkt der letzten Änderung: Unbekannt / Innerhalb der letzten Woche / des letzten Monats/Jahre“ (last changed date: unknown / within the last week/month/year). The selecting of a special date (range) was not possible.



Search in Windows XP: no option for the exact creation date available

Even through using the option „Erweiterte Suchfunktionen verwenden“ (advanced search) the search for a creation date was not possible. Consequently, the test participants did not think of searching this option again, back on the startup window (it is implemented in „Dateien und Ordner“: files and folders).

5.6.6 Burn data CD

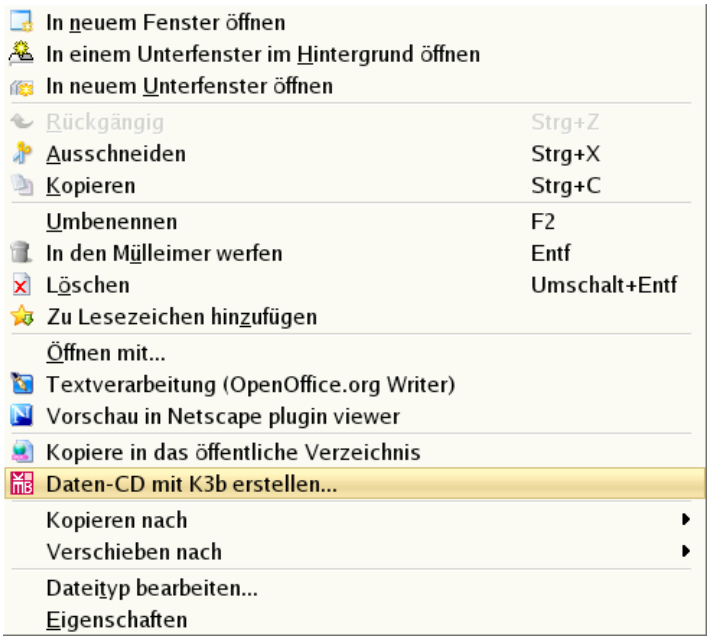
Task: “Save (burn) the previously copied document ’Besprechung.doc’ (in your created folder) onto a CD (which you will find beside you).
Afterwards, remove the CD from the drive.”

The results of this task, at first, come as a surprise: It took the Windows XP test participants, on average, 29 seconds longer to complete this task than those testing Linux. With an average rating of 3.9 this happened to be the most difficult task for the Windows users. On the other hand, it was rated as 2.9, on average by the Linux users.

The reason for the low scoring of Windows XP is the considerable integration of the CD writing application with Windows Explorer. In addition, many test participants did not understand the sequence of necessary steps which lead to completion of this task. On Linux, the CD writer K3b is a classic stand alone application.

On Linux there are three possibilities of starting K3b: using KMenu's submenu „Multimedia“ → „CD brennen (K3b)“ („burn“ a CD (K3b)), using the desktop icon „CD-RW/DVD“ or using (in Konqueror) a file's context menu with the entry of „Daten-CD mit K3b erstellen“ („Create data CD with K3b“) .
The last option involves the right-click of one file in Konqueror and then choosing the stated option to start K3b with a prepared data project for this file, ready to be written to the CD. However, only two of the test participants chose this option.

The screenshot shows the RMB/context menu of a file in Konqueror, showing „Open in new window“, „Open in tab in the background“, „Open in tab“; „Undo“, „Cut“, „Copy“; „Rename“, „Trash“, „Delete“, „Add to bookmarks“, „Open with...“, „Word processing (OpenOffice.org Writer)“, „Preview in Netscape plugin viewer“; „Copy to public folder“, „Create data CD with K3b...“ (highlighted), „Copy to →“, „Move to →“; „Change file type...“, „Properties“.

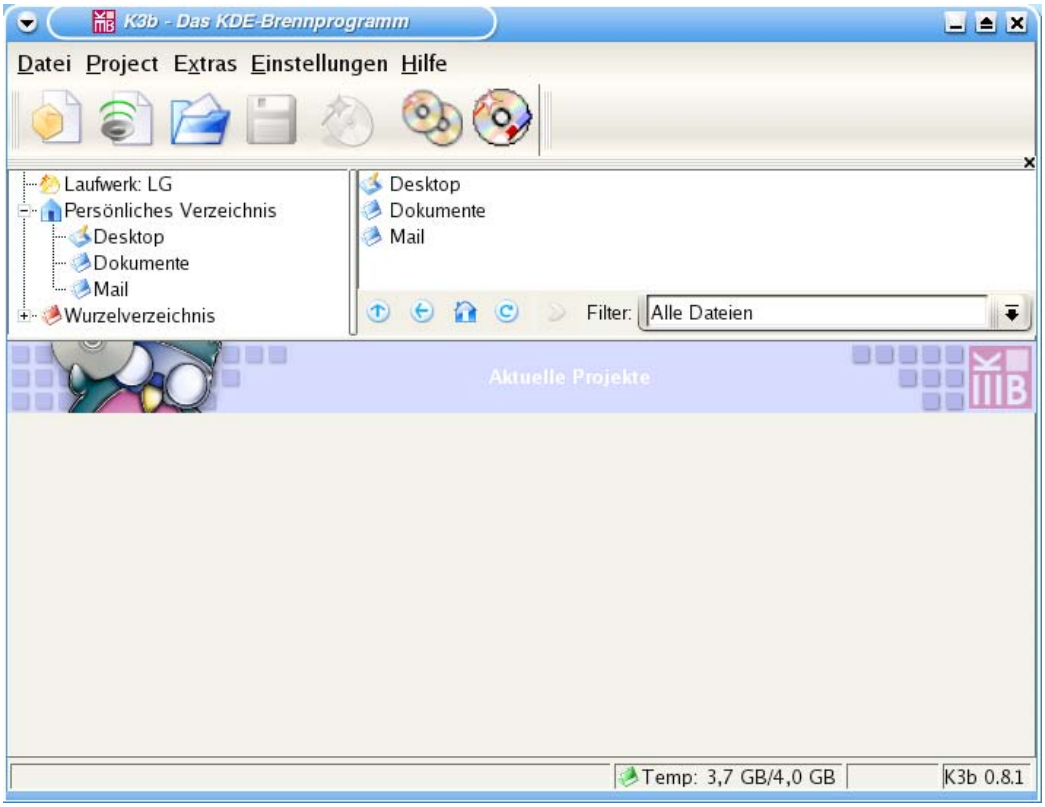


Context menu with K3b entry

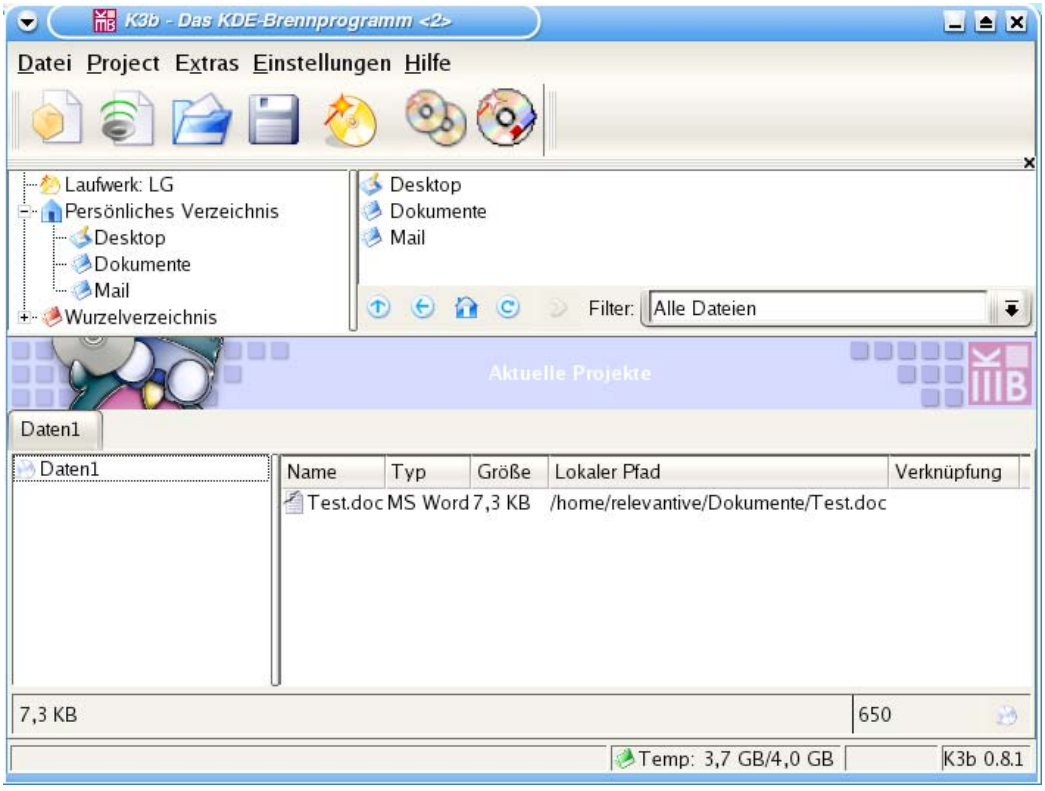
If K3b got started by menu or desktop icon, the startup GUI did not explain to the participants the next necessary steps. If the displayed file is moved to the lower area called „Aktuelle Projekte“ (current projects) by drag&drop, nothing happens, with not even a hint of what the user did wrong (if he or she did anything wrong).
If the user right-clicks on the file that is to be written on to the CD, a context menu shows up: „Zum Projekt hinzufügen“ (add to project). As no project is yet started, you are asked if that is intended. The default is audio project here which did not pose many problems: Nearly all of the test participants using this option chose „Datenprojekt“ (data project).

The third group of test participants chose K3b's menu option „Datei“ → „Neues Projekt“ → „Neues Datenprojekt“ (File → New Project → New Data Project).
Those participants who were acquainted with similar CD writing applications, completed this very fast, while it took the others a very long time to scan the menus and eliminate possible strategies (see also chapter 5.4 Wording).

The first screenshot shows the startup view of K3b without project. The lower part of the window (gray background) is not usable with drag&drop and offers no hints of its intended use.
The second screenshot shows K3b with a data project.



K3b without data project

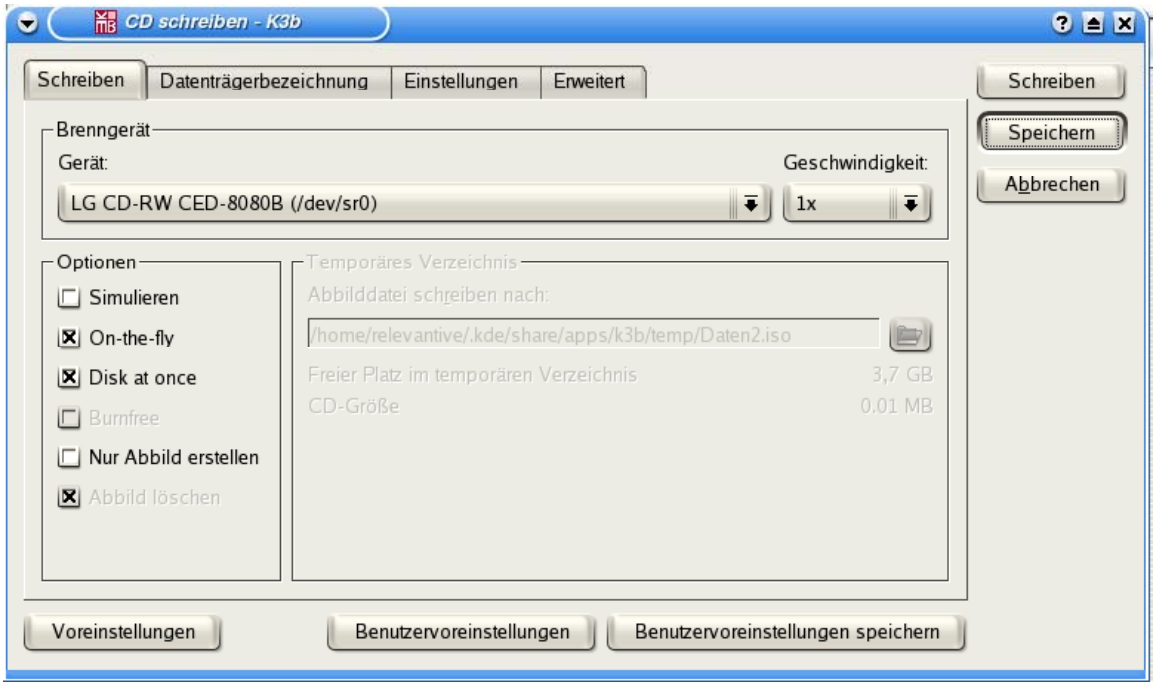


K3b with data project

After these difficulties were mastered, it took nearly all of the test participants some time to locate the „Write“ button (third icon from the right).

The next dialog box (see screenshot), which offers plenty of options for writing the CD (simulate, on-the-fly, disk at once, burnfree, only image, delete image) confused the less experienced users and offered, again, no explanation about what to do next. A

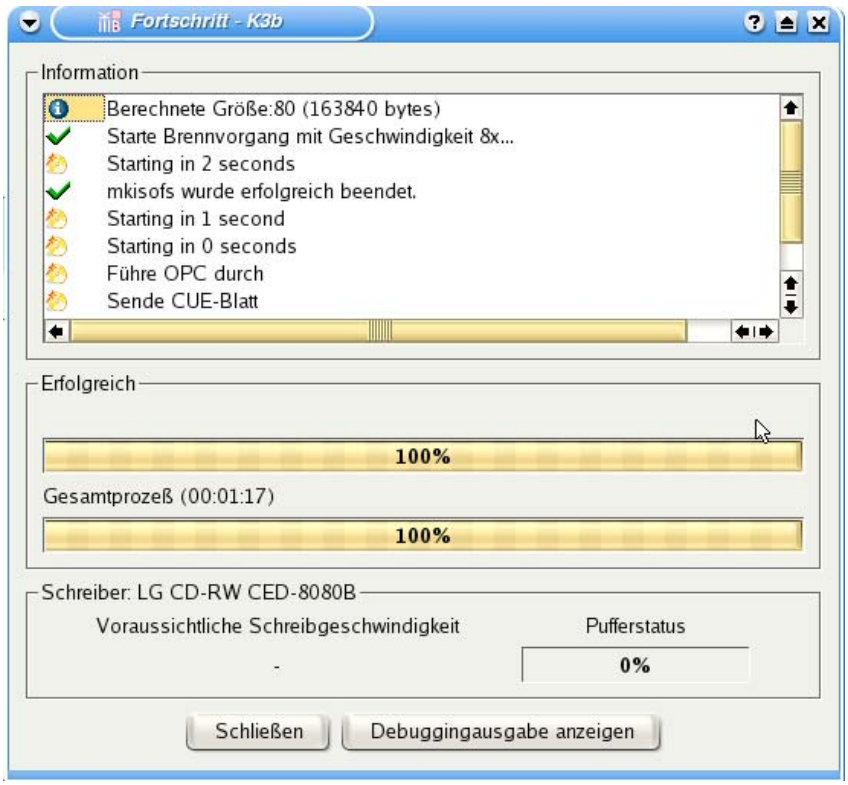
new wording problem showed up as the three crucial buttons are labeled „Schreiben“ (write), „Speichern“ (save) and „Abbrechen“ (cancel). The emphasis is on the „Save“-button, even though the next action should normally be to select „Write“. Again, the term „Schreiben“ got used instead of the more commonly used „Brennen“ (burn).



K3b: Write or save?

Less experienced users asked if you „save“ the files on to the CD or if you „write“ them. Ten of the test participants chose „Save“. As the following dialog box did not match their expectations, they cancelled it and chose „Write“ afterwards.

The next window offered further difficulties, leaving the participants clueless. The screenshot shows the window illustrating the status of the writing process.
The upper half offers „Information“ of the following kind: „Calculated size...“, „Starting write process...“, „mkisofs successfully finished“, „performing OPC“, „sending CUE sheet“...
The lower half shows two status bars with the heading „Erfolgreich“ (successful), and between them the line „Gesamtprozeß...“ (entire process).



K3b: Progress of the burning process

The logging area „Information“ showed plenty of entries that were not understandable for normal users („Sending CUE sheet“). This, in some cases, led the user to believe that the writing process would not function correctly or had got stopped („mkisofs successfully finished“). The uncertainty of the test participants was increased because the status bar stayed at zero during the whole writing process. Only the time displayed on the „entire process“ line changed. Most of the participants checked the CD drive to see if something was happening.

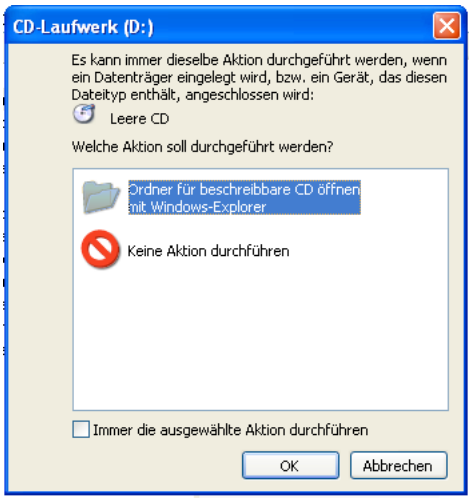
It should be added that the deficiency of this status bar is partly due to the fact that the file itself had only a size of 280KB, so the writing process was very short whilst most of the time was taken up by writing the lead-in and lead-out (which are also part of the „entire process“ and should have been shown by the proceeding status bar).

When the writing process is finished, the CD is ejected before the dialog communicates the successful completion. Because of this, all test participants first looked at the CD drive in the computer, then on the screen. And the message on the screen was hardly visible: a small header saying „successful“ and a process bar with 100% on it.

On Windows XP, the CD writer is tightly integrated into the file manager. The necessary steps to write a CD are, nevertheless, more complex than with a „classic“ CD writer. In addition, the wording (in German) was rather unfamiliar for many test participants. Again, „Write data on CD“ is used.

In the tests, many participants were initially looking for a stand-alone application. When they could not find one, about two thirds entered, at first, an empty CD which caused a dialog to be shown for the desired application. Since no CD writer was in the

list, they had no choice but to select „Open writable CD folder using Windows XP “ (see screenshot).



Windows XP: Pop-up dialog box after inserting a blank CD

5.6.7 Email and Organizer

Task: “Open the email application. You have received a new mail which mentions the date of an appointment. Have a look at the organizer and see whether you are still free on that date. If that date is still available, please enter the appointment.“

This task, together with the following one, are typical for desktop use in a business context. It was rated much better by the Linux test participants (2.1 on average) than by the Windows XP test participants (3.5).

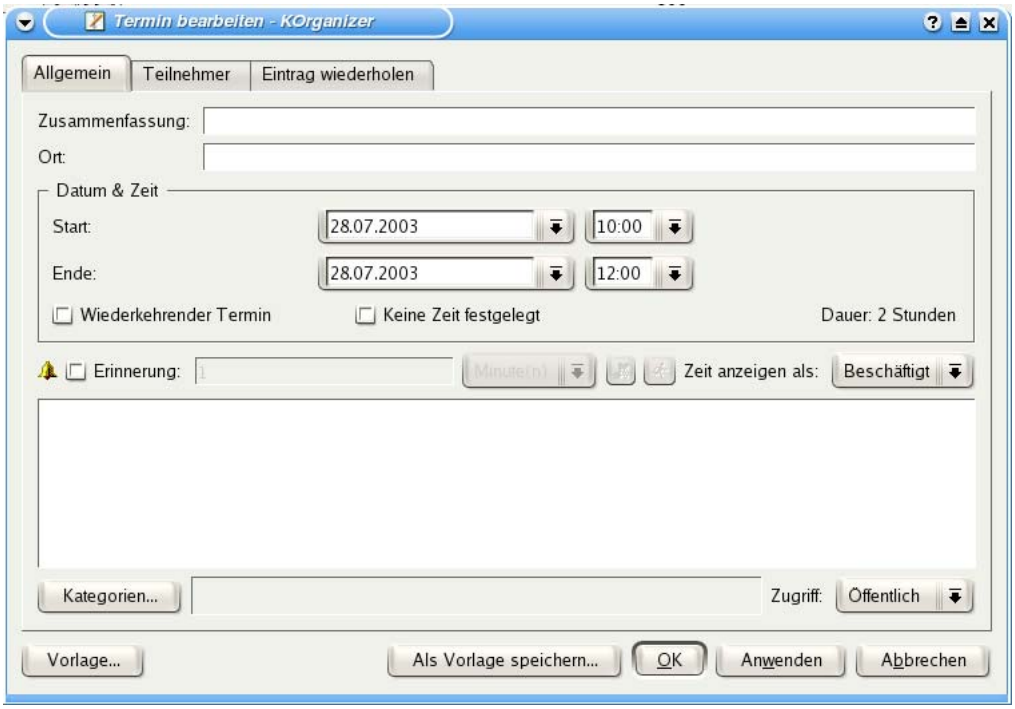
Since there was no integrated groupware or PIM solution available for Linux at the time of the tests, stand-alone applications were used. How these applications interact with each other was, therefore, of interest. In this task, this applies to KMail and KOrganizer, in the next task KMail and KAddressbook.

Finding an Email application and reading the described mail was no problem. However, those who looked for an email application in the KMenu needed some more time because the menu entry was placed in „Internet“, not in „Office Applications“ (Büroprogramme), where it was expected.

Most of the test participants looked for the calendar within the email application. When they did not find a menu entry, they went to the „Office Applications“-entry (Büroprogramme) in the KMenu (by default, KOrganizer is listed under „Utilities“). In the pretests it was not found in this place and assumed to be in „Office Applications“.

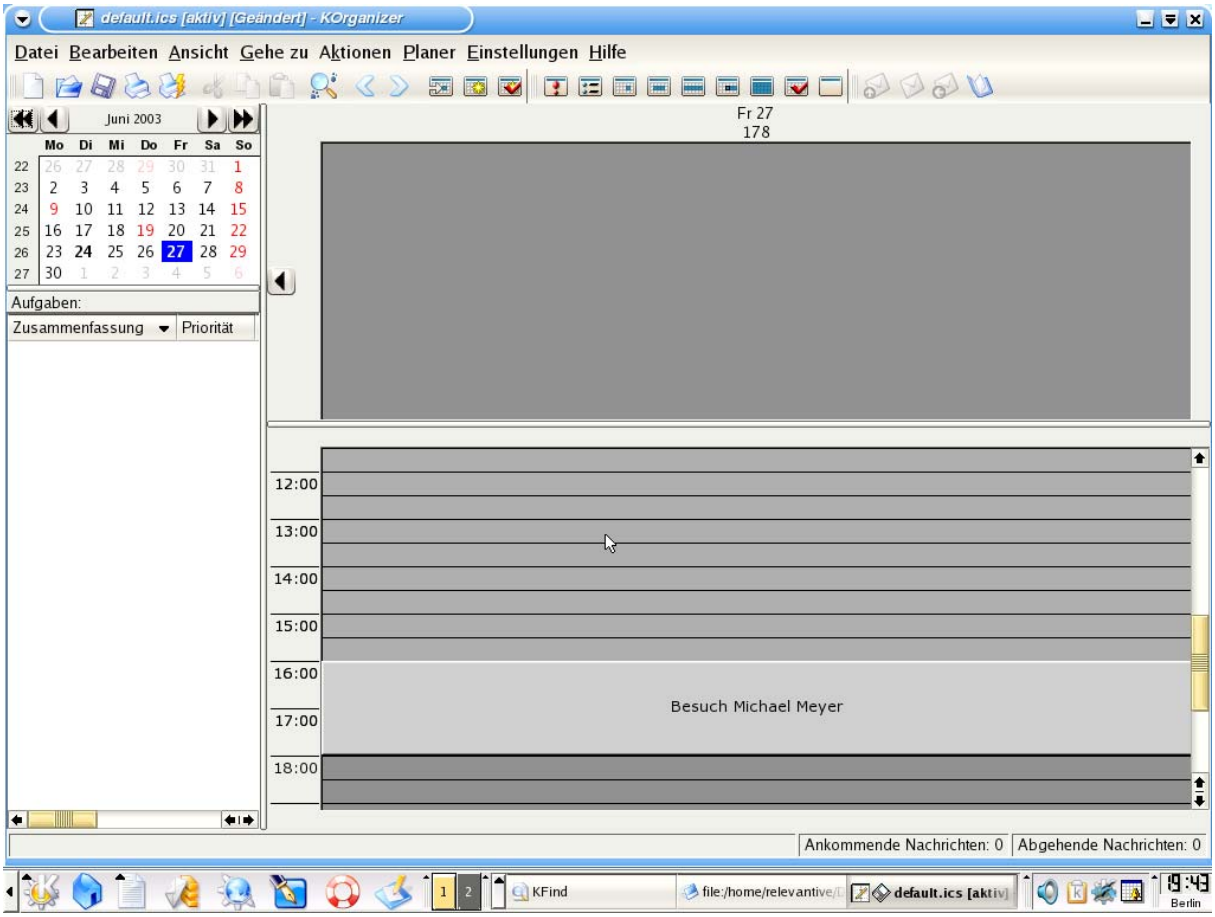
KOrganizer was less easy to use, but was eventually mastered in all cases. There were two pitfalls: The first one was that 90% of the test participants tried to click on and just type in the schedule sheet. Neither this nor a right mouse button click works, which just deletes the marked time span. About two thirds then tried a double click which opens a dialog for a new event. The other third used the menu „Actions → „New Event“ („Aktionen“ → „Neuer Termin“).

The second pitfall was a wording problem. The field with the title of the meeting named „Summary“ („Zusammenfassung“), which about half of the users did not understand as the title of the event. Instead they entered the title in the large blank text box at the bottom of the dialog (e.g. „Meeting Michael Meyer“), which resulted in the fact that, after closing this dialog, the entry had no title.



KOrganizer: New event

The rest of the interface of KOrganizer is not very clear, since about one fifth of the space is used for all day events (which is not communicated; see screenshot, upper gray field). Also the head title of the current day with the day's number in the year was rather useless.



KOrganizer: Event in day view

With Windows XP / Outlook, this tasks was rather difficult for the test participants, partially because of the strong integration of the email with the calendar. Several of the participants switched to the calendar view, chose the right day, but forgot the time. In switching to the mail and back to the calendar, they had to choose the correct date again, since it was set back to the current day. Some test participants did not notice this and entered the event on the wrong day.

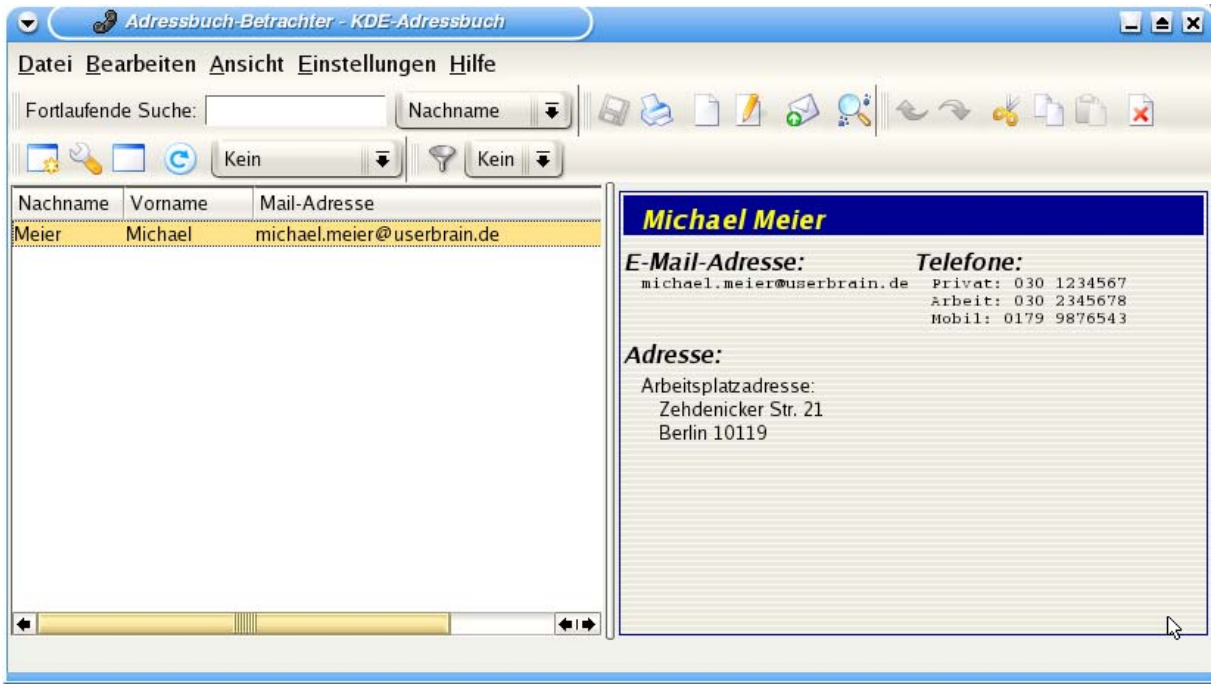
5.6.8 Email and Contacts

Task: „Please write an email to Michael Meier, whose contact details can be found in the address book. As subject, please write „Anfahrt“, in the text body please write „Anbei die Anfahrtskizze“. Include with the email a document (as attachment) with the name „Anfahrsskizze.gif“, which can be found in your personal documents in the „pictures“ folder. Send the email.“

This task was rated significantly better by the Linux test participants (2.7) than by the Windows XP test participants (3.5). The reason why this task was rated more difficult than the last one (2.1) by the Linux test participants was mainly because of the poor interface design of KAddressbook, e.g. the use of fonts. Generally speaking, those who solved the task through opening KAddressbook, had difficulties writing a new email to the person listed in the address book.

The following screenshot shows the entry relating to the person whom you should email. The email address in the right half of the screen is very small and in courier

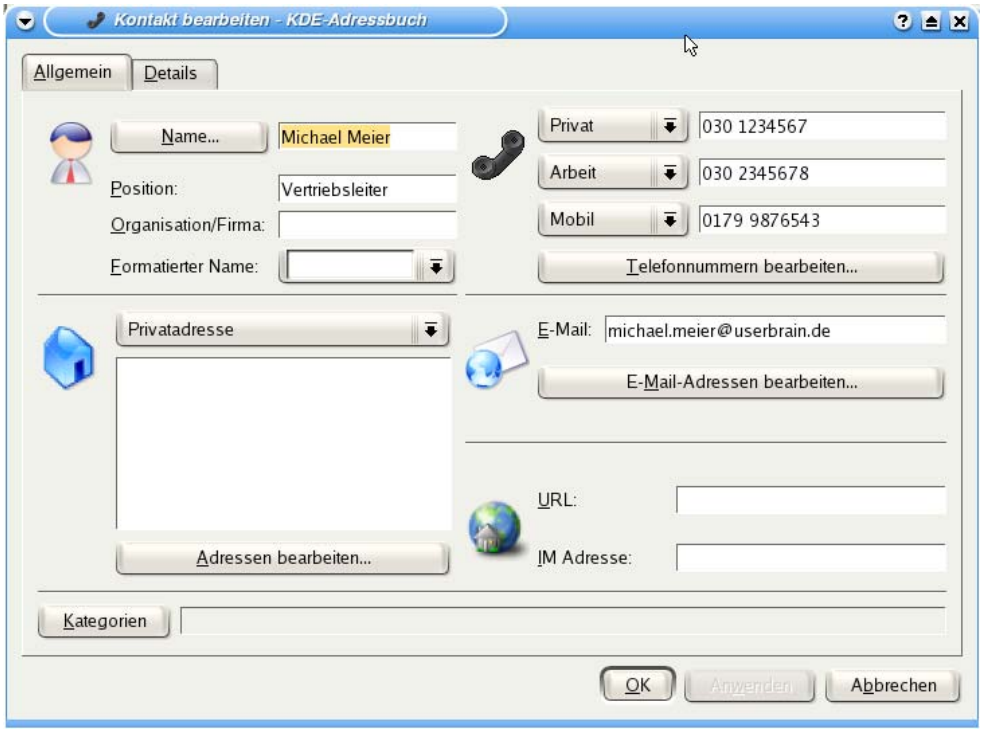
font. This is actually a link that opens a new mail with the correct address. However, this was not understood.



KAddressbook: Overview

As a result, the test participants applied different strategies. 11 opened the detail view and copied the email address by copy&paste into a new email which was created within KMail. Two participants, by chance, clicked on the email address in the overview, which creates a new mail to the contact. Five participants found – after some time of searching – an appropriate icon, which is described in the tooltip as „Send“ („Versenden“).

One person was even successful in trying to drag&drop the email address into a new email created in KMail. This option is supported by both applications.

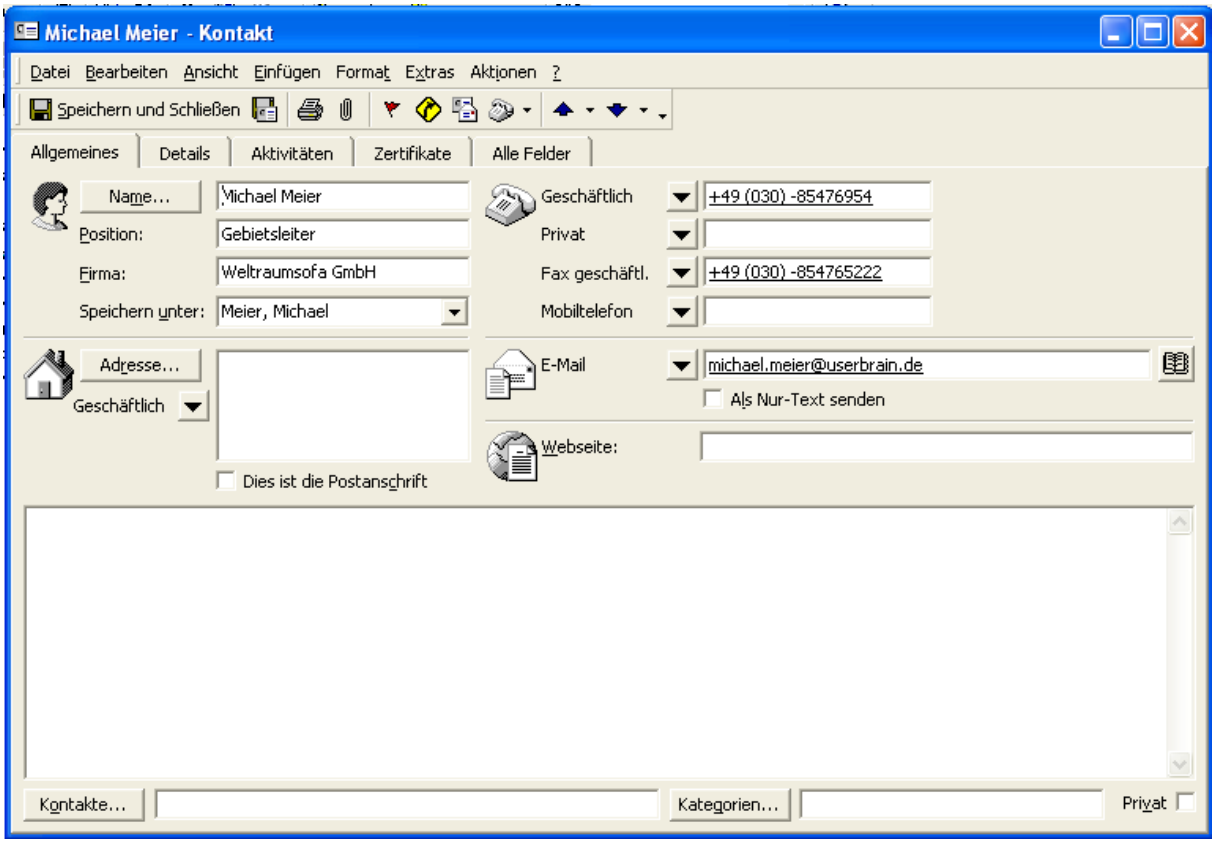


KAddressbook: Detail view

However, there are two simple alternatives, which were not discovered by the majority of the test participants. Without explicitly starting the KAddressbook, it is possible in KMail to use the button on the right hand corner of the address field („..."), which shows a list of all email addresses in the address book. It is also possible to just type into the address field. Thanks to the autocompletion of the address book, this is probably the most elegant way.

Windows XP

In Outlook, the general list view does not allow the user to directly write a new email to the person. A right click reveals the option „New message to contact" („Neue Nachricht an Kontakt"), but this was only used in two cases. Obviously, the words „message" and „contact" are not clear in this context. In the details view, the participants had similar problems to those of the Linux users. The only possibility to write an email to the person was to use the menu „Actions" → „New message to contact". A click into one of the data fields in the details view does not create a new email.



Outlook: Detail view of the contact

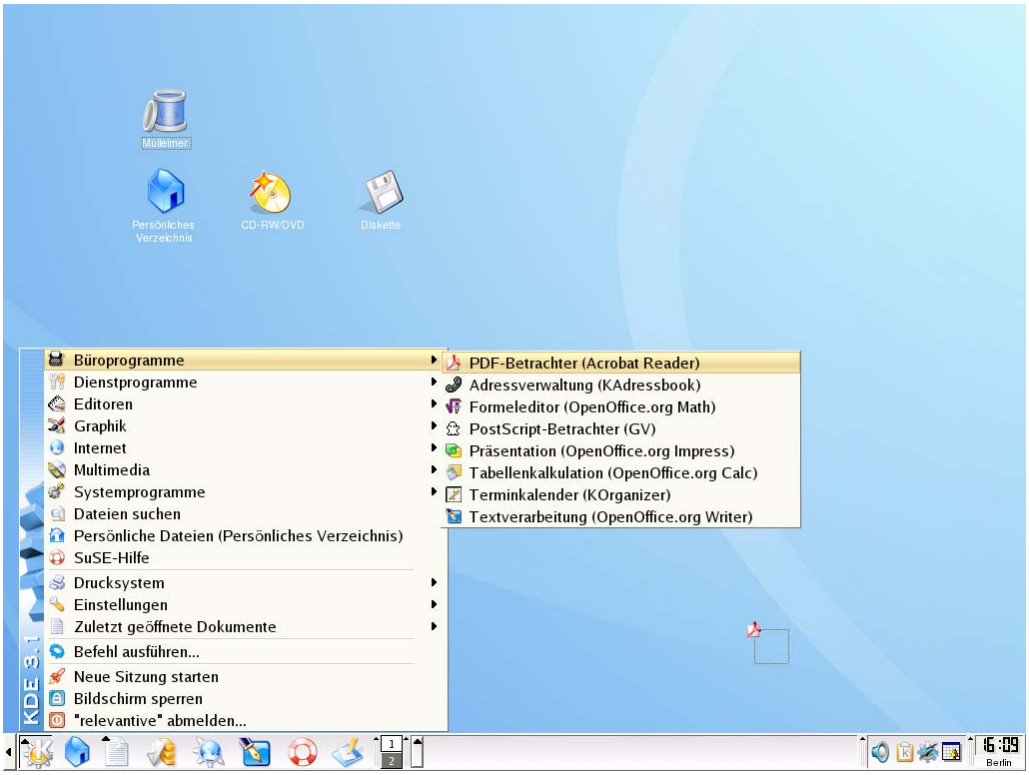
5.6.9 Icon in Quick Launch Bar

Task: "Look for a program which can display .pdf files.
Place an icon/symbol of that application in the bottom bar so that you can start the application with a single click."

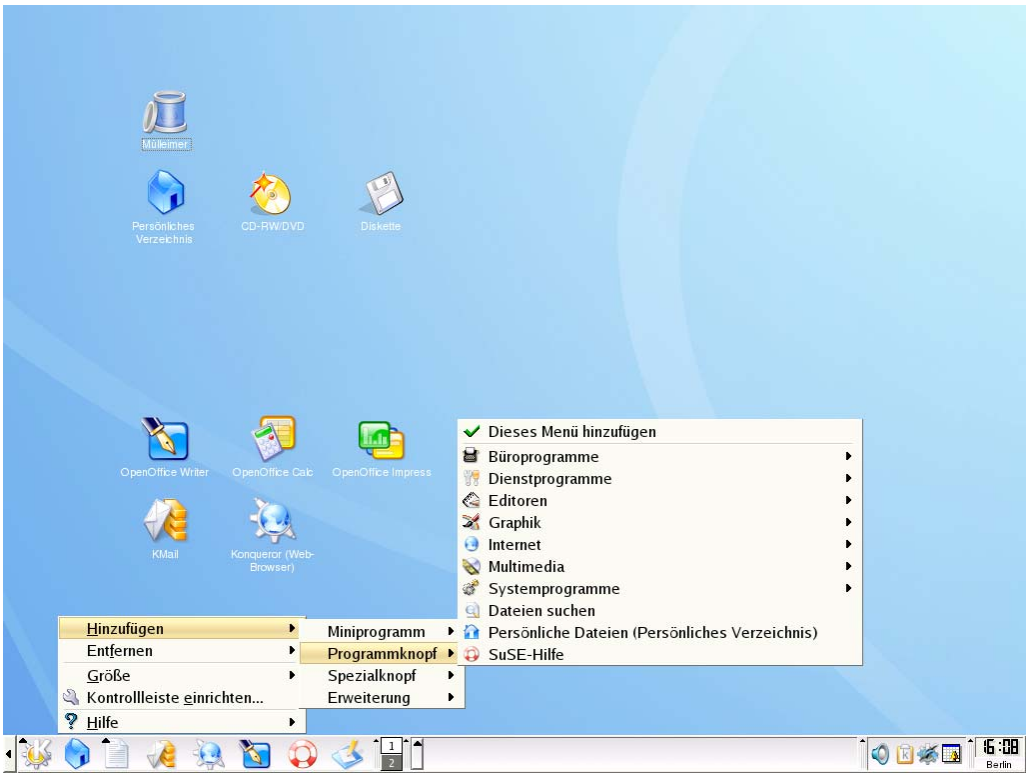
The purpose of this task was to identify whether users are ready to try out solutions which come intuitively to them, even though these solutions may not be known from Windows experience.

The Linux participants rated this task 2.9, the Windows XP participants 3.4. The mean duration was 2:38 minutes on Linux, 3:46 minutes on Windows XP.

Looking closer at these results, the reasons for them become clear. On Linux (in this configuration) there are two ways to place the icon: by drag&drop directly from the KMenu (see first screenshot below), and via the context menu of the panel itself (see second screenshot below).



Drag&drop of the icon from KMenu



Context menu of the panel

Since there was no icon for Acrobat Reader on the desktop, the participants had to use the KMenu. There, most of the users tried to find an appropriate option by a right mouse click, yet the result was the launch of the application. In some cases, this action was repeated because the users thought they had done a left mouse click. Nevertheless, there is no context menu.

Some participants said they had never done „something like this“ before. If this was the case, they were told by the moderator to just try it.

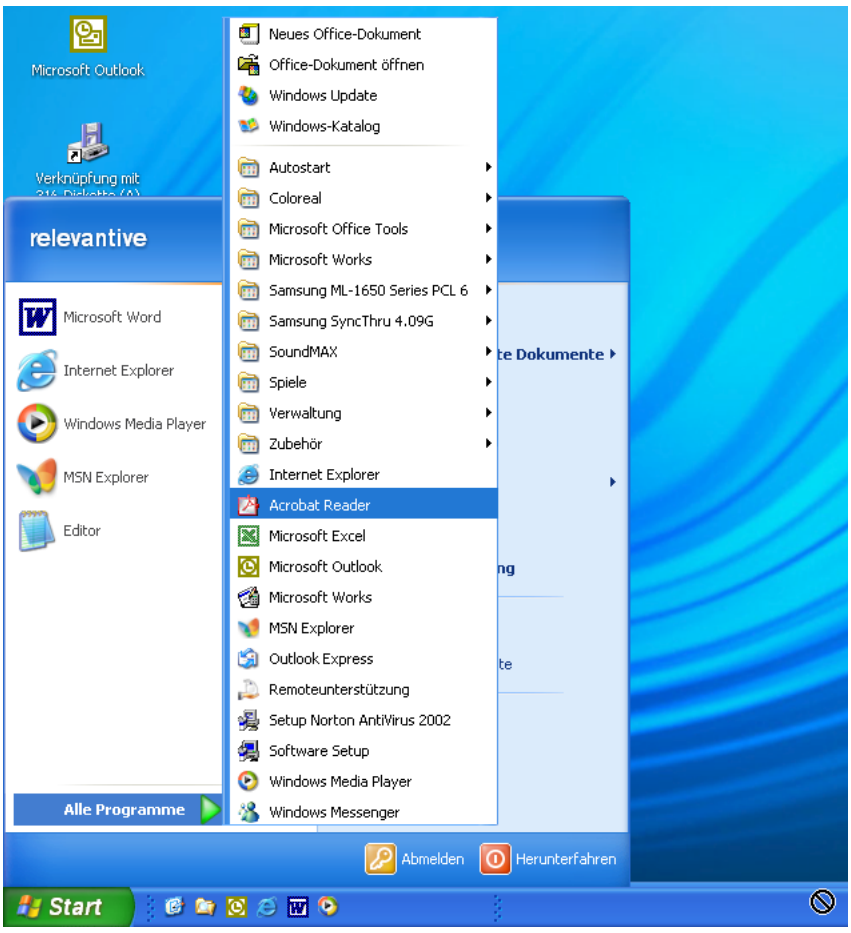
About a fourth of the participants tried to solve this task within Acrobat Reader. This task, therefore, served as a good indicator for the categorization of the user types. Those who tried to find this option within the application did not separate between the application and the desktop. Only after some time of looking around did they realize that they had to find another way.

All in all, about 70% tried to drag the icon from the KMenu into the panel. Since there is an immediate visual feedback for this action, the placing itself was not much of a problem. However, KDE allows the icon to be placed at any position within the panel. Often the icon had to be moved which resulted in a duplication. The first icon was then, in most cases, removed via a right mouse click. Some users dropped the icon, in the first instance, onto another application icon because no insert mark was shown. In all cases, the „mistake“ was realized immediately and in the next attempt the icon placed between two icons.

The other 30% solved this task by right-clicking on the panel. There, the option „Application Button“ („Programmknopf“) was chosen directly in most cases. Since the submenus reflect the KMenu nearly completely, the recognition and the selection of the Acrobat Reader icon was no problem.

The majority of the participants were positively surprised by how easy this task was. Sometimes they spontaneously said that this would be more difficult on Windows.

On Windows XP, this task was more difficult to solve because the only way (the participants found) was to drag and drop the icon into the panel. The context menu of the application in the „Start“-Menu does not show the desired option. If the icon is not dropped at the quick launch bar, but at any other place within the general panel, the icon is refused. This had, in some cases, the result that the participants did not try it again and, instead, looked for another way. Only after finding none did they try it again with drag&drop, sometimes more than once, until they found the correct place.



Windows XP: The icon can not be dragged to any place in the conrol panel.

5.6.10 Desktop Background / Wallpaper

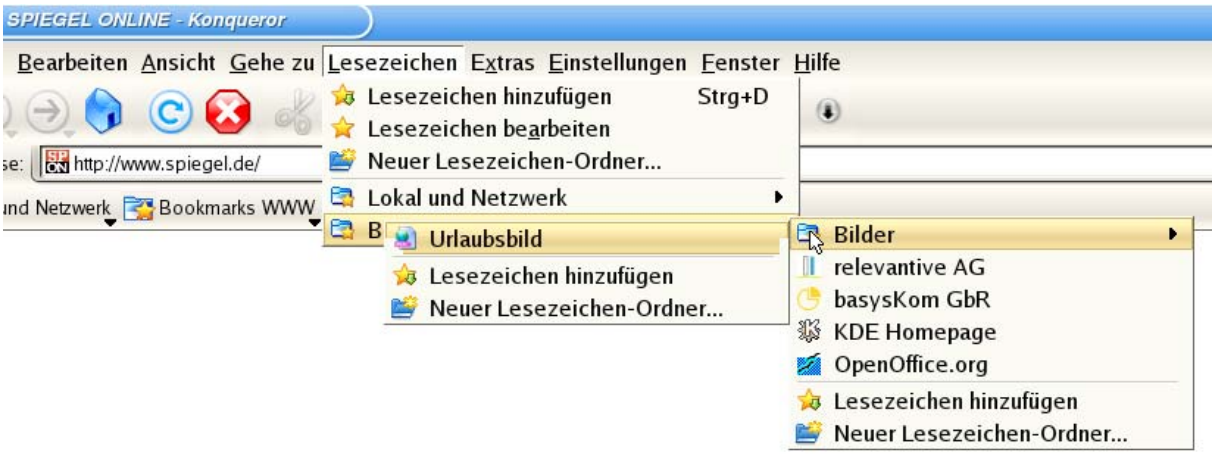
Task: "Please open a Web Browser and load the web page that is listed in the bookmark folder „Pictures" („Bilder"). Set the picture shown on this web page as the desktop background of your computer".

This was difficult on the Linux system we used for the tests since there was no direct possibility of setting the image as a desktop image from within the browser, as this is possible on Windows XP (in KDE 3.2 it will probably be possible). This can also be seen in the time needed for this task: 5:34 minutes on Linux, 3:03 minutes on Windows XP. The fasted participant needed 1:32 minutes on Linux, on Windows the fastest participant needed only 0:34 minutes. On Linux, seven participants needed more than 10 minutes, while on Windows XP no participant needed more than 9 minutes.

The rating was less different (3.2 for the Linux system, 2.9 for Windows XP). The reason may be that after understanding how it works (on Linux), it was considered to be not very difficult.

The main purpose of this task was to see which strategies the participants chose. The clue is that it takes two steps: Save the image to a local folder and then set the image as the background in the appropriate settings. Like the previous one, this task was a good indicator for categorizing the users.

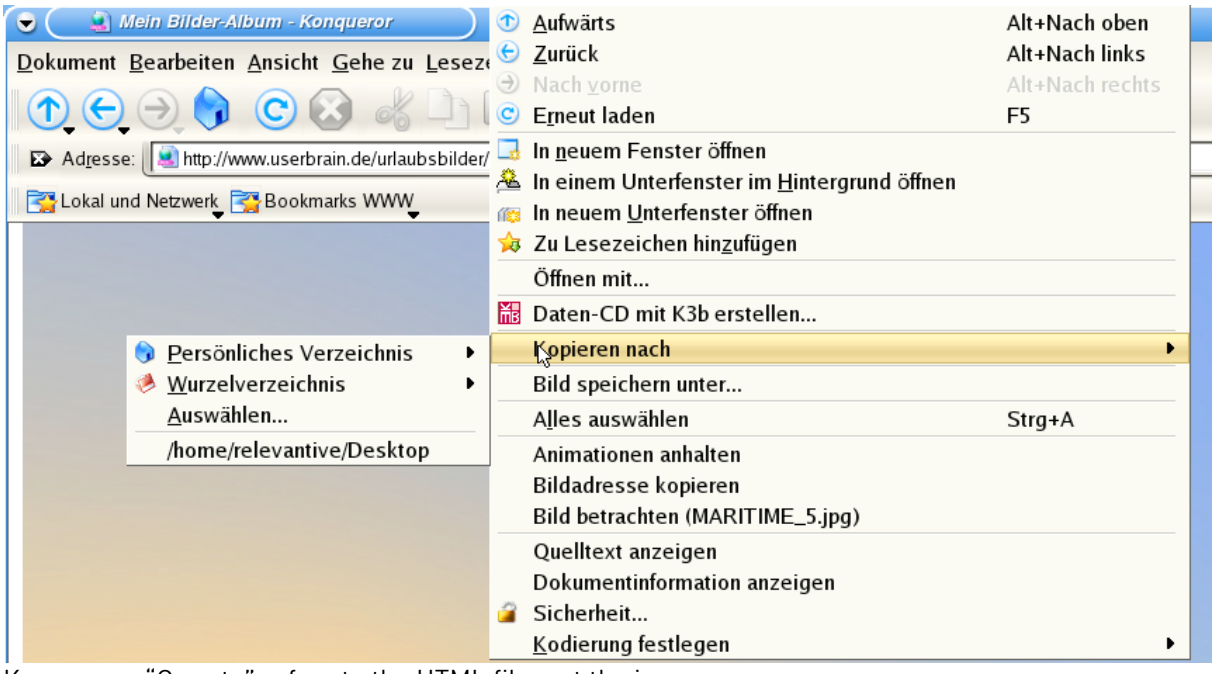
All participants first opened the browser „Konqueror“, which was found quickly, and then went to the bookmarks („Lesezeichen“). Here, the inconsistent unfolding of the submenus lead to confusion: The arrow, in certain cases, points in a different direction to where the panel is opened (see following screenshot: the „Bilder“-arrow points to the right, the according menu is displayed on the left).



Konqueror: The menu unfolds to the left while the arrow points to the right

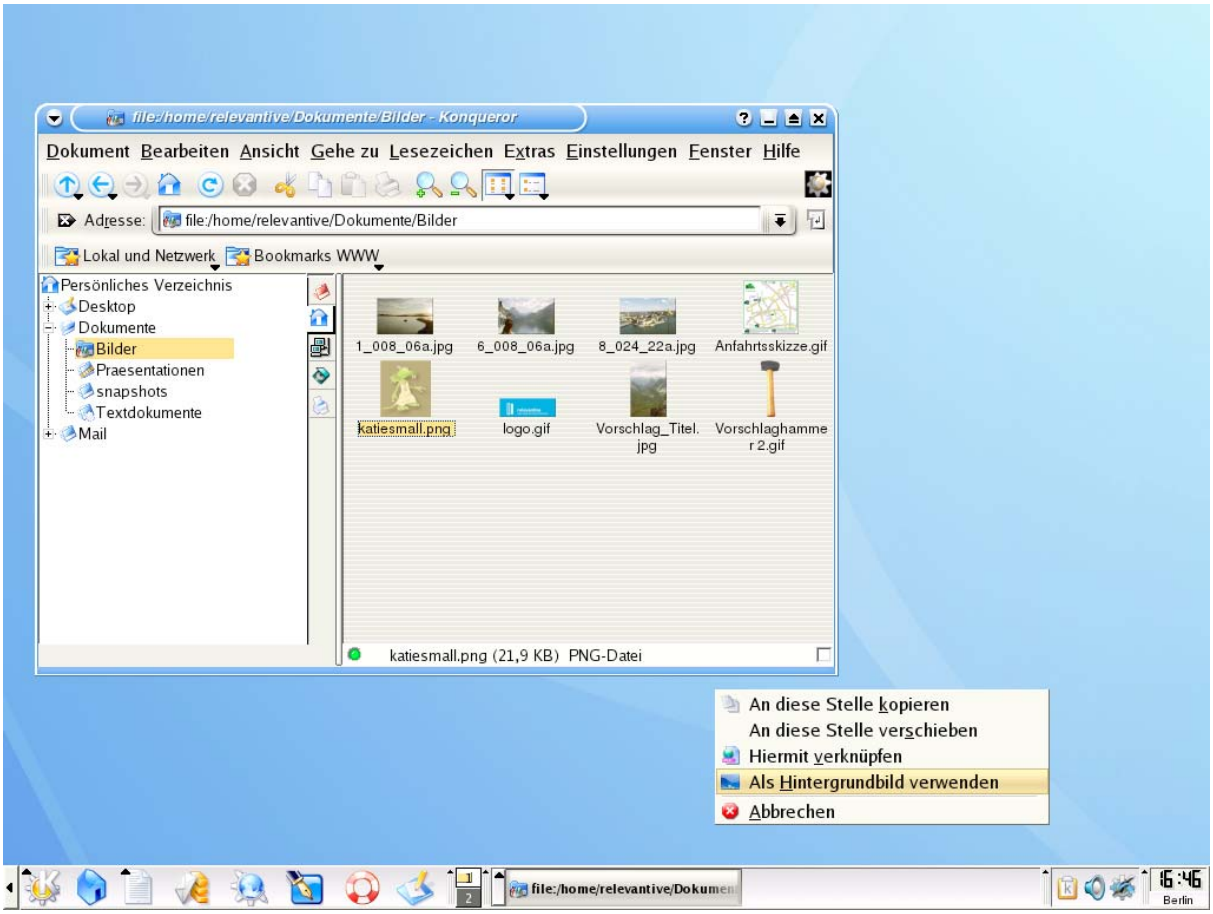
Having found the correct website, it proved very difficult to save only the image and not the HTML-page. In the menu, the „Edit“-section („Bearbeiten“) only offers „Save as ...“ („Speichern unter ...“), which saves the HTML page without images. If the participants then tried to set this file as the desktop background, they could not find it, since only image files are listed in the setting's dialog.

The only way to save the image in the Konqueror was by right-clicking on the image and choosing „Save image as ...“. But unfortunately this context menu showed another option which for many users seemed more fitting: „Copy to ...“ („Kopieren nach“). This resulted, again, in the saving of the HTLM file without images. Even more confused were those users who saved this file in the desktop folder, assuming that this would lead to the setting of the background image.



Konqueror: “Copy to” refers to the HTML file, not the image

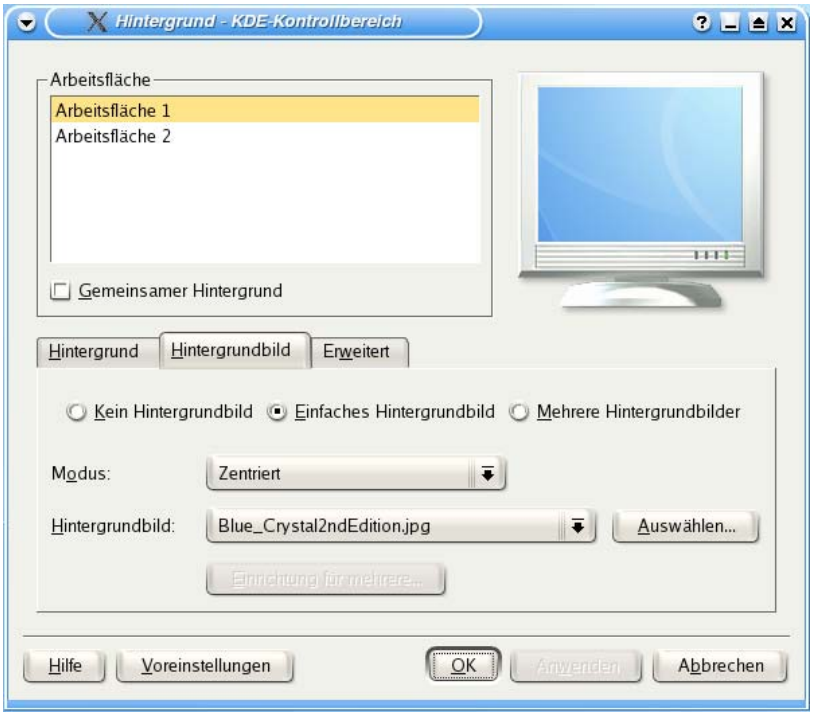
A further way to set the background image was not discovered by any of the test participants. If the image is saved locally, it can simply be dragged on(to) the desktop (from the Konqueror in file manager mode). A context menu appears showing the option „Use as background image" (see following screenshot).



Konqueror as file manager: Set image as wallpaper by drag&drop

If the image was saved locally, the following requisite steps were no problem, although some users tried „Settings" → „Desktop" in the KMenu, which did not lead to the desktop background options. The settings can be found in the "Look&Feel" menu.

Those participants who were not able to save the image often had problems with the interface in the settings dialogue. The reason was a layout problem, as the following screenshot shows.

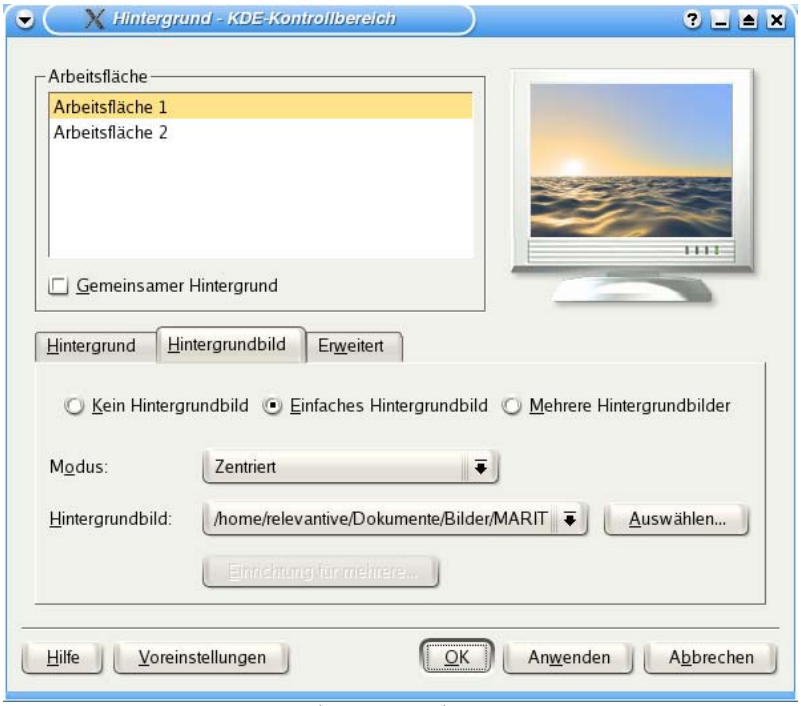


KControl: Wallpaper settings

Many participants thought that the button „Auswählen“ (actually “select”) would refer to the dropdown to its left which lists all wallpapers installed in a default directory. Instead, it offers a file dialog. The German word “auswählen” is probably an incorrect translation, since the English GUI uses the appropriate term “Browse”.

A few participants tried to enter the URL (Web address) of the page as the source for the wallpaper. At any rate, they were shown a descriptive error message saying that only local files are allowed at the moment. This lead to the correct conclusion that the image had to be saved locally in the first step.

There was a small final challenge (see screenshot): after selecting the correct image, the users may confirm this action by two buttons „OK“ and „Apply“ (anwenden). However, this was only slightly confusing.



Kcontrol: Hintergrundbild (wallpaper) – OK or apply?

On Windows XP this task was solved significantly faster and more easily – if the user right-clicked on the image in the browser (Internet Explorer 6). There, an option is shown „Set as wallpaper“. Those who did not use the context menu had similar problems as the Linux users did. Yet on Windows XP, it was possible to save the web page with the images and to use it as wallpaper.

5.7 User Types

In order to customize the Linux desktop to user groups, it is necessary to know about their competences and usage patterns. This can be found out by user typifications, based on usability / usage tests.

In what follows, three user types are described according to the results of the tests. The main criteria for the identification is to what extent the users have a general (abstract) understanding of the computer system.

Apart from this categorization, one has to be aware of usage strategies. Even users who can unambiguously be categorized into one of the user type groups will employ different usage strategies depending on the application or task they have to master. This applies to the usage of menus and icons (on the desktop and inside applications), drag & drop, usage of RMB/context menus and keyboard shortcuts (e.g. for copy&paste).

It is not possible to clearly assign particular strategies to only one definite user type, or to customize a configuration accordingly. That is why configurations have to conform to the „There is more than one way to do it" guideline: There is always more than one way to complete a task.

The categorization into user types, to some extent, follows the four types as outlined by JoAnn T. Hackos and Janice C. Redish in „User and Task Analysis for Interface Design"*. For our purpose, we use only three types that can be closely linked to the factors observed in the tests.

The three groups can be described in the following way:

1. Group: Inexperienced performers
Users with procedural knowledge that is strongly dependent on an accustomed environment.

- They cannot mentally differentiate between OS, desktop environment and application.
- Their skills were acquired in heterogeneous system environments with a limited freedom of use and a limited amount of applications.
- They mainly use program menus, and RMB / context menu only where it is already known from former situations.
- Alternative ways of usage, e.g. drag&drop or RMB / context menu are only applied in contexts where they have been used before (e.g. file manager), but not in other contexts (e.g. place a program icon by drag&drop).
- If a certain way is not successful, they try the same way again until they finally realize that it does not lead to the goal.
- They continue with a certain way even if it does not seem to be the right one. As a result, they get „messed up" and need a long time to get back to their initial situation.

* Hackos, JoAnn T. and Janice C. Redish (1998): User and Task Analysis for Interface Design. New York: Wiley & Sons.

- They are reluctant to try out new ways and cannot foresee the results of their actions.
- They are goal orientated and not interested in understand how they get there ("Now it is working").

2. Group: Experienced performers
People with quite a lot of experience with different computer systems and a tendency to „try out".
- They know some possibilities and limitations of different systems and will try out whether these can work "here" as well.
- Their knowledge and understanding is rather broad but incomplete. They use alternative ways but may not think of these in special contexts.
- They are interested in understanding how something works.
- They consider themselves to be the cause of an error, not the computer.
- They are rather impatient and quickly look for an alternative way if they feel that the original one is not going to work ("There must somehow be a way to do it").

3. Group: Professional performers
People with a strong ability to abstract
- They try to understand the general model of the system in order to draw from it in special cases.
- For each tasks, they have a set of ways that are evaluated in advance according to their potential efficiency.
- They plan their steps by their assumptions of the potential ways that the systems may offer.
- The can identify the "errors" or "inadequacies" of the system.

These three types (groups) deal differently with a "new" desktop system and, therefore, have different problems:

The first group ("Inexperienced performers"):
- Due to their fixation on program menus they often have problems with wording, especially in situations where the looked-for label is not in the expected position or not present at all. This was the case with the Linux / Konqueror system e.g. for the label „directory". The test participants were looking for „folder" and hesitated for a very long time or even asked the moderator, before they chose „directory".
- Foreign layouts had the effect that some options (buttons, menu) were not noticed. E.g. many users from this group were looking for a network directory within the directory tree, but not in the menu „Local and Network", which was placed above the directory tree.
- In order to place an application icon (Acrobat Reader) in the desktop bar at the bottom, they were looking for this option within the application itself (and did not succeed). This was the case for 21 of the 60 Linux test participants.
- They used e.g. drag&drop only in the file manager (Konqueror) but not in other contexts / applications.
- If they tried something out, they waited a long time before they took another step. As a result, this group was rather successful with the display of the network folder, since it took several seconds until the content was loaded and displayed..
- Because of their slow mouse movements, the tooltip appeared in most cases, so that there was additional information for those users.

- They left an application open and tried to perform all further tasks within this application. For instance, they created a new folder using the file dialog of the word processor.
- They started applications by either using the „KMenu“ (Linux) or „Start“ (Windows XP), or by using the desktop icons, but both in an alternating way. As a result, those who had so far used only desktop icons had problems with later tasks since for some applications no icons were placed on the desktop.
- They were confused by a high number of options and tried to find a familiar option from which they could start exploring the others.
- They were lost when they accidentally switched to the second virtual desktop on Linux as they did not understand how they got there.
- In Konqueror, they preferred to use the undo-/back-option than to navigate hierarchically in the directories.
- Error messages or system feedback made them feel rather uncertain which lead them to abort the action.

The second group („Experienced performers“):
- They tried drag&drop (or „ctrl-c ctrl-v“) in several situations. If they were successful in the first instance, they applied or tried it in the further tasks as well.
- If an action did not show an immediate result, they chose another way and only came back much later to the initial action. Hence, this group needed to have the network folder displayed for quite a long time as they clicked somewhere else before the folder content was updated and displayed.
- Due to their impatient navigation, they did not see some (sometimes important or helpful) options. Also, they could hardly see the tooltips since they moved the mouse too quickly before the tooltip had been displayed.
- They used icons, the „KMenu“ / „Start“ or the quick start panel inconsistently, depending on what they saw first.
- They left applications open and then sometimes had problems in identifying the application they were looking for in the task bar.
- If they came to the second virtual desktop on Linux, they were able to get back since they remembered how they had got there.

The third group (“Professional Performers”):
- They had problems especially when they did not expect a certain system behavior. This could be observed e.g. in Windows XP when they tried to write a file on a CD, since this function is integrated into the Windows Explorer, while those users expected a stand-alone application.
- They frequently used the RMB / context menu in order to see the available options. In the same way, they, firstly, tried to get an overview of the installed applications and the configuration options.
- They were quite focused in performing a task quickly and effectively and therefore complained that in Konqueror, when inserting a copied file by the context menu, they first had to choose between „move“ and „insert“.

In the chapter „Recommendations“, we discuss some consequences resulting from the described usage and mistake patterns.

5.8 Posttest Questionnaire

After the completion of the tasks, the test participants were asked to answer questions concerning their opinion of the test system.

The questions were:

- What did you like most?
- What did you not like at all?
- Was it fun to work with this computer system?
- Do you think that you could quickly get accustomed to this computer system?
- How long would it take you to feel as competent on the new system, as you are on your current one?
- Please rate the following aspects: Use, design, clarity, icons, wording.
- Was there a situation in which you would have called the support? When?

5.8.1 Likes

The question of what the test participants liked most on the tested computer system gave the following results. The answers were grouped by categories. Multiple answers were allowed.

Linux (60 test participants):

Statement:	Entries:
Design (appearance, layout)	19
Usability	12
Similarity to Windows	11
Applications	10
Clarity	8
Menus	7

Windows XP (20 test participants):

Statement:	Entries
Applications	8
Ease of use	6
Design	6

5.8.2 Dislikes

The question of what the test participants disliked most gave the following results. The answers were grouped by categories. Multiple answers were allowed.

Linux (60 test participants):

Statement:	Entries
Applications:	16
OpenOffice Writer	*6*
„Unknown applications“	*3*
File search	*3*
Labels	7
Settings	6
Directory structure	6

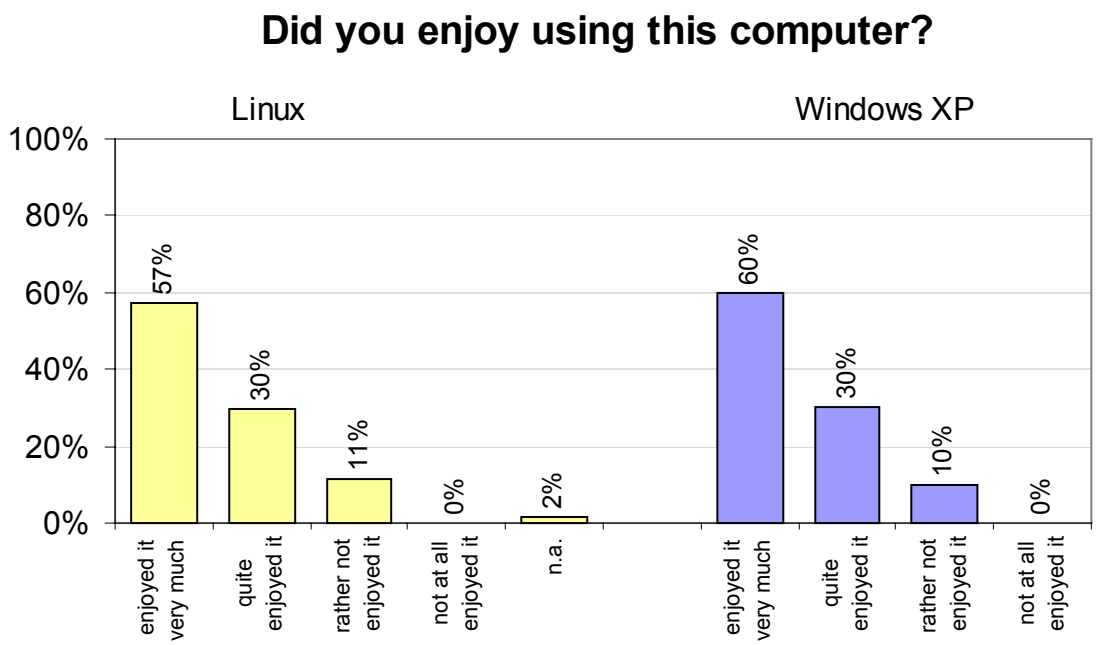
Windows XP (20 test participants):

Statement:	Entries
Applications:	21
Write CD	*6*
File search	*6*
Outlook	*5*
Settings	8
Symbols/Icons	3

5.8.3 Enjoyment

„Did you enjoy working on this computer?“

Although this question seems rather strange in this context, it has two important aspects:
Firstly, the answers give an idea of how the test participants felt during the test. It was therefore a control question aimed at finding out what sort of an influence the test situation had. Secondly, pleasure is an important component of User Experience. A positive user experience is a crucial factor for the success of a software system. A system that makes users curious and feel good is more likely to be worked with, enhances the willingness to learn and, hence, enhances the acceptance.



The chart shows a similar distribution of answers for the Linux and the Windows XP system.
Over all, 87% of the Linux test participants said they enjoyed working with the new computer system.

5.8.4 Time required for learning

„Do you think that you would quickly learn to work with the computer system that you have just tested?“

Linux (60 test participants):

Statement:	Entries	%
„Yes“	32	53%
„Possibly“ / „after a warm-up time“	15	25%
„Not very quickly“	5	8%
„With training“	4	7%
„Rather not“	3	5%
„No“	1	2%

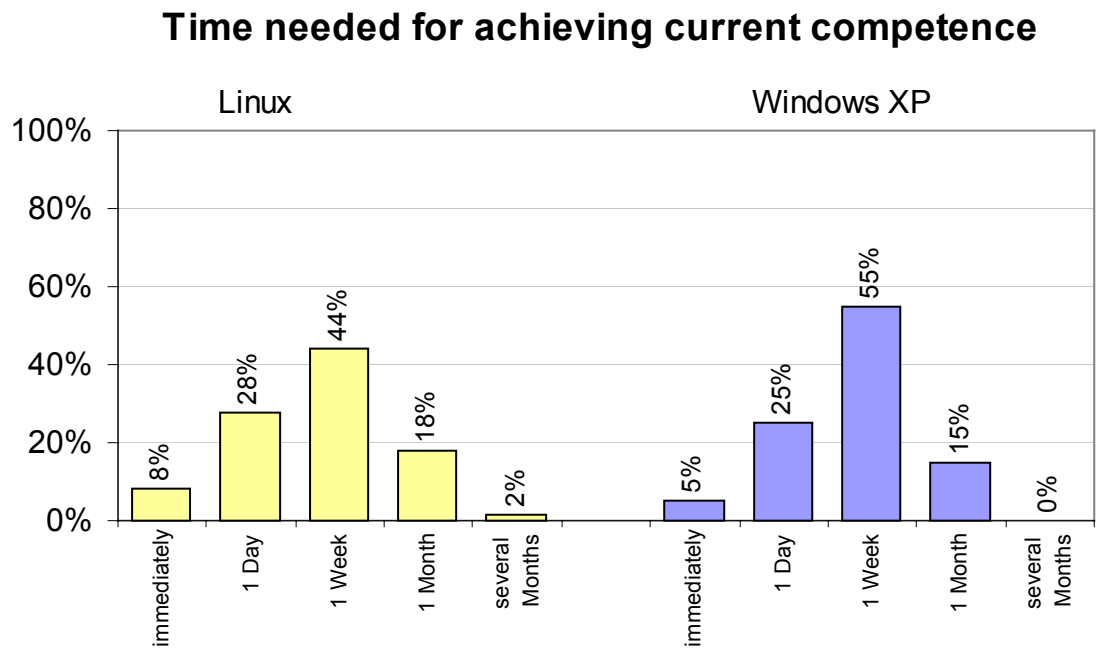
Windows XP (20 test participants):

Statement:	Entries	%
„Yes“	10	50%
„Possibly“ / „after a warm-up time““	6	30%
„Rather not“	1	5%
„No“	1	5%
N.A. / „Do not know“	2	10%

More than half of the Linux test participants assumed that they would quickly be able to work with the new system. Only four participants considered training necessary.

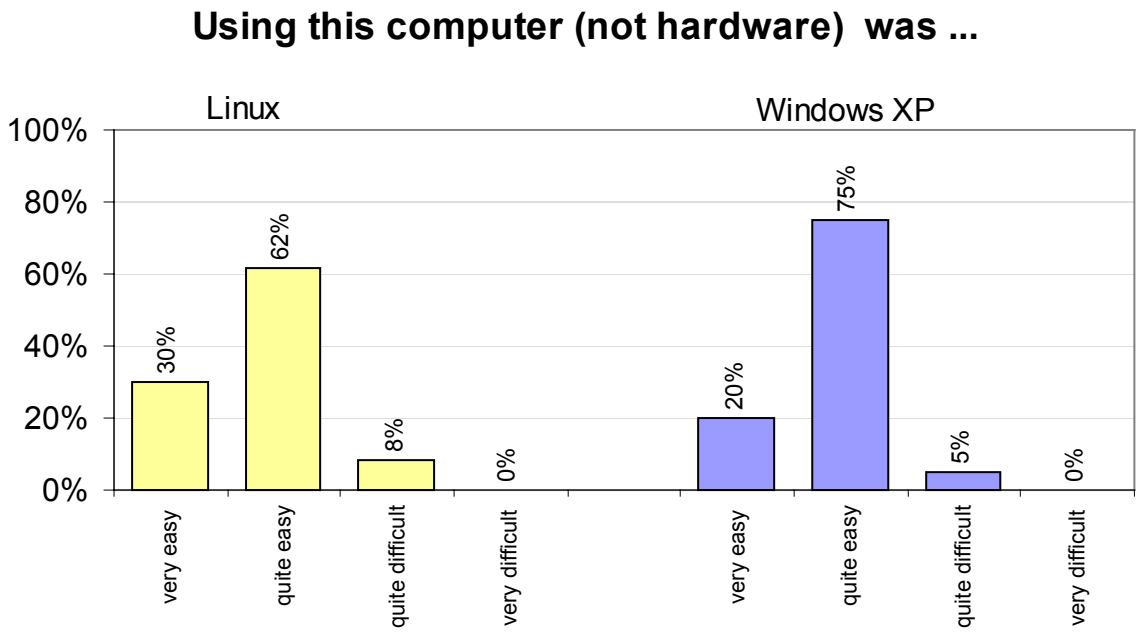
5.8.5 Time required for regaining competence

„How long would it take you to feel as competent as you are on your current computer system?“.



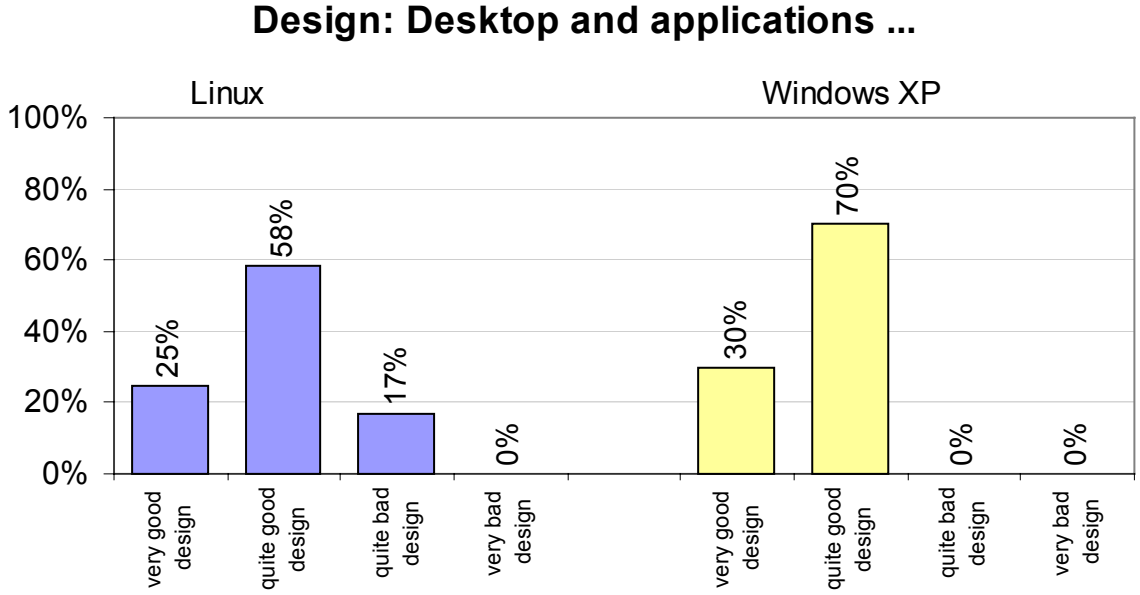
80% of the Linux test participants said they would need one week or less in order to feel as competent on the tested computer system as they do on their current system.

5.8.6 Ease of use



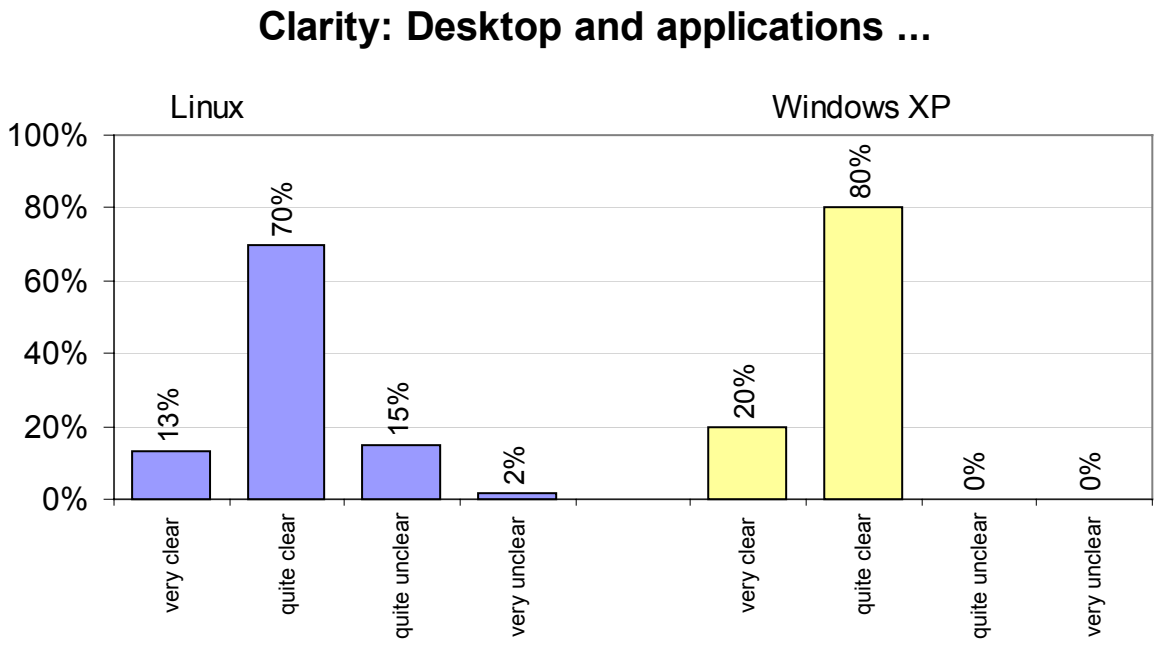
92% of the Linux test participants said that using the computer was easy.

5.8.7 Design



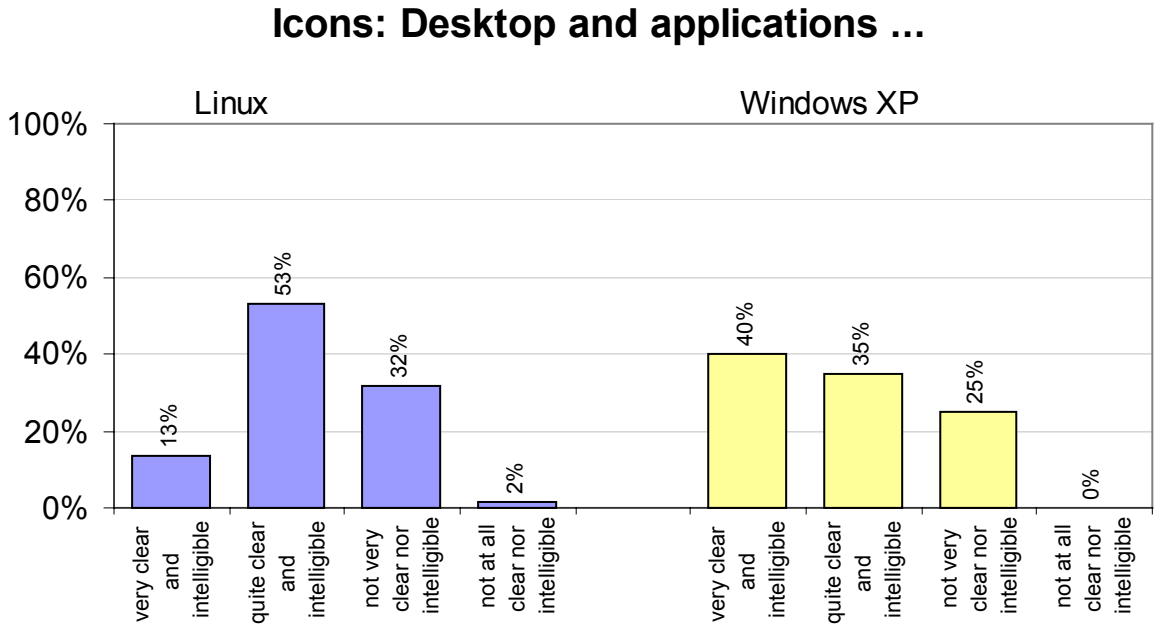
The design of the Linux desktop was rated as poorer than that of Windows XP: 17% think that the desktop and the applications are quite poor.

5.8.8 Clarity



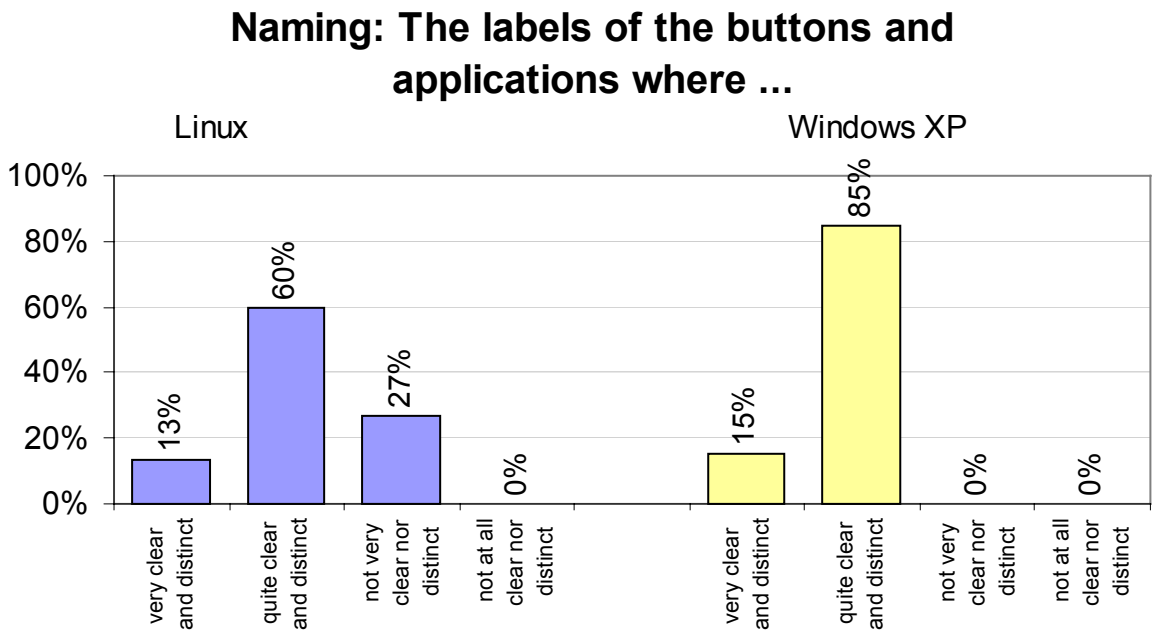
Similar to the previous question, the clarity of the Linux desktop and the applications were rated as less clear than Windows XP: 17% again said they find it „(very) unclear".

5.8.9 Icons



Regarding the intelligibility of the application icons there is no clear tendency: 34% of the Linux test participants found them „not very clear nor intelligible" or „not at all clear nor intelligible".

5.8.10 Naming



The results concerning the naming are similar: 27% of the Linux test participants rated the labels of buttons and applications as „less clear and distinct". All in all, both systems could not convince in this category: Only 13% of the Linux test participants and 15% of the Windows test participants found the labels „very clear and distinct".

5.8.11 Support

„If you had done these tasks on your computer at work, would there have been a situation where you had called the support? If yes, which situation?"

Linux (60 test participants):

Statement:	Entries
Yes	30
Write CD	*7*
File search	*4*
Icon placement	*4*
No	27
No answer	3

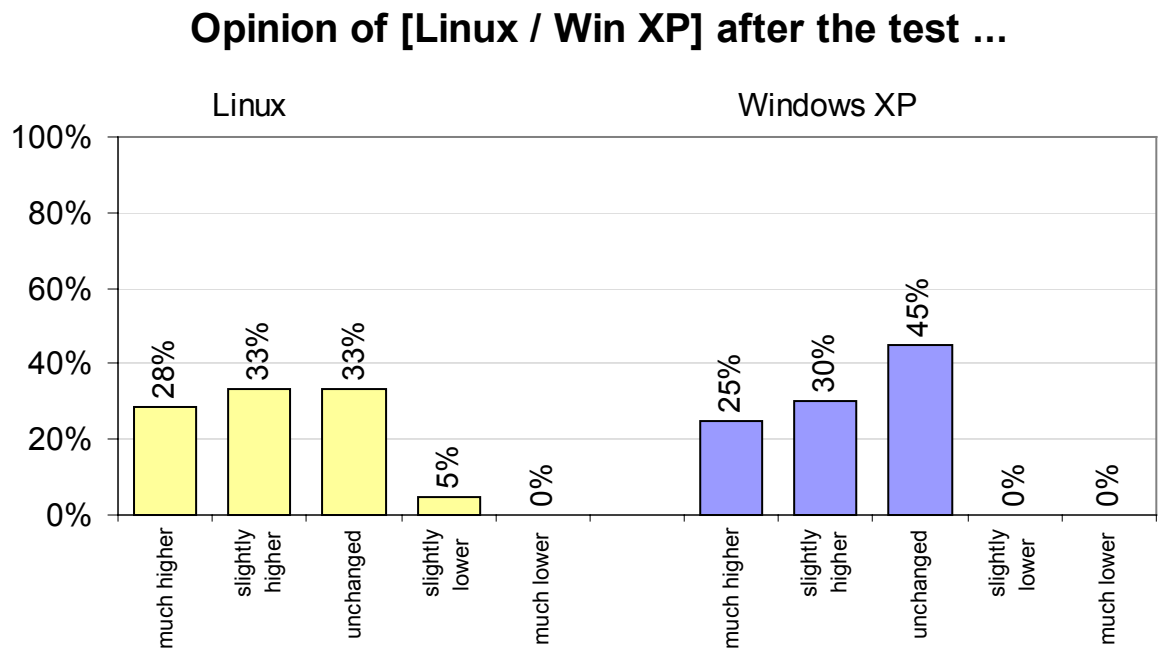
Windows XP (20 test participants):

Statement:	Entries
Yes	11
Outlook	*5*
Icon placement	*3*
No	7
No answer	2

On both systems, about half of the test participants would have needed help.

5.8.12 Change of opinion

„The computer system you just used was equipped with the operating system Linux / Windows XP. Did your opinion of Linux / Windows XP go up or go down through the test?



61% of the Linux test participants and 55% of the Windows XP test participants had a higher opinion of the tested system after the test.

6. Recommendations

We will now analyze and evaluate the study's results in terms of different target groups:

- Decision-makers (on the pros and cons of a migration) in public administration and business
- Human Resources and on-the-job training officials
- System administrators responsible for adapting and configuring the employees' desktops
- Developers, designers and translators of open source software, e.g. the KDE community

6.1 Decision-makers

The results showed that the Linux Desktop is not a user's nightmare. On the contrary, the test participants liked it and enjoyed using it.
Not only was the general look and feel accepted by the users but some Linux applications even turned out to be more usable than their Windows XP equivalents. Also, the general productivity did not decrease.

Additionally, there is the advantage of a flexible and highly configurable system, highly adaptable to the needs of an individual company and its employees. Linux offers advantages in many ways, not least on the desktop. This adaptation has to take into account the employees' experiences, skills, expectations and potentials. The return on this comparably low investment will be high because of higher acceptance of the new desktop system, a shorter settling-in period and lower training needs. In even just taking into account the employees' experience the course of the migration will provide positive feedback.

However, apart from these generally positive results, we have to be aware of the following facts:
The tested system was not „out of the box“ but pre-configured with usability guidelines in mind. This dealt with many of the problems that the users would have encountered using some default system. Based on the detailed results of our (and coming) usability tests, this configuration may be further optimized.

To summarize: It should be noted that a migration towards Linux, above all if it concerns the employees' desktops, is not only a technical or economic process, but essentially a matter of Human Resources. If this is taken into account, the effort of migrating to Linux will be comparable to migrating to any other operating system.

6.2 Training and Human Resources

Precisely because Linux offers the possibility of adapting the system to the employees' needs, the responsibility of desktop migrations can not be left solely to the IT department. The personnel department, the employees' representatives as well as the employees themselves have to be part of the migration process (User Centered Design). By analyzing different user types (within the staff), training may be conducted more precisely and effectively.

6.3 System administrators

The best results in terms of the employees' satisfaction and productivity will be achieved using desktop configurations tailor-made for these users' needs. Which means: No configuration equals another.

Of course, these adaptations can not be tailored to every single employee, but different companies or units will need different adaptations. These must be expertly carried out and, in the best case scenario, will take two or more steps: Configure one test system, let the users check it out and optimize it based on the usability tests results.

It must definitely be assumed that the administrators will use the system in a different way than the employees will, as a result of the formers higher technical competence. This is why they have to learn from the users, see how they approach the applications, instead of generalizing their own usage strategies.

Keeping the default settings on the system due to lack of time does not add to the migration's efficiency. Many adaptations are made quickly and easily but contribute significantly to the employees' contentment and their productivity.

We also recommend communication between administrators and developers. The Open Source community offers a diversity of channels from mailing lists to bug reporting. The software developers profit from the administrators' feedback and may be able to fix problems at short notice.

6.4 Developers

The KDE developers are committed to usability, as are the people behind the SuSE distribution.
The study's results support and advance this cause. Two topics are most important: The choice of default settings as well as extended configurability.

From the test results we can see that even the „out of the box“ product may be improved by changing default settings, e.g. the structure of KMenu, or hard coded properties of GUIs, for example the deficient user guidance of the CD writing application K3b.
If defaults are used within more complex applications they should be structured by profiles (e.g. K3b offers default settings for writing audio CDs or data CDs.

Extended configurability refers, on the one hand, to details (e.g. icon text, tooltip text, order of menu items) and, on the other hand, add-ons to KPersonalizer are recommended. This tool offers, at the first launch of the desktop, some basic settings concerning the desktop's look & feel. It uses rough categories like, for example, whether the desktop theme should be the KDE default or should resemble Microsoft Windows' settings.
Based on usability tests and user typing, a more sophisticated categorization could be offered.

To summarize: The users' perspective have to be further integrated into the software development process. The Open Source community has to offer solutions for a more

user centered design and a feedback mechanism comparable to the institutionalized form of bug reporting. Efforts are already being made in this direction, e.g. by the KDE Usability Project.
It is often useful for the developer to watch a normal person, without technical knowledge, use his/her application. Even this smallest model of usability testing raises sensitivity towards user-friendly software development. Linux on desktop is already a competitive operating system, which may be advanced by taking usability to be one of the central paradigms of development.

In addition, the compilation of a usability style guide, complementary to existing designing style guides, would prove beneficial (as would requesting that the contributors refer to these guidelines). In many cases, these guidelines could lower the workload of the developers in that they can concentrate on the business logic of the application while referring to the style guide for GUI structuring. This could, for example, help in implementing consistent wording.
The KDE project has already compiled basic guidelines in Human Interface Guides (KDE User Interface Guidelines).

The same purpose is served by using design patterns (e.g. for file dialogs). This contributes to a unification of the GUIs and, thus, to the ease of learning as well as the general usability.
The following topics could be used as usability guidelines for developers:

- offering more than one way to achieve the same ends
- thoughtful and consistent wording
- logical information hierarchies and categorization
- usage of RMB/context menus
- usage of (significant) tooltips
- wizards for complex task sequences

Also, there must be exhaustive documentation in the form of clearly structured, task-oriented help texts. Not every problem or exception can be caught beforehand. Well formulated, comprehensible manuals which are easy to navigate would offer essential support.

Last but not least, the translators must be addressed and their role in the software development process. The previously stated naming problems are their responsibility (insofar as the developer has not labeled the German GUI him/herself). Usability test could help them to recognize naming and wording problems as well as to decide on terms which prove intuitive to the users.

7. Perspectives

It goes without saying that this test could only deal with a small sample of aspects concerning the usability of Linux on Desktop. Further questions regarding, for example, the users' performance after a time of adjustment to the new system, in-depth testing of the named application or testing of further applications, tasks or scenarios may be posed.

Essentially, this study should provide some influence towards sensitization regarding usability and its potential. We hope that this study's results will be recognized as well as amended and expanded in many ways.

8. License

9. About the authors

As technical project manager, **Jutta Horstmann** lead the configuration of the testing environment for Linux and was responsible for many parts of the test design.
After gaining a Masters in Political Sciences, she is now heading for a Masters degree in Computer Science at the TU Berlin. Horstmann also works as system administrator for the Library Center of the Social Science Research Center Berlin (WZB).
Jutta Horstmann was born in 1976 in Karlsruhe/Germany.

Jan Muehlig is CEO and Co-Founder of the **relevantive AG**. He is responsible for the test design and the project planning.
His focus is on usability projects and research on the integration of usability into development processes.
He studied at Regensburg, Mainz, Chicago and Lausanne and gained a Masters in Sociology.
Jan Muehlig was born in 1971 in Reutlingen/Germany.

Eva Brucherseifer and **Ralf Ackermann** from **basysKom** provided important expertise on the design and configuration of the Linux desktop. Their profound knowledge of Linux und KDE enabled us to create a desktop environment that is tailor-made and especially appropriate for the specific demands of larger companies and public administrations.

Translation of this report

The Linux Usability Test Report was translated by the following persons (in alphabetical order):
Clare Bielby, Eva Brucherseifer, Rosa Lou Freund, Jutta Horstmann, Jan Mühlig, Jörg Tegeder.

10. Contact

relevantive AG
Zehdenicker Str. 21
D – 10119 Berlin
Germany
www.relevantive.de
Tel: +40-30-23455-630

General Contact (and Press):
Jan Muehlig
Mail: jm@relevantive.de

Technical Contact:
Jutta Horstmann
Mail: jh@relevantive.de

basysKom GbR
Am Pelz 94
D – 64295 Darmstadt
Germany
www.basyskom.de
Tel: +49 170 5533642

Eva Brucherseifer
Mail: brucherseifer@basyskom.de

Ralf Ackermann
Mail: ackermann@basyskom.de