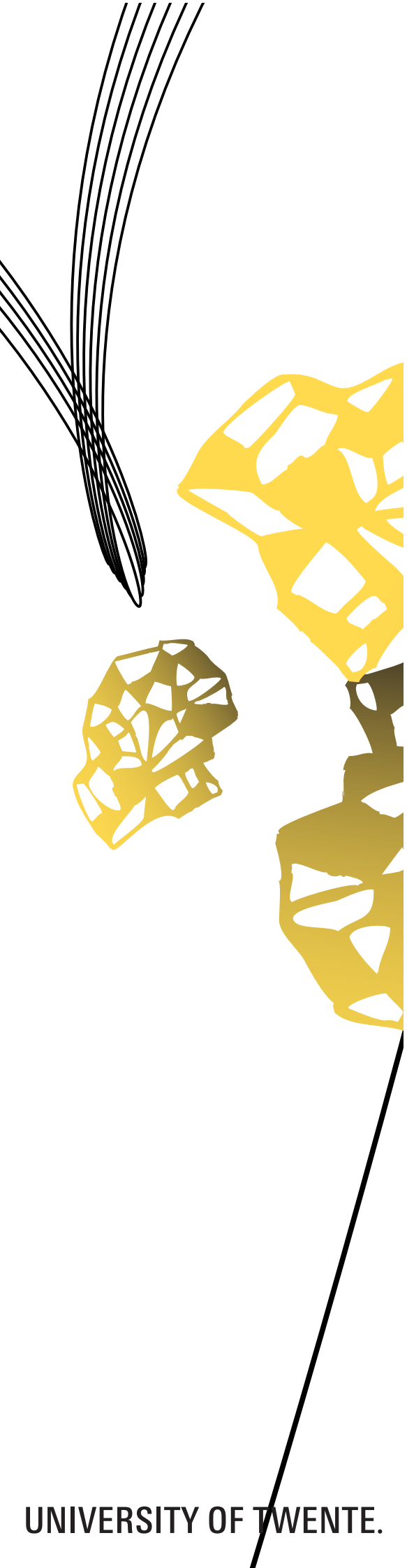

CREATING A GRAPHICAL USER INTERFACE CONCEPT FOR GEO-BASED 3D PLANNING SOFTWARE

BACHELOR THESIS

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Abstract

The focus of this bachelor thesis is on the redesign of a graphical user interface (GUI) for a geo-based 3D planning software named Win3D, which is developed by the company ROM3D. The software can place objects in a virtual 3D landscape to visualise situations before something is built in real life. In the past, employees of the company would prepare these visualisations for clients, but clients have requested access to the software themselves, which has been granted. The software, however, was never built for new users, which lead to new users quitting or needing extensive help. The challenge of this bachelor thesis is to redesign the GUI for both user groups, with a focus on new users, where users do not quit the program or need extensive help. The research question of this thesis is: how to build a graphical user interface concept for a geo-based 3D planning software?

A good GUI should be easy and intuitive to use. It should not cost the user much effort to accomplish their tasks and a user should never feel lost. Design principles (e.g. visibility, affordance, feedback) are examined to use as guidance during the design process to achieve a good GUI. The current GUI is mapped in its entirety and a list of functions that should reappear in the new GUI is produced.

A first concept is co-created with new users. This concept is discussed with other new users and a main concept design is produced. This main concept design is for a large part implemented in a prototype so it can be tested and evaluated. The prototype is tested by new and experienced users. All issues found during testing were relatively small and quite easily solvable. New users believed that the tested concept would make it possible for them to work with the program on their own without receiving external help. The employees of the company stated that the concept design resolves all large annoyances that came with the current interface. It is their plan to turn the concept design into a working GUI.

Contents

Chapter 1

Introduction

The focus of this bachelor thesis is on the redesign of a graphical user interface (GUI) for a geo-based 3D planning software named Win3D. Win3D is software created by the Dutch company ROM3D. The software was built in 2011 and started out as a tool to visualise wind turbines in a 3D virtual landscape.

1.1 Background

Future clients saw possibilities in Win3D and started to approach ROM-3D for 3D visualisations. However, some clients requested other uses for Win3D that were not included in the software. ROM3D accepted these requests and added new modules (e.g. solar energy, water, agricultural) to the initial software. What started as a small program evolved into a complex program with different modules and a variety of functions.

Until recently it was ROM3D who made the visualisations in Win3D. These visualisations would then be presented in information meetings for clients and possible other interested parties. Clients could also request a workshop, where they could create together with ROM3D a virtual landscape.

Recently the province of Overijssel requested full access to the software, instead of ROM3D doing the visualisations for them, since the province wants to stimulate the transition toward sustainable energy. The province plans to involve many people and the province believes that this can be best achieved by giving these people access to the actual planning software. ROM3D accepted the request of the province of Overijssel, also because ROM3D recognises similar interests from other parties, and the project started in January 2017. Employees of different municipalities and companies can now access and use the software.

1.2 Problem

The software of Win3D has never been built with the thought in mind that other parties than ROM3D would use it. Therefore, when new functions where being added to the software, there went not much thought into where and how these functions should be placed in the GUI. The

GUI grew larger and more complicated with each module adding new buttons, menus and icons. However, the employees of ROM3D evolved with the program. Because they have known the program from the start, and have had the ability to adjust to the changes in incremental steps, they still understand the program and find it logical to use. A new user, on the other hand, misses this learning process and insights of previous versions, making the software illogical and not intuitive to them.

An example is the closing of a pop-up window on the screen. There was no symbol 'X' in a top corner of the window to close it, nor would clicking outside the window work. The window would only close by pressing the escape button on the keyboard. The employees of ROM3D knew that they must press the escape key to close pop-up windows, but this is not knowledge that is available to a new user. A new user would expect a symbol 'X' or something with a red colour to give an indication on how to close the pop-up window. Without a hint, a new user would have to guess what to do, making the software more difficult to use. ROM3D resolved this issue by placing the symbol 'X' in the upper right-corner of a pop-up window which users could click to close the window. However, many similar examples, both small and large, remain that should be resolved.

Because such issues exist and because the software was never built to be intuitive and usable for other users than ROM3D employees, it is more efficient to redesign a new GUI for new users than to build further on the current GUI. This bachelor thesis will therefore focus on restructuring and redesigning the entire Win3D planning method, which will result in a concept design for a new GUI.

1.3 Research question

The main research question of this bachelor thesis is stated as follows.

> How to build a graphical user interface concept for a geo-based 3D planning software?

By researching and answering this question, guidelines will be provided for building a GUI for current or future geo-based planning software.

1.4 Challenge

There are multiple challenges to redesigning a GUI for a geo-based 3D planning software. ROM3D does not have an overview of functions of the software. Therefore, a method must be found to map and order all the current functions. Another method must be discerned for building up the structure of the new interface and for visualising the concept. An evaluation method is also needed to validate the concept.

1.5 Language

The examined program is mainly written in Dutch and is focused on a Dutch audience. It is therefore requested that the GUI concept is written in Dutch as well. Original terms from the program (e.g. module

names, text on buttons) will be used in this thesis and a translation to English will be given the first time a new Dutch term is encounted. A full list of Dutch words and their English meaning can also be found in appendix A.

1.6 Project

The new GUI should in the end facilitate various users (e.g. employees of the Ministry of Economic Affairs (The Netherlands), the Ministry of Infrastructure and the Environment (The Netherlands), Kadaster, municipalities, developers of wind and solar projects). However, this bachelor thesis will focus, due to its scope, on the current users of Win3D; public servants of different municipalities. The expectation is that this user group will have different expertise regarding knowledge on topics (e.g. wind, water, agricultural) and different expertise in computer skills. The input received from interviews from this group will give insights in how the current GUI is perceived and what the expectations are for a new GUI. Their input combined with a literature study on GUI design will lead to a first concept. This concept is discussed with other interviewees consisting of public servants from municipalites, leading to a main concept design. This concept will need further validation, and is therefore recreated into a prototype. This prototype is tested with new and experienced users.

1.7 Outline

This thesis consists of nine chapters. Chapter 2 delves into the literature, methods and principles of GUI design. Chapter 3 outlines other geo-based 3D planning software and games with similar mechanics. Chapter 4 analyses the current GUI of the software. Chapter 5 discusses interviews held with current users and details how these interviews lead to the first concept design and later to the main concept design. Chapter 6 details the main concept design of the new interface. Chapter 7 explains how the main concept design is turned into a prototype that can be used for testing. Chapter 8 focuses on the prototype testing done with new users to validate the main concept design. Chapter 9 concludes with the evaluation, conclusion, recommendation for future work and acknowledgements.

Chapter 2

Background research

Before designing a GUI it is important to know what qualities make a GUI good and why it is important for a GUI to be good. This chapter explores these principles by comparing papers on the definition and importance of GUI design. This chapter also discusses the importance of design principles and the differences between menu types and between interview methods. Further attention is given to human-centered design, with a focus on designing for different types of users and participatory design.

2.1 Definition of a good graphical user interface

There are different factors that determine if a GUI is a good GUI. Researchers do not seem to contradict each other in what those factors are, however, they often do appoint a different factor as the most important factor for a GUI. Stone *et al.* [1] claims that a good GUI has three core abilities: (i) the interface is easy to use and understand, making the user almost forget that they are using a computer, (ii) the interface supports the user to carry out their tasks and (iii) the interface will meet the needs of the intended user. The determining factor to reach these abilities is the usability of the interface. Usability is defined by Stone *et al.* as:

> The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

Effectiveness is determined by how much the interface allows users to complete their tasks accurately. Efficiency is defined as how much effort it costs users to complete their tasks. Satisfaction entails how easily users accept the interface and if they are comfortable with using it.

Gu and Yu [2] state that a good GUI is determined by having great affordances. These affordances will enable the user to use the interface intuitively, which will lead to the user being able to select the correct action regarding what the user tries to accomplish. This will lead to almost the same outcome as Stone *et al.* endeavours to reach with a good interface. However, both appoint a different factor as the main factor to reach this goal. Other researchers shift their focus to the menu part of an interface, and claim that there lies the key to producing a good GUI [3].

Although menus are an existential part of an interface, they are often also accompanied by several icons and toolbars. These menus, icons and toolbars increase in complexity when a program becomes more elaborate. This increase might cause the interface to become complex and hard to organise, as parts become useless to the user or invisible. This is called by some researchers 'creeping featurism' or 'bloated software' [4]. Al-Omar and Rigas [5], and Park and Han [6] agree that a good GUI avoids this cluttering of options at all costs.

Although researchers often appoint a different factor as the most defining factor for leading to a good GUI design, they all agree to what a good GUI should entail. A good GUI should be easy and intuitive to use. It should not cost the user much effort to accomplish their tasks and a user should never feel lost.

2.2 Importance of a good graphical user interface

Although the definition of a good GUI is now better understood, the question remains open as to why it is important for a GUI to be good. George Saadé and Alexandre Otrakji [7] state that the interface is the determinative factor for a user to decide if it will adopt the application, and therefore the GUI must be good, where they define a good interface as resulting in no cognitive overload and a well oriented user. Consequences for a user that experiences disorientation are frustration, less efficiency and a loss of interest. Similar computer-related distress in the workplace may lead to an increase in mistakes, irrational beliefs or decreases in performance. Stone *et al.* name similar results for a bad GUI, but also list the benefits a good GUI can bring to the workplace, like higher staff productivity, lower staff turnover and higher job satisfaction. A good GUI would also require less training, leading to a financial benefit for businesses.

An increasingly large portion of computer users has no specialist knowledge of computers, which increases the importance of having a good GUI [1], [7]. A well-designed interface supports the tasks people want to do, by being easy to use and understand, enabling users to reach their goals without becoming frustrated. A good GUI will therefore make a program more attractive to a larger group of users.

There are no conflicting opinions about the importance of a good GUI, instead researchers only strengthen each other's opinions. A good GUI will decide adaptation of the application, be beneficial in the workplace and allows a larger population of end-users to use the application.

2.3 Design principles

Design principles are used by designers to guide them during the design process and to aid their thinking [8]. Design principles can also be used to evaluate and critique the design ideas of prototypes [9]. The principles are abstract and broad and are more generalizable abstractions then specific rules. They are based on the experience of other designers.

The list of design principles is extensive and researchers often deviate on which design principles are the most important. Stone *et al.*, Benyon *et al.* [9] and Sharp *et al.* [8] have three design principles in common that they find important: (i) visibility, (ii) affordance and (iii) feedback.

2.3.1 Visibility

Examples of highly visible controlling devices are knobs, buttons and switches. An example of an invisible controlling device is the activation zone people must pass by to let a faucet run with water. When such an activation zone is out of sight and first encountered, then it is more difficult for people to find out how to use the device [8]. It is therefore encouraged to make design visible, because it increases the chance that users can achieve their goal [1].

2.3.2 Affordance

Affordance is designing something so it affords the right response. 'Affording' can be interpreted here as 'to give a clue' [10]. By giving the right clue as a designer you can inform a user on what to do without using a picture or instructions [1]. Norman [11] distinguishes to kinds of affordance: (i) perceived affordance and (ii) real affordance. Real affordance applies to physical objects, like the affordance of a chair to sit on it or the affordance of a lever to pull it. According to Norman screen GUIs do not have real affordance because a GUI is not a physical object. GUIs must be conceptualised as having perceived affordance, which are basically learned conventions.

2.3.3 Feedback

Feedback is the information that is send back to the user in response on an action performed by the user [8]. Keeping the feedback consistent will give the user a feeling of control [9]. An example of feedback is going back a page after pushing the arrow pointing to the left in a browser.

2.3.4 Constraints and consistency

Benyon *et al.* and Sharp *et al.* agree on adding two more to this list: (i) constraints and (ii) consistency. Constraints are used to restrict users in their behaviour. The main advantage of constraints is that they prevent users from making errors. It also becomes more visible for the user what their possible choices are. A well-known example of constraints in a GUI are the options in a menu that are shaded grey if they cannot be used. Consistency in design should lead to similar operations to do similar tasks. A GUI will become more easy to learn and use when it is consistent [8]. However, being consistent becomes increasingly difficult with the increase of complexity of a GUI.

2.3.5 Other principles

Benyon *et al.* recognises seven more important design principles: (i) familiarity; using concept (e.g. icons, language) that the user is already familiar with. (ii) Navigation; give users an overview of the layout of a GUI. (iii) Control; making clear who is doing the actions, the user or the system. (iv) Recovery; users should be able to recover from errors. (v) Flexibility; let users personalise the system. This will accommodate users with different experiences with the system. (vi) Style; make GUIs

both stylish and attractive to users. (vii) Conviviality; make a GUI polite and avoid aggressive messages.

2.4 Menus

Menus are used in a GUI to organise and store the available commands [9]. A user can perform an action by selecting a command from a menu list. Menus are often used as the main navigation method for a GUI, although they are in most cases accompanied by tool bars and command buttons. Menus should be kept simple to improve ease of use. However, it might become difficult to do so if a GUI has many and complex commands. Choosing a fitting menu type can help to keep menus simple.

2.4.1 Flat menu

A flat menu is the most basic option for a menu style. It displays all the options a menu has on to the screen. Flat menus are often discarded by designers due to the space they take up in a GUI.

2.4.2 Drop-down

A drop-down menu, see figure 2.1, is one item when it is inactive. If this item is pressed and becomes active, more items will appear. This type of menu is the most common [1]. A drop-down menu may lead to a roll-up menu. These menus can be rolled up, leaving only the top function visible.

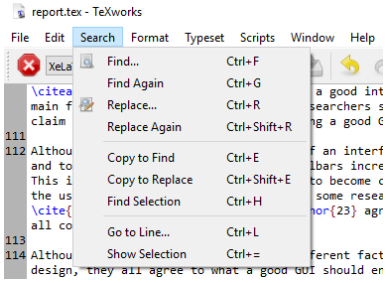

Figure 2.1: An active drop-down menu.

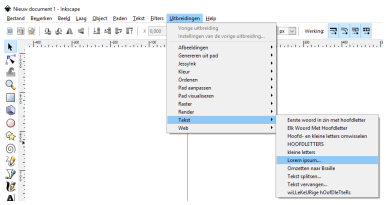

Figure 2.2: Example of a hierarchical or cascading menu.

2.4.3 Hierarchical or cascading

Hierarchical or cascading menus, see figure 2.2 are menus that start with a primary menu, which is often also a drop-down menu. By hovering over a primary menu item in the primary menu a secondary menu is displayed with menu items belonging to the hovered over item. Hovering over a secondary menu item may then lead to a tertiary menu, and so on. A downside to this type of menu is the precise mouse control that is needed by a user due to the hovering action required [1], [8]. Still, this downside does not prevent it from being one of the most common used expanding menus in GUIs. Especially its ability to show more options on a single screen than would be possible with a single flat menu list, makes it popular with designers [8].

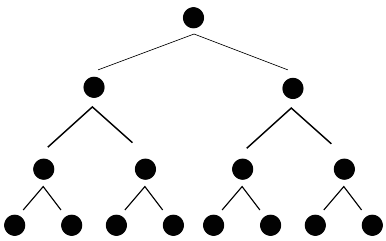

Figure 2.3: A deep and narrow structure.

2.4.4 Breadth and depth

A designer should decide the depth and breadth of their menus when choosing hierarchical menus. A menu can be deep and narrow, see figure 2.3, where the user has few choices per level but many levels to go through, or a menu can be shallow and broad, see figure 2.4, where a user has many choices per level but only a few levels to go through. Research on the preference of depth and breadth has consistently appointed the shallow and broad style as the most preferred by users [12].

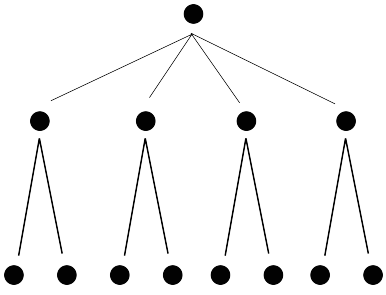

Figure 2.4: A shallow and broad structure.

2.4.5 Simultaneous and sequential

In a hierarchical menu, items are presented in a sequential manner when going through the different menus. However, the possible choices inside a menu do not need to be themselves in a hierarchical order [12]. For example, a hierarchical menu on a recipe website lets a user first choose an ingredient, then the type of meal and next the difficulty of preparing the meal. This is not the order in which these questions must be asked, making the questions themselves non-hierarchical. These options could also be presented in a simultaneous menu, making it possible to select any of these three options at any given time. Simultaneous menus are more often used for complex tasks while sequential menus are preferred for simpler tasks.

2.4.6 Pop-up

A pop-up menu, is, as the name invokes, a menu that pop-ups somewhere on the screen. See figure 2.5 for an example. This window is not attached to another menu or panel and is floating over the other parts of a GUI. It often closes by using a standard method for closing a panel or by clicking on a menu item inside the pop-up menu. The precise menu items of a pop-up window often depend on the location where the pop-up menu was called upon. The item beneath the cursor is what responds with the menu items inside the pop-up menu [1]. This attribute make it also a contextual menu.

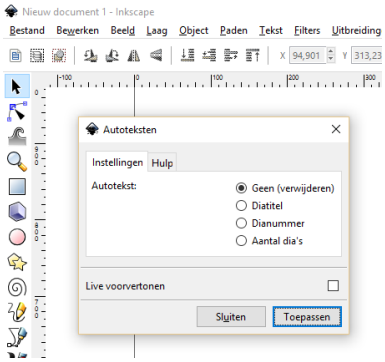

Figure 2.5: An example of a pop-up menu.

2.4.7 Contextual

A contextual menu will vary in accordance to what invoked the menu. They try to help a user with their task by suggesting appropriate commands. An example of a contextual menu is the menu a user can see when right-clicking on an image in a browser. This gives the user options like saving the image or opening it in a new window. Due to the location of the cursor of the user, namely the image, the browser deduces that the user wants to do something with the image, giving it therefore a contextual menu that limits its menu items to actions regarding the image.

2.5 Human-centered design

A human-centered design focuses on what people want to do, instead of what it is that the technology can do [9]. Focusing on humans and their needs requires designs that include diversity and that involves people during the design process. These requirements can be fulfilled by designing for users with different expertise and by including participatory design.

2.5.1 Designing for users with different expertise

There are multiple methods and options for designing a GUI for users with different expertise. However, before employing these methods a

designer should become familiar with the psychological characteristics, cultural background, physical attributes (i.e. age, vision or hearing) and level of experience of the user [13]. This informs the designer of the breadth of their users and can aid in deciding the limitations of a GUI design.

Studies agree that satisfying users with different backgrounds can best be achieved by offering a personalised GUI [3], [5], [14], [15]. This provides users with the possibility to hide functions they do not use while highlighting the functions that they do use, making the GUI more efficient by providing clarity and structure [15] There are three approaches to personalising a GUI: (i) adaptive customisation, (ii) adaptable customisation and (iii) mixed-initiative customisation. An adaptive GUI will adapt to its user. The application decides how and what it will change and will base its decisions on earlier behaviour of the user. An adaptable GUI is also able to change. However, it is the user who is in control regarding what will change when. A mixed-initiative GUI combines the approaches of an adaptive and an adaptable GUI. Therefore, both the system and the user can control some of the interaction. The opposite of a personalised GUI is a static GUI.

Gajos *et al.* [14], Findlater and McGrenere [15], Park *et al.* [3] and Al-Omar and Rigas have performed studies where they researched the different approaches of personalisation. Gajos *et al.* focused on different forms of adaptive GUIs in comparison to a static GUI. Remarkably they did not include an adaptable GUI, although their literature research showed that adaptable design is often better appreciated. Findlater and McGrenere compared a static, adaptive and adaptable GUI, Park *et al.* conducted an experiment with a static, two adaptive and an adaptable GUI and Al-Omar and Rigas investigated the use of different forms of adaptive, adaptable and mixed-initiative GUIs. An overview of the different focusses can be seen in table 2.1.

	static	**adaptive**	**adaptable**	**mixed**
Gajos *et al.*	X	X		
Findlater and McGrenere	X	X	X	
Park *et al.*	X	X	X	
Al-Omar and Rigas		X	X	X

Table 2.1: Overview of focusses of four studies.

All four studies concluded that the adaptable GUI was preferred by users over the other options. Remarkably this did not entail that in terms of performance the adaptable GUI was always the fastest. Findlater and McGrenere concluded that the static menu was not that different from the adaptive menu and Gajos, Czerwinski, Tan, *et al.* stated also that adaptive menus were not faster than the other two approaches. Gajos *et al.* and Al-Omar and Rigas theorised before their experiments that an adaptive GUI would be preferred to an adaptable interface by users. Gajos *et al.* hypothesizes that the results differed from the theory due to a cost that the user experiences that was not accounted for. This cost can be divided in two factors: (i) the user experiences an incorrect adaptation and (ii) the user needs to become aware of the adaptation. Users preferred the adaptable GUI because they experienced a low cost and a high benefit. All four studies concluded that, although the adaptable GUI was perceived as most favourable, that further studies should investigate further the possibilities of a mixed-initiative design. Gajos *et al.* and Park *et al.* acknowledged mixed-initiative design as interesting future research. Findlater and McGrenere noticed that there was still a large group of users preferring strongly the adaptive GUI. They therefore concluded that a mixed-initiative de-

sign might be best to satisfy all users. Only Al-Omar and Rigas included mixed-initiative design in their experiments, but they admitted that there was a drawback in their menu design, which might have been the reason why mixed-initiative design did not perform better than adaptable design for their experiment. Therefore, they recommend further experimentation to examine the mixed-initiative design against the adaptable design.

Another option to accommodate a broad group of users is by providing 'self-training' modules [7]. These modules can help users to acquire specific information quickly which enables users to learn and use new technologies fast. Users can determine themselves what they find important, making it accessible to a group of users with different expertise.

In summary, three options were found to assist in making a GUI more personalised: (i) learning the characteristics of the different users, (ii) using one of the different approaches to personalise an interface, where a mixed-initiative and adaptable interface are favoured, and (iii) by providing 'self-training' modules.

2.5.2 Participatory design

Participatory design (also called co-operative design or co-design) is a design philosophy that takes into consideration the needs and preferences of users [12]. This philosophy is aware that designers are not end-users and that designers should understand the requirements of the actual users [9]. Participatory design therefore includes users to enable designers to become aware of the needs and preferences of users. User inclusion can exist of interviews, observing users, focus groups, workshops, etc. Including users can inform designers on current problems users have and can give designers an understanding of the requirements that are needed for a design. A design created with participatory design can lead to a higher satisfaction and a better work process for users [16].

2.6 Aspects of interviews

Design choices will be based on literature research and interviews. There are different methods and rules to interviewing users. Three main types of interview can be discerned: (i) a structured interview, (ii) a flexible or unstructured interview and (iii) a semi-structured interview [1]. Other aspects of interviewing are also important, like maintaining a good atmosphere, avoiding leading questions and choosing a suitable form of data gathering.

2.6.1 Structured interview

A structured interview consists of predetermined questions in a specific order. Closed questions work often well and ideally questions should be short and clearly worded [8]. The order of the questions should be maintained throughout the interview. According to Stone, Jarrett, Woodroffe, *et al.* there are limited possibilities to explore additional topics that arise during an interview. However, Lazar, Feng, and Hochheiser [12], Benyon, Turner, and Turner and Sharp, Rogers,

and Preece state that there should be no room for deviations from the questions or their order. Lazar, Feng, and Hochheiser reasons that deviating would interfere with the core motivation of using a structured interview, namely ensuring that the same questions are asked to all the interviewees. Advantages of using a structured interview are that they are relatively easy to analyse and are easy to carry out due to their predetermined structure that the interviewer should follow [9], [12]. Structured interviews are also more easy to carry out for interviewers with less experience and skills in doing interviews [12]. Disadvantages are, as mentioned earlier, having to give up on exploring unexpected answers and topics and acquiring less extensive data.

2.6.2 Flexible or unstructured interview

A flexible or unstructured interview has a list with topics established beforehand, but can change the order or the specifics of questions and can dive further into unexpected answers [1]. They resemble conversations in a way and often go into considerable depth [8]. The interview often starts with an initial open question and the interviewer will see where the interview will go from there. The interviewee can choose where to focus on regarding topics that they find important, giving them the ability to steer the conversation in a specific direction. This is a benefit of flexible interviews and it should therefore be avoided that an interviewer imposes too much structure [12]. Another benefit is the rich amount of data that can be acquired from flexible interviews [8]. However, that is also where the disadvantage lies of a flexible interview. The data is often complex and unstructured, making it a difficult and time-consuming task to analyse. A balance should therefore be found between checking that the main topics of an interviewer are covered during the interview, but that there is sufficient room maintained to explore new lines of enquiry [8].

2.6.3 Semi-structured interview

A semi-structured interview combines the features of a structured and an unstructured interview. It has often a similar list of questions as used for a structured interview, however, during a semi-structured interview, interviewers can probe for more information after a question has been answered or can allow the conversation to go where it may [12]. The order in which the questions are may also vary. Semi-structured interviews are most often used by designers [9].

2.6.4 Atmosphere

Effort should be put into letting an interviewee feel comfortable and at ease during an interview. This can be achieved by familiarising with the world around the interviewee and by dressing and talking accordingly [8], by being friendly and supportive and by showing interest in the story of the interviewee [12]. If interviewees are feeling comfortable they are inclined to give more honest and useful feedback.

2.6.5 Leading questions

An interviewer should avoid asking leading questions that might guide the answer of an interviewee in a specific direction [1], [8], [12]. Questions should not encourage interviewees to give answers they think the interviewer wants to hear. Interviewers should be extra alert for these responses when talking about a design of which the interviewee knows that the interviewer designed it [12]. Body language should also be kept neutral by the interviewer, because smiles and frowns can be interpreted as an approval or disapproval of a question or answer, which in turn might influence the response or interpretation of the interviewee [8].

2.6.6 Data gathering

There are four forms of data gathering to capture the data of an interview: (i) video recording, (ii) audio recording, (iii) taking photographs and taking notes. These forms may also be combined. Video data gives the most complete data gathering of an interview, however, it takes time to set up and the interviewee's behaviour might change [1]. Audio recording an interview is less intrusive for an interviewee and it takes less time to setup for the interviewer. However, it is recommended to combine audio recording with taking notes to capture observations (e.g. mood, initial thoughts, documenting non-verbal cues) of the interviewer [12]. Photographs can be used to supplement notes or to remind the interviewer of the settings of an interview [8]. Permission of the interviewee should be asked before video recording, audio recording or taking photographs. All written notes and recording should be treated as confidential and be kept securely [12].

Chapter 3

State of the art

Win3D is a hybrid between a virtual globe and a geographic information system (GIS). Both terms will be explained in this chapter and software belonging to these groups wil be discussed. Furthermore, similar software to Win3D will be shown for the most extensive module of Win3D; the wind module. No similar software has been found that provides multiple modules with 3D visualisations. Games that use object placement in landscapes will also be discussed.

3.1 Geographic information system (GIS)

A geographic information system is 'a computer system capable of integrating, storing, editing, analysing, sharing and displaying geographically-referenced information' [17]. In a broader sense, it is a tool that enables users to create interactive queries, to analyse spatial information, to edit data, to edit maps and that can present these results to the user. Since geo-spatial information refers to almost anything, GIS are ubiquitous distributed systems.

3.1.1 Google Maps

The most well-known GIS is Google Maps, a web mapping service developed by Google [18]. A screenshot of Google Maps can be seen in figure 3.1. The software is free to use. The software makes use of satellite imagery to provide street maps [19]. The more high-resolution images of mostly cities consist of photos taken from a plane. It also provided 360 degrees' panoramic views of streets and route planning for both private and public transportation.

3.1.2 GeoServer

[1]Source: http://docs.geoserver.org/latest/en/user/_images/services_WMS_watermark2.png

Figure 3.1: Screenshot of Google Maps.[1]

GeoServer, see figure 3.2, is software that enables users to view and edit geospatial data [20]. It can create maps based on the spatial information the user provides. The spatial information can be transformed to various 2D outputs. It can integrate with existing mapping APIs (e.g. Google Maps, Microsoft Virtual Earth, Google Earth) to display in a 3D environment. GeoServer is open source and free.

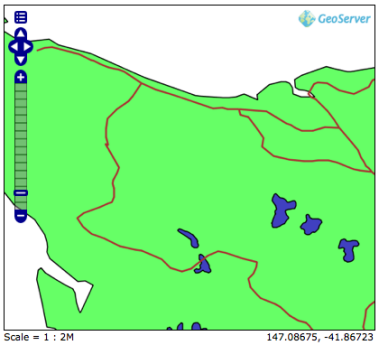

Figure 3.2: Screenshot of GeoServer.

3.1.3 GRASS GIS

GRASS GIS software can render maps, store spatial data and visualise different types of data [21]. GRASS stands for geographic resources analysis support system. It is free and open source and has existed since 1982 and was originally developed by the U.S. Army Corps of Engineers Construction Engineering Research Laboratories. Due to its long existence, it contains over 350 modules and it has many capabilities like DTM-analysis, geocoding, SQL-support and vector analysis. It can support geospatial analysis in different fields like geography, hydrology and ecology [22]. GRASS GIS provides a GUI and a command line syntax to make use of these functions. The command line makes the program better usable for people with a high computer expertise and not for novice users. GRASS GIS has a standard 2D map display, but it can also map in 3D. However, these images are made with 3D interpolation, diminishing the quality of the 3D visualisation.

3.2 Virtual globe

Virtual globe software can represent (parts of) the Earth or another world three-dimensional. See figure 3.3 for a screenshot of the software. The main difference of a virtual globe with a GIS is that virtual globe software enables the user to 'drop down' into a virtual environment and to walk around in that environment. This enables the user to explore the world from different angles and positions. Another feature of virtual globe software is the possibility to zoom out to look over the whole region and to seamlessly zoom in to focus on a small part of a region [17]. Virtual globes often do use GIS data for their representations.

[2]Source: https://grass.osgeo.org/uploads/images/Gallery/gui/Grass-arccr500.png

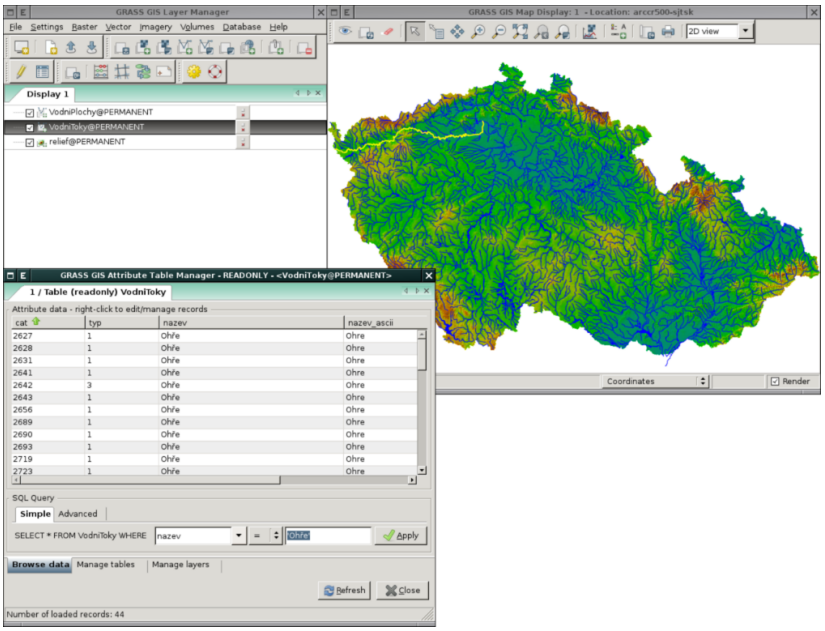

Figure 3.3: Screenshot of GRASS GIS.[2]

3.2.1 Google Earth

One of the most well-known virtual globes is Google Earth [23], see figure 3.4, which was originally created by Keyhole, Inc which was acquired by Google in 2004 [22]. Google Earth consists of two versions: (i) the basic and free Google Earth and (ii) Google Earth Pro. The latter was a paid upgrade ($399 for a year) but is as of January 2015 also free for users. Google Earth uses satellite images, mainly collected by NASA's shuttle radar topography mission, aerial photographs and GIS data to visualise the whole globe [22]. The basic functions for a user of Google Earth are the ability to browse to a location and to move around in that location, to see various layers of mapping information (e.g. roads, recreational areas, borders) and to add personal points of interest.

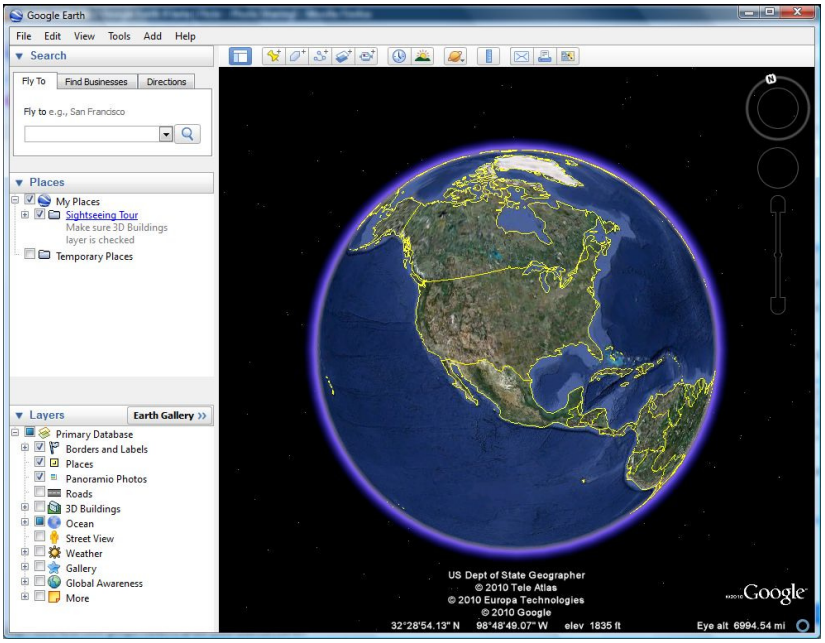

Figure 3.4: Screenshot of Google Earth.

3.2.2 World Wind

World Wind, see figure 3.5, is a virtual globe software that has been developed by NASA Ames Research Centre [24]. Most noticeable in comparison with other known virtual globe software like Google Earth is that World Wind has been developed and distributed under an Open Source Agreement from the start [25]. NASA wants to provide users with the opportunity to study, improve and redistribute their code. Another difference is that World Wind is not targeting end-users. World Wind provides the software and information that software engineers need to build their own applications.

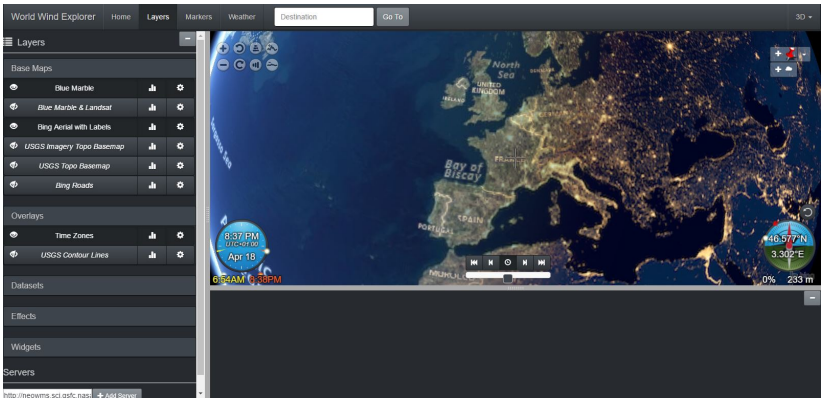

Figure 3.5: Screenshot of World Wind.

3.2.3 WorldWide Telescope

WorldWide Telescope offers similar Earth visualisation options as Google Earth or World Wind [26]. What it provides extra are 3D visualisations of eight celestial bodies, namely Venus, Mars, Jupiter, the four Galilean moons of Jupiter and the Earth's moon. The software also provides high quality images of the sky, where images are presented at their actual position in the sky. Another feature is the visualisation of our solar system, where the user can move forward and backward in time with the software, see figure 3.6. The images used for the software are acquired from many different sources, like the Hubble Space Telescope, the Chandra X-ray Observatory, IRAS, GALEX and other space and ground-based telescopes. The software was originally created by Microsoft Research in 2008. However, it is now an open source project and is managed by the American Astronomical Society.

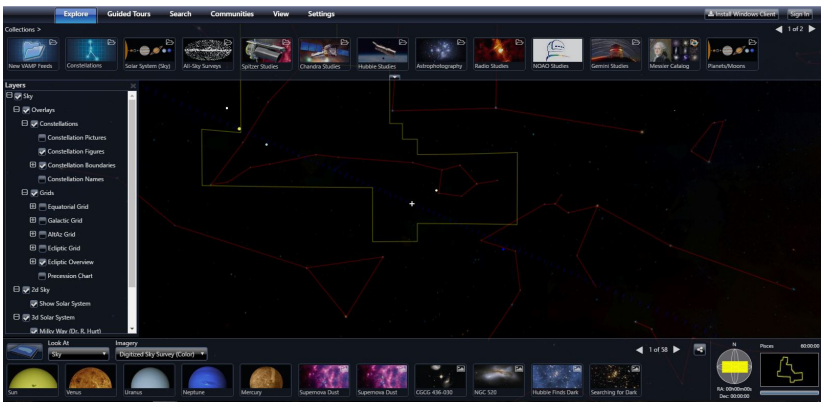

Figure 3.6: Screenshot of WorldWide Telescope.

3.3 Wind software

Win3D originated as software that focused on the placement of wind turbines in the landscape. There are other programs that work with wind turbines and landscapes, although they all differ from the approach of Win3D. Different examples of such software are given below.

3.3.1 2D software

There are many software options to calculate the energy a wind turbine might yield, but almost all software options are using 2D maps to place the wind turbines in. Examples of such software are WAsP[3], Openwind[4] (figure 3.7), Furow[5] (figure 3.8), WindFarmer[6] (figure 3.9) and Windographer[7]. There is a large difference between visualising in 2D and 3D. A 2D visualisation focusses more on the number that result from visualisation, like energy yield and possible financial profits, which is mostly interesting for the client that is building the wind turbines. 3D visualisation, however, also lay a focus on the aesthetic aspect of wind turbines, making it more suitable to convince stakeholders like residents to lend their support [27].

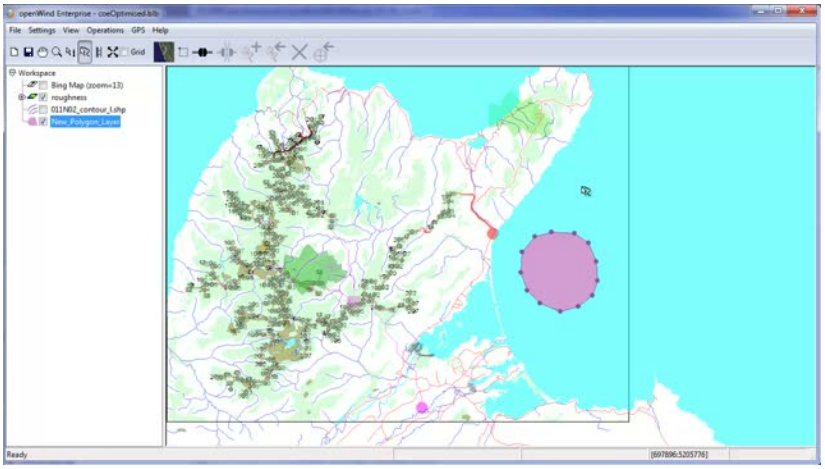

Figure 3.7: Screenshot of Openwind.[8]

3.3.2 Windfarm

Windfarm is commercial software by ReSoft [28]. The software can analyse, design and optimise wind farms by calculating cost of energy and energy yields, noise modelling, shadow occurrences and creating turbine data. The software can be used to place wind turbines in a 3D environment. However, this 3D environment can only be displayed in a wire-frame view, see figure 3.10, when working in the software. It is

[3]Source: http://www.wasp.dk/wasp
[4]Source: http://software.awstruepower.com/openwind/
[5]Source: http://solute.es/en/furow
[6]Source: https://www.dnvgl.com/services/windfarmer-3766
[7]Source: https://www.windographer.com/
[8]Source: https://videos.files.wordpress.com/aYf8kBL8/digitising-in-openwind_dvd.original.jpg
[9]Source: http://www.solute.es/sites/default/files/fig86_wrwindspeed.jpg
[10]Source: http://enertekglobal.com/wp-content/uploads/2016/03/WF-Base.jpg

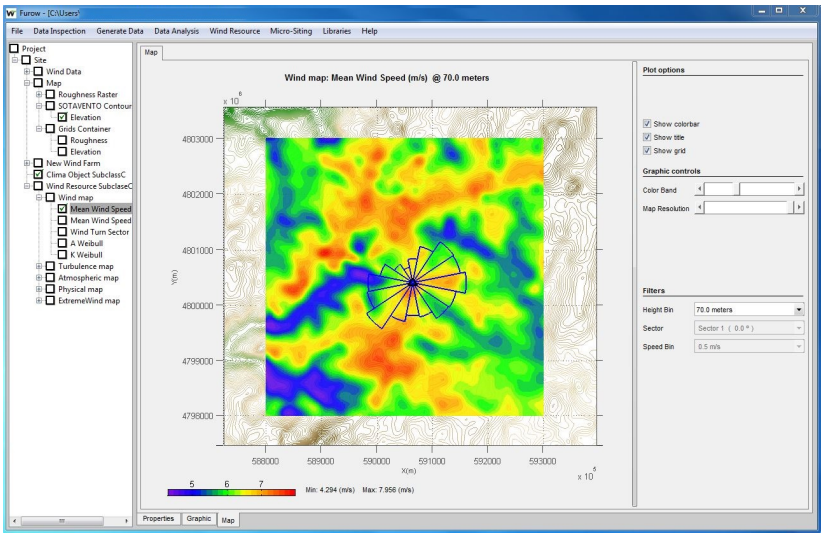

Figure 3.8: Screenshot of Furow.[9]

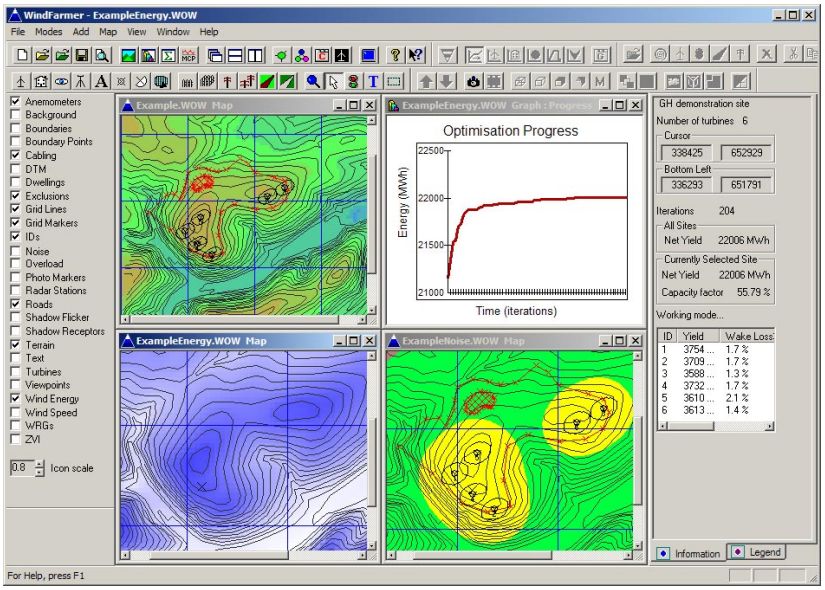

Figure 3.9: Screenshot of WindFarmer.[10]

possible to create a photo-realistic impression by rendering the wind-turbines over a provided photograph of the landscape, see figure 3.11. It is not possible to maintain this realism while working in the program.

3.3.3 VisAsim

The most similar to the wind module of Win3D is a visual-acoustic simulation prototype tool called VisAsim [29]. This tool was part of an interdisciplinary study called 'VisAsim – Visual-Acoustic Simulation for landscape impact assessment for wind farms', was funded by the Swiss National Science Foundation (SNSF) and took place from 2011 to 2014 [27]. Manyoky *et al.* [27] stated that a multi-sensory approach is needed to acquire social acceptance by the public. A prototype tool, see figure 3.12 for a screenshot, was therefore built that could provide

[11] Source: http://www.resoft.co.uk/assets/images/WireFrame2.png
[12] Source: http://www.resoft.co.uk/assets/images/Photomon2720.jpg

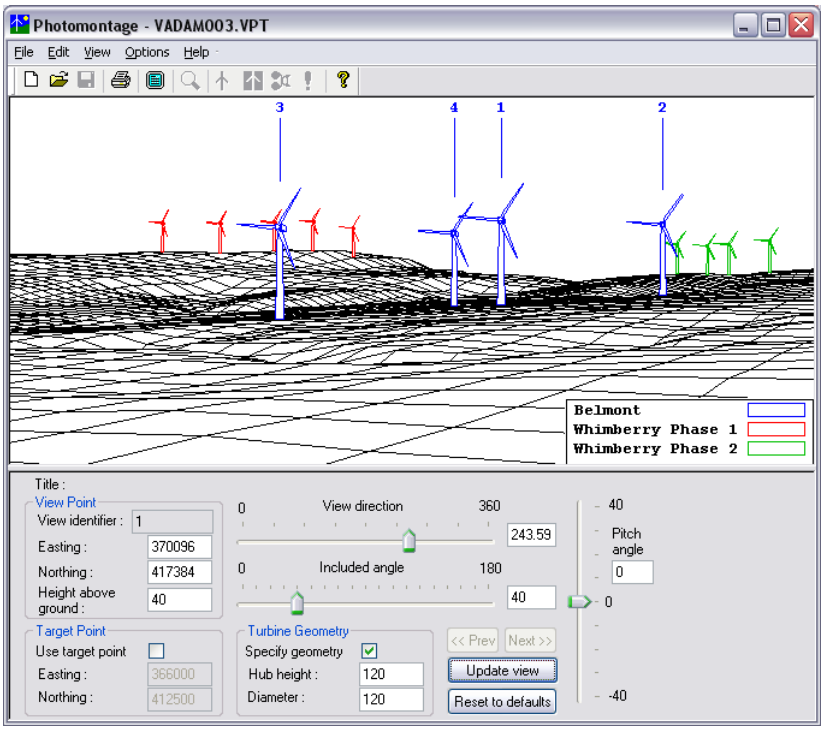

Figure 3.10: Screenshot of WindFarm in wire-frame view.[11]

Figure 3.11: Screenshot of a photo-realistic impression with WindFarm.[12]

a high-quality visualisation in combination with a sound representation of the noise wind turbines can produce. However, the prototype tool was only able to visualise a small pre-determined landscape.

3.4 Games

Games have a different function than geo-based 3D planning software, but both have similar mechanics. Construction games also have an interface for placing objects in landscapes. Games are generally playtested before release and playtesting allows for evaluating the GUI and its ease of use. Examining these GUIs can lead to insights or design choices which might be applied to the concept designs.

[13]Source: http://www.visasim.ethz.ch/gallery/Visualizations/VisAsim_Huegelgebiet%20(1890x1048).jpg

Figure 3.12: Screenshot of VisAsim.[13]

3.4.1 The Sims

The Sims[14] is a life simulation video game series. The game allows people to build houses and to place objects in and around these houses. A player can sort and choose the objects they can choose from in two ways: (i) by selecting a type of room (e.g. kitchen, living room, bedroom) and then selecting the object type associated with such a room, see figure 3.13, or (ii) by selecting a function (e.g. comfort, entertainment, decoration) and then selecting the object type associated with such a function, see figure 3.14. An object is selected by clicking on

[14] https://www.thesims.com/en_GB/

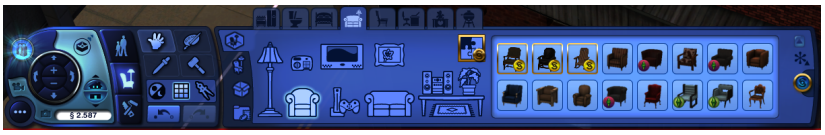

Figure 3.13: Example of room selection and object type selection.

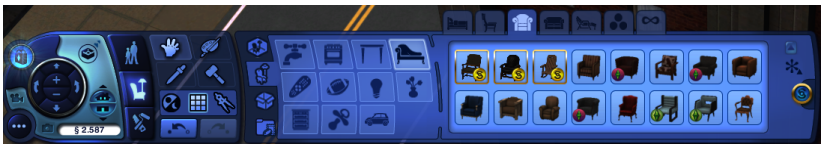

Figure 3.14: Example of function selection and object type selection.

it. Clicking again in the landscape places the object. An example of the object is given before placing it. Holding the left mouse button allows the player to rotate the object. An object is picked up again by clicking the object. An object is deleted by pressing the delete key while the object is picked up.

3.4.2 Cities: Skylines

Figure 3.15: Wind turbine selection.

Cities: Skylines[15] is a city-building video game. A type of object that can be placed in the game are wind turbines, which can be selected by choosing the electricity group, represented by a lightning icon, and by clicking on the wind turbine icon, see figure 3.15. A wind turbine can then be placed in the landscape by clicking somewhere on the land. Objects cannot be rotated. Clicking on the object opens a pop-up window with object specifications, see figure 3.16. Clicking the bottom left button with a house and two arrows icon allows the player to move the object around again. Selecting a bulldozer icon on the screen and clicking an object removes that object.

Figure 3.16: Pop-up window when clicking an object.

[15] http://www.citiesskylines.com/

3.5 Conclusion

No software has been found with the abilities of Win3D. VisAsim has similarities with the wind module of Win3D, but no software has been found that can simulate multiple modules like Win3D in a 3D environment. This makes the software unique and therefore its GUI problem novel. Furthermore, no other research has been found on the creation of a GUI for geo-based 3D planning software.

Chapter 4

Interface analysis

The final product of this graduation project is a new interface concept design for geo-based 3D planning software. However, before any thought can go into how this concept should look, an analysis is necessary on the current interface and functionalities of the software. This analysis consists of experiencing the software as a new user, mapping behaviour and routes of menus and windows, listing all functionalities, looking at the interface regarding the design principles elaborated in paragraph 2.3, and distinguishing and categorising problems and faults within the interface and, if applicable for this research, software. Software problems found that are not of interest for this graduation project have been communicated to the employees of the company but will not be included in this thesis.

4.1 New user experience

The employees of the company have no trouble navigating through the software with the current user interface. They have experienced the incremental steps that the user interface has taken over the years. Each step required only a small adaption in behaviour and had a short learning curve with a slight slope. This results in them being able to navigate through the interface with ease, even though the program is elaborate and has many functions, because they have had the time and the opportunity to grow with the program. Furthermore, changes and additions to the interface have been made with the realisation that all employees already knew how everything worked. Therefore, no thought went into a possible user that was new to the program when making changes or implementing additions.

The company has provided access to its 3D geo-planning software for different provinces, municipalities and companies. This access was given after a request from these institutions. Until this request came there had been no awareness on how the software would be used and experienced by new users. The company provides in two manners help for new users: (i) they provide a manual to the program and (ii) they give personal instructions to help new users get started with the software.

4.1.1 Reception

Access was given from January 2017 and onwards and new users have had time to experience and experiment with the software. Two main reactions were registered among new users: (i) users had difficulty with using the program and would contact ROM3D (in person or by telephone) for further instructions and guidance and (ii) new users gave up trying to learn the software due to the difficulty of navigating through the program and using its functions. These latter users would often then request ROM3D to do the visualising for them instead, similar to how the situation had been before access was given to the software.

4.1.2 Guidelines for exploration

Somehow the software results in many new users who give up trying to learn to work with the program. The employees of ROM3D find it hard to pinpoint where the trouble lies with the interface and navigation due to them being accustomed to the software and its design. To discover where a new user has trouble with working with the software, two guidelines were made for exploring and mapping the interface: (i) no manual would be used while exploring the software and (ii) minimum help would be asked and only after extensively trying to figure things out independently. These guidelines allowed for an experience similar to a new user with no direct access to help from ROM3D employees.

4.2 Mapping behaviour and layout of the interface

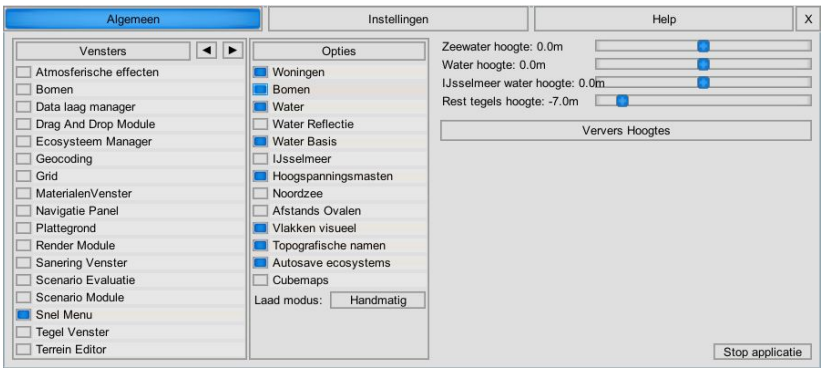

Figure 4.1: Main menu.

The exploration of the current interfaces is documented in two ways: (i) listing everything that was surprising, questionable, remarkable or had another reason to be noteworthy in a text document with the addition of a few images for further clarification and (ii) mapping the different menus, windows and other user interface aspects of the software. The mapping of the current interface is important for four reasons: (i) it documents smaller aspects of the program that might be forgotten with time, (ii) it is less likely that functionalities of the interface will be missed during the exploration face due to the necessity to document the interface accurately, (iii) employees of ROM3D can more quickly and accurately determine if there are parts of the interface that have been missed by studying the mapping documentation and (iv) a com-

plete list of functions can be extracted from the mapping documentation.

The current interface revolves around a main menu, see figure 4.1. This is one pop-up window that provides access to everything the software offers. The main menu is divided in three tabs titled (i) *algemeen* (English: general), (ii) *instellingen* (English: settings) and (iii) help. Under the tab *algemeen* there are two more tabs titled *vensters* (English: windows) and *opties* (English: options). The first tab *algemeen* gives access to almost all functionality of the software and consists of different 'modules', as the program calls them. Each module option opens a new window with corresponding menus. For each module, a mapping document has been made. Separate documents were made due to each module being self-containing, meaning that a user cannot go from one module to another module, but will always need to go through the main menu to open module windows. There is one exception, where a user can go to the *scenariomodule* (English: scenario module) through the drag and drop module if a user selects an object while not yet having selected a scenario. This is mentioned in the mapping documentation while both modules retain their own document.

4.2.1 Mapping documents

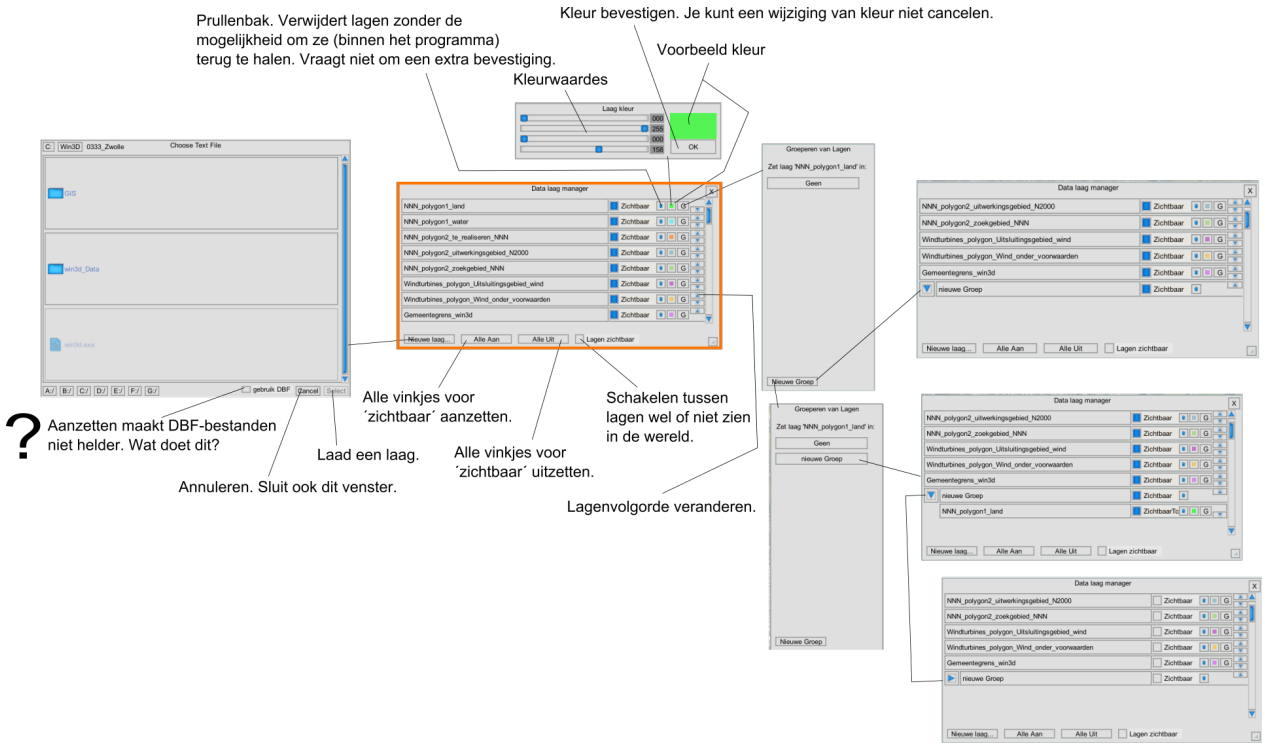

Figure 4.2: The mapping document of the *datalaagmanager* module.

In figure 4.2 an example can be seen of a mapping document. The window with the orange outline is how the window looks when opened from the main menu. This window is the starting point for all the outgoing lines. Black lines have two function: (i) the line can lead from a button, a slider, an entry field or a window to another window. The start of the line indicates what has been pressed, dragged, filled in or clicked and the end of the line indicates what this action resulted in. Multiple lines can go from one location, meaning that performing the connected action can lead to multiple changes in different windows.

(ii) The line can lead to a remark or clarification of an aspect of the interface.

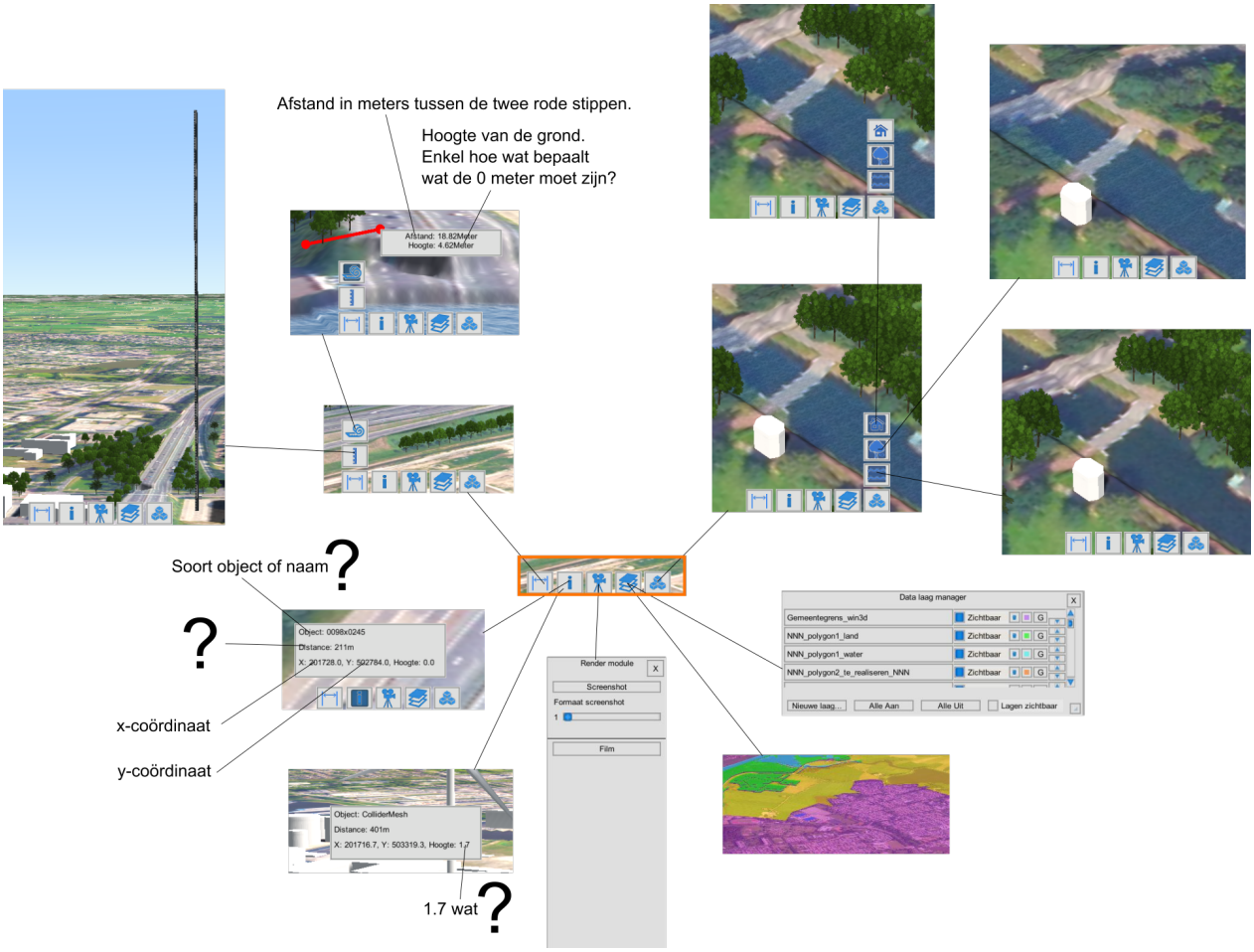

Figure 4.3: The mapping document of the *snelmenu* module.

A question mark, as can also be seen in figure 4.2, represents a part of the interface that is not clear or cannot be determined after following the guidelines to experience the interface as a new user without receiving external help. Clarification on all question marks were asked after finishing the mapping documentation. The answer to each question mark is documented in the text document, keeping the question marks in the mapping documentation intact to keep an overview of where the interface can possibly be problematic to a new user.

Next to all window menus, important changes in the landscape of the program actuated by menu input were also documented. An example can be seen in figure 4.3, where buttons from the *snelmenu* lead to landscape manipulation or measurement. The entire mapping documentation can be found in appendix B. The text document can be found in appendix C.

4.3 Important workings and modules of the current interface

This paragraph will elaborate on a few key functions and the most important modules of the current interface to provide readers with a basic

understanding of the current interface and the possibilities and limitations of the software. Remaining and less important modules are briefly discussed in paragraph 4.4.

4.3.1 Main menu

As mentioned in paragraph 4.2, the current interface revolves around the main menu, since access to all functions of the software is given by that specific menu. The portal to all module windows is under the tab *vensters* in the main tab *algemeen*. The second tab *opties* gives to possibility to toggle different options on and off in the landscape, like displaying buildings, trees and water, usage of high quality water, displaying topographical names and showing circles around wind turbines to signal how far wind turbines should stand from each other. Next to the tab *opties* there are sliders to change the height of the water level and the terrain surrounding the 3D terrain.

The second main tab *instellingen* gives access to changing the performance and settings of the program. The first tab *resoluties* (English: resolutions) changes the resolution of the screen and the second tab *kwaliteit* (English: quality) changes the computer power needed to run the program and subsequently the quality of the screen image. The tab *kwaliteit* can also change the anti-aliasing, controlling the smoothness of lines in the program, where a higher smoothness requires more computing power. Other options in this main tab are toggling between showing or hiding different information (e.g. frames per second (FPS) counter, memory counter) on the screen, see figure 4.4, toggling between full screen and windowed mode, and switching between two languages: (i) Dutch and (ii) English, although the English translation is not complete.

The last main tab help includes an e-mail address for asking questions and the version number of the program. Lastly, all main tabs have a button to quit the program.

Figure 4.4: FPS counter and memory counter (top) and device information (bottom).

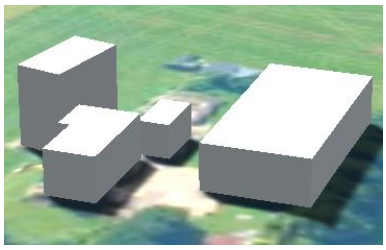

Figure 4.5: Example of buildings.

Figure 4.6: Example of trees.

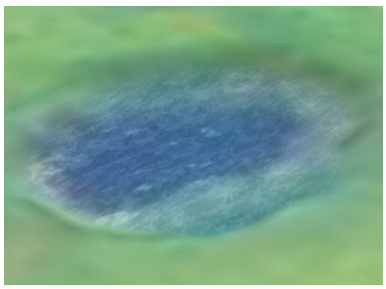

Figure 4.7: Example of water.

Figure 4.8: The landscape with height differences.

4.3.2 *Tegelvenster* module

The software starts with a 2D satellite photo draped over a ground plane and a blue sky with a sun. The module *tegelvenster* (English: tile window) can be used to load in 3D models of a specific area. The landscape exists of different tiles, with a tile representing an area with a size of two kilometres by two kilometres. Tiles of interest to the user can be selected in the *tegelvenster* and can then be loaded, meaning that all 3D objects belonging to that tile are retrieved from folders belonging to the program and are placed over the flat 2D satellite photo ground plane. There are three different 3D objects that will be loaded from the *tegelvenster*: (i) buildings, see figure 4.5, (ii) trees, see figure 4.6, and (iii) water, see figure 4.8. The plane itself will gain different heights over which the satellite photo is draped, see figure 4.7. Users are unable to remove 3D objects that have been loaded in via the *tegelvenster*. However, aesthetic changes can be made to these objects, like draping the satellite photo over the roofs of buildings or changing the colour of tree leaves.

4.3.3 Camera navigation

Camera navigation happens with the right mouse button for looking around with the camera, WASD keys (referring to the letter keys W, A, S and D on a keyboard) for moving the position of the camera forward (W), left (A), right (D) or backward (S), the left and right arrow keys to turn the camera left and right while the position of the camera is maintained and the page up and page down keys for moving the camera up and down respectively. There are four different speeds for camera movement: (i) the slowest speed attained with only using WASD keys, (ii) a faster speed attained by using WASD keys in combination with holding the alt key, (iii) an even faster speed by using WASD keys in combination with holding the shift key and (iv) the fastest speed by using the WASD keys and holding both the alt key as the shift key.

4.3.4 Loadable 3D objects

The main reason for existence for 3D geo-planning software is to allow users to create new setups in an environment that mirrors an existing environment. The conversion from a real environment to a similar digitalised environment will be done and provided by ROM3D for users. This conversion entails the placement of buildings, trees and water in the landscape and giving the landscape different heights in accordance to the real situation. This conversion done by ROM3D is what is loaded into the program when using the *tegelvenster* module.

Users cannot add, change or remove objects from this conversion. This means that no buildings, trees or water that have been loaded in from a tile can be removed. However, buildings, trees and water can be hidden from the landscape. It is also not possible for users to add new buildings or water, but users can add new and different trees. Aesthetic parts of the loaded in objects, however, can be changed, like the colour of buildings or the thickness of tree leaves. The height of the landscape is also open for change and there are two terrain editor modules a user can use to change the terrain (e.g. lower or raise the terrain, paint the terrain, smooth the terrain).

4.3.5 Placable 3D objects

The user is free to create new setups in the digitalised terrain. Users can place objects in the landscape after loading tiles and the accompanying 3D models. Object manipulation exists of placing, moving, scaling and removing objects. These objects can be placed one by one or values can be given to create fields with many objects. However, before objects can be placed, a scenario must be selected in the *scenariomodule*. This module provides the possibility to save the placement of objects. It does not save edits to the terrain or aesthetic changes to the landscape and 3D objects, since these edits are saved separately in the corresponding modules or automatically by the software.

4.3.6 Scenario module

The scenario module revolves around saving different setups for the placement of objects. Multiple tabs can be made in the module and each tab can have multiple scenarios. However, only one scenario can

be selected and made active in a tab, while multiple tabs can be active. Only the objects belonging to an active tab can be seen in the landscape.

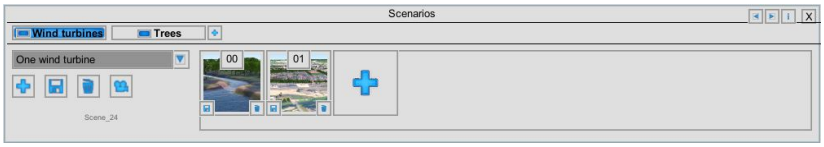

Figure 4.9: Scenario module example.

Tabs can be used for assigning different regions, themes or functions. For example, a landscape architect can be curious to how the ratio of wind turbines and trees can affect the landscape. They can then make two tabs, one called 'wind turbines' and the second tab called 'trees'. They can then choose to make inside the wind turbines tab three scenarios; (i) a scenario with one wind turbine, (ii) a scenario with three wind turbines and (iii) a scenario with ten wind turbines. They will decide to make four scenarios in the trees tab, with each scenario an increase in the number of trees, going from a few lonely trees to a soil-covering forest. The module will then look as in figure 4.9. Both tabs are active, as can be seen by the blue boxes next to the tab titles. In each tab one scenario can be selected and this scenario will be displayed in the landscape. This enables the landscape architect to see both the trees and the wind turbines in the landscape while toggling between the different alternatives regarding the number of wind turbines and trees, allowing for an exploration of different combinations.

Each scenario has the possibility to save a camera position. After a camera position has been saved it is possible to fast travel to this position by clicking the corresponding image of the camera viewpoint miniature, see figure 4.10. This allows for fast travel and makes it easier for storytelling. Employees of ROM3D use it often when going through the landscape with a client after ROM3D has fulfilled an assignment and is talking the client through it, or when holding a presentation.

Figure 4.10: Two saved camera positions and a plus button to add a new camera position.

4.3.7 Drag and drop module

After selecting a scenario, it is possible to drop objects into the landscape from the drop and drag module, see figure 4.11. The different objects are divided in this order under the following tabs:

- *Zonnepanelen* (English: solar panels)
- *Windturbines* (English: wind turbines)
- *Vegetatie* (English: vegetation)
- *Tekenen* (English: drawing)
- *Overige* (English: remainder)
- *Onkruid* (English: weeds)
- *Onderbegroeiing* (English: undergrowth)
- *Naaldbomen* (English: coniferous trees)
- *Loofbomen* (English: broad-leaved trees)
- Import
- *Helmgras* (English: European marram grass)

Figure 4.11: Drag and drop module.

- *Biovergisting* (English: anaerobic digestion)
- *Basisvormen* (English: basic shapes)
- *Aankleding* (English: stage setting)

An object can be selected by clicking on a button with its name after which the button will be highlighted. The selected object can then be placed in the landscape by clicking on the position the object must be placed. One click places one object. Clicks will result in the placement of new objects as long as the object is selected in the drag and drop module. Deselection occurs by clicking on the button with the name of the object a second time.

It is possible for a user to change the position of an object after it has been placed in the landscape. Objects in the landscape can be selected one by one by holding the control key and clicking with the left mouse button on each object that needs selecting. By clicking a second time an object gets deselected. Multiple objects can be selected by holding the control key and left mouse button pressed, resulting in a field which can be dragged with the mouse over the area with objects that need selecting. See figure 4.12 for an image of the selection field. Deselecting multiple objects can be achieved by the same method, except the alt key should be pressed instead of the control key. Selected objects can be removed by pressing the delete key. Other select options can be found in the quick menu, see figure 4.13, which can be opened by clicking the right mouse button on a selected object.

Figure 4.12: Selection field.

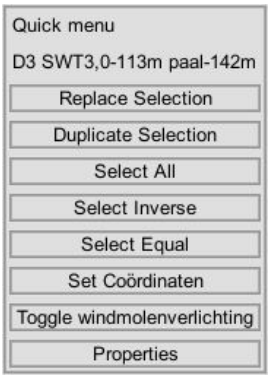

Figure 4.13: Quick menu of a wind turbine.

Selected objects can be moved, rotated or scaled, depending on which option is active of a radio button (i.e. a button that only allows one option to be active) in the drag and drop module. The first option, see the button below the 'X' button in figure 4.11, allows for moving the object in all directions. Eliminating movement in (a) certain direction(s) can be done by pressing the x, y and/or z button. The second option, see the button below the 'Y' button in figure 4.11, allows for rotating the object. Rotation can only happen in the y-direction. The *roteer 45°* button rotates selected objects quickly 45 degrees clockwise when pressed. The third option, see the button below the 'Z' in figure 4.11, allows for scaling the object. Scaling can also happen in all directions or be limited to one or two directions. Selected items can be moved, rotated or scaled by pressing the left mouse button and dragging the mouse around the landscape.

4.3.8 *Tekenen* tab

The *tekenen* tab in the drag and drop module contains something else than objects that can be used for visualisations. The tab contains two markers; (i) an *animatiepad* (English: animation path) marker and (ii) a *polygoon* (English: polygon) marker. A *polygoon* marker can also be placed from the *ecosysteemmanager* (English: ecosystem manager) module detailed in paragraph 4.3.9. Placement of both *animatiepad* and *polygoon* markers in the landscape results in the placement of the same shape, see figure 4.14. However, each marker has a different function. When holding the shift and control key while clicking with the left mouse button on the marker gives each item a different menu. The *animatiepad* marker opens a menu as seen in figure 4.15 and the *polygoon* marker opens a menu as seen in figure 4.16.

Figure 4.14: *Animatiepad* marker (left) and *polygoon* marker (right).

The *animatiepad* menu enables users to place path points in the landscape, creating a line in the landscape that the camera can follow,

meaning that the line determines the position of the camera. A second line can be placed to indicate where the camera should look at. An example of such lines can be seen in figure 4.17. The movement speed of the camera and height of the path points can also be adjusted. A preview of the camera movement can be seen before rendering the frames.

The polygon menu leads to an important function of the software; the placement of polygon shapes called fields, in which multiple objects can be generated. A field is created by placing three or more path points, see figure 4.18. A group can then be made in the *groepenmanager* (English: group manager) where one or multiple types of objects can be selected and given values for placement. Access to the *groepenmanager* is possible through both the *polygoon* menu as the *animatiepad* menu. There are five different types of groups: (i) *langs de lijn* (English: along the line), (ii) *distributie* (English: distribution), (iii) grid, (iv) *rijen* (English: rows) and (v) *animatie* (English: animation).

Langs de lijn group

Objects in this group are only placed along the lines around the polygon shape. How far objects differ from the line and each other can be filled in. This group can also be placed along an animation line.

Distributie group

Objects in this group are placed randomly inside the field. The density of the objects can be changed. Solar panels are often placed with this type of group.

Grid group

Objects in this group are placed in vertical and horizontal rows and the distance between the objects in both direction is kept the same. These distances can be filled in.

Rijen group

Objects in this group are, like the grid group, also placed in vertical and horizontal rows, but the software will fill the rows in as efficiently as possible, placing as much objects as possible within the field. This is not possible with the grid group because objects need to stay horizontally and vertically in a neat row. The *rijen* group, however, only has objects in a neat horizontal row, while objects do not have to form a row horizontally. Distances between rows can be filled in by the user.

Animatie group

Objects in this group can only be placed along an animation line. The objects will move along the animation line. When an object reaches the end of the line then it will start over at the beginning of the animation line. The number of objects and the speed with which the objects will move can be adjusted. The animation line is meant for making car or people objects move in the landscape, but it is possible to choose any

Figure 4.15: Menu of a *animatiepad* marker.

Figure 4.16: Menu of a *polygoon* marker.

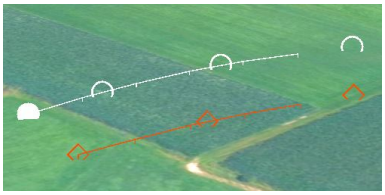

Figure 4.17: Camera line (white) and viewpoint line (red).

object. Therefore, it is possible to make also trees or wind turbines move through the landscape.

Purple blocks, see figure 4.19, indicate where objects will be placed within the field. These blocks can be moved and rotated to change where the objects will stand. The *langs de lijn* and *animatie* groups do not produce purple blocks before placement.

4.3.9 *Ecosysteemmanager* module

This module has similarities to the *polygoon* menu from paragraph 4.3.8. The *ecosysteemmanager* module can also place objects within a polygon field. However, choosing objects and assigning values works differently and a user can only select vegetational objects.

A user starts with making a new ecosystem. This leads to a new window. Inside this window users can change the name of the ecosystem and choose a type of soil. Users can also make different groups. Each group can consist of one or multiple objects. There is a list of objects to choose from, like grass, swamp sawgrass or maize. The minimum and maximum height for these objects can be given to allow for a variation of sizes. The distribution of objects for a group are given in percentages. For example, a group with two objects, (i) grass and (ii) maize, can exist of 80% grass and 20% maize, see figure 4.20. How much each group is represented in an ecosystem is also given in percentages. The user must fill in a number to specify the objects per square meter. This number in combination with the percentages of both the groups as the objects allows the program to calculate how to fill in a polygon field.

The user needs to specify in the *polygoon* menu which ecosystem it wants to use for the field belonging to the polygon marker. The ecosystem field can then be generated via the *ecosysteemmanager* module. Only selected polygon fields can be planted with their linked ecosystems or all polygon fields on a tile can be planted at once. The terrain can also be cleared again from all ecosystems.

Only one ecosystem can be planted at a given time in a field, meaning that two or more ecosystems cannot overlap. Objects made with the *groepenmanager* can overlap and groups can therefore be placed over each other. These objects can also be placed atop a planted ecosystem.

Two other attributes that can be changed through the *ecosysteemmanager* module are: changing the distances that determine if an ecosystem is displayed in (i) the landscape and (ii) on a screenshot. The performance of the program can be enhanced by setting the distance to display ecosystems in the landscape low, since the program then only needs to use its computing power to render an ecosystem when it is close to the ecosystem.

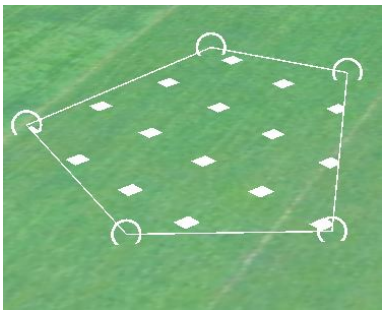

Figure 4.18: A field with five path points.

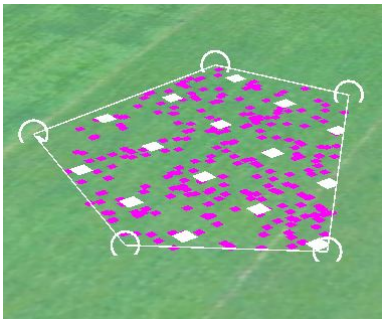

Figure 4.19: Purple placement blocks of objects in a *distributie* group.

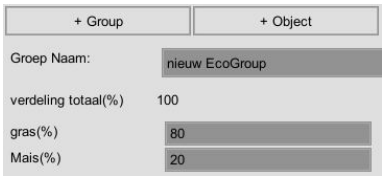

Figure 4.20: Example of a distribution between two objects.

4.4 Overview of remaining modules of the current interface

Lesser important modules not yet mentioned are discussed briefly in this paragraph.

4.4.1 *Atmosferische effecten* module

The *atmosferische effecten* (English: atmospheric effects) module can change the position of the sun and the illumination of the sky by changing the date and the time. All objects cast a shadow, and especially for wind turbines it is helpful to know where shadow from the wind turbine blades (Dutch: *slagschaduw*) is located. Different positions and lengths of shadows can be studied by changing the date and time. The progression of the sun can also continue automatically, where the user can specify how fast the sun should travel along the sky.

Sky domes can also be selected, making it possible to change the image used for displaying the sky. Furthermore, clouds can be toggled on and off and information about the sunrise, sunset and length of the day is displayed.

4.4.2 *Bomen* module

The *bomen* (English: trees) module can change two aesthetic aspects of trees: (i) the colour of the leaves and (ii) the density of the leaves. All trees can be given the same changes or changes can be made separately for each tree type. All changes can be saved, loaded or restored.

4.4.3 *Datalaagmanager* module

The *datalaagmanager* (English: data layer manager) module allows the on and off toggling of layers. A layer consists of a shape that is draped over the ground plane and exists of one transparent colour, see figure 4.21. Layers are visual guides to locations of regions or other aspects of the landscape. There are often layers provided by ROM3D, however, users can add their own layers by importing shapes from their computer. Different layers can be made visible or invisible and layers can be grouped together to keep a clear overview.

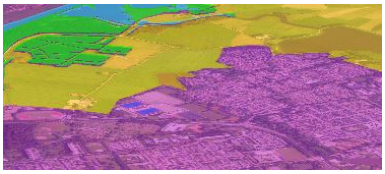

Figure 4.21: Multiple transparant colours of layers.

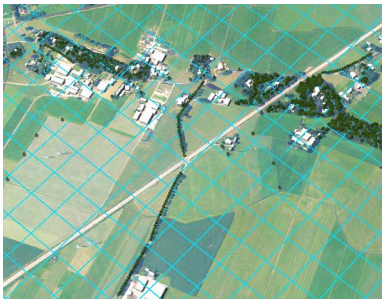

Figure 4.22: Grid placed over the ground plane.

4.4.4 Geocoding module

The geocoding module functions as an address search engine. A user can fill in an address after which the program gives suggestions regarding what the user might have meant. The user can click on one of the suggestions which will move the camera location to the selected address.

4.4.5 Grid module

The grid module places a grid over the ground plane, see figure 4.22. The distance between lines can be adjusted, the grid can be rotated and the grid can be moved to the x-direction and the y-direction through the grid module.

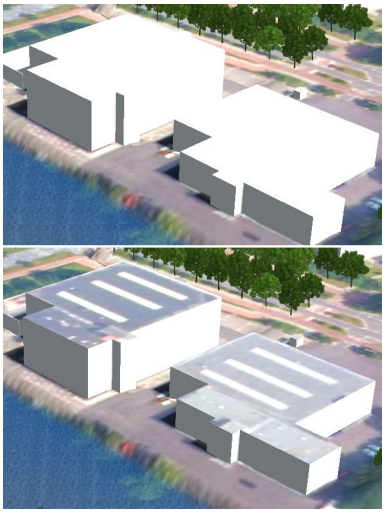

Figure 4.23: Building with and without a satellite photo on its roof.

4.4.6 *Materialenvenster* module

The *materialenvenster* (English: materials window) module can change two types of 3D models: (i) buildings and (ii) water. For buildings, it

can change two aspects: (i) it can toggle the placement of the satellite photo over the roofs of the buildings on and off, see figure 4.23, and (ii) it can change the colour of the buildings. The module can also change two aspects of water: (i) the colour and its opacity of the water and (ii) the shininess of the water, which changes how much the light reflects on the water.

4.4.7 *Navigatiepaneel* module

The *navigatiepaneel* (English: navigation panel) module has two main functions: (i) displaying and changing the wind direction and (ii) displaying and changing the wind speed. The position and height of the camera are also provided and the position can either be displayed in *rijksdriehoekscoördinaten* or latitude and longitude and the height can be displayed in either the Amsterdam Ordnance Datum (Dutch: *Normaal Amsterdams Peil* (NAP) measurement or the height from the ground up in meters.

There is a separate slider for changing the wind speed for the ecosystems. The wind speed for the ecosystems can, in contrast to the normal wind speed slider, also be toggled on and off.

4.4.8 Plattegrond module

The *plattegrond* (English: map) module shows the map of the landscape in a top view, see figure 4.24. Only tiles that have been loaded are shown in the map. A larger window for the map can be created by dragging the bottom right corner away and zooming in and out is achieved by scrolling the middle mouse button. The position and location of the camera is represented by a green icon existing of two lines.

A wind map can be placed over the topographic map. The opacity of the wind map can be changed. The wind speed on heights of 80 meter, 100 meter and 120 meter can be shown and is given in meters per second.

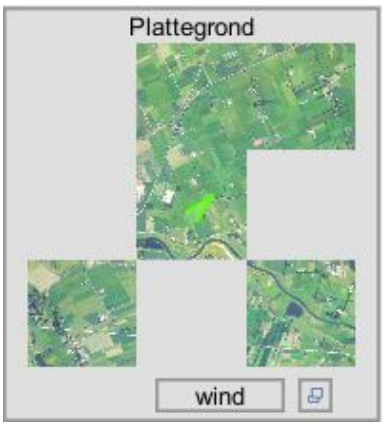

Figure 4.24: Map with five tiles loaded.

4.4.9 Render module

A screenshot can be taken with this module, where the screenshot can have one of five different quality levels. The lowest quality results in a screenshot with a size of averagely 1.600 kilobyte with a resolution of 1600 by 900 pixels. The highest quality screenshot has a size of averagely 27.500 kilobyte with a resolution of 8000 by 4500 pixels. All screenshots are placed inside a folder named ‘screenshots’ within the home folder of the Win3D application.

Screenshots can also be taken continuously while the user moves around the camera. These screenshots are placed inside a folder called ‘rendermovie’. By using another application to place these screenshots in a row and showing them quickly one after the other, a movie can be created.

4.4.10 *Scenario-evaluatie* module

The *scenario-evaluatie* (English: scenario evaluation) module calculates what placed wind turbines and solar panels will theoretically earn. An overview can be seen for all placed objects or per tab (i.e. the tab from the scenario module from paragraph 4.3.6). Information per object is also given when selecting a tab. All information can be exported to a text document.

The overview for all objects and per tab reveals five aspects: (i) how many wind turbines there are placed, (ii) how much megawatt these wind turbines could produce, (iii) how many households could live of this energy, (iv) how many solar panels are placed and (v) how much watt-peak (i.e. nominal power) they could produce.

For each wind turbine is individually stated the following six aspects: (i) the name of the wind turbine, (ii) how much megawatt it can produce, (iii) the shaft height of the wind turbine, (iv) the rotor diameter, (v) the x location and (vi) the y location. For individual solar panels two aspects are stated: (i) the name of the solar panel and (ii) the watt-peak the solar panel would be able to produce.

4.4.11 *Snelmenu* module

The *snelmenu* (English: quick menu) is the only module that is active when Win3D is opened. The module can be found in the middle of the screen at the bottom and exists of five buttons: (i) a measurement icon, (ii) the letter 'i', (iii) a camera, (iv) three layers stacked on top of each other and (v) three blocks, see figure 4.25. Buttons (iii) and (iv) open the render module and *datalaagmanager* module respectively. This gives the same result as opening these modules from the main menu, but opening them via the *snelmenu* module can be done more quickly. The modules can also be closed via the *snelmenu* module.

Figure 4.25: The *snelmenu* at the bottom of the screen.

Button (i) leads to a measuring tape button and a ruler button. When active, the former can produce a red line combined with a measurement in meters of the length of the red line. The length of the line is determined by the distance between a left mouse click (i.e. starting point of the red line) and how far the mouse is then dragged around while the left mouse button is hold in place (i.e. ending point of the red line). The ruler button deposits a vertical ruler in the landscape with a click of the left mouse button.

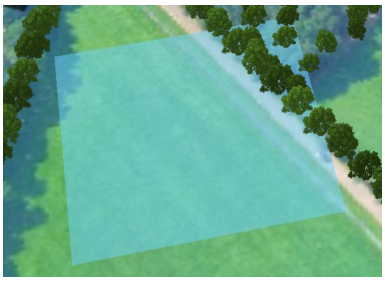

Figure 4.26: Blue square from the *terreineditor*.

Button (ii), when active, gives information about the location where clicked with the left mouse button. This information exists of the name of the object or, if no object has been clicked, the name of the tile, the distance from the object to the camera location and the x location and y location of the object as well as its height.

Button (v) can toggle buildings, trees and water on and off in the landscape. This can also be achieved from the main menu.

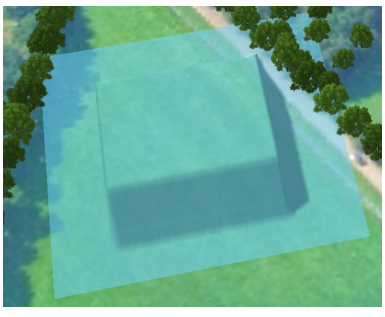

Figure 4.27: Ground raised with the blue square.

4.4.12 *Terreineditor* module

The *terreineditor* (English: terrain editor) module is one of two modules that can customise the terrain, the other module being the *terreineditor* two module explained in paragraph 4.4.13. There are six actions to change the terrain: (i) place a tree in the landscape, (ii) remove a tree

from the landscape, (iii) paint the terrain, (iv) increase the height of the terrain, (v) decrease the height of the terrain and (vi) levelling the terrain to a given height in meters. Removal of trees can only be performed on trees who are placed with this module, meaning that no trees placed with the drag and drop module can be removed with the trees removal tool from the *terreineditor* tool.

When this module is active there is a blue square around the mouse icon, see figure 4.26. The size of this square can be adjusted and action (iii), (iv), (v) and (vi) react to the size of the square. Painting, increasing, lowering or levelling the terrain can only be done in a square shape, see figure 4.27. Changes to the landscape can be saved but after saving there are no possibilities to revert to the initial height and texture of the landscape.

4.4.13 *Terreineditor* two module

Like the *tereineditor* module in paragraph 4.4.12, this module can customise the terrain. This module has six actions to change the terrain with: (i) increase the height of the terrain, (ii) decrease the height of the terrain, (iii) level the height of the terrain, (iv) paint a texture onto the terrain, (v) place trees in the terrain and (vi) paint details in the terrain. These are actions similar to the actions in the *terreineditor* module. The main difference between the two modules lies in the customisation of the brush. The *terreineditor* module uses one brush shape; a square. The *terreineditor* two module can use twenty different brush shapes. These brush shapes are also customisable in size and opacity. All twenty different shapes applied to the landscape can be seen in figure 4.28. Changes can be saved and, unlike the *terreineditor* module, it is always possible to restore the terrain to the original height and texture of a tile.

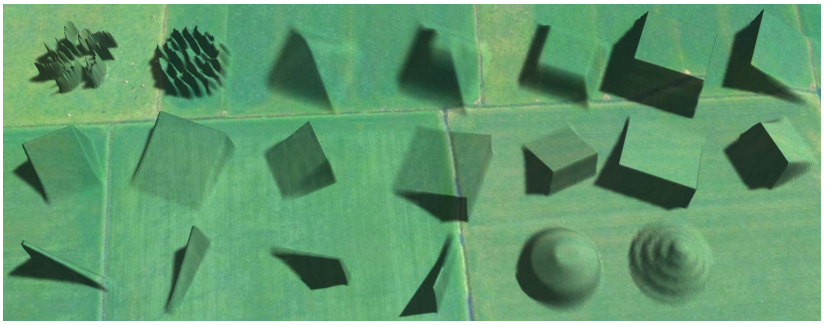

Figure 4.28: Twenty brush shapes used on the landscape.

4.4.14 *Windmolenconfigurator* module

A wind turbine can be created and customised with the *windmolenconfigurator* (English: wind turbine configurator) module. The length of the tower, the width of the base and the top of the tower and the length of the blades can be given in meters. A wind turbine can have two or three blades. Furthermore, the amount of megawatt the wind turbine should produce can be specified. After all values have been filled in a wind turbine can be created. The values of a newly created wind turbine can still be changed and the wind turbine can be deleted.

New wind turbines will appear in the drag and drop module under the main tab *windturbines*. From there they can be placed in the landscape.

It is not possible to place custom-made wind turbines from the *windmolenconfigurator* module.

4.4.15 *Windmolenverlichting* module

The *windmolenverlichting* (English: wind turbine illumination) module controls the illumination of wind turbines. Wind turbines with a blade-tip height of more than 150 meter are required to have illumination. During the day, this illumination is white and during the night it is red.

All illumination can be toggled on and off in this module. If all illumination is toggled on then the illumination on the tower can be toggled on and off separately. The lights can burn constantly or blink on and off. The blinking speed can be set faster or slower. The illumination settings for during the daytime can differ from the illumination settings for the night. Meaning that lights could blink during the night but burn constantly during the day. The light intensity can also be adjusted. It is also possible to let all wind turbines blink on and off synchronously.

4.4.16 *Zonnepanelenconfigurator* module

The *zonnepanelenconfigurator* (English: solar panel configurator) module allows a user to create a new solar panel with custom dimensions. A solar panel has usually multiple solar cells. There are eight main customisation aspects: (i) the number of solar cells (ii) the length and amount of the poles on which the solar panel is placed, (iii) the number of watt-peak a solar panel should be able to generate, (iv) the tilt angle, (v) the material used for the solar panel, (vi) if the solar panel should be pointed to the south or the southeast, (vii) if the solar panel should be tilted or placed flat and (viii) the name of the solar panel. A preview of the solar panel can be seen before creation. Custom-made solar panels can be modified and deleted. Placement of the custom-made solar panels goes through the drag and drop module, like the custom-made wind turbines from paragraph 4.4.14.

4.5 List with functions

Functionalities are grouped together by ROM3d in modules. However, these combinations of functionalities are not necessarily the most logical, intuitive or efficient. Especially since most decisions regarding the layout of the interface were not made with new users in mind. The way functions are grouped should be reconsidered for the concept of the new interface. All functions should be sorted anew.

A list with all functionalities was created from all modules and the main menu. These are the first ten items on the list, to give an example of how different functionalities are divided and written down:

- Playing with the sun – aesthetic
- Toggling clouds on and off – aesthetic
- Choosing another sky background – aesthetic
- Change the colour of tree leaves – aesthetic
- Change the leave density of tree leaves – aesthetic

- Toggling layers on and off – informative
- Placing objects in the landscape
- Selecting, moving and scaling objects
- Give objects coordinates to go to
- Give objects a build and remediation operate date

The entire list contains 89 functionalities and can be found in appendix D. The entire list has been printed out and cut up per functionality, resulting in 89 pieces of paper with one functionality per piece. This allowed for making changes more easily and trying out other combinations while maintaining an overview of all functionalities.

Two types of ordering and grouping were discerned: (i) ordering first by type and then by action and (ii) ordering first by action and then by type. For example, a tree is connected to many functionalities, like changing its colour, placing a tree in the world, scaling a tree, etc. The tree is here a type (other types being wind turbines, solar panels, etc.) and changing its colour and such are actions. So, to give a tree a different colour the two different types of ordering would be: (i) first selecting the tree and then specifying that its colour needs to be adjusted or (ii) specifying that the colour of something needs to change and then selecting that the action should be performed on a tree.

When ordering the pieces of paper first by type and then by action, it became evident that many functionalities had to be printed and cut again to complete the grouping. However, no duplicated functionalities were needed when arranging the papers first by action and then by type. From this it was concluded that grouping the functionalities first by action and then by type is more efficient.

4.5.1 Categories

The pieces of paper also helped to discern which functions are (almost) never used together and which functions are (almost) always needed. A category should contain functions that are needed together, without them relying on a function in one of the other categories. This should prevent the user from needing to switch between categories when performing a certain action. Sorting the papers with these criteria resulted in six group, of which one group existed of functionalities that are always necessary when using the program. Five categories could be discerned from the remaining five groups: (i) *objecten* (English: objects), (ii) *velden* (English: fields), (iii) *terrein* (English: terrain), (iv) *eigenschappen* (English: attributes) and (v) *animatie*.

Objecten

The *objecten* category is useful when users would like to place one object at a time in the landscape. Placing one object at a time needs more precision than placing many in a field, but the placement of one object is faster than creating a field. Placing one object at a time is often done when placing wind turbines.

Velden

The *velden* category is useful when users want to place multiple objects inside a field. Making fields is often used when placing vegetation or placing solar panels in the landscape. From interviews and conversations with employees of ROM3D it became apparent that toggling between placing fields and placing objects rarely happens.

Terrein

The *terrein* category is useful when users want to make changes to the terrain. It is often only interesting to place new objects or to create new fields after a terrain change has been concluded.

Eigenschappen

The *eigenschappen* category is useful when users want to make aesthetic changes to the landscape. When placing objects or creating fields, it is not yet important how hard the wind blows or what the performance quality of the water is. These settings are therefore placed in their own category.

Animatie

The *animatie* category is useful when users want to capture the results of their visualisation. Objects placement and setting changes need to be concluded before it is useful to make screenshots or render movies.

4.6 Analysis on the current interface and design principles

In paragraph 2.3 five main design principle were explained: (i) visibility, (ii) affordance, (iii) feedback, (iv) constraints and (v) consistency. Issues with the current interface that have a connection to these principles are discussed in this section.

4.6.1 Visibility

Main menu

The main menu is the portal to all functions of the software and is therefore an important part of the program. When the program is started, there are two items visible on the screen: (i) the buttons of the *snelmenu* module and (ii) a large grey beam at the top left corner of the screen, see figure 4.29. The main menu will not open of itself and can be opened in three ways by the user: (i) pressing the M key, (ii) pressing the escape key and (iii) clicking with the left mouse button the beam at the top left corner of the screen.

Figure 4.29: Large grey beam at the top left corner of the screen.

The escape key is often used in games to open the main menu. Other keys often used in games are the tab key and the I key. Win3D is created in Unity[1], a cross-platform game engine developed by Unity Tech-

[1] https://unity3d.com/

nologies. For users familiar with games it might be intuitive to use the escape key for opening the main menu, or these users might be more inclined to try the escape key as one of a few possibilities to open the main menu. However, for users without an understanding of games, the escape key may not be among the logical buttons to try out. The escape key may even be consciously avoided, since the key is in many applications connected to words as 'quit', 'exit' 'cancel' or 'abort' [30].

The main menu starts with the letter 'm', which is the connection for opening the main menu with the M key. However, in games the 'M' key is often used for opening the map. There are programs that use the M key for opening the main menu, but this is not seen often and can therefore not be counted as general knowledge among users. During the exploration phase the function of the M key was discovered by accident, because the M key still triggers the main menu when the key is used when typing a word in an entry field.

The title beam in the top left corner, figure 4.29, does not look like a button, which has five reasons: (i) the beam melts into the background, something that is not expected from a button, (ii) the beam is very large and (iii) the mouse does not change from an arrow into a hand when hovering over the beam. A reaction from the mouse on the beam would indicate that something could be done with the beam, where clicking it would be the most logical action to take. Also, (iv) the beam itself does not react to the mouse, while highlighting the beam while hovering over it with the mouse would indicate that an action could be performed on the beam and (v) if the beam was only grey, then the user might wonder why it is there. However, the title of the program and of the digitalised area are displayed in the beam, making it possible for the user to conclude that the beam is for placing the title and location and dismissing it at that. All in all, there is no affordance to press the grey beam.

During the exploration phase, it was never discovered that the beam could be used as a button to open the main menu. Only after reading the manual at the end of the exploration phase was this function discovered.

There is no hint or guidance in the program for how to open the main menu. Either the user has been told how to open it, the user read it in the manual, the user experimented on its own and found it with luck or the user has a gaming background or uses by chance a program with a similar logic that enables the user to deduce which key to use. That the route to opening the main menu is invisible is problematic because the main menu is the heart of the program.

Fold out buttons

Some buttons make more buttons fold out when pressed. However, it is not always clear that more options can be found by pressing these buttons. An example is in the main menu under the *opties* tab with the button 'water', see figure 4.30. When made active, two more options appear: (i) *waterreflectie* (English: water reflection) and (ii) water *basis* (English: basic), see figure 4.31. The two extra options are also not discernible in appearance from the other options, making it impossible to tell from appearance alone that these options are fold out options of the water buttons. Therefore, a user cannot be sure if any of the other options is a fold out button of another button or if there are more fold out options hidden.

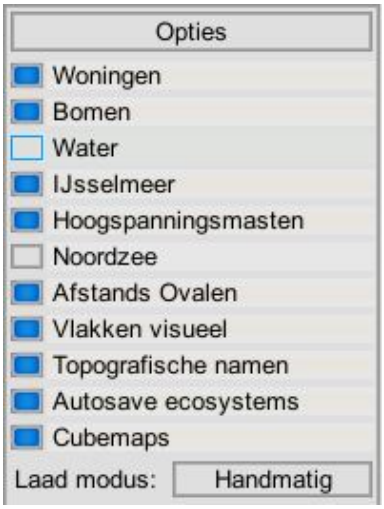

Figure 4.30: Water option inactive.

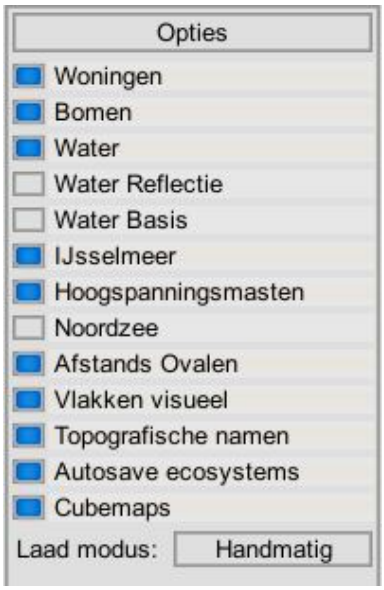

Figure 4.31: Water option active.

No stop button

The render module allows a user to take many screenshots at regular intervals by pressing the film button. All windows disappear during this film mode and no new windows are opened. There is no indication how to stop with the film mode and screenshots keep being taken during the time it takes a user to figure out. The escape key will stop the film mode, but the user must discover this by simply trying it out or the user must have been told.

Module names and content

Some module names differ with their content from the expectations they create with their name. This can lead to functions becoming hard to find because module names do not hint correctly at what to expect within. An example is how almost all aspects regarding wind can be controlled from the *navigatiepaneel* module, while navigation is not a word that is immediately associated with wind.

4.6.2 Affordance

Tegelvenster

Almost all modules work only after a tile has been loaded from the *tegelvenster* module. There is no hint as to the importance of this module or that the 3D part of the program must be loaded in before the program functions decently. The list of modules is ordered alphabetically, resulting in the *tegelvenster* module standing somewhere below in the list of modules without any significance to it, see figure 4.32.

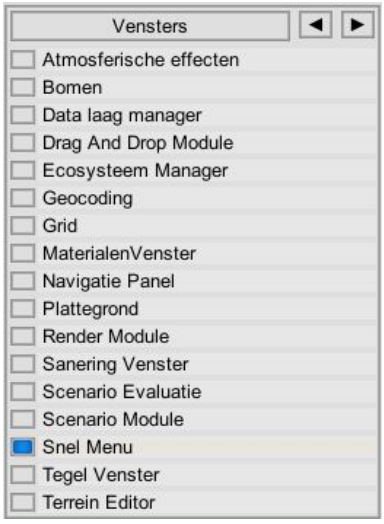

Figure 4.32: List of modules, first page.

During the exploration phase the decision was made to go through the modules alphabetically, because there was no indication that a specific order was recommended. None of the modules seemed to work properly and after trying out eight modules, help was sought from a ROM3D employee. The employee explained that the *tegelvenster* module first had to be used and made it sound as if that was the most logical thing in the world. To this person, this was such common knowledge, that the idea of someone not understanding this seemed strange to them. The reaction of this employee strengthens the assumption that ROM3D employees have trouble imagining the thoughts and logic of a new user.

During an interview with a user from a municipality, the user indicated that the program did not seem to work. After inquiring if the user had loaded in the 3D objects, the user answered that they were not aware that the 3D environment had to be loaded in. An explanation was given that one of the modules would allow the user to load in the 3D environment and the user was asked to guess which module would fulfil this purpose. The user first guessed the *datalaagmanager* module, then the *navigatiepaneel* module and lastly the render module and was not able to deduce that the *tegelvenster* module was necessary to load in a 3D environment.

The hurdle of not understanding the usage and importance of the *tegelvenster* module can lead to users giving up to work with the program. The program can do almost nothing if users do not understand how to use the *tegelvenster* module. The *tegelvenster* module has currently an

equal affordance for opening it as the other modules have, but needs a higher affordance than the other modules to emphasise its importance and to minimise the chance that users cannot continue with the program due to missing the function of the *tegelvenster* module.

Drag and drop module

The title of the drag and drop module creates an affordance to click and hold the left mouse button on an object from the module and to drag that object to the landscape after which the left mouse button is let go. This will not result in the object standing in the landscape. The correct procedure for placing an object is to make the object button active in the module after which a click in the landscape will place that object at the location of the mouse. Renaming the module select and click module would create a more accurate affordance.

4.6.3 Feedback

Placing an object

A user must select an object in the drag and drop module and click with the left mouse button in the landscape to place the selected object. However, there is no feedback given to the user that selecting an object enables the possibility to place an object in the landscape by clicking in it. Feedback could be given by changing the shape or image of the mouse or by attaching a transparent image of the object to the mouse. Doing the latter would have two advantages: (i) it becomes clear that performing an action with the mouse in the landscape is linked to the object selection the user has just performed and (ii) the user receives feedback on how the object would look in the landscape before placing the object.

4.6.4 Constraints

Useless modules

Many modules are useless while no tile has been loaded via the *tegelvenster* module. However, all modules are accessible while no tile has been loaded yet. This gives the impression that those modules can be of use to the user, while in truth they cannot.

It will become visible to the user what their choices are by constraining access to modules that are useless while no tile has been loaded. This increases the chance that a user will perform the necessary action to continue with the program.

Drag and drop module

The drag and drop module also provides the function to switch between moving, rotating or scaling an object. It is possible to move or scale an object in all three directions. Rotating can only happen in the y-direction. However, when the rotate function is active it is still possible to make the x-button and or z-button active. The user will then be

unable to rotate the object. By constraining access to the x-button and z-button a user will not be able to get into a situation that has no use.

Negative numbers

It is possible to fill in a negative number when building a custom wind turbine in the *windmolenconfigurator* module. This will result in a wind turbine that turns inside out. Win3D is used as an application to visualise possible scenarios as realistic as possible, deeming a wind turbine that can turn inside out worthless. The possibility to fill in a negative number should be constrained, since there is no use for negative numbers when building wind turbines.

4.6.5 Consistency

Titles, terms and units

Titles of modules or windows are not always consistent. The *atmosferische effecten* module, for example, leads to a window called *zonnestudio* (English: solar studio). The map of the *plattegrond* module has a button called 'wind', but when clicked it opens a window called '*windkaart*' (English: wind map). Terms are also not always used consistently. 'Tiles' and 'terrain' are often used as interchangeable terms. A new user must discover that both terms mean the same, and prior to that realisation there may be unnecessary confusion.

Notations are also not always consistent. In the *atmosferische effecten* module the time of the slider is notated in the 24-hour notation, however, the information given regarding the sunrise, sunset and length of day is provided in the 12-hour notation. In the *zonnepanelenconfigurator* module the uses of breadth and depth are not consistent. Units are also often missing, making it sometimes difficult to know what number should be filled in or how a number should be interpreted.

Colours

Many objects or attributes can be given a colour. Selecting a colour is always done in a separate window. However, this window can have three different appearances, as can be seen in figure 4.33.

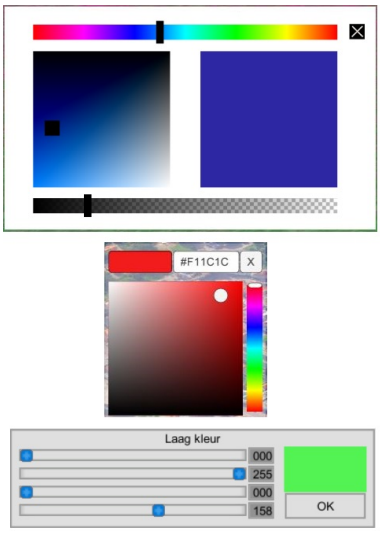

Figure 4.33: Three different colour windows.

Language

The program can be represented in Dutch or in English. However, the Dutch interface is often mixed with English words. This can vary from one English word hiding between many Dutch words to a whole module, like the *terreineditor* two module, being almost completely in English.

Icons

Icons are not always used consistently. The *snelmenu* miniatures from the scenario module have two icons in their corners: (i) on the left is a floppy disk icon and (ii) on the right is a trash bin icon. The former

icon seems to indicate that by pressing it the quick travel miniature will be saved. However, when pressed it replaces the current camera position used for that miniature with the current camera position. No quick travel miniature will be saved until the actual save button located under the scenario options is used. Therefore, the icon at the bottom left should have been a revolving arrow indicating its refresh function instead of a floppy disk icon.

Another example is the 'x' icon next to the sliders of the grid module, see figure 4.34. This icon puts the slider back to its original state with the knob in the middle. However, the 'x' seems to indicate that something is going to be removed. An arrow going backwards might be a better icon to indicate the undo function of the button.

Figure 4.34: Grid module.

A third example is the 'i' button that can be found in the top right corner of the scenario module. The window that opens after the 'i' button is pressed can do three things: (i) create a new tab, (ii) rename a tab and (iii) delete a tab. Creating a tab can also be achieved outside this window, but renaming and deleting a tab can only be achieved through using the 'i' button. However, an 'i' button is often used for obtaining information about something and not for performing tab management.

4.6.6 Recovery

Loading tiles

The *tegelvenster* module can have many tiles. These tiles require computing power and a computer can have trouble with functioning properly if too many tiles are loaded in the program. However, it is not possible to manually unload these tiles. The program must be rebooted first, making it not possible for a user to mend its mistake of loading too many tiles.

Trash bin

The trash bin icon does not always ask for a confirmation before deleting something, like the trash bin in the *datalaagmanager* module. This trash bin will remove the layer it belonged to immediately after it has been clicked. These layers are often put in manually by ROM3D, specifically for that region and customised to the interests of its users, and are therefore valuable. There is no possibility to retrieve a layer after it has been deleted, except by deleting and reinstalling the program. Being able to remove a layer with an instant click increases the chance of a user making an error. It also does not help that the trash can icon is the first icon of a row of icons, see figure 4.35, and that the image of a trash bin is barely recognisable.

Figure 4.35: Row of icons from the *datalaagmanager* module.

Chapter 5

Interviews and concept

Three interviews were held to create requirements with users for a first concept. Three more interviews were held with different users after the first concept was created. Their input led to a main concept design, discussed in chapter 6.

5.1 Methods

Participatory design tecniques involve users in the design process, see paragraph 2.5.2. This technique is applied during the interviews, meaning that design concepts are created together with users by discussing with them what their problems are with the current interface and what their wishes and requirements are for the new interface. This lead after three interviews to a first concept design. This design was presented in three interviews to other users, so further input from users regarding the concept could be acquired and applied to a main concept design.

Each interview was performed with one user. The interviews were unstructured, see paragraph 2.6.2, to allow the interview to be more like a conversation and to give the interviewer the opportunity to dive further into unexpected anwers. Given answers, observations, remarks and suggestions were written down on paper by the interviewer.

5.2 First three interviews

Three interviews were held with public servants who are new users of the software.

5.2.1 Purpose

Each interview started with questions to understand which purposes interviewees wanted to fulfil with the program. The main reason for using Win3D was for all three interviewees the same; being able to place wind turbines in a virtual landscape for visualisation. They could also imagine that one day they might want to use the program for visualising a photovoltaic power station (Dutch: *zonnepanelenpark*).

The reason they want to visualise wind turbines are two: (i) being able to provide additional visual information when having a meeting with

colleagues and (ii) to remove speculation and discussion based on feelings instead of facts. The latter reason is mainly regarding residents. An example of the latter was also given by an interviewee.

In Deventer, a city in the province of Overijssel in the Netherlands, plans were made for placing wind turbines in the surrounding landscape of the city. Opponents of these plans photoshopped a wind turbine in a photo of the concerned landscape. The wind turbine was made large and obvious and this image was used to convince other residents of the supposed negative consequences for the aesthetic part of the landscape. The public servants of the city of Deventer tried to communicate that the image was false and that the wind turbines would be far less obtrusive, but their words were less strong than the photoshopped image, resulting in such a strong opposition that much time was lost before the wind turbines could finally be build. In the end, the wind turbines proved to be barely visible in the landscape. They were not larger than a pinprick and an observer would first need to know where to look. Thereupon all remaining opposition ceased.

The interviewee pointed out that Win3D could have helped in this case or similar cases to subdue speculation. The program would allow false images and strong emotions to be countered and replaced by facts. This could lead to progress in discussions instead of accusations going to and from.

Something similar was mentioned by another interviewee. An interested party wanted to know if there was an opportunity for placing one wind turbine on a small plot of grass that was vacant. However, the plot of grass was located next to a stadium and they could already imagine the protestations that the wind turbine would drop its shadow over the stadium. The interviewee stated that the program would allow them to visualise how the shadow would fall and that this visualisation would also be helpful when discussing the situation with stakeholders of the stadium.

5.2.2 How and where to start

One of the interviewees did not have access to the current version of Win3D, but was still using a version with scenarios provided by ROM3D. In this version, the user can study the scenarios but is not able to add anything to the visualisation. The remaining two interviewees did have access to the current version of the program, but indicated both that they had trouble with using the program.

The main trouble originated from not understanding that 3D objects had to be loaded into the program before any objects could be placed. Therefore, there was no reason to look for the location of the *tegelvenster* module. After explaining the necessity of 3D objects, both interviewees were asked which module they thought was meant for loading these 3D objects into the virtual world. One of the interviewees answered *plattegrond* module, grid module and *datalaagmanager* module, the other interviewee mentioned the *geocoding* module, *plattegrond* module and the *navigatiepanel* module. Both failed with three guesses to name the *tegelvenster* module as the correct module, indicating that the module title alone is not enough to guide users through the first part of the program.

5.2.3 How to move around

Another important issue is with the movement of the camera. The camera is directed towards the sky when starting the program, which results in an image as can be seen in figure 5.1. One interviewee concluded that the entire visual world still had to be loaded in and did therefore not try to move the camera to another position or angle. Another interviewee had discovered that the camera angle could be rotated by holding and dragging the right mouse button. However, they had not discovered how to make the camera move to a different position.

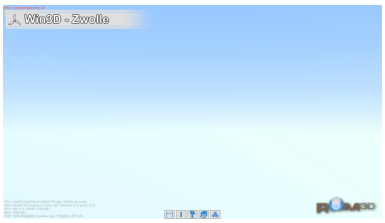

Figure 5.1: Starting position of the camera.

After explaining that it was possible to move through the landscape with the camera, each interviewee was asked how they thought they could move the camera forwards. Both the mouse and the arrow keys were tried, but none worked for moving the camera position forward. An explanation of the WASD keys had to be given. It was also explained how WASD keys are often used to move around in games and that for gamers using the WASD keys is more intuitive and logical. The interviewees were then asked if they played or had played computer games.

One interviewee answered that they had played such games during the early nineties, but they remembered moving around with the arrow keys. This can be expected from games from that period, since it was customary then to move with the arrow keys due to games not yet using a mouse and the right hand was available for handling the keys [31]. The right hand became more often occupied with handling the mouse after the mouse was introduced in gaming, resulting in the left hand becoming necessary for moving around. Placing the left hand on the right part of the keyboard was uncomfortable, so eventually gamers settled on a new location for moving around on the left side of the keyboard; the WASD keys. Therefore, people who stopped gaming somewhere in the mid-nineties will probably not be familiar with the WASD combination and usage.

It was also explained how the shift key, the alt key and the combination of both could increase the speed of the camera movement in different degrees. The concept was understood easily, but the implementation of using the keys in this manner proved more difficult. Especially finding a correct placement for all fingers was difficult.

5.2.4 Categories

Each interviewee was presented with the five categories from paragraph 4.5.1 and asked what their thoughts were regarding the division. The division was found logical and comprehensible. No further changes or additions were deemed necessary.

5.2.5 Expectations for the new interface

The final part of the interview focused on what interviewees would expect as users from a new interface for Win3D. Three aspects were strongly mentioned: (i) being recognisable and intuitive, (ii) having a low learning curve and (iii) simple goals, like placing a wind turbine, should be accomplished by performing simple actions. Interviewees also mentioned that they have no interest in understanding how the program works behind the scenes or how the technical intricacies work. They only want their layout to be simple to use and understand.

Interviewees mentioned how they are accustomed to certain programs and how they want to use that existing knowledge for a new interface. An interviewee mentioned how most programs often have buttons at the side of the screen for menu options. Similar buttons were missed in Win3D. One of the main purposes of the program, namely placing wind turbines, should also be achieved with a few mouse clicks and which buttons to click or options to choose should be easily understood.

5.3 First concept

The first concept of the user interface is based on the input of the interviewees, the insights acquired by studying the program as a new user and following the design principles mentioned in paragraph 2.3.

5.3.1 Overall layout and buttons

Interviewees requested a clarity of functions in combination with buttons which could be handled with a few mouse clicks to perform simple actions. This results in a first concept with visible buttons in the screen, see figure 5.2. At the top and the bottom of the screen are menu rows

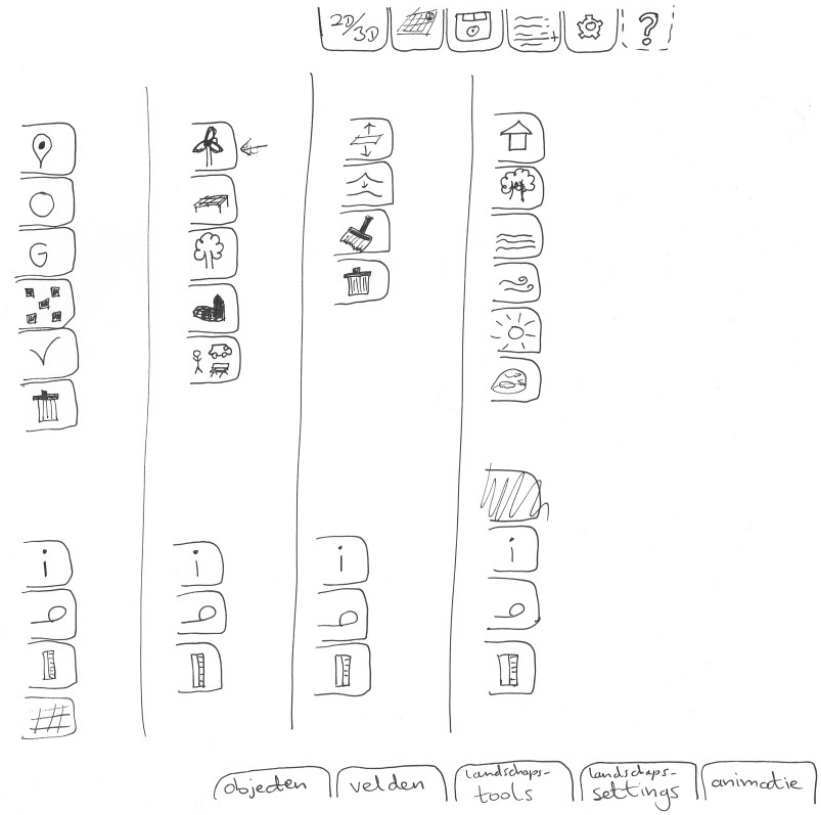

Figure 5.2: First concept design main menu, toolboxes and category selection.

with buttons that are always visible. The main menu can be found horizontally on the top of the screen and gives access to the loading of 3D objects, the map, saving, calculating how much wind turbines and solar panels are placed in the landscape, settings and the possibility to quit the program. The bottom row consists of the category selection and has five buttons, each consisting of one of the categories. Each of these category buttons opens a different toolbox on the left of

the screen. Almost all functionality can be accessed through the main menu and the category selection, in contrast to the current interface where important menus are sometimes hidden (e.g. the quick menu of polygons, which can be reached through pressing both the shift key and the alt key and clicking with the left mouse button on the polygon marker).

There is a buffer space between the buttons to prevent users from accidentally clicking on the wrong icon. The buttons have also icons on them instead of text. Replacing text with buttons reduces the time users need to gain an overview of what is offered on the screen and icons are easier to remember [8]. However, the meaning of icons needs to be obvious to replace text efficiently [9]. Their understandability needs to be tested during further interviews and prototype tests.

5.3.2 Upon starting the program

As mentioned by the interviewees, it is difficult for users to know where to start in the program and better guidance is desirable. Therefore, there are only three buttons to choose from when starting the program and all other buttons are marked inactive by being coloured grey. The options a user can choose from are: (i) the loading of 3D objects, (ii) settings and (iii) quitting the program. It is handy that a user can close the program, and the settings are sometimes necessary for changing the resolution or amount of computing power needed. Even if the user visits both menus, it should become obvious that none is going to help the user get on with the program. That leaves only the menu to load in 3D objects.

The icon of the 3D object load menu is a text saying '2D/3D', which refers to the transformation from 2D to 3D that the menu enables. A concept sketch of this menu can be seen in figure 5.3. The save button close to the 2D/3D button becomes only active after a minimum of one tile has been loaded or the load setting has been changed from *handmatig* (English: manually) to *afstand* (English: distance) or *vast aantal* (English: fixed number). The user then needs to select a *tabblad* (English: tab) and scenario to activate all buttons. The activation happens immediately after the save conditions are fulfilled, so the user receives immediate feedback that their actions were sufficient to give access to the rest of the program.

5.3.3 Toolboxes

Each category has its own toolbox placed vertically on the left side of the screen. The toolboxes of the *terrein* (named on the first concept design sketches *landschapstools* (English: landscape tools)), *eigenschappen* (named on the first concept design sketches *landschapssettings* (English: landscape settings)) and *objecten* categories give immediate access to all buttons. The remaining two categories, (i) *velden*, and (ii) *animatie*, have buttons in their toolbox inactive if an action cannot be performed. The sequence in which actions can be performed corresponds to the order of the buttons inside the toolbox. The user starts therefore with an active button at the top of the toolbox. The next button becomes active once the actions belonging to the first button are sufficiently performed. This system continues to the next button and the next thereafter, until the last button is reached. This limits the choices a user can make and protects the user better

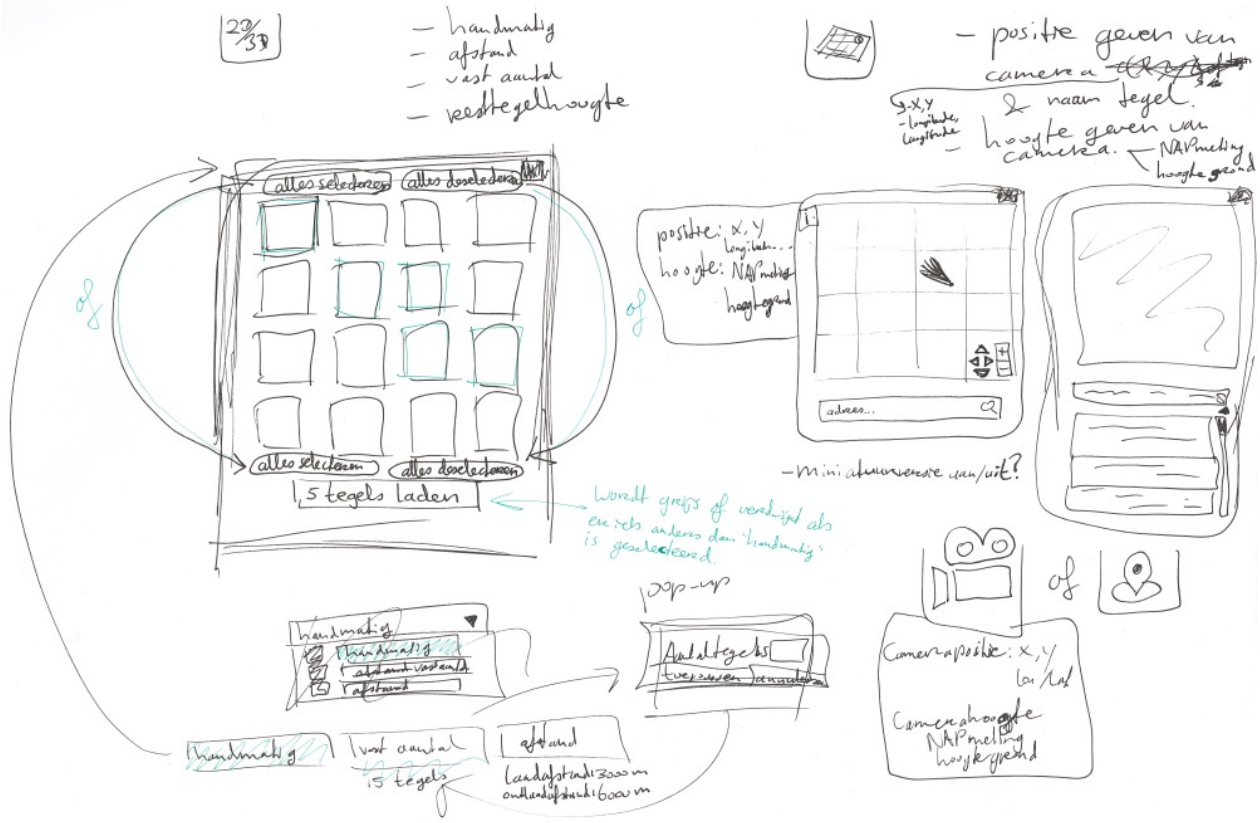

Figure 5.3: Sketch of 2D/3D window (left), map and location windows.

from making an error, which increases the chance that a user can go through the menu successfully. This provides guidance, like the interviewees requested.

The creation of the toolbox of the *velden* category emerges from listing which actions are needed to plant multiple objects in a polygon field and in which order these actions should be performed. A sketch of the creation of the side menu can be seen in figure 5.4. All concept sketches can be found in appendix E.

The actions belonging to the *eigenschappen* category are self-contained and can be used immediately. This category is meant for the aesthetic changes a user can make, like changing colours or altering the position of the sun. The buttons inside the toolbox are ordered by theme, as can be seen in figure 5.5. Each theme should contain the settings belonging to it, making it hopefully easier for a user to find a sought after setting.

5.3.4 Placing a wind turbine

All interviewees wanted the ability to place a wind turbine with a few clicks. If a user has loaded a tile and selected a location for saving, then a user needs to select the *objecten* category, select the wind turbine button from the side menu, select a wind turbine and click somewhere in the landscape to place a wind turbine. The first concept needs therefore four clicks to place a wind turbine in the landscape when starting with nothing selected. The current interface needs with the same conditions five clicks.

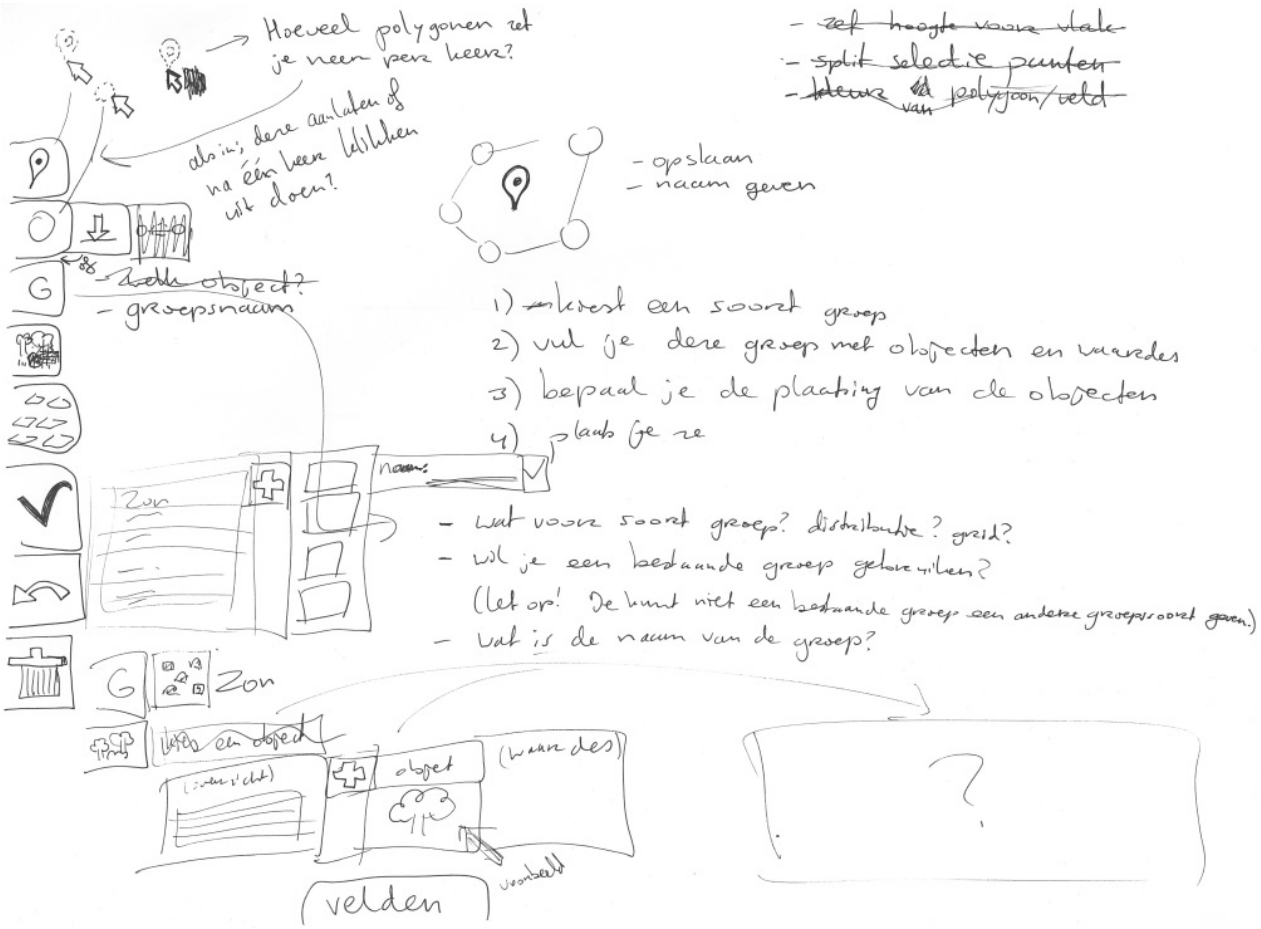

Figure 5.4: Sketch of the *velden* toolbox.

5.3.5 Key layout help

Interviewees talked about their trouble with moving around in the program, as mentioned in paragraph 5.2.3. Therefore, an extra button with a question mark icon is added to the top row menu. This button opens a screen with a keyboard and mouse layout where users can discover or remind themselves what each key and mouse button does inside the program.

5.4 Second three interviews

Three more interviews were conducted after finishing the first concept. These interviews allowed for further discussion, revisions and improvements with actual users. This paragraph will first look at smaller aspects of the interface and received comments and ideas and will then conclude with how the interface was received overall.

5.4.1 Maintaining a clear screen

The concept design divides, unlike the current interface, object categories further before returning a list with items. For example, choosing the vegetation object category gives a window to choose a type of vegetation. Choosing a type results then in the object list. Interviewees

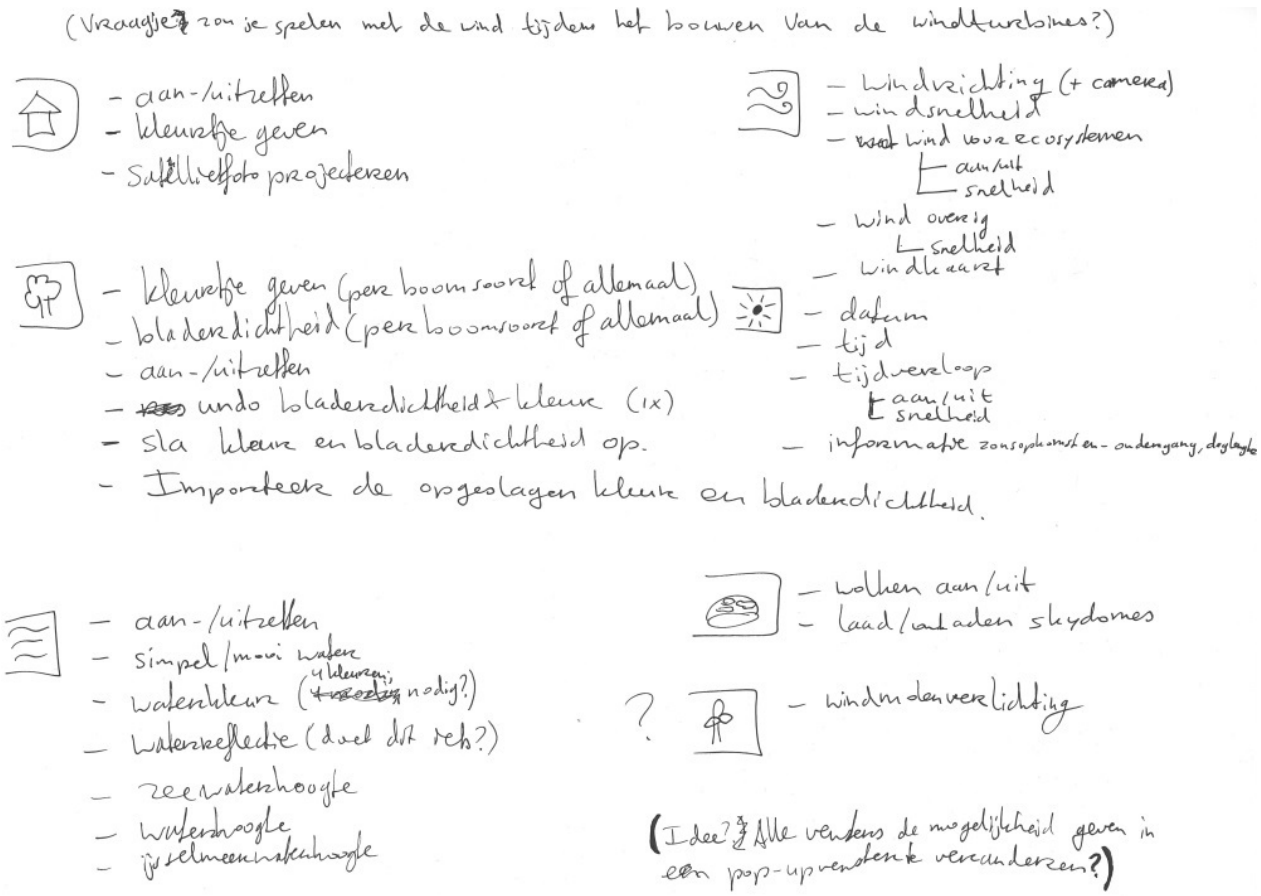

Figure 5.5: Sketch of the *eigenschappen* toolbox distribution.

noticed how the windows would take up space from the screen. This might get irritating if many of the same objects need to be placed and different selection options will not be relevant for some time. Two interviewees requested therefore possibilities to clear the screen of windows.

5.4.2 Object example

One interviewee noticed how, with the first concept design, it was only possible to know how a wind turbine or other object would look after it was placed in the landscape. It would also require an extra click to see the properties of the object. This interviewee would prefer to receive this information before placing the object in the landscape. The other interviewees did not mention something about wanting an example themselves, but after being asked if they would see value in such a function, they responded both that such a function would be handy and appreciated.

5.4.3 Sorting objects

The lists with objects are alphabetically ordered in the first concept design. Two interviewees noted how they would prefer to also order wind turbines on manufacturer, height or other aspects. Especially because a list containing different wind turbines could get quite long, making it harder to find wind turbines with certain specifications.

5.4.4 Adaptable quick buttons

The first concept design has four quick buttons on the screen: (i) a ruler, which places a large ruler vertical in the landscape, (ii) a measuring tape, for measuring the length of two point, (iii) a letter 'i', for providing information, and (iv) a grid, for placing a grid over the landscape. However, two interviewees pointed out that they would prefer the possibility to also add quick buttons themselves. One interviewee believed that this could improve the understandability of the program and the other interviewee thought that it would become easier to learn how to perform certain actions because the action would take less clicks through menus.

5.4.5 Overall reception

All three interviewees were enthusiastic and positive about the first concept design. It was mentioned how it would be already a major improvement over the current interface in terms of clarity and ease of use and that interviewees were happy if something resembling this concept design would be implemented. Interviewees were specifically happy with how easy it seemed to choose and place an object in the landscape. This is an action that two interviewees did not manage to accomplish with the current interface.

The separation of the main menu and category selection were understood and appreciated. All toolboxes were quickly understood except for the toolbox of the fields category, which needed a longer explanation. However, interviewees thought that understanding would come easier if they could click the buttons and go through the corresponding menus. Guiding users through the tile selection part at the start of the program by making other buttons inactive was appreciated. A key and mouse layout map was strongly welcomed by all interviewees.

5.4.6 Changes to the first concept

Changes to the first concept design were made based on these interviews. Some of these changes are the possibility to clear the screen, the possibility to sort objects on different aspects, seeing an image and the specifications of an object before placement, adding an adaptable quick button option and other (smaller) changes. These changes and the overall design are discussed in chapter 6.

Chapter 6

Main concept design

The main concept design is created from the input and suggestions of the interviewees on the first concept design. The main concept design is converted from a paper sketch to a digitalised version. This digitalised version is created in Inkscape[1], a free and open-source vector graphics editor. There are two main benefits of drawing vector images: (i) vector lines can always be manipulated, making it possible to make changes to images later in the design process and (ii) vector images remain always sharp when zooming in or out, meaning that there will never be a loss of quality.

[1] https://inkscape.org/en/

This chapter discusses and explains the main concept design and the reasoning behind certain choices. It also looks at the main concept design in comparison to the design principles and how it has changed from the first concept design and the current GUI.

6.1 Main concept design explanation

Each side of the screen fulfills a different function. The top side of the screen houses the main screen and the quick menu, see figure 6.1. Functions that are not necessarily connected to one of the categories and that a user may always need when using the program, belong to the main menu. This menu is always visible when using the program. On the right of the main menu is the quick menu, which provides easy access to different smaller functions. The content of this menu can be adapted with the small button on the right, as was requested by interviewees, see paragraph 5.4.4. The bottom side of the screen lets the user select a category. Each category selection opens a toolbox on the left of the screen, belonging to the selected category. The right side of the screen is for object manipulation and information.

6.1.1 Main menu

The functions inside the main menu do not belong to a specific category, but have always the possibility to be interesting to a user. Therefore, they can be always accessed and seen when using the program.

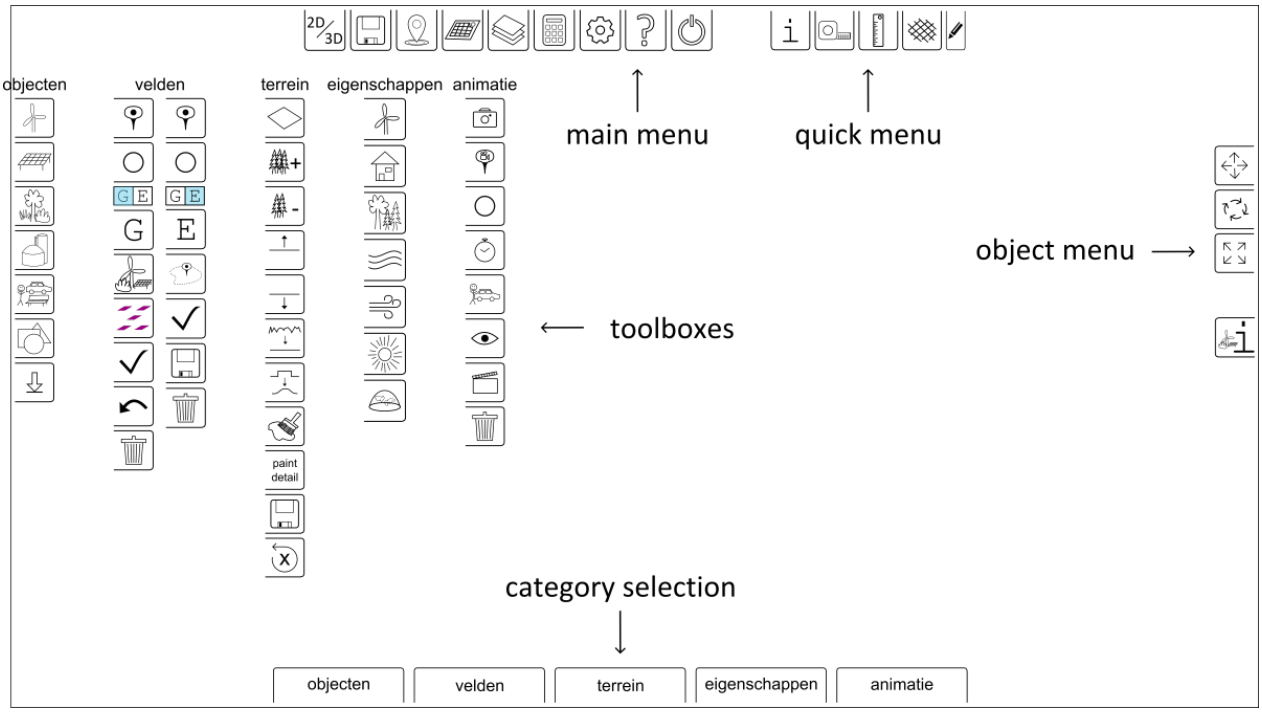

Figure 6.1: All side row menus in an overview.

First button: tile selection

The icon of the first button are the letters '2D/3D' and opens the tile selection window, see figure 6.2. These letters represent the function to go from a 2D landscape to a 3D landscape. One of three load types can be selected: (i) loading by manually selecting tiles, (ii) loading a specified number of tiles or (iii) loading tiles when reaching a specified camera location height. Choosing (i) allows users to select tiles from the tile overview. All tiles can also be selected or deselected at once. Tiles can be loaded after selecting them.

Second button: saving

The second button depicts a save icon and allows users to designate a saving location, see figure 6.3. A new tab can be created with the plus button beneath the tab list, which opens a second window on the right where a tab name can be provided. Filling in the tab name creates automatically a new tab in the tab list with the provided name. Adding a scenario to a tab can be achieved by pressing the plus button beneath the scenario list, which will open a third window where a scenario name can be given. It is also possible to save camera locations in this window by pressing the large plus icon.

Third button: location

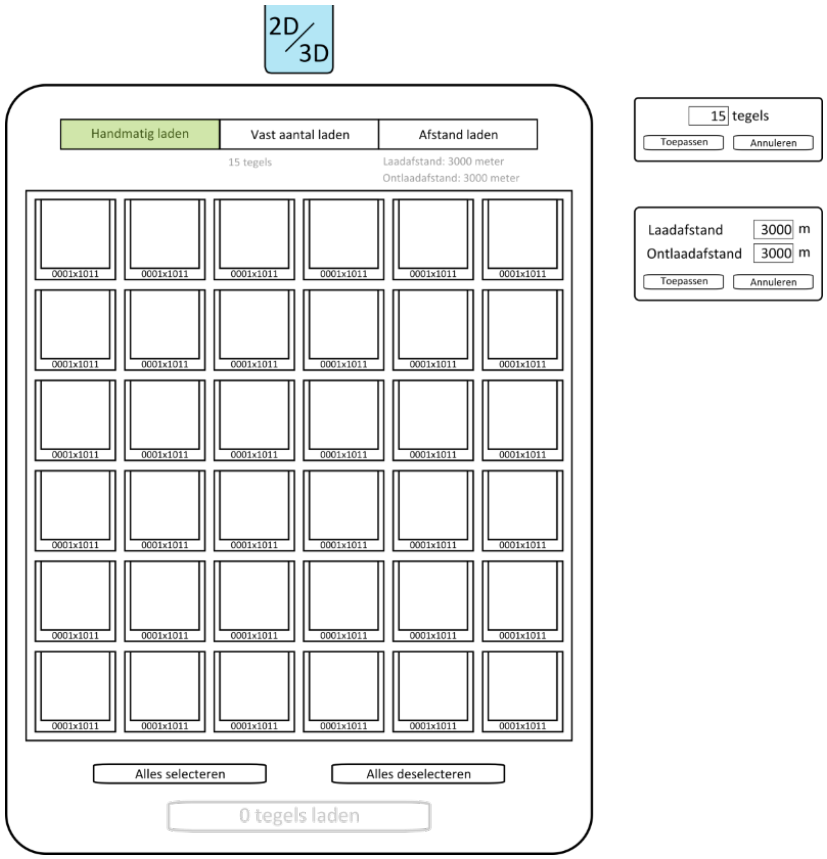

Figure 6.2: Main tile selection window (left), providing a value for loading a specified number of tiles (upper right), providing values for distance loading (lower right).

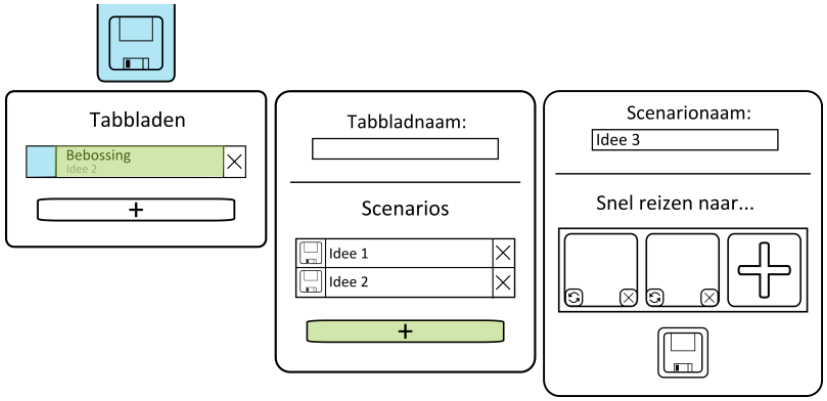

Figure 6.3: Saving windows.

The third button depicts a location icon. When clicked, a window is opened that details the x and y location of the camera, as well as its height, see figure 6.4. The values change live with any camera movements.

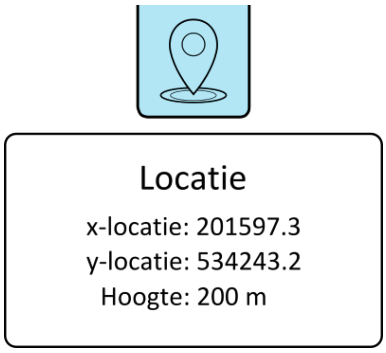

Figure 6.4: Location window.

Fourth button: map

The fourth button is represented by an icon of a map. The map window is divided in two important sections: (i) a map section and (ii) an address search section, see figure 6.5. The map section displays the satellite map, the position and direction of the camera and buttons for moving the map around and zooming in and out. A miniature map

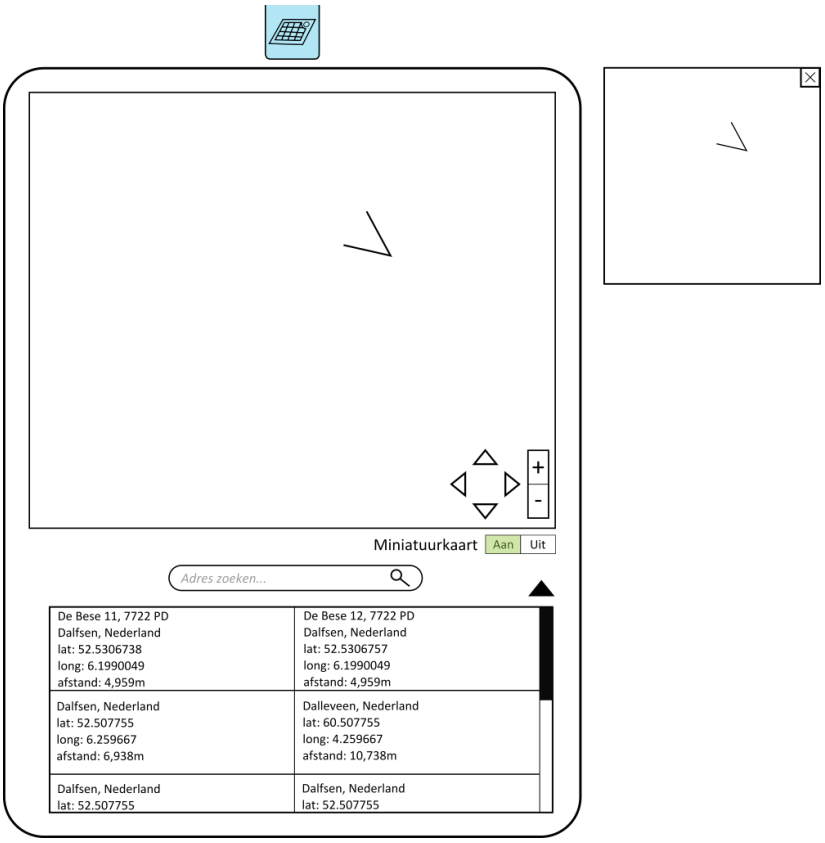

Figure 6.5: Main map window (left), minimised map (right).

can be toggled on and off, which is placed in the top right corner of the screen. This map will remain on the screen when the map button becomes inactive, which will close the larger window. The miniature map can be closed by opening the larger map window again and toggling the miniature map off, or by simply pressing the 'x' icon in the top right corner of the miniature map. The entry field below the map can be used for searching an address or postal code. Search results are shown beneath the entry field.

Fifth button: data layers

The fifth button depicts an icon with three layers on top of each other. Layers can be toggled on and off and given different colours, see figure 6.6. Layers do not belong to a group by default, but can be ordered into groups. A new group is created by clicking the '+ *nieuwe groep*'

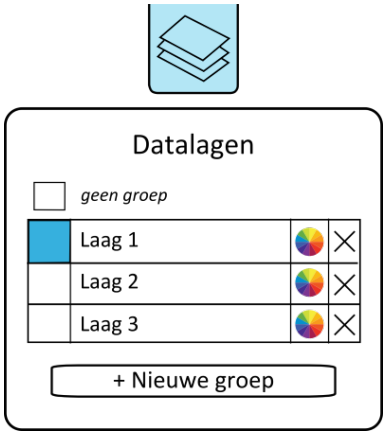

Figure 6.6: Data layer window.

button. This opens a new window to give the group a name and to create it. The newly added group can be edited, which opens a window with a list of all layers. Layers can be selected to add to the group or deselected to remove them.

Sixth button: income and overview

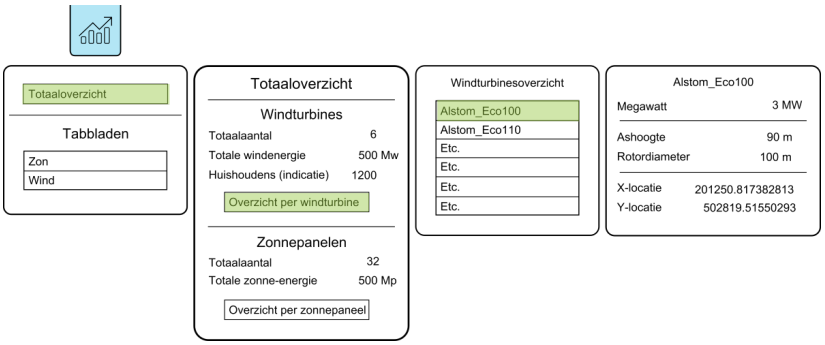

Figure 6.7: Windows of the overview function.

The fifth button depicts a calculator icon. This button leads to an overview of wind turbines and solar panels, see figure 6.7. It can state per tab (i.e. the tabs from the saving menu) how many of these objects there are placed but it can also give an overview of all tabs combined. Information of each individual wind turbine or solar panel can also be examined.

Seventh button: settings

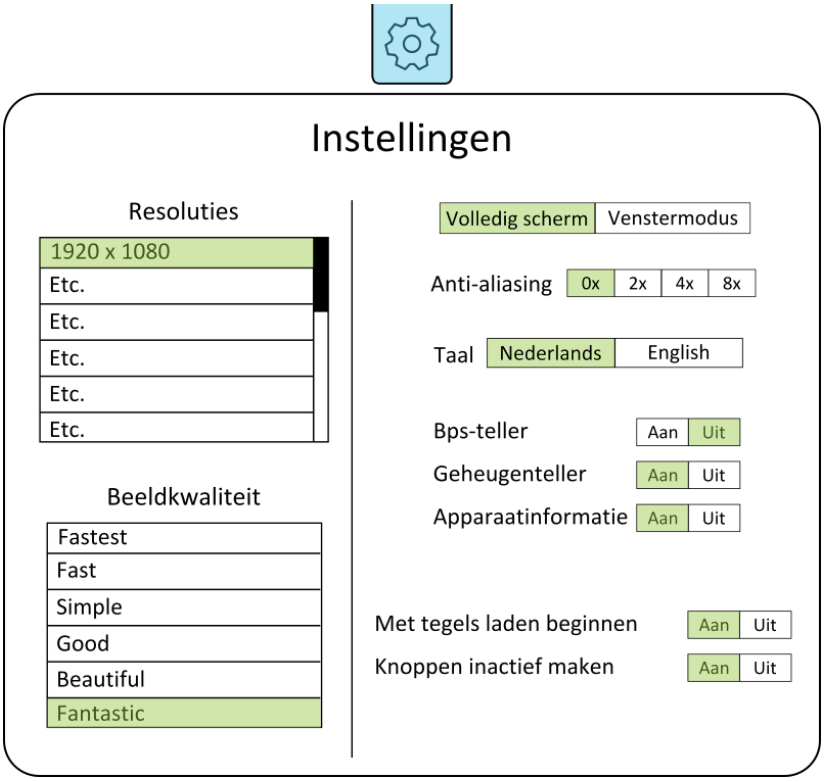

Figure 6.8: Settings window.

The seventh button is represented by a cogwheel icon, where the settings of the program can be found, see figure 6.8. Resolutions, performance quality, window modus, anti aliasing, language and toggling the visibility of the frames per second counter, memory counter and device information on and off can be changed in this window.

The settings window also lets users adapt the interface. The necessecity to first select a tile before other functions work, can be toggled on and off. The guidance the GUI offers by making buttons that cannot perform a function yet inactive, can also be toggled on and off. The possibility to turn these function off are added for the benefit of the experienced user, who already understands how the program works and knows what their limitiations within the program are.

Eight button: help

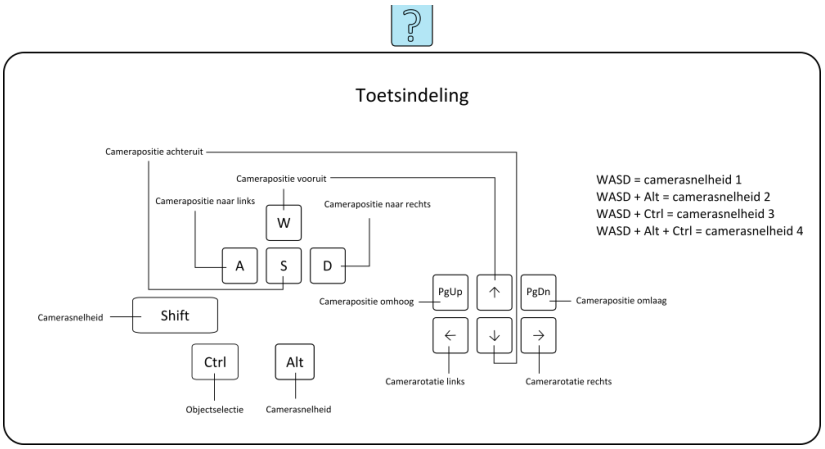

Figure 6.9: Help window.

The eight button depicts a question mark and opens the help window, see figure 6.9. The help window displays the keyboard layout. Note that this is an example and that not all functions are represented.

Ninth button: quitting

The ninth button is denoted by an on/off icon and leads to a window where a user can make a choice; quit the program or continue working, see figure 6.10. A confirmation is needed to prevent users from accidentally closing the program.

Figure 6.10: Quit window.

6.1.2 Category selection

The category selection provides access to different toolboxes. Each category has its own toolbox, where the *velden* category has two versions of its toolbox. An overview of all toolboxes can be seen in figure 6.11.

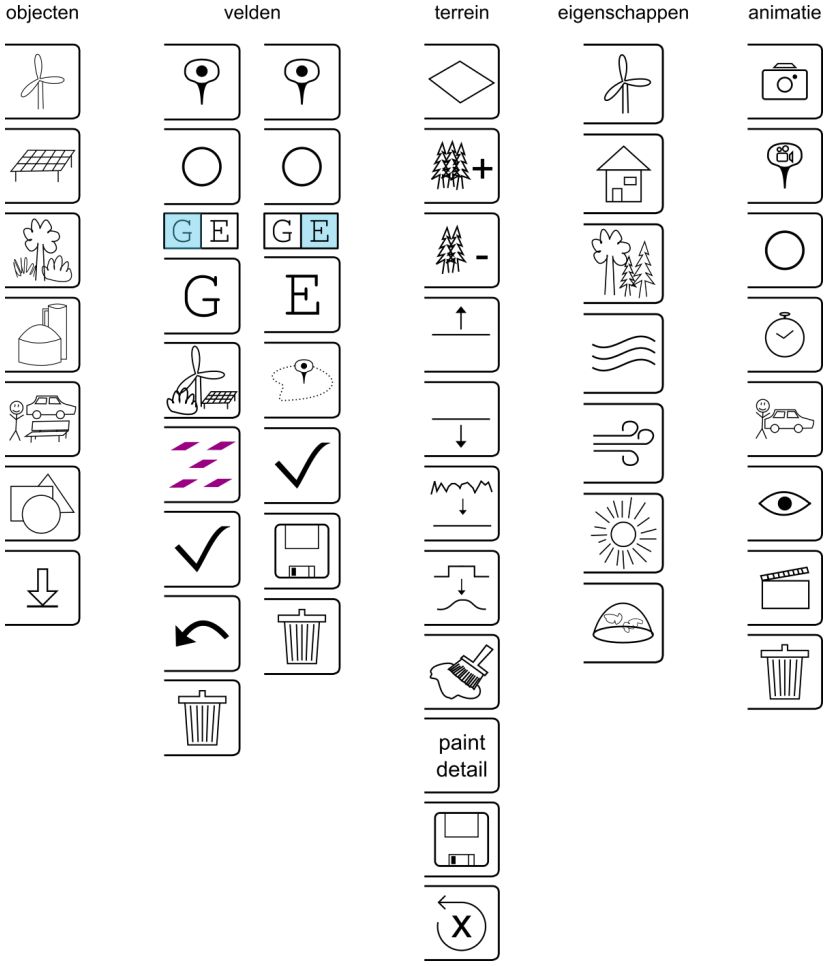

Figure 6.11: From left to right: toolboxes for the objects, fields, terrain, attributes and animation categories.

6.1.3 *Objecten* category and toolbox

The object category is comparable to the drag and drop module from the current interface and enables users to select an object and to place this object in the landscape. Only one object can be selected at a time and only one object can be placed per mouse click in the landscape. The two main actions performed in this category are (i) the selection action and (ii) the placement action.

The user knows often beforehand which object they would like to place. Selecting this object should be an easy and fast process. A problem with the current interface is that vegetational objects are separated and located in different tabs, making it difficult for the user to find what they are looking for. The main design concept reorders the current grouping of objects into the following seven groupings: (i) wind turbines, (ii) solar panels, (iii) vegetation, (iv) anaerobic digestion (Dutch: *biovergisting*), (v) landscape decoration, (vi) basic shapes and (vii) import. A user can click on the object button to get access to the object toolbox. This toolbox consists of the seven object groups and can be seen under *objecten* in figure 6.11.

Object list and example

Each group leads (eventually) to a list with objects. An object can be selected from this list by clicking on the name of the object. This

will highlight the object and the user is able to click somewhere in the landscape to place the object. It is also recommended to add a sorting possibility, discussed in paragraph 5.4.3, although further research should reveal which sorting options users would prefer. This window

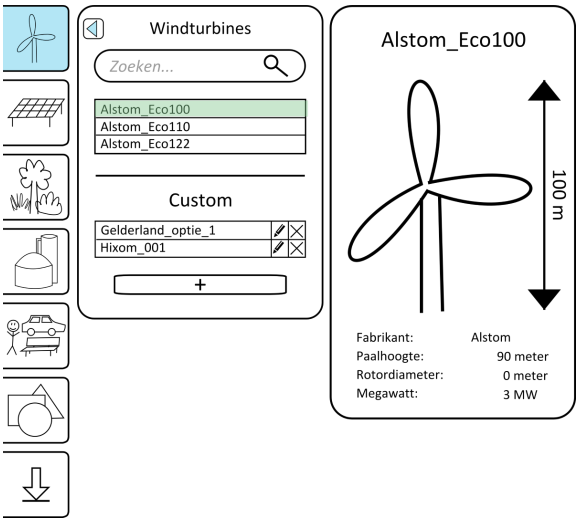

Figure 6.12: Example of a mouse hovering over the first object on the list.

also has a search field to allow the user to find their object quickly if they know the object name. Hovering over an object name will open a new window to the right of the object list window, where a rotational model shows how the object looks and provides specifications, see figure 6.12 for an example. The height of the object is also mentioned in this window. Adding an object example before selecting an object fulfills the request of interviewees, as mentioned in paragraph 5.4.2.

Subgroups and minimised windows

Two groups are divided further into subgroups, namely (i) vegetation and (ii) landscape decoration. Vegetation leads to five further subgroups: (i) broad-leaved trees (Dutch: *loofbomen*), (ii) coniferous trees (Dutch: *naaldbomen*), (iii) grass, (iv) flowers and (v) weed. The land-

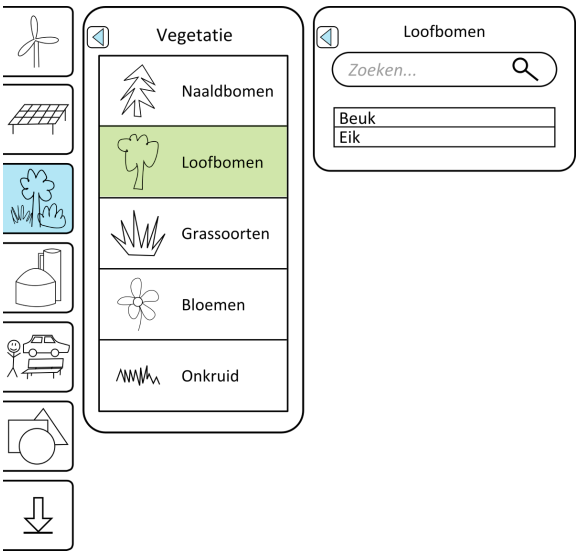

Figure 6.13: Example of a chosen subgroup and its object list.

scape decoration button leads to three further subgroups: (i) human

figures, (ii) car models and (iii) park benches. The corresponding object list window will appear after a subgroup is selected. An example can be seen in figure 6.13.

Each window can be minimised by clicking the arrow symbol in the top left corner, fulfilling the request of interviewees as discussed in paragraph 5.4.1. Minimising the windows of figure 6.13 will lead to the minimised windows in figure 6.14. A minimised window denotes the subject of its window and, if applicable, the selected subgroup or object.

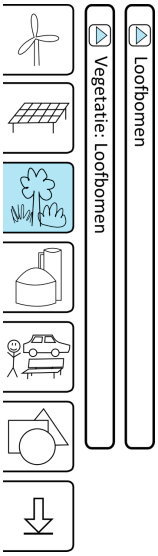

Figure 6.14: Example of two minimised windows.

Custom-made objects

Selecting the wind turbine group opens a list with wind turbine objects that is divided in two parts: (i) a list with wind turbines that pre-existed with the program and (ii) a list with custom-made wind turbines. The latter list will first be empty until a user creates a new wind turbine. The plus icon at the bottom of the window, allows a user to open a window, where the user can provide the program with the numbers necessary for creating a custom wind turbine. A new window opens at the right of this window once sufficient values for the custom-made wind turbine are provided. This new window shows live how the wind turbine would look with the current given values. The object list window, wind turbine building window and live custom wind turbine example window and their positions can be seen in figure 6.15.

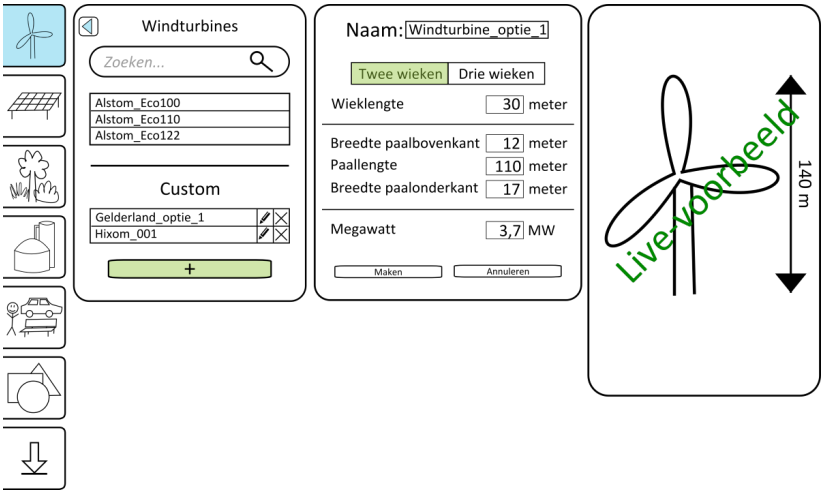

Figure 6.15: Object list, wind turbine building and live example windows.

In the current interface the user must go to two modules to create and place the custom-build wind turbine, namely (i) the drag and drop module and (ii) the *windmolenconfigurator* module. The user needs the latter to build the wind turbine and the former to place it. Only after placing the wind turbine in the landscape can the user see what their filled in entry fields resulted in. In the main design concept the user can create and place a wind turbine from the same menu and the user can study its custom-build before creating it by receiving immediate feedback.

The solar panel object menu works similarly as the wind turbine object menu, with also the possibility to build a custom solar panel. The solar panel custom-build menu has other entry fields to fill, but there are no other differences. A custom-build entry can with both object groups always be changed or deleted.

6.1.4 *Velden* category and toolbox

In the current interface the user should understand the importance and function of a polygon marker found in the drag and drop module before the user will be able to create a polygon field. The user should also be aware of the special shift key and alt key combination needed for bringing out the menu necessary for creating a field. The interviews made clear that this functionality was not discovered by users without a manual. The main concept design places all field functionality inside the field category and requires no special key combinations for access.

There are two different approaches to filling a field with objects: (i) the group approach and (ii) the ecosystem approach. The group approach in the current interface is in the polygon menu, see paragraph 4.3.8, and the ecosystem approach can be found in the *ecosysteemmanager* module, see paragraph 4.3.9. Each approach works differently and has no connection to the other approach. Only the two first steps of placing a marker and path points is the same. The user can select which type of field they want to create and depending on that choice the toolbox can take on one of two appearances. Both toolbox appearances can be seen under *velden* in figure 6.11, where the left toolbox belongs to creating a group field and the toolbox on the right is necessary for creating an ecosystem field. The first two buttons of both toolbox appearances have the same function.

First button: polygon

The first button has a polygon icon on it and when active the user can place a polygon marker in the landscape. This marker allows the user to easily locate and select the associated field. The first button becomes inactive and the second button active after a marker is placed in the landscape.

Second button: path point

The second button has a path point as its icon and allows the user to place path points that connect to each other to create a field between them, see figure 4.18. If the button is active a user can place path points. By clicking the path point button a second time the button will become inactive and path points can no longer be placed in the landscape. The window belonging to the second button, see figure 6.16, can change the colour of the path points, change their height, add new path points between selected path points and import path point shapes.

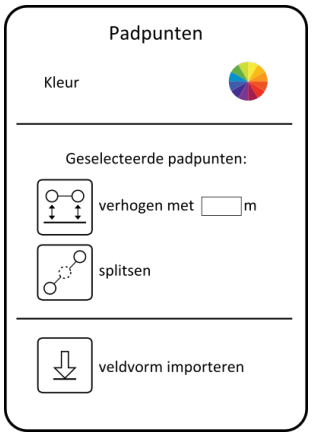

Figure 6.16: Window belonging to the path point button.

Toggle button

Between the second and third button is a radio button with a ‘G’ icon on its left button and an ‘E’ icon on its right button, see figure 6.17. This button allows users to switch between the group and ecosystem variants of the *velden* category toolbox.

Figure 6.17: The radio button to toggle between the group and ecosystem toolbox variants.

Third button (group approach): group

The third button has a letter 'G' as its icon and is used to create groups. If there are not yet any groups then the user will only see a window with a plus sign to create a new group.

To create a group two aspects must be indicated: (i) the name of the group and (ii) the type of the group. After creation, the new group will appear in the list of groups and before each group name it will be visible which type of group it belongs to. See figure 6.18 for both windows belonging to the group button.

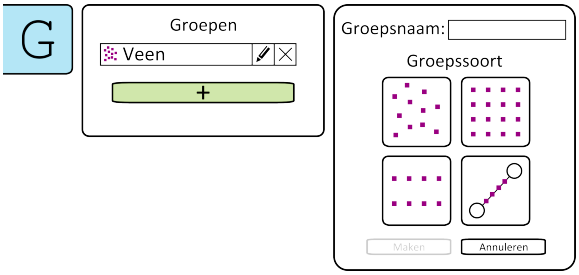

Figure 6.18: The left window shows the group list with one group and the right window is for creating a new group.

Only one group can be selected at a time. The name of the group can always be changed and a group can be deleted, but the type of group cannot be adjusted once a group has been created. When making the group button inactive it will be visible next to the button which group is active at that time, see figure 6.19. This reminds users which group they had selected without making it necessary for a user to re-open the group menu.

Figure 6.19: The inactive group button when a group has been selected.

Fourth button (group approach): object

The fourth icon can add objects to the selected groups. The user must specify which object they want to add. A window for values will then open to let the user specify in which quantity and size they want to see the object appear in the field, see figure 6.20. The appearance of the

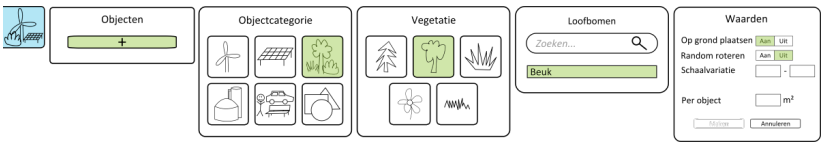

Figure 6.20: Creating a new object.

values window depends on which group type has been selected. The grid group and row group provide the same value window.

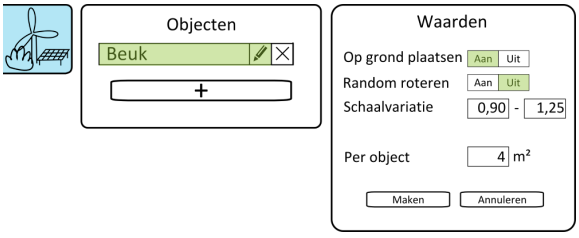

Figure 6.21: Adjusting values of an existing object.

The object will be added to the object list after creation. Values of objects can still be altered after creation by pressing the pencil icon next to the object name, see figure 6.21.

Fifth button (group approach): location

The fifth icon has multiple purple tilted squares as icon and enables the user to change the placement of the objects. Once a group has been selected and has objects added to it, purple square marks will appear in the field. Each mark represents the location of an object. The squares can be moved in the four wind directions or can be rotated in the location window, see figure 6.22, that appears on making the fifth icon active. Information is also given regarding the size of the field in square meters and the number of objects that might be placed with the current location settings.

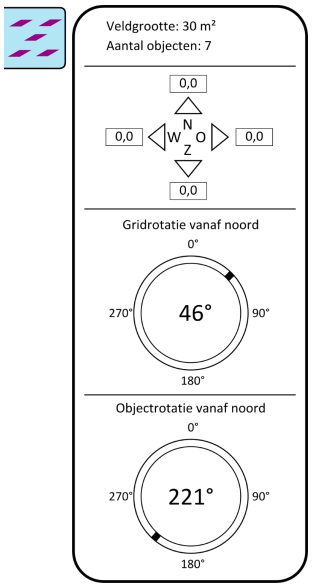

Figure 6.22: Location window.

Sixth, seventh and eight button (group approach): placement, undo and delete

The sixth icon, a checkmark icon, places the objects of the selected group in the field in accordance to the location placement indicated by the purple square marks. The seventh icon, consisting of a return arrow, can undo placements and the eight icon, a trash bin, clears the field of all objects.

Third button (ecosystem approach): ecosystem

The third button has a letter 'E' as icon and is used to create ecosystems. Clicking the button opens a window with a list of ecosystems.If no ecosystem has been created yet, then the list will be empty. To create a new ecosystem, a user clicks the plus button beneath the ecosystem list and a new window will open. The user then needs to provide the new ecosystem with a name and selects a type of soil, see figure 6.23. After creation, this window closes and the new ecosystem is added to the ecosystem list.

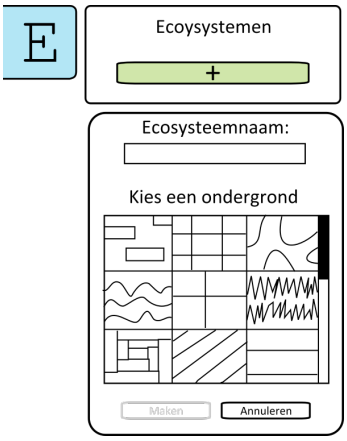

Figure 6.23: The creation of a new ecosystem.

An ecosystem starts empty. A user can create a new group inside the ecosystem and to each group new objects can be added. A new group can be added by clicking the '+ *nieuwe group*' (English: new group) button. This opens a new window to provide a group name after which the new group can be created. Adding a new object can be achieved by clicking the '+ *nieuw object*' (English: new object) button under a created group. Each group has its own button for adding objects. Clicking such a button opens a new window that allows the user to choose an object and its measurements. Creating the object will close the window and add the object to the list of groups and objects. See figure 6.24 for an example of these windows.

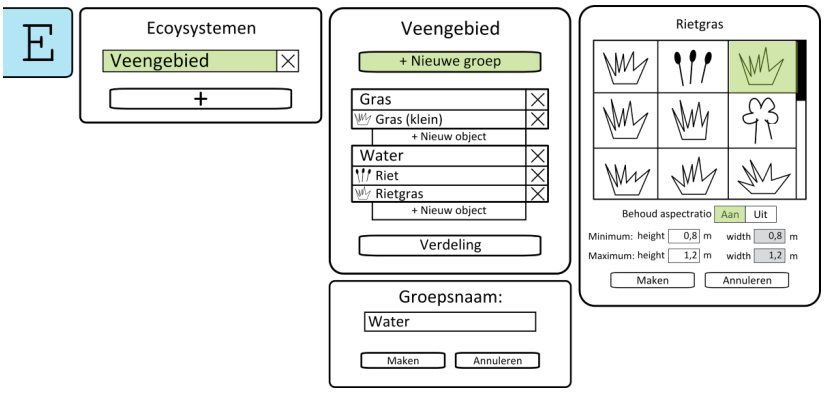

Figure 6.24: Ecosystem list window (left), group and object list window (upper middle), creating a new group (lower middle) and adding a new object (right).

The group approach can create fields after a user has specified how many objects must be placed per square meter. The ecosystem approach, however, works with percentages. By clicking on the divide button at the bottom of the group and object list window, a new window is opened below, see figure 6.25.

Behind each group and object is an entry field to fill in a percentage. The filled-in percentage determines how many objects are placed. For example, in figure 6.25 there is a 20% distribution of *riet* (English: reed) in the group 'water'. The group itself will be for 40% part of the field. This results in 8% of all objects in the field being a reed object.

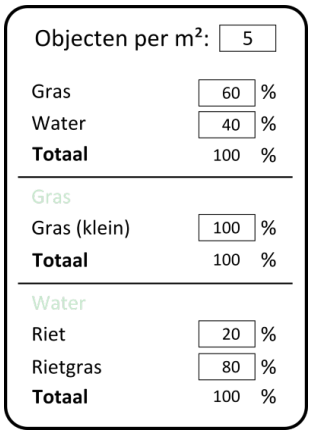

Figure 6.25: Objects and groups divided in percentages.

Fourth button (ecosystem approach): selection

The fourth button consists of a marker symbol circled by a dotted line representing a selection. This button is for selecting which markers will plant an ecosystem in their fields if the fifth button for placement is clicked. A user can choose to plant an ecosystem in selected fields or in all fields of a tile, see figure 6.26. The radio button is positioned on *handmatig* by default.

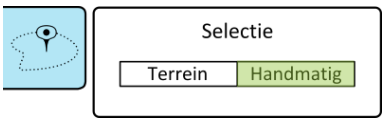

Figure 6.26: Radio button belonging to the selection window.

Fifth and sixth button (ecosystem approach): placement and delete

The fifth button, a checkmark icon, plants the objects of an ecosystem in the appointed fields. The sixth button, a trash bin icon, removes all ecosystems from the landscape.

6.1.5 *Terrein* category and toolbox

The *terrein* category is a combination of the current *terreineditormodule* and *terreineditor 2-module*. No large faults were found or mentioned regarding the current layout for editting terrein. The current terrain modules were therefore remodeled in accordance to the logic used for the concept, without any major changes to the terrain concept.

Figure 6.27: Tile selection.

Selecting a tile

The top button in the side menu of the *terrain* category displays an icon of a tile. No changes to the terrain can be made without selecting a tile first. Therefore, the first button is the only active button until a tile is selected. When opening the corresponding tile window, the user is informed if a tile has been selected and why selection is necessary and how a selection can be made, see figure 6.27. All other buttons from the side menu become active after a tile is selected.

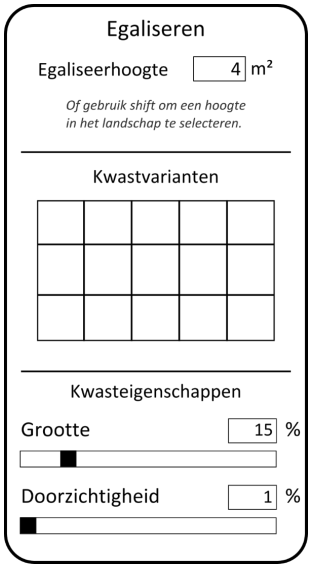

Figure 6.28: Window belonging to equalise button.

Trees and terrain height

Button two allows the user to add trees, button three removes trees, button four and five change the height of the terrain, button six can equalise the terrain and button seven can smooth the terrain. The windows of all six buttons are quite similar. An example of one of those windows is given in figure 6.28. The squares under *kwastvarianten* (English: brush variants) represent the different brushes the software offers, as seen in figure 4.28.

Painting

The eight button, painting terrain, and the ninth button, painting detail, are not functioning in the current interface. No windows have therefore been designed for these buttons. These should be designed after the company knows what it wants to achieve with the functionality of these buttons, and cannot currently be designed.

Saving and restoring

A user can save their terrain changes by pressing the tenth button in the side menu. This button is active when unsaved changes are present, and is inactive when there are no changes that can be saved. The eleventh button restores the terrain to its original state that came with the program.

6.1.6 *Eigenschappen* category and toolbox

The *eigenschappen* category stores the functions that are used for making aesthetic changes to objects or the landscape. These functions come from the main menu and different modules from the current interface and are reorganised in this category.

First button: wind turbines

The first button of the side menu of the *eigenschappen* category, has a wind turbine as icon and leads to different wind turbine settings, see figure 6.29. The red, oval shapes used for marking the advised distance between wind turbines can be toggled on or off, all the illumination or specifically the lights on the tower can be toggled on or off, the light during the day time or during the night time can burn constantly or blink, and the settings for how often a light should blink or if wind turbines should blink synchronised, is changeable.

If the user turns all illumination off, then all settings regarding wind turbine illumination will become inactive. Turning the illumination on again will make all settings active again. If there is no blinking selected for the day and night time, then the blink settings will become inactive.

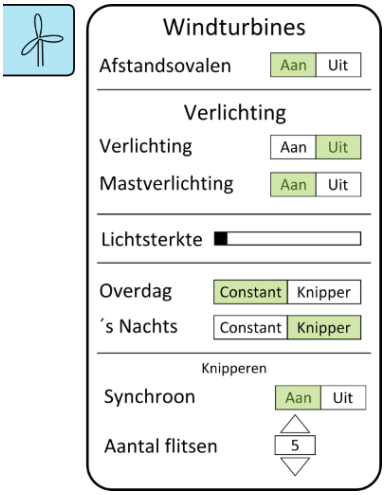

Figure 6.29: Wind turbine window.

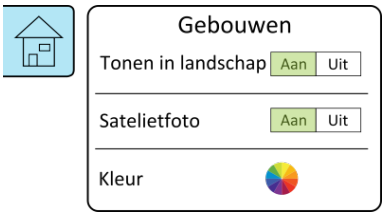

Figure 6.30: Building window.

Second button: buildings

The second button depicts a house icon and changes the settings for the buildings in the landscape, see figure 6.29. There are three settings to change for buildings: (i) toggling them on and off in the landscape, (ii) toggling a satellite photo on and off over the top of the buildings and (iii) changing the colour of the buildings. Toggling (i) off will make (ii) and (iii) inactive.

Third button: trees

The third button depicts trees as icons and regulates the setting of the trees in the landscape, see figure 6.31. The visibility of these trees can be toggled on and off in the landscape. The colour of the leaves

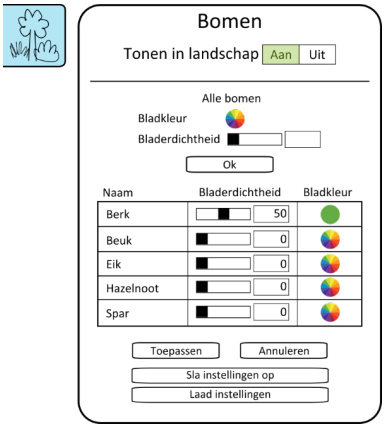

Figure 6.31: Tree window.

can also be adjusted per tree type or for all trees at once. Similarly, the density of the tree leaves can be changed. These changes can be saved or restored. Making the trees invisible in the landscape will make the colour and leave density settings inactive.

Fourth button: water

The fourth button has three waves as an icon, representing water, and changes the different water settings, see figure 6.32. The visibility of the water can be toggled on and off, the quality of the water can be changed to lower computing power needed, the colour of the water and the reflection of the water can be changed and three different water heights can be changed.

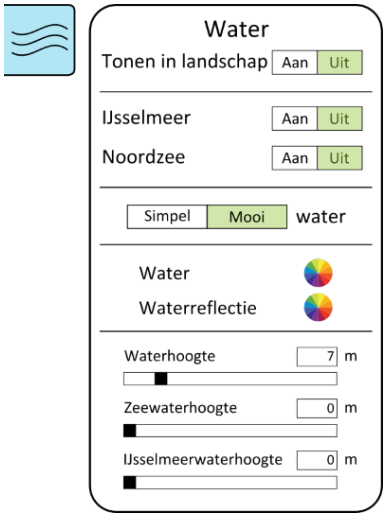

Figure 6.32: Water window.

Fifth button: wind

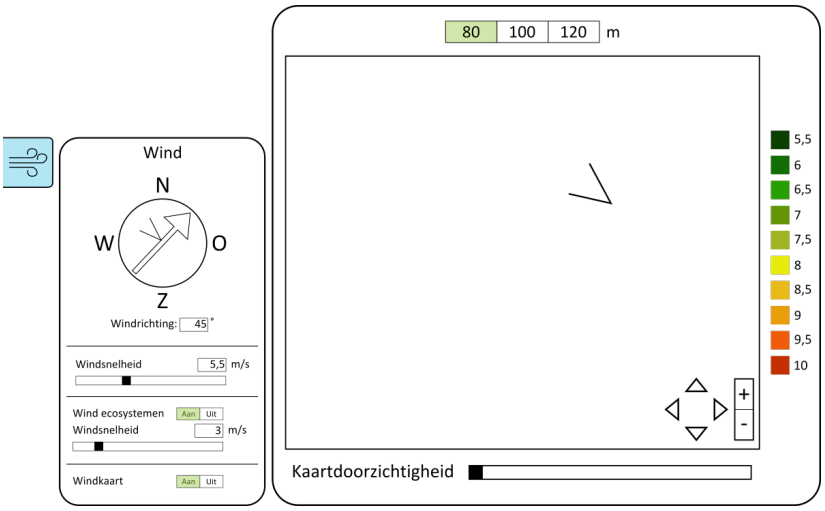

Figure 6.33: Wind window default (left) and wind map (right).

The fifth button represents wind and opens a window to different wind settings. A user can change the wind direction, the overall wind speed and the wind speed for specifically the ecosystems and can open a wind map, see figure 6.33. This map provides an overview with how strong the wind blows on three different heights of the ground. The wind map is placed over the satellite map and the user can change the opacity of the wind map to regulate the ratio between the two maps.

Sixth button: sun

The sixth button depicts a sun icon and regulates the position of the sun. A user can change the date and time, which will reposition the sun in the sky accordingly. Changing the date opens a window to select a day and a month. The time can be changed by typing in the numbers. Enabling the time speed moves the sun around the earth in a loop. The speed of the rotation can be changed. Information regarding dawn, dusk and the length of the day are also provided.

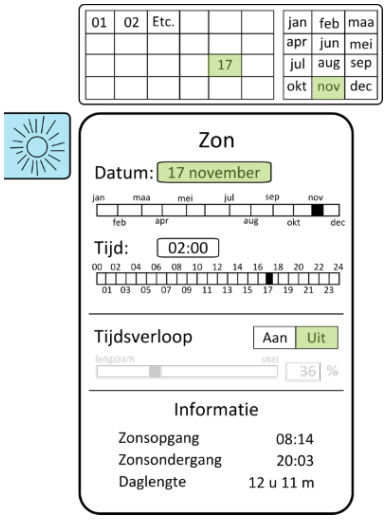

Figure 6.34: Sun window (bottom) with a date selection window open (top).

Seventh button: skydome

The seventh button depicts a sky dome and regulates the sky settings, see figure 6.35. Here, users can toggle the visibility of clouds on and off and an image of the sky can be loaded to be placed over the default blue sky.

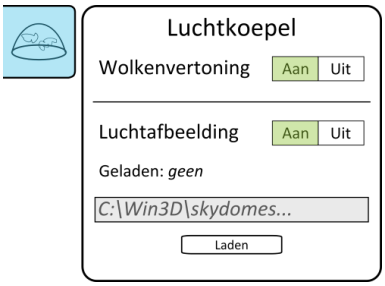

Figure 6.35: Skydome window.

6.1.7 *Animatie* category and toolbox

The *animatie* category has two main functions: (i) taking a screenshot and (ii) making a movie. The latter part can be accomplished in the current menu by placing an *animatiepad* marker and visiting its menu by clicking on the marker while pressing both the shift key and the control key, as described in paragraph 4.3.8. This menu is difficult to find for users without a manual. The concept design makes the functionality of filming and rendering easily accessible, without a need for the user to consult the manual.

First button: screenshot

The first button, with an icon of a camera, opens the screenshot window, see figure 6.36. A file size can be selected and a screenshot can be taken with the large button with a camera icon at the bottom. This screenshot is saved in a folder designated by the program.

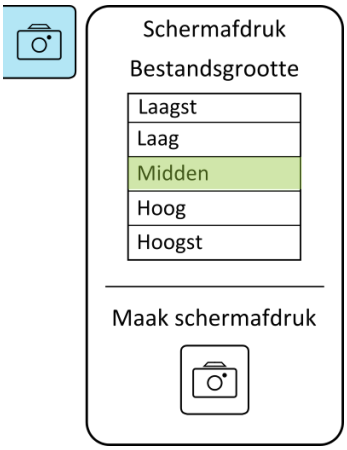

Figure 6.36: Screenshot window.

Second button: film marker

The second button depicts a film marker. The current interface uses the same appearance for the field and the animation marker. Therefore, it is not possible to discern one marker from the other without clicking on it. A marker with a camera icon can represent an animation marker while the current marker with a dot inside can keep representing a field marker.

Making the second button active allows the user to place an animation marker in the landscape.

Third button: path points

The third button depicts a path point and inside the accompanying window a user can select if they want to place path points for the location of the camera or path points for the direction in which the camera should look, see figure 6.37. Looking at a direction path point can also be turned off, after which settings belonging to those path points will become inactive. The line between points can be made smooth or rigid, the path points can be changed in height, path points can be added between selected points and the colours of path points can be changed.

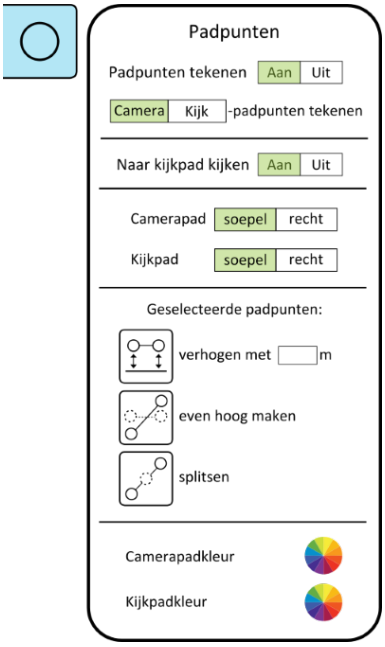

Figure 6.37: Path points window.

Fourth button: duration

The fourth button represents a watch and allows the time duration for the movie to be set, see figure 6.38.

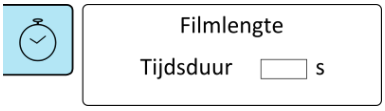

Figure 6.38: Duration window.

Fifth button: movable objects

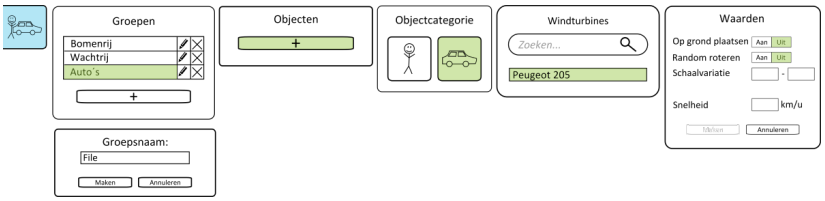

Figure 6.39: Object window.

The fifth button depicts objects that can move. Groups can be created and objects can be selected to add to groups. Only objects that can move in real life, like humans and cars, can be added. A selected group will move its objects along the camera line, making it possible to let cars drive around or to let humans walk around in the landscape.

Sixth button: preview

The fifth button depicts an eye and allows users to see a preview of their movie before rendering it. The preview can be started with the play button and stopped with the stop button. When starting the preview, everything disappears from the screen except the stop button. This solves the current interface problem of not knowing how to stop the preview, as mentioned in paragraph 4.6.1. There is also an option to keep the preview in a loop.

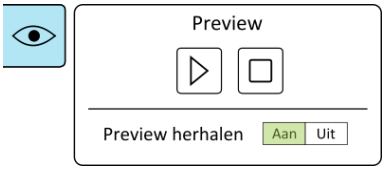

Figure 6.40: Preview window.

Seventh button: rendering

The sixth button has a clapperboard icon and starts the rendering of the movie.

Eight button: removing

The seventh button depicts a trash bin and deletes the selected animation marker and its path points.

6.1.8 Object menu

The object menu controls the manipulation and information of object. The menu appears when an object or a marker is selected. The first three buttons allow for the moving, rotating and scaling of the object. The fourth button appears when an object is selected and shows the object information, see figure 6.41.

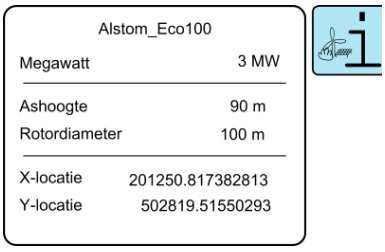

Figure 6.41: Object information window.

6.2 Implemented design principles

The main concept design is created with the design principles in mind. The connection between the five main design principles and the main concept design is elaborated here.

6.2.1 Visibility

The current interface has many functions hidden behind keys, key combinations or the right mouse button, as discussed in paragraph 4.6.1. The main concept design has no hidden functionality and all actions can be performed with the menus and buttons on the screen. For some menus it is still possible to navigate them with the mouse, but a clear alternative option will always be offered for users who are not aware or not comfortable with using the right mouse button or key combinations. An example is the map inside the map window, where the map can still be navigated with the mouse, but where navigation buttons have been added as an alternative option, see figure 6.42.

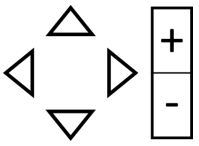

Figure 6.42: Alternative visible navigation for the map.

No functions are hidden deep inside the program. Almost all functions can be reached with a few clicks. This makes it easier for a user to discover that they are not looking for a functionality in the right place. It also enables users to gain quickly an overview of the possibilities the program provides.

6.2.2 Affordance

The program can limit the amount of active buttons a user sees, as explained in paragraph 6.2.4. The affordance to click the right button will increase by leaving only a few buttons clickable. Also, most functions can be performed by the buttons that are visible in the screen. The visibility of buttons increases the affordance to press them, making it likely that functions inside windows will be discovered and used.

6.2.3 Feedback

The main concept design tries to always provide users with immediate feedback. Save buttons will be inactive when no changes have been made that can be saved, but will become active when it is possible for the user to save. Buttons used for opening windows will be coloured to indicate that they were used for opening a window and to communicate that they can be clicked again to close the newly opened window.

In the current interface, no feedback is given to the user that an object can be placed in the landscape, as discussed in paragraph 4.6.3. For the main concept design it is recommended that a small and transparant object icon is attached to the mouse when an object can be placed in the landscape. This might be especially useful for the marker symbols and path points used for fields and animation, because without feedback the user might be confused what they can do when the corresponding buttons are active.

6.2.4 Constraints

As discussed in paragraph 5.2.5, the target audience is a group of users who, on average, are not proficient in learning new computer applications and who do not want to spend much time on exploring and learning the ins and outs of a computer application. This user group is prone to quit if the learning curve is too steep.

The main menu of the current interface is the portal to all functionality, but gives no clue to which function is more important or should

be employed first. The list with modules is ordered alphabetically and no module title has a specific emphasis. The user should understand all modules or deduce from the module names its function before a user would be able to properly use the software. However, module names are not always logically connected to content, as detailed in paragraph 4.6.1. Providing a user with information regarding which modules are important when, would diminish the learning curve significantly.

The interface can help the user by providing guidelines to what is important and what is not. One method to achieve this is by greying out options that cannot be used by users at that time. This will limit the choices a user can make and will increase the chance that a user finds the option that they are looking for. Also, by greying out a button instead of making it invisible, a user is still aware that the button and its functionality exists and a user can conclude that an action has to be performed before they will gain access to the inactive button.

A problem with the current interface is that users who miss the importance or the existence of the *tegelvenster* module cannot do anything of importance with the program. The main concept design tries to resolve this issue by making only four buttons visible at the start of the program: (i) the quit button, (ii) the settings button, (iii) the help button and (iv) the tile button, see figure 6.43. The first three buttons

Figure 6.43: The begin screen with restrictions for a new user.

are respectively needed for quitting the program, changing the resolution and other options and enabling a help screen with explanation when hovering over a main button. The last button will enable a user to choose one or more tiles to load. All other buttons will appear after one or more tiles have been loaded into the program. The limitation will prevent users from wandering through the program without understanding why nothing seems to work.

Further constraints are employed in the toolboxes of the *velden*, *terrein* and *animatie* categories. The first button, and for animation the first two buttons, will always be active. The order for going through the toolbox will always be from top to bottom. So performing enough action within the last active button will make the next (few) buttons active.

6.2.5 Consistency

One of the main principles of design is consistency because being consistent will allow the user to learn one principle that can be used many times instead of learning multiple principles for doing something similar. Being consistent leads therefore to a shorter learning curve. All windows will therefore close by performing the same action and input controls like radio buttons, entry fields and checkboxes will have the same appearance in each window.

Division of the screen

Assigning a specific function for a part of the screen and ordering functions in accordance, results in a division with consistent rules. Once users understand these rules, they can deduce where functions are in all probability located. This diminishes the learning curve and gives users the possibility to navigate through the interface efficiently.

Chapter 7

Implementation

The main concept design discussed in chapter 6 needs evaluating to discern its worth. A prototype is created to test the most important features of the main concept design. This chapter discusses what is tested with the prototype, explains how the prototype was made and details what the prototype can do.

7.1 Invision

There are multiple programs for creating a prototype of an interface, like Axure, Mockplus, Balsamic Mockups, Adobe Experience Design CC (Preview), JustInMind, Sketch and Invision. Adobe Experience Design CC (Preview) is still in beta and can only be accessed by people with Mac OS X. All other programs are behind a paywall, except for Invision[1] who offers one free prototype. Invision has other benefits. For instance, there is no programming involved, unlike Axure and JustInMind, and the program has a low learning curve. The program also allows for easily testing the prototype while building it. Therefore, Invision is chosen for creating a prototype of the main design of the new interface concept.

[1] https://www.invisionapp.com/

7.2 Choosing what to test

Making a prototype takes much effort and costs time. It is therefore recommended to choose beforehand what the goals are of a prototype so it can be determined which parts of an interface concept should be included and which parts should become interactive or remain static.

The functionalities identified as most important by interviewees are the placement of wind turbines and the creation of photovoltaic power stations. Interviewees also expressed trouble in getting the program to function at the start and wished that the new interface would be intuitive and easy to use with a slow learning curve. The following questions were established to answer if the current concept design is fulfilling these wishes and expectations of users:

- Can the user discover how to make all the buttons active at the start of the program?
- Can the user make a close guess as to what to expect from each button in the side menus?

- Can the user place a wind turbine in the landscape?
- Can the user make a custom wind turbine or solar panel?
- Can the user change a custom wind turbine or solar panel?
- Does the user think they would be able to place and customise objects on their own in the future without help?
- Can the user make a group with beech objects?
- Can the user make an ecosystem group with various groups and objects?
- Does the user think they would be able to create and place objects in fields on their own in the future without help?
- Can the user understand the difference between a normal group and an ecosystem group?
- Can the user find logic and understanding in the *eigenschappen* category?

These questions focus mainly on the main menu and the *objecten*, *velden* and *eigenschappen* categories. The *terrein* and *animatie* category are less interesting for examining with a prototype. The former is barely altered from its original form and no interviewee expressed interest in using the functionality it offers, and the latter is similar in layout to the *velden* category which is already tested twice by the group and ecosystems variants.

7.3 Preparing images

Each change in design or layout results in a new image needed for Invision. It is therefore helpful to have one document containing multiple versions of menu's and windows to acquire an arsenal of building blocks and to allow for quick placements, see figure 7.1 for an example. In the middle of all building blocks there is an empty space of 1600 by 900 pixels located. This space is used for the actual building and only this space is used for exporting a PNG image. 295 images were in the end created to use in Invision.

7.4 Linking everything together

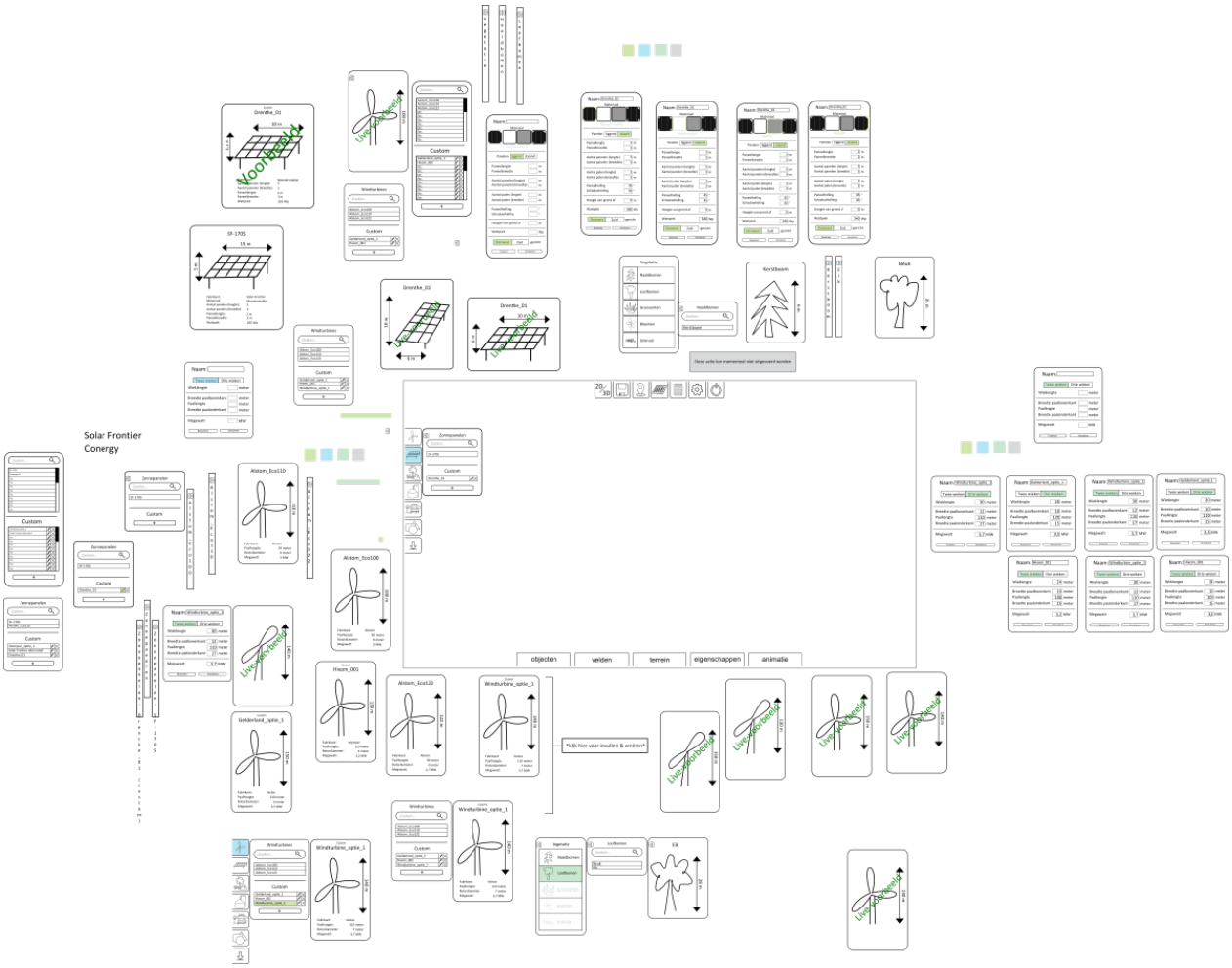

Figure 7.1: Building blocks for prototype images.

Each of the 295 images needs to be linked to another image to make it possible to move between images in Invision. A blue square can be drawn over an image to indicate the space where an action should take place if clicked. An example of such squares can be seen in figure 7.2. Squares are green when being part of a template, which are discussed in paragraph 7.4.1.

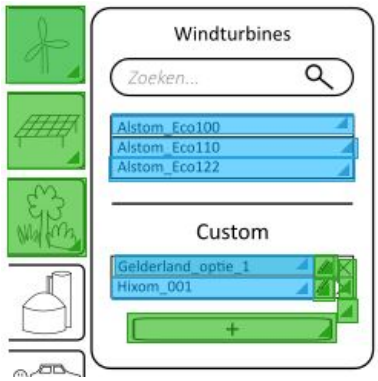

Figure 7.2: Blue and green squares to indicate clickable areas.

A square needs two inputs to function: (i) an assigned image and (ii) an action. Multiple types of actions can be assigned to a square, but three specific actions have been used for this prototype: (i) clicking, (ii) hovering and (iii) lay-over. Clicking the square results in going to the assigned page. Hovering over the square shows a different page but the current page returns if the mouse leaves the square. A lay-over is a smaller image that is placed over the current image if the square is clicked. The lay-over disappears if a place outside the smaller image is clicked.

7.4.1 Templates

Each image contains between one and seventeen squares. A template can be created and used to prevent that every square must be created and assigned separately. A template is a collection of squares, belonging to one image, grouped together. The template can be assigned to other images. These images will then receive the same squares and

linkages. The final prototype uses seventy templates.

7.5 End result

In the final prototype, it is possible to travel through all main menu buttons and to open three categories: (i) *objecten*, (ii) *velden* and (iii) *eigenschappen*. If a category is active, then access to the main menu becomes unavailable. Access can be regained by closing the category. Opening a category resets any previous process gained in that category, so a tester always begins with the same image when opening a category, even though they have been there before and clicked around.

7.5.1 The main menu

The first image to begin with when testing the prototype is called 'B1'. This image gives access to the window to load in 3D tiles, the settings window and the quit window. The save window becomes available after a tester has loaded at least one tile. It is possible to load in the prototype the first, the first two or all tiles in the window. In the save window a tester can create one *tabblad* with two scenarios. All other buttons become clickable after a save location has been selected. The third button opens the location window. The fourth button opens the map, where also a miniature map can be opened, although this miniature map disappears if another button is selected or the map is closed. The fifth button gives examples of overviews of all wind turbines and solar panels and per tab.

7.5.2 Inside the *objecten* category

Inside the *objecten* category a tester can place five wind turbines, of which two are custom wind turbines. A tester can also place one solar panel and three types of vegetation. The user can hover over each wind turbine, solar panel or vegetational object to see the specifications of that specific object. The tester can create and edit one wind turbine and one solar panel.

7.5.3 Inside the *velden* category

A tester can create and place a marker and path points to create a field. A group can then be created and renamed and a beech object can be added to this group. The position of the object location can be moved in four directions and rotated. The objects can be planted in the field which results in seven beeches being placed inside the field, see figure 7.3. This action can be undone or the beeches can be deleted.

Placing the seven beeches enables the tester to continue to an alternative version of the *velden* category where the possibility to choose from an ecosystem group is included. The tester can again place a marker and path points and can then choose between a group or ecosystem field toolbox. The group toolbox has no further clickable options, since it could be explored in the previous *velden* variant. The ecosystem group toolbox enables the user to give a new ecosystem a name and a type of soil. It is then possible to create two groups, where the first

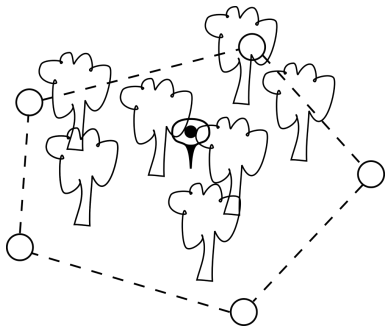

Figure 7.3: Seven beeches placed inside a field.

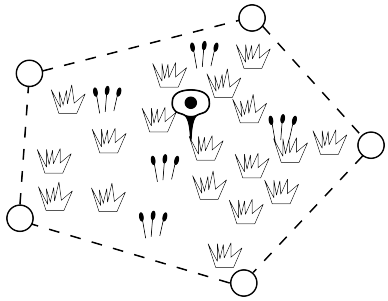

Figure 7.4: Grass and reed placed inside a field.

group can contain one object and the second group two objects. The distribution of percentages between groups and objects can always be visited and with two groups and three objects created its values can also be changed. When at least one group and one object are created, a tester can choose a selection method and select the marker. A field of grass and reed can then be planted in the field, see figure 7.4. The placement can also be deleted again.

7.5.4 Inside the *eigenschappen* category

Inside the *eigenschappen* category there are seven buttons to choose from. Each button gives access to settings belonging to the theme of that button. All radio and regular buttons are clickable, but other values cannot be adjusted. It is important that a tester understands what they see and if they find logic in the ordering and placement of buttons and functions. Therefore, it is not necessary that all values are clickable.

7.5.5 Access to the prototype

The prototype as tested by the user can be accessed and examined by visiting the following link:

https://invis.io/6RCF5UDHT#/241119620_B1

The same page and prototype, but with hints with where clickable places are when misclicking, can be accessed and examined by visiting the following link:

https://invis.io/CBCF5RXVT#/241119620_B1

All images have been optimised for a screen with a resolution of 1600 by 900 pixels. It is advised with this resolution to clear the screen of other external menu bars, so no scroll wheel remains on the side.

Chapter 8

Testing

Testing the main design is necessary before any statements can be made regarding its quality or virtues. The created prototype, as discussed in chapter 7, is used for testing the main design with users. Two types of users are discerned during testing: (i) users from the public sector who are relatively new to the program and (ii) users that are employees of ROM3D and who are experienced users.

Testing started with two student testers to discover any remaining small mistakes. Then two new users and three experienced users were tested. Small adjustments to the prototype were made based on the results of these tests. Finally, one last new user test was performed.

8.1 Error testing

295 images are connected in Invision to create a prototype of the main concept design. Small mistakes and errors can easily sneak in with such numbers. Many mistakes and forgotten links were found by going through the prototype multiple times, but even then, it is not assured that no errors are remaining. A new pair of eyes and hands might see or do things differently, which might result in different discoveries that went previously unnoticed.

Two student testers have searched for mistakes, errors and dead ends that did not belong. Each student tester clicked around in the interface for an hour. Some of this time was also spent on discussing the interface and design choices. Found errors were written down on paper and after the error testing session corrected.

A few observations worth mentioning are that student testers understood quickly their limitation on buttons that is in place at the start of the program, and were quick to figure out that loading tiles resolved that limitation. They also understood the meaning behind icons quickly and figured out from the start how to make a button inactive again. Although both students had limited background knowledge about the program, they were both able to discern the functions and logic of the program while going through the interface.

8.2 Testing procedure

Each test was performed with one tester and one test attendant. A list with actions guided testers through the prototype and ensured that at least these actions were performed by all testers. The list tries to answer the questions listed in paragraph 7.2. The list with actions is:

- Load in tiles. (Say: "What would you try first when encountering this interface?")
- Make a tab with two scenarios.
- Explore the main menu.
- Place a wind turbine called Alstom_Eco110 in the landscape.
- Create a custom wind turbine with three blades and place this wind turbine in the landscape.
- Place an oak.
- Minimise all windows from the vegetation objects.
- Place a Christmas tree.
- From which material is solar panel SF-170 created?
- Make a custom solar panel.
- Change the material of the custom solar panel to amorphous material, with standing panels and positioned to the south.
- Place multiple beech objects inside a field.
- Place multiple objects inside an ecosystem in a field.
- Make a group with an object.
- Visit the division window after creating the object *gras (klein) (English: grass (small))*.
- Make a second group with two objects.
- Explore the *eigenschappen* category.

Testers did not read from the list themselves, but were asked to perform each action by the test attendant. Testers could explore further than the list indicated. The test attendant and tester could talk with each other during testing, which resembled an unstructured interview. The atmosphere was relaxed and open, and no stopwatches or timers were involved.

The test attendant asked during the testing if testers could identify the meaning of icons before opening windows, if testers could perform certain actions and if testers could repeat what they had just done in the prototype. The test attendant also explained functions to testers, unless it was of interest that such information was not (yet) provided. For example, the test attendant would not help with explaining the function of the menu to load in tiles at the start of the prototype, since it was important to know how fast and easy testers could get through that part on their own. Furthermore, the test attendant listened to remarks made by testers and would encourage testers to share their thoughts.

Each tester will divide their focus differently and might notice aspects that are difficult to predict beforehand. Some testers might prove to be more talkative while others need questions to discuss their thoughts. Testers might also try to perform an action that would be possible to perform in the actual interface, but that cannot be performed in the

prototype. The test attendant needs to explain such a limitation when encountered and can then narrate how such an action would have influenced the real interface. Therefore, a more open and unstructured mix of testing and discussing is better suited for the testing of this prototype than a structured test where the test attendant would not be allowed to explore interesting topics or remarks, or provide additional help.

As discussed in paragraph 4.1.1, the two main reaction for new users is (i) to give up learning and using the program and (ii) to ask for extensive help from the employees of the company. Testers are asked at the end of the test procedure in how far they would be inclined to show one of these reactions with the prototype GUI. This should determine if these reactions are (partly) solved with the main concept design. A focus will also lie on the effectiveness and efficiency testers are able to perform tasks with and on how satisfied testers are. Effectiveness, efficiency and satisfaction play an important role in determining if a GUI is good, as explained in paragraph 2.1.

8.3 First test - new users

The first prototype was tested by two new users and each test took around an hour and a half to conclude.

Loading tiles and saving

The first screen starts with three clickable buttons of which the 2D/3D button provides access to all other functionality. Both testers tried first to click on the other two clickable buttons, (i) the settings button and (ii) the quit button, before trying as the last possible option the 2D/3D button. They explained that they could imagine beforehand what to expect from these two buttons while the 2D/3D button was a bit more mysterious. It felt therefore safer to first explore the familiar options before challenging the unknown. However, since the settings and quit button are relatively small windows, there was not much time wasted to reach the correct window, so this exploring behaviour should not be a problem.

Testers understood quickly that there was not much more to do in the 2D/3D window than select tiles. The button that can load these tiles becomes only active after at least one tile has been selected. Both users noticed that the button became activated and were therefore more prone to click the button. The subsequent activation of all buttons on the screen was apparent to both testers.

The saving window proved a bit more difficult, due to the entry field for the tab and scenario name being located in the next window. Also, when testers made a new scenario, the window for filling in the scenario name hardly change, making it difficult for testers to deduce that they had to use that window again.

8.3.1 Main menu

Besides the 2D/3D button and save button, there are seven other main menu buttons in the prototype, see figure 8.1. Testers were asked to imagine to which functionalities each button would lead, having only

Figure 8.1: The seven main menu buttons represented in the prototype.

the icon image and position of the button to go on. The first tester could guess the functionality of the location, settings and on/off button, but thought that the icon of the map button had something to do with tiles and could not think of a function for the calculator button. Their actual function became apparent to the tester after being able to study the windows the buttons lead to. The tester did not find it necessary to change the icons.

The second tester was not able to guess beforehand to what kind of functionality the location and calculator buttons would lead. They expected to travel to different locations in the landscape with the location button and could not think of a functionality for the calculator button. However, the function of both buttons was understood quickly after opening the corresponding windows. The tester gave as advice to change the calculator icon to an icon of a rising and falling line, see figure 8.2, to better represent its functionality.

Figure 8.2: The suggested replacement for the calculator button.

It was explained to testers that two main menu buttons were missing from the prototype: (i) a button for toggling and sorting layers in the landscape and (ii) a help button that would provide a map of keys from the keyboard and their functions. Especially the latter was deemed essential by testers for making the interface easy to use and understandable and it was stated that including it should not be an option but a requirement.

8.3.2 *Objecten* category

Both testers deduced correctly what the *objecten* category would enable them to do. Both testers were asked to place an Alstom_Eco100 wind turbine in the landscape. The toolbox was quickly understood, so both testers could go to the wind turbine selection with one click.

The first tester first studied the window to understand the difference between the two lists present, one being a list with wind turbines included in the program and the other being a list with custom-made wind turbines. Then they searched for the correct wind turbine and clicked it. The selection became green and the tester understood it had made the button active. They also understood there was nothing else to do in that window, but where at a bit of a loss as to what to do next. After the test attendant suggested that in the actual program there would have been a transparent wind turbine attached to their mouse, they understood they had to do something inside the landscape and clicked there, placing the wind turbine.

The idea of the selected object attached to the mouse was suggested to both testers, and each found merit in the idea, although both thought differently about how the preview should look. One tester believed that the preview should have the same size as the object would have after placement, so the user could see the consequences of placing an item before placing it, like how furniture is placed in The Sims, see paragraph 3.4.1. This should help in making the decision as to the location of the placement. The other tester argued that the preview should only be used for indicating that an action was now possible with a mouse click inside the landscape, and preferred therefore a small representation of the object attached to the mouse.

Both testers could create and modify custom objects in a timely manner and they could minimise windows with the arrow icons, see figure 6.14. One tester noticed how a selected object was also stated on the minimised window and thought that functionality to be handy. The

other tester mentioned specifically how the preview of an object, when hovering over that object, was welcomed. They also stated that it was good that the preview would disappear after selection, but would like to see the preview return when the mouse would hover over the object name again, even if the object was selected, something the prototype did not do.

8.3.3 *Velden* category

It was difficult for testers to imagine beforehand what the *velden* category would do. The test attendant explained thereupon that this category was for placing multiple objects at once inside a field. One tester mentioned that the term *velden* (English: fields) might not be clear enough, but could nog give a suggestion for a different name.

Velden - group version

Only the top button of the toolbox is clickable when opening the *velden* category. Remembering the limitations of the 2D/3D window at the start of the prototype, both testers were aware that there was not much else to do but click on the first button. Both testers needed guidance to become aware that clicking the first button enabled them to place a marker in the landscape. One tester noted how not realising a marker could be placed in the landscape was a consequence of the nature of the prototype and not of the layout, due to the prototype not being able to show an interactive landscape. They believed that they could have placed the marker without help if they would work in a real program, especially if the preview functionality for the mouse, mentioned in paragraph 6.2.3, was also implemented.

Most buttons became only active after sufficient actions were performed in the window of the button before. However, in the prototype the next button became only active after making the current button inactive. So, there was no immediate feedback on the action of testers regarding the possibility to continue to the next button. This confused both testers, and the test attendant had to indicate when it was possible to continue to the next button.

Both testers wondered beforehand what the 'G' on one of the buttons would stand for, but, after opening the accompanying window, understood easily that it stood for *groepen* (English: groups). Although both testers did not understand clearly where these groups were for, there was nothing else to do in the window than to make a new group, so they did. The next button, the object button, was also not understood immediately, but here there was also not much else to do than to select a new object. After making a group and selecting an object, both testers could reason out what they had just done, namely creating a group and placing an object inside that group. One tester mentioned that it was helpful to have the name of the group next to the group button, so it was easier to connect the object to the group.

The placement window was understood after it was explained that each purple square, see figure 8.3, represented a location of an object. The check mark button placed all the chosen objects inside the field, see figure 7.3, which provided a better insight for the testers into what they had just achieved.

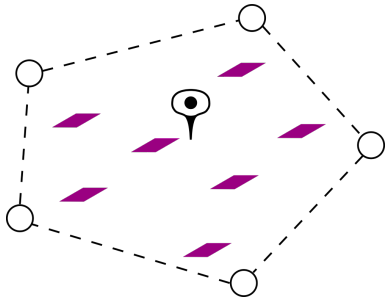

Figure 8.3: Purple squares in a field in the prototype.

When the testers started inside the *velden* category, it was not yet clear what it was they were working towards. However, since there were limited choices to follow, the testers could attain the goal of the *velden* category; placing multiple objects inside a field. After going through the steps, they understood better the logic and functions behind each button. It is important that users will feel like this, because reaching the point where a user has placed objects, means that all buttons remain active and limitations are lifted, making it necessary that a user can go through the functions without further guidance. (Note: if a user nullifies necessary conditions for placement, like removing all groups or not selecting an object, then corresponding limitations will still occur.)

Velden - group and ecosystem version

After placing the objects, testers went to an alternative version of the *velden* category which gave testers also the possibility to work with ecosystems. Testers understood quickly that pressing the 'G' icon on the radio button in the side menu, see figure 6.17, lead to the same buttons they had seen before and that the buttons shown by pressing the 'E' icon on the radio button were new.

The 'E' from the 'E' button was quickly understood to stand for *ecosystemen*. There was only one action to perform, namely creating an ecosystem, which testers did without difficulty. Testers could then also create a group, which the test attendant asked them to do and testers did so without difficulty. The test attendant then asked to add an object to that group, and to create a new group and add two objects to that group. It took testers a bit longer to figure out how to create a new object, but creating a second and third object was thereafter done quickly.

The distribution window, located under the *verdeling* (English: distribution) button, is an important aspect of the ecosystem function and should therefore be easily understood by users. Testers were not able to figure out entirely how the distribution window worked without guidance of the test attendant. However, they could also not give a suggestion as to how the window could become clearer.

The remaining three toolbox buttons were easily understood and used, especially after experiencing the placement of the objects in the other version of the *velden* category.

8.3.4 *Eigenschappen* category

The functionality of most buttons could be guessed by their icons and otherwise they were quickly understood when opening the windows. The *eigenschappen* category was found easy to use and logical. Testers showed no trouble going through the different windows and explaining correctly what it was they believed the window would allow them to do. One tester, however, remarked that *luchtkoepel* (English: skydome) should be renamed *atmosfeer* (English: atmosphere).

8.3.5 Remarks and overall reception

The font size was found a bit too small to read comfortably. It also took a bit of time before testers understood that a button could be made

inactive by clicking the button again, but this was not seen by testers as a bad aspect.

Overall, the testers were satisfied. The prototype was found intuitive and easier to use than the current program. The guidance of providing only access to buttons where the user could do something, was welcomed. Both testers stated that they would like to see the prototype implemented as a real program for them to use. One tester also noted that this prototype made it possible to place wind turbines without trouble in the landscape, something they saw as an important function of the program, and something that is difficult to do with the current program.

8.4 Test - experienced users

The interface concept is focused around the input of users that are not employees of ROM3D and have therefore not experienced the growth of the program or the initial logic it was built with. However, it is important to determine if experienced users can still work with an interface centred on the needs of new users. Also, letting experienced users test the prototype might reveal forgotten functionality or misunderstood purposes. Three experienced users tested the prototype.

8.4.1 Suggestions and remarks

Map and address

In the map window, accessed by clicking on the map button, a large map and a search area for addresses is displayed, see figure 6.5. It is also possible to display a miniature map in the top right corner of the screen, which will remain there after closing the map window. The possibility to display a miniature map in the screen was welcomed. However, a tester remarked how they also saw merit in a smaller window for the search function that could stay on the screen while working with the program. They stated that they were used to working with such a function to travel quickly to different places when showing the landscape in workshops or meetings.

Saving

A tester noticed how the save window did not indicate which tab was used for saving. Some form of aesthetic distinction should be applied. An idea to indicate beneath the save button which tab and scenario are used for saving, was welcomed by all testers. One tester suggested to also make the text clickable, which would result in saving any changes made. This would remove the necessity to open the save window each time a user would like to save their changes.

Ecosystems marker

One tester noticed that something essential had been forgotten in the concept, namely the link between a marker and an ecosystem. A marker is assigned to a field and in this field, objects belonging to a specific

ecosystem can be placed. However, the current concept is not able to assign an ecosystem to a marker. So, if a user would select multiple markers and give the command to place ecosystem in their fields, the software does not know which ecosystem to plant in which field.

Missing functions

Three missing functions were recognised by testers: (i) no access to spherical panorama photos (Dutch: *bolfoto's*), (ii) toggling transmission towers on and off in the landscape and (iii) a field of view adjustment option.

8.4.2 Overall impression

The overall reception could be described as hesitant enthusiasm. Experienced users understand the need to make their program friendlier and more accessible to new users, however, that means changing their current workflow and adapting to a new interface. This requires some getting used to, but testers say they are willing to adapt to the current concept, based on what they have seen from the prototype. They see the prototype as a clear improvement over the current interface.

8.5 Adjusting the prototype

Based on received feedback and perceived behaviour, three changes were made to the prototype: (i) loading in tiles would give access to all other functionality, making it no longer necessary to first designate a saving location, (ii) the next button(s) from the toolbox become immediately active after the tester has fulfilled all requirements, solving the problem discussed in paragraph 8.3.3 and (iii) it is now possible to click on the main menu buttons after closing a category. Before, it was not possible to regain access to the top menu buttons once a category had been opened. However, testers sometimes wanted to return, which was not possible and which seemed to confuse testers. Therefore, testers can now access all buttons on the screen at any time.

8.6 Second test - new user

A second and final test was held with the revised prototype and one new user. Any comments or behaviour that differ significantly from the first two tests, detailed in paragraph 8.3, will be noted in this paragraph. Other observations will be briefly summarised.

8.6.1 Starting and top button menu

The tester understood that there was not much else to do but go to the 2D/3D window, when examining the first image of the prototype. After unlocking the remaining main menu buttons, the tester could guess correctly their functions before opening their windows, except for the calculating window. The window layout and corresponding functions were found clear.

8.6.2 Three categories

The *objecten* and *eigenschappen* categories were easily understood by the tester. The *velden* category was fully understood after the last action (i.e. placing the objects in the field) was performed and the tester could repeat correctly what it was they had done.

The tester approved the suggestions to add a help window with key layout and to attach a preview of an object to the mouse if an object can be placed. However, they did miss an 'X' icon in the corner for closing windows and menus. They understood that a window could be closed by pressing the button again that made them active, but they still preferred a recognisable 'X' icon.

8.6.3 Overall reception

The tester was convinced that they could reproduce all actions a second time without any guidance. They found the prototype to be intuitive with a low learning curve. They also noticed that the prototype seemed usable for users moving the cursor around with a graphic tablet instead of a mouse, something the tester found important due to them finding it painful for their wrists to work with a mouse.

8.7 Changes

8.7.1 Saving

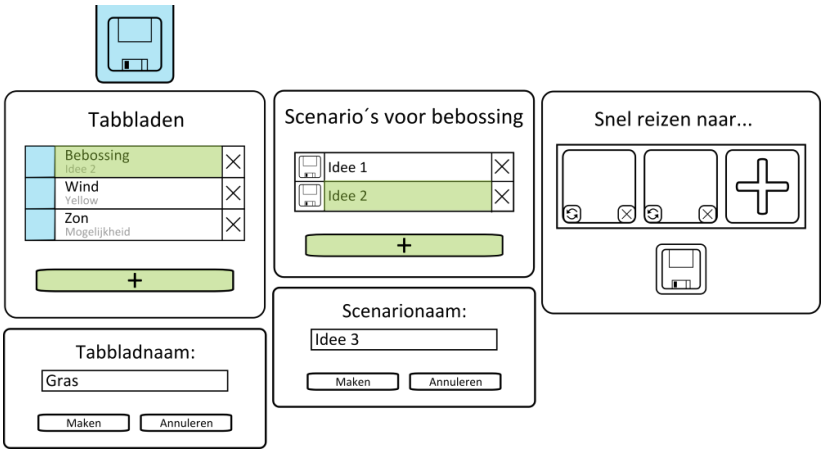

Figure 8.4: Altered save window.

Testers found the saving window difficult to use due to the location of the name entry fields, see paragraph 8.3. The save window has been changed by providing a seperate window for creating a tab and scenario, see figure 8.4. The '*scenario's* title has also been altered to '*scenario's voor* [tab name]', to indicate that scenario's belong to a specific tab. Another change to the saving aspect is the addition of the name of the tab and the chosen scenario under the main menu save button, see figure 8.5, as suggested by an experienced user tester, see paragraph 8.4.1. The text can also be clicked for quick saving progress.

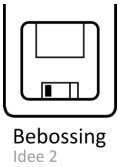

Figure 8.5: Altered save button.

8.7.2 Additions to the help window

Another suggestion received during the experienced user tests was to guide new users who want to do something specific, like building a wind turbine. A new section is added to the help window based on this suggestion, see figure 8.6. The lower part consists of an 'I would like to...' phrase combined with multiple suggestions. Clicking on such a suggestion brings the user to the part of the program that would enable the user to perform such an action. So if a user clicks on the suggestion to build a wind turbine, then the *objecten* category is opened and the wind turbine button is selected which opens the wind turbine object list where the user can select a wind turbine from.

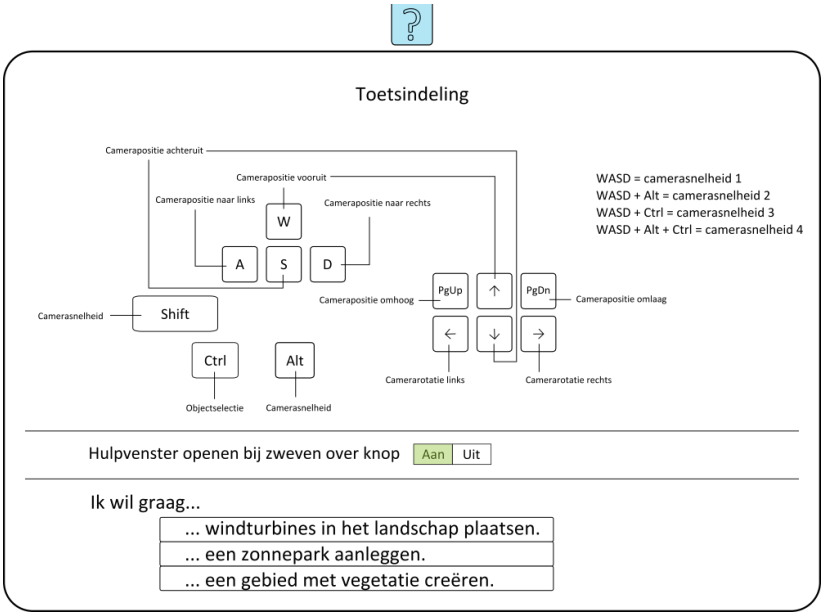

Figure 8.6: Altered help window.

Another addition to the help window is the possibility to toggle on or off a help pop-up window. This window will appear when hovering over a button for a pre-determined amount of seconds, and provides an explanation of the functionality of the button.

8.7.3 Two additional *eigenschappen* toolbox buttons

A few small functions were not included in the main concept design, as indicated by an experienced user tester, see paragraph 8.4.1. A few other small functions were also found missing. The field of view function was included in the settings window. Two new buttons were added to the *eigenschappen* toolbox to include the missing functions: (i) a marker button and (ii) a ground button. The marker button toggles all three different markers in the landscape on and off seperately, see figure 8.7, and the ground button can toggle on and off topographical names and electricity pylons, and can change the height of the ground surrounding the 3D landscape tiles, see figure 8.8.

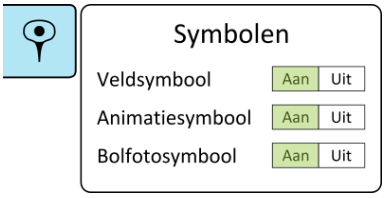

Figure 8.7: Added marker window.

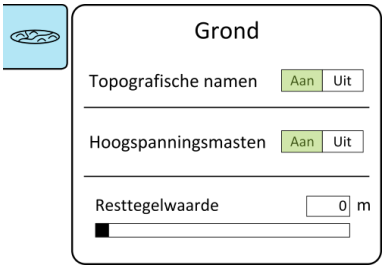

Figure 8.8: Added ground window.

8.7.4 Other

A miniature address search window was requested by and experienced user tester, see paragraph 8.4.1, and added to the design, see figure 8.9.

Figure 8.9: Added miniature search address window.

The missing possibility to link an ecosystem to a marker, as discussed in paragraph 8.4.1, is solved by placing a button in the object menu when selecting a marker, which leads to a window where the marker can be linked to an ecosystem, see figure 8.10. Furthermore, the overview button icon of a calculator is replaced by a rising arrow, see figure 8.2, as suggested in paragraph 8.3.1. The skydome window is renamed *atmosfeer*, as suggested in paragraph 8.3.4. Lastly, changes have been made to the division window to enhance understanding, see figure 8.11. Filled in group percentages are now repeated above the object sections to make users understand the connection between the group and object percentages.

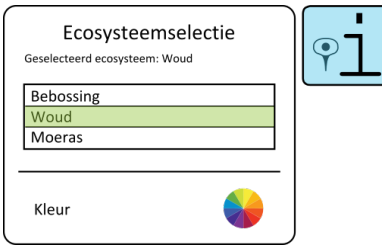

Figure 8.10: Marker information window.

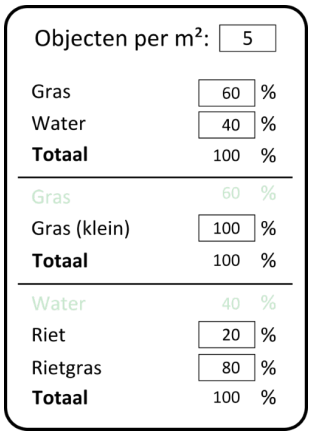

Figure 8.11: Altered division window.

Chapter 9

Conclusion

This chapter provides an evaluation of new users regarding the testing procedure and of experienced users given during an evaluation session. Furthermore, a conclusion to the thesis, a recommendation for future work and acknowledgements are given.

9.1 Evaluation

The evaluation is divided between new users, were the test sessions concluded with an evaluation, and experienced users, with whom a special evaluation session was held.

9.1.1 Testing

All issues found during testing were relatively small and quite easily solvable. No large issues were found or dissatisfaction expressed. Testers indicated that they would like to see the concept worked out as a real GUI, stating that they believed it would be a large improvement over the current GUI. Testers also believed that the concept would make it possible for them to work with the program on their own without receiving external help, which leads to the conclusion that the two problematic main reactions on the current GUI, discussed in paragraph 4.1.1, do not appear with the main concept design. Furthermore, testers could complete their tasks without much effort, which meets the requirements of a good interface, namely being effective and efficient. Testers also indicated to be satisfied with the concept.

9.1.2 Employees

A final concept design is created with the changes included that emerged from the testing procedures, as detailed in paragraph 8.7. The final concept design can be examined in appendix G and by visiting the following link:

https://slxh.eu/~terez/win3d/finaldesign.svg

The final concept design was send to the provider of this thesis, the owner of the company, and to the employees of the company to evaluate, together with a text document which explains and describes shortly

each aspect of the concept, see appendix F. An evaluation session was held a few days later with the owner and all employees of the company.

During the evaluation session, employees stated that they themselves had not anticipated that the conversion of the GUI would be such a complex and elaborate task. There are many aspects to consider when turning a GUI over, and smaller functions are easily forgotten to implement. Employees admired therefore the completeness of the concept design. They also appreciated the rigorous approach with which each phase was carried out.

They noticed how letting a person not belonging to the company do the interviews, led to more elaborate and honest responses, which gave some valuable insights. They also expressed their contentment with the results of the testing phase, concluding that new users seemed happy with the concept design.

Employees themselves also rated the concept design as good, seeing the concept as a good connection to the next step. They stated how the concept design resolved all large annoyances that came with the current interface, and that the concept design is a quality product where they can continue their work with.

9.2 Conclusion

This thesis focused on how to build a GUI concept based on an already existing GUI of a geo-based 3D planning software. The end product of this thesis is a final concept design that can be used as a blueprint for the next GUI implementation of the software.

Many steps were taken before creating the end product. The process started with understanding how the current interface worked and what its functionalities and problems were. The current interface was mapped in its entirety and remarks were listed. Mapping the interface resulted in a list with all functionalities of the current interface, which had to return in the GUI concept.

GUI concepts were co-created with users, which led to a main concept design. This design was used for creating a prototype so the concept could be tested. Tests were performed with both new and experienced users. The tests pointed out some small issues, but overall both groups agreed that the concept is a large improvement over the current interface. New users believed that they could perform their tasks without help if the concept would be implemented. Employees have stated that it is their plan to turn the concept into a working GUI.

9.3 Recommendation for future work

The concept is a blueprint for the actual GUI. The concept advises on the order and placement of buttons and menus, provides texts, gives suggestions for what kind of icons to use, etc. However, the aesthetic part of the GUI still needs to be determined. Currently the company is redefining itself and its products by looking for a new corporate identity. The colours and style belonging to this identity should be recognisable in their products. Their corporate identity should determine if their windows will be rounded or sharp-edged, if their lines are thick or

thin, if icons are coloured in or are black and white, etc. Another bachelor research project might be suited to explore the aesthetic issues of a geo-based 3D planning software in-depth.

9.4 Acknowledgement

Six people of different municipalities have been so kind to lend me their time, their suggestions and their ideas. The creation of the concept designs is largely based on co-creation with users. Without the willingness of these people to make time free in their busy schedules, (some interviews and tests took over two hours to conclude), it would not have been possible to fulfill this bachelor project.

A thank you is also in place for the employees of ROM3D, who gave me a place in their office and who answered all my questions. Their willingness to indulge my questions and observations was essential for gaining a thorough understanding of the current interface. Without such an understanding, it would not have been possible to create such an extensive concept.

I would also like to thank Dr. M.I.A. Stoelinga for realising the small chance to meet the person providing this bachelor project while on holiday. It has given me the possibility to work on a great bachelor project that otherwise would not have been there. I would also like to thank her for giving me more space and time when I needed it. This enabled me to finish this bachelor thesis as I envisioned it.

Special thanks goes to Dr. J. Zwiers, who provided advice on short notice when it was difficult to maintain an overview of what still needed to be done. Without this advise, the last few weeks would not have been spent as efficiently.

Chapter 10

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Appendix A

Word list

aankleding - stage setting
afstand - distant
algemeen - general
animatie - animation
animatiepad - animation path
atmosfeer - atmosphere
atmosferische effecten - atmospheric effects
basis - basic
basisvormen - basic shapes
biovergisting - anaerobic digestion
bomen - trees
datalaagmanager - data layer manager
distributie - distribution
eigenschappen - attributes
gras (klein) - grass (small)
groepen - groups
groepenmanager - group manager
handmatig - manually
helmgras - european marram grass
instellingen - settings
kwaliteit - quality
kwastvarianten - brush variants
landschapssettings - landscape settings
landschapstools - landscape tools
langs de lijn - along the line
loofbomen - broad-leaved trees
luchtkoepel - skydome
materialenvenster - materials window

naaldbomen - coniferous trees
navigatiepaneel - navigation panel
nieuwe groep - new group
onderbegroeiing - undergrowth
onkruid - weeds
opties - options
overige - remainder
plattegrond - map
resoluties - resolutions
riet - reed
rijen - rows
saneringsvenster - remediation window
scenario-evaluatie - scenario evaluation
snelmenu - quick menu
tabblad - tab
tegelvenster - tile window
tekenen - drawing
terreineditor - terrain editor
vast aantal - fixed number
vegetatie - vegeatation
vensters - windows
verdeling - distribution
waterreflectie - water reflection
windkaart - wind map
windmolenconfigurator - wind turbine configurator
windmolenverlichting - wind turbine illumination
windturbines - wind turbines
zonnepanelen - solar panels
zonnepanelenconfigurator - solar panel configurator
zonnestudio - solar studio

Appendix B

Mapping documents

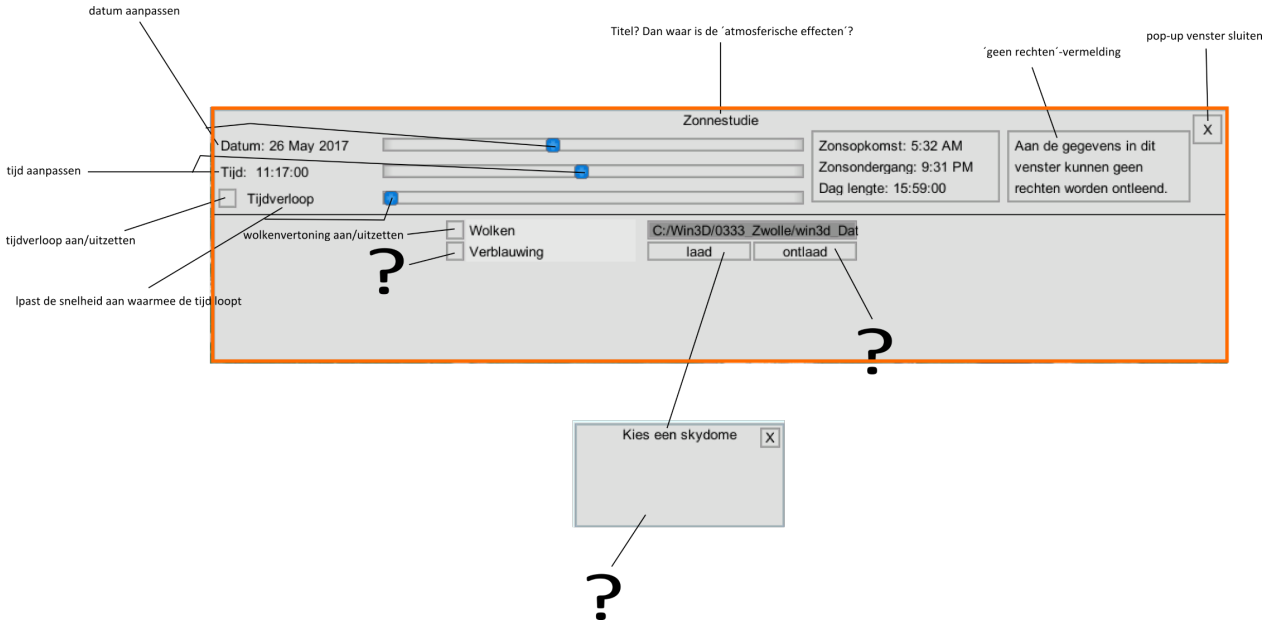


Figure B.1: *Atmosferische effecten* module

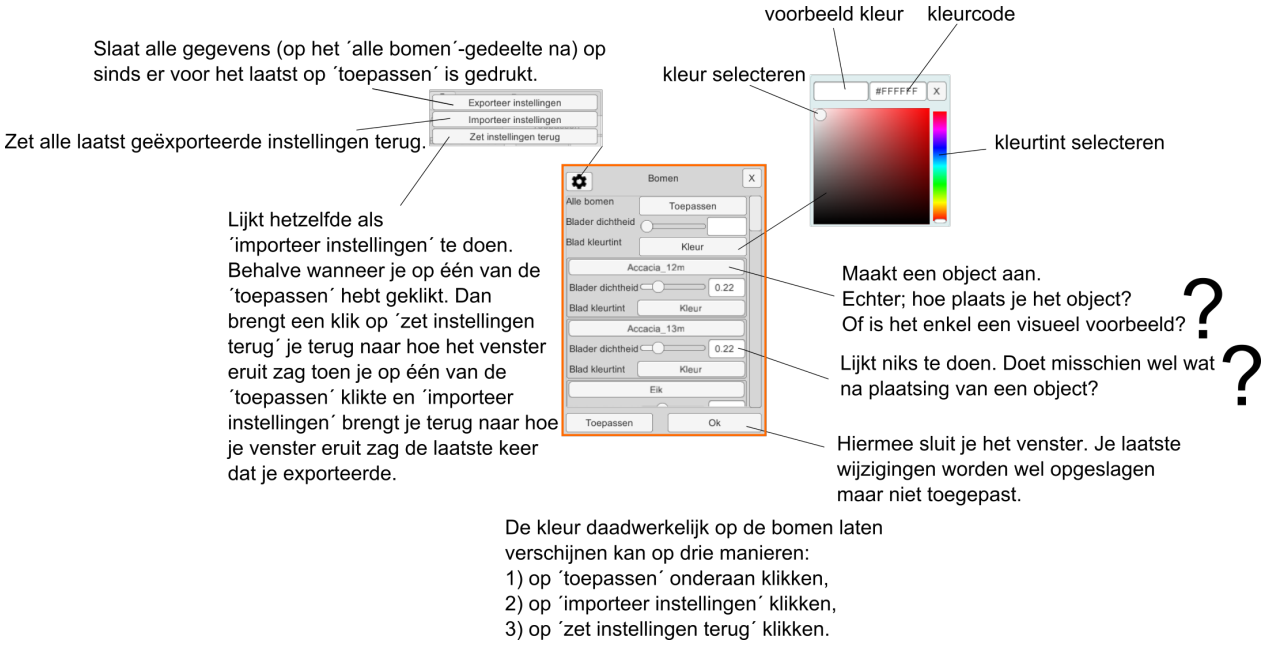


Figure B.2: *Bomen* module

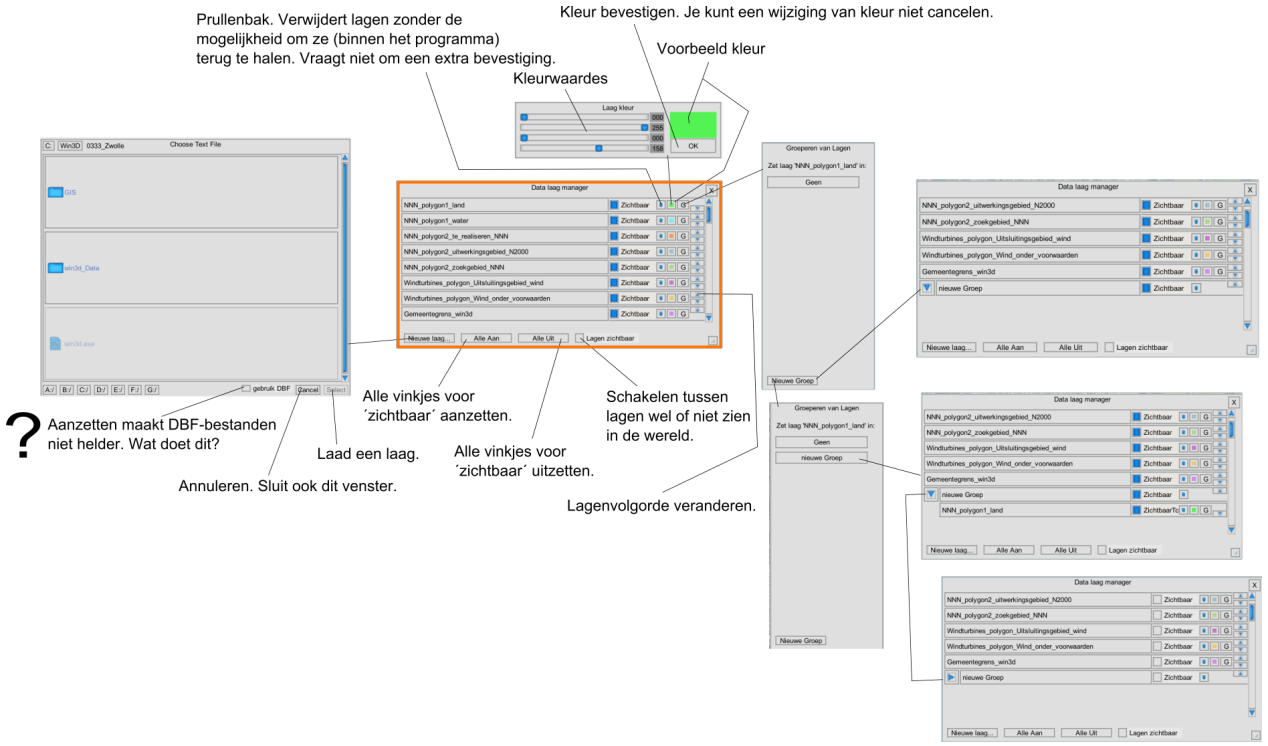


Figure B.3: *Datalaagmanager* module

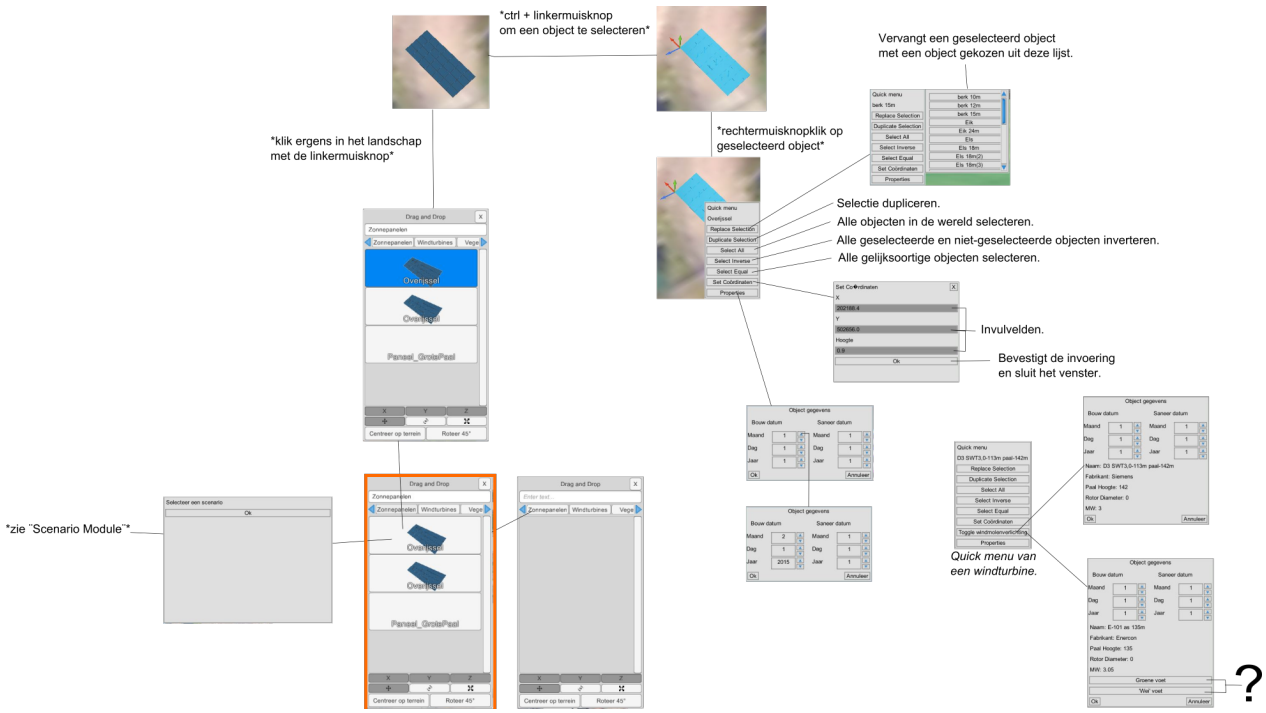


Figure B.4: Drag and drop module

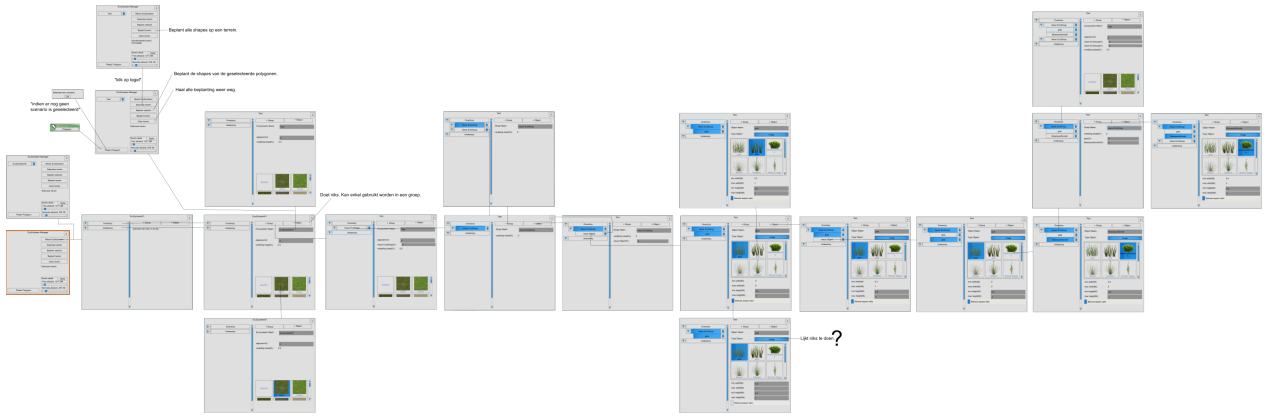


Figure B.5: *Ecosysteem manager* module

Figure B.6: *Geocoding* module

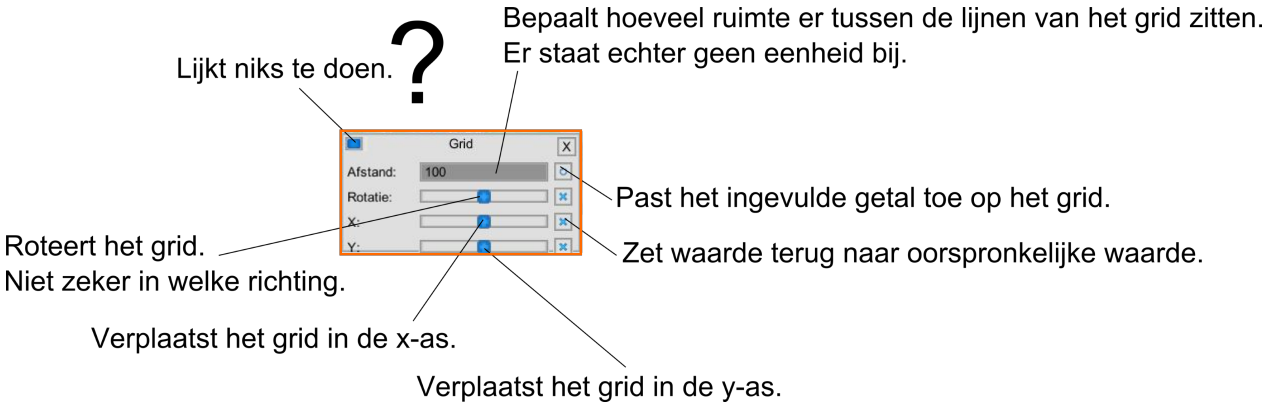


Figure B.7: *Grid* module

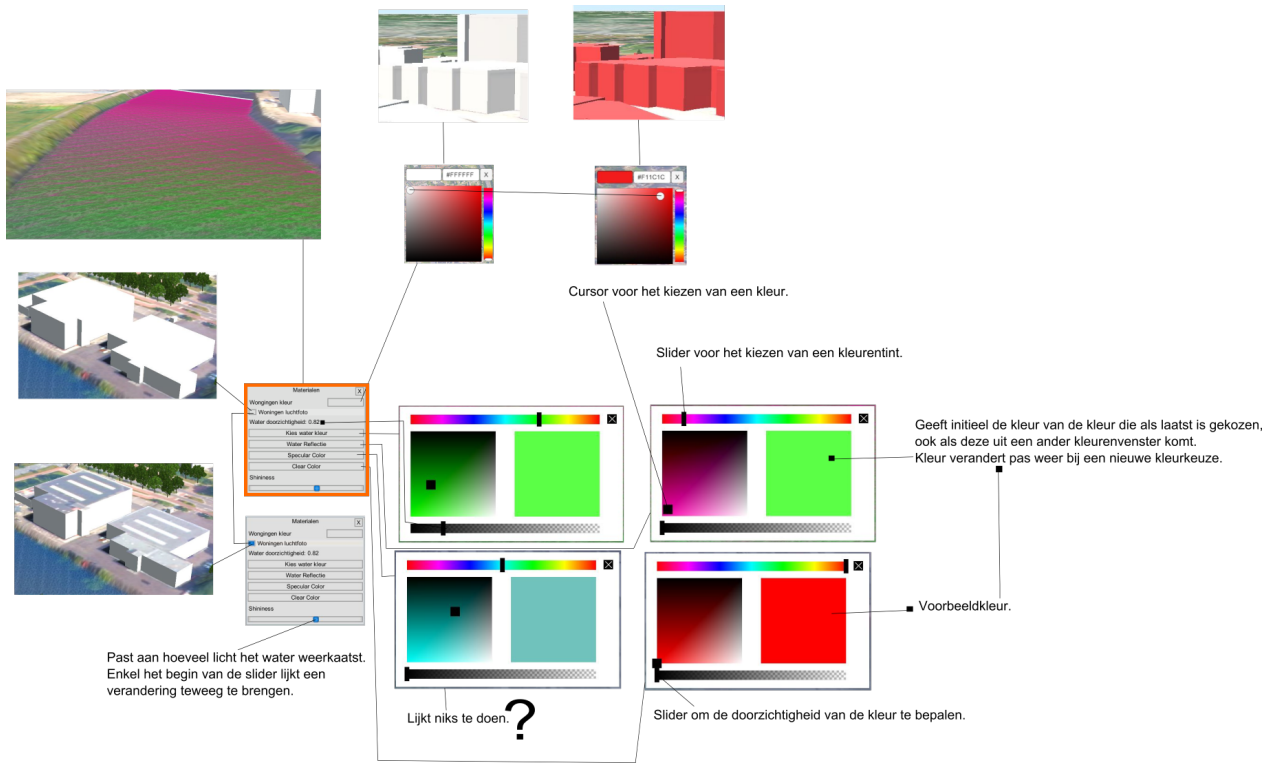


Figure B.8: *Materialenvenster* module

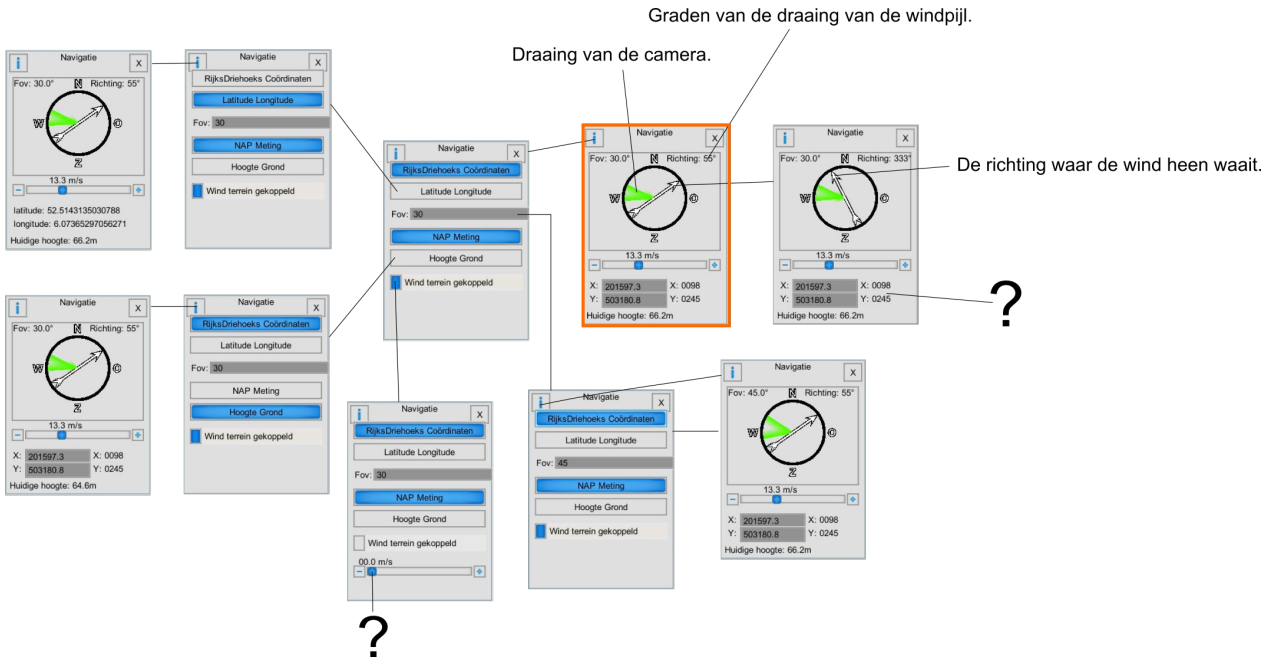


Figure B.9: *Navigatiepanel* module

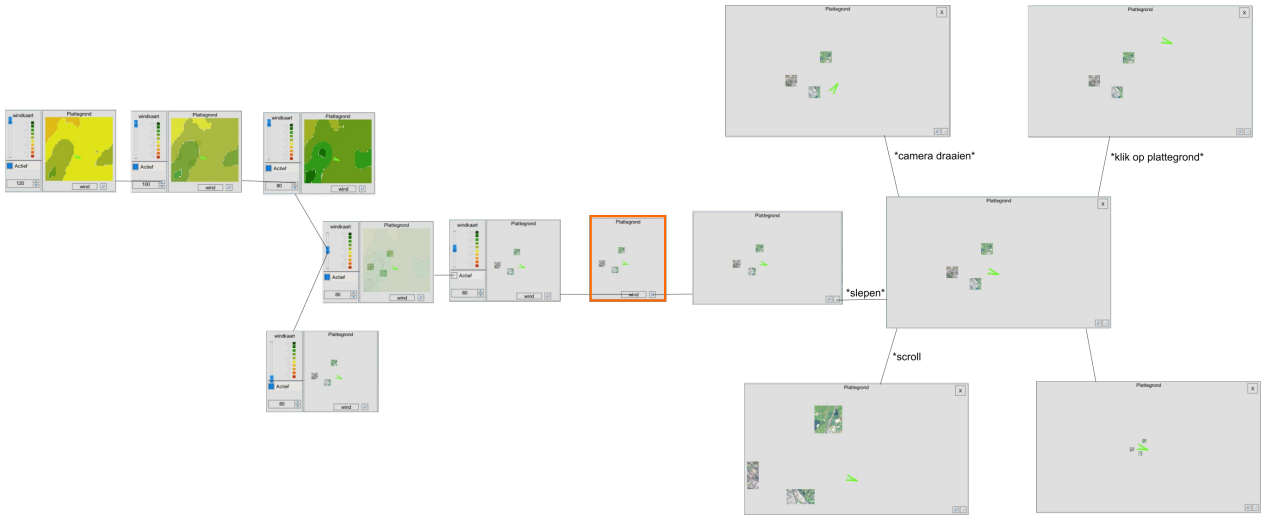


Figure B.10: *Plattegrond* module

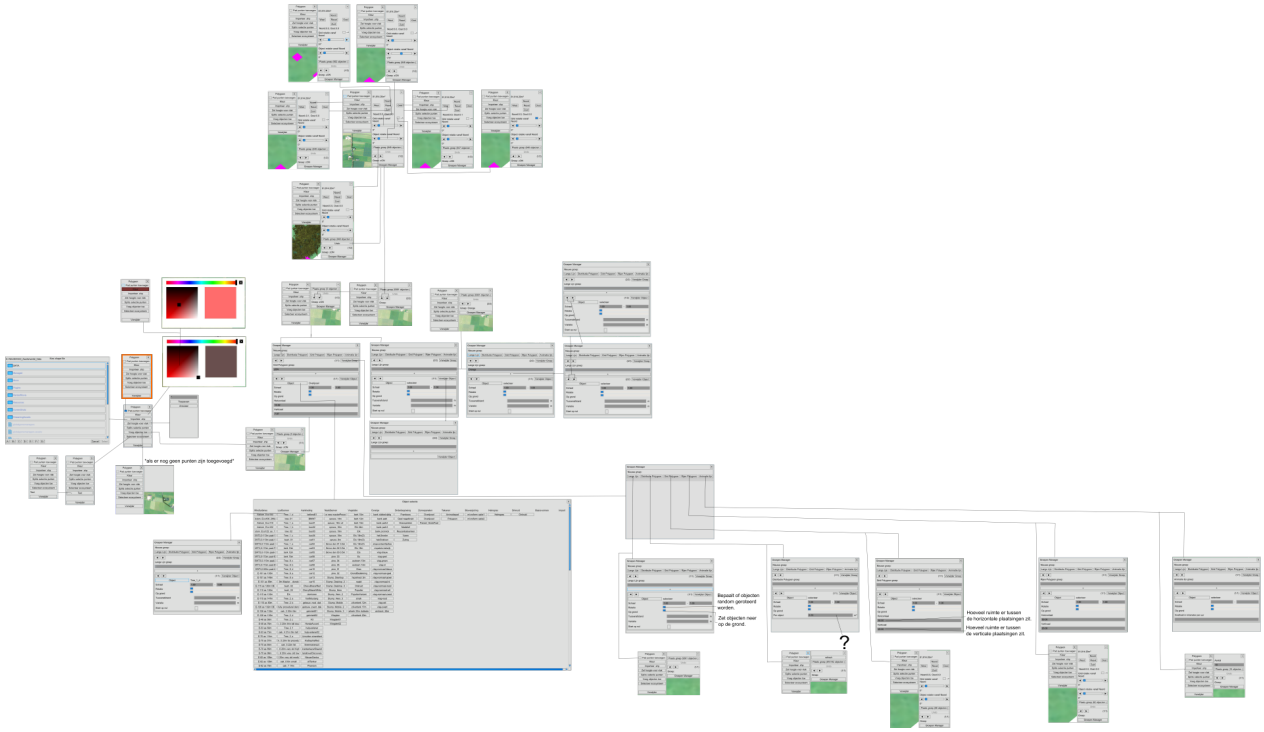


Figure B.11: *Polygoonmenu* module

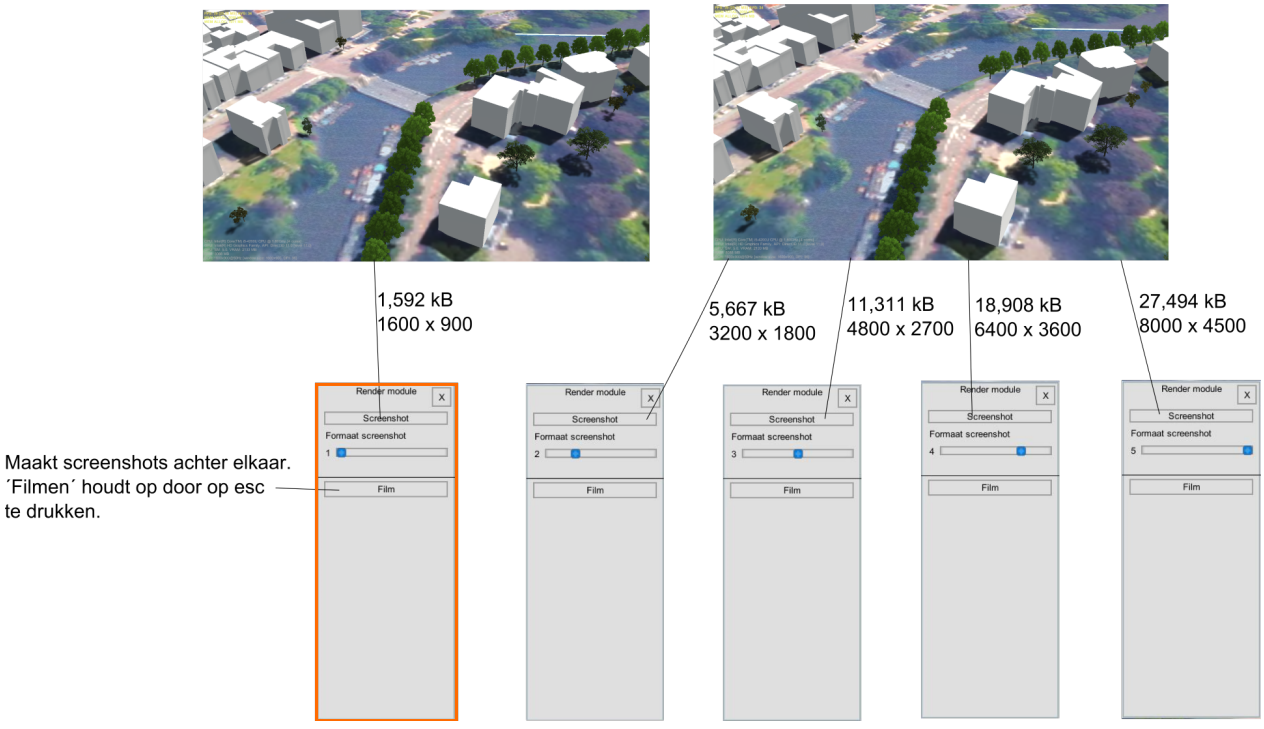


Figure B.12: Render module

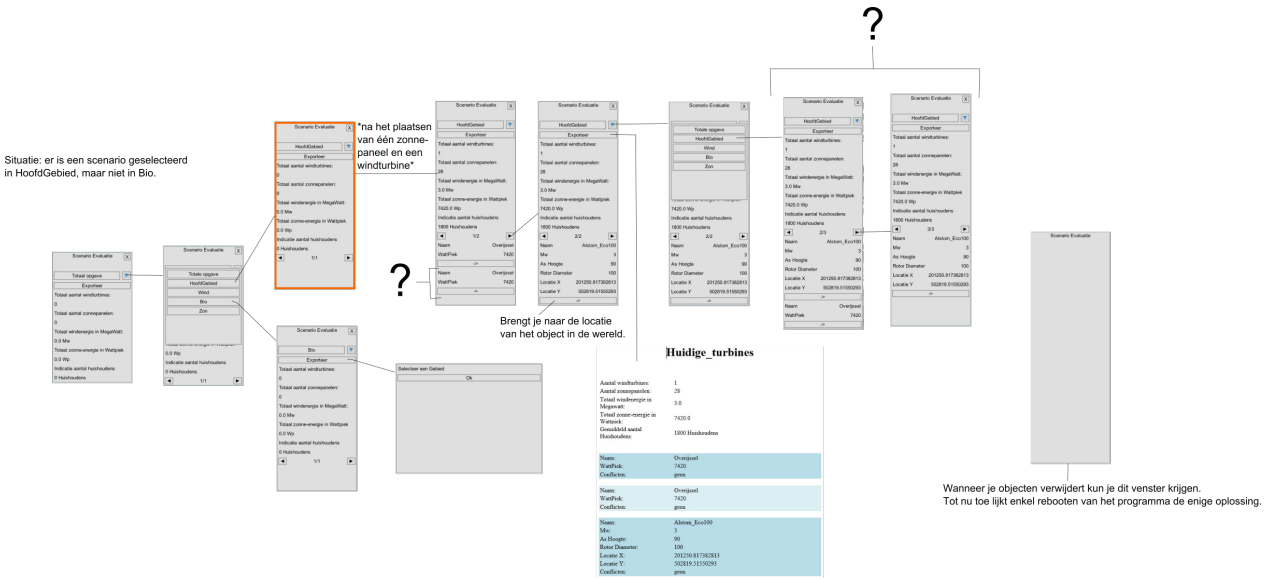


Figure B.13: *Scenario-evaluatie* module

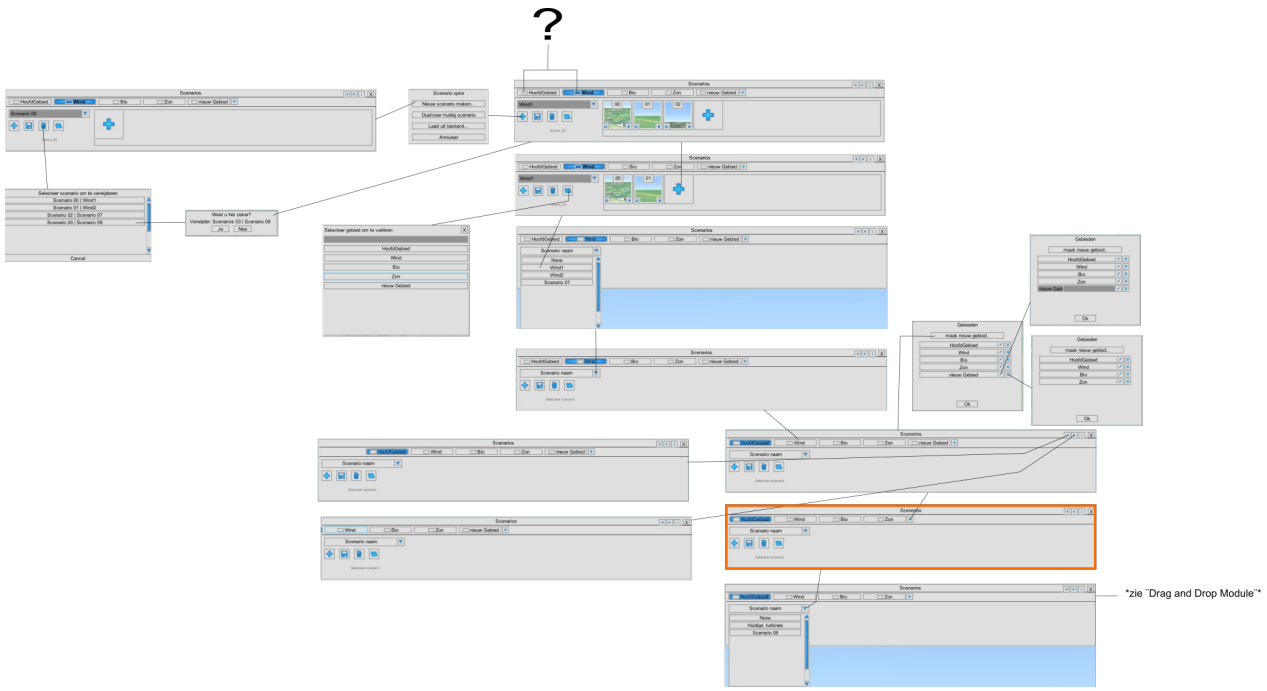


Figure B.14: Scenario module

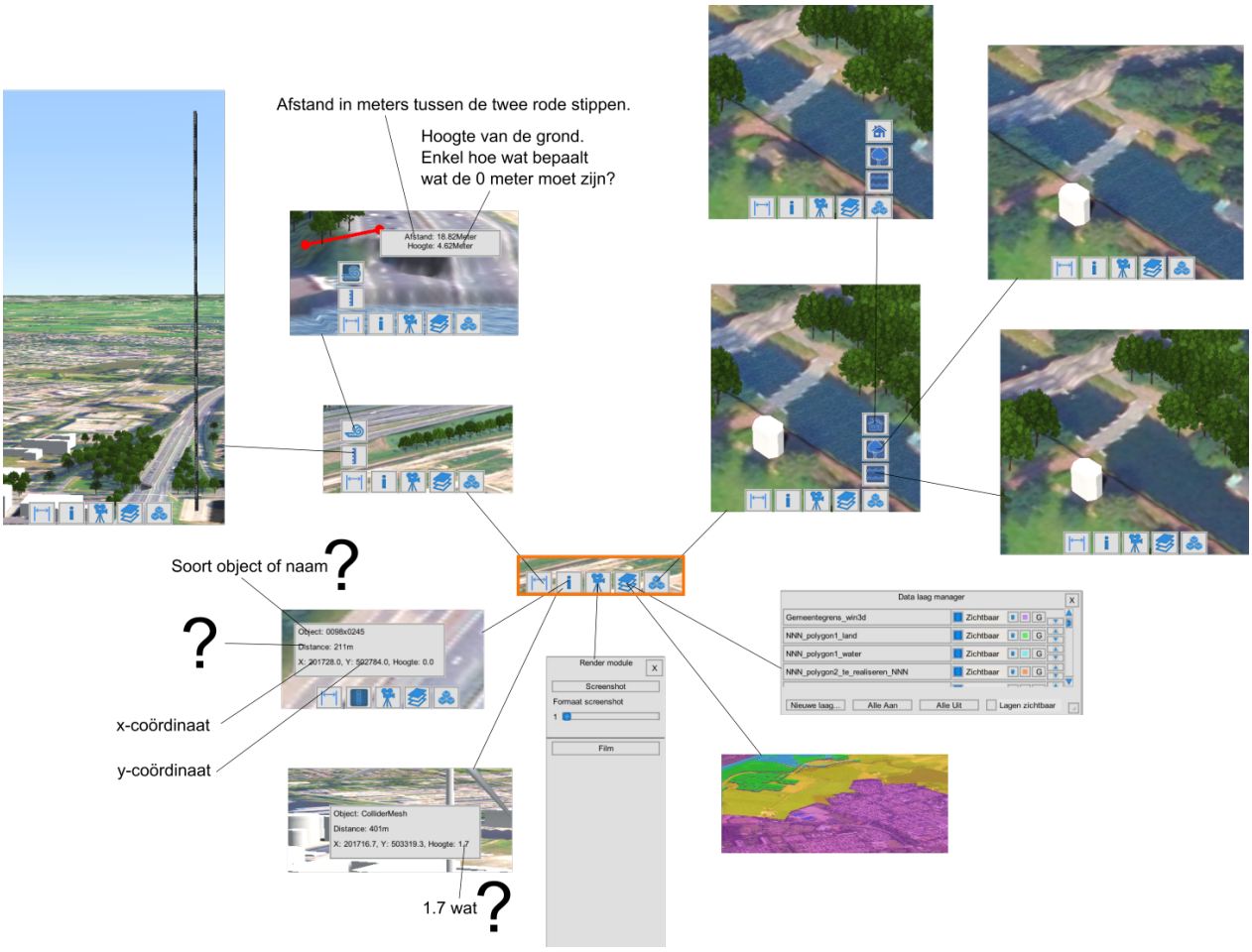


Figure B.15: *Snelmenu* module

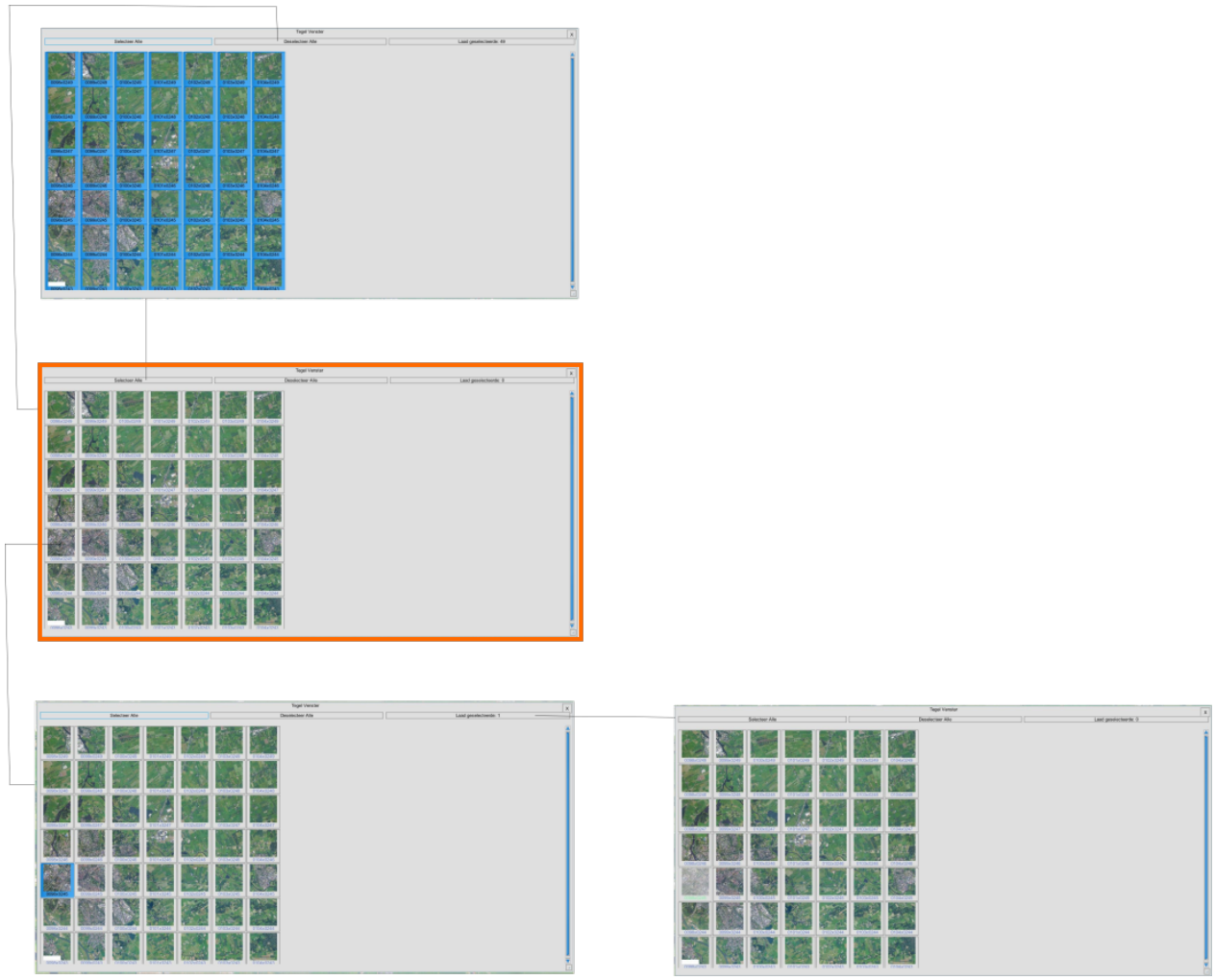


Figure B.16: *Tegelvenster* module

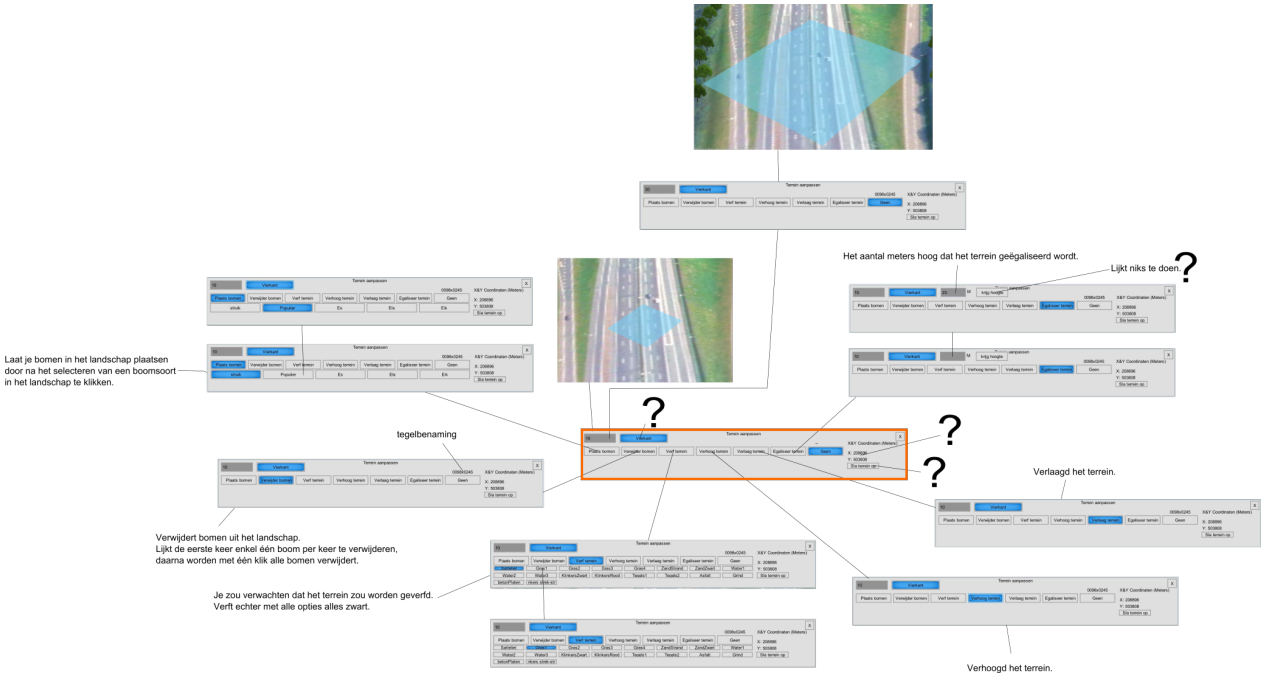


Figure B.17: *Terrein-editor* module

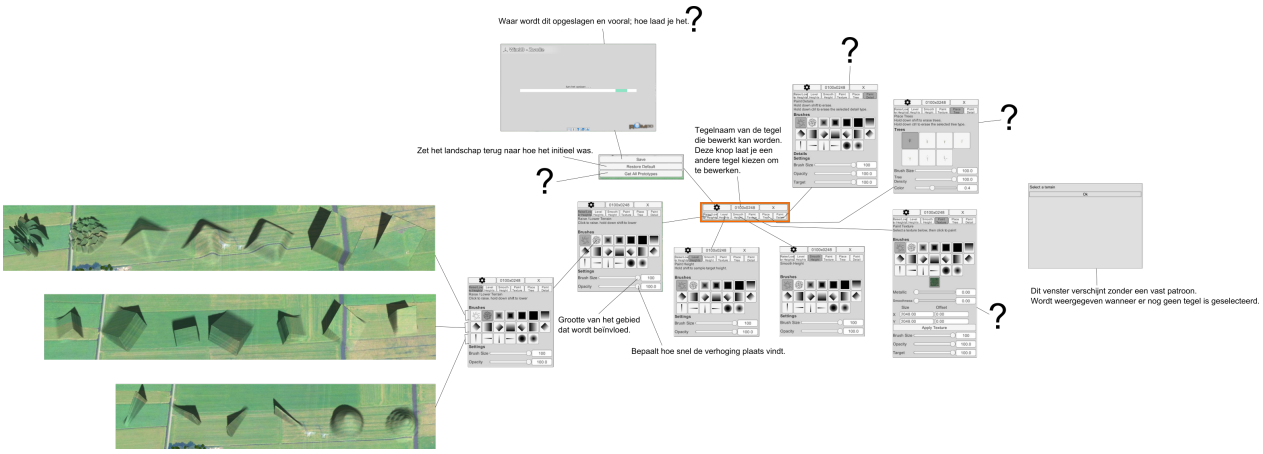


Figure B.18: *Terrein-editor* 2 module

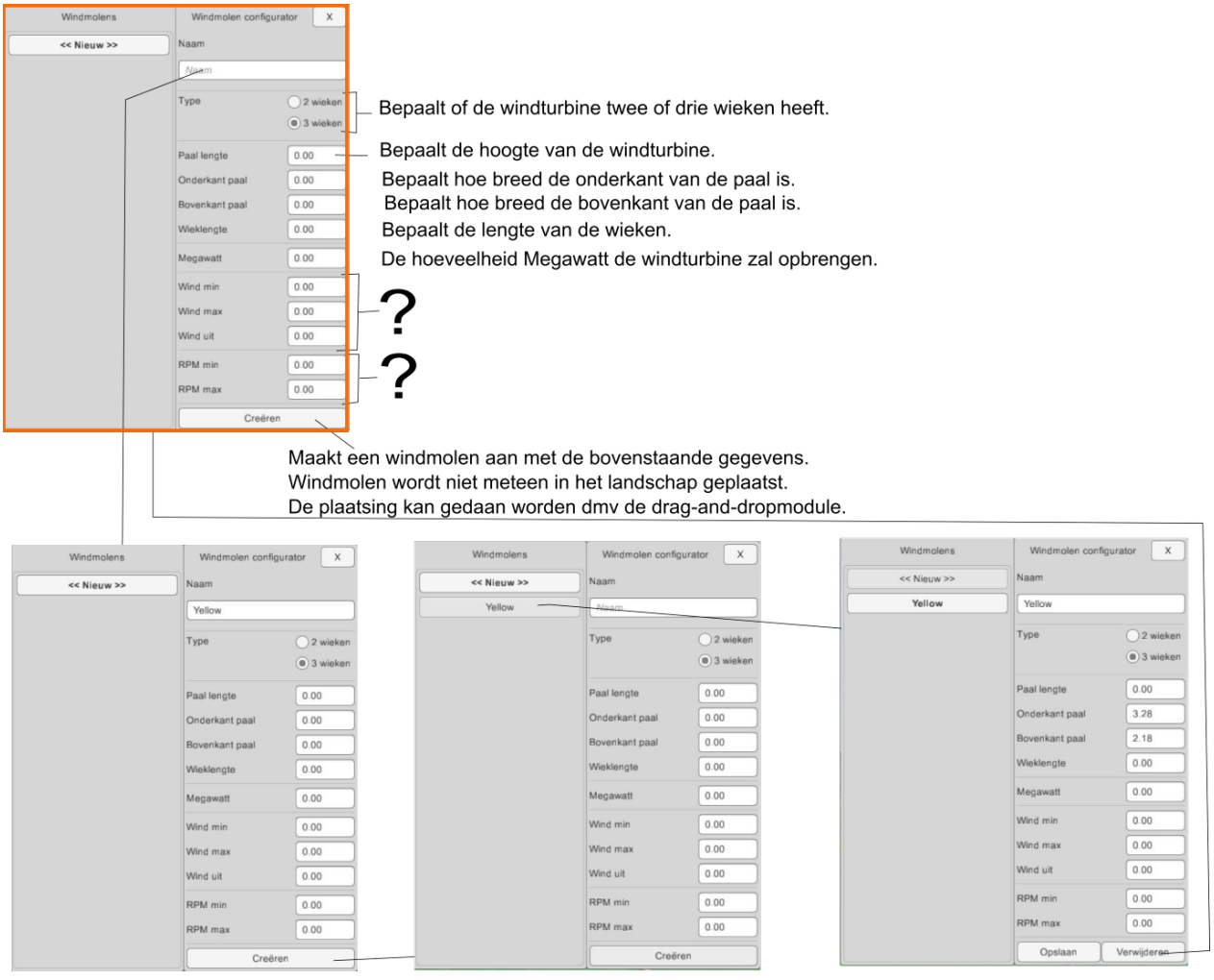


Figure B.19: *Windmolenconfigurator* module

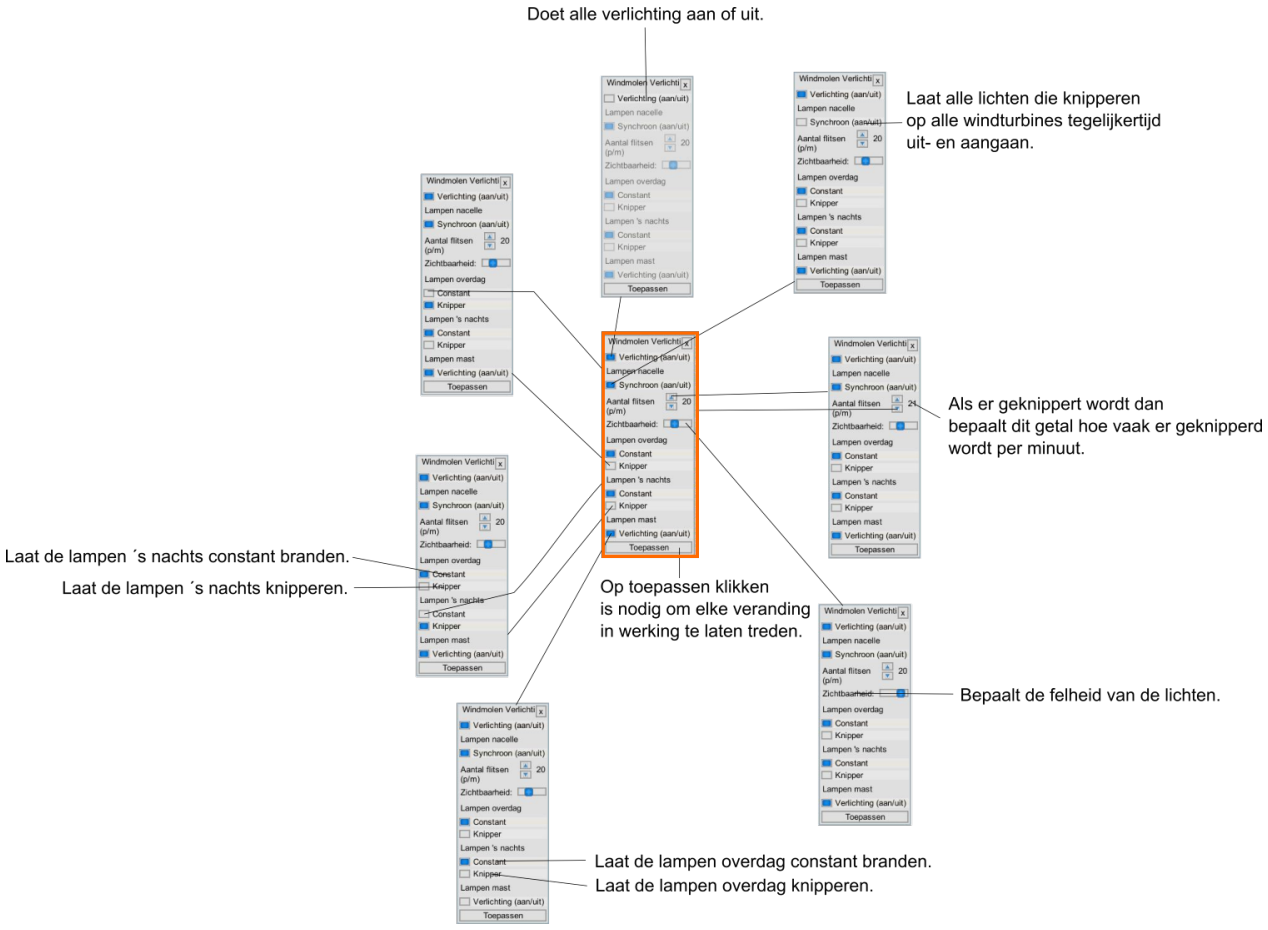


Figure B.20: *Windmolenverlichting* module

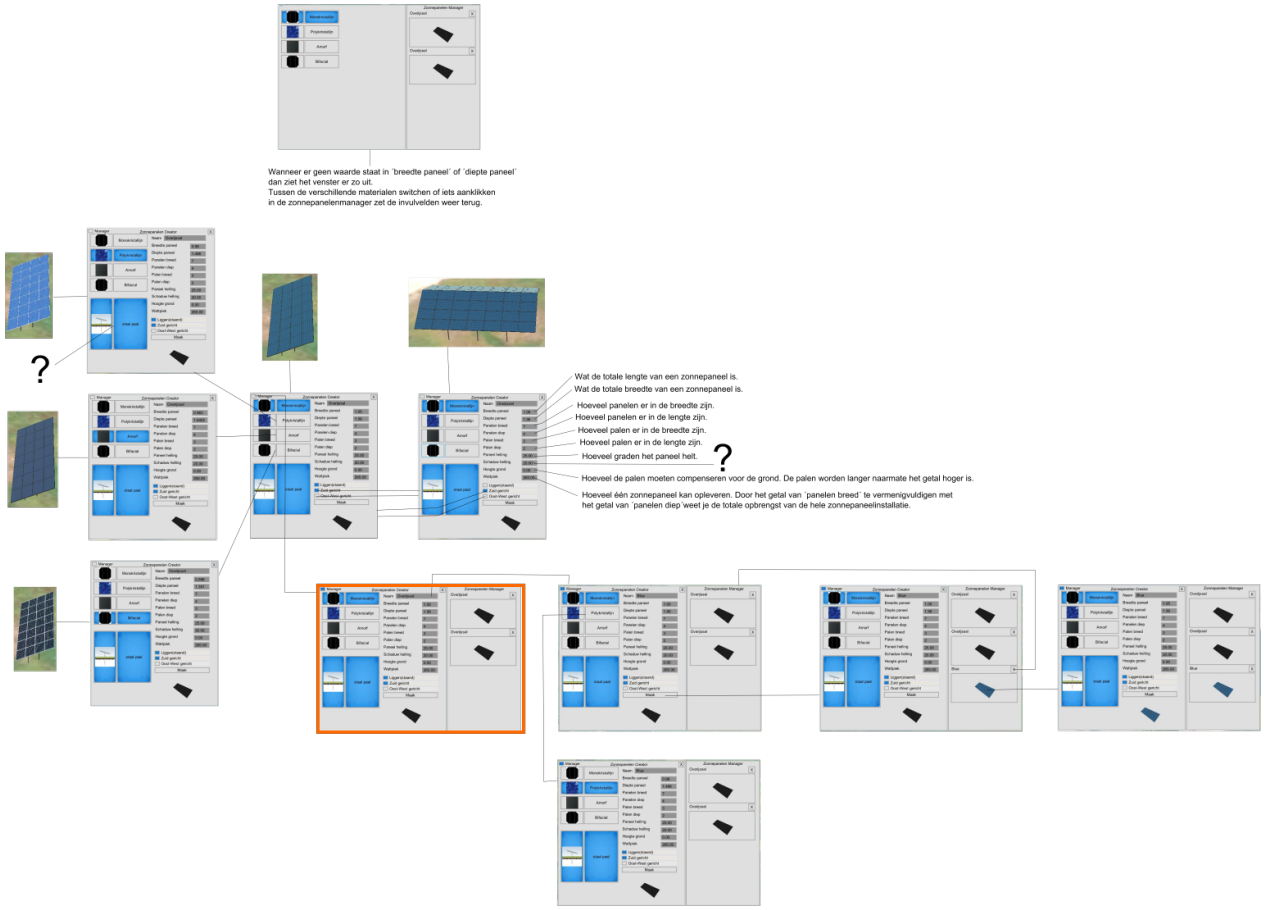


Figure B.21: *Zonnepanelenconfigurator* module

Appendix C

Text document

Knoppen

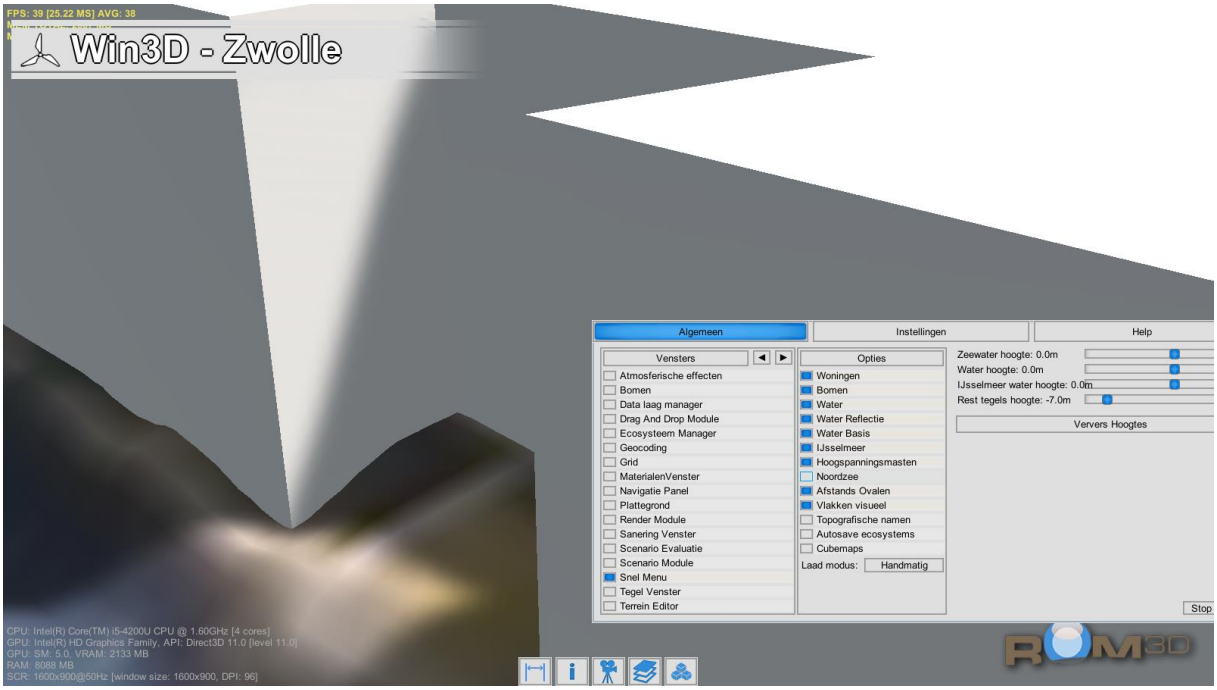
- Tildeknop: gegevens op scherm uitzetten.
- Rechtermuisknop: camera ronddraaien.
- Pijltjestoetsen: camera besturen.
- WASD-toetsen: speler bewegen.
- Ctrl + linkermuisknop: selecteren.
- Z: lichte zwaartekracht aanzetten.
- Alt + linkermuisknop: deselecteren.
- Alt + WASD = sneller 1
- Shift + WASD = sneller 2
- Shift + Alt + WASD = sneller 3

Algemeen

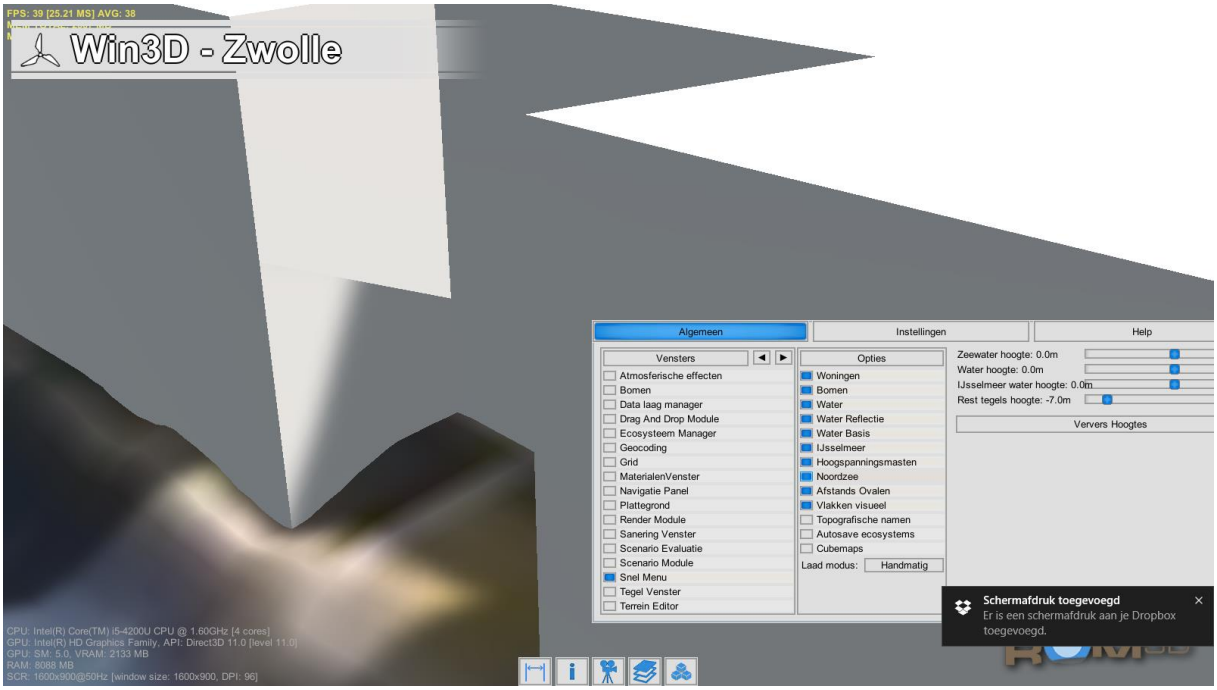
- Wanneer je in een invulvenster met de pijltjes naar links en rechts beweegt, dan beweegt het scherm mee.
- Nieuwe vensters zijn soms wel en soms niet te verslepen.
- Vensters zijn soms qua klikken ‘doorzichtig’. Als in; dan klik je op een venster die over een ander venster heen staat en waarbij knoppen van beide vensters elkaar overlappen. Dan wordt er met een klik op beide knoppen geklikt.
- De cursor gaat niet weg wanneer je op enter hebt gedrukt in een invulveld.
- Ctrl + z voor laatste actie ongedaan maken zou wel fijn zijn geweest.

Hoofdmenu

- Hoofdmenu heeft geen titel.
- Je kunt niet met vensters slepen als het hoofdmenu open is. Correctie: je kunt niks doen met vensters wanneer het hoofdmenu open is.
- Algemeen -> opties: ‘Water’ heeft twee subsecties: (i) Water Reflectie en (ii) Water Basis. Deze twee worden uitgeklapt wanneer ‘Water’ wordt aangezet. Echter worden ze zonder indenting uitgeklapt, waardoor het niet op subsecties lijken. Ook is het onbekend voor een nieuwe gebruiker dat ‘Water’ subsecties heeft omdat er niet iets van een indicatie van een omlaagwijzend pijltje bijstaat.
- Algemeen -> opties: ‘Noordzee’. Waarom verandert de schaduw wanneer ‘Noordzee’ wordt aangezet? Zie figuren beneden.
- Dat je het hoofdmenu ook tevoorschijn kunt halen door op de titelbalk te klikken is niet intuïtief.
- Waterreflectie lijkt niks te doen.
- Laad modus -> tegel laad modus = tegellaadmodus
- Laad afstand = Laadafstand
- Ontlaad afstand = Ontlaadafstand
- Hoofdmenu verschijnt door de letter ‘m’ in te drukken. Dit gebeurd ook als je in een invulvak iets aan het typen bent.
- Doet ‘ververs hoogtes’ iets?



'Noordzee' uit.



'Noordzee' aan.

- Water Reflectie = Waterreflectie
- Water Basis = (hangt ervan af wat er met deze woorden bedoeld wordt.)
- Afstands Ovalen = Afstandsovalen
- Zeewater hoogte = Zeewaterhoogte
- Water hoogte = Waterhoogte
- IJsselmeer water hoogte = IJsselmeer waterhoogte
- Rest tegels hoogte = Resttegelshoogte
- Anti aliasing = Anti-aliasing
- Algemeen -> opties: waarom wordt er niet onthouden dat er bij de laatste sessie het 'IJsselmeer' en de 'Noordzee' zijn aangeklikt?

- Instellingen -> Kwaliteit: waarom lijkt er geen anti-aliasingoptie te zijn geselecteerd?

Animatiepadmenu

- Bewegende objecten uit de animatielijngroep lijken niet meer weggehaald te kunnen worden nadat ze geplaatst zijn. Ook niet wanneer de druppel wordt verwijderd.

Atmosferische effecten

- Titel is 'zonnestudio' en 'atmosferische effecten' is niet meer terug te vinden.
- Je kunt enkel met de slider de tijd en datum instellen. Echter is de slider niet heel nauwkeurig te hanteren. Exact 3 juli 2017 om 11:40 instellen is een hel. Door ook een getal in te kunnen voeren of door aan de zijkant van de slider pijltjes neer te zetten die per klik één getal opschuiven, wordt de nauwkeurigheid veel groter.
- Waarom begint het schuifje van de balk 'blend' helemaal rechts?
- 'Emission' en 'blend' zijn Engels.
- De tijd voor de slider werkt met de 24-uursnotering en bij het informatiegedeelte wordt de tijd weergegeven met AM/PM.
- Tijdverloop = Tijdsverloop
- Bij 'daglengte' wordt de waarde in de vorm 00:00:00 gegeven, maar de seconden zijn altijd 00.

Bomen

- Bomen in het 3D-model zijn niet selecteerbaar zodat je kunt zien wat voor soort boom het is.
- Kleurmenu: wanneer je in de rechterbalk ergens anders klikt verandert de kleur pas bij de tweede keer ergens anders klikken.
- Je kunt bij de dichtheid van de verschillende bomen een waarde van vier cijfers invoeren. Echter kunnen er maar drie weergegeven worden.
- Blader dichtheid = Bladerdichtheid
- Blad kleurtint = Bladkleurtint
- Kleurenvenster: Je kunt het kleurenvenster niet 'cancelen' waarna je teruggaat naar de kleur die je had toen je het venster opende. Een gemaakte wijziging is een definitief gemaakte wijziging, al kun je misschien nog wel de kleur terugkrijgen door gebruik te maken van 'importeer instellingen' of 'zet instellingen terug'.
- Bladerdichtheid; 1 is leeg en 0 is vol.
- Waarom heet het 'bladkleurtint' terwijl je naast de tint ook een volledig andere kleur kunt kiezen. Hoort het dan niet 'bladkleur' te heten?

Datalaagmanager

- Data laag manager = Datalaagmanager
- Waarom staat de prullenbak als eerste icoon van de drie?
- Prullenbakicoon is niet heel duidelijk.
- Kleurenvenster: Laag kleur = laagkleur
- Kleurenvenster: Een kleur kan alleen bevestigd worden. Als je de oude kleur toch wel mooier vond maar je hebt waarden lopen aanpassen en je weet de oude waardes niet meer; jammer dan.
- Alle lagen worden op zichtbaar gezet wanneer je een nieuwe laag inlaadt. Echter behoudt de laag zijn oorspronkelijke waarde. Dus als een laag op onzichtbaar stond dan blijft de laag hier ook op staan al wordt hij vanaf het laden van de nieuwe laag aangeduid als zichtbaar. Wanneer je op het vakje naast onzichtbaar van een dergelijke laag klikt, dan gaat het vakje uit en blijft de laag nog steeds onzichtbaar. Het opnieuw aanzetten van het vakje laat de laag weer verschijnen.
- Nieuwelaagvenster: Waarom zijn er nog steeds geen DBF-bestanden in te laden nadat 'gebruik DBF' is aangevinkt?

- Nieuwelaagvenster: Wanneer een niet-bestaand station wordt aangeklikt blijft het venster staan op het laatste wel-bestaande station.
- Nieuwelaagvenster: Zijn alle stations ook nodig? Kan het programma niet kijken naar welke stations er zijn en enkel deze weergeven?
- Prullenbakicoon gebruiken is blijvend. De laag wordt meteen verwijdert zonder nog een keer om een bevestiging te vragen. De laag lijkt terug te halen te zijn door deze opnieuw in te laden vanuit het nieuwelaagvenster, maar de daadwerkelijke informatie voor de herkenning van de laag lijkt niet mee te komen.
- Wanneer je een nieuwe groep aanmaakt dan heet deze 'nieuwe Groep'. Wanneer je een tweede nieuwe groep aanmaakt dan heet deze ook 'nieuwe Groep'.
- Bij het aanmaken van een nieuwe groep kun je niet meteen een naam geven aan deze groep.
- Je kunt niet het nieuwegroepvenster uit wanneer je op de 'G' hebt geklikt terwijl deze laag nog niet in een groep zat. De enige manier om uit het nieuwegroepvenster te komen is door een groep aan te klikken. Klikken op 'geen' doet niets.
    - Bij een laag die al wel in een groep zit kun je enkel uit het nieuwegroepvenster door de laag te verplaatsen (klik op 'geen' of een andere groep) of door de laag te dupliceren (klik op de groep waar de laag momenteel inzit).
- Je kunt niet alfabetisch sorteren.
- Waarom kan de scrolbalk zoveel verder naar beneden scrollen dan dat er lagen zijn?

Drag-and-dropmodule & scenariomodule

- Drag and Drop Module = Drag-and-dropmodule
- Wanneer je in het scenariosvenster met het plusje een nieuw gebied aanmaakt, dan moet je weten dat je via de 'i' rechtsboven de naam kunt veranderen. Dit is niet waar ik deze optie verwacht. Ook kun je enkel bij de 'i' het tabblad verwijderen.
- Scenariosvenster: Scenario naam = Scenarionaam
- Hoofdvenster -> Scenariosvenster -> klik op plusje linksonder: Scenario optie = Scenario-optie
- Met ctrl + linkermuisknop selecteer je; maar hoe deselecteer je? (Het duurde even, maar we zijn erachter. Ctrl + linkermuisknop.)
    - Waarom kun je iets niet deselecteren door buiten het object te klikken?
- Rechtermuisknop op geselecteerd object -> Set Coördinaten: Het venster heet vervolgens Set Co?rdinaten. Ondanks dat coördinaten niet altijd fout gaat lijkt het alsof ASCII-tekens nog niet helemaal lekker lopen.
- Gebeurt er iets wanneer je de coördinaten wijzigt in het 'set coördinaten'-menu?
- Rechtermuisknop op geselecteerd object -> Properties:
    - Object gegevens = Objectgegevens
    - Bouw datum = Bouwdatum
    - Saneer datum = Saneerdatum
- Wat wordt er bedoeld met 'sanering'?
- Heeft een boom een saneerdatum?
- Wanneer er nog geen scenario is geselecteerd verschijnt er een venster met dat je een scenario moet selecteren. Dit venster verschijnt per klik op een item. Dus een item vijf keer aanklikken zorgt ervoor dat het venster vijf keer over elkaar heen verschijnt.
- Is 'drag-and-drop' de correcte benaming? Want ik sleep niet een windturbine naar het landschap waarna ik mijn muisknop loslaat. Ik selecteer een windturbine en dan klik ik ergens in het landschap om de windturbine te laten verschijnen.
- Wanneer je nog een item om te droppen geselecteerd hebt en je probeert te slepen door ctrl ingedrukt te houden, dan sleep je niet alleen, maar plaats je waar je met slepen begon ook een geselecteerd item.
- Misschien een doorzichtig voorbeeld aan de muis plakken wanneer er een item geselecteerd is in het menu maar nog niet geplaatst is? Dan kun je namelijk inschatten hoe groot iets is in het landschap voordat je het plaatst.

- Waarom is er een tabblad ‘vegetatie’, wat doet suggereren dat daar alle vegetatie instaat, terwijl er daarna tabbladen volgen met kopjes als ‘naaldbomen’, ‘loofbomen’, ‘onderbegroeiing’ en ‘onkruid’.
- Onderbegroeing = Onderbegroeiing
- Items onder het tabblad ‘tekenen’ zijn enkel te selecteren door ctrl ingedrukt te houden en dan specifiek op dat item te klikken, i.p.v. met een selectieveld dat gemaakt wordt door ctrl ingedrukt te houden en met de muis te slepen.
- Wanneer je een item centreert op het terrein door op ‘centreer op terrein’ te klikken dan blijven de xyz-pijltjes op de oude locatie achter.
- De knop onder de y werkt niet met een x- of een z-waarde maar je kunt deze waardes wel nog steeds selecteren in het menu (waarna het object niet meer kan bewegen totdat enkel de y-waarde weer geselecteerd is).
- Quick menu -> Engels
- Heel het ‘quick menu’ is Engels op het woordje ‘coördinaten’ na.
- Op sommige objecten, zoals de eik, lijkt de rechtermuisknop niet gebruikt te kunnen worden voor het ‘quick menu’.
- Ik mis het best wel dat je een selectie niet ongedaan kunt maken door ergens buiten de selectie te klikken.
- Je kunt door ctrl ingedrukt te houden en te slepen met de linkermuisknop een veld creëren waarmee je objecten kunt selecteren. Met alt kun je eenzelfde veld creëren maar dan om te deselecteren. Door ctrl ingedrukt te houden en op een object te klikken selecteer je een object. Door nog een keer op het object te klikken deselecteer je het weer. Je kunt echter niet deselecteren door alt ingedrukt te houden en op een object te klikken.
- Misschien is het handig om ook bij het ‘quick menu’ te kunnen door met de rechtermuisknop op een object te klikken dat niet geselecteerd is.
- Er is een ‘select all’ in het ‘quick menu’ maar niet een ‘deselect all’.
- Bij ‘object gegevens’ (onder ‘quick menu’ -> ‘properties’)
- Wanneer er meerdere objecten geselecteerd zijn lijkt de ‘set coördinaten’ in het ‘quick menu’ maar op één object te werken als je een waarde verandert, en dit is niet persé het object waar het ‘quick menu’ is opgeroepen.
- Bevestigt de invoering.
- Wanneer ik kies voor ‘beplant terrein’ dan wordt maar één van mijn twee polygonen op dat terrein beplant.
- Objecten onder het tabblad ‘Overige’ zijn een kwartslag gedraaid.
- Het opslaanicoon bij de vierkantjes hoort eigenlijk een refreshicoon te zijn, gezien het niets daadwerkelijk opslaat. Daarvoor heb je het grotere opslaanicoon links nodig.
- Waarom is er een scenario getiteld ‘Zon’? Je kunt waarden uit het atmosferische effectenmenu toch niet opslaan in een scenario?
- Dupliceren van een scenario werkt alleen als je meteen daarna op opslaan klikt.
- Het is niet mogelijk om alle richtingen (x, y en z) uit te schakelen. (Dit is goed.)
- Roteer 45 graden werkt enkel als de roteeroptie is geselecteerd.

Polygoonmenu

- Menu van de polygoon kun je tevoorschijn halen door ctrl+shift+linkermuisknop op de polygoon te doen.
- Een geselecteerde punt is te verslepen met de middelste muisknop.
- Geselecteerde punten zijn van hoogte te veranderen door met de middelste muisknop te scrollen.
- De punten die je neerzet op het pad kun je wel deselecteren door ergens buiten de punten te klikken. (Dit is een pluspunt.)
- Nadat je de hoogte van het vlak hebt aangepast kun je deze niet meer terugzetten naar de oorspronkelijke hoogte.

- Groepen Manager = Groepenmanager
- Polygoon groep = Polygoongroep
- Ik heb net met de groepenmanager bomen neergezet, maar ik tel er 24 i.p.v. de 2449 objecten die beweerd worden in de groep te zitten.
- Undo -> Engels.
- Ik klikte op 'undo' bij één groep in het menu waar ik een groep kan plaatsen, maar verwijderde ook een andere groep. (Ik heb het al door; de 'undo' maakt ongedaan elke voorgaande keer dat er 'plaats groep (… objecten)' is geklikt. Je kunt dus per actie terug. Dit lijkt vaak niet mogelijk bij andere functies van Win3D.
- Object selectie = Objectselectie
- Grid rotatie = Gridrotatie
- Object rotatie = Objectrotatie
- Bij 'horizontaal' en 'verticaal' bij de 'gridpolygoon' en de 'rijenpolygoon' staan geen eenheden.
- Misschien elk object een ander plaatsingskleurtje geven.

Ecosysteemmanager

- EcoySysteem Manager = Ecosysteemmanager
- Nieuw EcoSysteem = Nieuw ecosysteem
- Clear (terrein) -> Engels
- Terrein detail = Terreindetail
- Foto afstand = Fotoafstand (of Foto-afstand)
- Apply -> Engels
- Object Naam = Objectnaam
- Groep Naam = Groepsnaam
- aspect ratio = aspectratio
- Ecoysysteem Naam = Ecosysteemnaam
- verdeling totaal = verdelingtotaal
- De groepsnaam is te veranderen, maar de objectnaam niet, terwijl de objectnaam wel de suggestie wekt ook veranderbaar te zijn.

Geocoding

- Live meezoeken is fancier en geeft betere feedback, maar hoeft niet.
- Wat doen de puntjes rechtsboven? Ze geven meer opties, maar waar zijn deze opties op gebaseerd?
- Vanwaar de naam "geocoding" voor dit venster?

Grid

- Aan/uitknop linksboven lijkt niks te doen, terwijl je zou verwachten dat je zou kunnen schakelen tussen een zichtbaar en een onzichtbaar grid.
- Er staat geen eenheid bij de 'afstand'.
- Is 'x' het juiste symbool als je iets terugzet naar de oorspronkelijke waarde?

Materialenvenster

- MaterialenVenster = Materialenvenster
- Woningen kleur = Woningenkleur
- Woningen luchtfoto = Woningenluchtfoto
- Water doorzichtigheid = Waterdoorzichtigheid
- water kleur = waterkleur
- Water Reflectie = Waterreflectie
- "Specular Color", "Clear Color" en "Shininess" zijn Engels.
- Alleen het begin van de slider van "shininess" lijkt een verandering teweeg te brengen.

- Je kunt niet slepen met de kleurenvensters met de witte achtergrond.
- “Clear Color” lijkt hetzelfde van kleur te veranderen als “Water Reflectie”.
- “Water Reflectie” overrides “Clear Color” (zolang de opacitybalk laag staat).
- Bij de kleurenvensters met de witte achtergronden krijgt de voorbeeldkleur (het grote rechtervak) de kleur van het vorige geopende venster wanneer een nieuw venster wordt geopend.
- De opacitybalk van de het “Clear Color”-kleurenvenster lijkt niks te doen.
- Het kleurenvenster van “Specular Color” lijkt niks te doen.
- Door de term “water doorzichtigheid” klinkt het net alsof de doorzichtigheid van het water zelf verandert, maar eigenlijk hoor het “waterkleurdoorzichtigheid” te zijn, gezien de doorzichtigheid van de waterkleur veranderd wordt.
- Er staat geen titel boven de kleurenvensters, waardoor je makkelijk je oriëntatie kwijtraakt.
- Ik verwacht iets anders bij de titel “materialenvenster”.

Navigatiepanel

- Navigatie Panel = Navigatiepanel
- RijksDriehoeks Coördinaten = Rijksdriehoekscoördinaten
- Latitude Longitude = Breedtegraad en hoogtegraad
- NAP meting = NAP-meting
- Hoogte grond = Grondhoogte (persoonlijke voorkeur)
- Wind terrein = Windterrein
- Fov = FOV
- Venster is niet te bewegen wanneer het ‘i’-venster er is.
- Cursor blijft in vak staan nadat bij FOV een waarde is ingevuld en op enter is gedrukt.
- Eenheid ontbreekt bij FOV-invulveld.
- Wanneer je bij FOV 360 of 180 invult dan gaan dingen stuk.
- Wanneer je bij FOV 250 invult dan staat alles op z’n kop.
- Hoe werkt de FOV?

Plattegrond

- ‘X’-knop rechtsboven verstopt zich tot je het venster groot genoeg maakt.
- In het windvenster; wat doet het getal onderaan? Wat is de eenheid?
- In het windvenster; slider doet niks zolang het vakje ‘actief’ niet is aangevinkt. Echter zit er een streep tussen de slider en het vakje, waardoor het initieel twee aparte dingen lijken.
- In het windvenster; de blokjes naast de slider lijken te impliceren dat de slider voor het veranderen van de windsnelheid bedoeld is. Enkel lijkt na gebruik de slider te zijn voor de doorzichtigheid van de windsnelheidoverlaykaart.
- Waarom heet de knop ‘wind’, ‘wind’ en niet ‘windkaart’ zoals het uitklapvenster heet.

Rendermodule

- Render module = Rendermodule
- Formaat screenshot = Screenshotformaat (persoonlijke voorkeur)
- Waarom heeft formaat 1 met de kleinste grootte wel schaduwen, maar de andere vier formaten (2 t/m 5) niet?
- Na op ‘film’ gedrukt te hebben kreeg ik screenshots in een mapje i.p.v. een film.
- Er is geen stopknop voor filmen.

Saneringsvenster

- Sanering Venster = Saneringsvenster
- Start Datum = Startdatum
- Sanerings datum = Saneringsdatum

- Elk streepje op de balk stelt een jaar voor. Echter zijn er geen streepjes meer zodra het aantal jaar tussen het startjaar en saneringsjaar onder de drie jaar zit.
- Je kunt enkel een datum selecteren met de pijltjes en niet door een datum te typen.
- Het zou fijn zijn als alle gesaneerde objecten direct zichtbaar zouden worden zodra je op ‘alles zichtbaar’ hebt geklikt i.p.v. pas wanneer je op de tijdlijn iets verandert.
- Je kunt wel dagen invullen in de propertiesvensters van objecten, maar je kunt enkel op maand verschuiven in het saneringsvenster.
- Misschien is het automatisch verschuiven van de balk een leuk idee.

Scenario-evaluatie

- Scenario Evaluatie = Scenario-evaluatie
- Totaal aantal = Totale aantal -of- Totaalaantal (met een voorkeur voor het eerste)
- As hoogte = Ashoogte
- Rotor diameter = Rotordiameter
- Waarom wordt er geëxporteerd naar een Word-bestand en niet naar pdf?
- Waarom wordt je niet doorgestuurd naar de scenariomodule als je nog geen scenario hebt gekozen? Net zoals bij de drop-and-dragmodule.
- Er staat ‘selecteer een gebied’ wanneer je nog geen scenario hebt gekozen, maar hoort dit niet net zoals de drop-and-dragmodule ‘selecteer een scenario’ te zijn?
- Scenario-evaluatie verandert wel live wanneer er objecten aan de wereld worden toegevoegd, maar niet wanneer ze worden weggehaald.
- Scenario-evaluatie lijkt stuk te gaan wanneer je alle toegevoegde objecten weer weghaalt. Toevoeging: het scenario-evaluatievenster was gesloten en één van de twee objecten is weggehaald. Bij het opnieuw openen van het scenario-evaluatievenster was het weer stuk. Met stuk wordt hier bedoeld: het venster is leeg.
- Wanneer je van een ingeladen ‘hoofdgebied’ met objecten naar de ‘totale opgave’ gaat en dan weer terug, dan zijn er ineens meer pagina’s bijgekomen aan de onderkant. Toevoeging; dit gebeurt zelfs wanneer je nog een keer op het ‘hoofdgebied’ klikt.
- Momenteel is er één zonnepaneel in de wereld, maar aan de onderkant van het scherm staat deze twee keer herhaald.

Zonnepaneel twee keer herhaald.

- Het naar de locatie brengen van een object lijkt niet altijd even lekker te werken. Tenminste, toen ik naar de windturbine wilde gaan leek deze niet centraal in het scherm te staan.
- Het vinkje van het scenario-evaluatie blijft na het sluiten van het scenario-evaluatievenster aanstaan in het hoofdmenu.
- Scenario-evaluatie lijkt niet altijd live te reageren met de scenariomodule.
- Eenheden ontbreken bij waardes.

Snelmenu

- Met ‘i’ krijg je ook informatie van objecten wanneer je in een venster klikt. Het venster is voor de ‘i’-functie daarmee onzichtbaar.
- Snel Menu = Snelmenu
- Je kunt onder het eerste kopje zowel het meetlint als de liniaal selecteren, maar dit doet niks. Het uitklapmenu gaat ook meteen weg als je iets aanklikt, dus je moet twee keer het uitklapmenu aanklikken voordat je kunt switchen tussen het meetlint en de liniaal. Misschien zou het handiger zijn als je met de selectie van de één de ander automatisch uitzet?
- Bij het meetlint wordt er gesproken over een hoogte, maar wat voor soort hoogte is het? Als in; hoe wordt bepaald waar de 0 meter ligt?
- Het vierde kopje brengt je naar de datalaagmanager. Ondanks dat in de datalaagmanager het vakje ‘Lagen zichtbaar’ op uit staat worden toch alle lagen getoond zolang er nog niet eerder op het vakje van ‘Lagen zichtbaar’ is geklikt.

Tegelvenster

- Waarschuw dat het inladen wel even kan duren.
- Tegel Venster = Tegelvenster
- Consistentie: wel of niet altijd hoofdletters? -> “Selecteer Alles” & “Laad geselecteerde”
- Misschien is het een idee om, wanneer je een tegel selecteert, dat deze in het 2D-veld ge-highlight wordt.
- Je kunt tegels niet ‘ontladen’. Je moet nu eerst het programma afsluiten.

Terreineditor

- Terrein Editor = Terreineditor (of Terrein-editor)
- X&Y Coordinaten = X- en y-coördinaten
- ‘Struik’ is met een kleine letter geschreven maar de rest van de bomen is met een hoofdletter.
- Er zijn hier minder bomen dan in de drag-and-dropmodule; is daar een reden voor?
- Waarom worden bij ‘verwijderen bomen’ alle bomen verwijdert? Vreemd genoeg leek het hiervoor wel maar één boom per keer te verwijderen. Bij al bestaande bomen die meekwamen met het programma lijken per klik alle bomen van dezelfde soort verwijdert te worden.
- Er wordt minder grond bewerkt dan het blauwe vierkant doet suggereren.

Het blauwe vierkant is flink groter dan het bewerkte gebied.

- Je verwacht bij het klikken op ‘geen’ dat het blauwe vierkant weer weggaat, maar dat gaat het niet. Het vierkant blijft liggen in het landschap.
- Er lijkt geen mogelijkheid te zijn om geverfd terrein weer ongedaan te maken.
- Het verven van het terrein resulteert enkel in een zwart terrein.
- De blauwe balk met ‘vierkant’ lijkt niks te doen.
- De ‘krijg hoogte’-knop onder ‘egaliseer terrein’ lijkt niks te doen.
- Verhoogt het terrein.
- Na het veranderen van de grootte van het vierkant (en op enter gedrukt te hebben), blijft het vierkant stilstaan tot je ergens in het terrein-editorvenster klikt.

Terrein-editor 2

- Terrein Editor 2 = Terrein-editor 2
- Dit hele venster is Engels.
- Instellingenmenu is niet te sluiten wanneer het venster klein is (dus zonder de brushes, etc.) zonder een optie te selecteren.
- Waarom moet ik na het terugzetten van de default-instellingen opnieuw een terrein selecteren terwijl er bovenin het menu nog een tegel geselecteerd staat?
- Na het terugzetten van de default-instellingen doet klikken in het landschap niks meer. Echter wordt je niet geholpen met dit op te lossen. Je moet maar net klikken op de tegelnaam of één van de bovenste opties. (Een brush aanklikken werkt dus ook niet.)
- Waarom wordt er ineens met het woord ‘terrein’ gewerkt, terwijl tegels bedoeld lijken te worden.
- De vormen van de brushes worden gepositioneerd volgens een vastgesteld kompas en niet volgens de locatie van de camera.
- Heeft het nut om voor brush size of opacity een waarde 0 te hebben?
- Paint texture, place tree en place detail, lijken niks te doen. Correctie: place tree heeft één keer gewerkt, maar deed het daarna opnieuw niet meer.
- Misschien is een rondje om het pijltje handig om de brush size aan te geven.
- Een geselecteerde optie van de bovenste vijf opties blijft niet altijd met een donkere kleur aangegeven dat deze geselecteerd is.
- Wat gebeurt er met het opgeslagen landschap?

Windmolenconfigurator

- Windmolen configurator = Windmolenconfigurator
- Waarom eigenlijk windmolens en niet windturbines?
- Er staan geen eenheden achter de invulvelden.
- Zou een live-voorbeeld niet handig zijn? (De zonnepanelenconfigurator maakt wel een live-voorbeeld in het landschap.)
- Als een al gemaakte windturbine gewijzigd wordt, dan veranderen de al neergezette versies van die windturbine niet mee.
- Onderkant paal => wordt de breedte van de onderkant van de paal mee bedoeld.
- Bovenkant paal => wordt de breedte van de bovenkant van de paal mee bedoeld.
- Het lijkt me logischer om het invulvakje voor het invullen van de bovenkant van de paal boven die van de onderkant te zetten, i.p.v. andersom zoals nu gebeurt.
- Wanneer wind min = 0, wind max = 0 en wind uit > 0 dan verdwijnen ineens de wieken van de windturbine.

Verdwenen wieken.

- Je kunt mingetalen invullen; is dat de bedoeling?

Windmolenverlichting

- Windmolen Verlichting = Windmolenverlichting
- Misschien handig om het aantal flitsen per minuut ook met de hand in te kunnen voeren i.p.v. enkel met de pijltjes.
- Het synchroon knipperen ging niet helemaal goed. Drie waren tegelijkertijd aan en de laatste was juist aan wanneer de andere uit waren. Alles uit zetten via het windmolenverlichtingsvenster en daarna weer aanzetten verhielp het probleem.
- Lampen nacelle -> Nacellelampen (persoonlijke voorkeur)
- Lampen mast -> Mastlampen (persoonlijke voorkeur)

Zonnepanelenconfigurator

- Zonnepanelen Configurator = Zonnepanelenconfigurator
- Zonnepanelen Creator = Zonnepanelen-creator
- Venster lijkt zonnepanelenconfigurator te heten maar er staat als titel boven het venster zonnepanelen-creator.
- Breedte paneel = Paneelbreedte (persoonlijke voorkeur)
- Diepte paneel = Paneeldiepte (persoonlijke voorkeur)
- Paneel helling = Paneelhelling
- Schaduw helling = Schaduwhelling
- Hoogte grond = Grondhoogte (persoonlijke voorkeur)
- Zuid gericht = Zuidgericht
- Oost-West gericht = Oost-westgericht
- staal paal = stalen paal?
- Zonnepanelen Manager = Zonnepanelenmanager
- Wanneer je een waarde invult voor ‘breedte paneel’ of ‘diepte paneel’ en dan naar een ander materiaal voor het zonnepaneel gaat en dan weer terug, dan zijn de ingevulde waardes vervangen door de originele waardes. Alle andere invulvelden doen dit echter niet.
- Na het maken van een zonnepaneel door op de ‘maak’-knop te drukken, lijkt deze niet in de drop-and-dragmodule te komen staan wanneer deze openstaat op het tabblad ‘zonnepanelen’. Door echter het zonnepanelentabblad te verversen komt het nieuwe

zonnepaneel wel in de lijst te staan. Dit is opmerkelijk omdat de windmolenconfigurator wel in staat is live toevoegingen te doen in de drag-and-dropmodule.
- Soms kun je niet bij het hoofdmenu wanneer de zonnepanelenconfigurator openstaat.
- Er staat een voorbeeldplaatje onderaan, maar deze reageert enkel op de zonnepanelenmanager, terwijl de locatie van het plaatje doet suggereren dat het live reageert op wijzigingen gedaan in de invulvelden.
- Invulvelden missen eenheden.
- Het gebruik van breedte en diepte is niet altijd consistent. Bij ‘breedte paneel’ en ‘diepte paneel’ wordt het omgekeerde bedoeld dan bij ‘panelen breed’, ‘panelen diep’, ‘palen breed’ en ‘palen diep’.
- Een vlak dat tweedimensionaal is (zoals in dit geval het zonnepaneel) heeft toch enkel dimensies in de lengte en breedte? Waarom is er gekozen voor diepte i.p.v. lengte?

Appendix D

List with functions

Spelen met de zon. (Informatie en esthetisch.)

Wolken aan-/uitzetten. (Esthetisch.)

Andere luchtachtergrond kiezen. (Esthetisch.)

Pas kleur van bladeren aan. (Esthetisch.)

Pas bladerdichtheid van bladeren aan. (Esthetisch)

Lagen kleuren en aan-/uitzetten. (Informatie.)

Objecten plaatsen in het landschap.

Objecten selecteren en verslepen en schalen.

Objecten coördinaten geven om naar toe te gaan.

Objecten een bouw- en saneerdatum geven.

Windverlichting aan-/uitzetten.

Scenario's maken met een opgegeven begroeiing.

Scenario's beplanten op terreinen of selecties.

Zoeken en gaan naar een gezocht adres.

Grid over het landschap plaatsen. (Informatief.)

Grid draaien en van breedte veranderen.

Kleuren van het water veranderen.

Luchtfoto over woning plaatsen.

Weerkaatsing van het licht op het water aanpassen.

Gebouwen een kleurtje geven.

Windrichting aangeven en aanpassen.

Draaiing van de camera aangeven (kompas).

Wind ecosysteem laten beïnvloeden (aan/uit en sterkte).

Wind alles naast ecosysteem laten beïnvloeden (sterkte).

Field of view aanpassen.

Positie geven in rijksdriehoekscoördinaten of hoogtegraad/breedtegraad.

Hoogte geven in NAPmeting of grondhoogte.

Plattegrond met geladen tegels weergeven.

Camerapositie/draaiing weergeven (plattegrond).

Legenda windkaart (informatie).

80/100/120 windsterktes tonen.

Opacity windkaart over plattegrond aanpassen.

Overlay windkaart over plattegrond aan-/uitzetten.

Camera verplaatsen door op de plattegrond te klikken.

Padpunten toevoegen aan polygoon.

Kleur van polygoonveld aanpassen.

Gebiedsvormen importeren.

Polygoonveld een hoogte geven.

Padpunten tussen geselecteerde padpunten zetten.

Ecoysysteem selecteren voor een polygoongebied.

Polygoongroepssoort kiezen en maken.

Polygoongroep invullen qua hoeveelheid en plaatsing.

Object(en) kiezen voor polygoongroep.

Object verwijderen (polygoon).

Polygoongroep verwijderen.

Naam polygoongroep veranderen.

Polygoongroep plaatsen in polygoonveld.

Polygoongroep weghalen uit polygoonveld.

Bij rijen- en gridpolygoon: rotatie en verplaatsing grid bepalen.

Screenshot nemen.

Kwaliteit screenshot bepalen.

“Filmpje” maken (veel screenshots nemen).

Startdatum en saneringsdatum bepalen voor tijdlijn.

Gesaneerde objecten zichtbaarheid aan-/uitzetten.

Slider om door saneringsevolutie te gaan.

Overzicht van hoeveel alles in het landschap oplevert.

Overzicht per scenario van hoeveel het scenario oplevert.

Overzicht per object en wat het oplevert.

Informatie van overzicht exporteren naar een Word-bestand.

Scenario maken, dupliceren, inladen of verwijderen.

Gebied maken of verwijderen.

Naam aanpassen van gebied.

Naam aanpassen van scenario.

Scenario opslaan.

Liniaal in het landschap zetten. Rolmaat gebruiken (afstand tussen twee punten meten).

Informatie over object/locatie weergeven.

Gebouwen aan-/uitzetten.

Bomen aan-/uitzetten.

Tegel(s) selecteren of deselecteren.

Tegel(s) inladen.

Landschap: hoogte aanpassen d.m.v. vormen (brushes).

Landschap: smooth maken.

Brushgrootte en brushssterkte aanpassen.

Tegel kiezen voor landschapsbewerking.

Landschapsbewerking opslaan.

Landschap terugbrengen naar hoe het oorspronkelijk was.

Bewerkingsvierkantgrootte aanpassen.

Plaats bomen in landschap met vierkant.

Verwijder bomen uit landschap (niet verbonden aan vierkant).

Terreinverhoging en -verlaging (met vierkant).

Egalisatie terrein (met vierkant).

Terrein verven (met vierkant).

Zelf een windturbine bouwen.

Zelfgebouwde windmolens verwijderen.

Windmolenverlichting aan-/uitzetten.

Windturbineverlichtingssettings aanpassen.

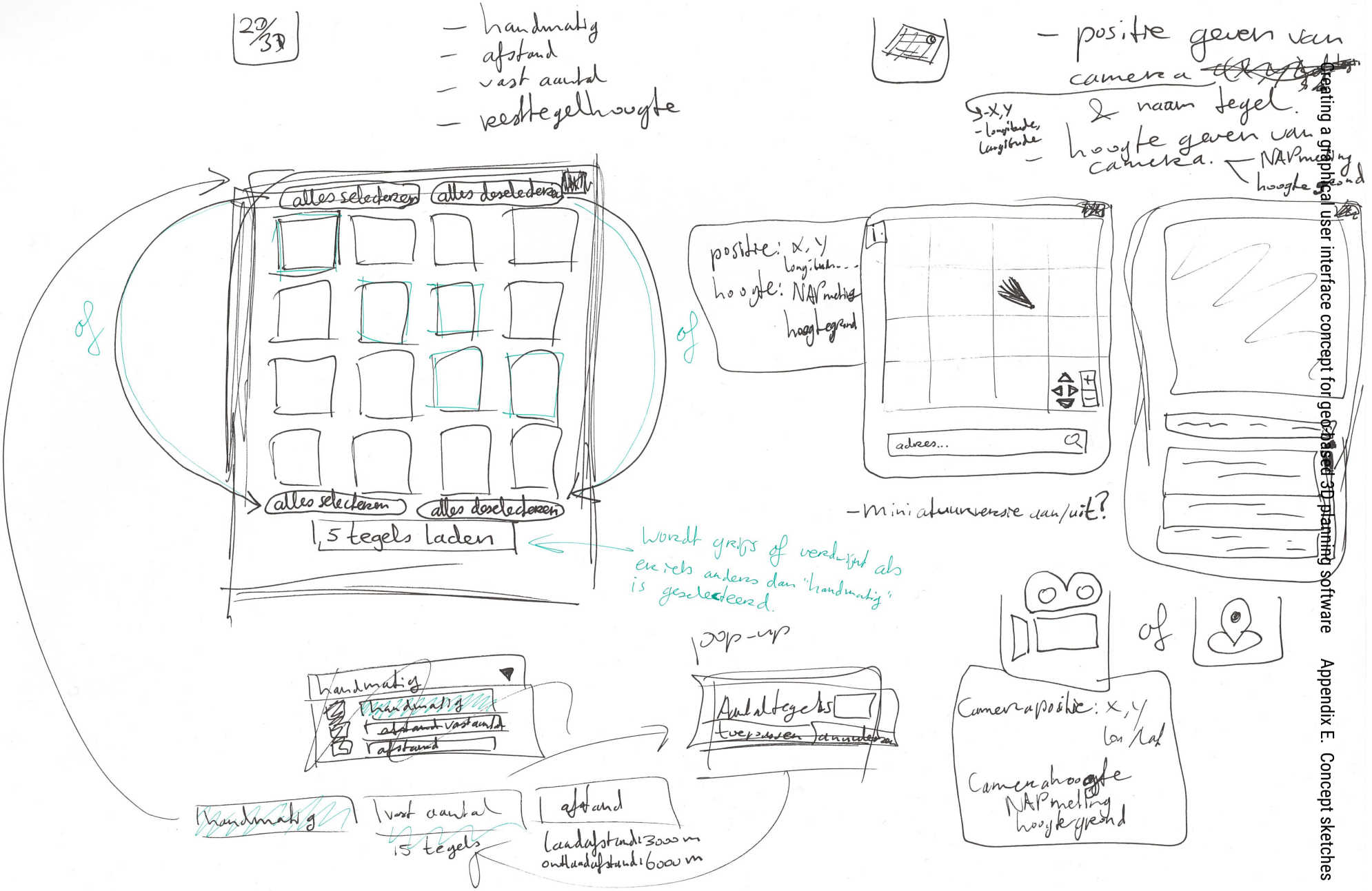
Zonnepanelen zelf bouwen.

Zelfgebouwde zonnepanelen verwijderen.

Bereik windturbines (rode cirkels).

Appendix E

Concept sketches


2D/3D
- handmatig
- afstand
- vast aantal
- resttegelhoogte
- positie geven van camera & naam tegel.
- x, y
- longitude, langitude
- hoogte geven van camera.
NAP meting hoogte grond
alles selecteren
alles deselecteren
1,5 tegels laden
of
positie: x, y
hoogte: NAP meting hoogte grond
adres...
- miniatuurversie aan/uit?
Wordt grijs of verdwijnt als er iets anders dan "handmatig" is geselecteerd.
pop-up
handmatig
vast aantal
afstand
Aantal tegels
Camerapositie: x, y
Camerahoogte
NAP meting hoogte grond
15 tegels
Laadafstand: 3000 m
Ontlaadafstand: 6000 m

(Vraagje? zou je spelen met de wind tijdens het bouwen van de windturbines?)

- aan-/uitzetten
- kleurtje geven
- Satellietfoto projecteren

- windrichting (+ camera)
- windsnelheid
- ~~exact~~ wind voor ecosystemen
  - aan/uit
  - snelheid
- wind overig
  - snelheid
- windkaart

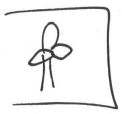
- kleurtje geven (per boomsoort of allemaal)
- bladerdichtheid (per boomsoort of allemaal)
- aan-/uitzetten
- ~~redo~~ undo bladerdichtheid & kleur (1x)
- sla kleur en bladerdichtheid op.
- Importeer de opgeslagen kleur en bladerdichtheid.

- datum
- tijd
- tijdverloop
  - aan/uit
  - snelheid
- informatie zonsopkomsten- ondergang, daglengte

- aan-/uitzetten
- simpel/mooi water
- waterkleur (4 kleuren; ~~trouble~~ nodig?)
- waterreflectie (doet dit reb?)
- zeewaterhoogte
- waterhoogte
- gemiddeld waterhoogte

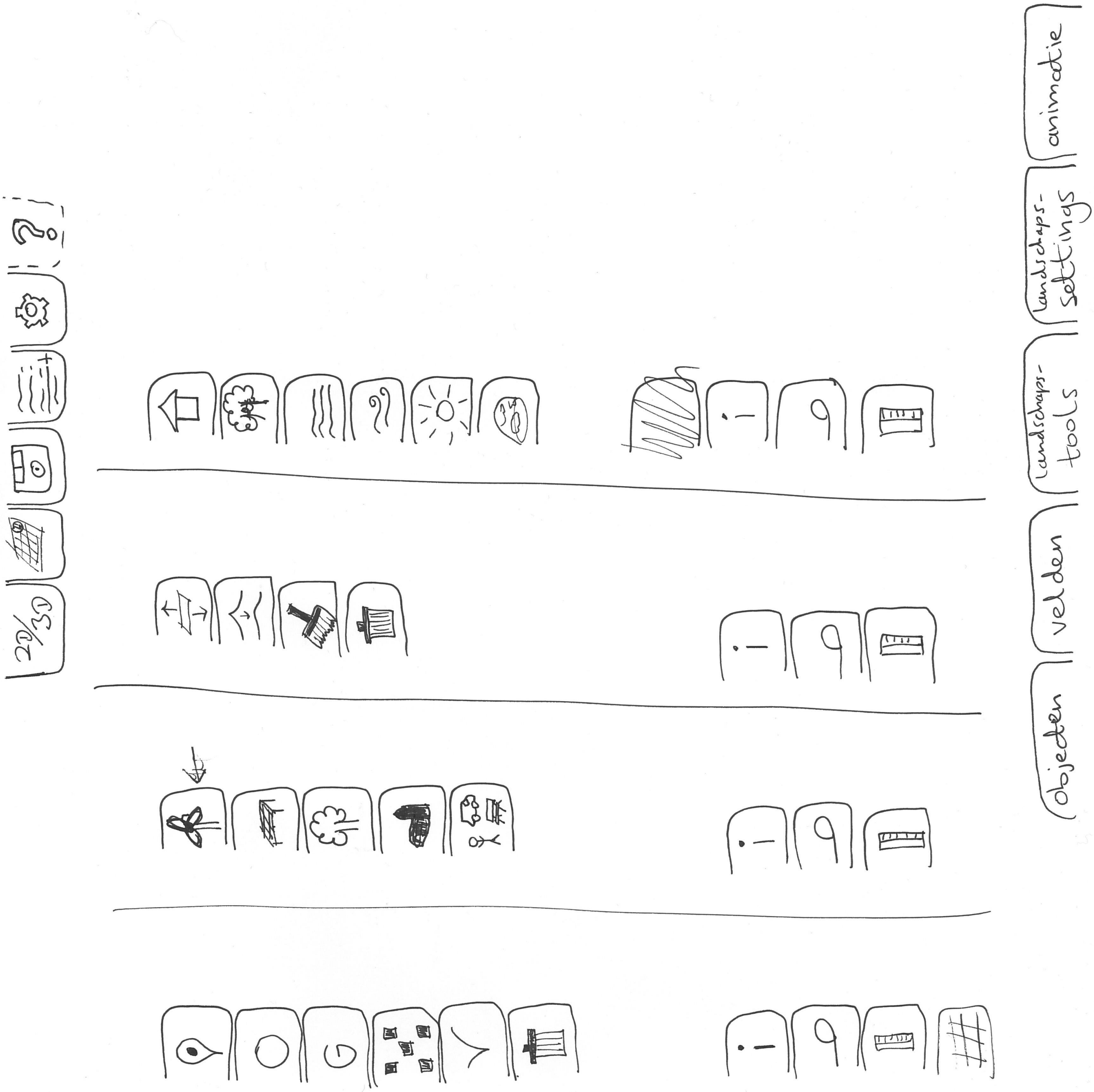
- wolken aan/uit
- laad/ontladen skydomes

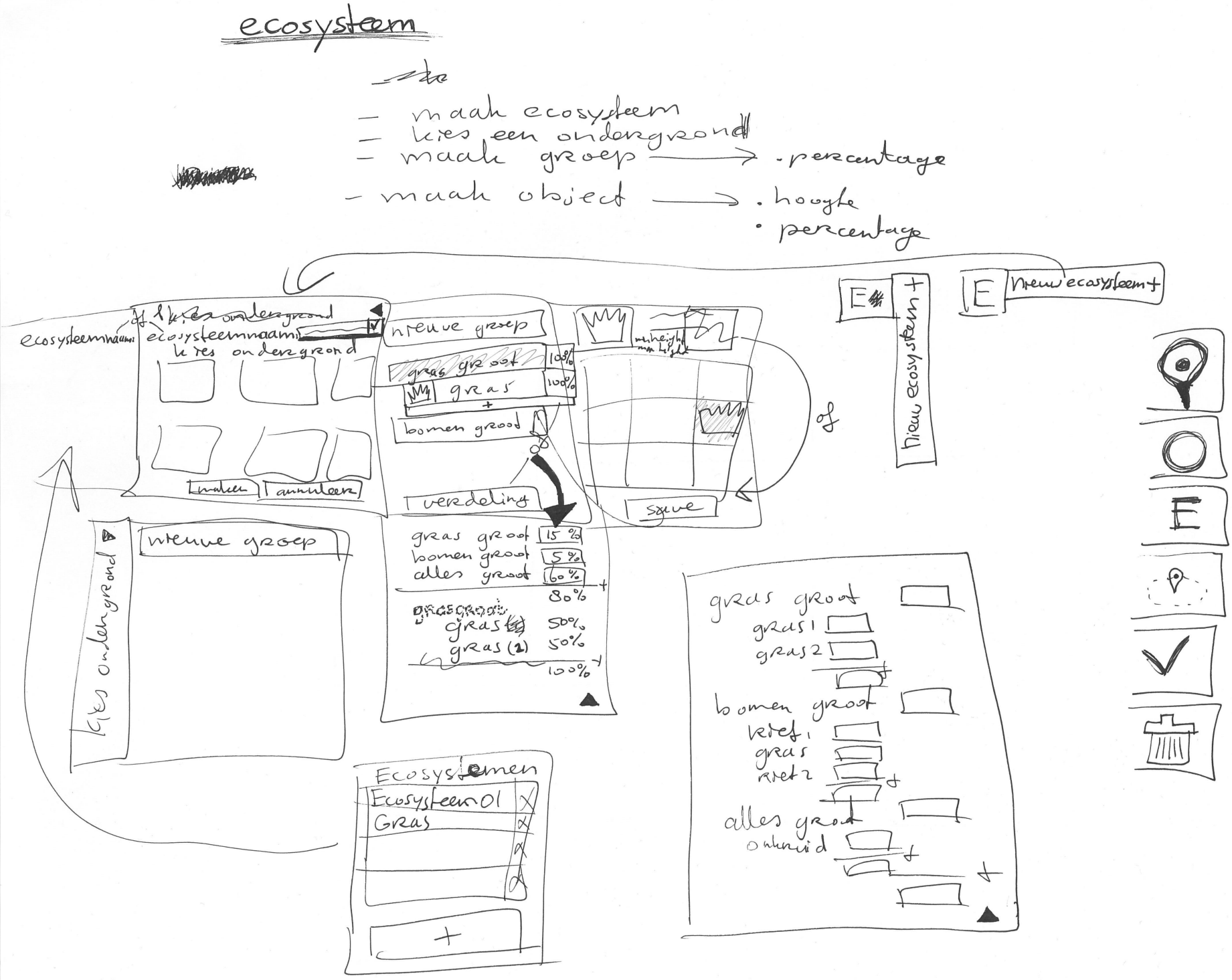
?

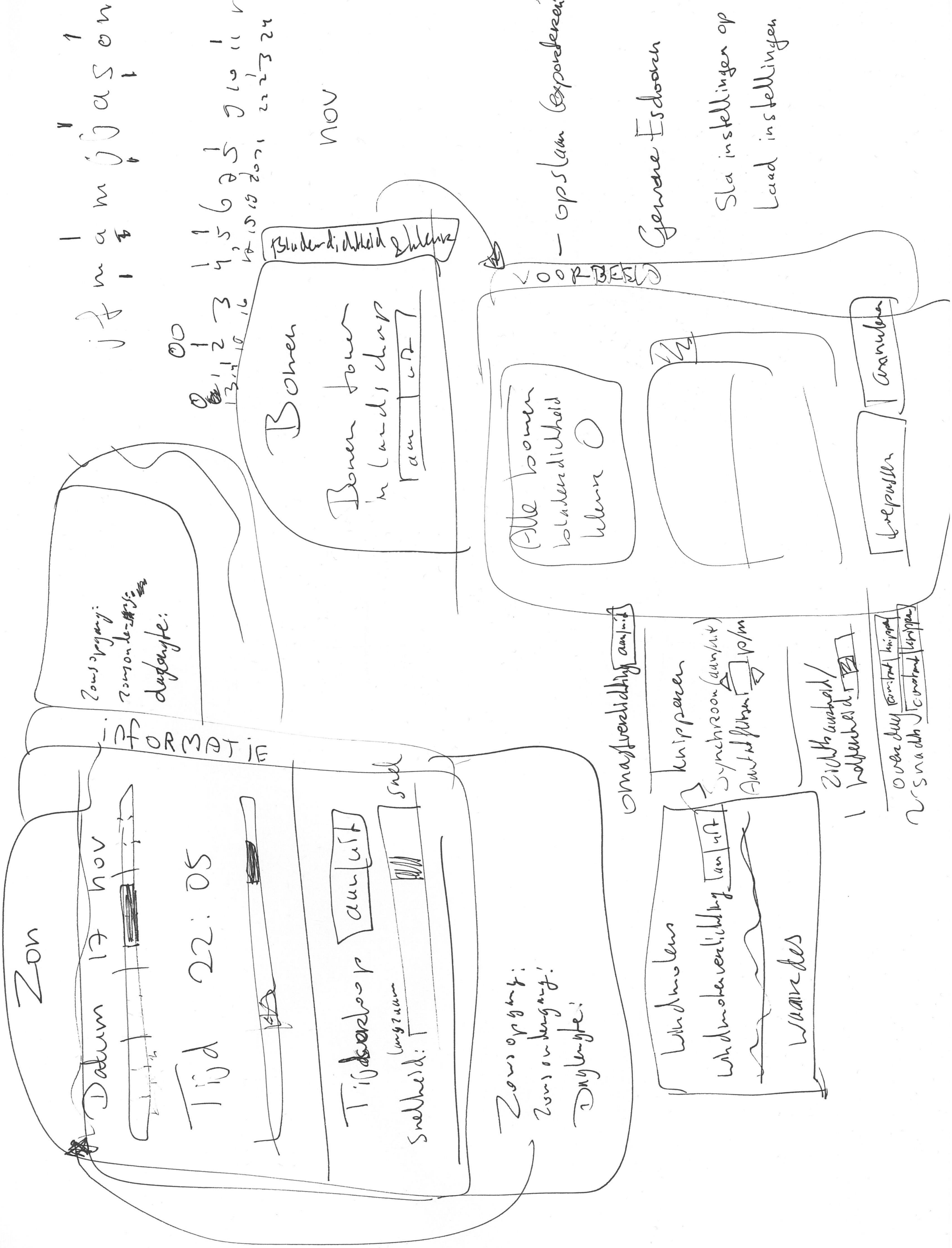


- windmolenverlichting

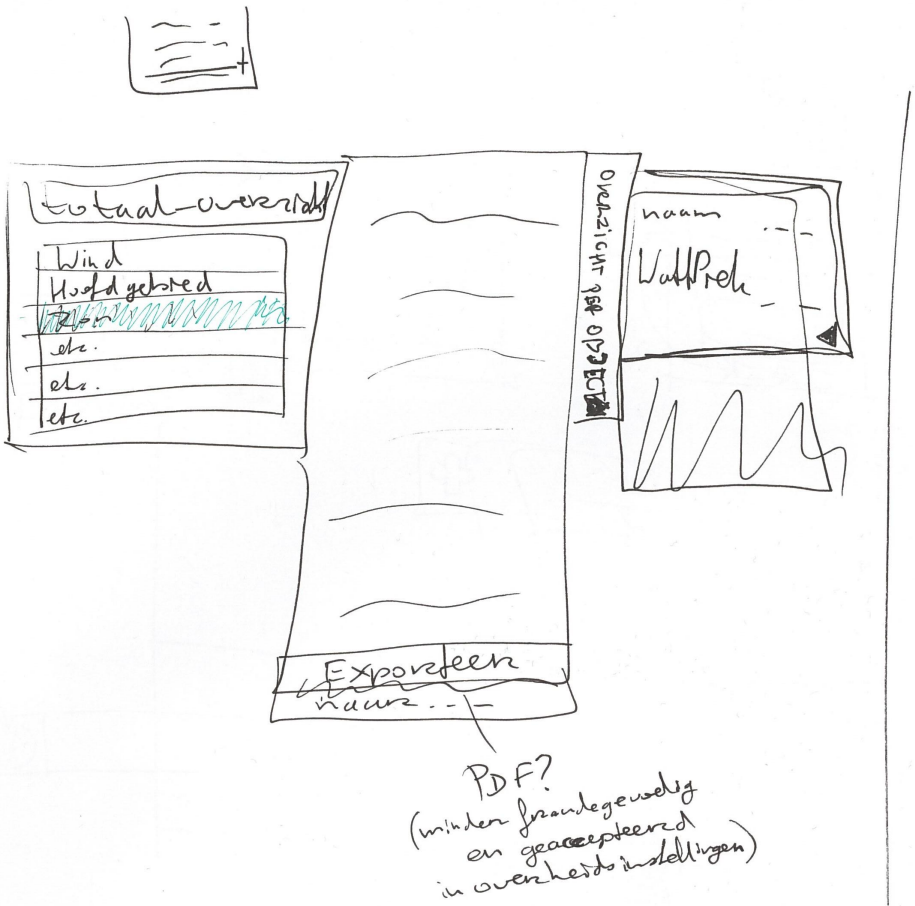
(Idee? Alle vensters de mogelijkheid geven in een pop-upvenstertje veranderen?)


2D/3D
animatie
landschaps-settings
landschaps-tools
velden
objecten

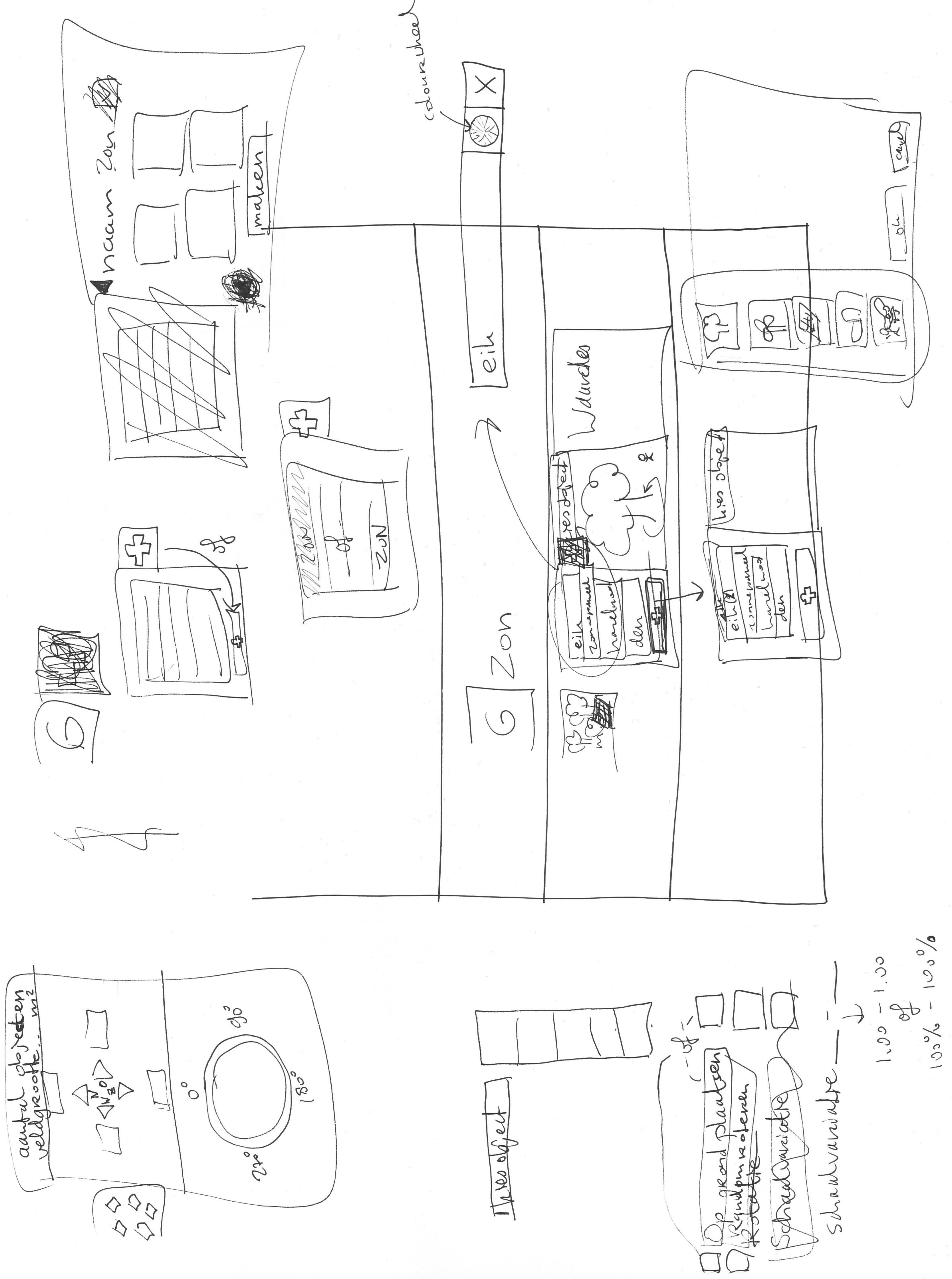

ecosysteem
- maak ecosysteem
- kies een ondergrond
- maak groep → . percentage
- maak object → . hoogte
. percentage
ecosysteemnaam
kies ondergrond
ecosysteemnaam
kies ondergrond
nieuwe groep
gras groot 100%
gras 100%
bomen groot
verdeling
snijden
annuleren
gras groot 15 %
bomen groot 5 %
alles groot 60 %
80 %
gras 50%
gras (2) 50%
100 %
kies ondergrond
nieuwe groep
Ecosysteem
Ecosysteem 01
Gras
gras groot
gras 1
gras 2
bomen groot
kiest
gras
kiest 2
alles groot
nieuw ecosysteem
nieuw ecosysteem

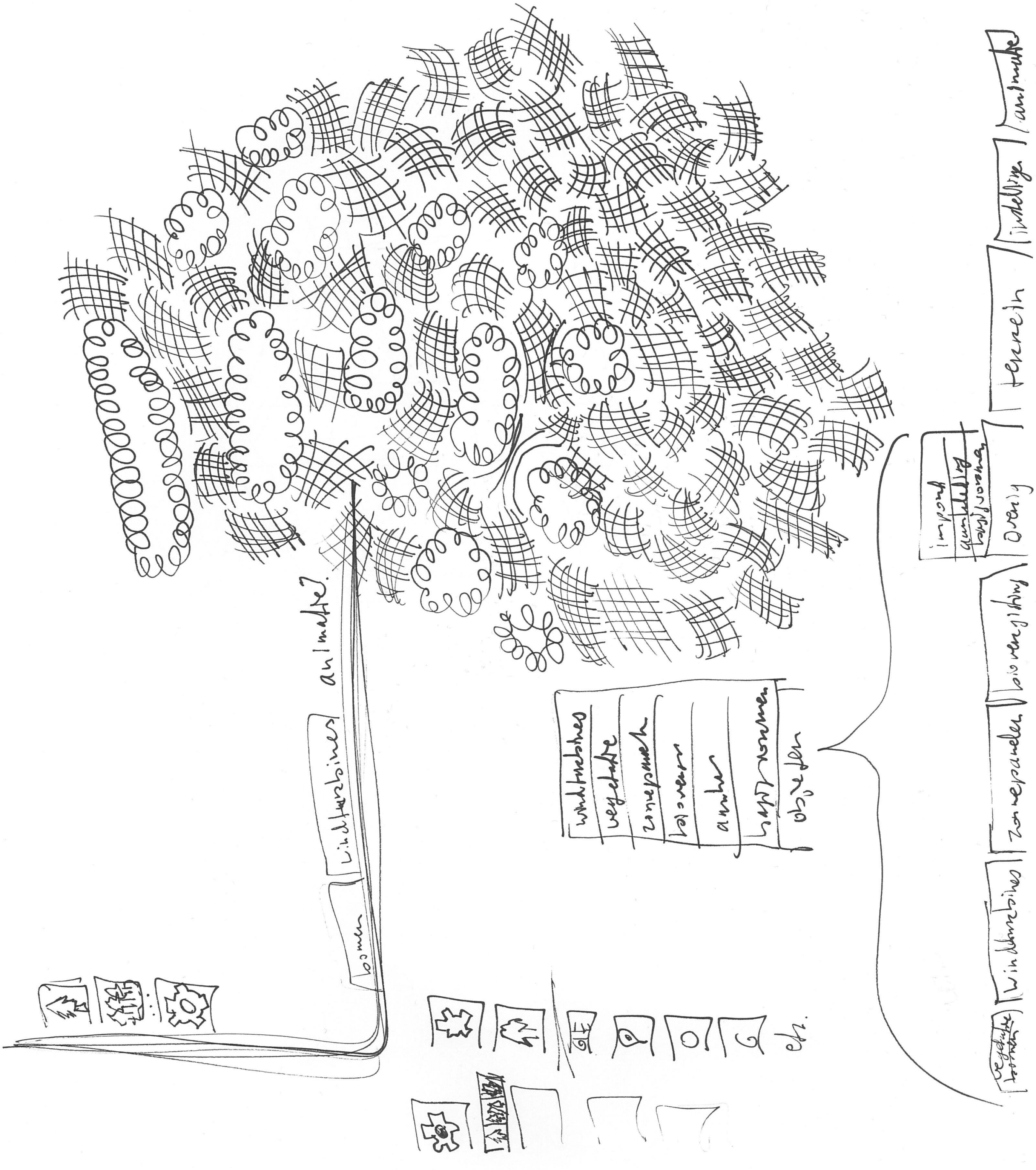

Zon
Datum 13 nov
Tijd 22:05
INFORMATIE
Bomen
VOORBEELD
Genereer Esdoorn
Sla instellingen op
Laad instellingen
Toepassen
Annuleren
Windmolens
Waardes
Knippen
nov


Hoeveel polygonen zet je neem per keer?
als in; deze aanlaten of na één keer telkens uit doen?
- opslaan
- naam geven
- groepsnaam
1) kiest een soort groep
2) vul je deze groep met objecten en waardes
3) bepaal je de plaatsing van de objecten
4) plaats je ze
naam:
Zon
- wat voor soort groep? distributie? grid?
- wil je een bestaande groep gebruiken?
(let op! De kunt niet een bestaande groep een andere groepssoort geven.)
- wat is de naam van de groep?
Zon
(waardes)
object
velden
voorbeeld
?

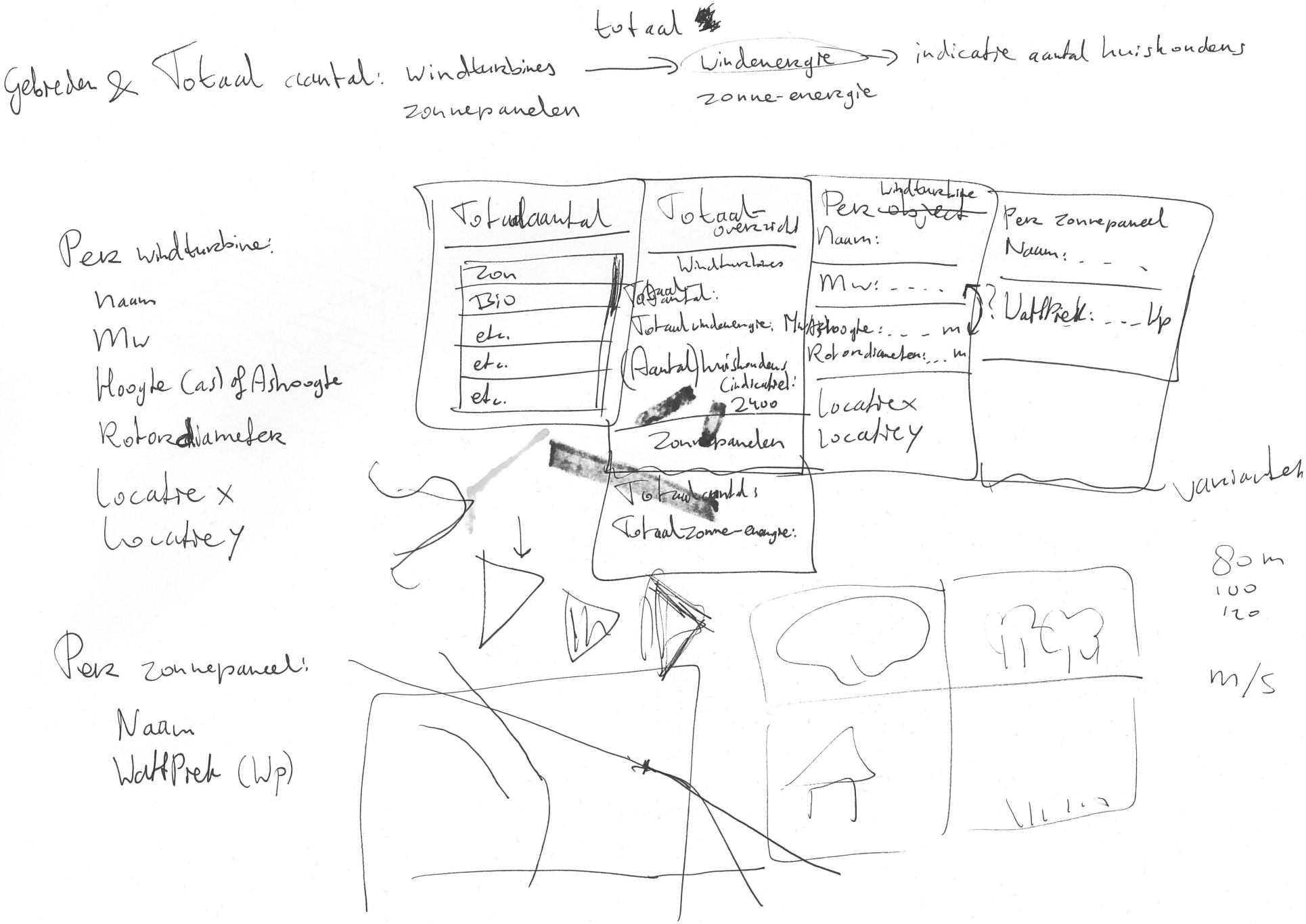


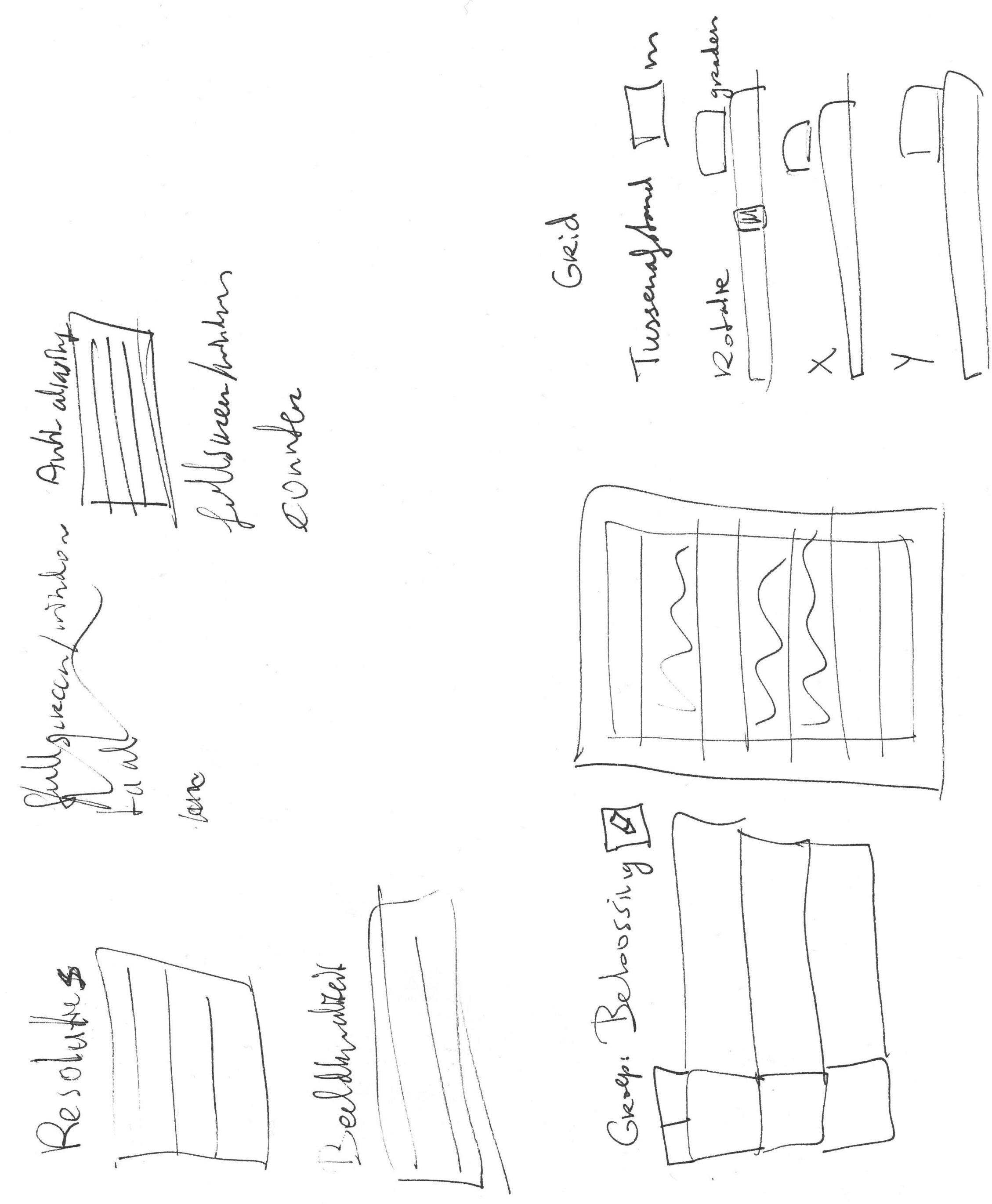
- resoluties
- beeldkwaliteit
- fullscreen
- taal
- ~~sluit applicatie~~
- tilde-informatie
- anti-aliasing
- controls (?)
- contact informatie (?)




objecten
windturbines
zonnepanelen
terrein
instellingen
import
bomen
etc.

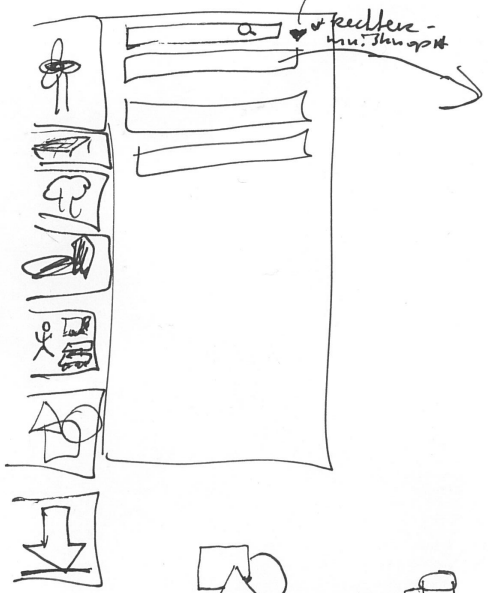

Gebouwen
aan | uit | zetten in landschap
Kleur
Satellietfoto
- Satellietfoto over dakvlakken
aan | uit
Foto op dak
Gebouwen tonen in landschap
aan | uit
Skydome
hemelbol
Wolkenverstoring aan | uit
laad
ontlaad
- tint
- emissie/uitstraling
- vermenging
- Rotatie/Roteren
- Waterdoorzichtigheid
Water
Water tonen in landschap
aan | uit
Simpel | mooi Water
Waterkleur 1
" 2
" 3
" 4
Waterhoogte m
Zeewaterhoogte m
Golfmeetwaterhoogte m
Wind
N
W
O
Z
45°
of
45°
Windsnelheid: m/s
Wind ecosystemen aan | uit
Windsnelheid: m/s
Windkracht
80/100/120
Opacity
- Waterkleur
- Waterreflectiekleur
- Spiegelingskleur ?
- "Clear colour" ?

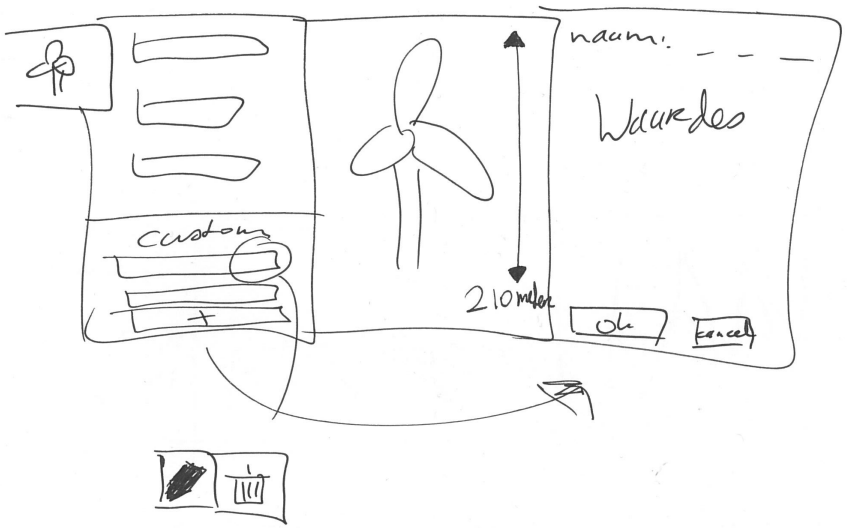

totaal
Gebieden & Totaal aantal: windturbines
zonnepanelen
windenergie
zonne-energie
indicatie aantal huishoudens
Per windturbine:
Naam
Mw
Hoogte (as) of Ashoogte
Rotordiameter
locatie x
locatie y
Per zonnepaneel:
Naam
WattPiek (Wp)
Totaalaantal
Zon
Bio
etc.
etc.
etc.
Totaal-overzicht
Windturbines
Totaalaantal:
Totaal windenergie:
(Aantal) huishoudens (indicatie):
2400
Zonnepanelen
Totaalaantal:
Totaal zonne-energie:
Per windturbine
Naam:
Mw: ....
Rotordiameter: ... m
locatie x
locatie y
Per zonnepaneel
Naam: ...
WattPiek: ... Wp
varianten
80 m
100
120
m/s

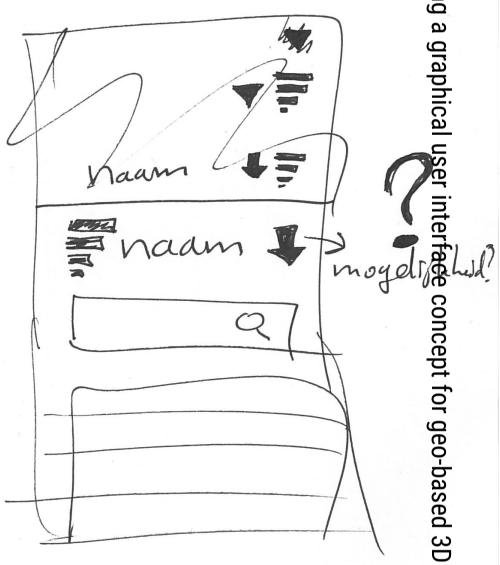


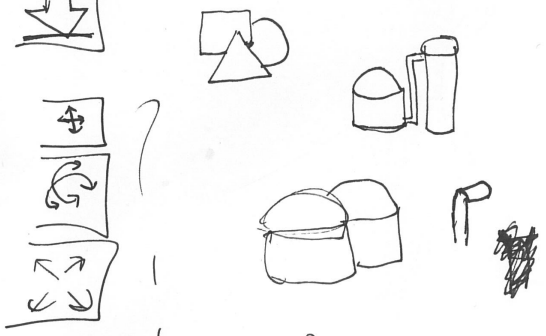
- Kunnen windmolens gegroepeerd worden op soort?

sorteer op...



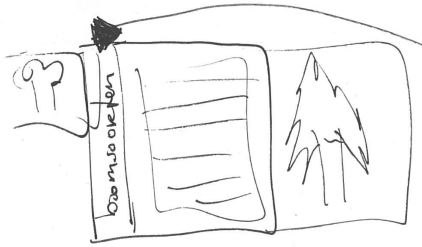






- roteer 45°
- centreer op terrein

- import
- basisvormen



etc.

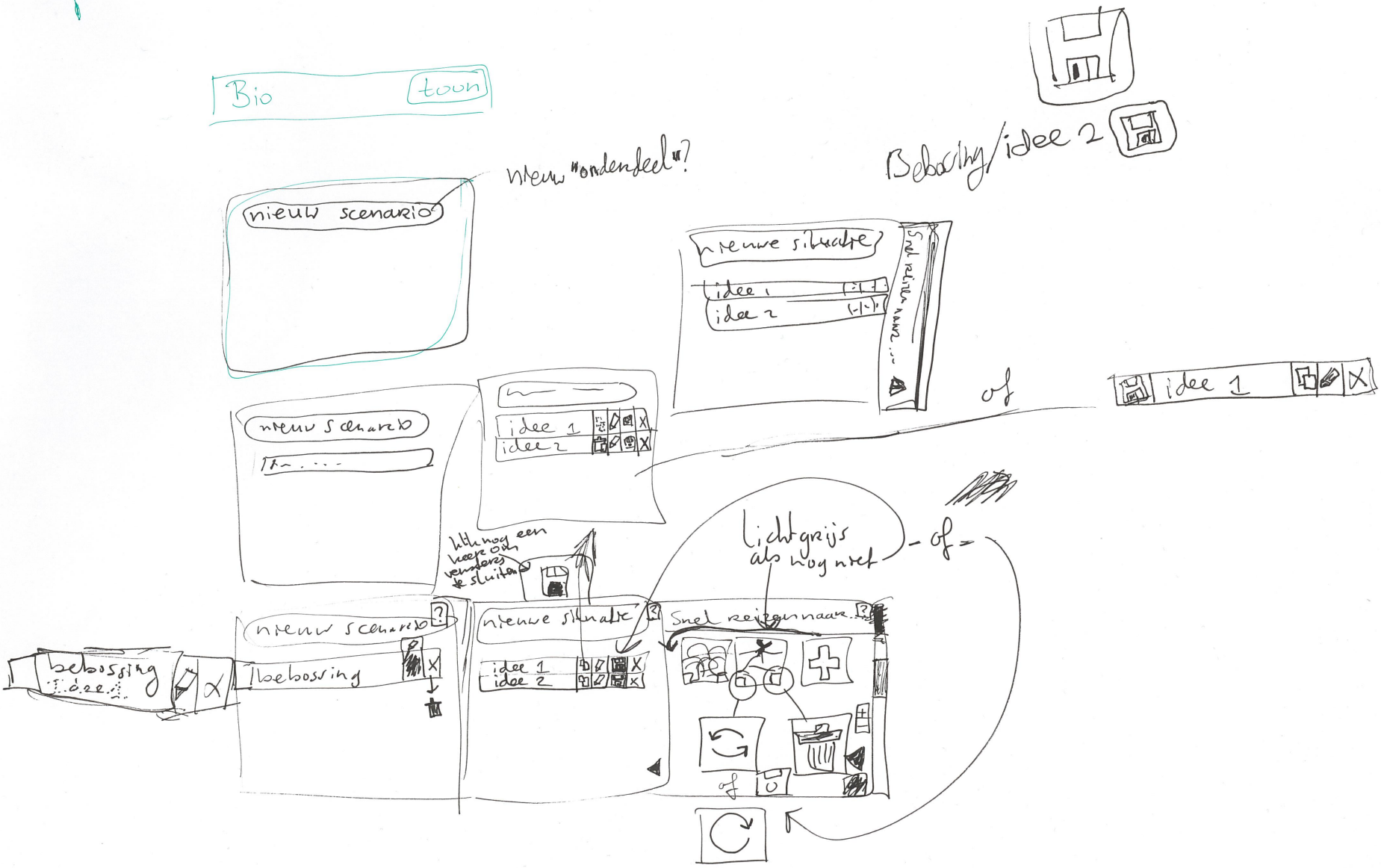
Paallengte

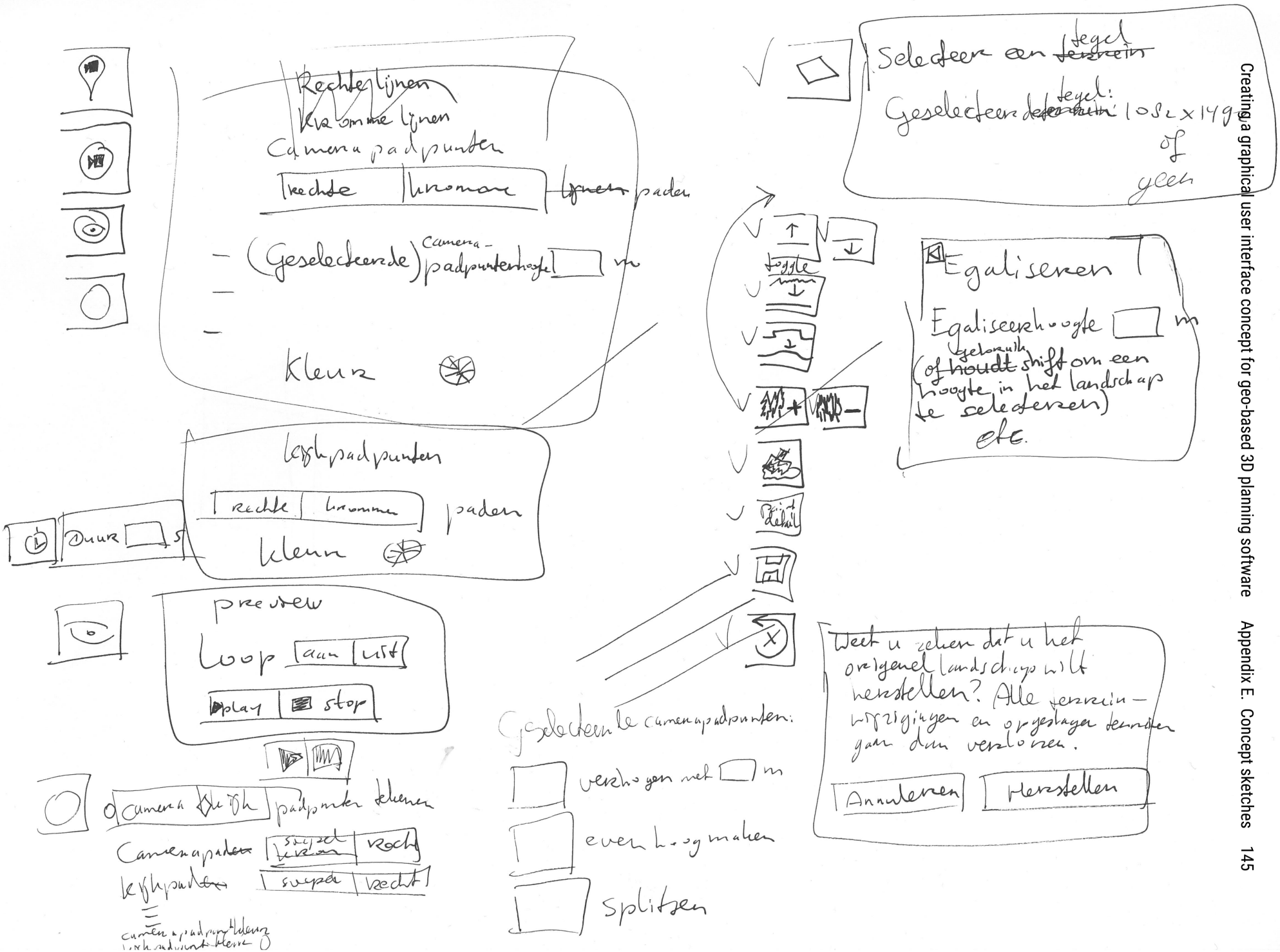
Breedte paalonderkant
Breedte bovenkant
Lengte paalonderkant

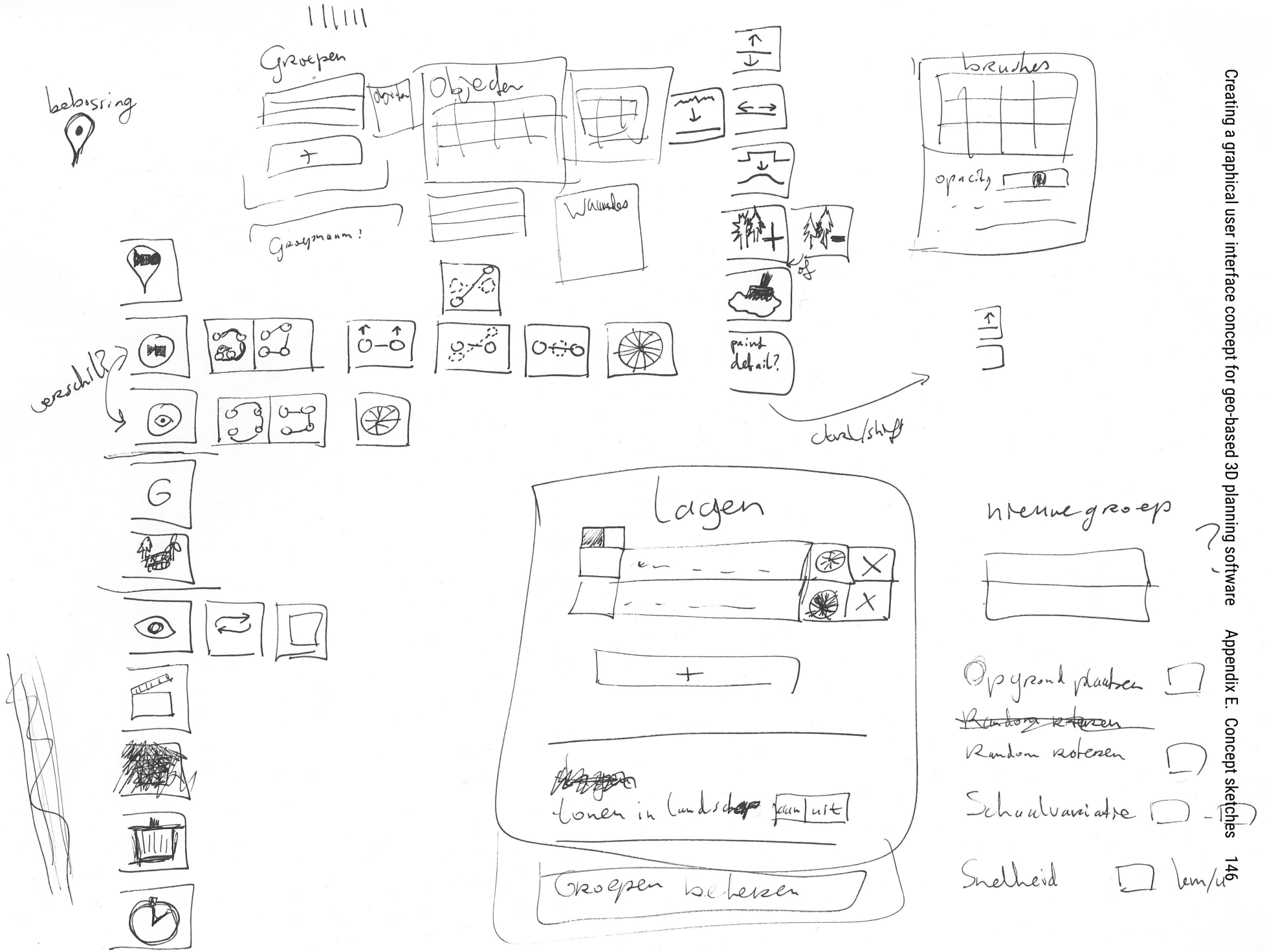
Wiellengte

2 of 3 wielen

- scenario verdeeld in categorieën/groepen.
- per groep kun je een situatie kiezen.
- je kunt per situatie de locatie vastleggen voor fast-travel.




Rechte lijnen
Kromme lijnen
Camera padpunten
Rechte
Kromme
lijnen
paden
(Geselecteerde) Camera-padpuntenhoogte
m
Kleur
Selecteer een tegel
Geselecteerde tegel: 10 x 14 m
of
geen
Egaliseren
Egaliseerhoogte
m
(gebruik shift om een hoogte in het landschap te selecteren)
etc.
Looptijd
s
Rechte
Krommen
paden
Kleur
preview
Loop
aan
uit
play
stop
camera
padpunten
Camera paden
Rechts
Links
Geselecteerde camera padpunten:
verschuiven met
m
even hoog maken
Splitsen
Weet u zeker dat u het oorspronkelijke landschap wilt herstellen? Alle tussentijdse wijzigingen en opgeslagen bestanden gaan dan verloren.
Annuleren
Herstellen


Groepen
Objecten
Groepnaam!
brushes
opacity
paint detail?
lagen
Opgrond plaatsen
Random roteren
Schaalvariatie
Snelheid
km/u

Appendix F

Concept description

Algemeen

- Knoppen zoals ‘maken’ of ‘bewerken’ zijn inactief als er nog niet aan de voorwaardes voldaan is om deze handelingen uit te voeren.
- Lijsten die anders te lang worden krijgen een scrollbalk.
- Groepsnamen wijzigen kan ook door te dubbelklikken op een naam.
- Knoppen die een venster openen worden gekleurd. Opnieuw op deze knop klikken sluit het bijbehorende venster weer.

Bovenmenu en rechtermenu (blauw)

Het bovenmenu begint voor een nieuwe gebruiker met alleen 1, 7, 8 en 9 actief. Alle overige knoppen zijn grijs om aan te geven dat ze inactief en daarmee niet-klikbaar zijn. Dit mechanisme zou ervoor moeten zorgen dat gebruikers niet meer op zoek hoeven naar waar ze mee moeten beginnen. Uiteraard kan er ook voor gekozen worden om standaard op ‘vast aantal laden’ of ‘afstand laden’ te staan, waardoor het niet langer nodig is om te beginnen met inactieve knoppen, maar aan de andere kant is het misschien juist goed om gebruikers aan het begin kennis te laten maken met het tegelvenster.

1

In het tegelscherm kan aangegeven worden op welke manier een gebruiker de tegels wil laden. ‘Vast aantal laden’ leidt naar 1a, ‘afstand laden’ leidt naar 1b. ‘Vast aantal laden’ of ‘afstand laden’ selecteren en een waarde opgeven leidt tot het actief maken van alle knoppen. Het handmatig selecteren en laden van knoppen leidt ook tot het actief maken van alle knoppen.

2

Het opslaanvenster begint met een lijst met tabbladen. Als deze lijst leeg is, is er enkel een knop met een plusje om een nieuw tabblad aan te maken. Dit leidt naar het venster met ‘tabbladnaam:’ om een naam op te geven. Een geselecteerd tabblad (hier te zien aan de groene kleur) opent een bijbehorend venster met een scenariolijst, hier getiteld ‘scenario’s voor bebossing’. Het plusje bij ‘scenario’s voor…’ leidt naar het kiezen voor een scenarionaam.

2a

Laat een lijstje van twee scenario’s zien, evenals het snelreizenvenster. De opslaanicoontjes, zowel in het scenariosvenster als het snelreizenvenster, zijn inactief, zie 2b, wanneer er niks is om op te slaan en actief wanneer er wel iets opgeslagen kan worden.

2c

‘Bebossing’ is het tabblad waarin opgeslagen wordt, te zien aan de groene selectie.

2d

Onder de oplaanknop staat een herinnering in welk tabblad en scenario er wordt opgeslagen. Fijn zou zijn als dit ook als knop zou kunnen dien om snel op te kunnen slaan.

3

Geeft de cameralocatie live weer.

4

De kaart kan nog steeds met muisbewegingen bewogen worden, maar er zijn knoppen toegevoegd voor gebruikers die meer houvast nodig hebben. Er is de mogelijkheid om een miniatuurkaart aan te zetten, welke leidt naar 4a.

4a

Deze miniatuurkaart wordt geplaatst in de rechterbovenhoek van het scherm en blijft ook na het inactief maken van de kaartknop in beeld. De kaart kan afgesloten worden door op het kruisje te klikken of door ‘miniatuurkaart’ via het grote kaartvenster weer op ‘uit’ te zetten.

4b

Functioneert hetzelfde als de 4a, maar wordt linksboven in de hoek geplaatst.

5

Datalagen (allemaal zonder groep) staan hier in een lijst. Alle datalagen kunnen geselecteerd worden door op het blauwe vakje naast ‘geen groep’ te klikken en weer gedeselecteerd worden door op het witte vakje daarnaast te klikken.

5a

Door op ‘+ nieuwe groep’ te klikken wordt een venster geopend om de groep een naam te geven.

5b

Door op het wijzigicoon naast de nieuwe groep te klikken, wordt de datalagengroepsselectie geopend. Gebruikers kunnen hier kiezen welke lagen er in de geselecteerde groep moeten.

5c

Drie lagen zijn aan de groep ‘riviergebied’ toegevoegd.

5d

De datalagengroepsselectie toont welke lagen er al geselecteerd zijn voor de selectie.

6

Het menu begint met enkel het eerste venster, waarna een gebruiker kan kiezen het totaaloverzicht te zien of de statistieken per tabblad. Hier is gekozen voor het totaaloverzicht, wat leidt naar de toevoeging van het tweede venster; een overzicht van alle windturbines en zonnepanelen. Het klikken op ‘overzicht per windturbine’ leidt naar een derde venster met een lijst met alle windturbines. Hier kan een windturbine uit geselecteerd worden, wat leidt naar het vierde venster.

6a

Hier is gekozen voor het tabblad ‘wind’. Dit leidt naar een totaaloverzicht. Klikken op ‘overzicht per zonnepaneel’ leidt naar het derde venster.

7

Hier staan de instellingen. De drie opties rechtsonder zijn voor de verschillende wensen van nieuwe mensen en bekenden met het programma. ‘Met tegels laden beginnen’ aanzetten, dwingt de gebruiker eerst tegels te laden voordat alle knoppen worden vrijgegeven. ‘Knoppen inactief maken’ bepaalt of knoppen die nog geen functie kunnen uitvoeren wel of niet inactief zijn.

8

Het helpvenster toont de toetsenindeling. Hier is een voorbeeld te zien waarbij niet alle knoppen/functies zijn toegevoegd. Dit zou eventueel ook een lijst met toetsen en functies kunnen zijn, dus zonder een afbeelding van alle toetsen.

Voor mensen die echt moeite hebben met nieuwe programma’s zou het een optie kunnen zijn om een functie toe te voegen waarbij er een pop-upvenster naast de muis verschijnt wanneer er over een knop wordt gezweefd voor langer dan een paar seconden. In dit venster zou dan een uitleg kunnen staan over de functie van de knop.

Voor mensen die weten wat ze willen, maar niet weten waar ze dit precies kunnen bereiken, zou de ‘ik wil graag…’ handig zijn. Klikken ze bijvoorbeeld op ‘windturbines in het landschap plaatsen’, dan worden ze doorgestuurd naar de objectencategorie en wordt de lijst met windturbines opengezet.

9

Geeft de gebruiker de mogelijkheid om het programma af te sluiten.

10

Onderdeel van het snelmenu. Is gelijk aan de ‘i’ uit het huidige snelmenu.

11

Onderdeel van het snelmenu. Is gelijk aan de rolmaat uit het huidige snelmenu. Als 12 actief wordt gemaakt dan wordt deze weer inactief.

12

Onderdeel van het snelmenu. Is gelijk aan de liniaal uit het huidige snelmenu. Als 11 actief wordt gemaakt dan wordt deze weer inactief.

13

Onderdeel van het snelmenu. Drapeert het grit over het landschap.

14

Leidt naar een lijst met functies die ook aan het snelmenu toegevoegd kunnen worden voor personalisatie van het programma.

15

Knoppen verschijnen enkel wanneer een object geselecteerd is. Knoppen zijn voor bewegen, roteren en schalen.

16

Geeft de objectinformatie van een geselecteerd object weer.

17

Geeft de mogelijkheid om een ecosysteem bij een geselecteerde marker te kiezen.

Objectencategorie (groen)

1

Geeft een lijst met windturbines weer, waarbij er onderscheidt wordt gemaakt tussen bij het programma behorende windturbines en zelfgemaakte windturbines. Windturbines kunnen ook zelfgemaakt worden via dit venster.

1a

Met het pijltje linksboven kan het venster uit 1 ingeklapt worden, waarna het in 1a verandert.

1b

Wanneer er over een windturbinenaam wordt gezweefd met de muis komt er een voorbeeld en specificaties van de windturbine in een venster ernaast te staan. Deze verdwijnt weer wanneer de muis weggaat. Er kan met een andere kleur worden aangegeven dat er momenteel boven een bepaald object wordt gezweefd, maar dit kan ook weggelaten worden.

1c

Een object is geselecteerd en zou nu in het landschap geplaatst kunnen worden.

1d

Ingeklapte 1c. De titel geeft aan dat er een object geselecteerd is.

1e

Venster voor het zelfmaken van een windturbine.

1f

Als er voldoende waardes zijn ingevuld om een live-voorbeeld te creëren, dan wordt een venster geopend met een live-voorbeeld.

1g

Een zelfgemaakte windturbine kan ook weer gewijzigd worden.

2

Venster voor zonnepanelen. Werkt hetzelfde als het menu voor windturbines.

2a

Enkel het invoerscherm voor het zelfmaken van een zonnepaneel verschilt.

3

Lijst met soorten vegetatie. Deze lijst is een voorbeeld.

3a

Ingeklapte 3.

3b

Na het selecteren van een soort vegetatie volgt een lijst met bijbehorende objecten.

3c

Ingeklapte 3b. Selectie van loofbomen staat aangegeven.

3d

Voorbeeld bij het zweven over de ‘eik’.

3e

Ingeklapte 3e. Bij loofbomen is nog niks geselecteerd.

3f

Eik is geselecteerd uit de loofbomenlijst.

3g

Ingeklapte 3g. Een eik is geselecteerd, te lezen aan de zijkant.

Veldencategorie (paars)

1

1 selecteren maakt de knop gekleurd en actief. Hierna kunnen er markers in het landschap geplaatst worden.

2

2 selecteren maakt de knop gekleurd en actief. Hierna kunnen er padpunten in het landschap geplaatst worden.

3

Laat de gebruiker een keuze maken tussen een groep of een ecosysteem plaatsen.

4

Als er nog geen groep is aangemaakt is hier enkel de knop om een nieuwe groep te maken te vinden.

4a

Een groep kan enkel aangemaakt worden als er een groepsnaam ingevuld wordt en een groepssoort gekozen worden. Er staan geen namen bij de groepssoorten omdat bij het testen werd aangegeven dat de afbeeldingen duidelijk genoeg waren.

4b

Een nieuw aangemaakte groep wordt geselecteerd. Als er één groep geselecteerd is kan er naar 5 gegaan worden, gezien een groep selecteren de objectknop actief maakt.

4c

Een groep kan bewerkt worden, maar enkel nog de naam kan veranderd worden.

4d

Een ongeselecteerde groep.

5

Als er nog geen objecten geselecteerd zijn dan is dit scherm te zien.

5a

Eerst kan er een objectcategorie geselecteerd worden.

5b

In het geval van vegetatie kan er daarna ook gekozen worden uit het soort vegetatie.

5c

Na het selecteren van een soort vegetatie volgt een lijst met bijbehorende objecten.

5d

Na het selecteren van een object wordt een waardenvenster geopend. Dit venster heeft drie versies, en welke versie wordt gebruikt hangt af van welke groepssoort gekozen is.

5e

Een geselecteerd object.

5f

De waardes van een object kunnen altijd weer gewijzigd worden.

6

De locatieknop en plaatsingsknop worden actief zodra er een object in een groep is geselecteerd. De locatieknop selecteren opent het venster waarmee de paarse vlakjes verplaatst kunnen worden. De plaatsingsknop, het vinkje, plaatst in het veld van de geselecteerde marker de objecten van de groep.

7

Zodra er objecten zijn geplaatst kan deze actie ook ongedaan gemaakt worden met de een-na-laatste knop en de prullenbak verwijdert alle objecten weer uit het veld. Zolang er aan alle voorwaardes wordt voldaan blijven alle knoppen actief. Maar niet een groep selecteren zal bijvoorbeeld de objectenknop, locatieknop en plaatsingsknop weer inactief maken. Dit begeleidgedrag kan uitgezet worden in het helpvenster van 8 (bovenmenu).

8

Er is nog geen ecosysteem en de gebruiker kan enkel een nieuwe aanmaken.

8a

Een nieuw ecosysteem kan aangemaakt worden nadat een naam is opgegeven en een ondergrond uitgekozen.

8b

Na het aanmaken van een ecosysteem is deze automatisch geselecteerd waarna het tweede venster rechts opent. In dit venster kunnen nieuwe groepen worden aangemaakt. Een groep is nodig om een nieuw object te kunnen aanmaken. De tekst met een plaatje ervoor zijn hier objecten. ‘Gras’ en ‘water’ zijn groepen.

Als er een nieuwe groep moet worden gemaakt, zoals hier gebeurt, dan opent een venster om de groepsnaam op te geven.

Op ‘+ Nieuw object’ klikken opent het rechtervenster, waar een groep en dimensies geselecteerd kunnen worden.

8c

Op ‘verdeling’ klikken opent het venster waar alle percentages verdeelt zitten. Gebruikers kunnen hier percentages toewijzen aan groepen en objecten. Bovenaan staan alle groepen, daaronder per groep alle objecten.

9

Hier kan een gebruiker aangeven op wat voor manier ze willen selecteren; alles in het terrein of handmatig markers selecteren.

10

Als er een of meerdere markers geselecteerd zijn waaraan ook ecosystemen zijn toegewezen, dan kunnen deze geplaatst worden met de knop met het vinkje erop.

11

De opslaanknop kan gebruikt worden om geplaatste ecosystemen op te slaan.

11a

Dit is hoe de knop eruitziet als er niks kan worden opgeslagen.

11b

De oplaanknop werkt alleen als ‘automatisch opslaan’ op ‘uit’ staat. Zodra deze op ‘aan’ staat dan is de opslagknop niet meer te gebruiken.

Met de prullenbakknop kunnen geplaatste ecosystemen weer verwijderd worden.

Terreincategorie (geel)

1

De eerste knop laat je een tegel selecteren.

2

Laat gebruikers een boomvariant kiezen en andere eigenschappen instellen.

3

Laat gebruikers bomen verwijderen.

4

Menu voor het verhogen van het terrein.

5

Menu voor het verlagen van het terrein.

6

Menu voor het egaliseren van het terrein.

7

Menu voor het gladstrijken van het terrein.

8

Deze opties hebben nooit goed gewerkt bij mij. Vandaar het ontbreken van een menu.

9

Klikken op de opslaanknop slaat wijzigingen op en is alleen actief als er wijzigingen zijn aangebracht.

10

Zet het terrein terug naar het originele landschap.

Eigenschappencategorie (oranje)

1

Alle visuele opties voor windturbines staan hier.

1a

Als alle verlichting uit staat kunnen er geen wijzigingen aan het licht worden toegebracht.

1b

Als er geen lichten knipperen kunnen er geen wijzigingen aan de knipperstandinstellingen worden toegebracht.

2

Alle visuele opties voor gebouwen zijn hier te vinden.

2a

Als ‘tonen in het landschap’ op ‘uit’ staat dan zijn er ook geen wijzigingen aan te brengen in de overige opties.

3

Alle visuele opties voor bomen zijn hier te vinden.

3a

‘Tonen in landschap’ staat uit.

4

Alle visuele opties voor water zijn hier te vinden.

4a

Als er geen water wordt getoond dan worden opties die invloed hebben op het water inactief.

5

Alle opties voor wind zijn hier te vinden.

5a

Een windkaart kan worden aangezet om de windsterktes te tonen.

6

Alle opties voor zon zijn hier te vinden.

6a

Tijdsverloop op ‘aan’ zetten maakt de balk actief om een snelheidswaarde op te geven.

6b

De datum kan geselecteerd worden door in een menu te klikken. De tijd kan met het toetsenbord worden ingevuld.

7

Zet alle soorten markers aan of uit in het landschap.

8

Hier zijn opties te vinden voor het vertonen van de topografische namen, hoogspanningsmasten en de hoogte van de resttegelwaarde.

9

Hier staan de opties voor de atmosfeer.

9a

Als er geen luchtafbeelding wordt gebruikt dan kan er ook geen nieuwe geselecteerd worden.

9b

Er kan uit een lijst met luchtafbeeldingen worden geselecteerd als het juiste pad is opgegeven.

9c

Een luchtafbeelding uit de lijst is geselecteerd, waarna op de knop ‘selecteren’ gedrukt kan worden.

9d

Het venster met een geselecteerde luchtafbeelding.

Animatiecategorie (rood)

1

Klikken op 1 maakt een screenshot.

2

Deze knop selecteren maakt de knop blauw en laat de gebruiker markers in het veld plaatsen. Deze markers zouden eigenlijk een onderscheidende factor van de andere markers moeten hebben.

3

Als 3 actief is kunnen er animatiepadpunten geplaatst worden. Ook kunnen er padpuntopties aangepast worden.

4

De tijd kan hier ingesteld worden voor de duur van het filmpje.

5

Kan speciale groepen maken en objecten toevoegen voor het animatiepad.

6

Een preview kan gespeeld worden. Enkel de stopknop blijft in het venster staan wanneer de preview wordt afgespeeld.

7

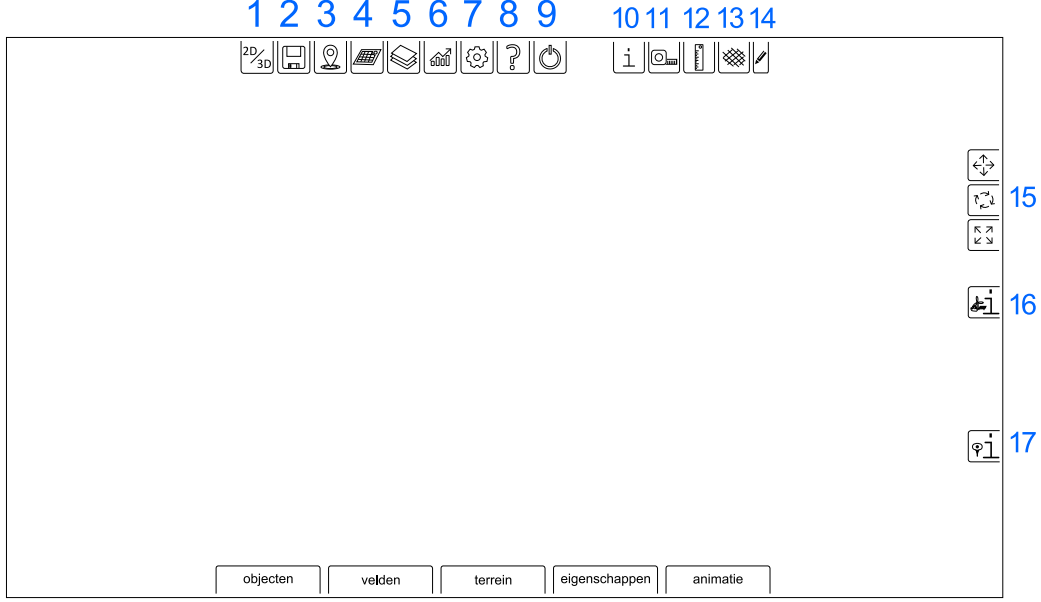
Rendert de film.

8

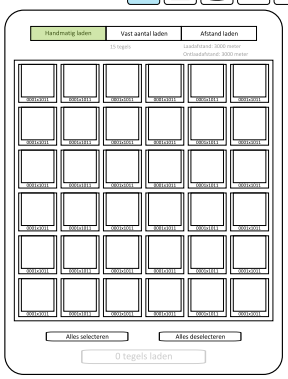
Verwijdert alle paden.

Appendix G

Design overview



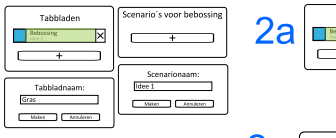
1



1a

1b

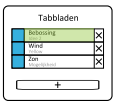
2



2a

2b

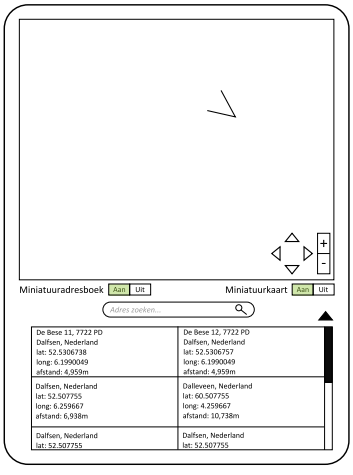
2c



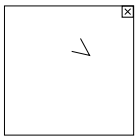
2d

3

4

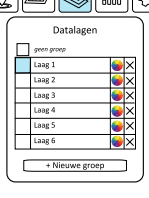


4a

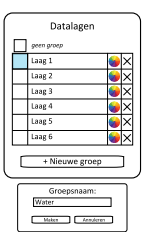


4b

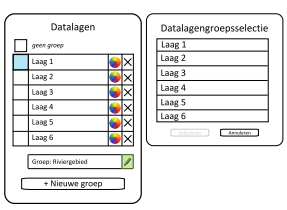
5



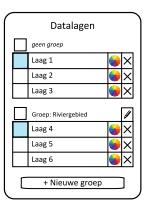
5a



5b



5c



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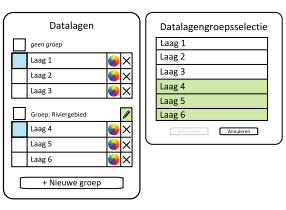

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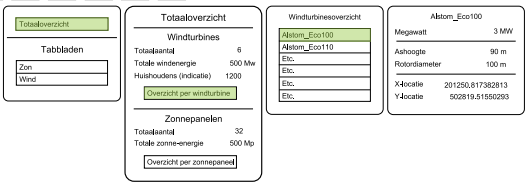
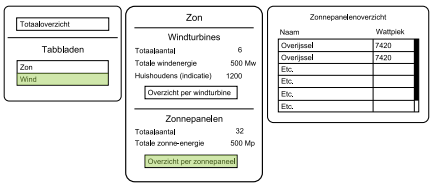


6a



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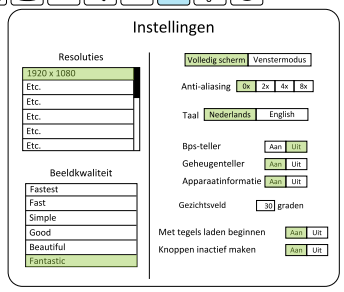

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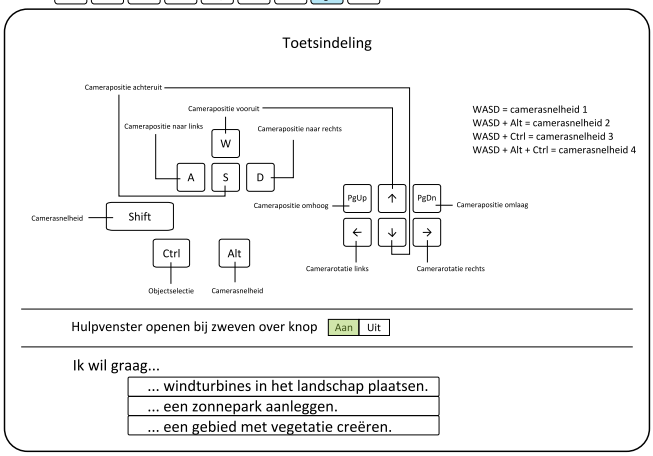

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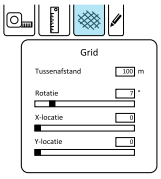

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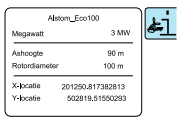

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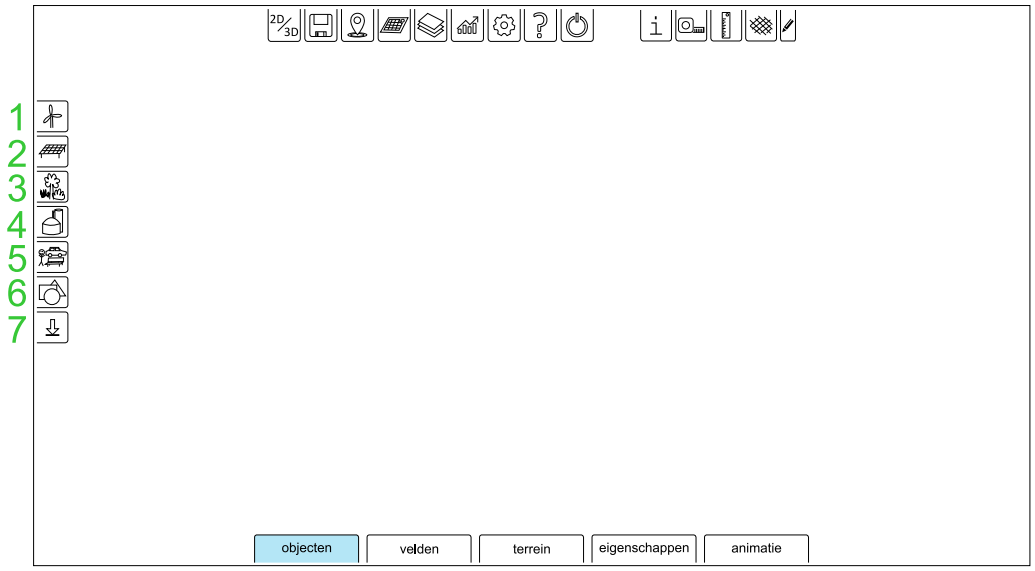
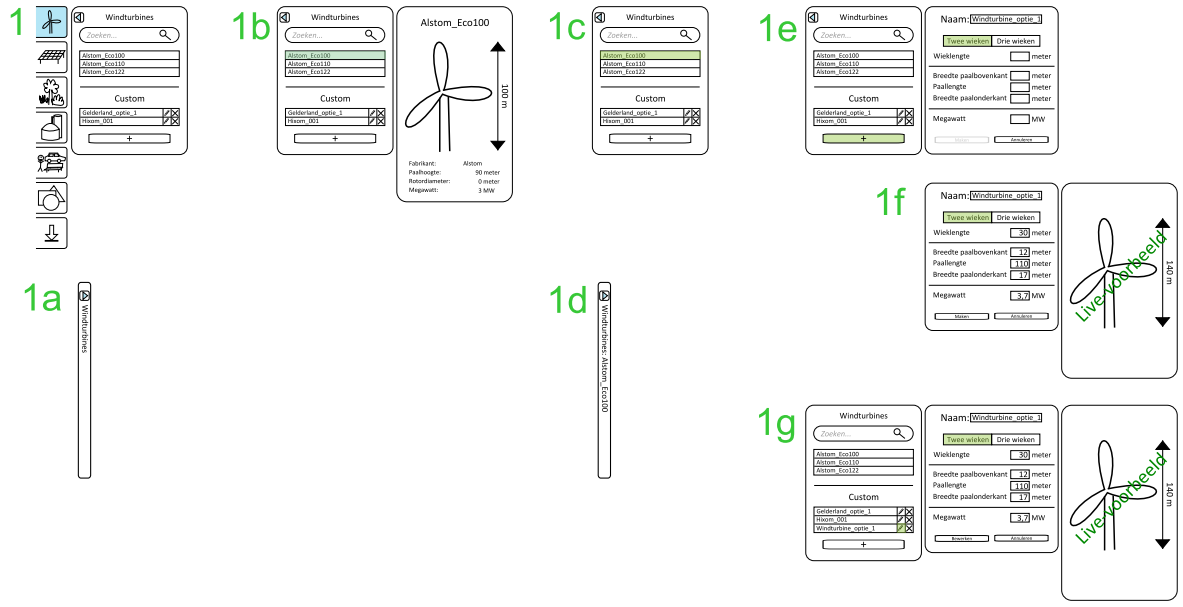
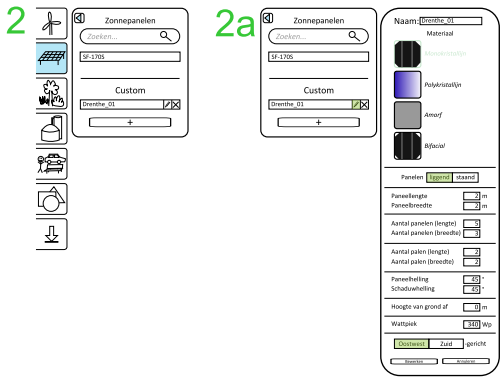
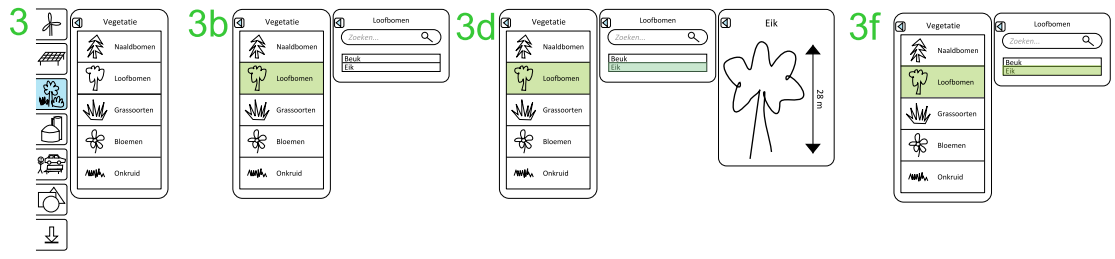
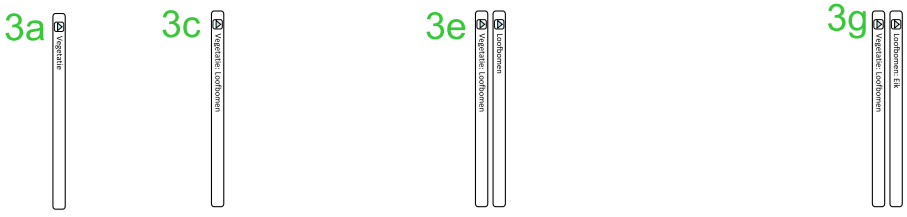
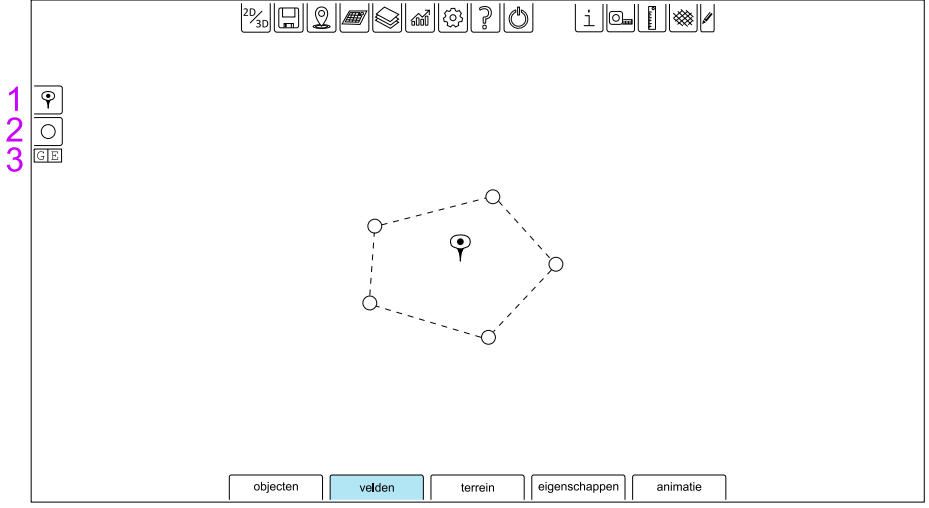

1
2
3
4
5
6
7
objecten
velden
terrein
eigenschappen
animatie

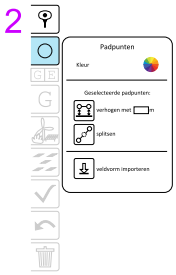

1
Windturbines
Zoeken...
Alstom_Eco100
Alstom_Eco110
Alstom_Eco122
Custom
Gelderland_optie_1
Hixom_001
1b
Alstom_Eco100
100 m
Fabrikant: Alstom
Paalhoogte: 90 meter
Rotordiameter: 0 meter
Megawatt: 3 MW
1c
1e
Naam: Windturbine_optie_1
Twee wieken
Drie wieken
Wieklengte meter
Breedte paalbovenkant meter
Paallengte meter
Breedte paalonderkant meter
Megawatt MW
1f
30 meter
12 meter
110 meter
17 meter
3,7 MW
Live-voorbeeld
140 m
1a
Windturbines
1d
Windturbines: Alstom_Eco100
1g
Windturbine_optie_1

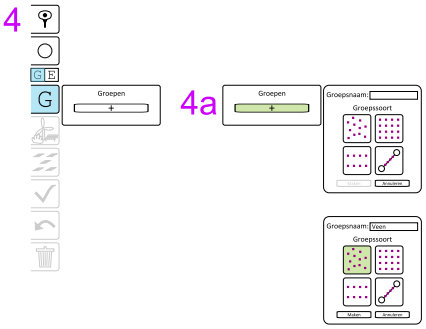

2
Zonnepanelen
Zoeken...
SF-1705
Custom
Drenthe_01
2a
Naam: Drenthe_01
Materiaal
Monokristallijn
Polykristallijn
Amorf
Bifacial
Panelen liggend staand
Paneellengte 2 m
Paneelbreedte 2 m
Aantal panelen (lengte) 5
Aantal panelen (breedte) 3
Aantal palen (lengte) 2
Aantal palen (breedte) 2
Paneelhelling 45 °
Schaduwhelling 45 °
Hoogte van grond af 0 m
Wattpiek 380 Wp
Oost-west Zuid gericht

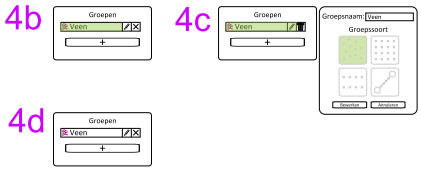

3
Vegetatie
Naaldbomen
Loofbomen
Grassoorten
Bloemen
Onkruid
3b
Loofbomen
Zoeken...
Beuk
Eik
3d
Eik
28 m
3f

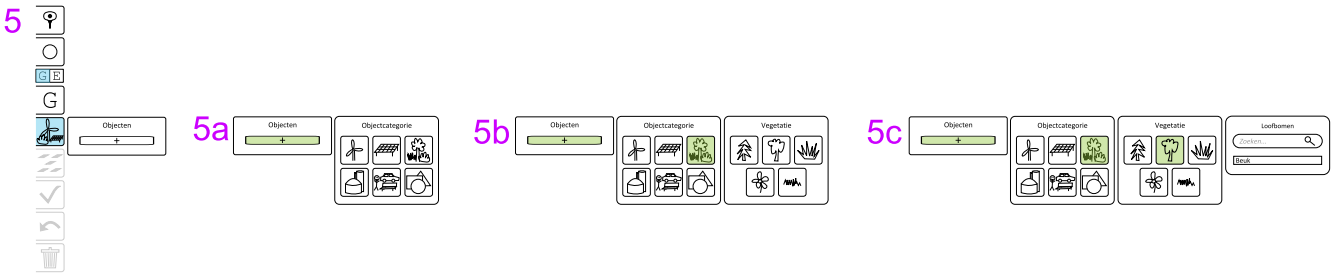

3a
Vegetatie
3c
Vegetatie: Loofbomen
3e
Loofbomen
3g
Loofbomen: Eik

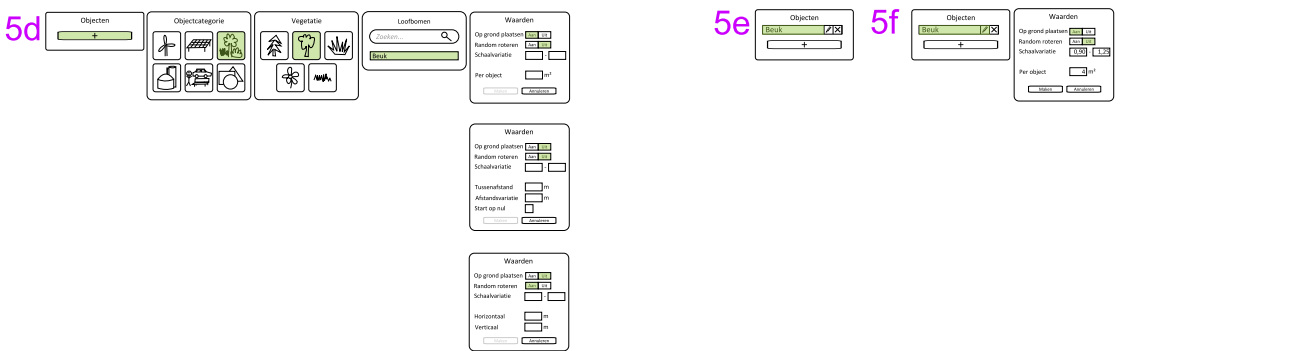

1
2
3
objecten
velden
terrein
eigenschappen
animatie


2
Padpunten
Kleur
Geselecteerde padpunten:
verhogen met
m
splitsen
veldvorm importeren

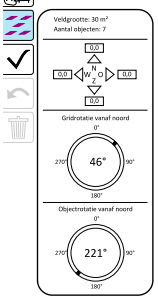

4
Groepen
4a
Groepen
Groepsnaam:
Groepssoort
Annuleren
Groepsnaam: Veen
Groepssoort
Maken
Annuleren


4b
Groepen
Veen
4c
Groepen
Veen
Groepsnaam: Veen
Groepssoort
Annuleren
Aanpassen
4d
Groepen
Veen


5
Objecten
5a
Objecten
Objectcategorie
5b
Objecten
Objectcategorie
Vegetatie
5c
Objecten
Objectcategorie
Vegetatie
Loofbomen
Zoeken...
Beuk

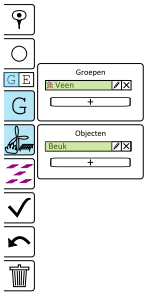

5d
Objecten
Objectcategorie
Vegetatie
Loofbomen
Zoeken...
Beuk
Waarden
Op grond plaatsen
Random roteren
Schaalvariatie
Per object
Maken
Annuleren
Waarden
Op grond plaatsen
Random roteren
Schaalvariatie
Tussenafstand
Afstandsvariatie
Start op nul
Maken
Annuleren
Waarden
Op grond plaatsen
Random roteren
Schaalvariatie
Horizontaal
Verticaal
Maken
Annuleren
5e
Objecten
Beuk
5f
Objecten
Beuk
Waarden
Op grond plaatsen
Random roteren
Schaalvariatie
0,90
1,20
Per object
4
Maken
Annuleren

6

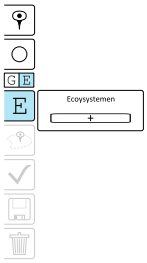


7

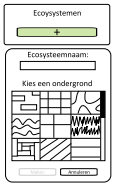
7a



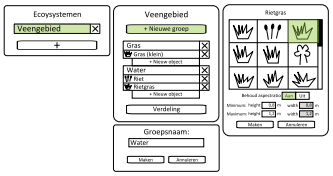
8



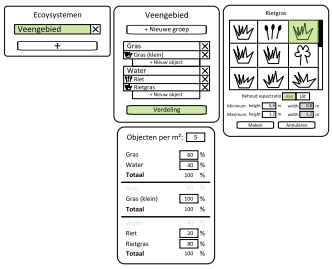
8a



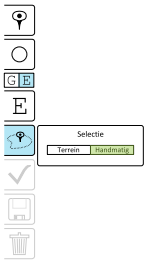
8b



8c

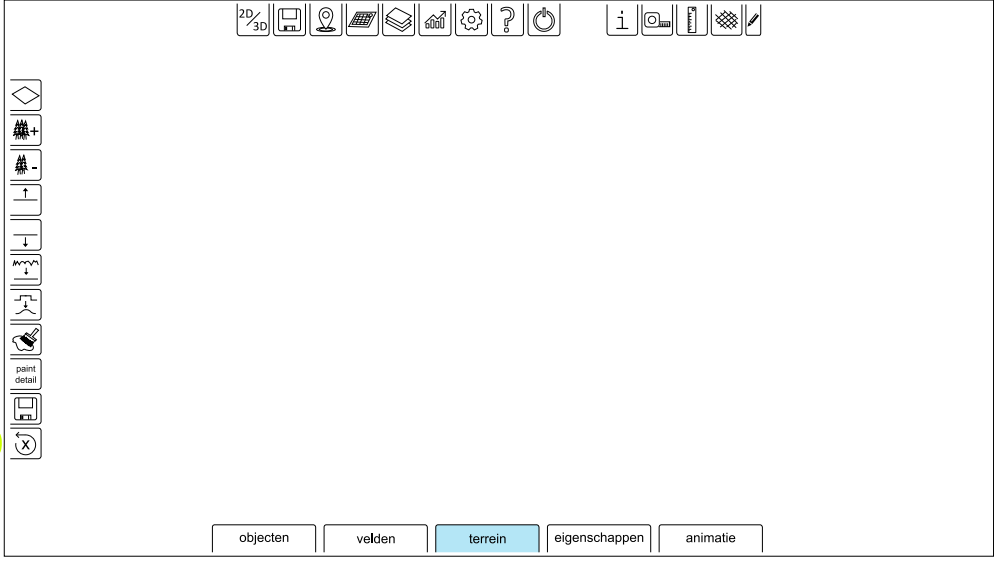


9



10

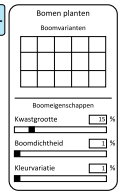
11


1
2
3
4
5
6
7
8
paint detail
9
10
objecten
velden
terrein
eigenschappen
animatie

1


Geselecteerde tegel: geen
Selecteer een tegel door op een tegel in het landschap te klikken.

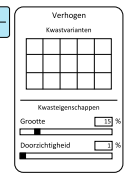
2


Bomen planten
Boomvarianten
Boomeigenschappen
Kwastgrootte 15 %
Boomdichtheid 1 %
Kleurvariatie 1 %

3


Bomen verwijderen
Boomeigenschappen
Kwastgrootte 15 %

4


Verhogen
Kwastvarianten
Kwasteigenschappen
Grootte 15 %
Doorzichtigheid 1 %

5


Verlagen
Kwastvarianten
Kwasteigenschappen
Grootte 15 %
Doorzichtigheid 1 %

6

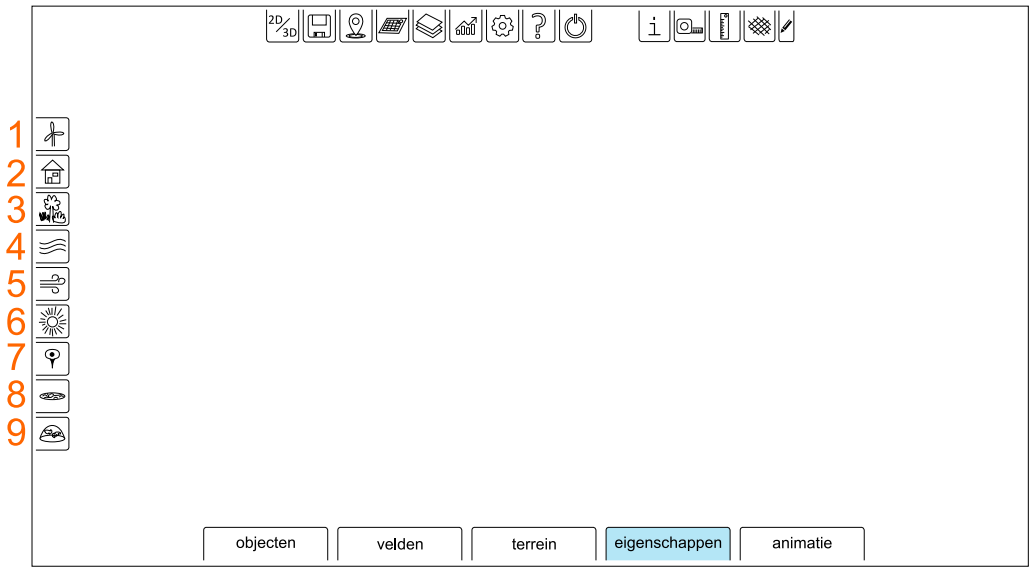

Egaliseren
Egaliseerhoogte 4 m
Kwastvarianten
Kwasteigenschappen
Grootte 15 %
Doorzichtigheid 1 %

7

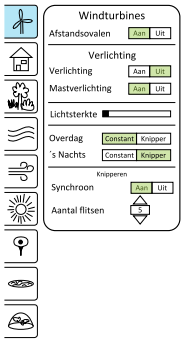

Gladstrijken
Kwastvarianten
Kwasteigenschappen
Grootte 15 %
Doorzichtigheid 1 %

10


Weet u zeker dat u het originele landschap wilt herstellen?
Alle terreinwijzigingen en opgeslagen terreinen gaan dan verloren.
Annuleren
Herstellen



1



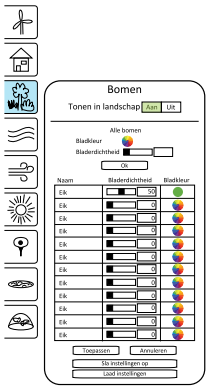
1a

1b

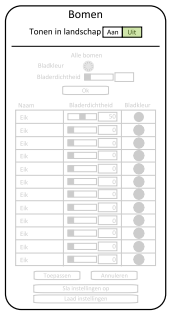
2

2a

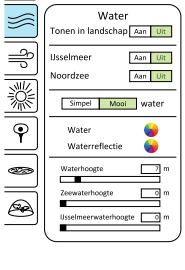
3



3a

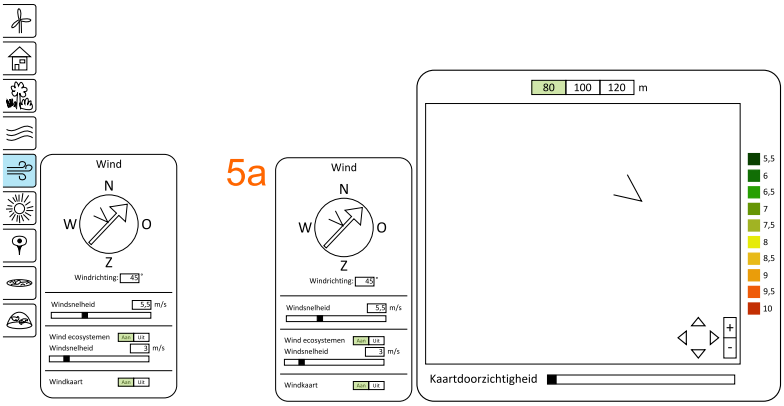


4

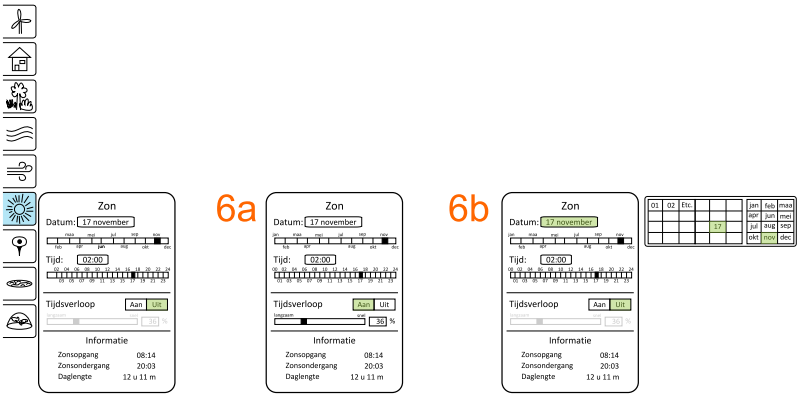


4a

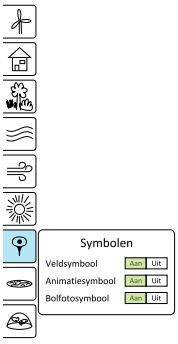
5


Wind
N
W
O
Z
Windrichting: 45°
Windsnelheid 5,5 m/s
Wind ecosystemen Aan Uit
Windsnelheid 3 m/s
Windkaart Aan Uit
5a
Wind
N
W
O
Z
Windrichting: 45°
Windsnelheid 5,5 m/s
Wind ecosystemen Aan Uit
Windsnelheid 3 m/s
Windkaart Aan Uit
80 100 120 m
5,5
6
6,5
7
7,5
8
8,5
9
9,5
10
Kaartdoorzichtigheid

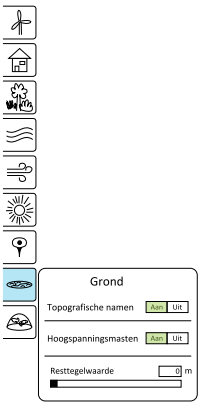
6


Zon
Datum: 17 november
Tijd: 02:00
Tijdsverloop Aan Uit
Informatie
Zonsopgang 08:14
Zonsondergang 20:03
Daglengte 12 u 11 m
6a
Zon
Datum: 17 november
Tijd: 02:00
Tijdsverloop Aan Uit
Informatie
Zonsopgang 08:14
Zonsondergang 20:03
Daglengte 12 u 11 m
6b
Zon
Datum: 17 november
Tijd: 02:00
Tijdsverloop Aan Uit
Informatie
Zonsopgang 08:14
Zonsondergang 20:03
Daglengte 12 u 11 m
01 02 Etc.
jan feb mrt
apr jun mei
jul aug sep
okt nov dec

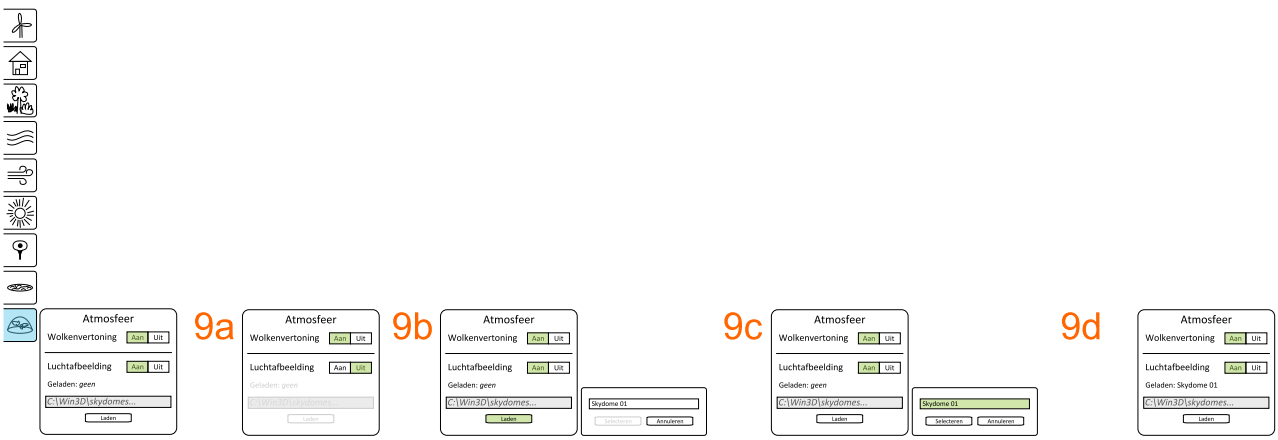
7

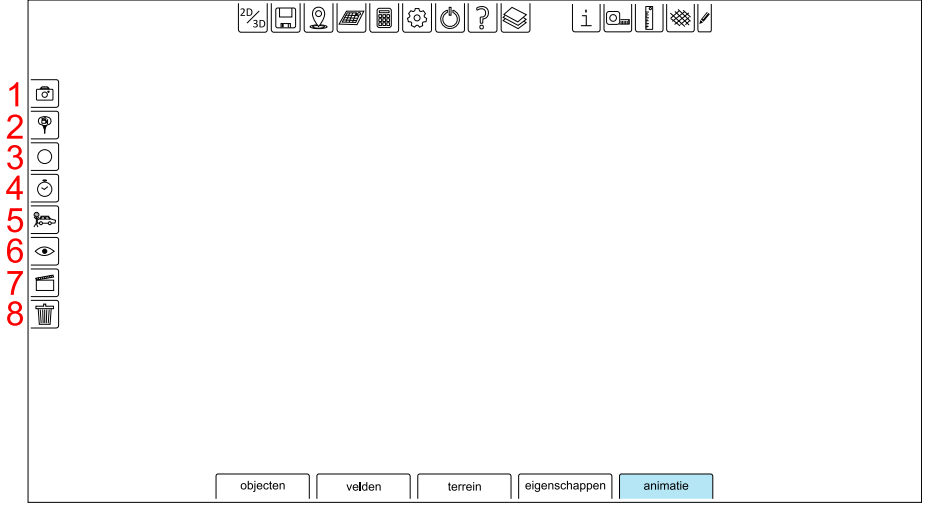

Symbolen
Veldsymbool Aan Uit
Animatiesymbool Aan Uit
Bolfotosymbool Aan Uit

8

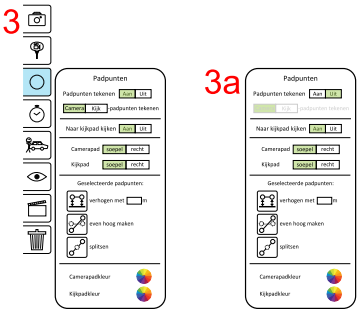

Grond
Topografische namen Aan Uit
Hoogspanningsmasten Aan Uit
Resttegelwaarde 0 m

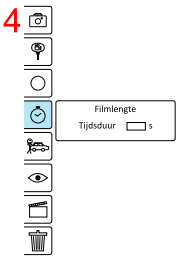
9

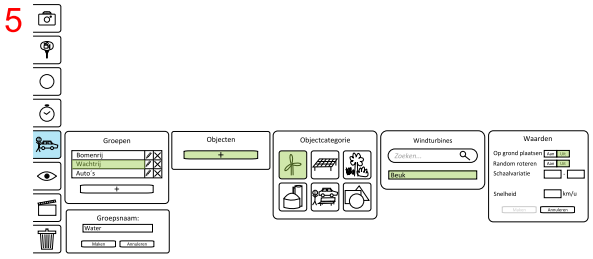

Atmosfeer
Wolkenvertoning Aan Uit
Luchtafbeelding Aan Uit
Geladen: geen
C:\Win3D\skydomes...
Laden
9a
Atmosfeer
Wolkenvertoning Aan Uit
Luchtafbeelding Aan Uit
Geladen: geen
C:\Win3D\skydomes...
Laden
9b
Atmosfeer
Wolkenvertoning Aan Uit
Luchtafbeelding Aan Uit
Geladen: geen
C:\Win3D\skydomes...
Laden
Skydome 01
Selecteren Annuleren
9c
Atmosfeer
Wolkenvertoning Aan Uit
Luchtafbeelding Aan Uit
Geladen: geen
C:\Win3D\skydomes...
Laden
Skydome 01
Selecteren Annuleren
9d
Atmosfeer
Wolkenvertoning Aan Uit
Luchtafbeelding Aan Uit
Geladen: Skydome 01
C:\Win3D\skydomes...
Laden

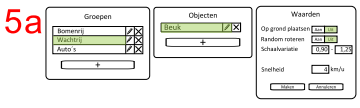

1
2
3
4
5
6
7
8
objecten
velden
terrein
eigenschappen
animatie

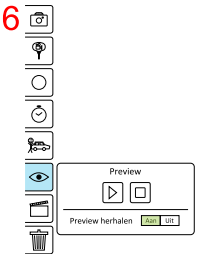

1
Schermafdruk
Kwaliteit
Laagst
Laag
Midden
Hoog
Hoogst
Maak schermafdruk


3
Padpunten
Padpunten tekenen
Aan
Uit
Camera
Kijk
padpunten tekenen
Naar kijkpad kijken
Camerapad
soepel
recht
Kijkpad
Geselecteerde padpunten:
verhogen met
m
even hoog maken
spiltsen
Camerapadkleur
Kijkpadkleur
3a
Padpunten
Padpunten tekenen
Aan
Uit
Naar kijkpad kijken
Camerapad
soepel
recht
Kijkpad
soepel
recht
Geselecteerde padpunten:
verhogen met
m
even hoog maken
spiltsen
Camerapadkleur
Kijkpadkleur


4
Filmlengte
Tijdsduur
s


5
Groepen
Bomenrij
Wachtrij
Auto's
Groepsnaam:
Water
Objecten
Objectcategorie
Windturbines
Zoeken...
Beuk
Waarden
Op grond plaatsen
Random roteren
Schaalvariatie
Snelheid
km/u


5a
Groepen
Bomenrij
Wachtrij
Auto's
Objecten
Beuk
Waarden
Op grond plaatsen
Random roteren
Schaalvariatie
Snelheid
km/u


6
Preview
Preview herhalen
Aan
Uit