

InfoPediA-NEXT

Software design
from a user-centred
perspective

Bachelor thesis
by
Marten Jacobs



InfoPediA_{NEXT}

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Table of contents

1) Abstract.....	5
2) Introduction	6
3) Project goal	6
4) Strategy	6
5) Analysis.....	9
User analysis	9
Platform choice	9
6) Idea generation phase	10
7) Designing a new interface	13
User interface design	13
Comparison of concepts and concept choice	14
Technical recommendations	14
8) Designed product	15
Changes to concept	15
Design philosophy.....	15
Home screen.....	16
Sub menus	17
Bookmarks.....	17
Data packets.....	18
Technical properties	18
Updating module.....	19
9) Prototype development	19
10) Evaluation	20
Results.....	20
11) Answering the main research questions.....	24
12) Conclusions	25
13) Recommendations for further research.....	25
Global search function	25
Integration with Teamcenter	26
User editable files	26
‘Last updated’-list or -indication.....	26
A better solution for menus with a single item	26
Testing with additional users.....	26
14) Reflection	26
What went well?.....	26
What could have been improved?.....	27
What makes a good design process?.....	27
15) Glossary	28
16) Bibliography.....	29
17) Appendices.....	31

1) Abstract

InfoPediA is a software application designed and build by PANalytical BV, one of the leading suppliers of X-ray diffractometers and X-ray fluorescence spectrometers in the world. InfoPediA is used by its customer support staff and its sales staff to access all the information they need to do their jobs. The software is, however, becoming outdated and it was decided to do a complete redesign of the application. One of the reasons for this was the user request to be able to use InfoPediA on more platforms than currently supported. This thesis discusses the design process that followed, carried out by a student majoring in Industrial Design. The student interviewed users to get an insight in their work. Based on the information they provided, a user survey was carried out to which almost half of all the software's users responded. From about 400 users, 165 target audience members responded. It was then concluded that a task-oriented interface design was most beneficial to InfoPediA users, as compared to the current document-based interface and other possible solutions. It was also concluded to focus the project mainly on the Apple iPad, which was one of the two platforms that would be specifically supported (the other being Microsoft Windows on a laptop computer). Another important aspect to PANalytical was the way in which the application would update the contained data. A number of technical requirements were obtained in response to improve on the current updating module. Also, the software's styling was important, as it would have to fit in with their existing corporate style. Three concepts were developed, all with different ways of implementing these requirements. One of these was then chosen based on user's preferences and experts, this was supported by a comparison against the product requirements. It was then detailed into a complete software design and rules and regulations were written to make sure the software under design would stay manageable and the design philosophy would be followed when developing, maintaining and updating the software. Substantiation was also written to support these design choices, philosophies and rules as a document for future developers of the final software. The design was then made into a prototype which was used for evaluation purposes. This confirmed that the design met the requirements.

2) Introduction

In this document, an overview will be provided to the design project of a new version of the InfoPediA software. This project was executed in the period between April 23rd and August 14th of 2012 by Marten Jacobs, undergraduate student of Industrial Design at the University of Twente. The project was commissioned by PANalytical BV, a leading supplier of X-ray diffractometers, X-ray fluorescence spectrometers and related products.

Employees of PANalytical have always had the need to access information about different products to support their jobs. Especially sales and customer support users need to access information located in many different files. To make their jobs easier, a software application was developed to make accessing these files easier. This application was developed out of need and from a technological point of view. Its function was simply to add a simple user interface in which users could locate the files they need quickly (see Figure 1). As the user group grew, the need for user-centred functionality grew accordingly. Many feature requests were included in subsequent versions and an updating mechanism was built on top of an infrastructure that was already in place. After a while, however, new problems started to arise and users started to ask for a version of InfoPediA they could use on their tablets. PANalytical then decided that it was time for a complete redesign of the InfoPediA software. When asked by the student if PANalytical had a project fit for a bachelor thesis, this project was proposed. After a meeting with the parties involved, the student defined the assignment in a short document that was presented to both PANalytical and the University of Twente for approval. This document can be found in Appendix A.

The new version of the software (dubbed InfoPediA-*NEXT*) would be built from the ground up as a user-centred application. This document describes the process that was carried out to develop a new design for the software. Most results that were produced throughout the process are included as appendices, these appendices are referenced where relevant. Bibliographies are included separately per appendix. Some words used in this text may require further elaboration and have been added to a glossary (on page 28). These words are printed in *italics* the first time they're used.

3) Project goal

The student is to research which advantages changing the *platform* on which InfoPediA runs might have to the user of InfoPediA from both a business and a human factors standpoint. This research will be limited to the current platform (Microsoft Windows on a laptop computer), the Apple iPad and a BlackBerry smartphone. When a platform is chosen, a new design of the interface of InfoPediA will be made to better incorporate *human factors*, to which end Wickens, Lee, Liu, & Becker, 2004, among others, will be used extensively. From this research and the next design steps, it can also be concluded if the current structure with three distinct versions should be maintained, or that the design should be able to cater to all user groups. The newly designed interface will then be incorporated into an interface prototype, which is not required to be functional but will show the newly designed interface into reasonable detail. An evaluation of the interface will then be performed using the prototype. An underlying information structure will not be designed as a part of the project. However, some underlying changes may be needed to support the newly designed interface, these will be presented as recommendations. The software used for maintaining InfoPediA will be left out of the project. (After Appendix B)

4) Strategy

Before the start of the project, a strategy had to be determined. The full project strategy can be read in Appendix B. It will be addressed here in short.

For practical reasons, PANalytical wants to investigate advantages of enabling InfoPediA to run on other (or multiple) platforms. A selection of platforms was made, consisting of Microsoft Windows on a laptop computer (the current platform of choice), iOS on an Apple iPad (a tablet platform they are already aiming to support in the near future) and BlackBerry OS on a BlackBerry smartphone (the only smartphone platform currently supported by PANalytical).

The first step in analyzing the target user group would be a survey in which usage situations, contentment, importance of different features would be explored. After this, technical properties will be explored by talking to PANalytical's specialists in this field. Other properties of the chosen platforms and PANalytical's corporate identity guidelines would be investigated next. Requirements could then be distilled from the information gathered. After this, an interface could be designed to cater to these requirements.

A prototype would be built based on this design. It would be researched which requirements will be most valuable to test and which technical possibilities were available for prototyping.

The project would be concluded with a validation of the design.

From this strategy, a research model and a project planning were created.

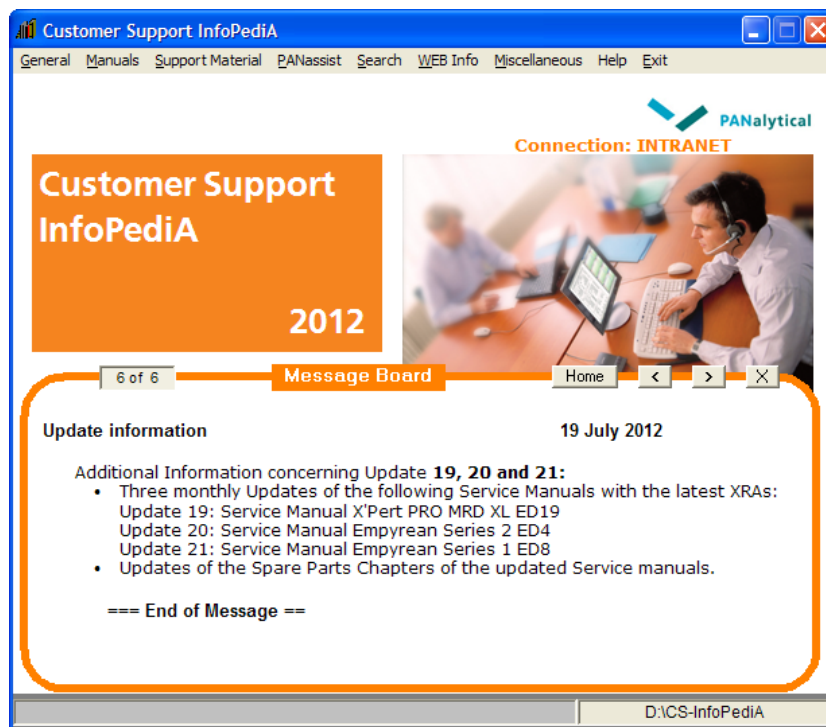


Figure 1: The current version of InfoPediA



Figure 2: Map with respondents' location (map: © 2012 Google, MapLink, Tele Atlas)

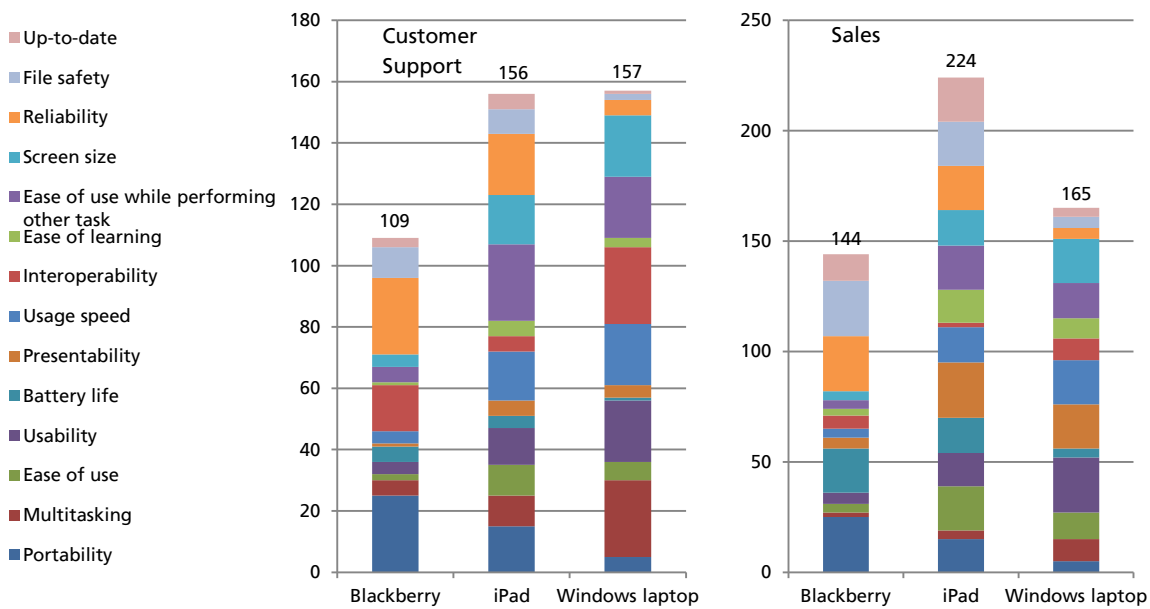


Figure 3: Comparison of platforms for both Customer support users (left) and Sales users (right)

5) Analysis

The analysis step of the project consisted of three major parts; first, the users were analyzed, then the possible platforms were researched, and lastly PANalytical's corporate requirements were investigated.

User analysis

To thoroughly analyze the target audience, first a number of interviews was carried out with specific users, during which questions about their usage of InfoPediA were asked, to find out information which could then be cross-referenced with the entire user group of InfoPediA. Findings of these interviews are available in Appendix C. Results from these interviews were the basis for the survey, which was conducted next.

In the user survey, all current users were asked about their opinions on many subjects concerning themselves and their use of InfoPediA. The complete survey is available in Appendix D. The survey was spread electronically to all users of InfoPediA (about 400 users). 213 responses were registered, of which 191 responses were completely filled in. After analyzing their job descriptions, 165 target group members remained. Their responses to the survey were analyzed. An analysis of their responses, compiled into a facts document, is available in Appendix E. The raw response data is available on the Content Disk. E-mail addresses have been redacted to protect the anonymity of respondents. To make sure the survey results include a reasonable cross section of users, a map was plotted showing the office location of respondents (see Figure 2). This map showed that responses were truly worldwide.

In addition to the survey, other aspects relevant to the product under design were investigated. Platform properties and technical possibilities were investigated.

Platform choice

The survey results and these investigated aspects were then used to make a list of requirements for the product under design. These requirements are available in Appendix F. The target platforms were then compared with a weighted scoring system which compared the stronger points of all three platforms against the importance these points had for different users. It was concluded that the BlackBerry platform was less suitable for InfoPediA than iPad and Windows (see Figure 3) as it scored significantly less on most points, most notably screen size, ease of use while performing other tasks, usability and multitasking. iPad and Windows scored similarly, but had different strong points. It was concluded that future versions of InfoPediA should run on both iPad and Windows. The full comparison is available in Appendix G. This scoring system was developed for this project, but was designed with more general applications in mind, so it could be used in other projects.

PANalytical's corporate requirements

Analysis of technical possibilities

Technical possibilities research focused mainly on the *data packet* updating mechanism, as this is a very often-used part of the application because around 2 to 3 data packets are updated daily. Other aspects, such as application updates, are outside of the scope of this project as they depend strongly on the platform. The updating mechanism performs updates on data packets (when new revisions become available) and the menu structure. PANalytical has some existing infrastructure in place for distributing InfoPediA updates. Currently, files are hosted in three distinct ways: the main source for all internal users is the *intranet*, on which a webpage exists from which all files that are to be updated are linked to. This page is read by the updating module. Next to this, there are a number of *network allocated storage devices* (NASs) placed worldwide to which local users can connect through their office network, these contain the same files as the intranet page, but are accessed directly. These NASs are placed in strategic locations worldwide to improve download speed for users in offices where connections to the intranet are not fast enough. Lastly, there is an *extranet* page, available to registered sales agents, where updates are available for them, this is comparable to the intranet page, but contains less sensitive information. This is a rather

complicated system, so perhaps some advantages can be found in simplifying it, for example in software simplicity or administrative burden. Also, the way users connect to the PANalytical network when they're not in their offices (through *VPN*) can be improved, as currently all users worldwide connect through a central point located in Amsterdam, the Netherlands. This creates two problems: because the connection is shared with many users, downloading updates takes a long time and because every connection has to go through the Netherlands, which means the signal has to travel for some time, users located far from the Netherlands have to wait a long time before they can access the current version of InfoPediA (as it checks for updates when starting). Based on this analysis, a number of recommendations were made to solve these issues. These are elaborated in the "Technical recommendations" section on page 14.

Corporate identity

Another aspect that had to be analyzed was PANalytical's corporate identity, which sets some fairly strict rules to graphic design. There is also a manual available for internal use with guidelines specific to software design. After a meeting with one of the responsible parties, however, it became clear that a major revision of the software design manual was at hand. Furthermore, this manual was compiled to support design of very specific software applications for Microsoft Windows. It was therefore decided that it was better to focus on the graphic design manuals. To properly apply these manuals to software design it had to be thoroughly analyzed, as in this case these manuals were used beyond their scope. A thorough understanding of the ideas on which PANalytical's corporate identity was based had to be obtained in order to properly design interface elements and structures to fit.

6) Idea generation phase

After analysis had been done, interface ideas were to be generated. After consultation with PANalytical, it was decided that the new interface design will focus mainly on the iPad platform. To support the user in their jobs, their tasks were investigated. The goal was to help the user perform their tasks as quickly as possible. To accomplish this, a task-based interface design philosophy was developed. An important part of this philosophy is the dialog style which is to be implemented. Three main principles of dialog styles for user-centred design (Wickens et al., 2004) were investigated, specifically search-based, filter-based and menu-based. An important part of idea generation is the sketching of ideas, which can be used to visualize an idea very quickly. A selection of the sketches that were made for the idea generation phase can be found in Appendix H.

Search-based

This type of application (see Figure 4) lets the user search for a file by entering a number of keywords. The application presents them with a list of data packets that contain these keywords, from which the user can select one. This type of application is primarily advantageous with a very large number of files that can be indexed easily and where a single item contains very specific keywords. As InfoPediA contains much data about similar subjects and it cannot be indexed easily, this would not work very well for this project. Furthermore, as the main input device for this approach tends to be a keyboard, this is less suitable for iPad, as the screen keyboard available on it does not work very fast.

Filter-based

A way to get around the keyboard limitation is a filter-based application (see Figure 5), which is often combined with a search function but requires much less typed user input, lets users select a combination of attributes which they know the data packet they're looking for has. The application then returns a list of data packets that do. This is a very powerful way of selection in a large information database where a number of attributes with a limited number of values are combined in many ways. As InfoPediA uses a very large number of values for attributes, this type of interface was not feasible.

Menu-based

Another approach to designing user interfaces is menu-based design. A menu-based application specifically supports the tasks a user might want perform by presenting them with only the menu options they might need to fulfil their task. This does not mean that the user should always first select which task they're performing (although this is possible) but rather that it should be focused on minimizing the number of steps (and thus time) necessary to access what they need. For this approach to work properly, the number of tasks a user might have to perform should be limited. Also, an overlap in the information a user already knows when starting a task is advantageous. Both these points apply to InfoPediA, so this was chosen as a basis for the design of a new version of InfoPediA. A description of task-oriented interface design and how it can be accomplished for InfoPediA is available in Appendix I.

Specific needs for InfoPediA

The menu-based dialogs should be designed with a number of other user properties in mind. Tasks that InfoPediA is used for are distinct to the two main user groups: customer support and sales. The main difference between these groups is that customer support users always know which type of product they are dealing with. Sales users do not, as the products or services the customer may buy are yet to be selected. A customer support user should therefore always be asked to select the relevant product first. Sales users need more ways to approach information; they should be able to approach by product, but also by market segment. Also, they should be able to give information about other services that PANalytical provides, not directly related to their products. Relevant data packets should be accessible through all menus to which they are relevant. It is not required that all tasks are explicitly defined in the application menu, as this may be of no advantage to the user. For example: if a user may have to perform a number of distinct tasks, but they require almost exclusively the same files, there is no advantage in asking the user which task he is performing, as the information is of no use to later menus and it will only take time.

After this phase, multiple concepts were created. This is discussed in the next chapter.

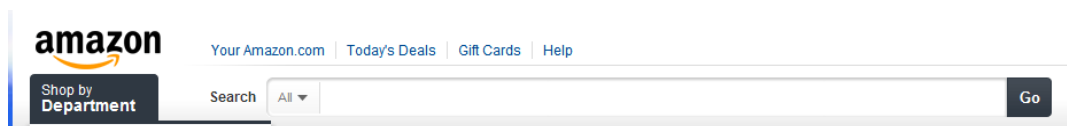


Figure 4: A Search-based application (from amazon.com)

Search player: (leave empty to search for all) or/and with these features:

High Definition: ☐ Blu-ray Disc(BD)

Video formats: ☐ DivX/XviD ☐ MP4 ☐ MKV ☐ JPG

Audio formats: ☐ MP3 ☐ WMA

Media formats: (Based on user reports) ☐ CDR ☐ DVD-R ☐ DVD+R ☐ BD-R
☐ CDRW ☐ DVD-RW ☐ DVD+RW ☐ BD-RE
☐ DVD-RAM ☐ DVD-R DL ☐ DVD+R DL ☐ BD-R DL

More Features: ☐ N/A ☐ Portable ☐ Memory Card Reader ☐ VCD
☐ N/A ☐ Changer ☐ Progressive scanning ☐ SVCD
☐ N/A ☐ TV ☐ DigitalTV/DVBS/C/T ☐ DVD-JPG
☐ VCR ☐ WMV9/WMV9HD ☐ MPEGISO
☐ Car Player ☐ DivXHD/XviDHD ☐ DVD-MPEGISO
☐ Recorder ☐ AVC/H.264 ☐ DVD-MP3
☐ Home Cinema System ☐ MPEG2HD/TS ☐ DVD-WMA
☐ Ethernet connection ☐ SACD ☐ MP3 long filename
☐ DVI Output ☐ DVD Audio ☐ MP3 ID3 Tag
☐ HDMI Output ☐ USB
☐ 1080i/720p UpScaling ☐ Radio tuner
☐ 1080p UpScaling ☐ Multisystem PAL/NTSC

MPEG4 Chipset: All

Order by: Name Hits per page: 50

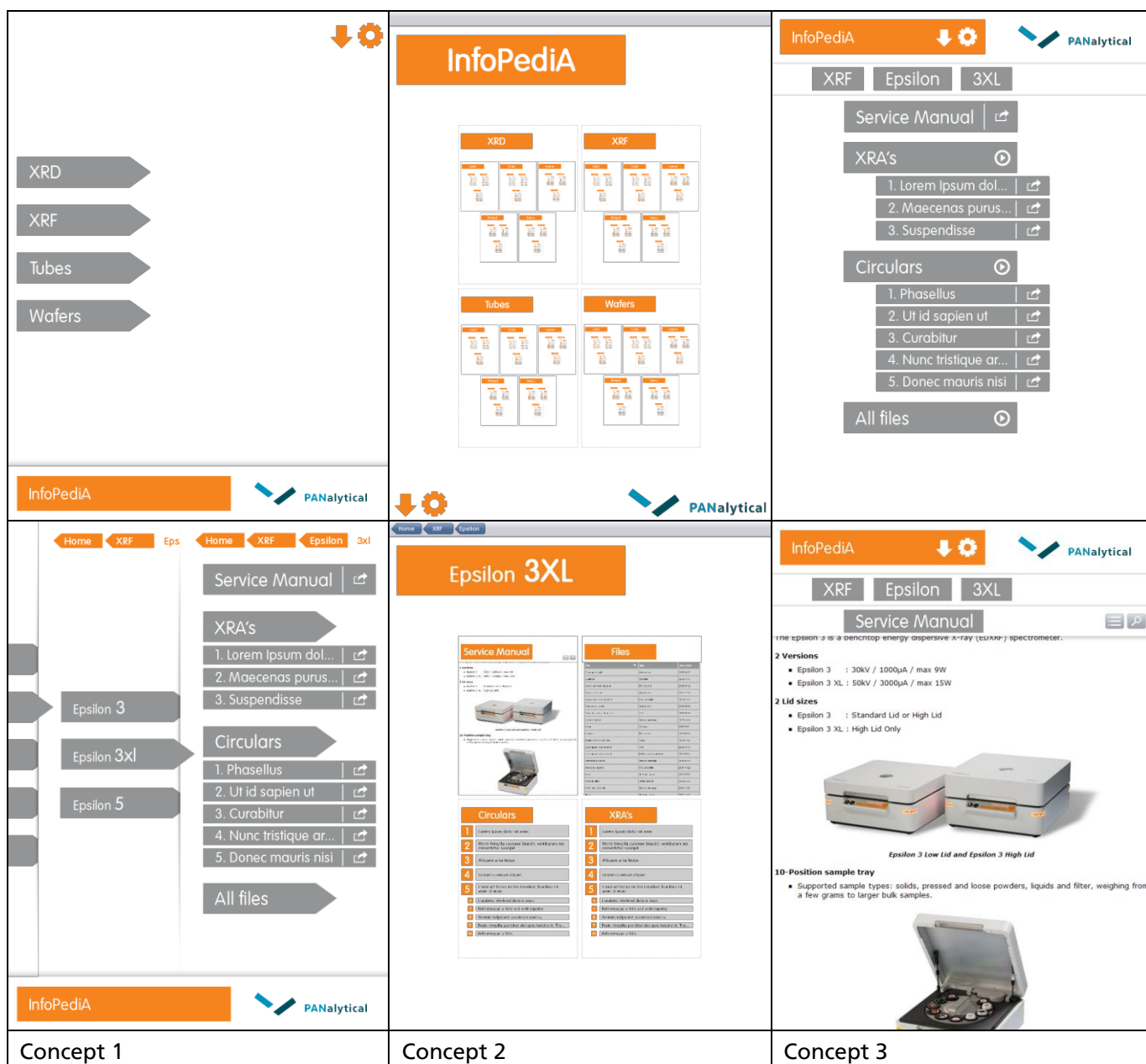
Figure 5: A Filter-based application (from videohelp.com)

7) Designing a new interface

When designing the new version of the software, focus was put towards the user interface. However, the back-end structure was not completely left out. In this chapter, both will be addressed.

User interface design

The new application design to incorporate a task-oriented user interface was performed based on the product requirements resulting from the analysis phase. A large number of ideas was first drawn by hand. From these ideas, three concepts were distilled that were subsequently compared. The concepts were interactive to a certain and equal degree, as to prevent bias towards a certain concept. The concepts are available on the Content Disk. They will be addressed here in short.



Concept 1

This concept consists of a series of screens (or panels) that slide in from the right. This means the user is constantly moving in a horizontal fashion. More to the right means deeper in the menu structure. The panels are static, this means *breadcrumbs* are built up and are shown next to each other on different panels. By sweeping from left to right, the user can quickly go back through open menu's. By tapping a breadcrumb the user is immediately moved back to the relevant menu and all sub menus are closed.

Concept 2

In this concept, a user is "zooming" through the menu structure. Each button consists of a miniature of its sub menu. The user can move through this structure by *pinching* or by tapping menus and breadcrumbs. A useful feature of this concept would be a faster way of navigation for power users. These users may already know which button they want in the sub menu and may thus double-tap this item immediately from the top menu.

Concept 3

When using this concept, a single menu contains a sort of tree view, in which one item can be expanded (all others are always collapsed). When a goal is reached (this means a link to a sub menu is tapped), the buttons fold together and slide to the top of the screen to form breadcrumbs. This concept will be very recognizable to users of the current version of InfoPediA, which also uses tree views extensively.

Comparison of concepts and concept choice

The concepts were compared to select the best one for further development. This was done using the product requirements. The current version of InfoPediA was taken as a control and the concepts were compared on how difficult it would be to conform to each requirement for the relevant concept. This way, a simple comparison could be made and the best concept could be selected. This comparison favoured concept 1 (18 points), followed closely by concept 3 (14 points). Concept 2 scored 7 points. The main differences in scores between the concepts were found in how organized and presentable they look, how compatible they are with PANalytical's corporate style and how much they need a user's concentration. The full comparison can be found in Appendix J.

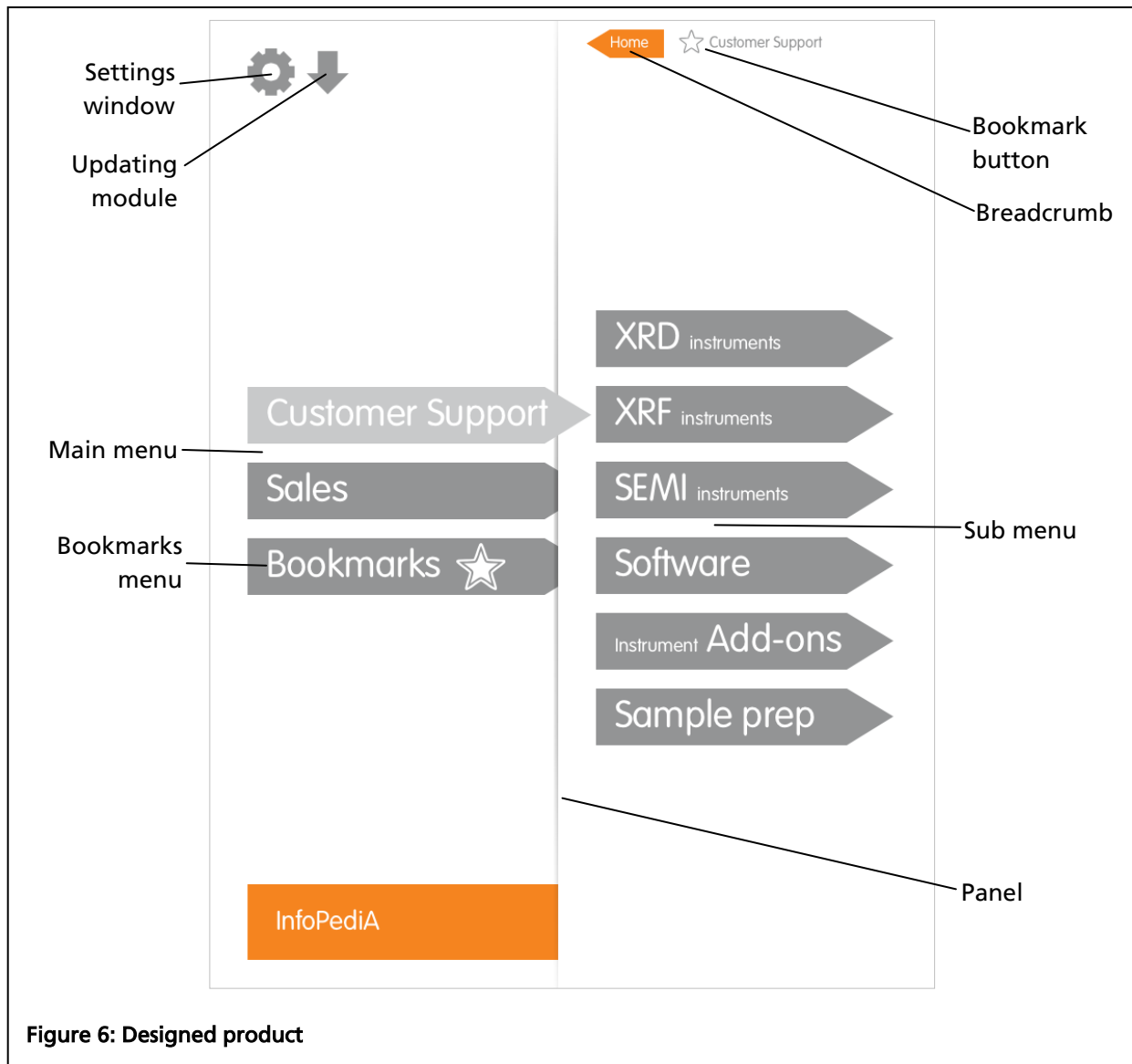
A number of users were also asked to state their preference. Their answers confirmed the results of empirical comparison, they preferred concept 1 mostly because of its clarity, simplicity and ease of use.

An interview with an expert on PANalytical's corporate style as applied to software was also performed, which yielded a preference to either concept 1 or 3. He thought concept 2 to look cluttered and not very professional.

Concept 1 was therefore chosen as the basis for the rest of the design process and the development of a prototype.

Technical recommendations



Next to designing a new user interface for InfoPediA, a number of key technical aspects were re-evaluated. The current updating mechanism of InfoPediA is based on multiple techniques, like web pages and windows sharing. Updates have to be added to the system manually. This is currently done weekly. A number of technical recommendations for the back-end structure and the updating client were made and bundled together. These recommendations are meant to improve speed, availability, simplicity, security, reliability and ease of use of the updating module. Users connecting remotely to the PANalytical network will be especially helped by these changes. They can be found in Appendix K.



8) Designed product

The newly designed product was, as stated above, based on concept 1. It was immediately implemented into the prototype. The following images are screen captures from this prototype. In this section, some of the design choices will be substantiated.

Changes to concept

The product design is mostly faithful to concept 1. There are, however, a small number of changes. The locations of the settings and updates buttons are changed from the right side of the screen to the left. This was done to improve their accessibility, especially when multiple panels are on the screen. Their colour was also changed to grey. This was an aesthetic choice. The information sub menu button icons were changed from  to , to better reflect their functionality. Functionality and interface elements for bookmarks were also added. The footer, containing the "InfoPediA" title box and the PANalytical logo was changed from a floating box visible at all times to a static box on the main panel. This way, this screen space is not wasted in deeper menus.

Design philosophy

The newly designed InfoPediA software has a certain design philosophy that makes sure its interface is consistent and clear to its users. This design gives the user a clear feeling of "progress" by moving right-to-

left. This direction is fairly universally seen as going forward, as a follow-up to survey respondents (see chapter ‘Analysis’) from both left-to-right writing origin as well as right-to-left writing origin confirmed. Arrow-ended buttons are used to indicate progress to a submenu. Goals (usually data packets) are always indicated with a square-ended button. An information sub menu is indicated with this icon: ⓘ, this is an icon most people will recognize as a symbol for information. To provide quick access to often-used files or files selected in advance, a user can add bookmarks. Items that can added to the bookmarks menu are marked with this icon: ☆. If an item is added to the bookmarks menu, this icon changes to ★. To enhance clarity, the bookmarks menu is also marked with the same icon. Stars are often used in software to show importance or special status. Movement in the right-to-left and opposite directions are the central focus of the design, so vertical scrolling should be avoided. An exception can be made for tables containing many items. These tables should always contain a filter box as well as sorting abilities.

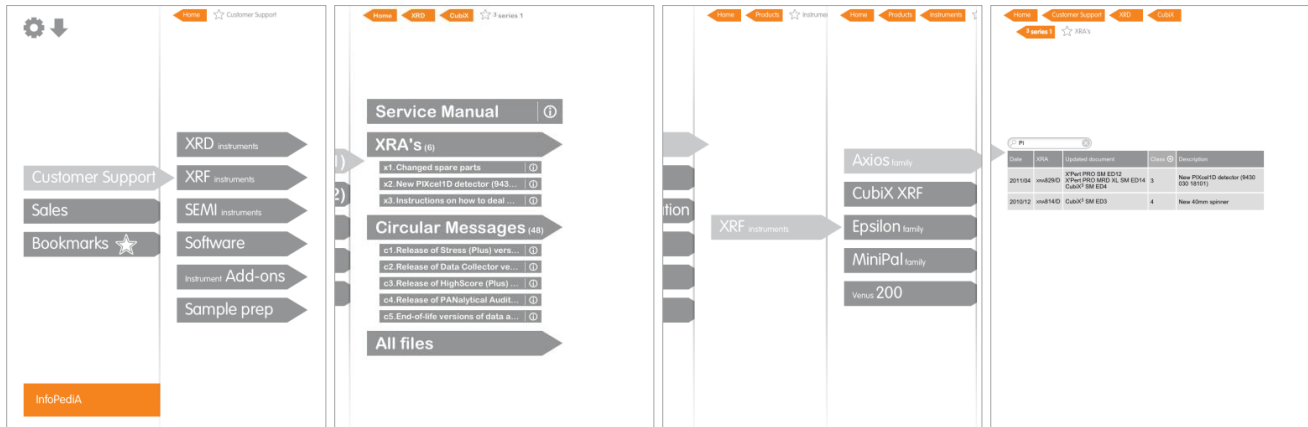
Important parts of the design philosophy are the menu design rules that were defined. These can be found (along with their substantiation) in Appendix L. A sample menu, which was later implemented into the prototype, was also built in accordance to the menu design rules. On PANalytical’s request, this information was later changed to remove references to their products in the customer support menu, the result can be found in Appendix M.

Home screen



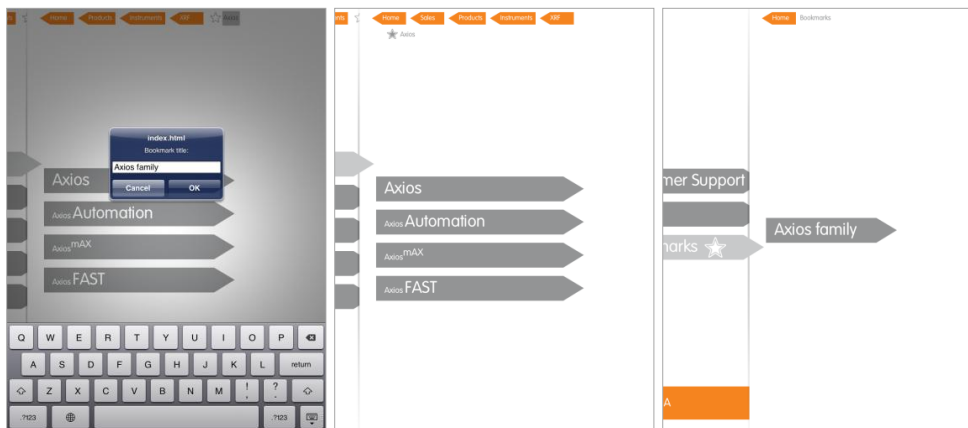
This version of InfoPediA unifies the three distinct versions that are currently maintained. There are, however, two distinct user groups who use the software very differently. Therefore, the menu structure is split in two parts immediately and options exist to enable users to only see the Customer Support branch or the Sales branch. The main menu also contains the “Bookmarks” submenu. In this menu, a user can access items they added themselves. The options menu can also be accessed from here. It will contain a way to select an initial branch (as mentioned before) and options to show or hide items only relevant to certain lines of business. Another button gives users access to restricted files that should be kept strictly confidential.

Sub menus



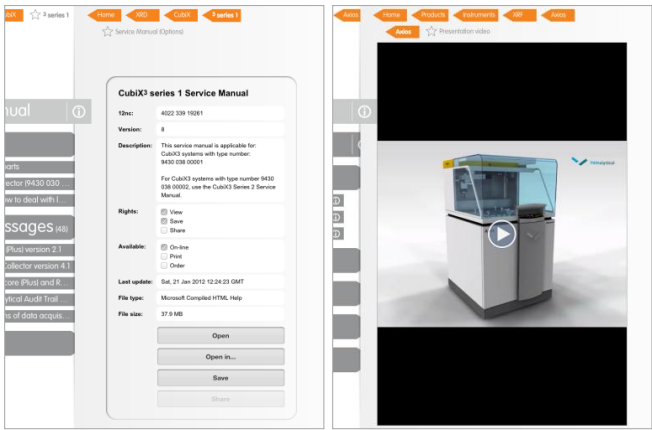
Sub menus slide in from the right. These menus can contain buttons to more sub menus, as well as “goal”-type buttons. These are buttons leading to a goal (normally a data packet) that a user is trying to reach. If a sub menu contains only one button (third figure), this button is activated without user interaction. Substituting menus with only one button has been looked into, but proved not to be possible in all cases because ambiguity could arise. It was therefore chosen to use this solution at this point. As stated in the menu design rules, most menus must not contain more than 7 buttons. An important exception is the “instrument”-menu (second figure). This menu contains direct links to some data packets. As this menu is very static and re-used for every instrument, a user can be expected to learn the structure of this menu very quickly. Another exception are table-menus. These are menus containing many data packets. These are needed at points where no more non-arbitrary distinctions can be made between data packets. These menus contain filtering and sorting facilities.

Bookmarks



Users can add bookmarks by clicking the current menu in the breadcrumbs bar. They are then requested to enter a name for the item (a suggestion is done). After clicking OK, the item is added to the bookmarks, indicated by the ★-icon next to the breadcrumb (replacing ☆). The item can then be found under the given name in the bookmarks menu.

Data packets



In this newly designed version of InfoPedia, all data packets are still contained in files. Certain file types are immediately viewable inside the application, for example PDF files and videos, other files will be opened in their respective applications. By clicking the ⓘ-icon next to the main data packet button, a menu with metadata is shown.

Technical properties

The new software will (as mentioned before) have to run on both iPads and Windows computers. While the user interface will differ, every button in every menu will be predefined in what is called the “intermediate interface” (see Figure 7). This means the applications built on top can be very simple and contain only the code needed to translate the intermediate interface to a user interface, as well as an updating mechanism. The intermediate interface is generated on a server, and is the same for all InfoPedia users. The intermediate interface must be built according to a strict set of rules. Defining these rules will be an important part of the development process. The intermediate interface should define the complete menu structure as much as possible without interfering with platform-specific properties, as these are to be defined in the native applications themselves.

User access control (granting permission only to read certain files on a per-user level) can be accomplished by setting it up on the server side. As every user must always be authenticated on the server, access should be restricted there. This also means that there is no way an unauthenticated user could download a file that he or she is not supposed to read. More information on this subject, as well as a relatively thorough explanation of a possible set-up is available in Appendix N.

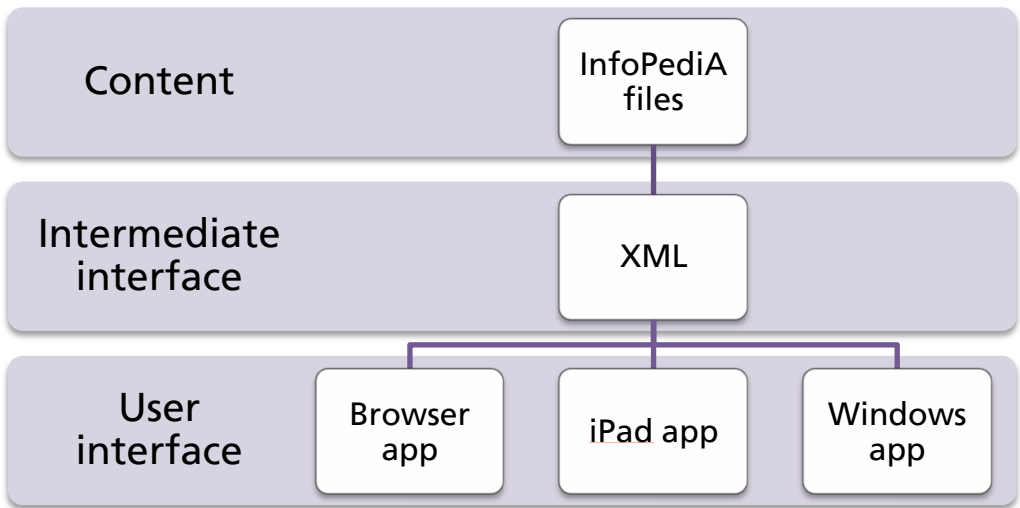


Figure 7: Application layers

Updating module

The updating module is an important part of InfoPediA, as it is important for PANalytical that users get the latest versions of files as quickly as possible, but users don't want the updating module to get in the way of their work. To find a good compromise for this, the updating module has the following properties:

- It installs small updates automatically
 - It asks for confirmation for larger updates
 - Larger updates are installed automatically if they're ignored for more than a week
- Updates are downloaded and installed in the background
- An exclamation mark (!) is shown next to the data packet button when it refers to an outdated version
- An icon (⬇) is shown next to the data packet button when it refers to a file which is currently being updated
- The rsync-based updating system as explained in Appendix K is used
- Updates are made available to users immediately, as opposed to the current situation in which they are done weekly.

9) Prototype development

After finishing the software design, a prototype had to be built to evaluate it. First, a selection was made of the product requirements, these are listed in Appendix O.

To prototype was then built using *HTML*, *CSS* and *Javascript*. There are a number of reasons for this:

It was decided that the new version of InfoPediA would first be implemented in a platform-independent way. Native applications would be rolled out later. HTML, CSS and Javascript are all supported on every major platform (and most minor ones), as they're the basic languages most web sites are built with. The prototype would be easy to develop and test on a Windows computer, and later tested on an iPad without a major rewrite.

Using JQuery, a Javascript library, animations could be added easily. Implementing animations was imperative to make the user see the direction of movement, and important part of the design philosophy. The student already had much experience writing these languages and could therefore quickly build the prototype without the need for expert support.

The prototype is available on the Content Disk, and comments have been added to all code.

10) Evaluation

After the prototype was ready, an evaluation plan was made. This plan listed all prototype requirements and the way in which they would be tested. This plan can be found in Appendix P. Many requirements could simply be “checked off” because they required a certain functionality to be available, others required different ways of evaluation. The design was submitted for expert review to the employees responsible for enforcing PANalytical’s corporate style. Legibility of the design had to be calculated using the Gunning fog index (Gunning, 1969). Lastly, a user test combined with a survey was carried out. This test was designed to test the design in a real-world scenario and compare it to the current version. Finally, a series of questions was asked. The documents used for this can be found in Appendix Q. This chapter explains most results in some depth. For a requirements verification matrix, which summarizes this chapter, see

Table 1. A full comparison between the current version of InfoPediA and the newly designed version can be found in Appendix U.

Results

Checking off requirements

For some requirements, outside help was not needed to perform an evaluation:

- **The product can be used with or without an internet connection that may or may not be reliable**
As the prototype is executed completely locally, we can expect an internet connection to make no difference at all. Of course, the updating module will have to fulfil this requirement as well. However, this was not tested in the prototype evaluation.
- **The product supports the user when preparing a visit to a client**
The prototype enables the user to add bookmarks, which will be very helpful when preparing a visit. Also, any information that must be hidden from a client is hidden by default. It has to be enabled per session.
- **All information that is available in the current version can be accessed**
Evaluating this requirement focuses on the possibility of adding all files to it. As the prototype contains only a few files, this cannot be tested in full. However, the structure is in place to support it, and the menu structure can also support it.
- **The user interface conforms to the platform’s Human Interface Guidelines**
Apple’s iOS Human Interface Guidelines (Apple Inc., 2012) were used to evaluate this requirement. Results were generally positive, but when encountering a menu which contains only one option, the application’s behaviour should be improved. Further research is in order.
- **Grade-equivalent should not be higher than 10 for any text**
To calculate a grade equivalent, the Gunning fog index was selected. A part of the menu structure was selected, and an index was calculated based on that. As the Gunning fog index formula was created to be used on standard English texts rather than menus, results remain inconclusive. They do, however, appear to indicate a positive result. The user survey should conclusively confirm whether this requirement is fulfilled. The complete assessment can be found in Appendix R.
- **The product provides all users with an overview of items per instrument type**
The design fulfils this requirement by, wherever possible, first asking the user to choose the instrument type they’re currently working with. Afterwards, only files relevant to this instrument type are shown.
- **The product enables the user to select information in advance and recall it quickly**
This requirement is fulfilled by letting the user add bookmarks which can be recalled very quickly.
- **Some information should be protected**
Information that must be hidden from a client is hidden by default and has to be enabled per session, so this is done only when needed.

- **The following attributes should at least be conveyed to the user: title, description, last update, version, privileges**

These attributes are all shown when the metadata is viewed for a file by clicking the ⓘ-icon next to the main data packet button.

Expert review

Employees responsible for enforcing PANalytical's corporate style were asked to review the design. These reviews yielded positive results. The experts stated that the "spirit" of the corporate style was applied very well. The only criticism from these experts was that logo placement was not satisfactory; the PANalytical logo should always be surrounded by a lot of whitespace. A minor adjustment to the design would solve this problem (see Figure 8). This updated design was confirmed by the same experts to solve this problem. Otherwise, both experts said they thought the design reflected PANalytical's corporate style well.

User test and survey

Based on the user test and survey, an evaluation can be made for the following requirements:

- **The product can be used while talking on the phone or in person**
In the user test, a real life scenario was carried out in which the operator played the part of a service engineer who needed phone support. Most users decided to let the interface provide a 'script' for their questions to the operator. This will reduce errors. Splitting focus between using the software and talking to the operator did not appear to cause any problems in using the application.
- **The product supports the user in his tasks: diagnosing an issue with an instrument, giving phone support, preparing a visit to a client**
The first two points were tested in the user test with the real life scenario mentioned above. This yielded positive results. Preparing a visit to a client was not explicitly tested, but is supported through the bookmarks functionality.
- **The product is easy to use, effective and useful**
Users rated ease of use and learning 4,3 out of 5 for the prototype. Effectiveness and usefulness scored 3,5 and 3,6, respectively.
- **Behaviour of buttons is predictable**
This was rated 4,0 out of 5 by users.

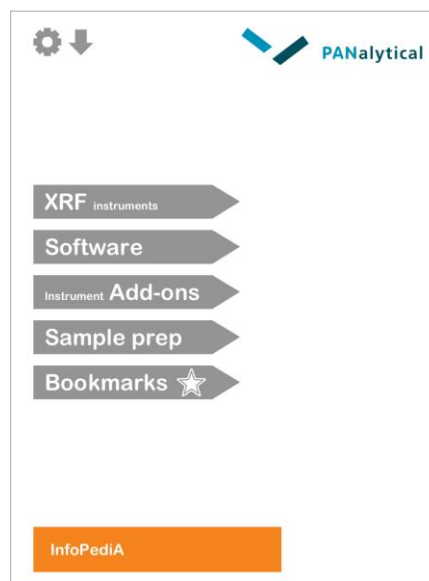


Figure 8: Updated design after expert reviews

- **The user gets a clear ‘sense of location’**
Users rated this 3,9 out of 5 for the prototype.
- **The product is fast**
The two versions are likely to be about equally fast when accessing the first file for an instrument (statistical probability of 60%). When switching to a different file for an instrument, the new version seemed to be faster (64% probability). Users rated the prototype’s speed 4,0 out of 5. Two facts should also be taken into account here: all subjects to the user test were very experienced users of the current version of InfoPediA and the prototype of the newly designed version is most likely slower than a native application.
- **All text in the product's user interface is easily legible and meaningful to the user**
When asked if all text in the prototype was easily legible, users scored it 3,9 out of 5.
Meaningfulness scored 3,8 out of 5
- **The product provides customer support users with quick access to service manuals, XRA’s and circular messages.**
When an instrument is selected, these three file types are immediately accessible. Other files are accessible through an “All files” submenu, where users can filter or sort to find the correct file. In the prototype user survey, this was part of the segment “usefulness” which scored 3,9 out of 5.
- **The product fits in well with PANalytical’s corporate style and looks professional, simple, smart and up-to-date to a customer**
Users rated this 3,6 out of 5.

The responses to the survey can be found in Appendix S.

Other aspects

Some requirements could not be evaluated using the prototype, but can still be tested against the requirements document.

Updating module

As no research had previously been done to enable predictions to be made for user annoyance from an updating module, a formula was developed by the student to measure how annoying an updating module is to the user. The formula was built based on previous knowledge about updating modules and has not been tested very thoroughly. Its results should therefore be seen as an indication. The formula was defined as follows:

$$a = 100 - \frac{5}{900} \cdot (n) \cdot \left(t^{\frac{1}{2}}\right) \cdot (190 + r) \cdot \left(4.6 - \frac{4}{100}d\right) \cdot \left(\frac{9}{10} - \frac{2}{10}b\right)$$

Where:

- a= Updating module annoyance factor
- n= Number of updates per month
- t= Average time taken per update (in seconds)
- r= Percentage of a file that has to be re-downloaded after connection lost at 90%
- d= Dependability (% of files fixed after connection lost)
- b= Background factor:
 - Updating blocks use of the software → 1
 - User must always allow update, rest in background → 2
 - User must sometimes allow update, rest in background → 3
 - No user interaction required at all → 4

The current version of InfoPediA scores about 14 points using this formula (n=4,5; t=20; r=100; d=20; b=1). The newly designed product cannot be tested for this, as the updating module has not been implemented yet. However, a prediction can be made. It can be expected that about every working day of the month an update will be made available (n≈22), and that the time taken will be the same total as in the current

version (as compression can be used in the new, it may even be a bit faster), this means ($t=4,5*20/22\approx4$). With the newly designed system, only the differences between files have to be sent and interrupted transfers can be resumed ($r\approx20$ and $d\approx95$). Lastly, the designed system only requires user interaction for large updates ($b=3$). These aspects make the design score about 88 points using the formula, well above the 75 points required.

Technical and management requirements

A number of technical requirements were defined. Management also had some requirements. These were mostly concerned with the way updates are handled by administrators as well as the software. They want users to always use the newest data, they want to minimize cost of updating and administration and they want to improve security of confidential information.

- **Bandwidth needed for updates is minimized**

By using an rsync-based updating process, only the difference between versions of files have to be

Requirement to be evaluated	How does it comply?
The product can be used with or without internet connection that may or may not be reliable	Internet connection has no influence
The product can be used efficiently while	Results of user test indicated that the application can be used while in a conversation, either on the phone or face to face, without any problems. Adding bookmarks enables the user to prepare a visit to a client.
The product supports the user in his or her tasks	
The product is easy to use and easy to learn	4,3 out of 5 in prototype user survey
Using the product is effective	3,5 out of 5 in prototype user survey
The product is useful and provides customer support users with quick access to service manuals, XRA's and circular messages.	3,6 out of 5 in prototype user survey
All information that is available in the current version can be accessed	This is possible with the new version
The product's user interface is clearly organized	The evaluation in Appendix T shows that the design complies with the iOS user interface guidelines. Predictability of button behaviour was rated 4,0 out of 5 in the prototype user survey and when asked if they were given a clear sense of location in the menu structure, it was rated 3,9 out of 5.
The product is fast (information can be reached at least as fast as in the current version by an experienced user)	The user test showed that the new version is likely to be faster than the current one. The two versions are likely to be about equally fast when accessing the first file for an instrument (statistical probability of 60%). When switching to a different file for an instrument, the new version seemed to be faster (64% probability). These tests were carried out with experienced users of the current version. When asked in the survey, users scored the prototype 4,0 out of 5 on speed.
All text in the product's user interface is easily readable, even when attention is split	When asked if all text in the prototype was easily legible, users scored it 3,9 out of 5. Appendix R shows that texts in the prototype are simple enough to read, as the grade equivalent does not exceed 10.
All text in the product's user interface is meaningful to the user	Users scored this 3,8 out of 5 in the prototype user survey.
The product provides all users with an overview of items per instrument type	An overview per instrument is available every user group
The product enables the user to select information in advance and recall it quickly.	The bookmarks functionality enables this
Some information should be protected	Some information has to be enabled for every session
The product should be clear about the contents of information packets	Title, description, last update, version and privileges are all given in the data packet information menu
The product fits in well with PANalytical's corporate style and looks professional, simple, smart and up-to-date to a customer	Experts reviewed the prototype and indicated it complied very well. Users scored it 3,6 out of 5 in the prototype user survey.

Table 1: Requirements validation matrix for the newly designed version of InfoPediA

transferred, this gives an immediate improvement in performance. Furthermore, by making updated files available immediately rather than weekly, bandwidth usage is spread out, which eases congestion.

- **All connections and data transfers are secured**

By enforcing all users to connect through SSH, security will be enhanced greatly. Users who will be downloading more sensitive information will be tunnelling the SSH connection through a VPN, which further improves security. Also, by enabling user access control, users can only access the data they need, decreasing the risk of information leaks. Extranet users, such as sales agents, will only be able to access a limited number of files, not containing any very sensitive information. Their connection will be secured with SSL, as it currently is.

- **As many of the current or already planned aspects of the network infrastructure as possible should be used**

The only change to the current structure is replacement of the NASs by a limited number of “real” servers. Distributed VPN may be used as an enhancement when it’s rolled out.

- **As much of the administrative work as possible can be automated**

In the new design, a number of tools will have to be built to automate most of the administrative tasks. Pushing updates to users will be fully automated.

- **Updates are performed as quickly as possible**

The updating module lets users postpone updates larger than 15 MB for a week. Other updates are installed immediately.

- **A user should be warned when he is using an old data packet**

An icon is shown when a data packet is outdated

- **The new version can be rolled out easily**

This is platform-dependent, but on iOS updates can be updated wirelessly on employees devices. On Windows, a simple update installer can be used.

11) Answering the main research questions

As the project has now been finished, we can answer the main research questions.

1. What is the best way to present the functionality to the user?

An application with a minimalist interface, available on both Windows and iPad, providing a task-oriented interface which should present the user with a script they can follow while talking to others. Data is organized in such a way that the files a user is expected to need are readily available. The updating module uses an rsync-based system to which updates are pushed immediately when they become available. The updating system is distributed worldwide on a number of servers and will be integrated with a distributed VPN system when this becomes available. The application captures the spirit of PANalytical’s corporate style but also fits in well with the other application on the same platform.

2. What is the best way to represent the redesigned software in a prototype?

A prototype was built in HTML, Javascript and CSS, as this is a very easy combination of languages to quickly build an application on a Windows laptop that will also run well on iOS. This means that some aspects were more difficult to test, for example the updating module. The updating module was not tested because of this reason and because it would require considerable back-end work as well to make it a worthwhile test. The speed and ease of use of the task-oriented interface and menu are the most important aspects to test, as users will not be satisfied with an application that makes them work slower. Of the designed system, as many aspects as possible were incorporated into the prototype. They were not all used for evaluation purposes but they may support the rest of the development project by making clear how certain functionality was designed to be implemented.

3. How does the interface prototype perform in the user survey?

The prototype was at least as fast as the current version in the user test and users agreed that it met all the requirements tested in the user survey. The survey was designed to increase reliability by asking users the same sort of question in different ways. This way, it could be determined how certain a user was about any aspect. Testing the speed of the application was done in two parts, first asking the user to select three data packets using the newly designed version and then doing another test in which a real-world scenario was played out. Lastly, the user was asked to open three files in the current version of the application, from which two files overlapped with the first test. This way, a reliable control could be set. A student's T-test was then used to establish the probability of one being faster than the other.

PANalytical requested a development plan with an indication of how much time it would take to develop and build the newly designed version of InfoPediA. This plan can be found in Appendix V.

12) Conclusions

A very thorough analysis phase was the basis on which the rest of the design process could be built. All aspects that may be of influence to the software design were analyzed and made explicit. Where necessary, research was done in literature relating to the fields of human factors engineering (Norman, 1988; Segars & Grover, 1993; Wickens et al., 2004) and human-computer interaction (Jacko & Sears, 2003), among others. The user survey also yielded very valuable information. It also showed that users are very interested in the application that was being designed, as almost 50% of all users responded.

The concepts that were developed all had their merits, but it was clear that most users, as well as the empirical comparison, preferred the same concept. As this concept was already fairly defined, the design phase only changed a few aspects of it. The prototype was a bit more difficult to build than expected, but it was an invaluable asset for making the design "speak" to users when performing the prototype user tests.

Based on the positive results from the evaluation phase, we can conclude that the project was successful. The design fulfils all requirements that emerged from the analysis phase. The application that was designed, implements a minimalistic approach to software design, which is helpful for this type of application as there are fewer distractions than when using other approaches. The task-based interface makes the user feel in control, but does provide them with a clear script to follow while doing their job. This clarity makes sure users will not become confused when sharing attention between the software and other tasks. By letting the user define bookmarks and hide certain lines of business, the application can, within limits, be customized to cater to any user's specific needs while remaining simple and clear to anyone.

13) Recommendations for further research

The main research questions have now all been answered, which brings the project to a close. A number of recommendations for further research can be made however, as it became apparent that some aspects may need to be taken into account in the next phases of the development project, but there was no time to fully include it into this project or they fell outside of the scope of this project.

Global search function

A global search function was not implemented into the prototype for technical reasons. The difficulty of searching in multiple file formats was one of the reasons. It may be advisable to add keywords to every file through metadata in manifests. These keywords can then be indexed and searched. It may also be possible to index files in an automated process on a server. These indexes could then be used by the client application.

Integration with Teamcenter

PANalytical has decided to move their product lifecycle management information to Teamcenter, a Siemens PLM Software suite. This means that all files provided by InfoPediA would in the future also be available in Teamcenter. This could create an opportunity for linking the two. Teamcenter could provide metadata and could contain information about user permissions and the data's location in InfoPediA.

User editable files

It was found that many Sales users make a specialized presentation for a client. This is done by merging relevant slides from multiple existing presentations. Embedding this functionality is probably outside of InfoPediA's scope. However, this functionality should be supported by letting users export these files (which is implemented in the design). It may also be interesting to explore possibilities of adding these files back to InfoPediA and perhaps even a sharing capability inside InfoPediA. It should be noted, however, that this may also exceed InfoPediA's scope. It should remain primarily an application for quick access to the information a user needs.

'Last updated'-list or -indication

In the survey and the interviews leading up to it, it was found that many users are interested in seeing which files were updated last. It may be advisable to make a clear menu option to see a list of recently updated files. Another possibility is that files that were updated since they were last viewed carry a visible (but unobtrusive) mark or icon.

A better solution for menus with a single item

Some menus can contain only one button under certain circumstances. For example: the software menu contains buttons for XRD- and XRF software, when only XRD items are shown, the software menu contains only one item. Currently, the prototype automatically clicks this item when the software menu is opened. This behaviour may not be desirable, given the consequences it has for the user's sense of being in control of the application. For more information, see the section on user control in the evaluation of the prototype against the iOS Human Interface Guidelines in Appendix T.

Testing with additional users

The user test was performed with only a limited number of users. A more extensive test could confirm that the design has improved on the current version significantly.

14) Reflection

As the project is done, it can now be reflected upon.

What went well?

Most of the project went very well. A very thorough design process was executed, it yielded good results and it was done on time. Even without much specific support in the fields of industrial design, software development and human factors, the student was very capable of planning, researching and performing a project integrating these fields. The results of this project were made using a combination of literary research and original research in the form of tests and surveys. Experts were also asked for their opinion where needed.

One of the things that went exceptionally well was the user survey in the analysis phase. Almost 200 valid responses were received, far more than expected and almost half of all users of the software. This helped both the student and PANalytical see that users are very interested in the software.

By having a progress review generally every week, an open dialogue was maintained by which the direction and goals of the project were safeguarded. PANalytical has indicated that they are very satisfied with the way the project was conducted and support its conclusions.

What could have been improved?

Some things could have been improved in the project. The planning was a bit off on some points, and a few points could be skipped (an interview for technical possibilities for a prototype was skipped, for example, as the available technologies were already clear at this point).

What makes a good design process?

Before a process starts, a planning should be made. This is often forgotten or not made explicitly, but it is very important. Even a project performed by a single person should have a planning. This makes sure all bases are covered in advance. The planning should be printed out and placed somewhere conspicuous, so it is seen often. During the process, it can help marking days that have passed. This way it becomes clear what should have been done and what is due. In this project, tracking the status of every part of the design process was of great use to the student, as it made sure the project was finished on time.

The basis of any design process should be the analysis phase. Many students (and post-graduates as well) seem to think they “know” their target audience, so no real analysis of it is needed. This creates a problem, as there is no paper trail supporting the designer’s work. A company will therefore be apprehensive to base any business decisions on it. The risks involved are simply too high when no empirical data was gathered to support design choices. A very thorough analysis of all aspects of the design is therefore extremely valuable to the rest of the design process; even if the designer is confident his understanding is already adequate.

The design process itself is performed differently by every designer, but an iterative phase should always be an integral part of it. An often held belief is that sketching for the sake of sketching is unnecessary, and is only done to support a conclusion that was already reached cognitively by the designer some time ago. There is a grain of truth in this claim as many sketches that students are required to make during their education take too long to make and therefore don’t support the design process but are more of a way of presenting its outcome while the process itself is performed in one’s head. However, very basic sketches (that are clear to the designer, not necessarily anyone else) are of major help to an iterative design phase as it lets the designer move his knowledge to the world, where he can review them and combine them. Simple but clear sketches can be used to communicate ideas to others and acquire feedback. Only in the latest parts of the design process detailed drawing should be made.

During and after the design phase it is important to document the design aspects and philosophies. This is not the same as writing documentation for the product but it can be seen as writing documentation for another designer who may be working on the product or someone who maintains the product or the design in some way. In this project, a list of rules was established to which an administrator of the product should abide. Laying down rules is not enough however: a strong substantiation is also necessary. This is simply because it helps to make them understand how the choices were made and that they were not made arbitrarily. This makes sure others work on the design in such a way that the basic concepts will remain intact over time.

After the design phase an evaluation should be done. This is also to add weight to the paper trail.

15) Glossary

Breadcrumbs

An often used navigation feature, that shows which menus a user has gone through to get to the current menu. They are used to get back to previous menus quickly.

Cascading Stylesheet (CSS)

This styling language is used to add styling to web sites in a more flexible way than allowed by HTML.

Data packet

Refers to the container of a discreet amount of data. In the current version of InfoPediA these are simply files. While designing the new version of InfoPediA, looking into other types of data storage had to remain a possibility. It was therefore decided that 'data packet' was a more correct term.

Extranet

A specialized web space only accessible to authorized users.

Human factors

A field of science which combines other disciplines to design equipment, software and devices to fit the human body and cognitive abilities.

HyperText Markup Language (HTML)

This language is used on (almost) all web sites. It is one of the main languages of the web and defines the content of a web site.

Intranet

A specialized web space only accessible from the PANalytical network.

JavaScript

This is a scripting language that can be used to make web sites more interactive

Network allocated storage device (NAS)

A simple device which is connected to a computer network and provides storage to the users of said network.

Operating System (OS)

The base software installed on a device. This software "operates" the device. Examples include Microsoft Windows, Linux, Mac OS X, iOS, Windows Phone, Android and BlackBerry OS.

Pinching

Moving thumb and index finger relative to each other, such that the distance between both changes, but not the angle. In a touch interface this gesture is often used for zooming.

Platform

A combination of device and *operating system*.

Virtual Private Network (VPN)

A technique through which users can connect to a private network (in this case the PANalytical network) through a secure connection over the internet.

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Appendices contain separate bibliographies

17) Appendices

Appendix A: Assignment description

Assignment description

Bachelor of Science, Final Assignment - Marten Jacobs (s0194824)

University of Twente - Faculty of Engineering Technology - Industrial Design

Client: PANalytical BV
Subject: InfoPediA redesign
Tutors PANalytical: Mr. D. Bootsma (Manager of ICT)
Mr. C. Stevelink (Designer and developer of InfoPediA)
Estimated start: April 2012
Estimated end: July 2012

Client

PANalytical BV is a high-tech company based in Almelo, The Netherlands. Before 2002, it was a part of Philips and was known as Philips Analytical. It develops and produces analytical instrumentation and software for X-ray diffraction and X-ray fluorescence spectrometry. These products find their application in many fields of industry and research where they are widely used for the analysis and materials characterization of products such as cement, metals and steel, nanomaterials, plastics, polymers and petrochemicals, industrial minerals, glass, catalysts, semiconductors, thin films and advanced materials, pharmaceutical solids, recycled materials and environmental samples.

Source: (PANalytical, n.d.)

Subject

InfoPediA is a software platform used by PANalytical to share information about their products with their sales engineers, agents and customer support engineers. The software gives users access to brochures, user manuals, support manuals and software updates, among many other things. Currently, there is one source package that produces three versions of the software, one for each target group. Different versions of the software provide access to different types of items, but there is an overlap. The software is used on laptop computers. PANalytical wants to explore advantages to porting the software to another platform, or using it on multiple platforms. As the current code base is not compatible with other platforms than Windows, these advantages should outweigh the cost of rewriting InfoPediA for another platform. The objective is to use the current design and underlying structure of the software, but part of the investigation is to define all requirements and to verify this objective. If needed, a redesign will be defined as part of this study.

Assignment

The student is to research which advantages changing the platform on which InfoPediA runs might have to the user of InfoPediA from both a business and a human factors standpoint. This research will be limited to the current platform (Microsoft Windows on a laptop computer), the Apple iPad and a yet to be selected smartphone. When a platform is chosen, a redesign of the interface of InfoPediA will be made to better incorporate human factors, to which end Wickens, Lee, Liu, & Becker, 2004 will be used extensively. From this research and the next design steps, it can also be concluded if the current structure with three distinct versions should be maintained, or that the redesign should be able to cater to all user groups. The redesigned interface will then be incorporated into an interface prototype, which is not required to be functional but will show the newly designed interface into reasonable detail. An evaluation of the interface will then be performed using the prototype. The underlying information structure will not be redesigned as a part of the project. However, some

changes may be needed for the redesigned interface, these will be presented as recommendations. The interface of the software used for maintaining InfoPediA will be left out of the project.

Deliverables

As mentioned, a number of deliverables will be produced during the project; these are listed here in a more orderly way:

- Interface prototype
- Product requirements document
- Report of requirements analysis
- Evaluation of the current design
- Report of redesign
- Project plan and weekly progress reports
- Presentation for PANalytical

These deliverables will of course also be presented in a bachelor thesis. As the corporate language of PANalytical is English, this is to be the language used in all deliverables produced during the project.

Other noteworthy information

As the information supplied by the InfoPediA software is often confidential, PANalytical requires that the student and the tutor assigned by the university sign an NDA (Non Disclosure Agreement) prior to starting the project. Also, depending on its contents, the student's thesis may be marked as confidential by PANalytical. In this case, if desirable, it may be possible to make a second, censored version of the thesis, which may be publicly available.

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Appendix B: Project Strategy

Project strategy

Redesigning the InfoPediA software from a Human Factors standpoint for PANalytical – Marten Jacobs (s0194824) – Industrial Design – Faculty of Engineering Technology – University of Twente

1) Main actant analysis

This section will only be regarding the client. Any other actants will be addressed in section 2.

PANalytical

PANalytical BV is a high-tech company based in Almelo, The Netherlands. Before 2002, it was a part of Philips and was known as Philips Analytical. It develops and produces analytical instrumentation and software for X-ray diffraction and X-ray fluorescence spectrometry. These products find their application in many fields of industry and research where they are widely used for the analysis and materials characterization of products such as cement, metals and steel, nanomaterials, plastics, polymers and petrochemicals, industrial minerals, glass, catalysts, semiconductors, thin films and advanced materials, pharmaceutical solids, recycled materials and environmental samples.

(PANalytical, n.d.)

PANalytical's goal with this project is to give their employees a better and easier experience when using InfoPediA to sell or service their products. Its external goal is to make their products or service organization look more appealing to the customer by providing information in an appealing way and improving customer support. PANalytical also wants to protect the confidentiality of the information contained in InfoPediA. Douwe Bootsma (Manager of ICT) and Cor Stevelink (InfoPediA administrator) will represent PANalytical in this project.

2) Exploration of the project context

InfoPediA

InfoPediA is a software platform used by PANalytical to share information about their products with their sales engineers, agents and customer support engineers. The software gives users access to brochures, user manuals, support manuals and software updates, among many other things. Currently, there is one source package that produces three versions of the software, one for each target group. Different versions of the software provide access to different types of items, but there is an overlap. The software is used on laptop computers. PANalytical wants to explore advantages to porting the software to another platform, or using it on multiple platforms. As the current code base is not compatible with other platforms than Windows, these advantages should outweigh the cost of rewriting InfoPediA for another platform. The objective is to use the current design and underlying structure of the software, but part of the investigation is to define all requirements and to verify this objective. If needed, a redesign will be defined as part of this study.

Problem statement

InfoPediA is currently built using Visual Basic 6, which will not be supported in future versions of Windows. Therefore, this is a good time for PANalytical to look at other ways to make InfoPediA easier to use for its employees and more appealing to its (potential) customers.

The current version of InfoPediA is used on laptop computers. This creates an issue for sales engineers, agents and customer support engineers who visit high-level companies in some industries,

for example diamond mining. These companies require any laptop computers that enter their premises to be completely checked on a component level, which may take up to 45 minutes. In PANalytical's experience, this is not required for tablet computers and smartphones.

Analysis of stakeholders

Users of InfoPediA

In this section, the users of InfoPediA will be addressed. These groups have different goals, but they have the same sort of expertise of the InfoPediA software, their expertise focuses on usage of the software in their respective fields.

Sales engineers

Sales engineers are employees of PANalytical. They are tasked with convincing a potential customer that a product from PANalytical is the best choice for their needs. They want to be able to give product information to customers quickly, properly and in an appealing manner. There are about 200 sales engineers, based all around the world.

Agents

Agents are external parties that are not employed by PANalytical, but they do sell PANalytical products. There are about 50 agents. Their goals are broadly the same as sales engineers, but as they work on a commission basis, they are of course more focussed on selling.

Customer support engineers

There are about 400 customer support engineers worldwide. They are tasked with supporting the customer, on-site if needed, when a product malfunctions. Their goal is to support the customer as quickly and properly as possible.

(Potential) customer

The customer is not a direct user of the InfoPediA software, but definitely has an interest in its functionality. If a potential customer is considering the purchase of a PANalytical product, it is important that the information provided is precise and appealing, to maximize the chance the customer chooses PANalytical instead of its competitors.

When a product has been purchased, the interest of the customer shifts. As the customer often has a major financial dependence on the proper functioning of the product, quick and decisive diagnosing and fixing of any problems by a customer support engineer is a major contributing factor to the contentment of the customer regarding the product and, by extension, PANalytical.

University of Twente

The University of Twente aims to supply high quality education to its students. This also means that students are held to high standards. Its goal is to maintain this quality by making sure the project is of a quality that is worthy of a student at a bachelor degree level. The tutor represents the University of Twente in this project. The tutor has expertise in the field of human factors engineering and can support the student with his research.

The student (Marten Jacobs)

The student is to perform the project in a timeframe of three months. During which time he will be working at PANalytical's facilities in Almelo, the Netherlands. The student will be trying to maintain a high quality of research. The main goal of the student is to deliver a project that is useful for PANalytical and proves he is worthy of a bachelor degree. To this end, he will use his expertise in project management, human factors engineering, software design and product development processes.

Relevant expertise of PANalytical

PANalytical has a lot of in-house expertise in the fields of software design and development, especially for the Windows-platform. The iPad platform is not as well supported as of yet, but PANalytical is aiming at doing so in the future. Currently, at least one iPad application is already under development: a ticketing system used by the customer support staff. The Blackberry platform is the only smartphone platform that is currently supported by PANalytical, mainly because of its enterprise level security. However, no applications have ever been developed by PANalytical to run on the Blackberry platform.

Douwe Bootsma, who is manager of ICT, will be able to help the student determine technical possibilities that can be applied to the redesigned software.

Cor Stevelink, who is InfoPediA's administrator, is the designer of InfoPediA and currently does the technical administration. This means user management, bug fixing, code maintenance, software updates and maintaining the underlying data structure. He has expertise in development and design of the underlying software and the structure of the underlying information. Also, he knows a lot about previous feature requests and therefore about the users.

Other possible solutions that have been designed or are under design

Of course, on the Windows platform, there is the current version of InfoPediA, which may be redesigned to improve the user's experience of the software. On the iPad platform, PANalytical has performed several tests to get the same functionality that InfoPediA offers on the iPad using existing applications, but has not succeeded as of yet.

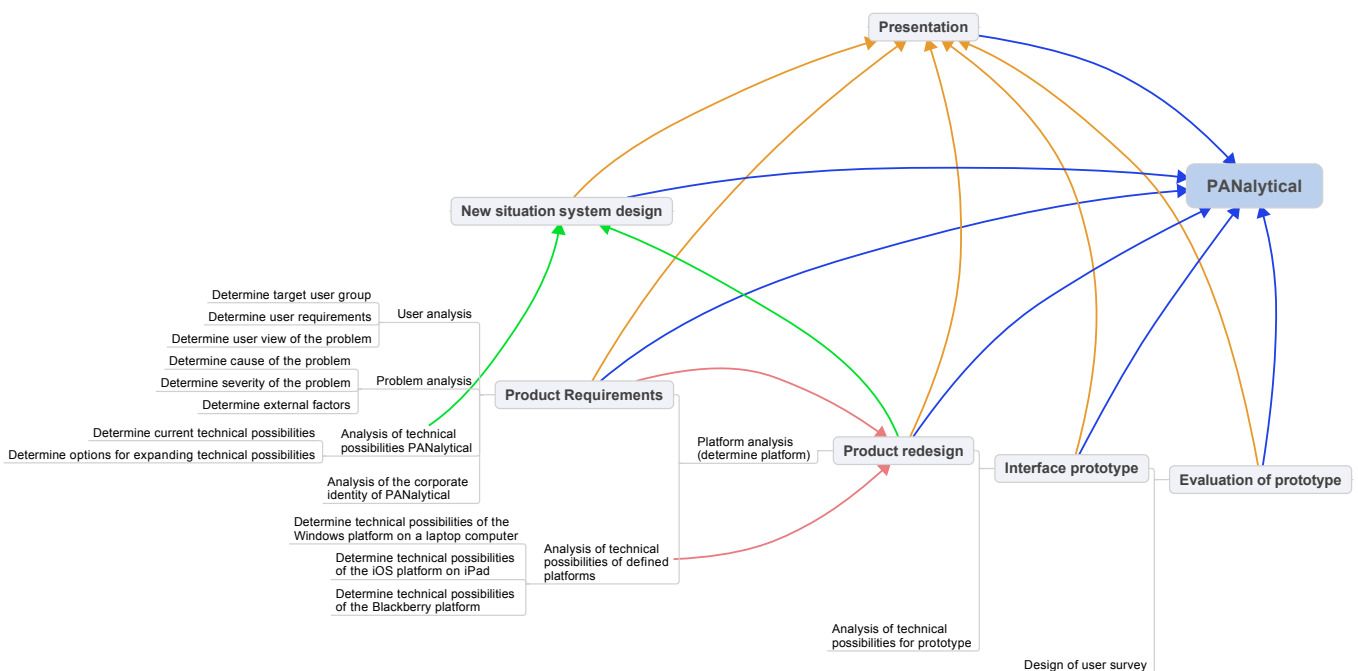
3) Project goal

The student is to research which advantages changing the platform on which InfoPediA runs might have to the user of InfoPediA from both a business and a human factors standpoint. This research will be limited to the current platform (Microsoft Windows on a laptop computer), the Apple iPad and a yet to be selected smartphone. When a platform is chosen, a redesign of the interface of InfoPediA will be made to better incorporate human factors, to which end Wickens, Lee, Liu, & Becker, 2004 will be used extensively. From this research and the next design steps, it can also be concluded if the current structure with three distinct versions should be maintained, or that the redesign should be able to cater to all user groups. The redesigned interface will then be incorporated into an interface prototype, which is not required to be functional but will show the newly designed interface into reasonable detail. An evaluation of the interface will then be performed using the prototype. The underlying information structure will not be redesigned as a part of the project. However, some changes may be needed for the redesigned interface, these will be presented as recommendations. The interface of the software used for maintaining InfoPediA will be left out of the project.

Solution strategy

An analysis of the target user group, the problem and the technical possibilities supplied by PANalytical that may be applied to the product will lead to a list of product requirements. This list will be combined with an analysis of the different platforms and an analysis of possible operation principles that may solve (parts of) the problem to determine which platform is the best candidate to run InfoPediA on. The requirements, technical possibilities and possible operation principles will then be combined to redesign the InfoPediA software on the determined platform. Wickens, Lee, Liu, & Becker, 2004 will be used extensively to accomplish this in such a way that the user experience is improved significantly.

4) Research model



Tree of questions

This tree of questions is not a project planning, it merely contains all questions that can be distilled from the research model, ordered by their parent/child connection (this means all child questions must be answered to answer their parent question). This does also not mean that the topmost questions are by definition the central questions to the project, as some of the goals may have to be fulfilled (and therefore some of the central questions have to be answered) to create the input for other central questions. Questions that will be central to deliverable items are bold.

How does the interface prototype perform in the user survey?

1. What is the best design for a user survey to test the prototype?
2. **What is the best way to represent the redesigned software in a prototype?**
 - A. Which properties of the prototype are the most important to evaluate?
 - B. What technical possibilities are there to build a prototype?
 - C. **What is the best way to present the functionality to the user?**
 1. What platform provides the best possibilities to present the functionality to the user?
 - a) What possibilities do the defined platforms provide?
 - (1) What possibilities does Windows on a laptop computer provide?
 - (2) What possibilities does iOS on the iPad provide?
 - (3) What possibilities does the Blackberry platform provide?
 - b) **What are the product requirements?**
 - (1) Which requirements do the target users have?
 - a) Who are the target users?
 - b) What are the target users' requirements?
 - c) What is the target users' view of the problem?
 - (2) What are the properties of the problem?
 - a) What is the cause of the problem?

- (b) How severe is the problem?
- (c) What external factors have an influence on the problem?
- (3) What restrictions do the technical possibilities of PANalytical impose on the design?
 - (a) What technical possibilities does PANalytical currently have to support the InfoPediA software?
 - (b) What technical possibilities can PANalytical add to support a redesigned version of InfoPediA?
- (4) What does the corporate identity demand of the style of the software?

5) Research questions

In this section, the main research questions and a few of their sub-questions will be addressed.

1. What is the best way to present the functionality to the user?
 - A. What platform provides the best possibilities to present the functionality to the user?
 - B. What requirements do the users have?
 - C. What properties does the problem have?
 - D. What restrictions do the technical possibilities of PANalytical impose on the design?
 - E. What does the corporate identity demand of the style of the software?
2. What is the best way to represent the redesigned software in a prototype?
 - A. What technical possibilities are there to build a prototype?
 - B. Which properties of the redesigned interface are the most important to evaluate?
 - C. Which properties of the redesigned interface will be simulated in the prototype?
3. How does the interface prototype perform in the user survey?
 - A. What are the demands the prototype should meet?
 - B. How can a user survey be designed best to determine if it does meet these demands?
 - C. How can this test be best conducted?

6) Strategy

A project strategy has been determined based on the solution strategy as put forth in section 3 and the research questions addressed in section 5. The tree of questions will also be referred to, to make sure all needed information will be gathered. This strategy is ordered chronologically. The column B.n. (Bottleneck) refers to the numbering in the next section.

Question	Strategy	Material	Sources	B.n.
1B 1C	Interview	People	Sales engineers Customer support engineers InfoPediA administrator	1
	Survey	People	Sales engineers Customer support engineers Agents	2
1D	Interview	People	Responsible ICT employees InfoPediA administrator	
1E	Literature research	Guidelines	Corporate identity guidelines	3
1A	Literature research	Device properties	Information for typical devices running Windows Information about iPad Information about BlackBerry smartphones	
		Software properties	Developer information for Windows, iOS, and BlackBerry	
	Determine best platform choice	Report	Results of questions 1B, 1C, 1D, 1E	

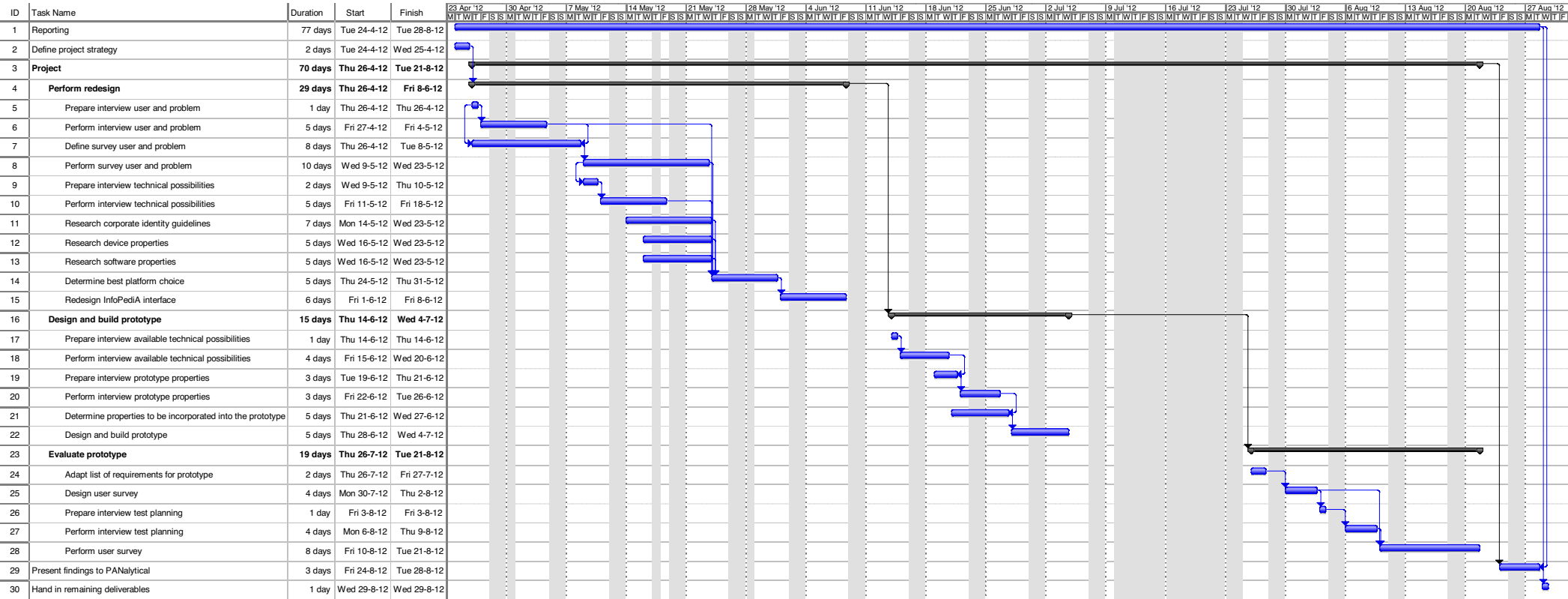
1	Perform redesign	Report	Results of questions 1B, 1C, 1D, 1E	
		Report	Results of question 1A	
		Book	Wickens et al., 2004	
		People	Expert input from tutor	
2A	Interview	People	Responsible ICT employees InfoPediA administrator	
2B	Interview	People	InfoPediA administrator ICT Manager	
	Properties	Interface design	Results of question 1	
2C	Select properties to incorporate into prototype	Report	Results of question 2A	4
		Report	Results of question 2B	
2	Design and build prototype	Report	Results of question 2A	5
		Report	Results of question 2C	
		Interface design	Results of question 1	
3A	Adapt list of requirements for prototype	Report	Results of questions 1B, 1C, 1D, 1E	
		Report	Results of question 2C	
		Prototype	Results of question 2	
3B	Design user survey	Evaluation type	Wickens et al., 2004 Other literature on evaluation types Expert input from tutor	
		Report	Results of question 3A	
3C	Interview	People	Sales management Customer support management	6
3	Perform user survey	Prototype	Results of question 2	7
		User survey	Results of question 3B, 3C	

7) Planning

Possible bottlenecks

- Sales engineers and/or customer support engineers not available
 - SOL: Interview sales management and customer support management instead
 - SOL: Interview only InfoPediA administrator
- Low response
 - SOL: Send all surveyed employees a reminder
 - SOL: Tell surveyed employees that the results to the survey may influence the company to provide them with a new device
 - SOL: Ask the managers of the surveyed employees to ask them to respond
 - SOL: Base answers to 1B and 1C purely on interviews
- Not all needed information can be found in the corporate identity guidelines
 - SOL: Interview the responsible Marcom (Marketing/Communication) employee
- Not all of the most important properties can be incorporated using the possibilities determined
 - SOL: Go back to 2A and try to find a way to incorporate said possibilities
- Not enough time to build the prototype with all functions defined in 2C
 - SOL: Go back to 2C and filter out some less important functions
 - SOL: Use extension time
- Sales management and/or customer support management not available
 - SOL: Interview InfoPediA administrator instead
 - SOL: Check corporate agenda to see when users are available
- Not enough users available
 - SOL: Use extension time
 - SOL: Go back to 3C and change the user survey to use fewer users, or use less stringent availability demands.

Planning chart



In this chart, grey days represent the weekend, bank holidays and the period in which the student is on holiday

8) Glossary

- **InfoPediA software:** the software package that PANalytical distributes to its sales engineers, agents and customer support engineers. It currently consists of three versions, all providing access to different information.
- **Target user group:** all current and future front-end users of the InfoPediA software.
- **On-site:** at the facilities where the product is located. This may be anywhere in the world, and there may or may not be an available Internet connection.
- **Tutor:** the person assigned by the University of Twente to assist, accompany and judge the project.
- **ICT department:** the department in PANalytical that is responsible for the network interfaces and all computer-related services that are needed for internal use (this means it is not responsible for the software delivered to customers).
- **Platform:** the device and operating system combination that the InfoPediA software will run on. In this project, only Windows on a typical laptop computer, iOS running on iPad and BlackBerry OS running on a typical BlackBerry smartphone will be investigated.
- **Operation principles:** technical principles that could be used to solve the problems the current version of InfoPediA is facing.
- **Human Factors Engineering:** the engineering science that focuses on human capabilities. In this project it will be used to lead the redesign of the InfoPediA software, so that the redesigned version will improve on user satisfaction, user trust, usage speed and user effectiveness.
- **Corporate identity:** the style and design elements that are defined by PANalytical to be used in all external manifestations of the company or its products.

9) Bibliography

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Appendix C: User interviews

Findings from two interviews with customer support specialists based in Almelo about InfoPediA

Version 2

On April 24 and May 1 2012, I conducted two interviews with four users of InfoPediA; they are all customer support specialists based in PANalytical's supply centre in Almelo. As they are third level support specialists, most of their time is spent training other customer support staff and providing technical support by telephone. Only if an issue arises that local (first level) or regional (second level) support staff cannot handle, they will be dispatched to the customer to fix it. This is what I found in respect to the use of and experiences with InfoPediA.

Interviewees

Ruben Kettelarij (April 24)
Rene Dijkstra (April 24)
Tim Jansen (April 24)
Imdat Yikilmaz (May 1)

Use

The interviewees mentioned multiple situations in which they use InfoPediA:

While diagnosing an issue.

In this case InfoPediA is used as a back-up checklist, or “knowledge in the world” (Wickens, Lee, Liu, & Becker, 2004), to make sure all protocols are followed correctly.

While installing an instrument.

Here it is used in the same manner as when diagnosing an issue.

While instructing the customer about their system.

It may be used to point out to the customer where he could find certain information in the user manual, while simultaneously explaining what it means.

While supporting customer support engineers and local PANalytical branches in the customer care centre.

In the customer care centre, all customer support specialists are frequently asked questions that do not refer to the type of instrument they're specialized in. This means they often have to resort to the information provided by InfoPediA. When a local service engineer or employee of a local branch asks for a certain file, they tend to lead him through the InfoPediA interface to the file he will need on the telephone or send a screen dump of the location of the file via e-mail.

When preparing for a visit to a customer.

The interviewees indicated they may want to prepare for a visit by rechecking information they might be needing during a visit, and to check which parts might be needed to perform a repair.

Repercussions of use

The interviewees were asked if they tend to use some files more than others. They replied that in their work they tend to open service manuals, XRA's and circular messages much more often than other files. Service manuals are used to search for specific information about an instrument; XRA's and

circular messages are often the subject of questions when they are released and they only contain the information that is of importance at that point. Also, when giving a course, they tend to focus on certain files for a period of time and in their normal work they tend to focus on the instrument of their expertise. They did, however, mention that when supporting customer support engineers in the customer care centre, every type of file is used.

Environment

Location

The interviewees pointed out that they always use InfoPediA on their own laptop computers, which they always take with them when giving lectures, working in the customer care centre, or teaching other staff in the practice room. While their office is relatively quiet, in the customer care centre or while teaching they tend to be surrounded by noise. They don't use InfoPediA at home. When they're being dispatched to a client (which only happens sporadically) InfoPediA is used in the facilities of the client.

Situation

When diagnosing an issue, while installing an instrument or when giving the customer information about the instrument, focus may be split between using InfoPediA and performing other tasks. It should however be noted that most of the time, a file that is provided by InfoPediA is in use instead of the software itself. When supporting staff in the customer care centre, most questions are asked either by e-mail or by phone. In these cases solving the issue is sometimes done while the local employee is on hold or he is contacted after a solution has been found. However, it does happen that files are selected while talking on the phone, which means focus might be split while using InfoPediA.

User interface

Style

What the interviewees think

Concerning the style of InfoPediA's interface, the interviewees said that it looks professional, and business-like, which is to their liking. They did think, however, it looks out-dated. The interface does also not feel very friendly, while they would like for this to improve, it should not compromise the professional look. The application does feel like a tool, not a companion. The interviewees like this aspect, as they have adverse feelings to applications that try to lead the user at all costs. They point out that InfoPediA tends to be used by experts in the field, so its main function is to be fast. However, they do think that some more ways of selecting and grouping files could be of help, as it could improve speed and overview. The general consistency and style of the interface is not great in their opinion, while it does fit with PANalytical's style, different screens are all laid out in different ways and both the structure and style makes it feel like an old Windows application. It clearly looks to be made from a technology-centred point of view.

What the client might think (according to the interviewees)

Many of the things the interviewees said about the style of the application were, in their opinion, in line with the opinion of a client that might see InfoPediA running on an employee's computer. The interviewees thought the application made them look more professional in comparison with a competitor. While it may look a bit out-dated, they feel the client will see it as a well-organized system. They're also of the opinion the customer will think PANalytical's support staff are better suited to fixing an issue because they use InfoPediA.

Other aspects

The interviewees were asked for their opinion on a number of aspects related to the user interface of InfoPediA.

Legibility: The interviewees said the interface was easy to read, while most of them did never read the news story on the front page (however, one interviewee mentioned that he did read it, and would like it to be a bit more active). The menus were long, which could be a bit overwhelming at first, but this is easy to get used to, besides, users who don't need access to all files, don't have to see all items.

Number of choices: When asked about the number of choices they have to make to reach a file, the users said that this, again, is something you get used to very quickly. When learning to use InfoPediA, you learn where to expect certain types of items.

Consistency: The interviewees said that, while they'd never really noticed before, the interface was not very consistent. The many different screens all had a distinctly different look. When asked, they mentioned that elements are not always in the most logical place on a screen, and it is not very consistent. However, this is also something a user learns very quickly.

Discriminability between files: Discriminability was said by the interviewees to be poor. They said that often they would look for a menu item for either an XRD or XRF type of instrument and they would select the wrong one because the type of instrument was mentioned last in the menu item name. (Author's note: discriminability between "XRD" and "XRF" might be difficult anyway, especially when scanning or reading quickly.)

Experiences

Opening the wrong file

When asked if they ever opened the wrong file from InfoPediA by accident, one of the interviewees, who is not yet a very experienced user of InfoPediA, mentioned that he sometimes selects the wrong file because the names look alike, especially because the part of the name that discriminates it is at the end. Sometimes the problem emerges when the model numbers of two instruments look alike, for example when concurrently looking at information of two instrument models, the item under the wrong tree node is sometimes selected. The more experienced users said that this does not happen to them. They only might open the wrong document when they are unsure in which document the information they're looking for can be found. Another interviewee noted that in some screens the different focus elements are too far away from each other, so sometimes the wrong one is selected, particularly when multitasking (he specifically mentioned the 'XRA number' and 'description'-columns to be too far away from each other in the XRA-screen). He estimates that this happens 30% to 40% of the time.

The tree view, which is employed by InfoPediA to enable the user to find a file quickly, is filled with group or document names on every tree level. It is therefore of utmost importance that these names are meaningful to the user. The interviewees indicated that, in their opinion, the names were long, but meaningful.

Search

The users remarked that they don't use the search function of InfoPediA, as they don't trust that it is able to search in every file type that can be accessed using InfoPediA. They do, however, often use the search function inside of a document (which is provided by its default application).

Overall experience

When asked which aspects of InfoPediA the interviewees liked most, they all agreed that the speed at which a file can be accessed is the best and most important one. They agreed this is the core functionality of InfoPediA and that it is very structured, so that a file is always in the same place.

When asked about some negative aspects of InfoPediA, the interviewees mentioned the reliability of updates. They mentioned that some updates that were no longer available, were not shown in InfoPediA's interface. There was no indication the older files that were currently available in the user's installation were not the latest files. Also, when a file becomes corrupted, the application cannot open it anymore and it has to be removed manually.

Another negative point was the fact that InfoPediA tends to look cluttered with its many options and menus.

Other thoughts

While the interviewees said that they'd never really given InfoPediA much thought, they did mention they thought of it as a simple tool that is used to support their knowledge. To this affect, InfoPediA does its job very well. They would like a way to see all files related to one instrument.

Findings from an interview with an application specialist based in Almelo about InfoPediA

Version 1

On May 3 2012, I conducted an interview with a user of InfoPediA; he is an application specialist based in PANalytical's supply centre in Almelo. As a part of his job, he provides sales staff with technical support and gives demonstrations of instruments. To him, InfoPediA's main function is to provide quick access to all the sales materials a user might need. He thinks the most important aspect of InfoPediA is the fact that everything he needs is available through it.

Interviewee

- Dick Kuiper

Use

The interviewee mentioned multiple situations in which he uses InfoPediA:

- In his office.
Most of the time, the interviewee works in his office. He often has to answer questions by telephone or via e-mail.
- In the application laboratory (applab).
When demonstrating an instrument, or preparing a demonstration in the applab, the interviewee sometimes uses InfoPediA to get datasheets or other information to support the task at hand.
- At a (potential) customer's facilities.
As the interviewee is not involved in sales directly, he only uses InfoPediA at a customer's facilities during a demonstration or a presentation about an instrument.
- At home.
When working from home, InfoPediA is also used to support the tasks at hand. These are mostly the same tasks as when working in his office.

Repercussions of use

The interviewee was asked if he tends to use some files more than others. He replied that in his work, he mostly uses application notes, datasheets and product information. He indicated that in his line of work, which file he uses it is not time-dependent (like accessing distinct files often temporarily during a project).

Environment

Location

The interviewee uses InfoPediA on his own laptop computer, which he takes with him to all locations where he might use InfoPediA. Most locations where he uses InfoPediA are relatively quiet, like his office or the applab. Of course, while working at home one can expect there to be some noise. When dispatched to a client, InfoPediA is used in the facilities of the client.

Situation

When working in his office or at home, the interviewee often has to split his focus between using InfoPediA and talking on the telephone (in most cases to a sales engineer). At home, he has all the distractions of being home to contend with as well.

The applab is very quiet. There are little to no distractions here, except when performing a demonstration of a system, in which case attention will be split whenever using InfoPediA. However, the interviewee indicated that in this case he often prepares himself by pre-selecting which files will probably be useful.

When at a (potential) customer's facilities, InfoPediA is often used to get some more information about an instrument when talking to the customer. This also means that focus will be split, this is especially important because the interviewee indicated that he is also worried about accidentally disclosing classified information at this point. The interviewee indicates that he normally halts any conversation while using InfoPediA.

User interface

Style and usability

What the interviewee thinks

Concerning the style of InfoPediA's interface, the interviewee said that it looks professional, and business-like, which is to his liking. He did note, however, that he thinks the loading screen looks unprofessional. In his opinion, legibility is good. He did say the number of choices given in some of the menus is too high, this is caused, among other things, by the multiple ways a file can be accessed. To him, the application is certainly more a tool than a companion.

The interviewee indicated that he never really opens the wrong file, but he does think that in some menus it can be quite difficult to find an item quickly, as the names are very similar. He also said that to find a file, you often have to visually inspect an entire list of items, which he said could be improved by a better keyword-based search function. He did indicate that he thinks all buttons are located where he expects them to be, and the interface is quite consistent in its layout, this makes the interface an integrated whole, in his opinion. It is, however, not consistent with other applications the interviewee regularly uses, but the menu structure is very clear. Also, the names in all lists were meaningful (while they did contain some terms that are only used in-house by PANalytical).

What the client might think (according to the interviewee)

Many of the things the interviewee said about the style of the application were, in his opinion, in line with the opinion of a client that might see InfoPediA running on an employee's computer. The interviewees thought the application made them look more professional in comparison with a competitor. He also thinks InfoPediA might help selling instruments, both because of the professional look and the easy way in which a sales engineer can react when a client mentions another sales opportunity. The interviewee stated that he thinks the client sees that the application is only a tool for the sales engineer. It does, however, look more of a Windows application than a PANalytical application, due to its interface structure.

Other thoughts

The interviewee said that he does not like the fact that the updating module does not give much feedback, and there is no easy way to see when a file was last updated in a list, or show a list of the files that were last updated. Also, he would like access to older files, especially to files from an older

type of instrument, as sometimes this might be very welcome to his job (especially datasheets and application notes).

Appendix D: User survey

InfoPediA user survey

Thank you for taking the time to answer a few questions about your experiences with the InfoPediA software.

PANalytical is currently looking into redesigning the InfoPediA user interface from a user centered point of view. To this end, a redesign will be considered on three platforms: Windows, iPad and BlackBerry. One or more of these platforms will run future versions of InfoPediA. Any insights you can give will aid the design, improve your user experience and help decide which device you will be using InfoPediA on in the future.

About you

1. What is your business email address?

This is only used to verify you are part of the target group. Your answers will be treated confidentially

2. What is your age?

- ☐ Less than 30 years old
- ☐ 30-39 years old
- ☐ 40-50 years old
- ☐ More than 50 years old

3. What is your gender?

- ☐ Male
- ☐ Female

4. Since how long do you use InfoPediA?

- ☐ Less than 6 months
- ☐ Between 6 months and 1 year
- ☐ Between 1 and 2 years
- ☐ Between 2 and 5 years
- ☐ More than 5 years

5. How much of your working time is spent using InfoPediA or the files it supplies?

- ☐ Less than 5%
- ☐ Between 5% and 15%
- ☐ Between 15% and 35%
- ☐ Between 35% and 75%
- ☐ More than 75%

6. What is your main reason for using InfoPediA?

- ☐ I'm a customer support engineer (go to question 9)
- ☐ I'm a customer support specialist (go to question 9)
- ☐ I'm not a PANalytical employee, but I service their products (go to question 9)
- ☐ I'm a sales agent (go to question 9)
- ☐ I'm a sales engineer (go to question 9)
- ☐ I'm an application specialist (go to question 9)
- ☐ I'm not a PANalytical employee, but I sell their products (go to question 9)
- ☐ Other (go to question 7)

7. What is your job description?

8. Which version of InfoPediA do you use most?

- Sales InfoPediA
- Customer Support InfoPediA
- Agent Sales InfoPediA

InfoPediA usage environment

In this section, we will investigate the environment in which InfoPediA is used.

9. How often do you use InfoPediA in the following situations?

	(Almost) Never	Sometimes	Often	Very often
In your office	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In a laboratory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While traveling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a client's facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. How often do you undertake these activities while using InfoPediA?

	(Almost) Never	Sometimes	Often	Very often
Talking on the phone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Talking to the customer in person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Talking to someone else in person	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reading e-mails	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surfing the internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diagnosing an issue ⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. Which of these platforms would you prefer to use InfoPediA on for your specific needs? Assume the interface will be (re)designed specifically for this platform

- A laptop computer (Windows)
- A desktop computer (Windows)
- A tablet computer (iPad)
- A smartphone (BlackBerry)

InfoPediA's user interface

In this section, we will investigate what you think of the current user interface of InfoPediA

12. How would you grade the following properties of InfoPediA?

	Extremely bad					Perfect				
Overall	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
User interface	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. How often do you use InfoPediA for the following activities?

	(Almost) Never	Sometimes	Often	Very often
Installing an instrument ⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diagnosing an issue with the customer's instrument ⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

While instructing a client about their instrument ⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Presenting an instrument to a (potential) customer ⁱⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When preparing for a visit to a customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While giving support over the telephone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. Do you use InfoPediA on more than one computer system?

- ☐ Yes, on more than 5 systems
- ☐ Yes, on 3-5 systems
- ☐ Yes, on 2 systems
- ☐ No

15. To what extent do you agree with the following statements?

	I strongly disagree	I disagree	I agree	I strongly agree
InfoPediA is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA is reliable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All text in InfoPediA's user interface is easily legible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The number of items and choices shown on a single screen is too high	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The text on menu items is too long	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Different items look alike in the list view	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA helps me find what I'm looking for	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA leads me when I'm searching for a file	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interface elements are always in the place where I expect them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All screens in InfoPediA have a consistent user interface	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The user interface of InfoPediA is consistent with other applications I use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All items have meaningful names	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are only a limited number of files I access regularly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often want to see all files related to a given instrument type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tend to use service manuals much more often than other files ⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often select which files I think I may need in advance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Older files are often removed too soon from InfoPediA ⁱⁱ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I always read the messages published in the message board on InfoPediA's main menu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. How often do the following issues occur when using InfoPediA?

	(Almost) Never	Sometimes	Often	Very often
Opening another file than you wanted to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being sure which is the file you want from the list	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clicking another button than you wanted to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Performing an action, getting a different result than expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. How would you classify InfoPediA's user interface?

Warm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cold
Functional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Stylish
Professional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Homely
Friendly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Fierce
As a companion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	As a tool
As a leader	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	As a follower
PANalytical's style	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Windows' style
An integrated whole	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Inconsistent
Up-to-date	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Out-dated
User-centred	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Technology-centred

18. What is, in your opinion, the most important function of InfoPediA?

- ☐ To enable me to find the file I'm looking for quickly
- ☐ To help me when fixing an instrument ⁱ
- ☐ To present the instrument in an appealing way ⁱⁱ
- ☐ To present a comparison of instruments ⁱⁱ
- ☐ To enable me to access all the files I need
- ☐ To compare an instrument with a competitor's product ⁱⁱ

InfoPediA and the client

In this section, we will investigate how a client may regard InfoPediA

19. How often does a (potential) customer see InfoPediA's user interface?

- ☐ (Almost) never
- ☐ Sometimes
- ☐ Often
- ☐ Very often

20. If/when a (potential) customer (would) see(s) InfoPediA, would you be worried about accidentally disclosing classified information?

- ☐ Absolutely not
- ☐ Perhaps
- ☐ Probably
- ☐ Certainly

21. If/when a (potential) customer (would) see(s) InfoPediA, how would this influence his/her opinion of PANalytical in the following aspects?

	Strongly deteriorate	Deteriorate	Improve	Strongly improve
Professionalism	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trust	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Appeal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Up-to-date	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Well-organized	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Updating module

In this section, we will investigate what you think of the current updating module of InfoPediA

22. To what extent do you agree with the following statements, in regard to InfoPediA's updating module?

	I strongly disagree	I disagree	I agree	I strongly agree
InfoPediA's updating module is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA's updating module is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA's updating module is reliable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
InfoPediA's updating module gives clear information about what it's doing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Remarks

23. Do you have any more remarks about InfoPediA that you would like to add?

ⁱ Customer support users only
ⁱⁱ Sales and Agent sales users only

Appendix E: User survey results

Results – InfoPediA user survey

By Marten Jacobs

Version 0.2

Users

- Of the 213 responses to the survey, 191 were completely filled in.
- Respondents had the following jobs:
 - 101 worked in customer support
 - 74 Customer support engineers
 - 24 Customer support specialists
 - 3 Customer support agents
 - 55 worked in sales
 - 1 Sales agent
 - 43 Sales engineers
 - 11 Application specialists
 - 35 Others
 - Of these, 26 responses were rejected, because the respondents did not fit into the target group, mainly because they tend to be content providers, who were explicitly excluded from the project at an early stage.
- The average age of users is around 44 years old
 - Sales users tend to be a little older than customer support users
- Users are overwhelmingly male, with only 8 users (3% of customer support and 8% of sales) being female
- A user has, on average, 4.4 years of experience with InfoPediA
 - Sales users average 3.6 years
 - Customer support users average 4.9 years
- Users spend, on average, 20.5% of their time using InfoPediA or the files it supplies.

Places of use

- Most users tend to use InfoPediA in their office. 73% of users say they do this often. Sales users use InfoPediA more in their offices than Customer Support users.
- Sales users do not regularly use InfoPediA in a laboratory, Customer Support users tend to do this more often, but still only 46% of customer support users say they do this often. Only 10% of sales users say the same.
- 80% of users say they use InfoPediA while traveling, but only 38% say they do this often.
- 68% of customer support users say they use InfoPediA often at a client's facilities, against 36% of sales users. However, 88% of users say this happens at least sometimes.
- Sales users strongly disagree on home use. 23% say they never do it, but about the same percentage say they do it very often. Customer support users mostly agree that it happens sometimes or regularly.

Activities while using InfoPediA

- While customer support users tend to talk on the telephone more while using InfoPediA, Both groups agree that it only happens sometimes. 87% of users indicated that it happens at least sometimes.
- When asked if they use InfoPediA while talking to the client, customer support users tend to agree that it happens sometimes, but not very often. Sales users' answers differ, but most (40%) say that it happens sometimes. 81% of users agree that it happens at least sometimes.
- Talking to someone else happens a bit less, especially to sales users (of which 27% say it never happens). Of customer support users, 31% say it happens often.
- Most users (81%) indicate they use InfoPediA at least sometimes while reading emails. 37% say it happens often.
- InfoPediA is not used regularly while surfing the Internet. While 40% of users say it happens sometimes, the same amount of users say it never happens. Only 11% of users say it happens often.
- Customer support users were also asked if they used InfoPediA while diagnosing an issue. Of the respondents, 82% indicated they did this often or very often.
- When asked if they use InfoPediA while undertaking another activity than the ones asked before, 19% of users said they did this very often. A follow-up may be in order to find these activities.

Tasks for which InfoPediA is used

- 85% of customer support users indicated they use InfoPediA for installing an instrument at least sometimes. 55% say this happens often.
- Even more customer support users (94%) say it's used for diagnosing an issue on a client's instrument. 78% say it happens often.
- 80% of customer support users say they use InfoPediA for instructing a client about his instrument. 40% say it happens often.
- Users indicated that they use InfoPediA to prepare a visit to a client. Sales users do this more often than customer support users (79% and 55%, respectively, say this happens often).
- Most users say they also use InfoPediA for giving phone support. Sales users tend to do this a little bit less. 94% of users indicate this happens at least sometimes, 60% say it happens often.

What users think of InfoPediA

User experience

- Most users agree that:
 - InfoPediA is easy to use (90%)
 - InfoPediA is easy to learn (90%). It was tried to get more information about this by breaking down the result by experience time and user age, but this yielded no results.
 - Using InfoPediA is effective (90%)
 - InfoPediA is reliable (77%)
 - All text in InfoPediA is easily legible (83%)

- Labels on menu items are not too long (77%)
 - InfoPediA helps the user when trying to find a file (85%)
 - InfoPediA has a consistent user interface (77%)
- About half of all users (52%) say that InfoPediA is fast. Only 13% of users have a strong opinion about this either way. Sales users tend to be more critical than customer support users, agreeing 45% of the time against 56%. A weighted average shows that the group opinion only differs 1% from neutral. This is likely to mean that users are unsure about this.
- Users are mostly of the opinion that there are not too many choices and items (66%).
- When asked if they think different menu items look alike, users are unsure. Only 5% have a strong opinion either way. Most (57%) tend to agree, but this is probably because people tend to agree when they're presented with a choice in which they have no opinion.
- When asked if InfoPediA leads them when searching for a file, 56% agrees. However, when looking at a weighted average (in which users who have a strong opinion are weighted more), the group opinion is neutral, we can therefore assume users are unsure about this question.
- When asked if they think all interface elements are placed where they're expected, sales users tend to answer negatively more than customer support users. Customer support users are mostly neutral, but sales users tend to disagree 66% of the time.
- Users are unsure about the question if InfoPediA's user interface is consistent with other applications. While 52% disagrees, most users do not have a strong opinion either way.
- Customer support users tend to say all items in InfoPediA have meaningful names (71%). Sales users are less sure, agreeing 53% of the time, but scoring almost neutral in a weighted average.

User interface

- Users tend to classify InfoPediA's user interface in the following way:
 - Warm
 - Functional
 - Professional
 - Friendly
 - Tool
 - PANalytical's style
 - Integrated whole
 - Up-to-date
- Users are unsure about classifying InfoPediA in the following categories:
 - A leader or a follower
 - User-centered or technology-centered

What users say about their relation to InfoPediA

- Of customer support users, 82% indicate they tend to use mostly service manuals.
- 82% of all users say they want to see all items for a given instrument type.
- When asked if they use only a limited number of files regularly, users answer neutrally.
- Sales users often select files in advance (84%). Customer support users tend to do this less (59%).

- Sales users were also asked if they thought old files were removed too soon from InfoPediA. The group answered neutrally to this question. A break-down by job description did not shed more light on these results. A break-down by user age showed that older users (older than 40), tend to agree more often than younger users (59% against 40%).
- About half of all users (55%) indicate they always read messages posted on the message board.

Client

- When asked if the client ever sees InfoPediA, most users (63%) say this almost never happens, while 30% of users say this only happens sporadically.
- 41% of users say they would be worried about disclosing classified information if a client sees InfoPediA.
- When asked how InfoPediA would influence a client's opinion about PANalytical, the users said it would improve their thoughts on: **When given a choice to agree or disagree**
 - Professionalism (96%)
 - Trust (96%)
 - Appeal (84%)
 - Efficiency (90%)
 - Service/Product quality (92%/83%)
 - Up-to-datedness (87%)
 - Well-organizedness (89%)

Issues

- 65% of users say they at least sometimes open the wrong file, but only 20% say this happens often.
- 35% of users say they are often unsure about which file they want. This happens more often to sales users (42%). 19% of sales users say this happens very often.
- Clicking the wrong button does not happen regularly. Only 9% of users say this happens often to them.
- The same can be said about getting an unexpected response to an action. 12% of users say this happens often to them.

Updating

- Most users agree that InfoPediA's updating module is easy to use (77%)
- 66% of users do, however, think it is slow
- It is unclear how users think about reliability. While 56% of users agree that it is reliable, a weighted average shows a small (2%) deviation in the other direction. This means that relatively many users (14%) think it is very unreliable.
- Users disagree about the clarity of information given by the updating module. 61% of users agree that the information is clear, but 10% strongly disagree.

Other facts

Preferred platform

Users were asked on which platform they would prefer to use InfoPediA. They were given a choice between a laptop computer, a desktop computer, a tablet computer and a smartphone. Both user groups agree that both the laptop and the tablet are the best options. However, while sales users prefer a tablet to a laptop (52% against 42% respectively), customer support users strongly prefer the laptop (65% against 30%).

Scoring the current version

Users were asked to both score InfoPediA as a whole and its user interface separately. As the scoring was on a range of 1 to 9, the 50% (pass) score is a 5. Overall, InfoPediA scored 7.0 and its user interface a 6.2. Sales users tend to be a bit more critical, scoring InfoPediA 6.9 overall and 5.8 for its user interface.

Number of computers used on

Users overwhelmingly indicated that they use InfoPediA on only one computer (93% of sales users and 79% of customer support users). Most of the users that use it on more than one system use it on two (7% of sales users and 11% of customer support users). No sales users use it on more than 2 systems. There are, however, a few customer support users who use InfoPediA on more than 5 computer systems. A follow-up may be helpful to find out what the reason for this is.

Most important function

Users were asked to pick the function they deemed most important from a list. The list consisted of the following functions:

- To enable me to find the file I'm looking for quickly
- To present the instrument in an appealing way
- To present a comparison of instruments
- To enable me to access all the files I need
- To compare an instrument with a competitor's product
- To help me when fixing an instrument

Sales users agree the most important functions are 'To enable me to find the file I'm looking for quickly' and 'To enable me to access all the files I need' with 94% of users distributed evenly among them. Customer support users mostly say 'To enable me to find the file I'm looking for quickly' and 'To help me when fixing an instrument' are most important, with 73% of users split evenly. 26% of customer support users said 'To enable me to access all the files I need' was most important.

Appendix F: Product requirements

Design brief v0.4

Product requirements InfoPediA-next

User requirements

- The product is usable everywhere a user might want to:
 - In offices (with an Internet connection)
 - In laboratories (with or without an Internet connection)
 - While traveling (with an unreliable Internet connection, or without one)
 - At a client's facilities (with or without an Internet connection)
 - At home (with or without an Internet connection)
- The product does not require the user's complete concentration, it can be used while:
 - Talking on the phone
 - Talking to someone in person
 - Reading emails
 - Diagnosing an issue with a client's instrument
- The product supports the user in his or her tasks:
 - Installing an instrument
 - Diagnosing an issue with an instrument
 - Instructing a client about an instrument
 - Preparing a visit to a client
 - Give phone support
- The product is easy to use and useful
 - Evaluate this with the methods put forth by (Keil, Beranek, & Konsynski, 1995), (Segars & Grover, 1993), (Adams, Nelson, & Todd, 1992) and/or (Davis, 1989)
 - Using the product is effective (all information that is available in the current version can be accessed)
 - The product supports the user's tasks
 - The product's user interface is clearly organized
 - The buttons in the user interface are placed in compliance with the device's Human Interface Guidelines
 - Behaviour of buttons is very predictable
 - The user gets a clear 'sense of location'
- The product is easy to learn (elements are placed where they're likely to be expected, the expected location can be found in other applications on the platform)
 - No training needed for efficient use
- The product is reliable (less than 1 crash per 1000 files opened)
- The product is fast (information can be reached at least as fast as in the current version by an experienced user)
- All text in the product's user interface is easily readable, also when attention is split, this means:
 - Easy to understand language
 - Good contrast

- use the method put forth by (Dale & Chall, 1948) or (Gunning, 1969) to determine grade-equivalent, this should not be higher than 10 for any text.
- All text in the product's user interface is meaningful to the user
- The product provides customer support users with quick access to service manuals, XRA's and circular messages.
- The product provides all users with an overview of items per instrument type
- The product enables the user to select information in advance and recall it quickly.
 - Certain information should also be editable to the user's needs
 - Other information should be protected
- The product should be clear about the contents of information packets
 - The following attributes should at least be conveyed to the user:
 - Title
 - Description
 - Last update
 - Version
 - Privileges
- The updating module should be as fast as possible
 - Maximize score in this formula, scoring at least 75:

$$100 - \frac{5}{900} \cdot (n) \cdot \left(t^{\frac{1}{2}}\right) \cdot (190 + r) \cdot \left(4.6 - \frac{4}{100}d\right) \cdot \left(\frac{9}{10} - \frac{2}{10}b\right)$$

Where:

 - n= Number of updates per month
 - t= Average time taken per update (in seconds)
 - r= Percentage of a file that has to be re-downloaded after connection lost at 90%
 - d= Dependability (% of files fixed after connection lost)
 - b= Background factor:
 - Updating blocks use of the software → 1
 - User must always allow update, rest in background → 2
 - User must sometimes allow update, rest in background → 3
 - No user interaction required at all → 4
- The updating module should be reliable
 - Less than 1 error per 1000 downloads, excluding connections lost due to external factors
- The updating module should give clear information
 - Show which items were updated when
 - Version updates should provide data about what was updated
 - Show available updates beforehand

Corporate identity requirements

- The product fits in well with PANalytical's corporate style
 - The EBL manual PANalytical GUI design should be consulted wherever possible
- The product looks professional, simple, smart and up-to-date to a customer

Technical requirements

- Bandwidth needed for updates is minimized

- Max. 20% more than the absolute uncompressed minimum is used
- All connections and data transfers are secured
 - Compliant with PANalytical security policy
- As many of the current or already planned aspects of the network infrastructure as possible should be used
 - Example: Distributed VPN can be used to get access to distributed file servers
 - Extranet login should be used for agents
- As much of administration work as possible can be automated
 - Installation can be performed unattended
 - Information sources can publish information directly to the product
 - Updates to information can be performed without any administrator interaction

Management requirements

- Updates are performed as quickly as possible (within 10 working days after a file is released)
- A user should be warned when he is using an old data packet
- The new version can be easily rolled out.
 - Accessible to all users
 - Can be installed without IT support
- User access can be withdrawn within 5 working days
- Information should be secured against stealing

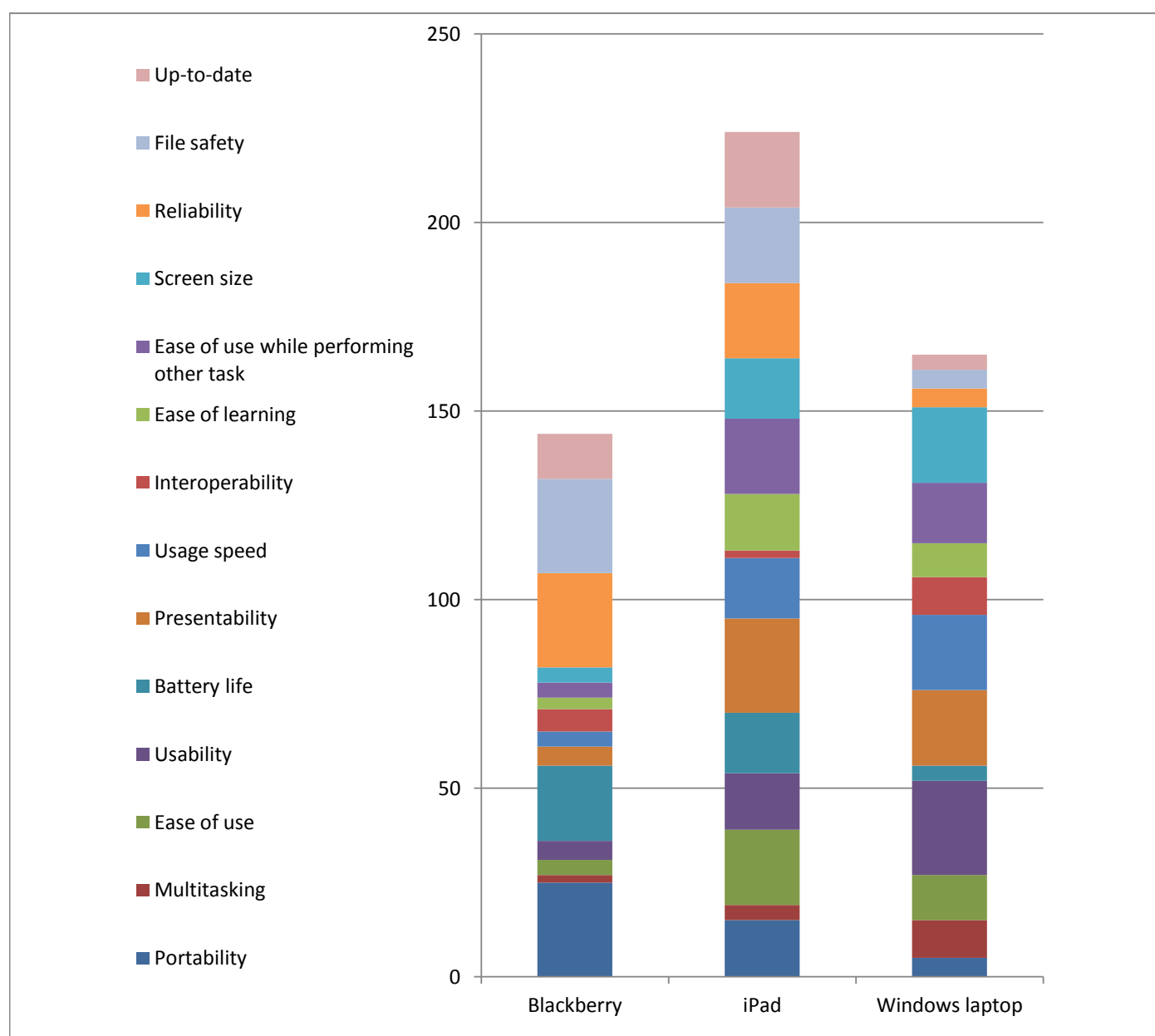
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Appendix G: Comparison of platforms

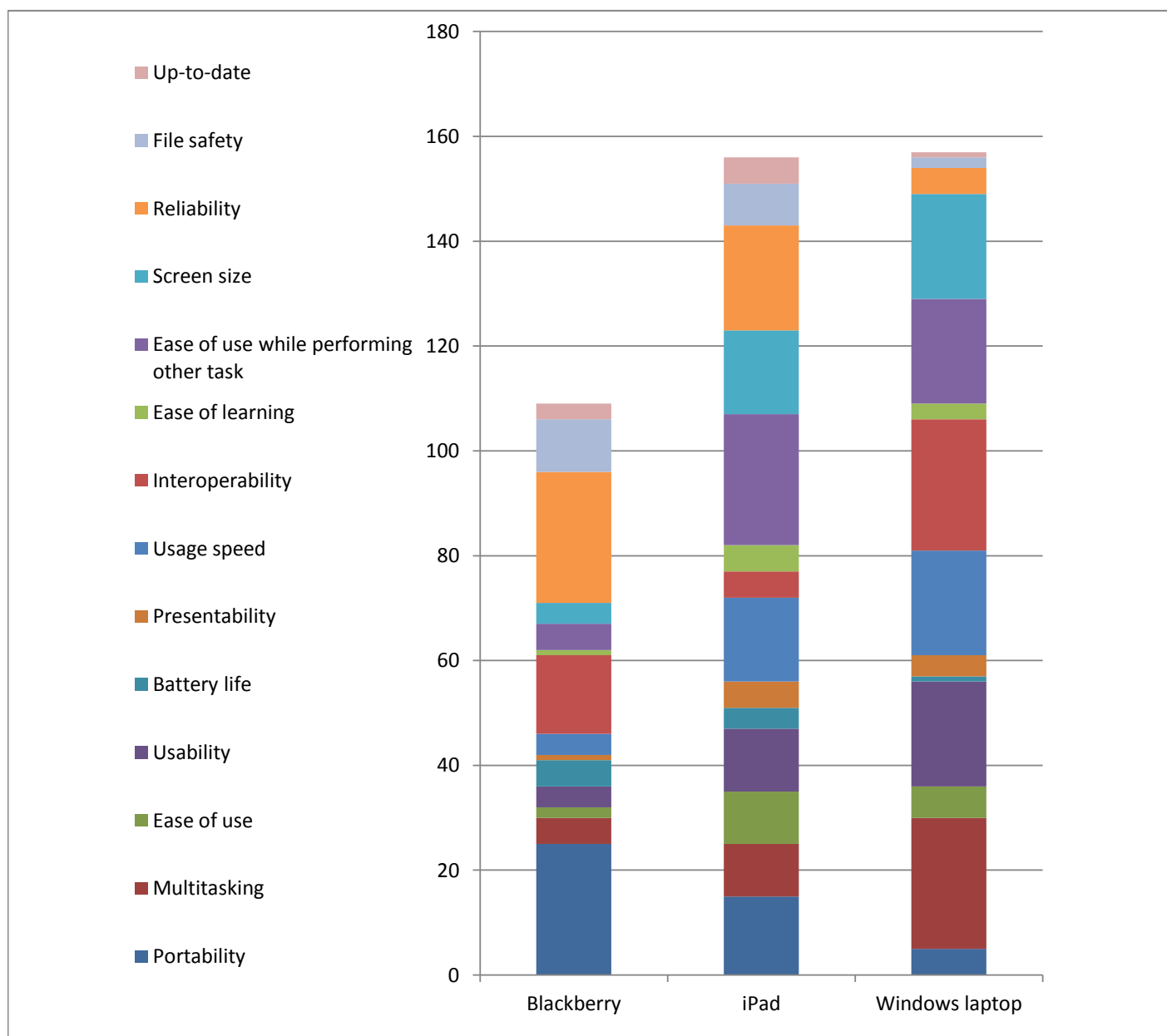
Comparison for Sales users

		Blackberry	iPad	Windows laptop
Example device type		BlackBerry Torch 9860	Apple iPad 3G (3 rd generation)	Dell XPS 15z
Operating system		BlackBerry OS 7	iOS 5	Windows 7
Device comparison	Weight	Points		
Portability	5	5	3	1
Multitasking	2	1	2	5
Ease of use	4	1	5	3
Usability	5	1	3	5
Battery life	4	5	4	1
Presentability	5	1	5	4
Usage speed	4	1	4	5
Interoperability	2	3	1	5
Ease of learning	3	1	5	3
Ease of use while performing other task	4	1	5	4
Screen size	4	1	4	5
Reliability	5	5	4	1
File safety	5	5	4	1
Up-to-date	4	3	5	1
Weighted total		144	224	165



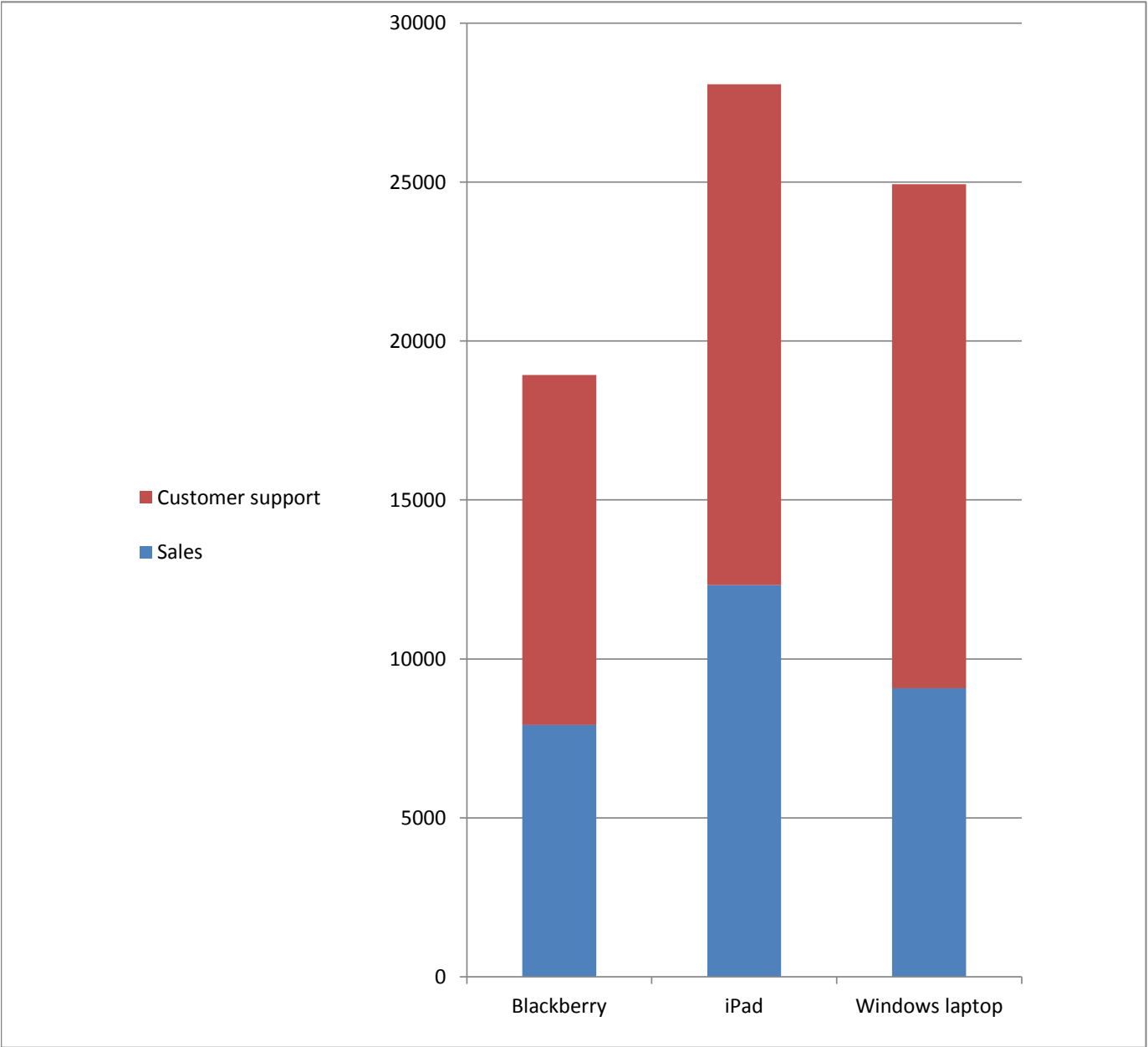
Comparison for Customer Support users

		Blackberry	iPad	Windows laptop
Example device type		BlackBerry Torch 9860	Apple iPad 3G (3 rd generation)	Dell XPS 15z
Operating system		BlackBerry OS 7	iOS 5	Windows 7
Device comparison	Weight	Points		
Portability	5	5	3	1
Multitasking	5	1	2	5
Ease of use	2	1	5	3
Usability	4	1	3	5
Battery life	1	5	4	1
Presentability	1	1	5	4
Usage speed	4	1	4	5
Interoperability	5	3	1	5
Ease of learning	1	1	5	3
Ease of use while performing other task	5	1	5	4
Screen size	4	1	4	5
Reliability	5	5	4	1
File safety	2	5	4	1
Up-to-date	1	3	5	1
Weighted total		109	156	157



Weighted total

		Blackberry	iPad	Windows laptop
Example device type		BlackBerry Torch 9860	Apple iPad 3G (3 rd generation)	Dell XPS 15z
Operating system		BlackBerry OS 7	iOS 5	Windows 7
Device comparison	Weight	Points		
Sales	55	144	224	165
Customer support	101	109	156	157
Weighted total		18929	28076	24932

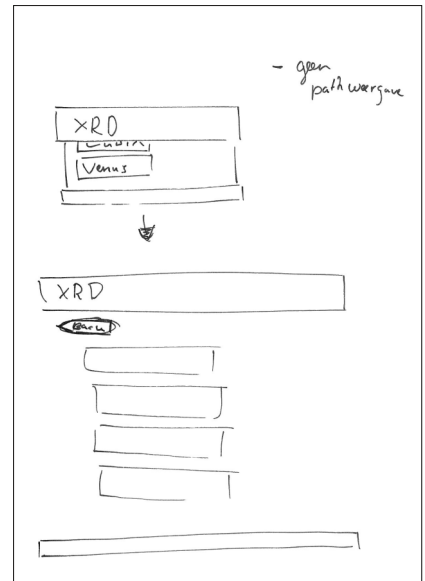
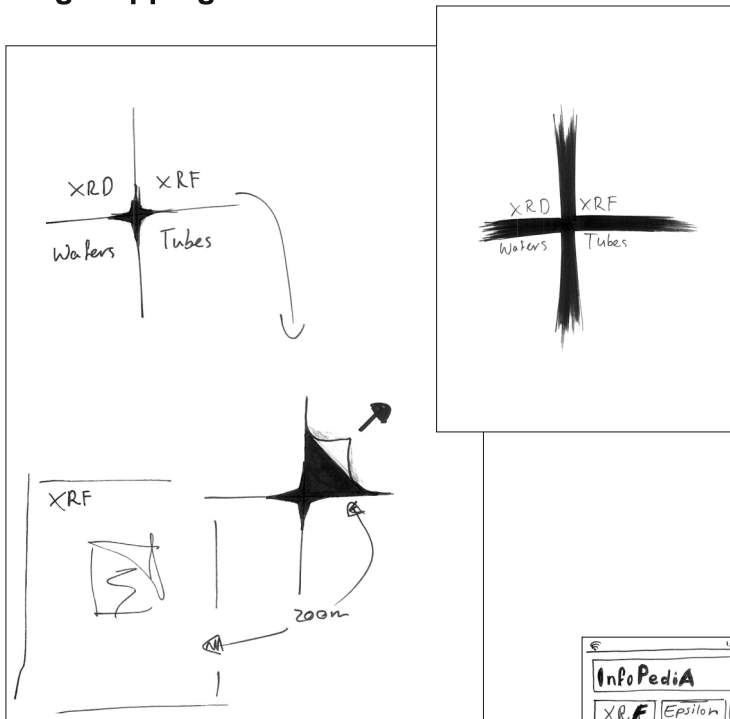


Appendix H: Idea sketches

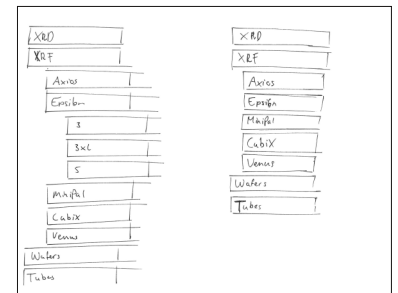
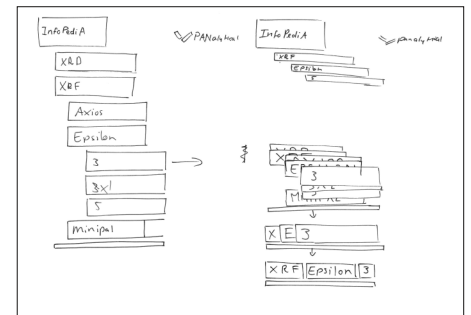
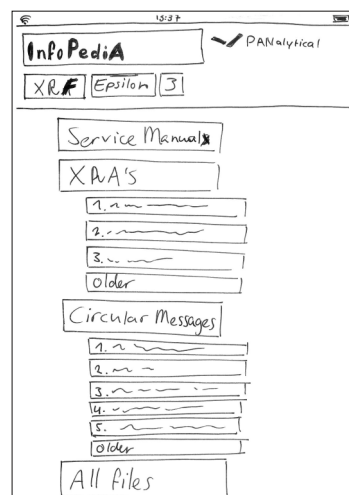
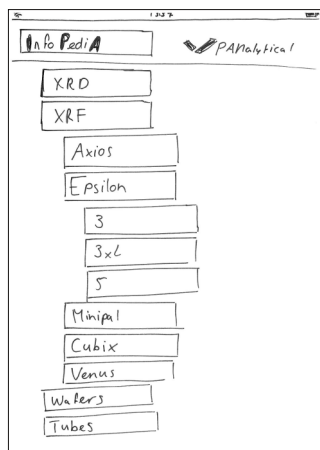
A selection of ideas

Sliding out

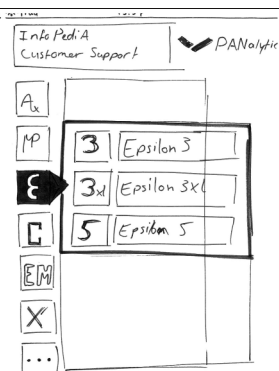
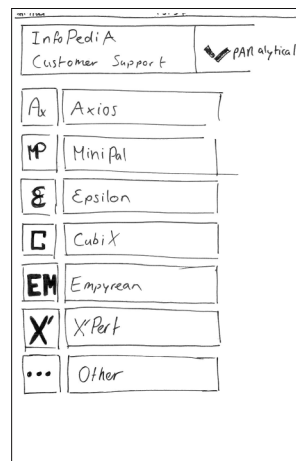
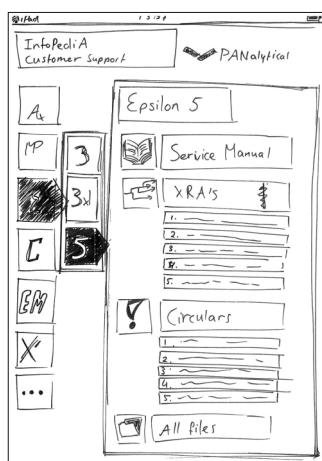
Page flipping



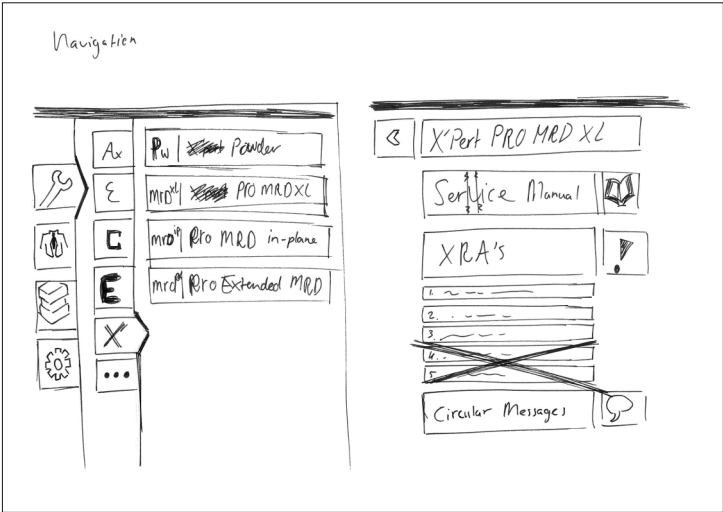
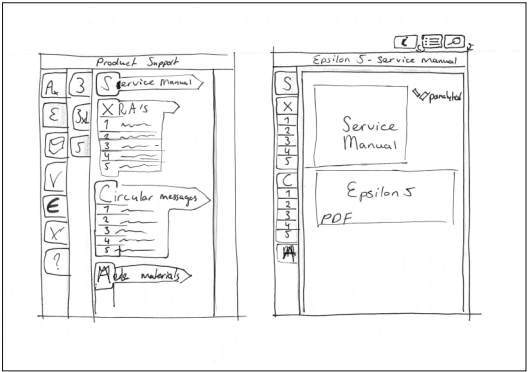
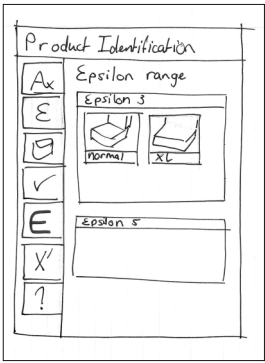
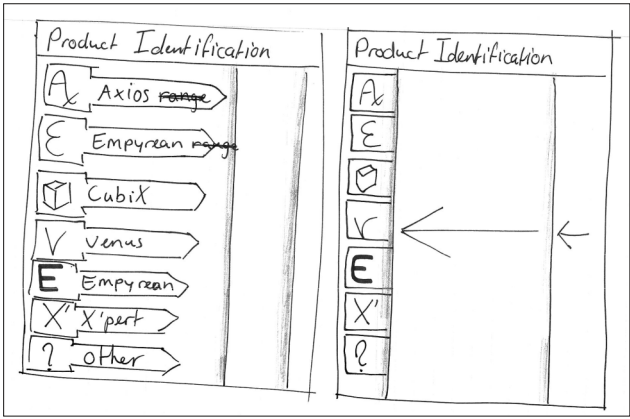
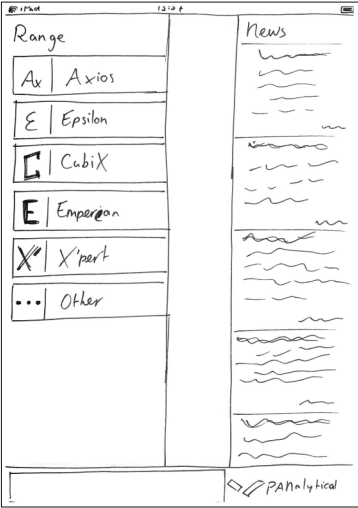
Tree-view type menus



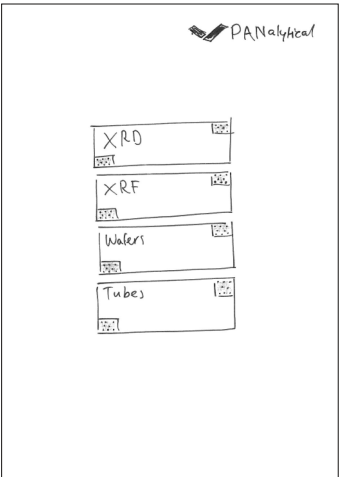
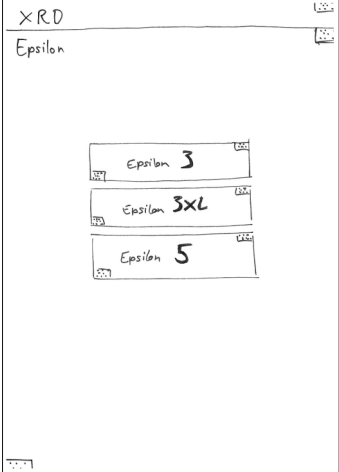
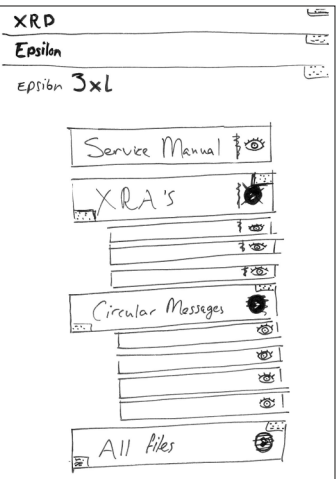
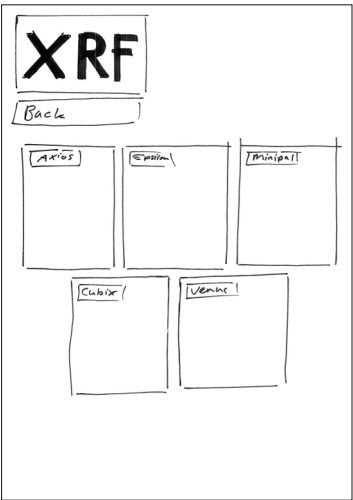
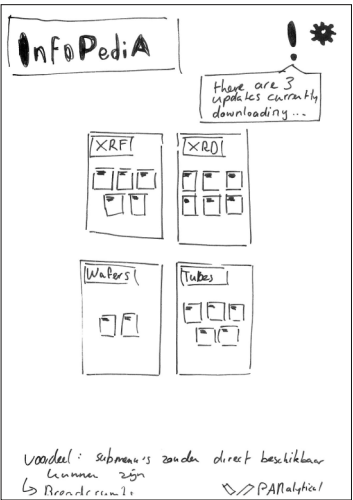
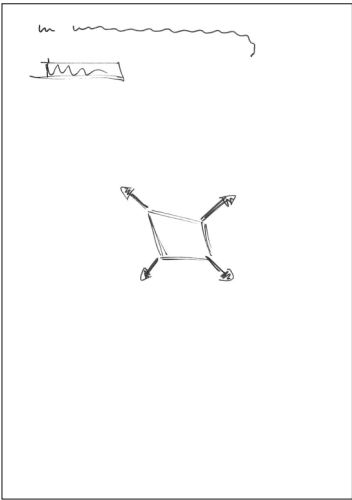
Basic submenus



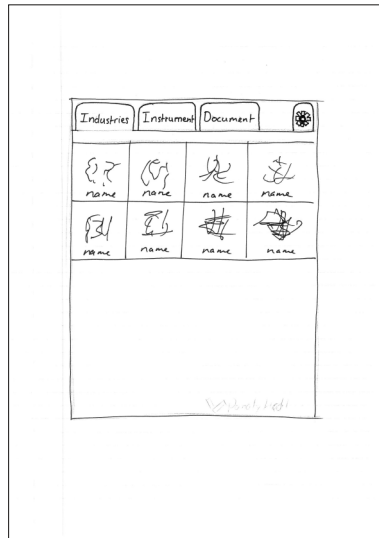
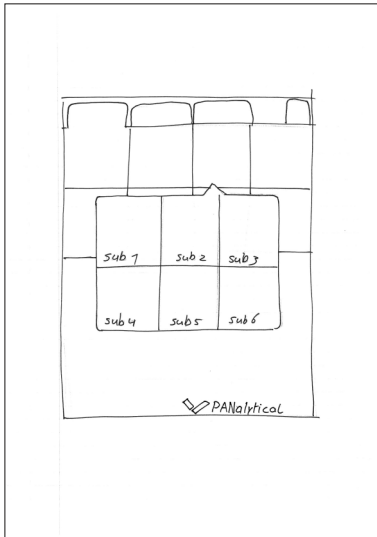
Sliding menus



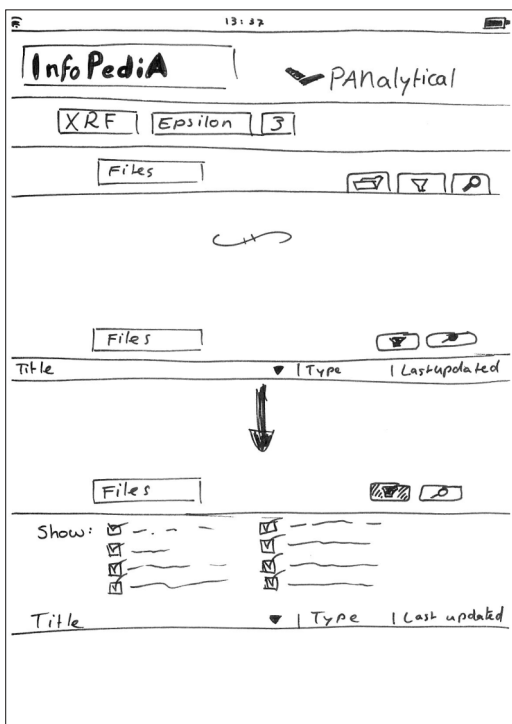
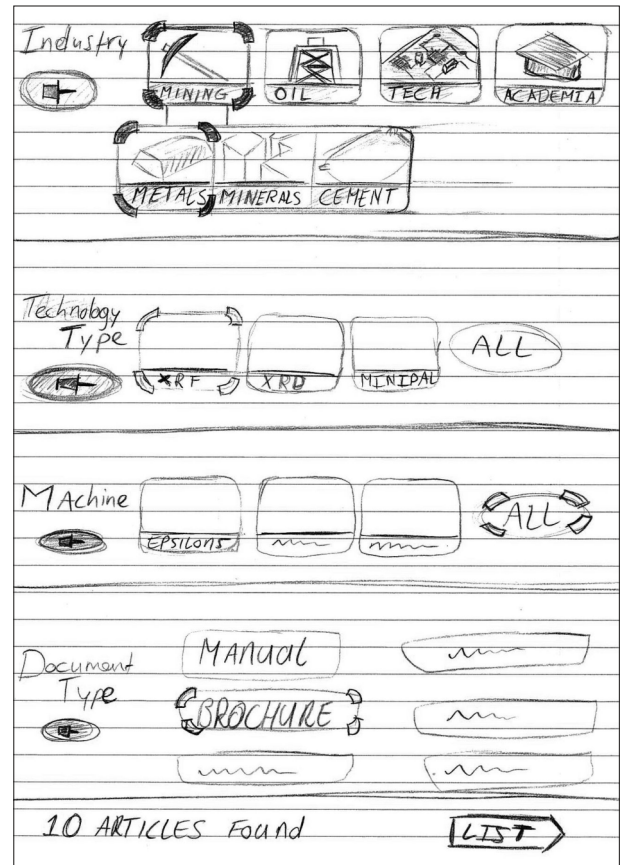
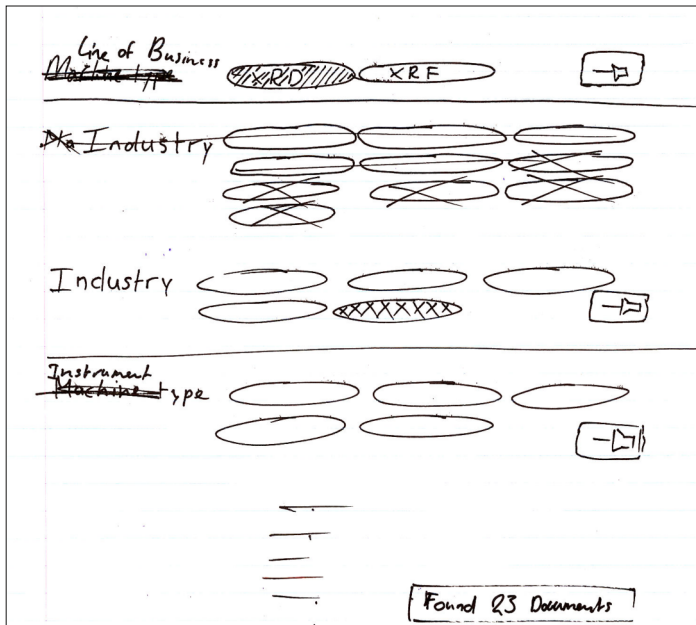
Zooming



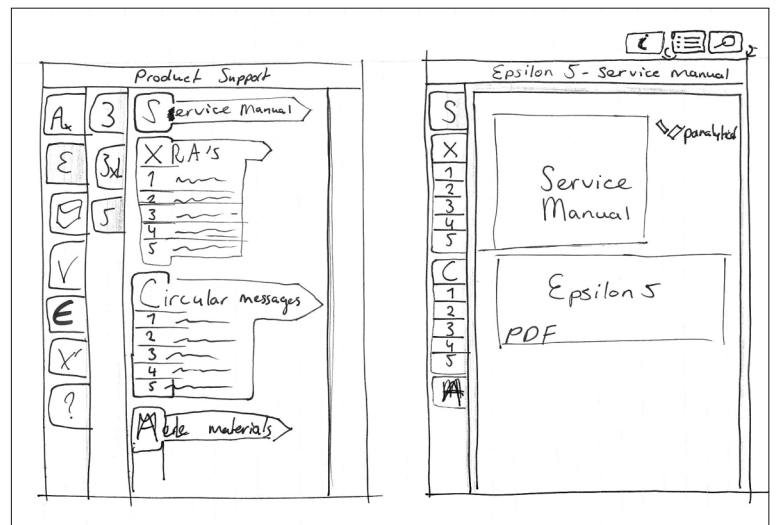
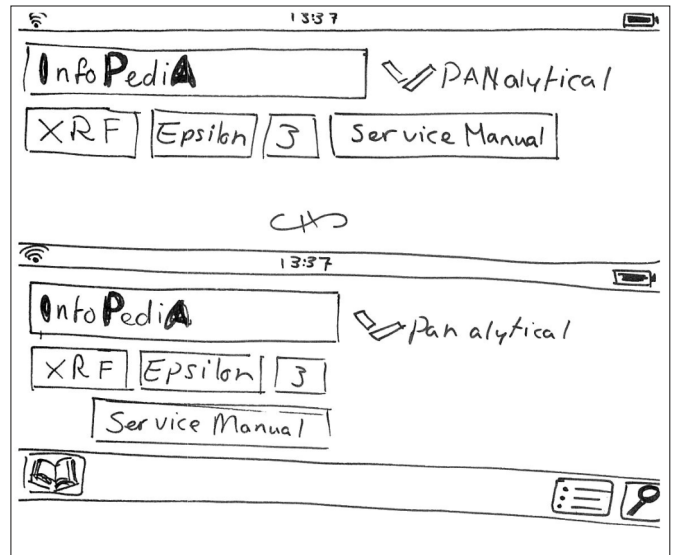
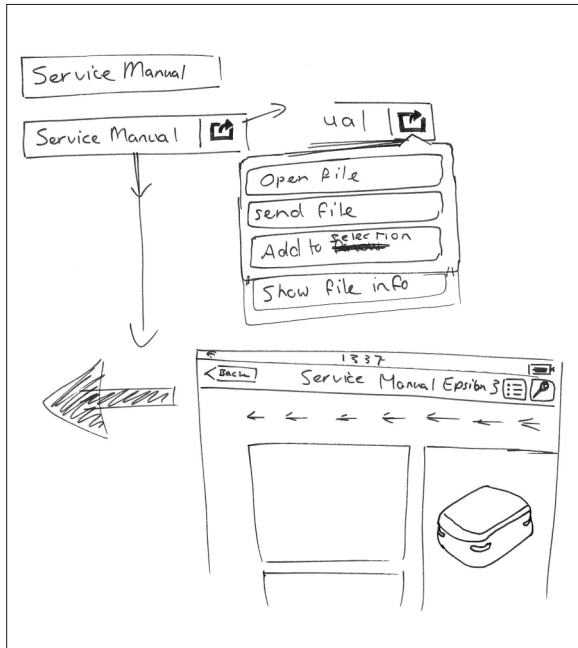
Popover menus



Filter based



File viewing



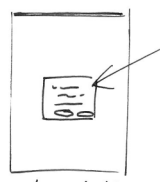
Epsilon 5 - All support materials			
	Name	relevant system	date
S			
X			
1			
2			
3			
4			
5			
C			
1			
2			
3			
4			
5			
A			

Cubix PRO - Service Manual	
S	
X	
1	
2	
3	
4	
5	
C	
1	
2	
3	
4	
5	
A	

InfoPedia		
PANalytical		
XRF Epsilon 3		
Title	Type	Last updated
	XRA	2012-03-05
	XRA	2012-09-18
	Circular	2010-01-27
	Brochure	2009-02-14
	Presentation	2011-08-07
	Datasheet	2011-12-10
	Service Manual	2010-11-30
	Datasheet	2003-06-20
	Circular	2012-07-05
	Tech. specs	2004-01-01
	System tree	2010-01-30

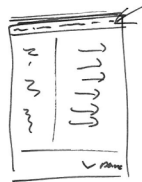
Updating

Ways of update announcing



when starting

- + ~~high~~ high response
- annoyance
- longer start time
- clicking no becomes automation.
- only visible on start



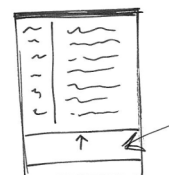
announcement bar

- + non-intrusive
- low response
- disappears



start automatically

- + high 'response'
- + non-intrusive
- no user control
- high data usage (perhaps on mobile networks)



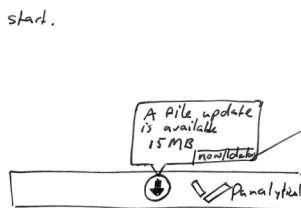
non-removable bar that increases in size

- + starts non-annoying
- + gets annoying ~~when~~ ignored
- + cannot be ignored for too long
- could look unprofessional

(perhaps only for files smaller than 0,5 MB?)

(perhaps only when on LAN?)

When an entire update (the sum of all files) is smaller than 10 MB, updates are performed without user interaction. otherwise, a user can ~~delay~~ delay for five days, after which the update will be performed the next time a WiFi connection is available. They will be reminded of these updates on every application start.

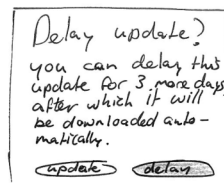


update

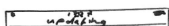
→ green: this is the 'correct' choice when clicked, no further messages, this should be the easy choice

delay

→ red: this is the 'wrong' choice when clicked: ask for confirmation, showing how many days the update can be delayed, this should be a more difficult choice.



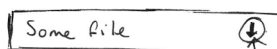
Automatic updates (when on WiFi)



show that updates are being performed

→ Update status: currently running **stop**

give possibilities for stopping running updates.



show that a file is currently being updated.

By running updates in a non-intrusive manner (~~only when~~ while allowing the user to use the application), resistance to updating can be minimized.

Appendix I: Task-oriented user interface design

Task oriented interface design for InfoPediA

Marten Jacobs, University of Twente, commissioned by PANalytical B.V.

Version 0.1

What is task oriented interface design in software development?

As the name suggests, task oriented interface design recognizes the higher goals of a user when using an application and makes these central in the user interface design. Task oriented design is therefore a sub type of user-centered design. This means the developer has to investigate his target group in detail before he starts developing the application. Every task a user is likely to perform using the application must be explicitly acknowledged and supported by the application. To make the application as light-weight as possible (to enable the task to be carried out quickly) the application should support very little besides these tasks. This approach to user interface design is especially beneficial when the tasks performed using the application are easy to group into few (less than about 10) decision trees, and decision trees are fairly shallow (normally not more than 5 steps deep, excluding the home step and taking into account that a user might start at another point in the tree than the root).

What steps should be taken?

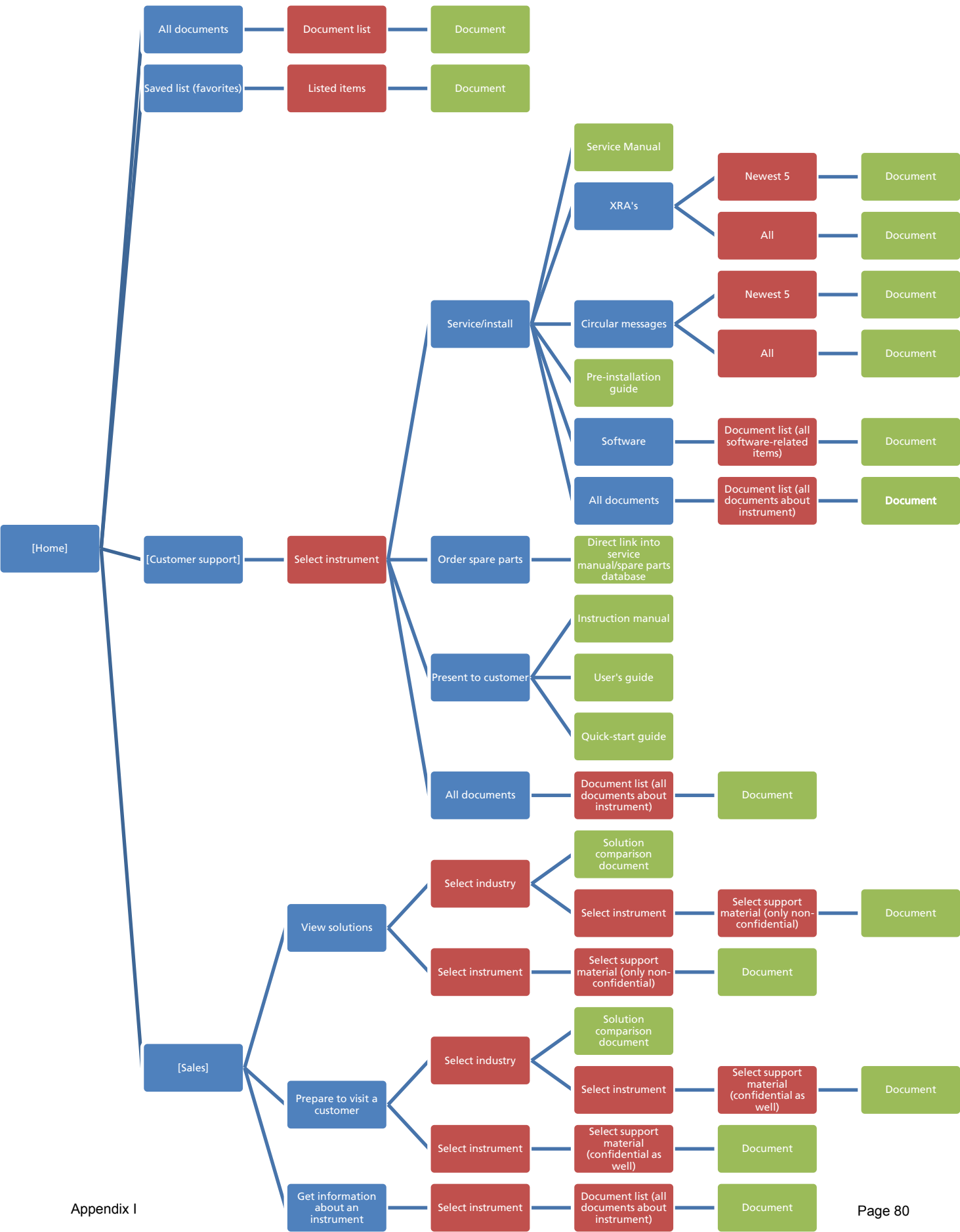
1. Compile an exhaustive list of user tasks based on user interviews, surveys and expert interviews
2. Ask users if there are any other tasks they might want to add
3. Determine which activities may coincide with the usage of this software
4. Determine the amount of free working memory the user has available to the application. For this, see Wickens, Lee, Liu, & Becker, 2004.
5. Create a decision tree that encompasses the choice flow the user could make in as few levels as possible, making sure every level contains a number of outputs that preferably fits into the user's working memory. Of course, you may have to balance the choice size and the level number. According to Wickens et al., 2004, if you have a question that needs many answers, try to either make it more complex to lower the number of answers, or to split it into more questions that do fit into the working memory (the first option is preferred).
6. Use the decision tree as a leading element in the further interface design.

InfoPediA and task-orientation

InfoPediA is used in different situations, but tasks can be grouped into the following list:

- Sell a solution
- Service/install an instrument
- Order spare parts for an instrument
- Prepare to visit a customer
- Support a service engineer
- Present an instrument
- Get certain information about an instrument
- Install PANassist (?)

Decision tree



Bibliography

Wickens, C. D., Lee, J. D., Liu, Y., & Becker, S. E. G. (2004). *An introduction to human factors engineering* (2nd ed.). Harlow: Pearson Education.

Appendix J: Comparison of concepts

Comparison of concepts (InfoPediA-next)

User requirements

- The product is usable everywhere a user might want to:
- The product does not require the user's complete concentration, it can be used while:
- The product supports the user in his or her tasks:
 - Installing an instrument
 - Diagnosing an issue with an instrument
 - Instructing a client about an instrument
 - Preparing a visit to a client
 - Give phone support
- The product is easy to use and useful
 - Using the product is effective (all information that is available in the current version can be accessed)
 - The product supports the user's tasks
 - The product's user interface is clearly organized
- The product is easy to learn (elements are placed where they're likely to be expected)
- The product is reliable (less than 1 crash per 1000 files opened)
- The product is fast (information can be reached at least as fast as in the current version by an experienced user)
- All text in the product's user interface is easily readable, also when attention is split, this means:
- All text in the product's user interface is meaningful to the user
- The product provides customer support users with quick access to service manuals, XRA's and circular messages.
- The product provides all users with an overview of items per instrument type
- The product enables the user to select information in advance and recall it quickly.
- The product should be clear about the contents of information packets
- The updating module should be as fast as possible
- The updating module should be reliable
- The updating module should give clear information

Corporate identity requirements

- The product fits in well with PANalytical's corporate style
- The product looks professional, simple, smart and up-to-date to a customer

Technical requirements

- Bandwidth needed for updates is minimized
- All connections and data transfers are secured
- As many of the current or already planned aspects of the network infrastructure as possible should be used
- As much of administration work as possible can be automated

Management requirements

- Updates are performed as quickly as possible (within 10 working days after a file is released)
- The new version can be easily rolled out.
- User access can be withdrawn within 5 working days
- Information should be secured against stealing

	Current IPA	Concept 1	Concept 2	Concept 3
Total	0	18	7	14
Weight				
2	0	1	1	1
2	0	2	1	1
1	0	2	1	2
	0	0	0	0
	0	1	1	1
	0	1	1	1
	0	-1	-1	-1
	0	1	0	1
3	0	-1	-1	-1
2	0	2	1	2
1	0	2	0	1
1	0	2	2	1
1	0	0	0	0
3	0	-1	-1	-1
1	0	1	1	1
1	0	0	0	0
1	0	2	2	2
2	0	1	1	1
2	0	-1	-1	-1
1	0	-1	-1	-1
1	0	1	1	1
1	0	0	0	0
1	0	0	0	0
1	0	1	-1	1
1	0	1	-1	1
1	0	1	1	1
1	0	0	0	0
1	0	0	0	0
1	0	1	1	1
1	0	0	0	0
1	0	1	1	1
1	0	0	0	0
1	0	0	0	0

2 extremely easy to comply

1 easy to comply

0

-1 difficult to comply

-2 extremely difficult to comply

Version: 0.1

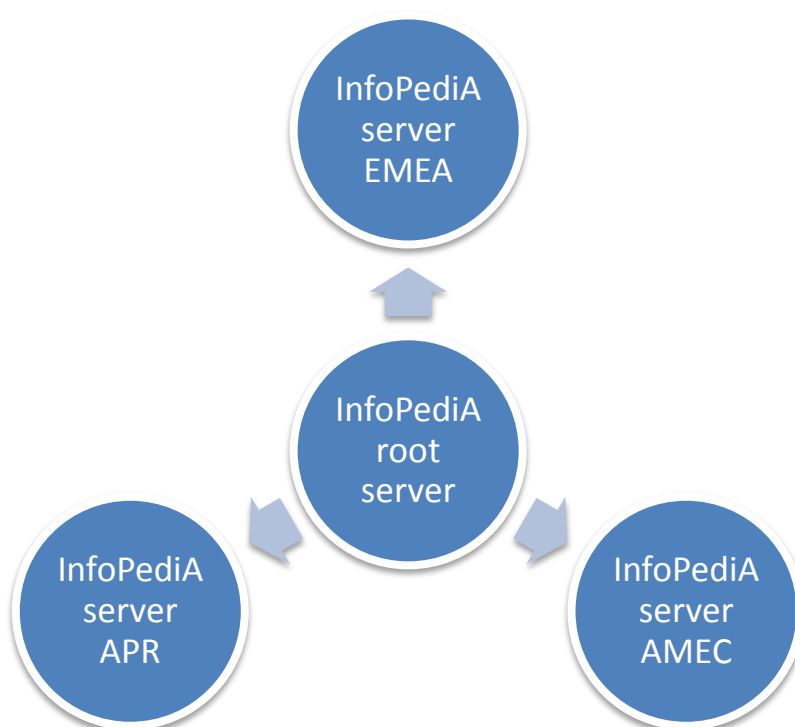
Appendix K: Technical recommendations

Technical recommendations for a platform-independent version of InfoPediA

Version 0.2

For the new InfoPediA system, a list of technical recommendations are to be made to improve speed, availability, security, reliability and ease of use of the updating module. Please see the glossary for more information about the applications it is built upon.

Back-end structure



InfoPediA root server

This server is the source for all InfoPediA data worldwide. This server might be on a shared machine in the SC Almelo, as it does not directly serve users. It only runs cronjobs that make sure the other servers in the world are always up to date. It is not remotely available for security reasons.

The InfoPediA root server is only accessible to InfoPediA administrative staff, they use a specially built client to place and remove files using rsync. It is important to use rsync for this, because it ensures data-integrity before uploading it to other servers.

On the root server, a cronjob runs an rsync command targeting every local server one at a time. At that point, all files are checked against the root server. When a file is found to be unequal to the one on the root server, non-existent or extraneous, it is updated, created or deleted, respectively.

DNS

For load balancing and mirror selection, a primary nameserver will provide the client with a choice of local nameservers to get the IP for the updating server. The client then sends a DNS request to all nameservers, and almost always chooses the first response. This means that:

- Every responding server is up
- The first responding server has the quickest ping; therefore it has the best combination of available resources and geographical location for the user.

This means it is a very easy and robust way to balance the load between different servers, while making sure every user gets the files as quickly as possible. To accomplish this, the primary nameserver will host a zonefile that would look like this (in the same network example as provided above):

```
emea.infopedia.panalytical.com A 243.214.21.3
apr.infopedia.panalytical.com A 15.14.35.134
amec.infopedia.panalytical.com A 140.64.42.3
infopedia.panalytical.com NS emea.infopedia.panalytical.com
infopedia.panalytical.com NS apr.infopedia.panalytical.com
infopedia.panalytical.com NS amec.infopedia.panalytical.com
```

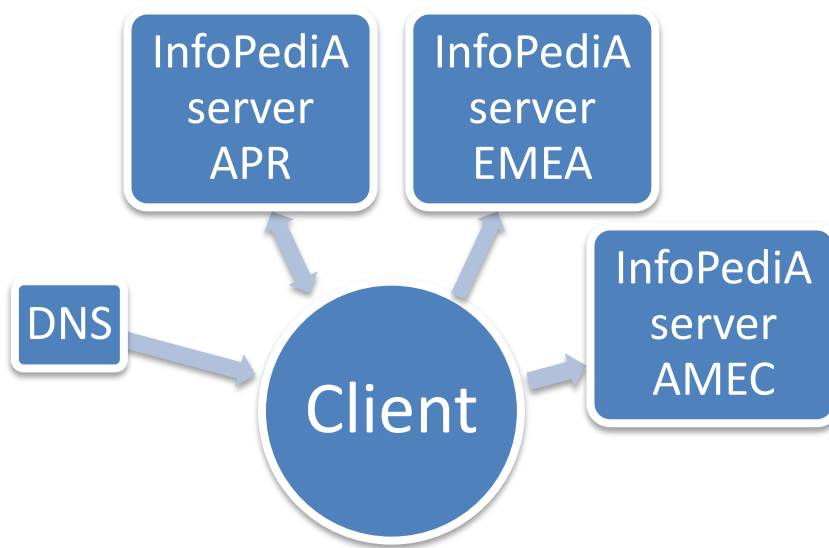
The first lines point the local redirects to the IP-addresses of the local servers (here, they are randomly picked). The bottom lines redirect the main hostname (here infopedia.panalytical.com) to the local servers. To make sure load is balanced correctly when a server goes down, a short TTL (time-to-live) should be used.

InfoPediA local servers

A number of local servers are provided to quickly distribute files to users worldwide. In this example, they are called EMEA, APR and AMEC. These servers accept files from the root server, and supply them to users. Different versions of InfoPediA are available in different folders, to which access restrictions can be applied. Remote users should only have access to the folders they need. Clients should only be able to read, and should not be allowed other shells than rsync and ssh. These local servers are also part of the load-balancing system. For this, they all host a simple zone file in which all hostnames in the correct zone are resolved to the server's public IP-address. For example, if a server's public IP-address were 140.64.42.3, the zone file would look like this:

```
@ in A 140.64.42.3
```

Front-end structure



Client

When the client application is started (be it on iOS, Windows, Blackberry OS or any other platform), a command is run in the background to check for an Internet connection and then run rsync in “dry-run” mode. This way, all files are checked against the server, but no changes will be made. If it is found that there is a difference between the client and the server, the user will be presented with a list of changed files and can choose to update now, or delay updates temporarily. When the user chooses to update, the rsync command is run in normal mode, and the user is presented with a list of changed files. If it is found that running the dry run on every startup uses too much battery, CPU or network data, it could be decided to do this every week. In this case, to support load balancing, the software should, after its installation, select a day of the week randomly. The software would then run the command once every time the selected day is passed every week. In this case, the user might be provided with a manual updating mechanism.

Extreme situations

In this section, a few situations that the system might have to handle are described, and the expected behaviour of the system is examined. To determine the expected behaviour, tests have been done.

File is updated while the user is downloading

Situation: The user is downloading a file from a local server while the root server is updating it.

Behaviour: rsync does not write into the replaced file directly, but into a temporary file first. Only when the transfer is completed successfully, the file is replaced with the new version. If the user is still downloading it at this point, he is served the old version completely. This was verified by testing.

The user interrupts the updating process

Situation: The user starts the updating process, but it takes too long, and he stops it.

Behaviour: As the user’s machine is also using rsync, the temporary file that was being downloaded into will be disposed of. When the updating process is started again, the user downloads the latest version of the file. This was verified by testing.

A local server goes down while a user is downloading

Situation: A local server is experiencing a power outage while a user is downloading a file.

Behaviour: The user's system will report a broken pipe, and stop updating. The temporary file that was being downloaded into will be disposed of.

A file becomes corrupted on the user's machine

Situation: The user's hard disk has a few bad sectors, and one of the files has become unreadable.

Behaviour: As long as the file system on the user's system is still intact, and it is possible to write to other sectors reliably, the broken file will be found when updating the next time, and it will be fixed.

Glossary

rsync

The new file distribution structure is built heavily on the open source rsync utility. This utility enables the user to synchronize two folders on different machines while using the least amount of data possible, as it only sends the differences between files. It is deemed very stable and reliable. Rsync is, as stated before, an open source utility and it is written in C. This means that it can be compiled on virtually every platform (including Windows and iOS); platforms that don't allow C code to be run, for example BlackBerry OS, usually allow Java (Oracle, n.d.). On BlackBerry OS (or any other J2ME-based platform), Cibyl might be used to port rsync (simon.kagstrom@gmail.com, 2011). Rsync also provides options for compression, recursive syncing and deleting files from the target that have been removed from the source. On BSD, Unix or GNU/Linux, a command that would look like this would be used:

```
rsync -rtvz --delete -e ssh user@src:/sourcefolder/ /targetfolder/
```

This command has the following parameters:

- -rtvz: recurse into directories (r), preserve modification time (t), increase verbosity (v), enable compression (z)
- --delete: delete files from target tree that don't exist in the source tree
- -e ssh: choose to use ssh as transport protocol
- user@src:/sourcefolder/: the source tree is the file tree inside /sourcefolder on machine 'src', ssh should connect as user 'user'. The trailing slash means only the contents of the folder should be synchronized and not the folder itself
- /targetfolder/: the target tree on the local machine. The trailing slash is not important here

When the client connects it should only check if any files should be changed, for this, the -n switch should be added to make rsync perform a "dry run" in which all files will be checked, but no files will be changed.

Source: (Tridgell, Mackerras, & Davidson, 2011)

SSH

Secure SHell (SSH) is a network protocol, which enables a remote shell connection in a secure manner. It also allows tunnelling and certificate authorization. In this system, it is used as the transport protocol used by rsync.

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Appendix L: Menu design rules and substantiation

InfoPediA-*NEXT* menu design rules

Marten Jacobs – University of Twente – Version 0.3

For the next version of InfoPediA, a task-oriented design path was chosen. An important part of the design is the menu structure through which a user can select an information packet to access. Menus should be designed to be consistent, logical, clear, and easily readable. By sticking to these design rules, these aspects of menu design can be ensured.

- Minimize the number of menu items without making the menu structure needlessly deep
 - No menus with 1 item
 - Optimal number of items is 4-6
 - No more than 7 items on a single menu
 - Exception: longer, list-type menus can be added, but they should not contain more menu layers but should always directly redirect to an information packet.
 - Exception: some menus that are used throughout the software will become well-known, so the user knows where to expect items. These menus should always be introduced by recognizable visual cues (the menu should have a recognizable form on its own, and the button leading to it should communicate to the user which type of menu follows)
- Make clear and easy to use menu items
 - Ask for easily determined information first, only ask for difficult to determine information when there is no better way
 - Make sure menu items are easy to discern
 - Put the discerning text in front of other text on menu items
 - Except for product family names and other information that is needed for recognizability (this text should be made to look less conspicuous, by making it smaller, for example)
 - Make sure text on menu items is understandable on its own (without having read all other menu items)
 - This means “other”-type menus should be avoided when no name can be thought of that describes the content better.
 - Exception: in short menus (3 or less menu items, including the “other”-type item), it is acceptable to use a “other”-type menu, because all other options can be identified with a single glance.

Substantiation of design rules

The aforementioned design rules were determined based on literature in the field of human factors engineering. Some of the rules speak for themselves, but for some, more information might be needed to understand the reasoning.

Number of menu items

Most menus

According to Wickens, Lee, Liu, & Becker, 2004, a function of the average time taken by a user to find an target in a set of items (in this case the correct menu item in a menu) can be determined by the following equation:

$$t_{sm} = \frac{1}{2}(t_i \cdot n)$$

Where t_{sm} is the average time taken for a single menu, t_i is the average time taken per item and n is the number of items. A point could be made that the Hick-Hyman law (Hick, 1952; Hyman, 1953) should be used to determine the best number of items in a menu. However, because the software design dictates that all menus are short, we should simply use the aforementioned equation, as we can't expect users to use an efficient searching algorithm, such as needed for the Hick-Hyman law. However, in some longer menus the Hick-Hyman law should be used. For this, see 'An exception for long menus' below.

When working with a menu structure as opposed to a single menu, we should also take into account that there is a small period of time during which the user must make a mental transition (and the software a visual transition) between menu's, this yields the following:

$$t_m = \frac{1}{2}(t_i \cdot n) + t_t$$

Where t_t is a menu's base processing time (Jacko & Sears, 2003). And t_m is the time taken for a single menu in a menu structure.

We can also determine the average depth of a menu structure based on the average number of items per menu. We know that:

$$g = n^d$$

Where d is the average depth of the menu structure and g is the number of goals to which the user could be navigating. This yields:

$$d = \log_n g$$

Combining these equations, we can determine the average time taken to reach a goal through the menu structure:

$$t_g = d \cdot t_m$$

$$t_g = \log_n g \cdot \left(\frac{1}{2} t_i \cdot n + t_t \right)$$

$$t_g = \log_n g \cdot \frac{1}{2} t_i \cdot n + \log_n g \cdot t_t$$

We can differentiate this to

$$\frac{\partial t_g}{\partial n} = \frac{\ln(g) \left(\frac{1}{2} \cdot n \cdot t_i \cdot (\ln(n) - 1) - t_t \right)}{n \cdot (\ln(n))^2}$$

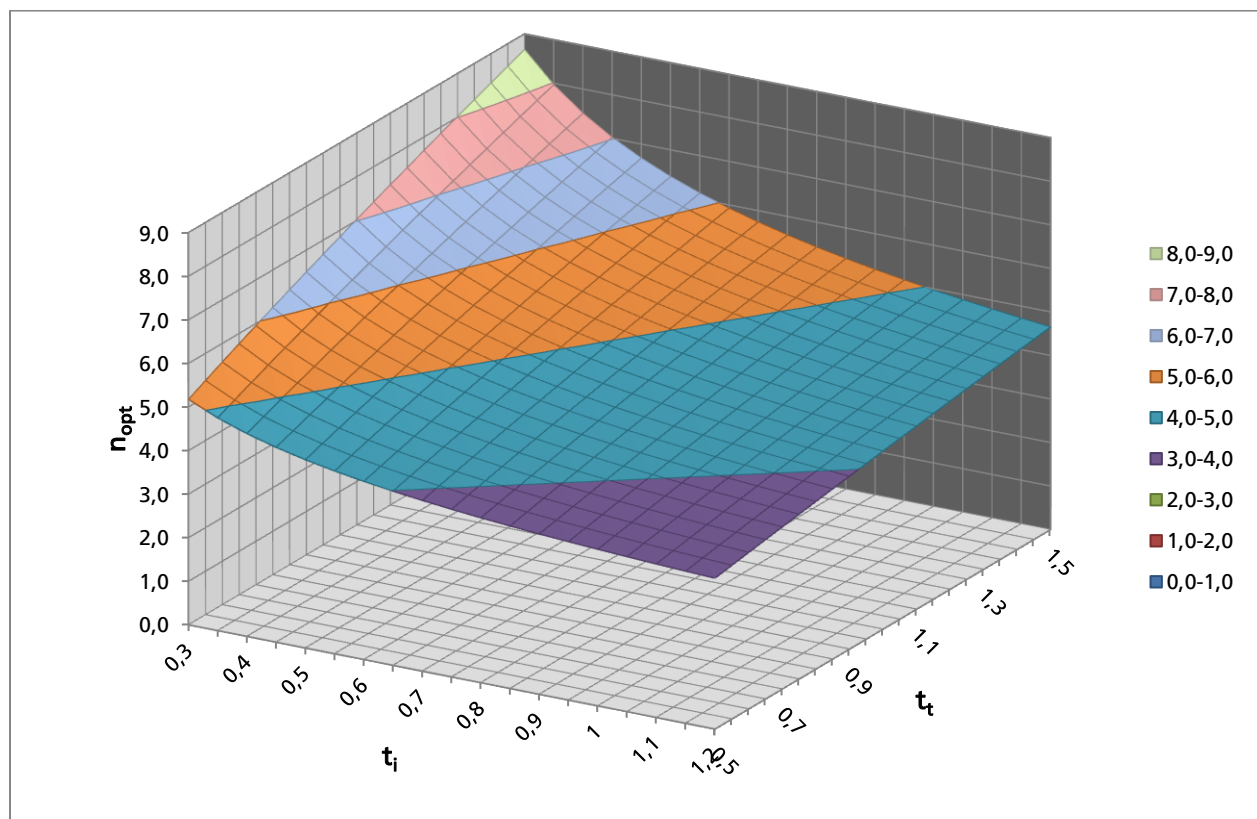
Because the $\frac{\partial t_g}{\partial n} = 0$ at the point where t_g is minimized (and thus optimized), we can find the optimal number of menu items for each g , t_i and t_t :

$$n_{opt} = e^{1+W\left(\frac{2 \cdot t_t}{e \cdot t_i}\right)}$$

Where W refers to the Lambert W function (Weisstein, 2006). As can be seen in this equation, g has no influence on n_{opt} .

We should then find reasonable numbers for t_i and t_t . As the values of t_t and t_i can only be accurately determined by testing, an estimate has to be used. We can expect $0.5 < t_t < 1.5$ and $0.3 < t_i < 1.2$.

We can show this data in a 3D plot:



As we can assume that a combination of very low t_i and very high t_t , as well as the opposite, is very unlikely, we can determine based on this plot, that a number of menu items between 4 and 6 is the most likely to be optimal for any menu. Menus with more than 7 items should be avoided altogether.

An exception for long menus

The above stands for most menus in the InfoPediA interface, as these menus are quite short by design. Some menus, however, might provide the user with many options (for example a list of all files relevant to a single instrument). These menus should always support the user in other ways by enabling searching, filtering or sorting, for example. This means the user can be expected to use a

more intelligent searching algorithm than in the case mentioned above. For such a menu, the Hick-Hyman law should be used (Hick, 1952; Hyman, 1953). This formula, when substituting t_m in the equation above, yields:

$$t_g = \log_n g \cdot (t_t + t_i \log_2 n)$$

When differentiating this, we find:

$$\frac{\partial t_g}{\partial n} = -\frac{t_t \cdot \ln(g)}{n \cdot (\ln(n))^2}$$

From this we can tell that there is no minimum to t_g , thus $n_{opt} \rightarrow \infty$. This means that in this case it should be avoided to add more menu layers below this type of menu.

An exception for well-known menus

Another exception is a menu that is used multiple times throughout the software. This type of menu will become very familiar to the user, and can be treated as such. This means it can contain more menu items. The menu should, however, never be higher than the screen, because this will cause the menu to lose its familiarity.

Other-type menus

The reason that 'other'-type menus should be avoided are the following:

They take more time

When a user searches a menu for an item, all items must first be scanned, to determine whether the menu contains the item the user is looking for. When items are grouped in an 'other'-type menu, the user is unsure about the contents of said menu. This cues the user to re-scan the menu first, perhaps more thoroughly, before making a decision. Because of this, menus containing 'other'-type submenus take more time to scan, especially when the option the user needs is in fact on this submenu.

They cause mistakes

When the user does not thoroughly re-scan the menu before making a decision to access the 'other'-type submenu, a mistake might be made. Correcting this mistake also takes time.

A notable exception

When the 'other'-type menu can be given a descriptive name, which avoids the aforementioned problems, it is acceptable.

Another notable exception

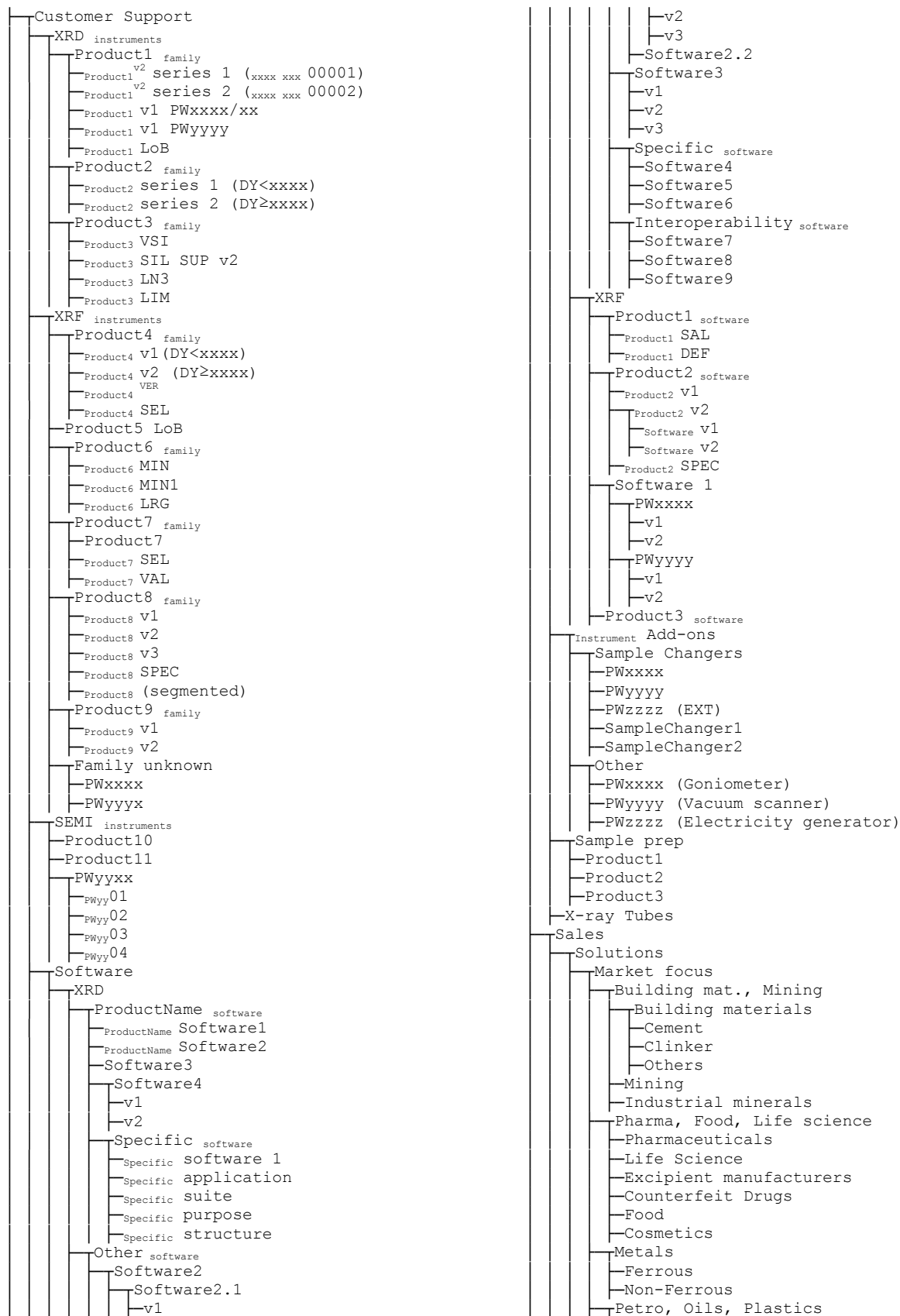
When the parent menu is very short (i.e. not containing more than 3 items), rescanning it takes very little time and can be done at a glance. The risk of mistakes and the cost of rescanning could in this case be outweighed by other issues.

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Appendix M: Sample menu structure

InfoPediA menu structure



	Petrochemical
	Oils
	Fuels
	Polymers, plastics
	Homogeneous polymers
	Filters and Additives
	Plastics
	Semiconductors
	Chip manufacturing
	LED, Solar, Compound, SiGe
	Data storage
	Nanomaterials
	XRD applications
	Solution modules
	Products
	Instruments
	XRD instruments
	CubiX ³
	CubiX ³
	CubiX ³ Cement
	CubiX ³ Minerals
	CubiX ³ Pharma
	CubiX ³ Potflux
	Empyrean
	X'Pert family
	X'Pert Powder
	X'Pert PRO Extended MRD
	X'Pert PRO MRD in-plane
	X'Pert PRO MRD XL
	XRF instruments
	Axios family
	Axios
	Axios Automation
	Axios mAX
	Axios mAX
	Axios mAX Advanced
	Axios mAX Cement
	Axios mAX Metals
	Axios mAX Minerals
	Axios mAX Petro
	Axios mAX Poly
	Axios FAST
	CubiX XRF
	Epsilon family
	Epsilon 3
	Epsilon 5
	MiniPal family
	MiniPal QC
	MiniPal 4
	SEMI instruments
	2830ZT
	Semyos
	Software
	Sample preparation
	PCs
	Chillers
	Tubes
	Services
	Expertise
	About PANalytical
	Publications
	Competition
	Redacted

Appendix N: User access control

InfoPediA user access control

Marten Jacobs – University of Twente – Version 0.1

This document describes a part of the back-end structure of the InfoPediA file servers. The new modular and extensible interface of InfoPediA requires that user permissions can be granted and on a per-user basis. The menu file should then also be built to support a specific user. The administrator should be able to assign files to groups and assign group permissions to users. As the back-end servers are using Linux, which is a UNIX-based operating system, this is not possible by default. To accomplish this anyway, Linux Access Control Lists (ACL) are to be used.

Set-up

Servers

In this document, the server is running Debian squeeze. However, most Linux versions will work in much the same way. The main servers are not exposed to the internet, as this would not comply to the PANalytical IT security guidelines. They are only accessible through the local network, or VPN (which will be distributed in the future). For external parties who need InfoPediA (agents), a second server (the agent server) should be set up. This server should allow connections from the internet and must only contain files that should be accessible to agents. All connections will be made through SSH, which is a very secure transfer protocol. Furthermore, all users are chrooted (jailed) to the InfoPediA root directory, so no access is granted to files outside this directory.

Database

A database (for example MySQL) should be set up on the main InfoPediA file server. This database should contain at least three tables: a user information table, a user grouping table and an access control table.

The user information table should contain all user names and public keys for VPN users, as well as access names and password hashes (as returned by 'crypt') for external users. The access control table should contain all files inside the InfoPediA root directory that may be accessed by users. The user grouping table should contain a "user"-field and a "group"-field. This table enables the administrators to give groups of users access to large groups of files without having to enable access to all files by hand. The final table is the access control table, in which all files are bound to their access controls. When a file is not available in this table, no user can access it. This table should contain at least three fields: "file", "user" and "group". Of these fields, either "group" or "user" should be NULL, the other one should contain a group or user that should have access to the file.

The database may also contain a table in which the main menu structure of the InfoPediA application can be adjusted.

Scripts

Users

A script should maintain a live copy (in `/etc/passwd`) of the user database, making sure the Unix users are always synchronized with the user database by adding/removing/modifying users as needed. On the main servers, remote users should be ignored, and passwords for all users should be randomly generated, as the user should always be forced to access the server with a public/private key combination for this is far more secure. The script should also write the user's public key to the user's `~/.ssh/allowed_keys` file. On the agent server, on the other hand, only the remote users should be set up. As the password hashes are saved in a format that is Unix-compatible, these can be inserted in calls to the 'usermod' or 'useradd' applications, while still being secure. Groups should be added to the users according to the user grouping table. This way, user access can be administered remotely though a user friendly interface.

File access

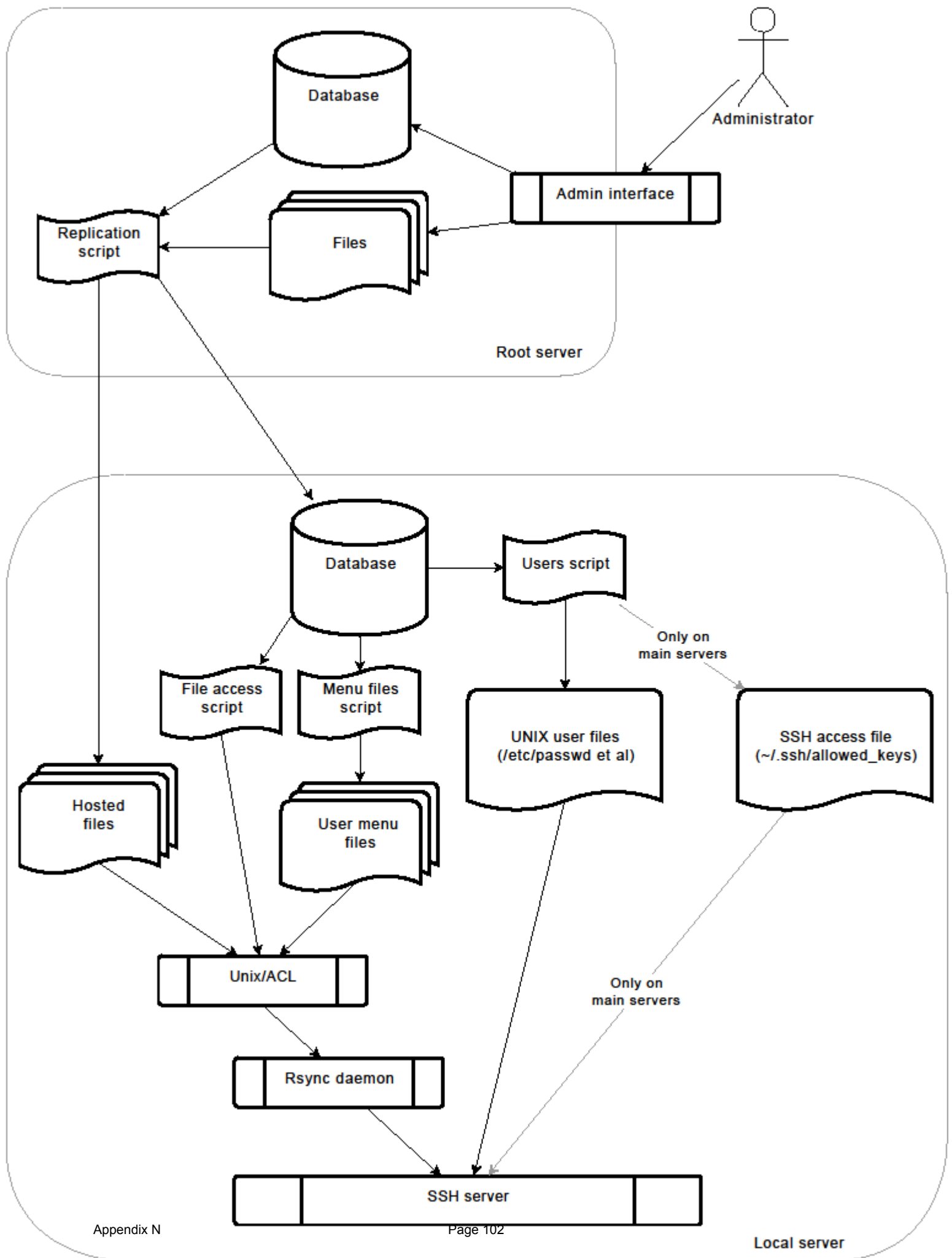
A script should run on the server, checking all files to see if their ACL is in sync with the database. To do this, it could simply call the 'mysql' application and let it execute a select statement to see all users and groups that should have access to the file, it could then compare it to the output of 'getfacl' and adjust it if needed with 'setfacl'. If the file is not found in the database, both 'chmod 000' and 'setfacl -b' should be ran on the file to disable all access.

Replication

When replicating files (syncing them) to the satellite servers that are located worldwide, they should be copied with mode 000 and without ACL. This way, the files are unavailable to users until the local file access script adds permissions to it. The replication script should make sure all files are pushed to all servers worldwide, as well as the database containing access information.

Menu files

A script should build a menu file for each user. By pre-building this menu file, performance is improved on the user's system. This file dictates the entire menu structure and should be in an XML format. The file is based on the manifest files that accompany each data file and the main menu structure as defined in the database.



Appendix O: Prototype requirements

Product requirements for the InfoPediA-next prototype

User requirements

- The product can be used with or without internet connection that may or may not be reliable
- The product can efficiently be used while:
 - Talking on the phone
 - Talking to someone in person
- The product supports the user in his or her tasks:
 - Diagnosing an issue with an instrument
 - Preparing a visit to a client
 - Give phone support
- The product is easy to use and useful
 - Evaluate this with the methods put forth by (Keil, Beranek, & Konsynski, 1995), (Segars & Grover, 1993), (Adams, Nelson, & Todd, 1992) and/or (Davis, 1989)
 - Using the product is effective (all information that is available in the current version can be accessed)
 - The product's user interface is clearly organized
 - The buttons in the user interface are placed in compliance with the device's Human Interface Guidelines
 - Behaviour of buttons is very predictable
 - The user gets a clear 'sense of location'
- The product is easy to learn (elements are placed where they're likely to be expected, the expected location can be found in other applications on the platform)
 - No training needed for efficient use
- The product is fast (information can be reached at least as fast as in the current version by an experienced user, because the prototype is not as fast as a complete product will be, the measured time can be multiplied by 0.9)
- All text in the product's user interface is easily readable, also when attention is split, this means:
 - Good contrast
 - use the method put forth by (Dale & Chall, 1948) or (Gunning, 1969) to determine grade-equivalent, this should not be higher than 10 for any text.
- All text in the product's user interface is meaningful to the user
- The product provides customer support users with quick access to service manuals, XRA's and circular messages.
- The product provides all users with an overview of items per instrument type
- The product enables the user to select information in advance and recall it quickly.
- Some information should be protected
- The product should be clear about the contents of information packets
 - The following attributes should at least be conveyed to the user:
 - Title

- Description
- Last update
- Version
- Privileges

Corporate identity requirements

- The product fits in well with PANalytical's corporate style
- The product looks professional, simple, smart and up-to-date to a customer

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Appendix P: Evaluation plan

Evaluation plan for the InfoPediA_{-NEXT} prototype

By Marten Jacobs – University of Twente

Version 0.5

Introduction

Evaluating the InfoPediA-next prototype will be done in two parts. First, some requirements that can be tested empirically will be reviewed and one requirement will be submitted for expert review. Afterwards, a user test and survey will be used to evaluate the remaining properties. A subset of the design brief requirements will be selected for evaluation. Table 1 shows all requirements and the planned evaluation methods:

Requirement to be evaluated			Evaluation method	
The product can be used with or without internet connection that may or may not be reliable			Check if internet access has any influence on use	
The product can be used efficiently while:	Talking on the phone		User test	
	Talking to someone in person		User test	
The product supports the user in his or her tasks:	Diagnosing an issue with an instrument		User test	
	Preparing a visit to a client		Check if available	
	Give phone support		User test	
The product is easy to use, effective and useful	The product is easy to use		User survey	
	Using the product is effective			
	The product is useful			
	All information that is available in the current version can be accessed		Check if possible	
	The product's user interface is clearly organized	The buttons in the user interface are placed in compliance with the device's Human Interface Guidelines		Check interface against platform's HIG
		Behaviour of buttons is predictable		User survey
		The user gets a clear 'sense of location'		User survey
The product is easy to learn (elements are placed where they're likely to be expected, the expected location can be found in other applications on the platform)	No training needed for efficient use		User survey	
The product is fast (information can be reached at least as fast as in the current version by an experienced user)			User test	
			User survey	
All text in the product's	Good contrast		User survey	

user interface is easily readable, even when attention is split	Grade-equivalent should not be higher than 10 for any text.		Gunning fog index
All text in the product's user interface is meaningful to the user			User survey
The product provides customer support users with quick access to service manuals, XRA's and circular messages.			User survey
The product provides all users with an overview of items per instrument type			Check if available
The product enables the user to select information in advance and recall it quickly.			Check if available
Some information should be protected			Check if available
The product should be clear about the contents of information packets	The following attributes should at least be conveyed to the user:	Title	Check if available
		Description	Check if available
		Last update	Check if available
		Version	Check if available
		Privileges	Check if available
The product fits in well with PANalytical's corporate style			Expert review
			User survey
The product looks professional, simple, smart and up-to-date to a customer			User survey

Table 1: Requirements to be evaluated and their evaluation methods

Empirical evaluation and expert review

All items in Table 1 that are not to be evaluated in the user test, user survey or by expert review, will be evaluated empirically. For this, methods are mentioned in the table. Most of these requirements can be evaluated by simply checking it against the prototype, but some require another method or a more extensive evaluation.

The visual style of the prototype should also fit in with PANalytical's corporate style (known colloquially as 'EBL'). To evaluate this requirement the prototype will be submitted for expert review to the person(s) responsible for auditing all corporate manifestations subject to the corporate style.

User test and survey

Requirements that cannot be evaluated empirically, will be subject to a user test and a user survey.

The user test will start with a few minutes in which the user can explore the new interface and get an idea of how it works. No questions about the user interface will be answered, as users should be able to start using it on their own. Only for very fundamental problems or problems not concerning the application itself, help will be provided. A note will be made if such a problem occurs. As not all data packets are available through the prototype, users will be given a printed list of those that can be accessed.

After getting acquainted with the software, the user will be given a series of tests.

First, the user will be asked to access two certain files. The interactions a user performs will be timed, and errors counted. An error means that a user must retrace his/her steps to reach the given goal.

Secondly, users will be asked to access a file while talking to someone. The user does not know which file he must access, the person he is talking to has this information. He must ask the user for the information he needs to access the file. Half the users will be talking to the other person in a face-to-face setting, the other half will be talking to the other person while keeping their eyes on the screen. This could be helped by placing the other person behind them, so no visual contact is possible (this is to simulate a conversation over the telephone).

After this test, the user will be asked to access the same two files as in the first step, but in the old version of InfoPediA. These results will be used for a comparison.

After the practical test, the user will be asked to fill in a survey. This survey will evaluate the remaining requirements. With the limited number of users that will be available for this test and consecutively the survey, special consideration should be given to making sure results of this survey are reliable. To accomplish this, some questions will be asked multiple, in different wordings, the answers will then be combined and a variance number will be calculated to the score ranging 1 to 5 (variance being the average squared deviation from the mean). Answers with a large variance (0,5 or higher) will then be rejected on a per-user basis. The questions and grouping will be as follows:

Questions, as asked to subject	Group	Supergroup
This version of InfoPediA would make my job easier	Makes job easier	Usefulness
Using this version of InfoPediA is difficult		
This version of InfoPediA is useful	Useful	
This version of InfoPediA would increase productivity	Increase productivity	
This version of InfoPediA is effective	Effectiveness	Effectiveness
This version of InfoPediA would increase my job performance	Job performance	
This version of InfoPediA is easy to use	Easy to use	Ease of use
Using this version of InfoPediA is difficult		
This version of InfoPediA is easy to learn	Easy to learn	
It is easy to become a skillful user of this version of InfoPediA	Easy to become skillful	
I will need to be trained extensively before I can use this version of InfoPediA effectively		
This version of InfoPediA is easy to use while talking to someone else		Easy to multitask
This version of InfoPediA would require my complete attention		
I could do something else when using this version of InfoPediA		
All buttons in this version of InfoPediA are placed where I expect them		Predictable element placement
In this version of InfoPediA, interface elements are placed predictably		
All buttons in this version of InfoPediA behave predictably		Predictable functionality
In this version of InfoPediA, all interface elements did what I expected them to do		

I get a clear sense of where I'm currently located in the menu structure when using this version of InfoPediA		Got sense of location
I got an idea of my position in the menu structure when using this version of InfoPediA		
This version of InfoPediA is fast		Is fast
Using this version of InfoPediA, I could access the data I needed quickly		
This version of InfoPediA gives me quick access to all the files I need		
All texts in this version of InfoPediA are very clear		Easily legible
All texts in this version of InfoPediA are easily legible		
All texts in this version of InfoPediA are very meaningful		Meaningful
I understood the meaning of every text in this version of InfoPediA easily		
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)		Good styling
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer		

The order of questions will be randomized, and when calculating the results, questions with a negative wording will be converted in such a way that they can be compared to answers to questions with a positive wording.

Appendix Q: User test and survey

InfoPediA user test and survey

Operator sheet

Getting acquainted

- Set InfoPediA to view all (menu root should be empty). Show all lines of business.
- Let the user try the prototype for about three minutes.

Practical test (Part 1)

- Set InfoPediA to Sales (menu root should be 2), showing only XRF.
- Start screen recording.
- **Assignment 1:** Open the presentation video for Axios
- Set InfoPediA to Customer Support (menu root should be 2), showing only XRF.
- **Assignment 2:** Open the Epsilon 3XL service manual
- **Assignment 3:** Open the newest XRA for Epsilon 3XL

Practical test (Part 2)

- Set InfoPediA to Customer Support (menu root should be 1), showing only XRD.
- **Even subject numbers:** Sit on the other side of the table, or next to, the subject. Try to talk to them in a conversational style.
- **Odd subject numbers:** Sit behind the subject, so no eye contact can occur. Talk to them as if over the phone.
- Tell the user you will be playing the part of a service engineer, whom they will be giving support.
- Wait for their questions. Give the following information if requested:
 - I'm servicing an XRD instrument
 - If they ask which instrument, give information in this order:
 1. It's a CubiX
 2. It's a CubiX³
 3. If they ask which series, ask what they mean
 - If they are stuck at this point, tell them you could look at the serial number
 4. If they ask for the serial number, tell them it's 9430 038 0001
 - If they ask what's wrong with the instrument, give information in this order:
 1. The background of the diffractogram has suddenly become unstable.
 2. The X'Celerator fan is defective
 - If they ask if you have performed a radiation safety survey, answer confirmatory

Practical test (Part 3)

- Clear stop watch. Start Customer Support InfoPediA.
- **Assignment 1:** Open the CubiX3 service manual
- **Assignment 2:** Open the newest XRA for Epsilon 3XL
- **Assignment 3:** Open the Epsilon 3XL service manual

Survey

- Ask them to fill in the survey

InfoPediA user test and survey

Subject sheets

Information

This test is designed to evaluate the InfoPediA-next prototype. You will first do a practical test that will take approximately 15 minutes. After this, you will be asked to fill out a survey. This will take approximately 5 minutes. Please don't read ahead to the introduction of the next section before you are asked to do so.

Getting acquainted

Please take some time to explore the prototype of InfoPediA-next. Be informed that this version is not a finished product. It does not respond or move quite as well as a fully developed version will and does not contain all files (known as data packets) available in the current version. In this prototype, only a few data packets and menus are available. When you think you understand how to navigate the prototype, we can proceed to the practical test.

Practical test (Part 1)

In this test you will be asked to open three data packets. Find your way through the user interface to get to them as quickly as possible (as you normally would). The data packets you are to open will be supplied one by one.

Practical test (Part 2)

In this test, a real-world scenario will be replicated. You will be talking to someone who has requested your support. To help him, you will need to navigate to a data packet. To reach the correct data packet, you will have to ask some questions. Once you have opened the data packet you think will contain the information the other person needs, the test is over.

Practical test (Part 3)

You will now be asked to open three files using the current version of InfoPediA. Find your way through the user interface to get to them as quickly as possible (as you normally would). The files you are to open will be supplied one by one.

Survey

As a final part of this test, you are asked to answer a few questions. This will take approximately 5 minutes.

General information

Test subject number:

Job description:

Age:

Questions

To what extend do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It is easy to become a skillful user of this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are easily legible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase my job performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use while talking to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this version of InfoPediA, I could access the data I needed quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very meaningful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The application gave me a clear indication of my position in the menu structure.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will need to be trained extensively before I can use this version of InfoPediA effectively	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the meaning of every text in this version of InfoPediA easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I get a clear sense of where I'm currently located in the menu structure when using this version of InfoPediA	O	O	O	O	O
I could do something else when using this version of InfoPediA	O	O	O	O	O
This version of InfoPediA is useful	O	O	O	O	O
This version of InfoPediA would make my job easier	O	O	O	O	O
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)	O	O	O	O	O
This version of InfoPediA gives me quick access to all the files I need	O	O	O	O	O
All buttons in this version of InfoPediA are placed where I expect them	O	O	O	O	O
Using this version of InfoPediA is difficult	O	O	O	O	O
All texts in this version of InfoPediA are very clear	O	O	O	O	O
In this version of InfoPediA, all interface elements did what I expected them to do	O	O	O	O	O
In this version of InfoPediA, interface elements are placed predictably	O	O	O	O	O
This version of InfoPediA is easy to use	O	O	O	O	O
This version of InfoPediA would require my complete attention	O	O	O	O	O
All buttons in this version of InfoPediA behave predictably	O	O	O	O	O

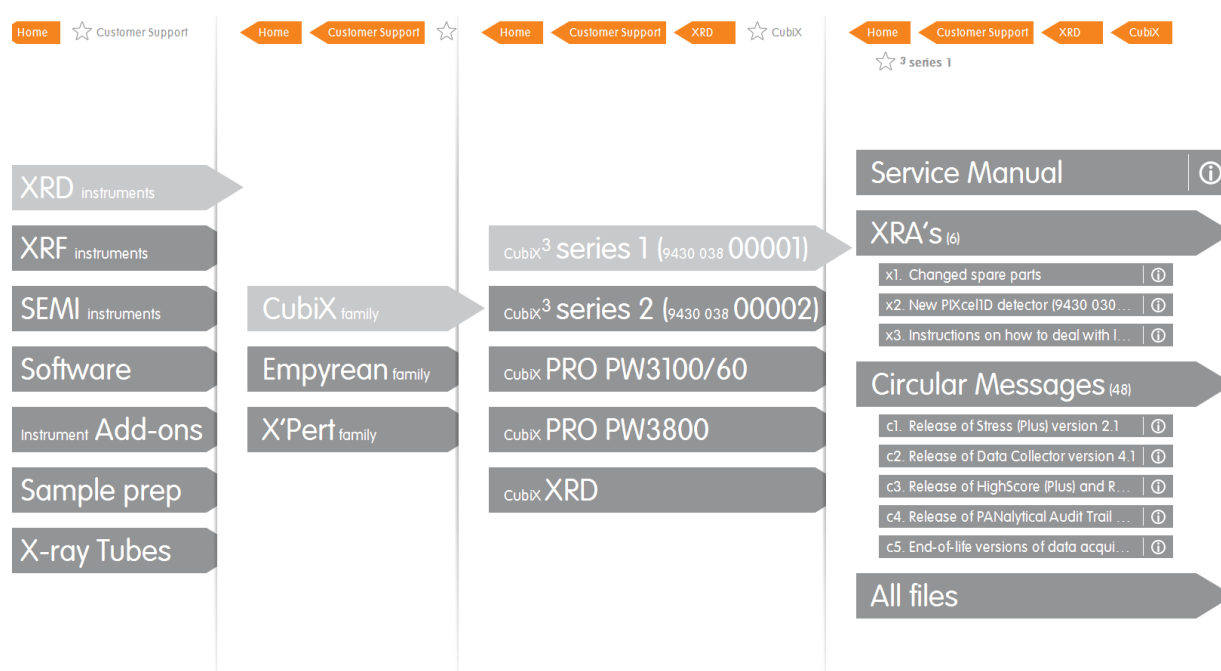
Thank you very much for your cooperation.

Appendix R: Assessing readability

Calculating a Gunning fog index for the InfoPediA redesign

By Marten Jacobs – University of Twente

To evaluate legibility of the redesigned version of InfoPediA, a grade equivalent was to be calculated. For this, a representative text of around 100 words was needed. A representative menu from the redesign was selected to accomplish this. As the Gunning fog index formula (Gunning, 1969) was created for English texts and not specifically menus, we should assume results could deviate significantly from the actual grade equivalent.



All text in this menu was then copied. Periods were added at the end of every button, as the end of a button clearly ends the sentence on it. This resulted in the following text:

XRD instruments. XRF instruments. SEMI instruments. Software. Instrument add-ons. Sample prep. X-ray tubes. Customer support. Home. Customer Support. XRD. CubiX. Home. Customer Support. XRD. CubiX. CubiX family. Empyrean family. X'Pert family. CubiX3 series 1. CubiX3 series 2. CubiX PRO. CubiX PRO. CubiX XRD. Service Manual. XRA's. Changed spare parts. New PIXcel1D detector. Instructions on how to deal with. Circular Messages. Release of Stress (Plus) version 2.1. Release of Data Collector version 4.1. Release of HighScore (Plus) and. Release of PANalytical Audit Trail. End-of-life versions of data acquiring. All files.

The first step in calculating a Gunning fog index is counting the number of major punctuation marks (variable p). In this case, only periods are used. 36 to be exact. The number of words with three or more syllables was to be counted next (c=19) and the total number of words (w=89).

XRD [instruments\[.\]](#) XRF [instruments\[.\]](#) SEMI [instruments\[.\]](#) Software[.] [Instrument add-ons\[.\]](#) Sample prep[.] X-ray Tubes[.] [Customer support\[.\]](#) Home[.] [Customer Support\[.\]](#) XRD[.] CubiX[.] Home[.] Customer Support[.] XRD[.] CubiX[.] CubiX [family\[.\]](#) [Empyrean family\[.\]](#) X'Pert [family\[.\]](#) CubiX3 series 1[.] CubiX3 series 2[.] CubiX PRO[.] CubiX PRO[.] CubiX XRD[.] Service [Manual\[.\]](#) XRA's[.] Changed spare parts[.] New PIXcel1D [detector\[.\]](#) [Instructions](#) on how to deal with[.] [Circular](#) Messages[.] Release of Stress (Plus) version 2.1[.] Release of Data [Collector](#) version 4.1[.] Release of HighScore (Plus) and[.] Release of [PANalytical](#) Audit Trail[.] [End-of-life](#) versions of data [acquiring\[.\]](#) All files[.]

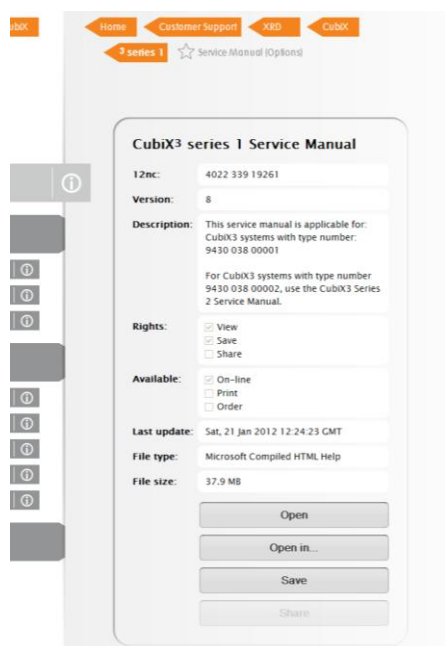
A Gunning fog index could then be calculated:

$$index = 0.4 \left(\frac{w}{p} + 100 \frac{c}{w} \right)$$

$$index = 0.4 \left(\frac{89}{36} + 100 \frac{19}{89} \right)$$

$$index = 9.53$$

As this is very close to the maximum grade equivalent that was established (10), another text was selected to improve the reliability of the result. This time a file information menu was selected, to further make sure the texts selected are representative for the entire application.



Home. Customer Support. XRD. CubiX. Service Manual (Options). CubiX3 series 1 service manual. Version. Description. This service manual is applicable for. CubiX3 systems with type number: For CubiX3 systems with type number: 9430 038 00001. For CubiX3 systems with type number 9430 038 00002, use the CubiX3 Series 2 Service Manual. Rights View Save Share. Available On-line Print Order. Last update. File type Microsoft compiled html help. File size. Open. Open in. Save.

Using the same algorithm, this text yielded a grade equivalent of 7.19. This is significantly lower than the previous result.

Conclusions

These results indicate that the grade equivalent of the texts in the redesigned InfoPediA is lower than 10, as required. However, these results are not conclusive, as the Gunning fog index was not meant for this sort of texts. To confirm this requirement is fulfilled, users should also be asked to judge their perceived readability. In this case, the users' perceived readability should be weighted more heavily than the results from this document.

Bibliography

Gunning, R. (1969). The Fog Index after twenty years. *Journal of Business Communication*, 6(2), 3–13.

Appendix S: Responses to prototype user survey

Survey

As a final part of this test, you are asked to answer a few questions. This will take approximately 5 minutes.

General information

Test subject number: 1

Job description: Wind Cust Supp. Specialist XRF

Age: 50

Questions

To what extend do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It is easy to become a skillful user of this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are easily legible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> Saa i
This version of InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase my job performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use while talking to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Using this version of InfoPediA, I could access the data I needed quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very meaningful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase productivity	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I got an idea of my position in the menu structure when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I will need to be trained extensively before I can use this version of InfoPediA effectively	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the meaning of every text in this version of InfoPediA easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I get a clear sense of where I'm currently located in the menu structure when using this version of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

InfoPediA					
I could do something else when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is useful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would make my job easier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA gives me quick access to all the files I need	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All buttons in this version of InfoPediA are placed where I expect them	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this version of InfoPediA is difficult	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very clear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
In this version of InfoPediA, all interface elements did what I expected them to do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
In this version of InfoPediA, interface elements are placed predictably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would require my complete attention	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All buttons in this version of InfoPediA behave predictably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Thank you very much for your cooperation.

Survey

As a final part of this test, you are asked to answer a few questions. This will take approximately 5 minutes.

General information

Test subject number: 2

Job description: Customer Support Specialist XRD

Age: 47

Questions

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It is easy to become a skillful user of this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
All texts in this version of InfoPediA are easily legible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
This version of InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase my job performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use while talking to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Using this version of InfoPediA, I could access the data I needed quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very meaningful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase productivity	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I have</i> I have an idea of my position in the menu structure when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I will need to be trained extensively before I can use this version of InfoPediA effectively	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the meaning of every text in this version of InfoPediA easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I get a clear sense of where I'm currently located in the menu structure when using this version of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

InfoPediA					
I could do something else when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is useful	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would make my job easier	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA gives me quick access to all the files I need	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All buttons in this version of InfoPediA are placed where I expect them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Using this version of InfoPediA is difficult	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very clear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
In this version of InfoPediA, all interface elements did what I expected them to do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
In this version of InfoPediA, interface elements are placed predictably	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would require my complete attention	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All buttons in this version of InfoPediA behave predictably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Thank you very much for your cooperation.

Survey

As a final part of this test, you are asked to answer a few questions. This will take approximately 5 minutes.

General information

Test subject number: 3

Job description: Custom Support Specialist XRF

Age: 61

Questions

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It is easy to become a skillful user of this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
All texts in this version of InfoPediA are easily legible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
This version of InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase my job performance	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use while talking to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Using this version of InfoPediA, I could access the data I needed quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
All texts in this version of InfoPediA are very meaningful	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase productivity	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I got an idea of my position in the menu structure when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I will need to be trained extensively before I can use this version of InfoPediA effectively	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the meaning of every text in this version of InfoPediA easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
I get a clear sense of where I'm currently located in the menu structure when using this version of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

InfoPediA					
I could do something else when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is useful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would make my job easier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA gives me quick access to all the files I need	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
All buttons in this version of InfoPediA are placed where I expect them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Using this version of InfoPediA is difficult	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very clear	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
In this version of InfoPediA, all interface elements did what I expected them to do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
In this version of InfoPediA, interface elements are placed predictably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
This version of InfoPediA would require my complete attention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
All buttons in this version of InfoPediA behave predictably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Thank you very much for your cooperation.

Survey

As a final part of this test, you are asked to answer a few questions. This will take approximately 5 minutes.

General information

Test subject number: 4

Job description: Application specialist

Age: 29

Questions

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It is easy to become a skillful user of this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are easily legible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase my job performance	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use while talking to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Using this version of InfoPediA, I could access the data I needed quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very meaningful	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I got an idea of my position in the menu structure when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will need to be trained extensively before I can use this version of InfoPediA effectively	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the meaning of every text in this version of InfoPediA easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I get a clear sense of where I'm currently located in the menu structure when using this version of	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

InfoPediA					
I could do something else when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is useful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would make my job easier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA gives me quick access to all the files I need	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
All buttons in this version of InfoPediA are placed where I expect them	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this version of InfoPediA is difficult	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very clear	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
In this version of InfoPediA, all interface elements did what I expected them to do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
In this version of InfoPediA, interface elements are placed predictably	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would require my complete attention	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All buttons in this version of InfoPediA behave predictably	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Thank you very much for your cooperation.

Survey

As a final part of this test, you are asked to answer a few questions. This will take approximately 5 minutes.

General information

Test subject number:5.....

Job description: ...Service Eng.....

Age:40.....

Questions

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It is easy to become a skillful user of this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are easily legible	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is fast	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA looks professional, simple, smart and up-to-date to a customer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase my job performance	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to use while talking to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
This version of InfoPediA is easy to learn	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using this version of InfoPediA, I could access the data I needed quickly	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
All texts in this version of InfoPediA are very meaningful	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
This version of InfoPediA would increase productivity	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I got an idea of my position in the menu structure when using this version of InfoPediA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I will need to be trained extensively before I can use this version of InfoPediA effectively	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood the meaning of every text in this version of InfoPediA easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I get a clear sense of where I'm currently located in the menu structure when using this version of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

InfoPediA					
I could do something else when using this version of InfoPediA	0	0	0	0	0
This version of InfoPediA is useful	0	0	0	0	0
This version of InfoPediA would make my job easier	0	0	0	0	0
This version of InfoPediA fits in well with PANalytical's corporate style (EBL)	0	0	0	0	0
This version of InfoPediA gives me quick access to all the files I need	0	0	0	0	0
All buttons in this version of InfoPediA are placed where I expect them	0	0	0	0	0
Using this version of InfoPediA is difficult	0	0	0	0	0
All texts in this version of InfoPediA are very clear	0	0	0	0	0
In this version of InfoPediA, all interface elements did what I expected them to do	0	0	0	0	0
In this version of InfoPediA, interface elements are placed predictably	0	0	0	0	0
This version of InfoPediA is easy to use	0	0	0	0	0
This version of InfoPediA would require my complete attention	0	0	0	0	0
All buttons in this version of InfoPediA behave predictably	0	0	0	0	0

Thank you very much for your cooperation.

Appendix T: Evaluation against iOS HIG

Evaluation of the InfoPediA prototype against the iOS Human Interface Guidelines

One of the requirements for the InfoPediA prototype was that it should comply to the platform's design guidelines. As the current redesign was primarily aimed at iPad, the iOS Human Interface Guidelines (Apple Inc., 2012) were selected for this purpose. Specifically, it was studied how the design performs on the six Human Interface Principles.

Principle	What does it mean?	How to evaluate?	How does the design perform?	Result
Aesthetic integrity	Application's appearance integrates with function	Check if the design conveys its function correctly.	Decorative elements are subtle and very few exist. Provides standard behaviours. No contradictory signals, the design is clear in its purpose. Standard controls are provided where they can be, other controls are designed to have a shape similar to standard controls.	
Consistency	The application takes advantage of the standards and paradigms people are comfortable with	Is the application consistent with iOS standards?	The application uses no system-provided controls, but the controls designed to look similar, but fit within PANalytical's style have a similar function and are used in the same manner. Device features, such as gestures, are used in a reliable way, functioning the same as in other apps	
		Does it use system-provided controls, views and icons correctly?		
		Does it incorporate device features in a reliable way?		
		Is the application consistent within itself?	Text is always used consistently, as well as icons. Behaviour is very predictable. As stated above, custom UI elements are designed to look both compatible with PANalytical's style and look familiar to users. Shapes of buttons are used consistently and tell about their function.	
		Does text use uniform terminology and style?		
		Do the same icons always mean the same thing?		
		Can people predict what will happen when they perform the same action in different places?		
		Do custom UI elements look and behave the same throughout the app?		
		Within reason, is the app consistent with its earlier versions?	This version was meant to be a revolutionary change when compared to the earlier version. It does, however, share the same terms and fundamental concepts (its goals have not changed)	
		Have the terms and meanings remained the same?		
		Are the fundamental concepts essentially unchanged?		
Direct manipulation	Users should be able to manipulate onscreen objects directly, without using an intermediary. For example: zooming should not be done with a "zoom" button, but with a pinch gesture.	User's actions have immediate, visible results	Buttons react immediately and give visual response by lighting up when touched. When swiping back through menus, direct visual response is also given.	
		Rotate or otherwise move the device to affect onscreen objects	There are no device movements implemented into the design. Rotation will be supported, however this was not implemented into the prototype	Not applicable
		Use gestures to manipulate onscreen objects	Users can swipe to move back through menus, letting them manipulate the screen directly	

Principle	What does it mean?	How to evaluate?	How does the design perform?	Result
Feedback	Feedback acknowledges people's actions and assures them that processing is occurring.	Subtle animations give people meaningful feedback that helps clarify the results of their actions. This helps them track change visually.	Transitions between menus are accompanied by a subtle animation for exactly this reason.	
		Operations that take more than a few seconds should display elapsed process or similar.	No process in this application should take more than a few seconds.	Not applicable
Metaphors	Visual objects that are metaphors for objects and actions in the real world are easily understood by users.	Metaphors should be used where direct manipulation is not practical. They should not be stretched too far.	On/Off switches are used instead of check boxes in the settings menu. The panels on which menus reside represent pieces of paper: they are themselves completely static and slide on top of each other (which is shown by adding a subtle shadow). Buttons are placed onto the menu as a sort of tab. When a menu slides in, it is placed between the paper under it and the tab, representing a paperclip. Sliding menus represents moving your gaze.	
User control	The user, not the application, should initiate and control actions.	A balance should be found between giving users the capabilities they need, while helping them avoid dangerous outcomes.	When we assume reaching data intended for a different instrument is a dangerous outcome (because it may, for example, lead the user to perform an action that damages an instrument or creates a radiation leak), this redesigned version performs well in that it asks the user to fully define the type of instrument first. It does not depend on the user reading the description accompanying the data (as the previous version does) when two instruments have the same name but a different serial number. The user, however, remains in control. The application does not make any decisions on its own.	
			Only when no choice is available (when a menu contains only one button), the application assumes the user wants to access this submenu. Another solution for the problem of menus containing only one items was researched, but no better solution was found. Further research may be in order.	Further research needed
		Controls should feel familiar and predictable	Buttons give a clear direction to the menu flow. These buttons are familiar to iOS users, as they are shaped very similarly to existing buttons. Their behaviour is always the same, which makes them very predictable	
		Users expect control over an operation before it begins and while it's running	There are no lengthy operations in this application to which this is applicable	Not applicable

Conclusions

Based on this evaluation, it can be concluded that the design conforms to the Human Interface Principles quite well. Because the design had to comply with PANalytical's corporate style as well, some design choices were made which diverge from standard iOS apps. However, the basic shapes of elements have been preserved so the this does not interfere with usability. As stated above, some further research may be needed to improve the behaviour of the application when encountering a menu with only one option.

Bibliography

Apple Inc. (2012, March 7). iOS Human Interface Guidelines. Apple Inc. Retrieved from

<http://developer.apple.com/library/ios/#DOCUMENTATION/UserExperience/Conceptual/MobileHIG/Introduction/Introduction.html>

Appendix U: Comparison of InfoPediA versions

Comparison of the newly designed version of InfoPediA to the current version

Requirement to be evaluated			Newly designed version	Current version	
The product can be used with or without internet connection that may or may not be reliable				Works, but starts very slowly when the connection is unreliable or slow	
The product can be used efficiently while:	Talking on the phone		Results of user test indicated that the application can be used while in a conversation	The application needs a user's attention. This was indicated in user interviews.	
	Talking to someone in person				
The product supports the user in his or her tasks:	Diagnosing an issue with an instrument			Adding bookmarks enables the user to do this	The current version does not perform well here, as it was designed from a document-centred point of view
	Give phone support				
	Preparing a visit to a client				
	The product is easy to use		4,3 out of 5 in prototype user survey	90% agreed in user survey	
	Using the product is effective		3,5 out of 5 in prototype user survey	90% agreed in user survey	
	The product is useful		3,6 out of 5 in prototype user survey	90% agreed in user survey	
	All information that is available in the current version can be accessed			This is the baseline	
	The product is easy to use, effective and useful	The product's user interface is clearly organized	The buttons in the user interface are placed in compliance with the device's Human Interface Guidelines		This was never checked for this version of InfoPediA, as it was not in the scope of this project
Behaviour of buttons is predictable			4,0 out of 5 in prototype user survey	12% of users in the survey responded that they often get an unexpected response	
The user gets a clear 'sense of location'			3,9 out of 5 in prototype user survey	This was never asked to users	
The product is easy to learn	No training needed for efficient use		Tested together with ease of use, scored 4,3 out of 5 in prototype user survey	90% agreed in user survey	
The product is fast (information can be reached at least as fast as in the current version by an experienced user)			The two versions are likely to be about equally fast when accessing the first file for an instrument (statistical probability of 60%). When switching to a different file for an instrument, the new version seemed to be faster (64% probability). These tests were carried out with experienced users of the current version.	About half of all users in the user survey thought the current version was fast.	
			4,0 out of 5 in prototype user survey		
All text in the product's user interface is easily readable, even when attention is split	Good contrast		Tested as "Easily legible", which scored 3,9 out of 5 in prototype user survey	83% agreed in user survey	
	Grade-equivalent should not be higher than 10 for any text.			This was not tested for this version	
All text in the product's user interface is meaningful to the user			3,8 out of 5 in prototype user survey	About 60% of users said that all text was meaningful	
The product provides customer support users with quick access to service manuals, XRA's and circular messages.			Tested with "Usefulness", which scored 3,6 out of 5 in prototype user survey	The user has to go back to the main menu to switch to a different document type	
The product provides all users with an overview of items per instrument type				Available only for sales users	
The product enables the user to select information in advance and recall it quickly.					
Some information should be protected				Currently, users have a different application containing only some files that are publicly available. When using InfoPediA, all data is visible	
The product should be clear about the contents of information packets	The following attributes should at least be conveyed to the user:	Title			
		Description			
		Last update			
		Version			
		Privileges			
The product fits in well with PANalytical's corporate style				No expert review was done for this	
The product looks professional, simple, smart and up-to-date to a customer			3,6 out of 5 in prototype user survey	Not asked in user survey	

Note: the values inside the cells should not be compared across versions as they were tested differently (for example: the user survey done in the beginning of the project did not allow the users to take a neutral position and the survey evaluating the newly designed version did)

Appendix V: Development plan

InfoPediA-*NEXT* development plan v0.2

This document was written to get an idea of the time it would take to design, build and implement the newly designed version of InfoPediA.

There are five major parts to consider when implementing this application:

1. The defining of standards and interfaces

When working in different teams, interfaces between the subsystems under design should be guarded. One person or team (the system engineers) should be in charge of these interfaces. One of the interfaces will be between the client application and the backbone server infrastructure. For this interface, a standard will have to be written for the XML intermediate interface, among other things. A standard for manifest files should also be defined, as it is an interface between the system and the outside world.

2. The backbone server infrastructure

The backbone server infrastructure should be built by an ICT infrastructure specialist or a team of ICT infrastructure specialists. This backbone consists of a root server and a set of servers that let a this root server write to a folder, and give certain users certain read access to files and folders through SFTP and rsync, based on their needs. There should be a way to synchronize these access restrictions from the root server to all other servers. This team should also build a load balancing system.

3. The client application

The client application should translate the XML intermediate interface to an interface that is easy to use and complies with PANalytical's EBL. The application should also provide a mechanism for reminding the user that updates are available and carry out these updates. As this is not possible in a local browser interface, a browser interface should only remind the user that he must update his system. For the first version, only a browser interface will be built. Native versions can be rolled out later in the year.

4. The automated building of an intermediate interface

A number of applications or scripts are likely to run on the root server. These will have to build the XML intermediate interface based on all manifests provided with individual files. They may also build a search index file that is used by the applications to search all provided files.

5. Creating manifests¹ for all files

All files currently available through InfoPediA should be provided with a manifest. A tool may be written to read data from the system files in the current version of InfoPediA to fill most fields in the manifest file. However, some other fields may have to be filled in by hand. About 5000 files are currently available through InfoPediA.

¹ In this text, a manifest is a universally readable file that accompanies content files and contains information about this file (metadata).

Appendix V

