PLANEAT APPLICATION REDESIGN

A USER-CENTERED INVESTIGATION AND REDESIGN OF THE PLANEAT APPLICATION

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ABSTRACT

This research aimed to identify how well does the current version of the PlanEat app supports the needs of its user base and how it can be improved in a redesign. The PlanEat app is operating on B2B market and is used by nutritionists, doctors and personal trainers for producing customized nutrition plans for their clients. The process of generation of the nutrition plan is based on complex algorithm which considers multiple variables to make the plan as precise as possible and therefore usable also for clinical practice. Unfortunately, the development of the algorithm surpassed the development of the user experience and user interface to that extent that potential users needs to take part in software trainings in order to use the app to its optimal capacity. Therefore, this user-based investigation set to identify users' needs, interface and functionality issues and use the results as a base for development of a new design of the app's interface. Since the numbers of people with obesity and consequential illnesses is on rise in Slovakia and other countries the demand for nutrition guidance rises as well. Improvement of the app's user interface and accommodation of other user's requirements should result in easier and more effective usage of the app and therefore support production of affordable nutrition plans and education in this area.

Content

1. INTRODUCTION

1.1 Executive summary

According to the *Organisation for Economic Co-operation and Development (OECD)*, more than one in two adults and nearly one in six children are overweight or obese and this trend has risen in past 5 years. (OECD, 2017, p.2) In order to prevent this growth is important to educate not only about healthy risks and consequences of obesity but also about nutrition and healthy eating habits.

PlanEat[1] is a company focused on improving the area of dietotherapy and the nutrition habits of people. They are developing a professional nutrition application, independent of any particular dietary practice, serving as a tool for creation of personalized nutrition plans. Within the app, professionals in a field of nutrition create dietary templates aimed for controlled weight loss, gain or stabilisation and medical conditions such diabetes or food intolerances and allergies. Users (e.g. doctors, nutritionists or personal trainers) are able to use the templates to produce nutrition plans customized for their clients.

By improving UX design of the software, users would produce nutrition plan more effectively and with better understanding. This would also result in time-savings which the users can spent on educating their clients about nutrition which is the sustainable goal in this area.

1.2 Problem statement

This research will examine the current PlanEat application, investigate the users' needs and wishes for a nutrition application, make prototype with proposed changes, evaluate the redesign and propose following changes until we have a product that will meet the users' needs. It all adds up to this problem statement:

> **How well does the PlanEat application currently support users' needs and how it can be improved in a redesign?**

To answer the problem statement, following research questions were created:

RQ1. Who are the users of the PlanEat application, and what is their current use of, and needs for, the app?

Besides investigating the use of the current app, the answer to this research question provided a list of requirements based on the users' needs. These requirements consisted of overall goals, interaction design requirements and information architecture requirements as well as requirements for user interface and visual design.

RQ2. How could the app be improved in a redesigned prototype to better meet the user base?

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[1] https://www.PlanEat.sk/en

The wireframe and visual design prototypes were based on the list of users' requirements in combination with a genius design approach and inspired by industry standards.

> **RQ3. How does the prototype meet the users' needs, and how can it iteratively be improved to meet the users' needs?**

The UI prototype was tested, and results will serve as a base for following improvement until the system will satisfy users' needs.

1.3   Significance & Contribution

Obesity and overweight is becoming a huge problem internationally. Last published statistics shown that 47% of men in Slovakia are overweight and 17% reached the state of obesity. The percentage of overweight women is 30% and of obese women is the same as for men 17%. Comparing to previous years these numbers are rising. (Statistical Office of the Slovak Republic, 2016, pp. 568 - 569) Overweight and obesity can cause high blood pressure, type 2 diabetes, coronary heart disease, some types of cancers and many more diseases. Generally, it can result in low quality of life, mental illness such as clinical depression, anxiety, body pain and difficulty with physical functioning. (Centers for Disease Control and Prevention, 2017)

This research aims to improve the user experience of the nutrition app PlanEat, which will allow produce nutrition plans more effectively with better comprehension. This could result in user's time savings, make nutrition plans more affordable for clients and improve the overall user – client relationship.

In a theoretical level, I believe that this study will contribute to the still new field of interaction design within the user experience. It will investigate the importance of early implementation of UX design fundamentals into software development by emphasizing the number of resources incurred in notion to rebuild the UX and UI of already built software.

2. RESEARCH APPROACH

This section will discuss possible choices as well as arguments for chosen approach that guided this research. Mackenzie & Knipe (2006) acknowledge the struggle of the right definition of the research approach, which early career researchers can encounter. I have found myself with the scope of this issue at the beginning of this research, however, through the study of broad literature sources I was able to identify the suitable approach for this research.

2.1 Research paradigm

Paradigm can be described as a theoretical framework for research that influences the way knowledge is studied or interpreted and sets the intent, motivation and expectation for the research. (Mackenzie & Knipe, 2006, p.) Mackenzie and Knipe state that the most used paradigms are positivist/postpositivist, interpretivist/constructivist, transformative and pragmatic. (2006, pp.193- 194)

Creswell defines pragmatic paradigm as the one that "arise out of actions, situations, and consequences rather than antecedent conditions (as in post positivism)" (1994, p.13). He states that instead on focusing on methods, researches use all approaches to understand the problem. Therefore, this approach opens the door for using multiple methods as well as different forms of data collection and analysis. (Creswell, 1994, pp.13-14) Martens describes pragmatic researchers as those who "decide what they want to study based on what is important within their personal value systems. They then study the topic in a way that is congruent with their value system, including units of analysis and variables that they feel are most likely to yield interesting responses." (2010, p.296). While Martens consider the transformative paradigm as a base for mix methods framework (2010, pp.296-298), Creswell highlights the similarities of the world view between mix-method researchers and pragmatists (1994, p.13). Mackenzie and Knipe (2006) confirm mix-method framework as they state that within the pragmatic paradigm, methods are matched to specific questions and purpose of research. They highlight that both quantitative and qualitative methods can be employed. The tools that are usually used may include both tools from positivist and interpretivist paradigm (e.g. interviews, observation, tests, visual data analysis, experiments etc.).

The research placed in the area of IS often struggles to balance the challenge of theoretical contribution and solving anticipated problems in practice. This is referred as the *rigor and relevance challenge*. Researchers, in notion to secure relevance of the research outcome are often collaborating with industry partners. Buckl, Matthes, Schneider & Schweda highlight that this collaboration often leads to a need for an early presentable result and provide *pattern-based design research* (PDR), to overcome this issue. Within this methodology," patterns can be understood as early stage design science artifacts observed in practice" (2013, p.73). Matthes et al. argue that patterns "enable researchers to build innovative artifacts that address current and anticipated problems of practitioners in an organizational context." (2013, p.73) In another words, using patterns established in methodologies and *design theory nexus* would allow researcher to theorize and contribute to the industry partner as well as perform rigorous and relevant research. (Matthes et al., 2013, p.73)

In order to achieve the theory nexus, Pries-Heje & Baskerville proposed four steps approach:

(1) alternatives evaluation – literature-based analysis of the different approaches available in the given area

(2) analysis - analyse approaches and methods to identify explicit or implicit conditions

(3) design - formulate approaches are assessed for practical relevance and reformulated accordingly

(4) implementation - develop tool that supports the evaluation regarding the fit for each design theory (Pries-Heje & Baskerville, 2008, pp.3-7)

The first step is discussed in chapter 3. Literature review and step 2-4 are discussed in the chapter 5. Methodology.

2.2   Research scope & Limitations

This research evolves within the field of *interaction design*. Interaction design can be tricky to define, mainly because its multidisciplinary nature. However, in one way it can be defined as the design of the interaction between users and products, most often of software products like apps or websites. The goal of interaction design is to "solve specific problems under a particular set of circumstances using the available materials." (Saffer, 2010, p.4) In another words, create products that enable the user to achieve their objective in the best way possible.

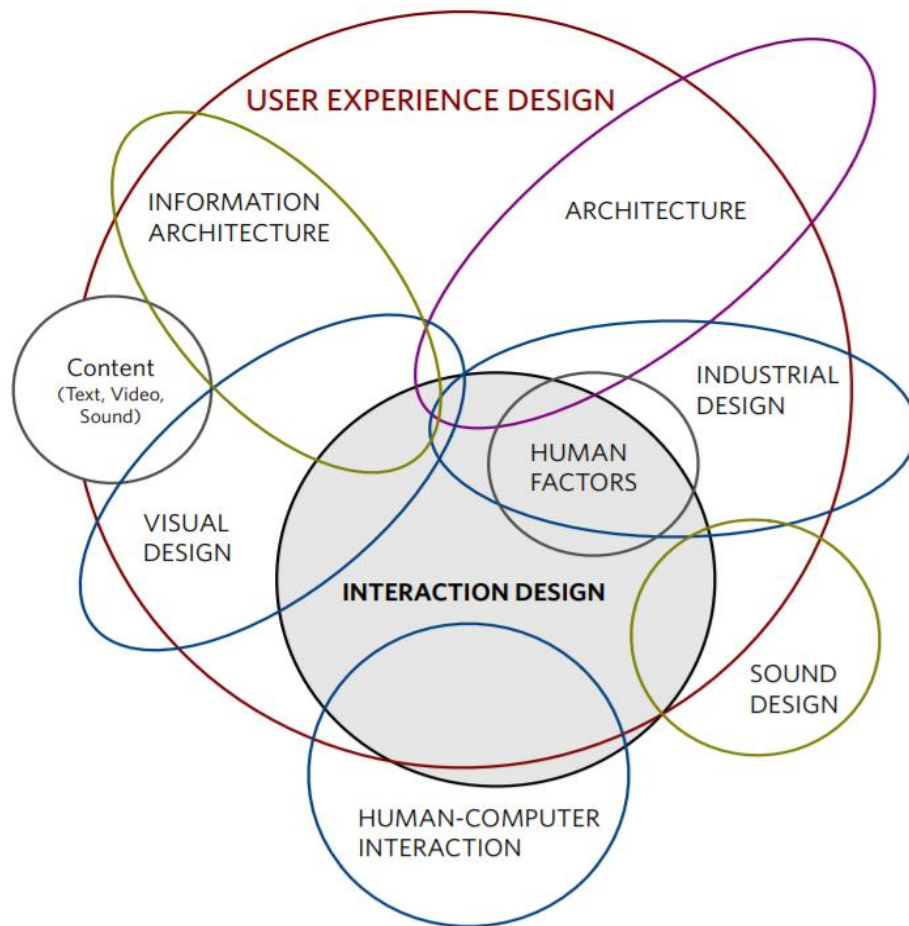FIGURE 1 THE DISCIPLINES SURROUNDING INTERACTION DESIGN. (SAFFER,2010, P.21)

According to Saffer's diagram (figure 1), all of the considered disciplines can be at least partially covered by the User Experience Design (UXD or UX) field. UX deals with all aspects (visual, interaction, sound, etc.) of the users' interaction with any type of product. *Information architecture* deals with organizing and labelling

information that would suit the users the most. *Visual design* covers fonts, colours, layouts of displaying information on all media but specifically, within terms of this research, in user interface. Saffer highlights the importance of the *Human factors discipline*, since this area deals with the limitation of the human body, both physically and psychologically. Therefore, it provides key knowledge for development of a *usable product.* The usability is an attribute that mainly concerns the Human-computer interaction (HCI) field. However, Saffer considers the HCI methods to be more quantitative in nature and since this research aims to be user-centered with a use of qualitative methods, it finds its place within the interaction design. (Saffer, 2010, pp.21-23)

The research and following redesign focuses on the most used functions of the PlanEat application from the point of view of the primary users (e.g. nutritionists, doctors, personal trainers etc.). The outcome of the research and possible changes won't affect the secondary users (e.g. end clients, patients, etc.). Therefore, this study won't cover behaviour of end clients regarding nutrition.

The development of the PlanEat app is based on extensive research in the field of nutrition in combination with practical experience of creators. Therefore, the research will focus on system components and functions only from a UX and UI perspective and not examine the accuracy of produced meal plans and their application in real life.

2.3   Design approach

Regarding the design, this research will focus on UX as well as UI. The basic components of the fields are introduced in following diagram:
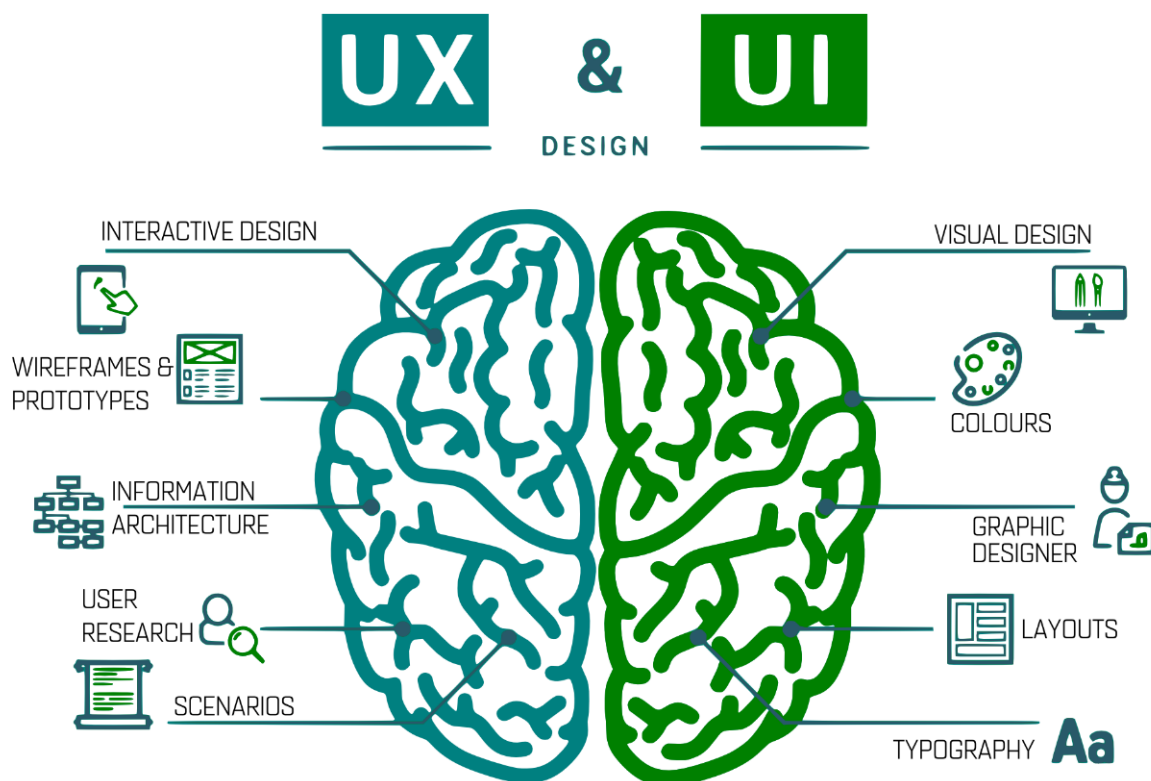
PICTURE 1 COMPONENTS OF UX & UI (INSPIRED BZ MOCKUP.COM,2016, RETRIEVED 16.5.2018)

In terms of UX, there are four possible approaches of interaction design (table 1) for developing a software or a product:

Approach	Overview	Users' role	Designer's role
User-centered design	Focus on user needs and goals	The guides of design	Translator of user needs and goals
Activity-centered design	Focus on the tasks and activities that need to be accomplished	Performers of the activities	Creates tools for actions
Systems design	Focus on the components of a system	Set the goals of the system	Makes sure all the parts of the system are in place
Genius design	Skill and wisdom of designers used to make products	Source of validation	The source of inspiration

TABLE 1 FOUR APPROACHES TO DESIGN (SAFFER, 2010, P.33)

The approach for the design within this research will be a combination of UCD and genius design as it can benefit from users' input as well as from skills of a designer. As stated in the Research scope section, this research won't question the justification of activities that users can execute within the app neither the app's components. Therefore, the activity-centered design and system design approaches are not relevant.

3. LITERATURE REVIEW

According to Rowley and Slack, all research needs to be informed and supported by existing knowledge in a given area. (2004, p. 31) The literature review needed for the scope of this research focuses on three main areas which could possibly enlighten the answers for the proposed research question. Following sections focuses on areas:

a) Users' behaviour (RQ1)

b) Design for nutrition app (RQ2)

c) Nutrition app development and evaluation (RQ3).

Literature search

The main source of relevant literature about methodology and theories were lists of recommended literature gathered during the master studies programme. The sources concerning user experience, web development and design were my own books gathered for personal study. Other relevant literature, books and papers were found through a literature search. The literature search was guided by proposed research questions in a way that the key phrases used for search were derived from their formulation. For the search were used portals Google Scholar[2] and the AAU AUB[3]. The applied technique for search was mainly *briefsearch*. During briefsearch, documents are retrieved crudely and quickly, which is according to Rowley & Slack is a "good start for further work" (2004, p. 35). Another used technique was *citation pearl growing*, which starts from one document and derive future searching queries from the text or relevant literature sources from the bibliography list. The *building blocks techniques* was used after further research influenced and modified initial search queries. During the search I also found valuable relevant suggestions, that are proposed when searching in the Google Scholar, which are based on searched terms by other researchers.

3.1   Users' behaviour

As described in the Research scope section, the app in the centre of this research is aimed to B2B segment. Therefore, I was interested in a subject of users' behaviour in relation to the use of the specialized nutrition software. Since this research aimed to be user-centered, there was also a need to enlighten how users will influence the investigation from the perspective of results interpretation. These two areas of interest are described in following sections.

Use of nutrition software

According to Probst & Tapsell, there two types of using a nutrition software:

"a) Computer-assisted dietary assessment in which a health professional, practitioner or researcher uses a computer to assist with dietary assessment and

b) Computer-assisted self-assessment in which a respondent uses the computer to complete their own assessment." (Probst & Tapsell, 2015, p.4)

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[2] https://scholar.google.com/
[3] http://www.en.aub.aau.dk/

This research concerns the former, since its aimed to nutritionists, doctors and personal trainers. Probst & Tapsell present numerous advantages of using computer-assisted assessment instead of non-computerized. Using a nutrition software can maximize effectiveness of dietary advice because it provides enhanced communication through pictures and standardisation of the questioning sequence. Moreover, it provides user with fast and easy ability of processing input information and increase the flexibility when potential changes will occur. As the tailored output may take the form of graphs or tables representing the adequacy of a person's nutritional intake, it is easy to follow for the end users. Another benefit is that some software can also produce nutrition related recommendations, recipes and generate related shopping lists. However, using a nutrition software for assessing and producing the nutrition plan requires computer literacy, which Probst & Tapsell consider a disadvantage. (Probst & Tapsell, 2015, pp. 5-7) The PlanEat app accommodates all mentioned features and therefore provide its users with stated benefits.

Verbalisation theory

Since this research aimed to be user-based investigation, the main source of information are actual users and stakeholders. Methods used in this research (interviews and think-aloud test) relies heavily on *verbalisation* of participants thoughts. Therefore, during analysis, one needs to be aware of factors that can influence verbalization. Verbalisation is the last step in a process of thoughts interpretation, which precedes *perception, retrieval, construction* and *storage* (Van Someren, Bernard & Sandberg, 1994, p.19). Van Someren et al. highlights that it is especially hard to verbalize information that resides in working memory for a very short time. This type of complex information occurs during think-aloud test and because of its non-verbal character, it may not appear in a protocol. (1994, p.124) The quality of verbalisation can be affected by disturbance in cognitive process, memory errors or interpretation by a subject. (Van Someren et al., 1994, p. 25) According to their experience, "the quality of verbalizations is not strongly associated with other properties that can easily be observed or measured". (1994, pp.33-34) Another issue, that can occur, is *idiosyncratic verbalisation* which produce different verbalisation although the content of the cognitive process would be the same. (Van Someren et al. 1994, p.124) Van Someren et al. conclude that "in most cases there is simply not enough psychological knowledge and knowledge about the people involved in the task to predict what will appear in the protocol." However, they propose a pilot testing to obtain the vocabulary and phrasing that appear in protocols as a possible type of solution. (1994, p.126) The method of pilot testing will be used also in this research.

Change aversion

When dealing with change within the software design, users often experience anxiety and confusion when faced with a new interface or changed functionality. This phenomenon is identified as *change aversion*. (Sadley & Muller, 2013, p.1) Sadley & Mullers argues that the users' negative reaction to proposed changes doesn't always mean that the changes are bad or undesired. It is often breaking of users' habit that causes the frustration. They propose a series of steps that would minimalize the change aversion:

1 Thoroughly plan the stages of the launch
2 Assess user impact prior to launch
3 Prime users for the upcoming change
4 Explain the benefits of the change
5 Give users transition guidance and support
6 Let users switch between new and old UI
7 Monitor and manage the change over time
8 Let users send feedback directly
9 Address your users' issues quickly

10 Tell your users what you improved (Sadley & Muller, 2013, p.7)

Proposed steps helped them launch new interface of the Google Drive service without causing change aversion and helped them secure the overall successful implementation of the changes. (Sadley & Muller, 2013, p.4) Described phenomenon raises question, how much users will be willing to share their potential dissatisfaction with the actual version of the PlanEat app.

3.2 Nutrition app development and evaluation

In order to find out about the state-of-art within the nutrition software industry, investigation of nutrition software evaluation and development on domestic and foreign markets was conducted.

Software development - Nutplan

Despite a broad literature search, only one study describing development of a nutrition software was discovered. In 2010 EURopean micronutrient RECommendations Aligned (ERURECA) developed the *NutPlan*, "user-friendly software programme with multiple functions: individual and group nutrition planning, recipe calculation, creating food labels, diet planning and nutrient intake assessment." (Gurinovic et al., 2010, p.1) The structure diagram (figure 2) showed similarities with PlanEat software.

FIGURE 2 STRUCTURE DIAGRAM OF THE PROGRAM NUTPLAN (SERBIANFOOD.INFO/PLAN_ISHRANE1, RETRIEVED 17. APRIL 2018)

Similarly, to NutPlan, PlanEat consist of food groups, contains recipes for every dish, has identical measure units, can compose similar types of meals and require similar input for calculating energy needs. However, PlanEat application is not designed to create menus for a group. In addition to NutPlan, PlanEat creates dishes that are interchangeable in terms of meal category (e.g.: customer can choose any lunch out of 30 options for any given day) while the overall nutrition values are maintained. Moreover, PlanEat can consider different dietary restrictions (e.g.: left out food group) and likes and dislikes (e.g.: exclude multiple groceries out of food group). According to Gurinovic et al., NutPlan was aimed particularly for small and medium enterprises

in the food industry, as well as by health professionals, researchers and policy maker in Eastern European and West Balkan countries. However, any food database in the right format can be imported and therefore customize the app for any region. (2010, p.1) PlanEat app does not allow importing of a database but allows users contributing to the already implemented one.

Regarding the actual development of the software, Gurinovic et al. used Microsoft Visual Fox as a local application for Microsoft platforms (Windows, XP and Vista). This resulted in some restrictions regarding the UX, UI (picture 2) and overall usability across platforms and different operation systems. The PlanEat software is web application therefore offers much more variability in design and is usable across all operation systems and multiple devices. Since the NutPlan is not available for download it was not possible to generate an example nutrition plan. Therefore, it was not possible to consider how accurate the results are or the overall user experience and interaction design.

PICTURE 2 NUTPLAN INTERFACE (SERBIANFOOD.INFO/PLAN_ISHRANE2, RETRIEVED 17. APRIL 2018)

Software evaluation

In terms of territorial jurisdictions, the closes available sources concerning proposed issue are conclusion from conference on *Public health nutrition* regarding central and eastern Europe. Gurinovic et al. (2015) conducted an investigation regarding the availability of nutrition tools, software and academic programmes in sixteen Europe countries including Slovakia and Czech Republic. They have concluded that the availability of proposed items is limited and there are opportunities for improvement in the field of nutrition and diet-therapy. (Gurinovic et al., 2015, p.372-377) Subsequent study by Gurinovic et al. (2016) investigated closely lack of standardized food composition database and dietary assessment tools. They identified a need for effective nutrition surveillance tools and training needs in dietary assessment tools development and application. (2016, pp.173-180)

To my knowledge there is no organisation in Slovakia that would deal with software approvement or evaluation. To this date there were released at lease eleven platforms on domestic market that deals with nutrition (Appendix 1 – List of competitors). Usually they are developed by small companies that in a past provided services of nutrition advisors and then created automatized platform. Their validity is however not approved by any official government body or agency. Within the documents available on websites of Ministry of Health of Slovakia[4] are no references to any nutrition software nor list of minimal requirements or instructions for approving these kinds of software in any legislation or other official document.

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[4] http://www.health.gov.sk/Titulka

The organisation SAVP[5] (Slovak Academy for Nutrition and Prevention) is a professional platform founded by doctors, scientists, sports physiologists and other health care specialists. According to their website, their main focus is providing proven information about the nutrition and health with the emphasis on prevention of illnesses connected to diabetes and obesity. It was established two years ago, but to this date did not presented any statement about the available nutrition software on domestic market or any statement about the state of the nutrition software development in Slovakia.

Regarding the evaluation of nutrition applications, Buzzard, Pierce and Warren published a paper in which they highlight the importance of quality nutrient database. They have stated that most evaluation papers focus on functionality which is unfortunate because a "program features are of little consequence if the nutrients calculated are not of acceptable quality." (Buzzard et al, 1991, p.7) They proposed 6 evaluation questions:

- Does the database contain all of the foods and nutrients of interest?
- Is the database complete for the nutrients of interest?
- Do the foods included in the database provide adequate specificity to accurately assess the nutrients of interest?
- Is the nutrient database kept up to date with the changing marketplace and the availability of new nutrient data?
- Are manufacturers contacted routinely for new information on reformulations of existing products?
- What quality control procedures are used to ensure the accuracy of the nutrient database?

This issue was discussed during the preliminary interview and is described in section 4.2.

3.3   Designing for nutrition app

In following sections are included theories and approaches that guided proposed research and influenced the redesign. To my knowledge, there is no published research or paper regarding the designing specifically for the nutrition software of this capacity, therefore the design was based on general principles for software development and web design.

User experience design principles
Strung & White (1935) formulated elementary principles and rules of usage and approaches to style. Majority of proposed principles concerns the formulation of expressions or language used in order to make the information comprehensive, which is not the main focus of UX or UI design. However, this research took advantage of following principles of composition proposed by Strung & White:

- Choose a suitable design and hold to it.
- Make the paragraph the unit of composition.
- Use the active voice.
- Put statements in positive form.
- Use definite, specific, concrete language.
- Omit needless words.
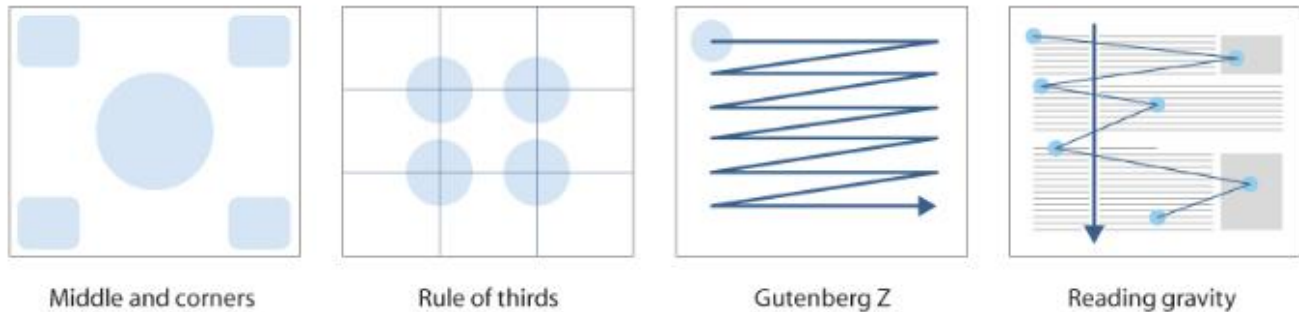- Avoid a succession of loose sentences.

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[5] http://www.savp.sk/index.html

- Express coordinate ideas in similar form.
- Keep related words together.
- In summaries, keep to one tense.
- Place the emphatic words of a sentence at the end. (2000, pp.15-34)

Lynch & Horton expands on the principles of composition with classical composition theory (picture 3)

PICTURE 3 CLASSIC RULES OF COMPOSITION AND OUR READING HABITS COMBINE TO GOVERN HOW WE APPROACH INFORMATION DISPLAYS. (LYNCH & HORTON, 2016, P.125)

Composition *Middle and corners* and *Rule of thirds* speaks mainly about comprehension of pictures and about homepages with graphics or photography within the website design. Regarding text composition of Western languages, the *Gutenberg Z* represents reading from left to right and from top to bottom. *Reading gravity* principle advise to place important information (e.g. headlines, announcements) at the beginning of the page since the users is not likely to go to the beginning again. (Lynch & Horton, 2016, p.125) Eye-tracking studies specified the users' movement on webpages starting from left upper corner downwards and then upwards through the right side of the screen (picture 4a). On a screen dominated by text, users read in F pattern with a majority of focus concentrated in left upper corner (picture 4b).
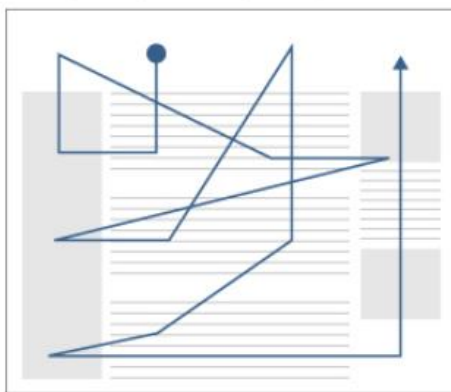

PICTURE 4 RESULTS OF EYE-TRACKING STUDIES (LYNCH & HORTON, 2016, P.126)

In information-oriented websites users expect to find specific kind of information in specific places (picture 5). Regarding navigation, users expect the general navigation in the horizontal order on the top of the page. A more specific navigation concerning the content of certain page is expected on the left side in vertical order. (Lynch & Horton, 2016, p.128)
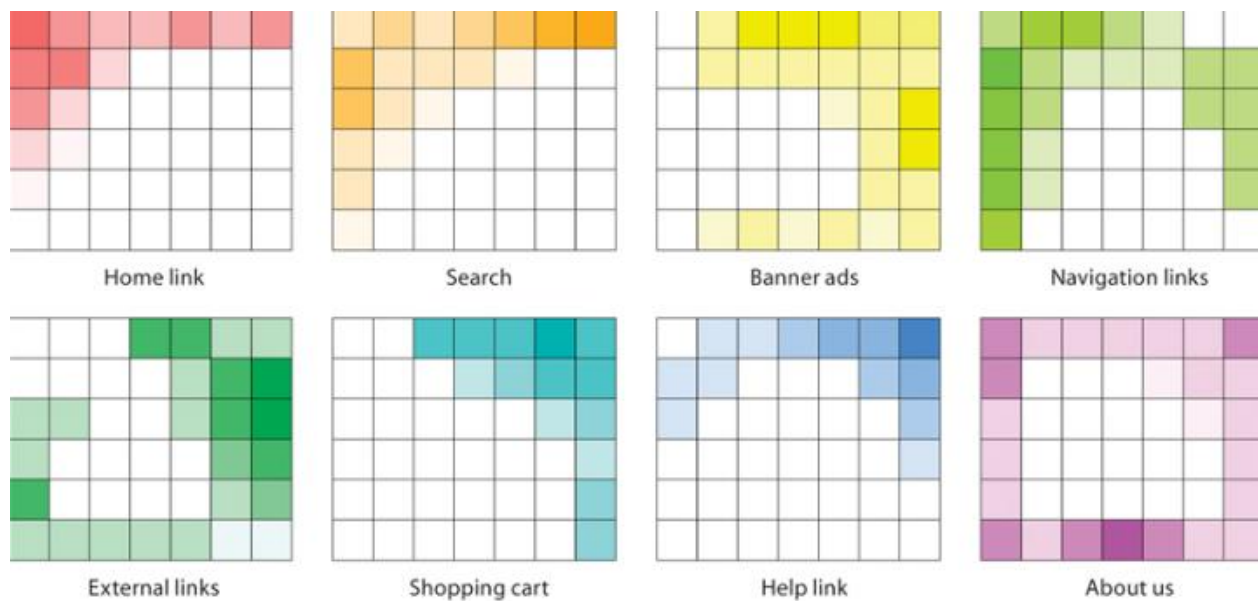
According to Krug, the basic principle of designing usable product for users is not to make them think about how to use it, where to navigate, what to click, etc. He describes usable website as *self-evident or self-explanatory* which means that users are not guessing the meaning behind buttons, texts or links and are confident in their actions. (2006, pp.11-19) Krug formulated following *facts of life* which were taken in mind when designing prototypes within this research:

- FACT OF LIFE #1: *We don't read pages. We scan them.*
  - usually because users are in a hurry or only interested in fraction of information available, they tend to focus on words and phrases that seem to match the task at hand or their current or ongoing personal interests.
- FACT OF LIFE #2: *We don't make optimal choices. We satisfice.*
  - users tend to go with first available choice that might take them where they wanted to go. The reason for this action is that users are aware that there is little to no penalty for making mistake and they can always go back or start over. Another reason is that the users know that in poorly designed site the long choosing process won't help them anyway and its quicker choose wrong and then go back if necessary. Also, there is an element of rewarding feeling if the guess is right.
- FACT OF LIFE #3: *We don't figure out how things work. We muddle through.*
  - users are not interested in how things could work properly if they can use now partially right, to achieve their goal. (Krug, 2006, pp.21-29)

User interface

The development of the UI prototype was guided by following principles and used practices.

Gestalt principles of perception, based on research of human visual ability of pattern recognition, are cornerstones of web design. Users tend to perceive grouped elements close to each other (picture 6a) and elements sharing same visual characteristic (picture 6b) as related. Users also prefer continuity and unbroken contours and paths. Therefore, two lines on picture 6c will be interpreted as two crossing lines.
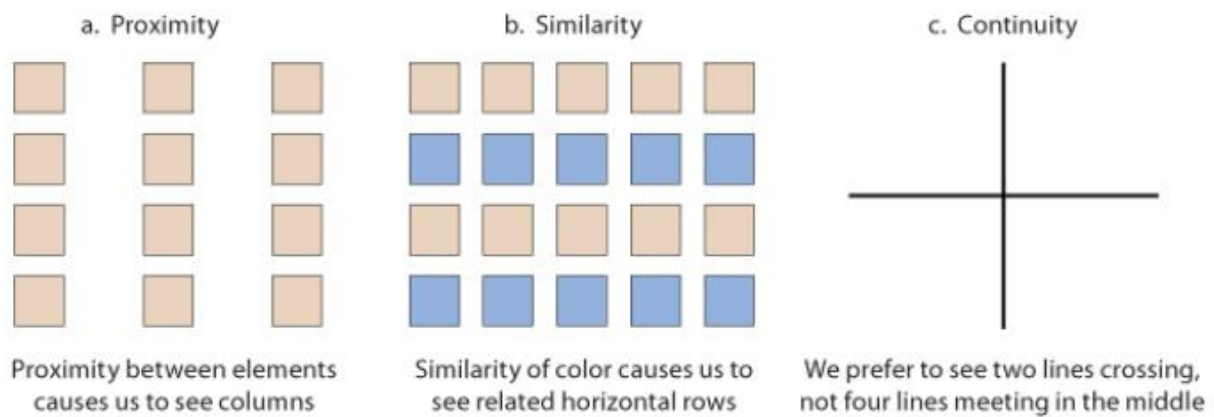
PICTURE 6 GESTALT PRINCIPLES OF PERCEPTION (LYNCH & HORTON, 2006, P.266)

Grids are often used in a print media and advertising. However, a use of a grid in web design can bring consistent structure to layouts without producing graphic monotony. The 12-column 960px grid (picture 7) became popular as a way to structure a fix width screen. With a raise of mobile technology and a necessity for responsive design, versions of a 12-column grid are used as they allow fluid adaption to small screens.
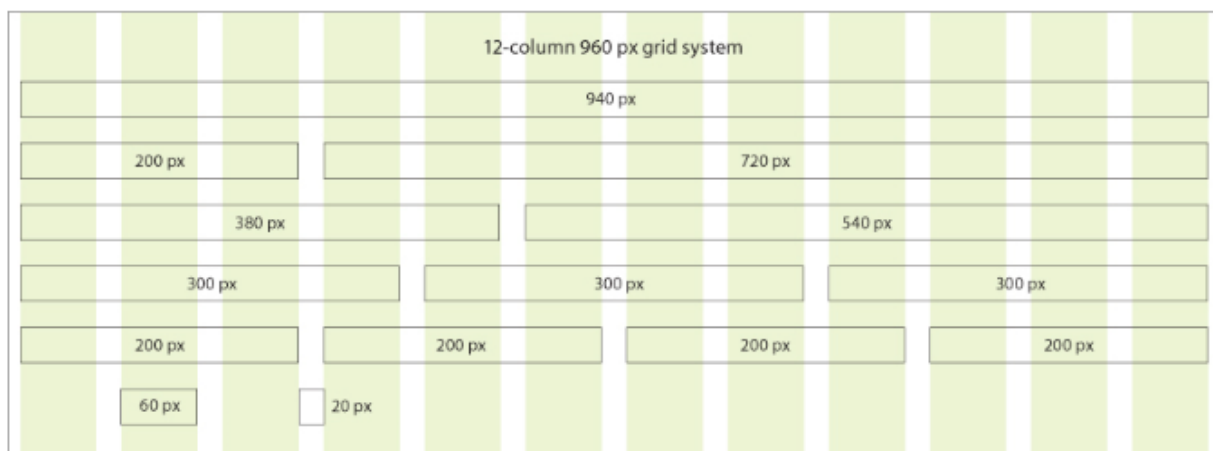
PICTURE 7 GRID SYSTEM (LYNCH & HORTON, 2006, P.227)

Executive summary

Literature review provided knowledge about key areas concerning the focus of defined research questions. Described literature sources clarified the reasons why potential users prefers computer-assessing software regarding nutrition management of a client. It also illustrated possible issues that may occur during user-based investigation and following implementation of design changes. Second chapter investigated the situation in the industry of nutrition software development and evaluation. It identified mainly lack of standardized norms for development and guidelines for assessment of nutrition tools. Last section dealt with principles of web development and user interface design.

4. PRELIMINARY INVESTIGATION

In this chapter is presented conclusion of preliminary investigation which consisted of interviews with Mgr. Michal Palenik, CEO and Founder of PlanEat s.r.o; Mgr. Martin Filek, CXO and Co-Founder of PlanEat s.r.o and RnDr. Barbara Sviezena PhD., Lecturer and Consultant for PlanEat s.r.o. These interviews helped me understand aims of the company, past development of the application and its current situation.

4.1   PlanEat company

As mentioned earlier in Introduction chapter, there are increasing number of people with morbid obesity and obesity not only in Slovakia but in countries all over the world. According to Mgr. Michal Palenik, CEO and founder of PlanEat, the reason for this increase is a combination of bad diet habits, not enough exercise and overall comfort living. Palenik claims that in 65% of all cases, the right diet can help patients who already suffers from illnesses related to obesity to significantly improve their health or recover completely. The possibility of improving people's lives was one of the reasons for starting PlanEat application company. He stated that the main goal of PlanEat is to support education of people about healthy nutrition and eating habits by providing personalized and complex nutrition plans.

Palenik stated that even though the most people are always trying some kind of specialized diet they are only following very wide structures without understanding of the body processes. Palenik claims that this was also one of the reasons why the target group of users of PlanEat application are educated trainers, nutritionist and doctors. This group of people can explain and guide their patients and clients through the process and not only ask them to follow the plan but also explain what to do so. (Appendix 2 – Part 1)

4.2   The PlanEat application

Development
Mgr. Martin Filek, CXO and Co-Founder of PlanEat described development of the application as a process with focus on functionality rather than usability. He stated that at the beginning of development there were just three of them, Palenik, a colleague programmer and himself. They were trying to develop an algorithm that would generate the smallest deviation for energetic intake and ratio of macronutrients. He stated that it took a long time and multiple iterations to develop a minimum viable product (MVP)[6]. With a short prognosis for a runway[7] of the company, they've just added a simple interface in order to secure future existence of the company. Since the launch of the product they have made a few changes in the interface, but they are still more focused on scaling the application functions rather than UX. Filek stated that they were aware of many flaws within the interface and they are receiving feedback from some users with suggestions. However, currently there are no one in the company that has the knowledge and ability to design the corrections. (Appendix 2 – Part 3)

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[6] MVP = Minimum Viable Product. The bare-bones version of a product required to achieve proof of concept. Often used in the creation of new software that will be Beta tested, and later upgraded with extra features.
[7] Runway = How long you have until the cash runs out and you must turn off the lights.

Trainings

The solution that they adapted, to compensate the interface shortcomings, was to develop a series of trainings for users. Within these trainings, the lecturer would explain basic functions and do a walkthrough. RnDr. Barbara Sviezena PhD., Consultant and Chief Lecturer, believes that a lot can be done in order to improve the interface. She stated that users can effectively use the application after absolving the training. However, Sviezena emphasized that often are not only the features of the application, that the potential users do not understand. She stated that often she needs to explain also relations and terms that the application uses, which was not the originally aim of the trainings. Now, the trainings consist of explaining features of the application, explaining terms (depends on a group) and providing basic guidelines for communication with clients. She and her colleagues teach, how users should talk to their clients, how to explain them nutrition basics in a level that they would comprehend and not get overwhelmed by too much information. Sviezena and Palenik consider this part of the training as very important as it is a part of the overall goal of education of the end customers about nutrition and healthy eating habits. (Appendix 2 – Part 2)

Application description

Uniqueness of the application is based on original algorithm that can calculate the right amount of ingredients for each meal while maintaining the overall daily kcal intake as well as the right amount of macro nutrients. Application can also substitute one ingredients with another from the same group if that will result in better composition of macronutrients. Produced plans are not merely aimed to weight loss but can be aimed to weight gain, weight sustainability or specific goals within diet restrictions, intolerance or illnesses. Application will take all requirement into consideration and produce a nutrition plan that can consist of 10 to 30 meal variations for breakfast, snack, lunch, afternoon snack and dinner. Each meal variation consists of list of ingredients, a recipe for preparation and detailed calculation of kcal and macronutrients. (Appendix 2 – Part 1)

In regards to the database, Palenik stated that there are different levels of the database. There is ALIMENTA database, which is official database produced by the Alimenta Natur company and it is officially approved by the Ministry of Health of Slovakia. The company is constantly updating the database and the updates are seamlessly implemented into the PlanEat. There is also a database created by the users. When they allow using food from this database they are aware that it's not reviewed and usually not that accurate. (Appendix 2 - Part 1)

Following screenshots capture parts of the app that will be the focus of the investigation and following redesign.

The first screen (picture 8) shows a *templates sections* in which users are able to create their own templates or copy and modify existing ones. The template is a set of handpicked meals that are based on users experience or in case of official PlanEat's templates, made in collaboration witch chefs. Users can set the overall goal of the template (e.g. weight loss or gain, etc.) and will set the recommended energy intake. The app's menu contains 4 main sections: Templates, Database, Clients, Tutorials [1]. In the main menu there is also button for purchasing credits [2] which are used as a form of payment for nutrition plans and client section [3].
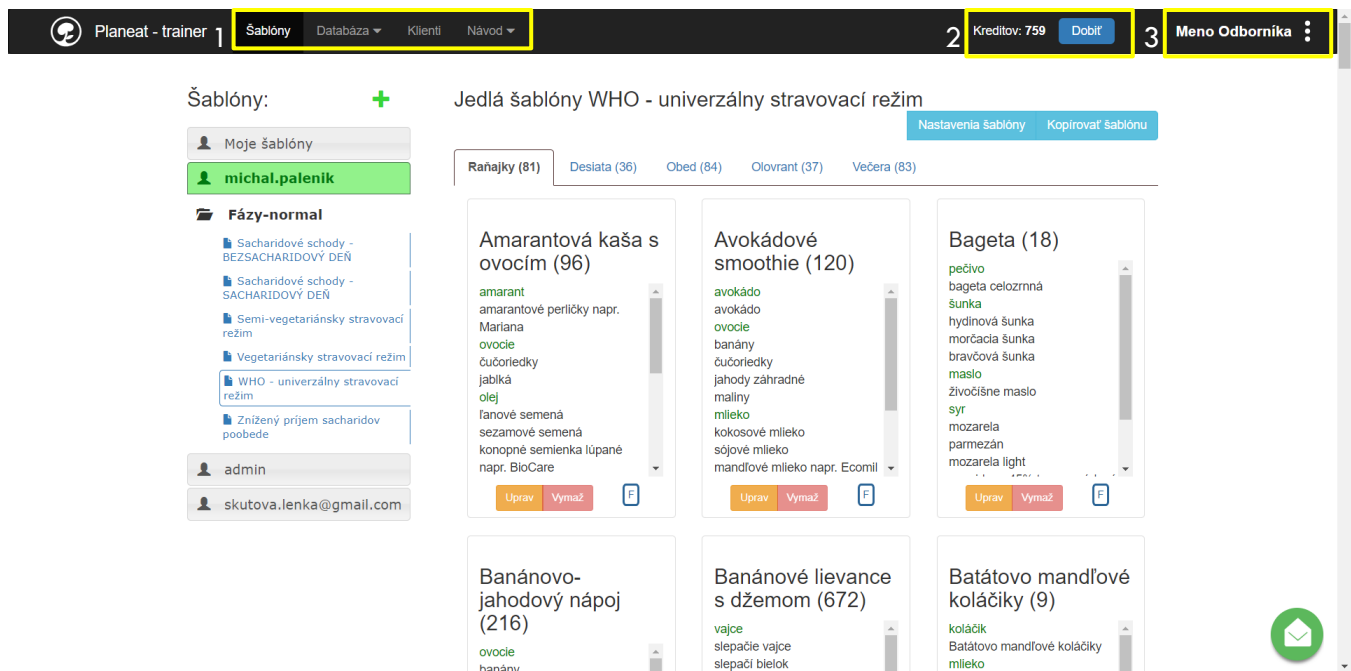
PICTURE 8 PLANEAT APP - TEMPLATES

Following screen (picture 9) represents a database of food with entries about energy, sugar, fat and protein. Meals are then compound of food from this database.
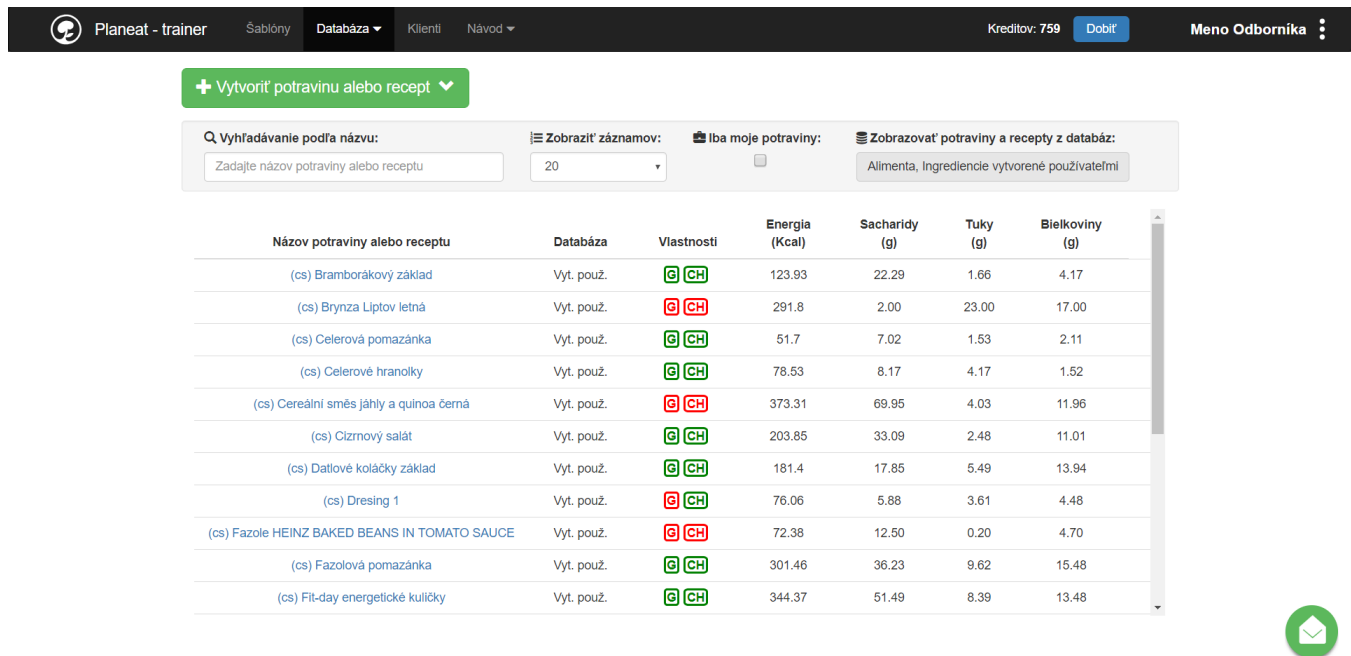
PICTURE 9 PLANEAT APP - DATABASE

Next screen (picture 10) shows a process of creation of a new client. The process starts with entering basic information about the client (name, age, gender, height, weight and contact information). Later the user will set the energy intake, mark clients food intolerances or allergies and mark his preferred and disliked food. On the left side of the screen are listed users' clients.

PICTURE 10 PLANEAT APP - USER PROFILE

Following screen (picture 11) capture the generation of a nutrition plan process. It starts with modifying energy intake distribution for number of meals for one day. The application will warn user if the summary of the energy intake differs from intended energy intake proposed in chosen template.

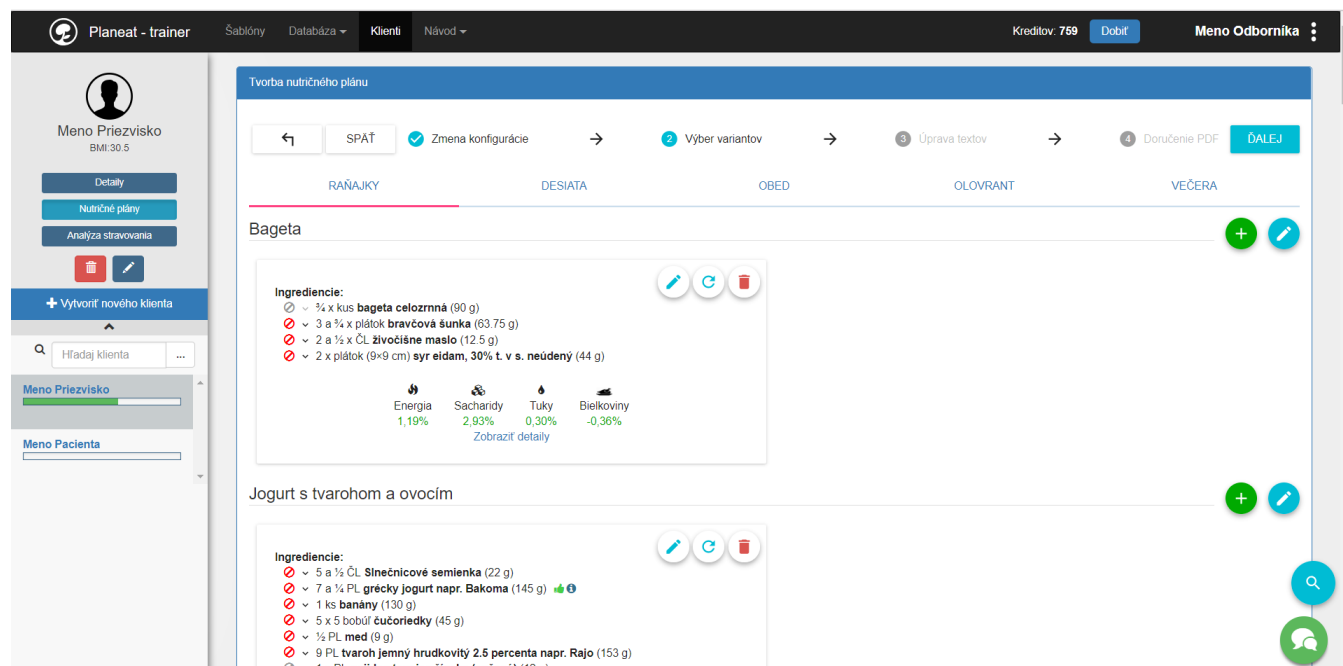**PICTURE 11 PLANEAT APP - GENERATION PROCESS**

Following screen (picture 12) captures the actual generation of the nutrition plan using the algorithm. This process takes from 3-7 minutes when using setting from the template or more if the energy intake was modified. During this process the algorithm calculate thousands of meal variations to fulfil the energy intake of

every meal while maintaining the daily energy intake and the overall goal set within the nutrition plan (e.g. maintaining weight, losing weight, etc.)
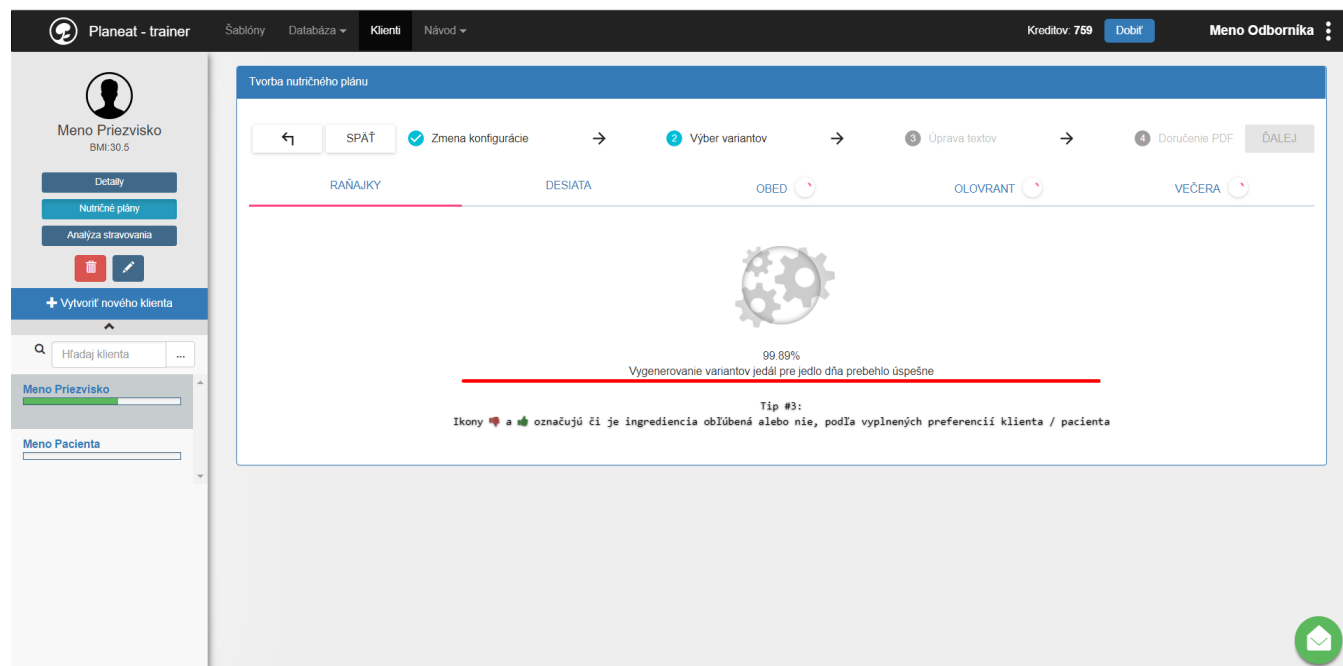
PICTURE 12 PLANEAT APP - GENERATION PROCESS

The process continues (picture 13) with showing variants of courses for each meal of the day (i.e. breakfast, snack, lunch, snack and dinner). Users can modify the variants by substituting food (e.g. substitute oats for wheats). The app will generate a different variant for each day, however, users can delete or add some variants.

PICTURE 13 PLANEAT APP - GENERATION PROCESS

Users are then allowed to write customized instructions and message that will be included in the nutrition plan to their clients (picture 14). The last step is choosing a form of the nutrition plan. Users can choose from very a detailed plan with description of all macronutrients, a meal plan without macronutrients only with recipes for meal preparation or a nutrition plan only with the meal components and their energy values.

PICTURE 14 PLANEAT APP - GENERATION PROCESS

The screen below represents start of process of buying credits, which are used as a form of payment in the app. The process continues with entering credit card information and billing address.

PICTURE 15 PLANEAT APP - PURCHASING CREDITS

Conclusion

PlanEat is a company that focuses on development of the application that produces nutrition plans based on original algorithm. The application is used by leading doctors, nutritionist and professional fitness trainers in the country. Currently, the company is providing trainings in which lectures explains features of the application and how to use it to its full capacity, but also fundamentals of communication with customers and often also basics terms and relation within nutrition field. According to representatives of the company, the application has some design flaws which could be addressed in series of design updates.

The need for explanation of application's features in trainings indicates that there is a room for improvement of UX and/or UI. During the interviews, representatives of the company strongly emphasized their interest in this project and its results.

5. METHODOLOGY

Based on the pragmatic paradigm and possibility of using multiple methods, the investigation will use a combination of different methods which Bryman calls *triangulation*: "Triangulation entails using more than one method or source of data in the study of social phenomena" (Bryman, 2012, p. 392). According to Bryman, this allows researchers to cross-check their findings and therefore increase the validity.

To choose the right methods for the research, one needs to know what a focus of the methods is. Following visualization (figure 3) shows how different user-centred methods are placed in relation to each other. As the intention was to look at users, their behaviour and their need from multiple aspects, within this research at least one method from each quadrant was executed.
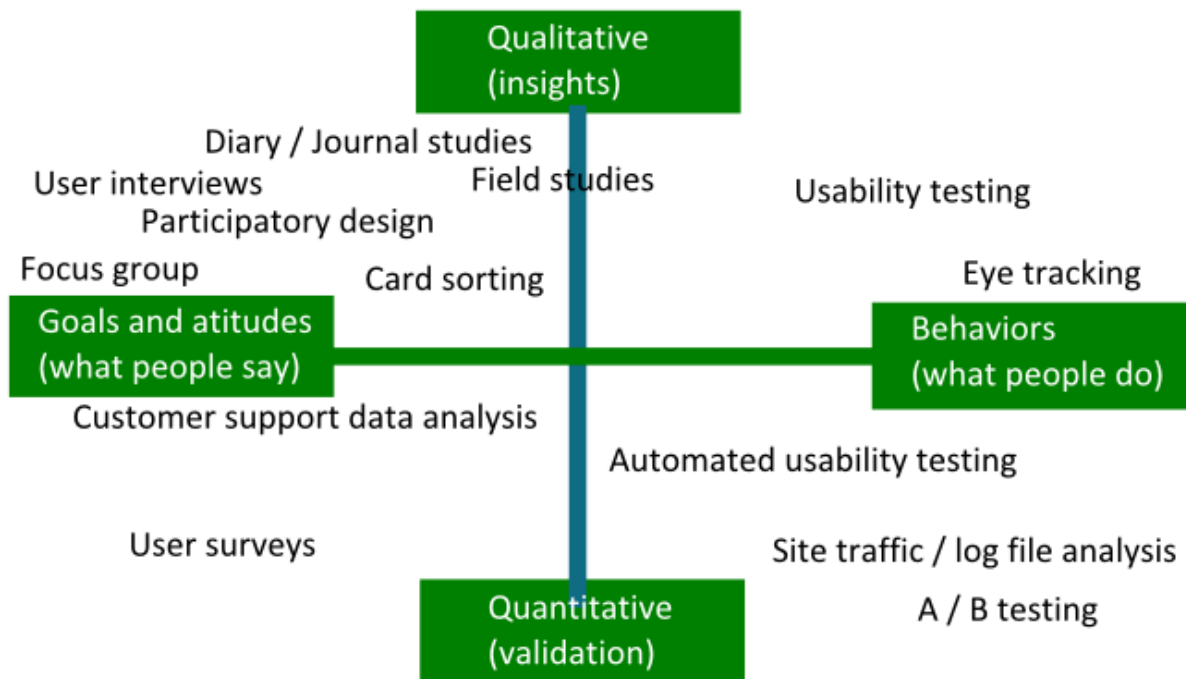

FIGURE 3 THE LANDSCAPE OF USER RESEARCH AND TESTTING TECHNIQUES (INSPIRED BY MULDER & YAAR, 2006, P. 40)

Following model (figure 4) represents planned workflow, employment of chosen methods and their relationship with research questions.
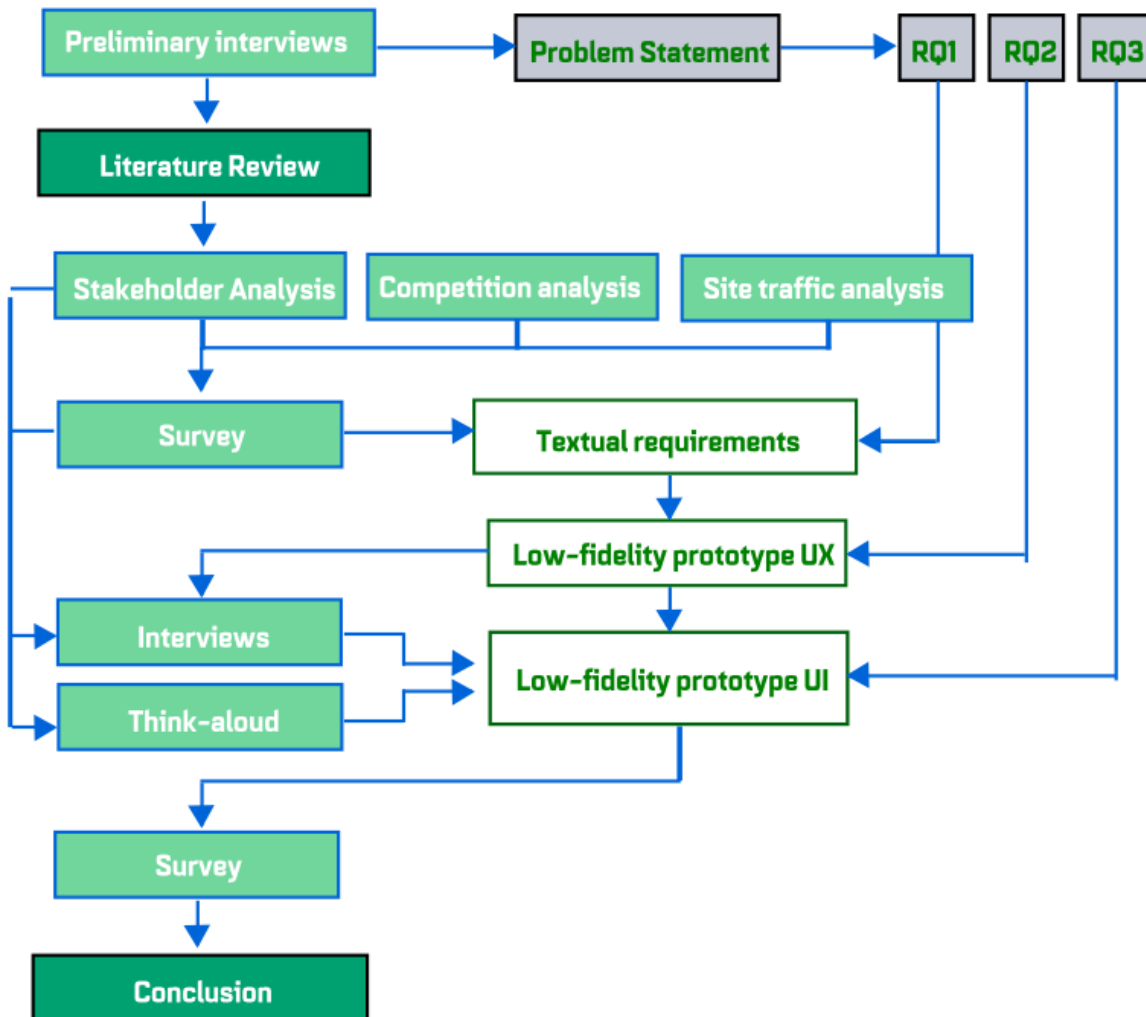

FIGURE 4 RESEARCH MODEL

5.1   Stakeholder theory

Prior to investigation of the users, one needs to define all involved stakeholders, how they interact with each other, what are their interests and goals. In this chapter are introduced principles of stakeholder theory and methodology used in this research.

Freeman defined stakeholders as a "groups and individuals who can affect, or are affected by, the achievement of an organization's mission." (1984, p. 52) Dix. Et al. expands the definition with stakeholders defined as people who "…are affected directly or indirectly by a system" (2004, p. 198). According to Freeman there are three levels of understanding the managing of relationships in organisation:

- Rational level - who are the stakeholders in the organization and what are the perceived stakes
- Process level – processes used to manage the organization's relationships with its stakeholders
- Transaction level - set of transactions or bargains among the organization and its stakeholders (1984)

Stakeholder rational perspective proposed by Freeman is anchored in Social Network Theory (SNT) concepts. He proposes three distinct measures to indicate structural centrality of organisation: degree, closeness, and betweenness (1979, pp.215-239).

In the study *Stakeholder analysis and engagement in projects*, Missonier and Loufrani-Fedida identified limitations of previously proposed method. They identified three key improvement areas: "the relevance, the dynamic, and the emergence of stakeholder analysis and engagement." (Missonier & Lougrani-Fedida, 2014, p.2) In terms of relevance, Jensen and Sandström (2011) recognized that current application of stakeholder theory is not sufficient and therefore not useful for managers. Eskerod and Vaagaasar (2012) recognized that majority of stakeholder analysis do not consider management of project as a dynamic and on-going process. Regarding the emergent nature of relationships, SNT focused only on "resultant" effects of stakeholders' relationships and understudied the co-evolution of the stakeholder identity and the project over time as described by Bourne and Walker (2005).

Missonier and Loufrani-Fedida addressed mentioned issues and proposed different conceptual approach (table 2) tailored for Information System (IS) projects. This approach is based on rational ontology, anchored in Actor-Network Theory (ANT). They findings showed that this ANT based approach "improves stakeholders' analysis of and engagement in a project by shedding light on the dynamic and emergent nature of the relationships" (Missonier & Lougrani-Fedida, 2014, p.1) They emphasize this focus, since the roles of stakeholders and their relations are co-evolving with the project development. They concluded that this approach provides managers with relevant base for observation and oversight over the project. (Missonier & Lougrani-Fedida, 2014).

	Stakeholder analysis		Stakeholder engagement	
	Stages	Contents	Stages	Contents
Morphological stakeholder network analysis (front-end)	(1) Identify stakeholders and analyse stakeholder relationships	- Poles (status and roles) - Intermediaries (what is produced, will produce and put into circulation by actors): nature, diversity, amount, and frequency	(A) Problematisation	Framing the problems, identifying other relevant actors, and highlighting how the problem affects the other actors
	(2) Identify stakeholder interests	- Interessement (identifying factors interests of members of poles in the project and devices)	(B) Interessement and enrolment	Ability of an actor to arouse the interest of others for his own project Assign a role to each pole
	(3) Assess stakeholder influence	- Identifying degree of convergence of the network (degree of alignment of interests and goals, degree of coordination)	(C) Mobilisation	Stabilisation of the stakeholders

Dynamic stakeholder analysis (over the project)	(4) Identify controversies	- Nature, i.e. the subject of the controversy and its stakes - Actants involved - Stabilisation whether a compromise seems to have been reached or not - Redefinition of the technical object		
	(5) Analyse effects of controversies on stakeholder network	Effects on the network		

TABLE 2 S. MISSONIER, S. LOUFRANI-FEDIDA / INTERNATIONAL JOURNAL OF PROJECT MANAGEMENT 32 (2014) 1108–1122

Since this research evolves in a field of IS project, it will follow this approach for identifying and categorizing stakeholders. The analysis is presented in section 6.1.

5.2 Competitor analysis audit

Business and competitive analysis (BCA) is critically important in determining how an enterprise can compete more effectively, provide high-value strategic decision support and deliver better value to its stakeholders. (Fleisher & Bensoussan, 2015, pp.3-17) Fleischer & Bensoussan highlights that performing business competitive analysis is difficult because "there is an element of tradecraft – or those shills built up through practicing intelligence analysis – to mastering it". (2015, p.22) In *10 business competitive analysis commandements,* they stressed the role of analyst using the best methods, tools and techniques available, negotiate and communicate input data and analysis outcomes with the client.

As it was not possible within the scope of this research to conduct proper BCA, the analysis conducted by the PlanEat's management was used instead (Appendix 1). They have compared the software in categories of market specifications, functionality and use. PlanEat's analysis in combination with the results of interviews and questionnaire allowed to select the strongest direct competitors in order to conduct the analysis of UX and UI.

According to Bosch & Molin, the decision taken during the architectural design have a large impact in the resulting system. (1999, p.1) They proposed four possible methods for assessing non-functional requirements on design:

- Scenario-based evaluation
- Simulation
- Mathematical modelling
- Objective reasoning (1999, pp.3-6)

The first three mentioned methods require developing a series of scenarios or tasks and performing them within the software. As the BCA was performed by the management of the PlanEat during the early stages of development of the app (in September 2015), the trial versions of software expired. Within the resources of this research was not possible to purchase another round of the trial versions. Therefore, this analysis executed the *Objective reasoning method* which does not require manipulation of the researched software. Objective reasoning is based on logical arguments, insights and reasoning of experienced software engineers and

designers. However, this approach tends to be less explicit and more biased since it is based on subjective factors as intuition and experience. (Bosch & Molin, 1999, p.7) Nevertheless, for the purpose of this research analysis, the basic comparison of the UI was sufficient in order to get an overview about the industry standards. The conclusions of this investigation are introduced in section 6.2.

5.3   Analytics audit

The investigation of the actual use of the PlanEat app, an analysis of analytics tools already deployed to track the app's performance, was performed. The aim was to investigate funnels, heat maps and general site traffic and traffic flows.

Site traffic

In order to do business effectively, one needs to continually refine and optimize online marketing strategy, site navigation, and page content. (Clifton, 2012, p.7) Within this analysis, the focus was on providing answers to the questions about daily visitors, average conversion rate, top-visited pages, average visit time or often visitors come back.

Goal conversion is a desired action on a website "which is defined as being more valuable than a standard pageview" (Clifton, 2012, p.6). In terms of the investigated app, it could be registering for the app, logging in, creating a new client or generation of nutrition plan. When considering the visiting time, one needs to set when to start and stop measuring the time. This is referred to as a *session*, which is a period of interaction between visitor and website. A session ends when a visitor either closes their browser or 30 minutes has elapsed without activity. (Clifton, 2012, p.6)

One of the onsite visitor-reporting tools, used for tracking activity on web, is Google analytics[8]. It is a free tool, that is easy to deploy and use. It provides the analysis of mentioned metrics as well as more advanced analysis used for complex sites. Analysis of site traffic can clarify how many users are using application, if there is a pattern, which sites are used the most but cannot show what users are doing on individual screens. To find out that, one needs to look at heatmaps.

Heatmaps

According to Metsalu & Viko, „Heatmap is a data matrix visualizing values in the cells by the use of a colour gradient". (2015, p.557) Heatmaps track individual user activity which is then stack into one visualisation. This will highlight "hot and cold" sections which indicates areas with high and low activity. Generating heatmaps can give one insights into how users are interacting with specific pages. This can be used for analysis and then for redesign or small adjustments in a way that will retain more visitors and improve a conversion rates. Heatmaps analysis can show whether visitors are interacting with important content or if they are reading and viewing what they are supposed to be reading and viewing. (Castro, 2017)

There is numerous available software for tracking user activity and creating heatmaps which differs in level of detail or additional analysis functions. For this investigation of PlanEat app, the already deployed Smartlook[9] application was used. This application provides tracking of users, visits and clicks, differentiates between mobile, tablet and desktop browser and also between clicks, moves and scrolls. The analysis provided information about activity of users on individual sites, which was used for justifying alteration of the interface.

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[8] https://www.googleanalytics.com
[9] https://www.smartlook.com

However, heatmaps cannot describe how users navigate through the application in order to achieve their goals. This issue is a concern of a funnel tracking analysis.

Funnels

Funnel analysis is a method of measuring and optimizing a consecutive set of customer activities that lead toward a desired outcome. (Rouse, 2015) The desired outcome is usually a conversion such as signing up, finishing order or within the range of this research creating a new client or generating a nutrition plan. The conversion is an action at the end of a workflow, i.e. specific set of steps (e.g. in case of creating a new client: click on button "new client" – filling information about the client – click on button "create"). By executing a funnel analysis, it is possible to pinpoint where users have troubles with completing the conversion.

For analysing the PlanEat App, the Heap analytics[10] app was used. The main advantage of the app is that once deployed, it gathers all data and the steps of the funnel can be defined afterwards. Another advantage is that the app allows segment users according defined criteria (e.g. users who have more than 5 clients vs. users who have less than 5 clients). This can show us how the funnel changes when users gather more experience with the app. As for limitation of Heap analytics and funnel analysis in general, it does not recognize the intention of a user. That means the users which had no intention to complete the conversions and were just looking around and exploring, are also included. (snowplowanalytics.com, 2017) The *explorers* could represent a significant number of the actual PlanEat app' users, as some pages provide wide range of settings which alter the end results. Therefore, it could be possible that users will just explore and "play around". Another possible shortcoming of the funnel analysis occurs when there are multiple possible workflows starting on a certain point. As it is not possible to know the intentions of the user, the funnel may record an abandonment, which in real life could mean just change of the user's mind. However, in the range of the PlanEat app there is only certain number of workflows, that the user can embark on from a specific screen. Therefore, it is possible to assume, that when user starts a workflow of creating a new client he intended to do so.

The aim of the funnel analysis was to investigate if the experience with the app influences ability to finish the task. Therefore, the user segments were defined according the level of experience with the app's use as follows:

- **Users with more than 5 clients** vs. **Users with less than 5 clients**

  (the margin number 5 was set according the setting in the trial version of the program, where users can create up to 5 clients for free)

- **Users with more than 3 nutrition plans** vs. **Users with less than 3 nutrition plans**

  (as in previous segment the margin number was set because user have enough credits to generate 3 nutrition plans in the trial version)

The analysis of proposed analytics tools is presented in section 6.3.

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[10] https://heapanalytics.com/

5.4   User survey

Bryman provides following diagram (figure 5) of available modes of administrating a user survey. Within this research both methods, structured interview and self-completion questionnaire, were deployed as they have both advantages and disadvantages (discussed later in this chapter).
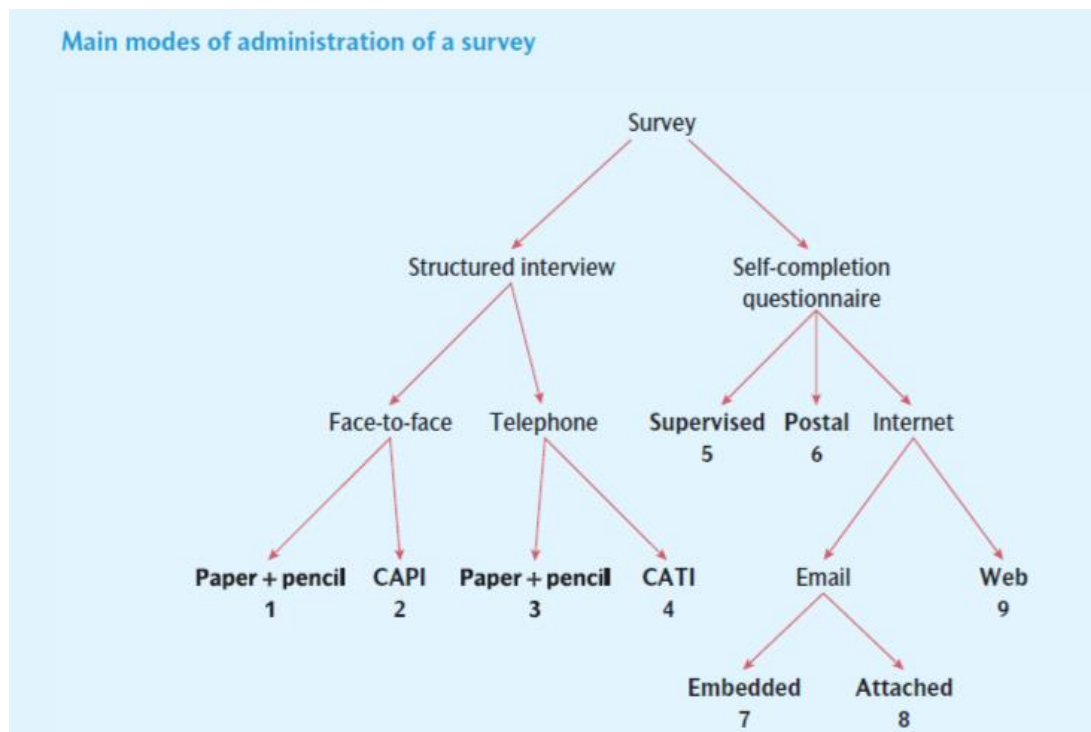

FIGURE 5 MAIN MODES OF ADMINISTRATION OF A SURVEY (BRYMAN, 2012 P. 186)

5.5   Questionnaire

Brace states that questionnaires are vital for the market researcher as they draw accurate information from respondents, give structure to interviews, provide a standard form on which facts, comments and attitudes can be recorded, and facilitate data processing. (2008, pp. 7-11)

This research will execute the *self-completion questionnaire*, a quantitative type of user survey. (Bryman, 2012, p. 232) With this method, it is possible to quickly gather information from a large number of users in a cheap way. Besides stated advantages, Bryman also lists an elimination of the interviewer's influence as another benefit. As for users, self-completion questionnaire is convenient, because they can complete it when and where they want. However, this type of questionnaire limits the researcher in number of questions that he can ask since there is greater possibility of respondent's fatigue and abandonment. (2012, pp.233-234) Fan & Yan advise to keep the length of completion under thirteen minutes in order to obtain good response rate. (2010, p.133) Another disadvantage is that the researcher cannot explain further any questions or clarify any terms. (Bryman, 2012, p. 234) This can be partially addressed by pilot testing of the questionnaire elaborated further in this chapter.

Bryman introduced three possible ways of administrating survey through online channels. In a case of embedded email questionnaire, the questionnaire is available immediately after opening the email. This type of administration mode usually achieves approximately 10% higher response rate than the average response rate of web surveys. (Fan & Yan, 2010, p.137) The second type of survey administrated via email is in form of attachment. Bryman noted that attached type of survey may affect completion rate, since users can fear of attached viruses or users not being able to open the attachment. On the other hand, embed questionnaire does require less computer expertise and therefore is easier to complete. (Bryman, 2012, p.670) Dommeyer and Moriarty conducted a study, where they compared mentioned types of questionnaire. Their findings showed that the embed questionnaire confirmed higher completion rate. On the other hand, participants considered appearance of the attached questionnaire more appealing. (2000, pp.1-10) Bryman concluded that the study was conducted during early days of online surveys, which limited the appearance. (Bryman, 2012, p.671) The third way of questionnaire administration is a web survey. This type of survey uses third party software or tools to create the questionnaire. Software, such as Survey Monkey, Formsite, Typeform or Google Forms, allows wide range of possibilities in terms of colour, formatting or response styles. In addition, they execute basic analytics on gathered data and can provide useful diagram and charts. This feature can save time and also reduce the likelihood of error during manual analysis. (Bryman, 2012, p. 671)

Within this research, the combination of mentioned administration modes will be deployed in order to complement their shortcomings. The survey will be created as a web questionnaire with a Google Forms tool. This tool allows distribution via email with personalized message and also possibility of embedding the questionnaire directly into the email. With this approach, it will be possible to preserve the appearance and functionality of web survey and allow user easy completion via embedding.

Development

The questionnaire was developed and consulted with the representatives of the company and development team. Questions were based on interviews form preliminary investigation, analysis of competition and analytics audit of the actual use of the PlanEat app.

Brace describes six classification types of question used in surveys:

- "open or closed, depending whether or not the answer can come only from a finite number of possible responses;

- spontaneous or prompted, depending on whether respondents are asked to reply in their own words or given a number of options from which to choose a response;

- open-ended or pre-coded, depending on whether the answer is recorded verbatim or against one or more of a number of predetermined answers". (Brace, 2008, p.46)

The questionnaire used in this research will contain open ended, closed and prompted questions. According to Brace, closed questions are usually easier to administer because respondents only has to choose the appropriate answer and the data are automatically recorded and can be analysed. The questions of this survey were divided into 4 sections:

- First section concerns the use of current PlanEat application, users' opinions about its usability and used or desired features and functions.

- Second section contains closed questions about the trainings that PlanEat company offers.

- Third section contains questions with Likert scales about users' attitudes towards certain elements and features of the app. According to Brace when using Likert scales, unbalanced number of positive or negative answers influences respondents. Therefore, a 5-point scale (2 positive, 2 negative and neutral answer) was used, which is the optimal number when researchers do not want to overwhelm users with too much to think about. (2008, pp. 67-69) The order of answers is also important, because participants tend to bias towards left, when answering a horizontal Likert scale. Brace also highlighted that participants tends to be more positive than negative. (2008, p.68) The order of the answers was set on a horizontal scale from negative to positive, therefore the two mentioned influences could cancel each other. Brace also stated, that responses to spontaneous questions rarely tell the researcher the complete picture regarding what the respondent knows or feels and that prompting helps people to recall actions and behaviour. (2008, p.51) In order to prompt the respondents, the screenshots of interface were added when asking about UI and usability of certain function of the PlanEat app.

- Fourth section contained demographic, experience and practice questions.

The order of sections was settled based on theory by Galesic & Bosnjak, which describes that participants' focus tends to drop further in process of filling the questionnaire. (2009, p. 358) The demographic sections were ordered as the last, assuming that the demographic questions do not require using the recollection and memory as they are describing the state of the participant and therefore would be easier to answer.

Andrews, Nonnecke and Preece (2010, p. 187) summarized a list of 15 criteria for quality electronic survey based on other electronic survey studies. By using Google Forms application, it was possible to implement 13 of proposed criteria. It secure that the survey was responsible and supported multiple platforms and browsers, provided automatic feedback with completion, automatically transferred answers into a database and prevented survey alternation. The interface of the survey is intuitive and does not require familiarity with the application and provides interactive buttons, menus and links to definitions. The survey allowed to collect open-ended question and presented questions in logical manner. The two not implemented criteria comes from limitations of the Google Forms app and concerns automatic detection of duplicate answers and option for saving survey for later to complete. The full checklist is included in Appendix 3 – Part 1.

Andrews et al. also emphasizes a need to acquire sufficient trust of participants with transparency, recognized credibility of researchers, and distribution procedures that attempt not to offend or intrude inappropriately. Cho & LaRose (1999, p. 421) describe four areas of possible violation of privacy and confidentiality:

- physical (unsolicited requests)
- informational (personal information control)
- psychological (personal choice control)
- interactional (relationship control) privacy infringements.

Andrews et al. proposed 22 privacy and confidentiality checkpoints that covers areas proposed by Cho & LaRose. In terms of physical area, it was no possible to send invitations and surveys separately, since the survey was embedded into email in notion to increase response rate. However, the sample was extracted from a mailing list of users who gave their consent to use of their email addresses for marketing and research use. Moreover, the distribution of the questionnaire was secured by an email with company suffix instead of private email address. In terms of protecting personal information, the email stated that the gathered data would be anonymized, the questionnaire would not use cookies or track participant and will not use link from personalized site. To secure personal choice control, the "rather not say" response was added in demographic questions. It was not possible to let user preview the whole questionnaire since the order of questions is based

on their answers. As a part of securing the interactional privacy infringements, users were offered an option to "opt-in" further research results. The full checklist is included in Appendix 3 – Part 2.

Pilot test

According to Bryman, "it is always desirable, if at all possible, to conduct a pilot study before administering a self-completion questionnaire or structured interview schedule to your sample." (2012, p.263) He explains that pilot testing is important for numerous reasons, among others for discovering redundant questions, clarifying and reformulatig terms and questions, test the form of self-completion questionnaire or practice administrating of a face-to-face interview. (Bryman, 2012, pp.263-264)

The pilot tests of proposed questionnaire were conducted with three users who responded positively to an email regarding participation in a PlanEat app investigation. The email (Appendix 4) was distributed to a list of participants of the latest PlanEat app training as the aim was to pilot test also the section about participation in similar trainings. The pilot tests were administrated through skype call while the questionnaire was sent to the participants. The participants were informed that the data form their questionnaire would not be part of the further analysis and were instructed to focus on a form of a questionnaire. The participants were encouraged to ask about any misleading questions, expressions etc. During the skype call, multiple issues were raise and are presented in following list.

ID-1 (completion time 7:26)	ID-2 (completion time 10:30)	ID-3 (completion time 8:45)
- user would like the 1.3 and 1.4 questions to be closed question with list of possible features as he used the app only a few times and cannot list all the features from recollection (especially those that he is not using) - would like the 4.2. Question to be multiple choice (he is a personal trainer and nutritionist)	- in the1.7. Question about frequency of use of other nutrition app, the respondent would like to state the answer "used only once" - did not understand term "information architecture" - did not understand term "colour scheme is informative" - would like an option of "external collaboration / advisor" in 4.2 - would like to add and option "Coaching" in question 4.5	- would like a list of option in question 1.4 - in the 2. Section the user would like to express more thoughts and clarify her answers on the asked topics - did not understand term "information architecture"

Based on proposed suggestions, following changes were made:

- ■ Question 1.3 & 1.4 - changed from open question to multiple choice

- ■ Question 1.7 – added answer "used only once"

- ■ Question 2.2 – "information architecture" replaced with "menu"

- ■ Question 2.7 – "colour scheme is informative" added "explanatory"

- ■ Question 4.2 – added option of "external collaboration / advisor"

- ■ Question 4.5 – added option "Coaching"

Not implemented:

- Space for clarification answers in section 2. – the respondents have chance to express their interest in further participation in last question of the questionnaire.

The average time of completion of the questionnaire was under 9 minutes.

The corrected and pre-pilot tested questionnaires are enclosed in Appendix 5.

Sample & Deployment

Proposed survey was embedded in email (Appendix 6) with message about requesting collaboration with the application development team. The email was sent by the management of the company, therefore the email address had company's suffix. The questionnaire was distributed through email database of 137 users that participated in the training of the PlanEat software application with response rate of 23% (32 users).

Analysis

The gathered data were exported and analysed in Microsoft Excel. From the data was possible to create descriptive tables, charts and pivot tables which are presented and interpreted in section 6.4.

5.6   User Interview

The interviews were used for gathering more in-depth information about users' motivation for using the application, reasoning behind their interaction with the application, their needs and requirements.

In structured interview the questions are asked in strict order which secures that every respondent receives exactly the same interview stimulus as any other. According to Bryman, "the goal of this style of interviewing is to ensure that interviewees' replies can be aggregated, and this can be achieved reliably only if those replies are in response to identical cues" (2012, p.210) He describes that questions in this type of interview are usually very specific and can be also pre-coded, close ended or closed. Bryman emphasizes that this approach is "reducing error due to variation in the asking of questions, and greater accuracy in and ease of processing respondents' answers." (2012, p.211)

Another type of survey is semi-structured interview. According to DiCicco-Bloom & Crabtree the semi-structured interviews is the format of interview that is most often used in qualitative research (2006, p. 315). In this mode, the interviewer has a series of questions that are in the general form of an interview schedule but is able to vary the sequence of questions. Also, the interviewer usually has some latitude to ask further questions in response to what is seen as a significant reply. (Bryman, 2012, p.212) Brace states that this type of interview has also benefits of possibility to explain the meaning of a question or possibility to correct missunderstatement of a question. Interviewer has also a possibility to encourage respondent to provide deeper responses to open questions. (2008, p.22)

Curasi (2001) investigated differences between interviews administrated via email and in face-to-face mode in terms of bias, grammatical correctness, commitment and motivation. She concluded that during email interview, the interviewer is less likely to have impact on the results since they are more remote. This form of administration can also provide grammatically more correct answers since the interviewees have more time to formulate their answers. However, she pointed out that this causes loss of spontaneity in answers. She concluded that the email interview requires greater commitment and motivation therefore the answers tend to be more detailed. (Curasi, 2001, pp. 361 - 375)

Bordens & Abbott highlighted a problem that occurs when using the face-to-face interview which is not present in mail or Internet interview – the interviewer persona. The appearance, characteristics and changes in behaviour may elicit different answers and therefore affect result and advise to use a trained interviewer for administrating the interview. However, they also stated that some of these issues can be detected by conducting a small pilot study and corrected before the actual interviews. (2014, p. 270).

The chosen face-to-face administration style of conducting a semi-structured interview was executed as a first part of user session followed by think-aloud test. By choosing this approach, it was possible to benefit from proposed advantages of additional questioning and spontaneous answers. The possible disadvantages were minimised by chosen administration style discussed later in this section.

Development

The actual interview process followed a developed interview guide (Appendix 7) based on 6 stages of interview proposed by Goodman, Kuniavsky and Moed:

- Introduction of both interviewer and respondent.
- Warm-up for focused answering of questions.
- General issues, as attitudes, expectations, and assumptions about the subject.
- Deep focus on participants experiences with the subject.
- Retrospective, evaluation of the subject compared with "general issues" description.
- Wrap-up. (2012, pp.129-130)

To secure a transparency, the development of the interview was guided by COREQ checklist (Appendix 8) developed by Tong, Sainsbury & Craig. (2007, pp. 349 – 357) They proposed 32 criteria divided in three domains for researchers to focus on in order to maximize the reliability of the interview.

As will be described further in this chapter, the interviewees were sampled from a pool of questionnaire's participants, therefore during the first stage, the interviewer were aware of the demographic information as well as his/her practice, expertise and level of experience with the PlanEat app. During the introduction phase, interviewer presented the aim of the study and the use of the gathered data. During the warm-up phase the interviewer described an agenda of the interview. The third stage consisted of questions about general practice of the respondent and possible use of tools and application during the practice. The respondent was also asked about his wishes and needs for this kind of tools. In the fourth stage the respondent was asked about his impressions of specific functions of the PlanEat app. In Retrospective phase, participants were asked to stat the overall impressions and suggestions. During the last phase, participants were asking for further additional comments and the interview was wrapped-up.

The complete interview guide is enclosed in Appendix 7.

Sample

Brace identified possible shortcomings of face-to-face administrating interview as a difficulty of obtaining a representative sample of the survey population. (2008, p.26) In this research we[11] set to interview representatives of different stakeholder groups differentiate on their level of experience (regular users, one-time users) and expertise (less than 5 years of practice, more than 5 years, etc.). As the interview and usability testing were about to be performed in the same session, the number of participants was provided by results of p-value calculation discussed in section 5.7. Although, according to Creswell, the goal when

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[11] In this research the collective pronoun "we" is used in instances, where the decisions were made in collaboration with the development team or members of the PlanEat's company management

conducting a qualitative research is to illuminate specific stories, instances, and/or experiences rather than possible generalisation of the results based on representative sample. (2013, pp.147-150)

Since the questionnaire was distributed to a specific group of regular users who have participated in the PlanEat trainings, there was a need to recruit more one-time users for the interviews in order to secure diversity in the interviewed sample. The interviews were therefore conducted with three participants chosen from the questionnaire's participants and three first-time users, students with nutrition or sport background. Since the user needs a certain level of knowledge to understand the language and possible choices in the app, first-time users were asked to confirm understanding of the terms used in the app.

Deployment

The face-to-face interviews were performed in a remote setting through the app Google Hangouts. This approach was chosen based on following reasons. The management of the company expressed a request "not to bother too much the users", therefore it was desirable to reduce the time required from the participants to minimum necessary level. Although, all users that participated in the interview session expressed their willingness for further collaboration in the questionnaire, there was a notion to meet the wish of the management. In the questionnaire, participants did not disclose the location of their practice, but from the analysis of Google Analytics showed that the current users are based in different parts of Slovakia and Czech Republic. By administrating the interview in remote mode, it was possible to reduce the time and cost of commuting for the interviews. This approach allowed participants to stay in their chosen environment and therefore, reduce the possible stress of a lab environment. It also allowed for them to choose their preferred time for the session, have enough time and be relaxed with no pressing issues following. The Google Hangouts app allows function of screen sharing therefore, it was possible to show participants screenshots of the interface of the app for better recollection during specific questions. The first-time users were given access to the app before, and they were asked to look around and get an overview of the abilities and functions of the app. The audio of the session was recorded, and transcriptions are enclosed in Appendix 9.

Pilot test

The pilot test of the interview was done in notion to test the formulation of the questions, understanding of used terms and to practice the technical aspects of the session as well as the administration of the interview.

As for the technical aspects, participants experienced no problem with the app Google Hangouts.

There were no raised issues regarding the formulation of the questions nor required explaining of term. However, a more general description of the app was added into the introduction since the first-time user asked additional information about the purpose of the software and its background.

Content analysis

According to Bryman, *grounded theory* is most widely used framework for analysing qualitative data. (2012, p.567) Grounded theory is an iterative process when the data collection and analysis occur in parallel as follows:

1. Research question formulation
2. Theoretical sampling and data collection
3. Coding -> generate concepts
4. Constant comparison -> generate categories
5. Saturation of categories
6. Explore relationships between categories -> generate hypothesis

7. Sampling and further data collection
8. Theoretical saturation
9. Testing of hypothesis –> generates substantive theory (Bryman, 2012, pp.570-572)

The objectives of content analysis can be derived from research questions. (Bryman, 2012, p.295) When coding, Bryman suggests focussing on count of words, occurrence of repeating subject and themes and disposition. Lazar & Feng & Hochheister describe, that a standard procedure of content analysis starts with set of data, in this research with set of transcribed interviews. (2010, p.289) When coding proposed topics, one needs to develop Coding schedule and Coding manual. The coding schedule is "a form onto which all the data relating to an item being coded will be entered", represented in a series of columns with descriptive headings. (Bryman, 2012, p.298) Coding manual than represents "a statement of instructions to coders that also includes all the possible categories for each dimension being coded". (Bryman, 2012, p.299) Bryman highlights the thorough construction of the coding manual, as it is a crucial element to successful coding. Lazar et al. proposed two ways of approach:

- A priori coding – based on established theories, groundwork and relate literature from which are derived the coding schedule and manual

- Emergent coding – used when there are no established theories and the coding schedule and manual are derived directly from the data (Lazar et al., 2010, p.289)

Within this research, the coding was performed by two researchers following emergent coding approach. The coding schedule, the coding manual and the results can be found in Appendix 10.

In terms of reliability is important to focus on inter-coder reliability (if done by two or more researchers) or intra-coder reliability (if done by one researcher). Inter-coder or Intra-coder reliability focuses on consistency of results over time. According Leighton (2017, pp.119-120), "the best-known measure used to calculate inter-rater reliability corrected for chance is the unweighted kappa coefficient."

$$k = \frac{(\Pr(a) \text{ agreement between raters}) - (\Pr(e) \text{ chance agreement})}{1 - (\Pr(e) \text{ chance agreement})}$$

According to Landis and Koch (1977), the following interpretation of kappa values can be used:

- 0 suggest less than chance agreement.
- 0.01 to 0.20 suggest slight agreement.
- 0.21 to 0.40 suggest fair agreement.
- 0.41 to 0.60 suggest moderate agreement.
- 0.61 to 0.80 suggest substantial agreement.
- 0.81 to 0.99 suggest almost perfect agreement.

The coding within this research reached almost perfect agreement when the inter-coder agreement was calculated as 96%.

To secure reliability and validity of the content analysis, the researchers were guided by Bryman's checklist consisted of 11 questions to answer before conducting the analysis.

5.7   Think-aloud

According to Van den Haak, "Think-aloud protocols are a widely used method for the usability testing of software, interfaces, websites, and (instructional) documents." (2003, p.339) During the think-aloud test user is asked to perform predefined tasks and comment on the performance during or after the test. In this way, user" generates direct data on the ongoing thought processes during task performance" (Jaspers, Steen, van den Bos & Geenen, 2004, p. 783). Van den Haak argues, that this direct process highlights validity of the method as "the data obtained reflect the actual use of an artefact, and not the participants' judgements about its usability". (2003, p.339)

Leighton explains, that the method is "used to measure *problem-solving processes* in working memory" (2004, p.21). Problem-solving process represents a goal-driven process of finding a solution to a problem defining situation. According Leighton, problems can be well-structured or ill-structured, which can be compared to simple and complex problem. In the area of HCI the simple problem could be "how to navigate to next page" with answer "click on NEXT PAGE button". The ill-structured and more complex problem would be "register a new user", which would require solving a set of simpler steps. Leighton highlights the importance of understanding the problem as key in the right formulation of tasks for think-aloud test. (Leighton, 2004, pp.22-28).

There are two ways of conducting a think-aloud test: *concurrent think-aloud* (CTA) where participants think-aloud while executing the tasks and *retrospective think-aloud* (RTA) where participants finish the tasks first and comment on them after completion of the test. There are advantages and disadvantages to the proposed administration forms. Ericsson highlights the importance of verbal expression of thoughts during task completion as the closest connection between actual thoughts and verbal reports is found when people verbalize thoughts spontaneously. (2006, p.227) Van den Haak et al. set to compare CTA and RTA in terms of task performance, participant's feedback and overall method feedback. Their results showed that the CTA method is more representative task-oriented usability test and results in significantly more problems detected by means of observation only. The RTA method, on the other hand, is likely to provide broader spectrum of users' reaction and verbalisation of more revealing problems that were not observable. (2003, pp. 344-350)

There are two issues that needs to be taken into mind when conducting think-aloud test: *reactivity* and *nonverdicality*. Reactivity (concerning CTA) is an effect, that verbalisation of thoughts has on the process of executing the task. It may alter the execution of the test or prolong the reaction time and therefore the overall time of task completion. Nonverdicality (concerning both CTA and RTA) occurs when the participant does not vocalize all of his thoughts or fabricate some thoughts. (Russo, Johnson & Stephens, 1989, p.760) However, a study conducted by Fox, Ericsson & Best showed no difference when comparing performance of task execution while giving concurrent verbalizations to a matching condition without verbalization. Although, their findings conclude that the task completion time prolongs during the think-aloud test and the performance of the participants is also higher.

There are also two other possible forms of administration of a think-aloud test: *remote* and *present*. Present administration mode is when the researcher and the participants are both present in lab while taking think-aloud test. The remote think-aloud test became more used in recent years as it significantly reduces costs, save participants' time and can be executed in the participant's natural setting. Moreover, recent studies found out that mostly due to natural setting, more relevant data are gathered from more representative sample (due to convenience of testing). (Oztorpak & Edbruk, 2008, p.1)

In designing computer systems, the think-aloud method can be used in two ways: (1) to analyse users' task behaviours in (simulated) working practices, after which a computer system is actually built that will support the user in executing similar tasks in future; or (2) to reveal usability problems that a user encounters in interaction with a (prototype) computer system that already supports the user in performing certain tasks. (Jaspers, 2006, p.598)

The think-aloud-tests performed in this research were concurrent in nature and administrated in remote setting. By choosing this approach, it was possible to benefit from proposed advantages of thorough problem detection while maintaining user's comfort and securing a representative sample.

Development

The tasks, and also the whole research, focuses on the area of client management section and generation of the nutrition plans. This area was suggested beforehand by the company management in the preliminary interviews.

Rubin and Chisnell are highlighting an importance of detailly prepared test, which could be secured by focusing on following materials early in a process of development:

- **Orientation script** – a communication tool meant to be read to participants beforehand, containing explaining of objective of the test, highlighting that it is the product that is being tested, not the participants. The orientation script used in this research is included in the interview guide (Appendix 7)
- **Background questionnaire** – contains participant's experience, attitudes, and preferences regarding the tested product. This was covered earlier in the research as half of the participants also filled the questionnaire. The firs-time users were asked about mentioned issued during the interviews.
- **Data collection instruments** – tools for recording participants responses. It is important that the administrator does not use too many instruments which would divide his/her attention. The software used for audio and video recording was set prior to each session, which left only operating of the Google Hangouts app for the researcher and participant.
- **Nondisclosure agreement** – participants were informed of the purpose of the test, ways of data gathering, use and anonymization. Participants gave their verbal confirmation of understanding and consent.
- **Pre-test questionnaire** – focuses on the first impressions and attitudes towards the product. This phase was covered during the interview prior to the think-aloud test.
- **Task scenarios –** Following tasks were created in collaboration with a member of the development team:

    - 1. task – Create a new client as it would be you.

        This task requires to input series of information about the client into the app (e.g. biological information, allergies, food preferences, description of client's lifestyle etc.). By asking participants to create a client based on themselves we wanted to ensure there would be no hesitation caused by the nature of the information that they would be inserting in to the system.

    - 2. task – Generate a nutrition plan for you (your created client) without modifying the template.

        When creating a nutrition plan, user can choose from predefined templates created by other nutritionists, doctors or specialized chefs. The chosen template won't affect the following steps

of the task. The choosing of a certain template affects ratios of the nutrients, macronutrients, energy intake but allows user to navigate through the same stapes independently of a template.

- 3. task – Buy 100 credits. Continue until you are asked to fill credit card information

- 4. Task – Copy existing template into your own folder and modify one meal

- 5. Task – Look for an amount of iodine in any chosen food

- **Post-test questionnaire** – focuses on overall impressions of the product with an intention to deepen researcher understanding of participants feelings about the strengths and weaknesses of the software. This topic was also covered with the interview prior to the think-aloud session.
- **Debriefing topics guide** – researcher can ask clarifying questions or participants can provide their statement (2008, pp.153-199)

Sample

According to Borsci, Martin & Barnett, one of the most important concerns regarding usability testing is deciding a number of participants. (2013, p.167) The controversy lies between inability to identify all usability issues with fewer participants and wasting valuable resources with more participants then necessary. Borsci et al. stress that the debate regarding the right number of participants is well established but valuable contributions were made in recent years.

P-value is used for calculation of percentage of problems detected in following formula: $D = 1 - (1 - p)^N$ where D is the percentage of problems discovered by the sample N is the number of participants (figure 6). According to Borsci et al., "When the p-value is equal to or greater than 0.3 (i.e., the standard), the sample has a high ability in discovering problems". (2013, p.160)

p value	Number of Subjects
	1	2	3	4	5	6	7	8	9	10
0.10	10%	19%	27%	34%	41%	47%	52%	57%	61%	65%
0.20	20%	36%	49%	59%	67%	74%	79%	83%	87%	89%
0.30	30%	51%	66%	76%	83%	88%	92%	94%	96%	97%
0.40	40%	64%	78%	87%	92%	95%	97%	98%	99%	99%
0.50	50%	75%	88%	94%	97%	98%	99%	99.9%	99.9%	99.9%
0.60	60%	84%	94%	97%	99%	99.9%	99.9%	99.9%	99.9%	99.9%
0.70	70%	91%	97%	99%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
0.80	80%	96%	99%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
0.90	90%	99%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%

FIGURE 6 THE DISCOVERY LIKELIHOOD OF A HYPOTHETICAL SAMPLE OF 10 INCREASING THE P-VALUES FROM 0.10 TO 0.90. (BORSCI ET AL.2013,P.176)

There are several prediction models using p-value: Return on investment (ROI), Good–Turing (GT); Monte Carlo (MC); and bootstrap discovery behaviour (BDB) model, which differs in formula for calculating the p-value. Borsci et al. compared introduced methods (figure 7) and concluded that "the p-values estimated with the models (pRaw, pGT, pMC, pBDB) show that the discovery likelihood of this sample, composed of six subjects, is insufficient to identify more than the 85% of the problems in the product under evaluation". (2013, p.189)

ROI		GT		MC Analysis		BDB Model	
p_{Raw}	>85% of the problems	p_{GT}	>85% of the problems	p_{MC}	> 85% of the problems	p_{BDB}	>85% of the problems
0.23	8 subjects	0.11	17 subjects	0.19	10 subjects	0.020	10 subjects

FIGURE 7 ESTIMATION OF THE P-VALUES AS CALCULATED BY DIFFERENT MODELS (BORSCI ET AL., 2013, P.189)

This research set follow conclusion of Borsci et al. by interviewing six participants.

Deployment

All tasks were performed in a special account set up for this purposed. By doing this, participants did not hesitate to start a generation of the nutrition plan as they would not pay for it with their credits. This scenario also secured the privacy of participant's clients which appears on left side of the screen.

All tasks were performed from the default screen and after each task we asked the participants to click on a logo in a left upper corner to bring them to the default screen. Participants was also asked to enter ID-# wherever they were asked to input their name.

The think-aloud tests were performed as a part of the remote interview session. For this we continued to use the app Google Handouts which allowed users to share their screen. This way we were able to record their activity with a software installed on our computer. This administration mode was chosen for following reasons. This approach didn't require installing a piece of new software on the participant's computer. Therefore, we were able to avoid a possible time loss of the actual time of the session. This also reduced possible malfunction of the recording software which could be not compatible with participant's operation system or for other possible reasons. This way of administration also allowed our participants to interact with the app through a familiar device therefore we reduce the possibility of the bias of a use of unknown device. As the users stayed in their own environment during the whole session we reduced a possible stress of a lab conditions.

Rubin & Chisnell proposed a checklist (2008, pp.213-214) for a successful deployment of a usability test which was followed in this research and is included in Appendix 11.

Pilot test

The pilot test of the think-aloud test was done in order to test the formulation of the tasks but also to test the setting of the test as it requires a use of multiple software. Participants for the think-aloud test were the same as for the pilot test of the interview, as it a part of the same session.

During the actual test no malfunction of the software occurred. Participants had no trouble to log into the special account nor share their screen and stop the screen sharing.

Regarding the formulation of the task, participants had no trouble with formulation of 1st, 3rd, 4th and 5th question. However, the second task offers a lot of possibilities for modification of meals, accompanying text description or a form of the exported pdf. Therefore, the set of sub-tasks was developed:

2.1 task – Change one ingredient in a one variant

2.2 task – Save this message as personalized message with caption your ID

2.4 task - Export this pdf as a version including recipes

The average time of the think-aloud pilot test was 17 minutes. However, since the pilot tests of think-aloud-test were performed with one first-time user and one regular user of the app, the expected time for the think-aloud test was set according the first-time user at 25 minutes. That also set the maximum length of the interview for 35 minutes, as the intention was not to extend 1-hour length of the whole session.

Analysis of think-aloud

According to Van Someren, Barnard & Sandberg, there are three important issues to focus on when conducting a think-aloud analysis:

- Constructing a mapping between protocols and model.
- Avoiding bias and interpretation errors in comparing protocols and model.
- Quantifying the correspondence between protocols and model. (1994, p.117)

Van Someren et al. highlight difference between think-aloud analysis and content analysis used for analysing interviews, as the former focuses on solving a problem and therefore involve process models. To address this issue, they propose to include special coding categories such as:

a) Talking about not-task related issues
b) Evaluation of the task or task-situation at a meta-level
c) Comments on oneself
d) Silent periods
e) Actions. The subject performs an action (1994, pp.118-122)

Leighton proposed 7-step analysis of verbal reports from think-aloud tests:

1. Reduce and segment the verbal reports according to the interview questions of interest;
2. Develop or choose a standardized coding scheme or formalism for rating verbal report utterances;
3. In developing a standardized coding scheme, indicate (operationalize) the verbal report utterances (i.e., provide examples of utterances) that serve as evidence for codes in the formalism for rating reports (mapping);
4. Calculate inter-rater reliability for the codes assigned to verbal report utterances;
5. Illustrate or depict the mapping of codes - for example, via a cognitive model such as a semantic network representation;
6. Develop or choose a categorization scheme for interpreting the patterns displayed in the cognitive model, including providing examples of inter-linkages that serve as evidence for specific levels of comprehension (i.e., knowledge integration and/or organization); and
7. Calculate inter-rater reliability for the categorization of the cognitive model into different levels of knowledge integration and/or organization. (2017, p.163)

This research will follow proposed 7-step analysis and will include special categories, proposed by Van Someren et al., into the coding scheme. The process of developing a coding scheme and manual, covered by steps 2.-7., is described in section 5.6.

5.8   Visualisation

According to Boukhebouze et al., an effective UI is a key success factor for interactive systems, particular attention should be paid to the UI design during the Requirement Engineering process (RE). (2014, p. 1) They emphasize the importance of representation of requirements in different formats as "it might potentially help

on both understanding the users' needs (i.e. the requirements are not ambiguous) and validating the gathered requirements (i.e. the requirements are correct) " (2014, p. 5)
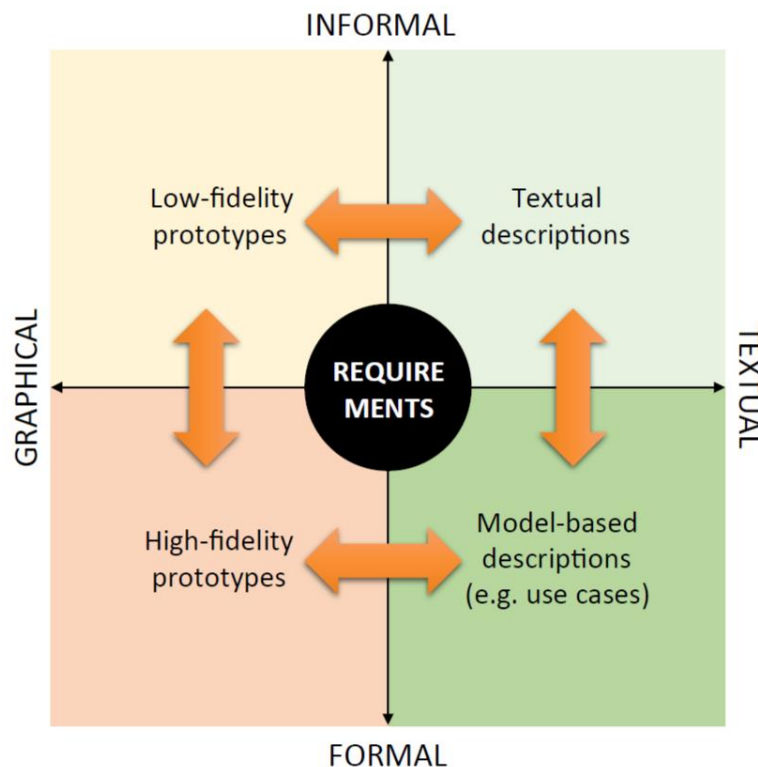

FIGURE 8 REQUIREMENTS VISUALIZATION, (BOUKHEBOUZE ET AL.,2014, P.3)

- **Textual requirements -** the users need are formulated in informal narrative description of interaction between users and the system. Textual requirements are capable of capturing functional requirements (features) as well as non-functional (quality, performance). Boukhebouze et al. highlights that the collection of textual requirement does not require any special set of skills. However, when using only this type of requirements, it is hard to ensure that the list is complete. This research set to produce a list of textual requirements based on the analysis of questionnaire, interviews and think-aloud test.

- **Model based description -** provide the overview of the functionality from system point of perspective. For this purpose, use case model or task model can be used. This format requires a significant knowledge and experience to produce. Since the functionality is not the point of focus of this research, the model-based description is not produced.

- **Low fidelity prototype -** are used in early stages of design process as they are easy to produce and allows for user-testing. Boukhebouze et al. state that testing of low-fidelity prototype can detect 80% of major interface problems. Within this research, the low fidelity prototype was based on results from the questionnaire analysis in combination with genius design and tested in the interview session.

- **High fidelity prototype -** contains UI version close to the final version and contains a lot of functional and aesthetic details, therefore is enable for evaluation of the usability of the final UI. The high-fidelity prototype is time-consuming to produce and often is produced without attention to the co quality. (Boukhebouze et al. 2014, pp. 3-4)

6. FINDINGS

In this chapter are presented results of the investigation and analysis. In every subsection's conclusions is described how the results contributed for answering research questions or influenced the design choices of the proposed app.

6.1 Stakeholder analysis

Following stakeholder analysis (table 3) was created in collaboration with representatives of the PlanEat company. The structure is based on Missonier & Loufrani-Fedida approach modified especially for IT projects (section 5.1).

		Stages	Primary Users of the application	Secondary Users' clients	Tertiary Management of PlanEat	Tertiary Developers of PlanEat
Stakeholder analysis	Morphological stakeholder network analysis	(1) Identify stakeholders and analyse stakeholder relationships	- create clients profiles - Produce nutrition plans - Record clients behaviour	- use nutrition plans - track their behaviour daily	- use analysis from system - sell system to third parties - acquiring feedback	- provide support and development of the app - analyse the use of the app
		(2) Identify stakeholder interests	- to have app that is based on solid algorithms - app that is easy to use - app that produces clear plans	- to have clear, easy and practical nutrition plans - to track only necessary data	- To have the best, most usable app - to gain as much users as possible	- to develop app that supports users' needs - to have no to minimum problems within the app
		(3) Assess stakeholder influence	- influence on PlanEat's management (if they do not like the app they will not use it and won't buy credits)	- influence on primary users (if they do not like the nutrition plans, they won't pay for this service)	- influence on included features - influence on resources for development team	- influence on correctness of algorithms - influence on UX and UI of the app
	Dynamic stakeholder analysis	(4) Identify controversies	- having hard time using the app - and have different demands on system's functionality (comes from different user background)	- the scope of this project does not concern secondary users and won't affect neither the nutrition plans that are the product of the app or the interface where the secondary users insert their daily reports	- not provided sufficient resources for development of the app (missing UX and UI team) - new resources needs to be provided to rebuild the interface	- missing UX team caused intuitive built which now must be rebuilt - implemented analytics tools are not analysed thoroughly and the results are not used
		(5) Analyse effects of controversies on stakeholder network	- needs trainings to discover functionalities of the app - use navigational videos and support sheets when working within the app		- Receiving negative feedback from users - needs to provide trainings on how to use the software - has troubles selling software to other parties	- insufficient analysis of deployed analytics causes guessing of direction of further development and not implementation of needs of primary users' needs

		Stages	Primary	Secondary	Tertiary	Tertiary
			Users of the application	Users' clients	Management of PlanEat	Developers of PlanEat
Stakeholder engagement		(A) Problematisation	- getting used to a new interface for the long-time users - possible slowdown of their workflow		- putting on hold other goals of the company	- in-depth user-centered analysis, market analysis and analytics analysis - creating new UX and UI design
		(B) Interessement and enrolment	- customers		- executive sponsors of the IT project	- executive developers and analysts
		(C) Mobilisation	- participating in user-centered research or providing feedback and implemented changes		- providing resources and support for the development team	- active participation in improvement of the app, clear direction of further development

TABLE 3 STAKEHOLDER ANALYSIS

Executive summary

Morphological analysis (1-3) described general goals of the stakeholders, their influences and needs. Second part (4-5) identified controversies of the built of the current app (the different requirements and missing UX and UI team during the development) and their effect on stakeholders, which accurately describes current situation in the company and the state of the app. The third part pointed out possible problems that may occur during and after realisation of the project and defined users' roles within the project. Last row contains actions that needs to be taken in order to finish the project successfully.

6.2   Competitive analysis

In this section are compared the three most used application on the Slovak and Czech market from the UX and UI perspective. These apps were chosen based on the list of competitors provided by the PlanEat company and results of questionnaire discussed later in section 6.4.

MOUNTBERRY

According to the website, the software Mountberry[12](picture 16) is designed for nutrition consultants, educational institutions, nutrition facilities, food manufacturers, fitness centres and dietitians, but also for anyone who wants to change their eating habits and lifestyle to improve their lifestyle. These are two very different user groups and the language and level of information seems to be more suitable for the former mentioned. It contains three modules: Fitness; Gastro; and Nutrition, which is relevant for this study. We were not able to download this software; however, the company is providing free tutorials, from which we could deduce quality of implemented features and get an overview about the UI and UX. Similarly, to the Nutris software it has visuals similar to old Microsoft Office applications.

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[12] http://www.mountberry.sk/zdravy-zivotny-styl/popis-nutricny-softver/6
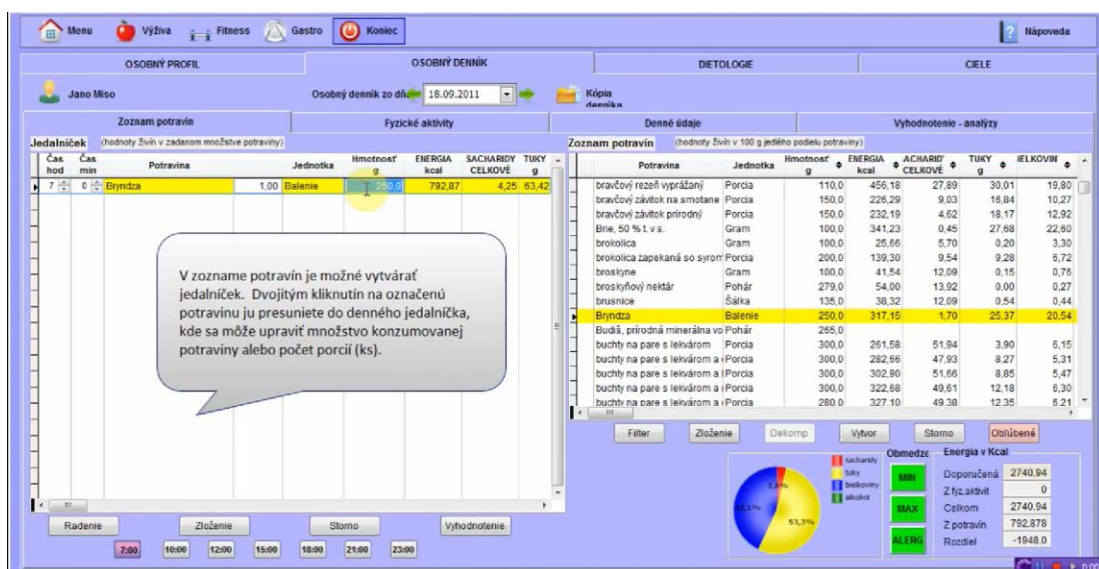
PICTURE 16 MOUNTBERRY SCREENSHOT

NUTRIS

Nutris[13], a company established in Czech Republic, is developing their own nutrition software since 2007. The Nutris software allows its users create nutrition plans by adjusting templates similar to PlanEat. According to the website, the range of features is based on the needs of nutrition consultants. It claims to provide users with a high level of comfort when it comes to diagnosing clients, a significantly wider database of foods and introducing brand new foods that have just emerged on the market. The software is not web-based (picture 17) so it needs to be downloaded and updated constantly in order to get access to new templates or food. The interface reminds of Microsoft Office applications and uses colours only for informative purposes.
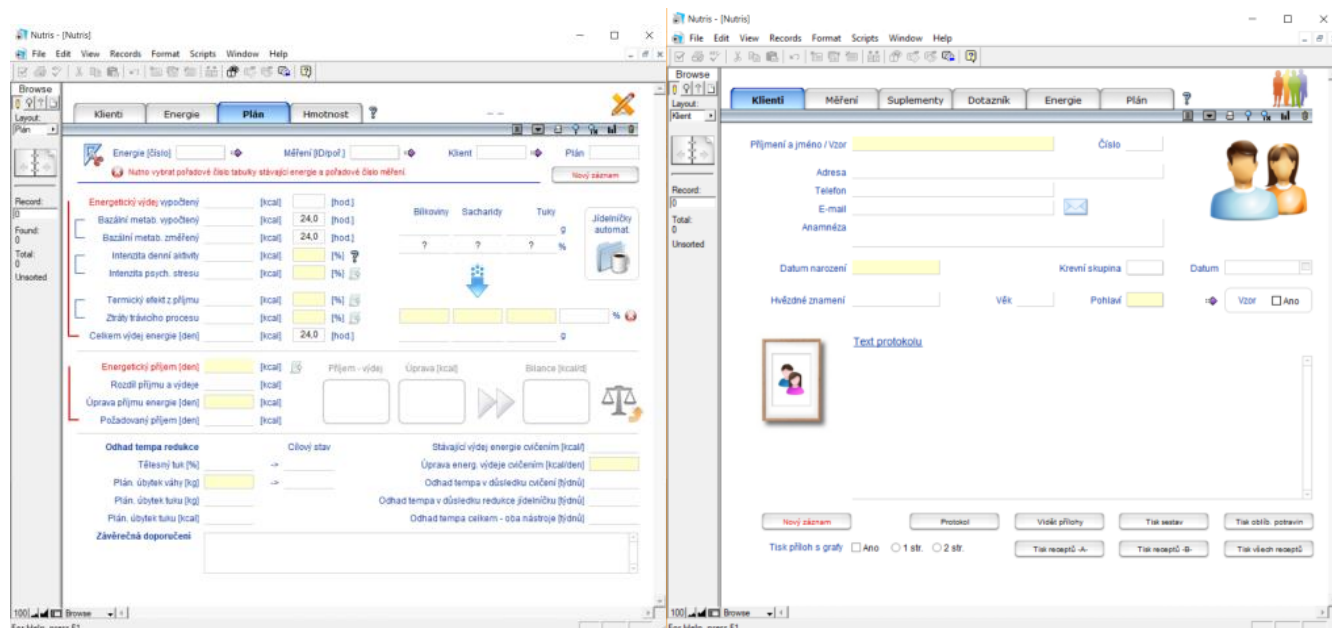
PICTURE 17 NUTRIS SCREENSHOT

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[13]http://nutris.net/software.php

FITMEE

The main focus of this application was tracking exercise activities in gym. Later they have expanded to ability to track other sports and then added nutrition planning. This app therefore provides the full service in regards of one's health management, however, the last section is the most general. This application is aimed at the general public therefore, the language and the level of information is also expressed accordingly. There are no to very little information about calculating caloric intake and displayed food database contains only four basic nutrient categories.
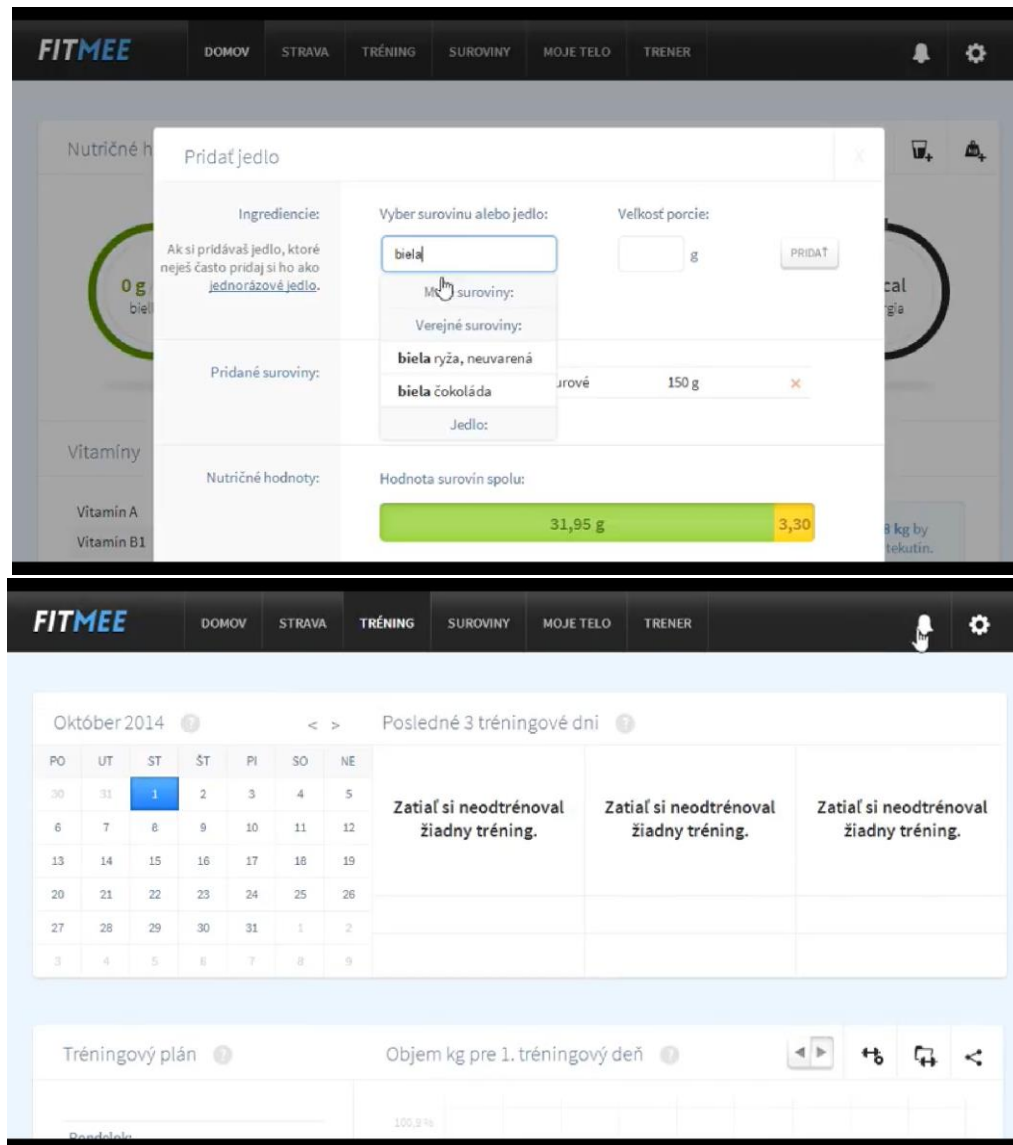
PICTURE 18 FITMEE SCREENSHOT

KALORICKE TABULKY

Kaloricke tabulky is another application aimed at the end user. The language and level of required knowledge is adjusted for a person with basic information about the nutrition and biology. This software has the advantage on PlanEat's app that it is fully responsive and can provide comfortable access through a mobile device. It also provides a version of client application which allow responsive view of the meal plan unlike PlanEat's app in which client can only view online PDF file. There is, however, no information about the

nutrition plans composition, which nutrients are taken into account and how precise the generation is, and it does not contain specification about allergens or illnesses.
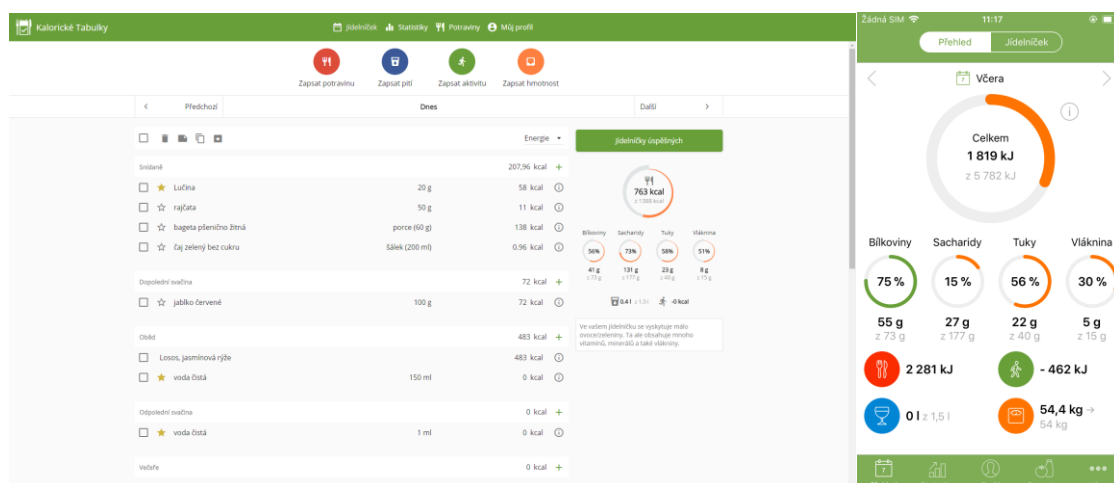
PICTURE 19 KALORICKE TABULKY SCREENSHOT

The results of the questionnaire (graph 1) showed that the participants were most familiar with the software Fitmee and Kaloricke tabulky. However, the majority of the users used the software only once or not at all. Only 3 participants are using Fitmee and 4 participants Kaloricke tabulky rarely.
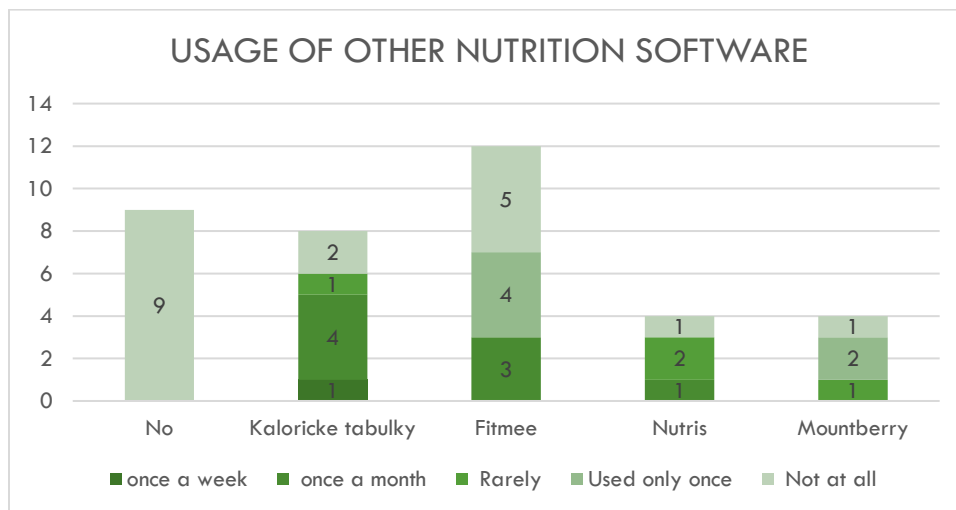
GRAPH 1

Executive summary

The software platforms deployed on domestic market are not regularly used by the participants of the questionnaire. This research focused on two B2B and two B2C applications. After review of available features can be stated that the PlanEat app contains all the features that the examined apps except for providing summary statistics. This feature contains the app *Kaloricke tabulky* which seems to be the most detailed. It also provides a responsive version and clients version of the app and has the most modern UI. However, from the websites or trial version is not clear how are the meal plans calculated. But since the Kaloricke tabulky is targeted at the end user, it's not a direct competitor to the PlanEat app.

6.3   Analytics audit

Following chapter describes the actual use of the app tracked by the analytics tools deployed by the PlanEat company.

Google analytics

Graph 2 shows the distribution of the Planet website's use in a timespan from 1st of February to 30th of April (full line) compared with timespan from 1st of November to 31st of January (dotted line). The peaks of activity, which can be seen during the November period, occurred in weekly period after broadcast of a TV reality show which mentioned PlanEat. The activity peak recorded on 10th of January followed broadcasting of a TV special concluding the reality show finale. This caused higher number of visits of the main website and also higher demand of nutrition plans from clients which manifested itself in higher number of created new clients in the app.
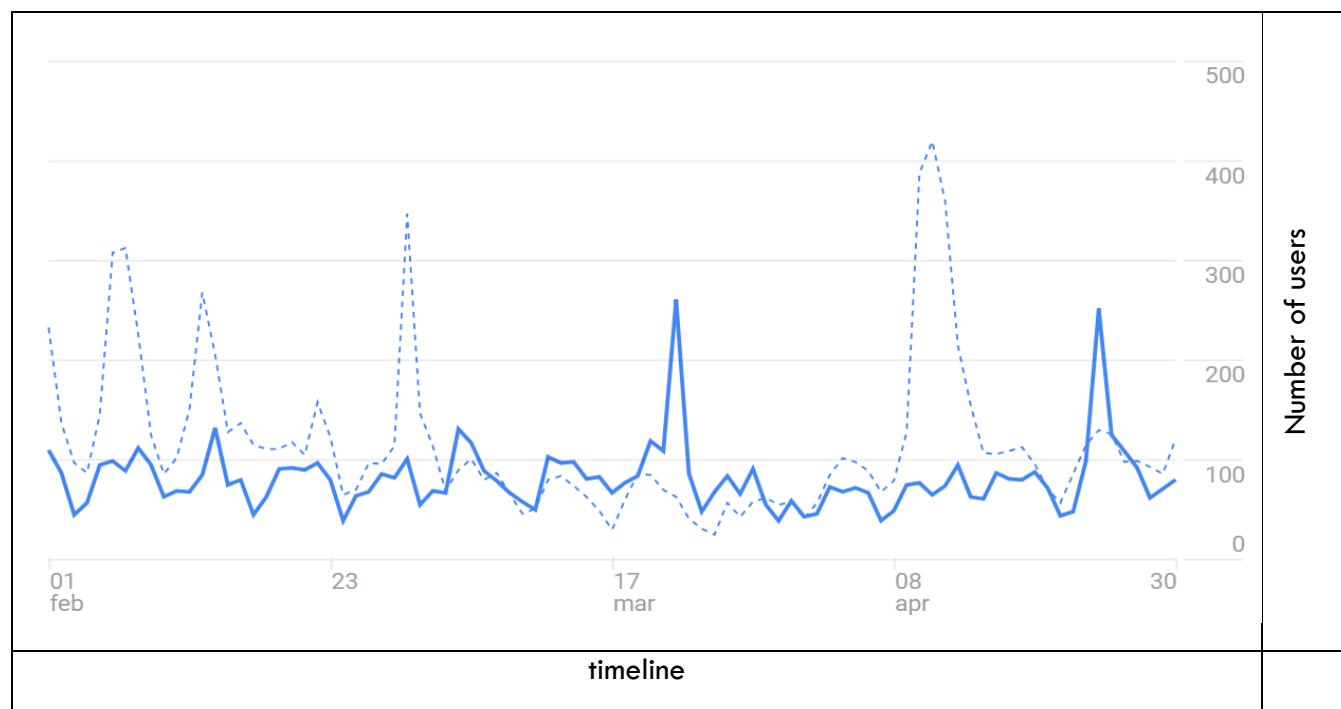
GRAPH 2 USAGE OVER TIME OF THE PLANEAT APP

During the February to April period (table 4), the main page was viewed more than 8 thousand times and the "clients" page which is shown after logging in was displayed 4621times. From this can be calculated that users displays the clients page (first page after logging in) 51,3 times per day in average. The third line shows the templates sections, in which admins can create or modify templates, is viewed in average 10 per day. The 5th 9th and 10th line shows also the activity of admins either in database or when defining kitchen units. In the line 4 and 7 are recorded number of visits of blog articles about nutrition with one of the best Slovakia's tennis players and popular actor, which were also published and shared on Facebook. This peak of activity can be also seen around 17th of March and by the end of April in previous chart.

Page content	Page URL	Page views	Unique page views	Average time spent

|					
1. Main page	/	⧉	8 189 (32,87 %)	6 054 (33,27 %)	00:01:09
2. Clients section	/clients	⧉	4 621 (18,55 %)	3 296 (18,11 %)	00:05:16
3. admin section - templates	/admin/diets/show/0	⧉	907 (3,64 %)	531 (2,92 %)	00:02:30
4. Blog post	/2017/09/12/michal-palenik-zdravo m-chudnuti/	⧉	788 (3,16 %)	672 (3,69 %)	00:02:48
5. admin sec. - Food database	/admin/food_database?mode=detail s	⧉	588 (2,36 %)	297 (1,63 %)	00:01:01
6. Nutrition Courses info	/courses/expertise/sk	⧉	415 (1,67 %)	281 (1,54 %)	00:01:20
7. Blog post	/2018/01/09/robo-jakab-teraz-chodi aca-reklama-jedalnicek-planeat/	⧉	342 (1,37 %)	322 (1,77 %)	00:03:29
8. App courses info	/courses/app/sk	⧉	336 (1,35 %)	249 (1,37 %)	00:01:53
9. admin sec. - New entry	/admin/ingredients/create	⧉	325 (1,30 %)	114 (0,63 %)	00:01:47
10. admin sec. - kitchen units	/admin/food_database?mode=kitch en_units	⧉	271 (1,09 %)	134 (0,74 %)	00:02:47

TABLE 4 PLANEAT APP'S USAGE

From the following table (table 5) of page views is possible to tell that the user group of nutritionists is the most active or the largest, followed by trainers and doctors.

Page content	Page URL	Page views	Unique page views	Average time spent
1. main page for nutritionists	Planeat - nutrition	5 788 (23,24 %)	4 019 (22,08 %)	00:03:38
2. login page	Planeat - Prihlásiť	3 242 (13,01 %)	2 004 (11,01 %)	00:00:40
3. main page for trainers	Planeat - trainer	3 207 (12,87 %)	2 204 (12,11 %)	00:03:07
4. landing page	Planeat - inovácie v personalizovanom stravovaní	2 990 (12,00 %)	2 416 (13,28 %)	00:01:34
5. main page for admin	Planeat - admin	1 656 (6,65 %)	1 226 (6,74 %)	00:02:33
6. main page for doctors	Planeat - medical	1 606 (6,45 %)	1 109 (6,09 %)	00:03:40
7. landing page in Czech language	Planeat - Inovácie v personalizovanom stravovaní	1 184 (4,75 %)	970 (5,33 %)	00:01:37
8. courses info	Planeat - školenia	847 (3,40 %)	598 (3,29 %)	00:01:33
9. blog post	Michal Páleník o zdravom chudnutí - Planeat BLOG	788 (3,16 %)	672 (3,69 %)	00:02:48
10. blog post	Planeat Trainer - Softvér na manažovanie stravovania	389 (1,56 %)	321 (1,76 %)	00:02:06

TABLE 5 PLANEAT APP'S USAGE

This provided an overview of which functions of the app are the most used. From this is possible to derive an information architecture.

When it comes to users' distribution in terms of demographics, the majority of users are females and the most users are in the age group 25-34 years.

■ female ■ male

23,2%

76,8%
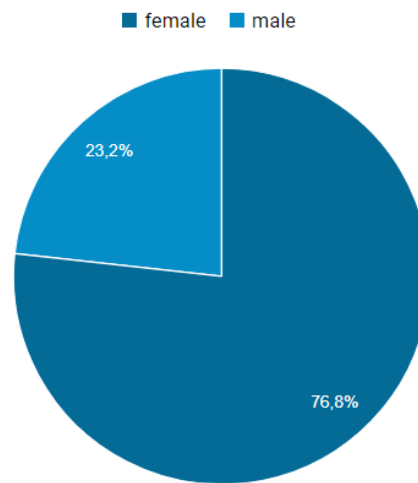
GRAPH 3 USERS GENDER DISTRIBUTION
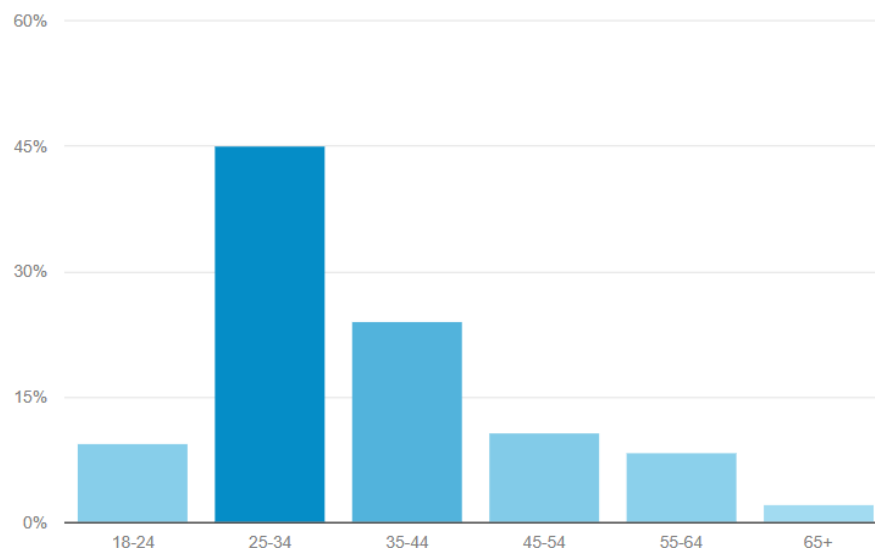
GRAPH 4 USERS DISTRIBUTION

Heatmap analysis

In this section is described the heatmap analysis of creating a client screen as it is the longest page within the app and the conversion rate was the lowest among all analysed heatmaps.
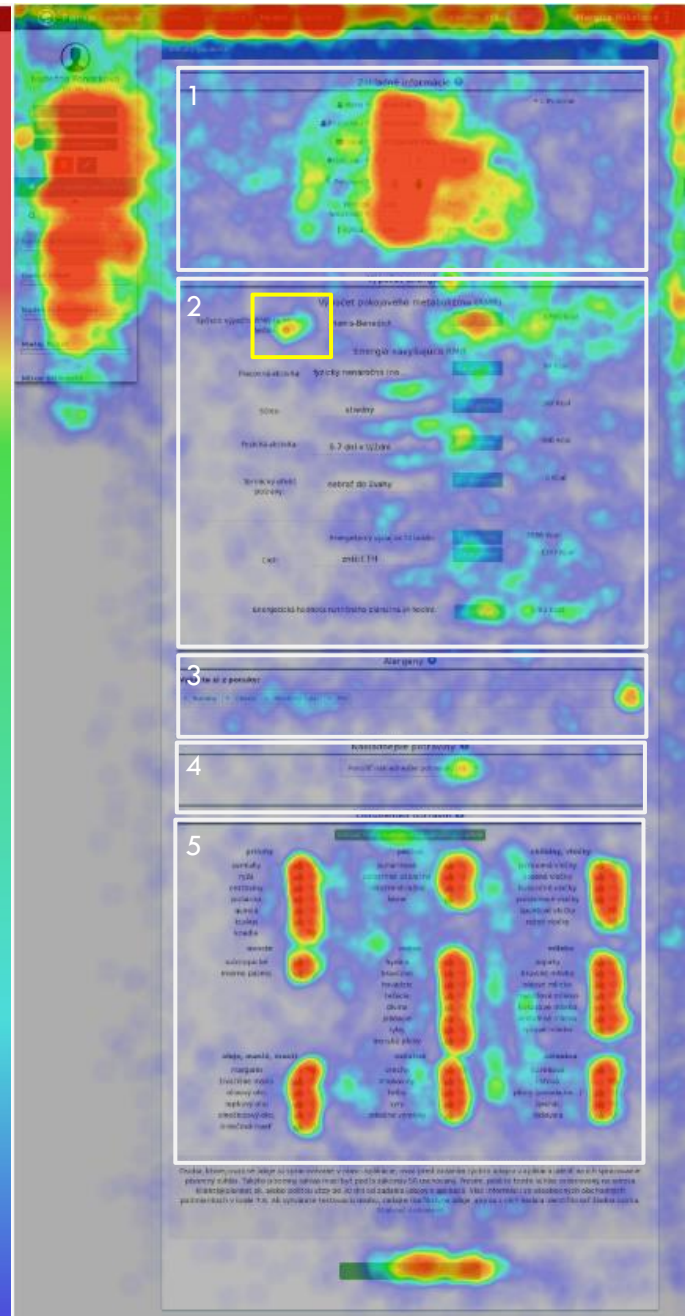
The picture 20 shows activity of 823 users on the page of client information measured by scrolling. 100% of users saw the red section and the yellow section more than 80%, depending on a screen size. The green section starts at 80% and continues down to light blue with 50%-40% of users displaying this section. The "save" button lies on a mark with 36% display activity. This means that 296 new clients were created, or their information altered in a span of three weeks.

The picture 21shows heatmap distribution of mouse movement on the same page. It is possible to see higher activity in the 1st section where users fill out basic information about the client and 5th section where they enter

preferred or disliked food. In the 2nd (energy intake), the activity is more distributed. Highlighted (yellow border) is information buttons that explains the meaning of specific section. Sections 3 (allergies and intolerances) and 4 (food price range selection) section allows users only to add or select information by clicking and the highlighted area.
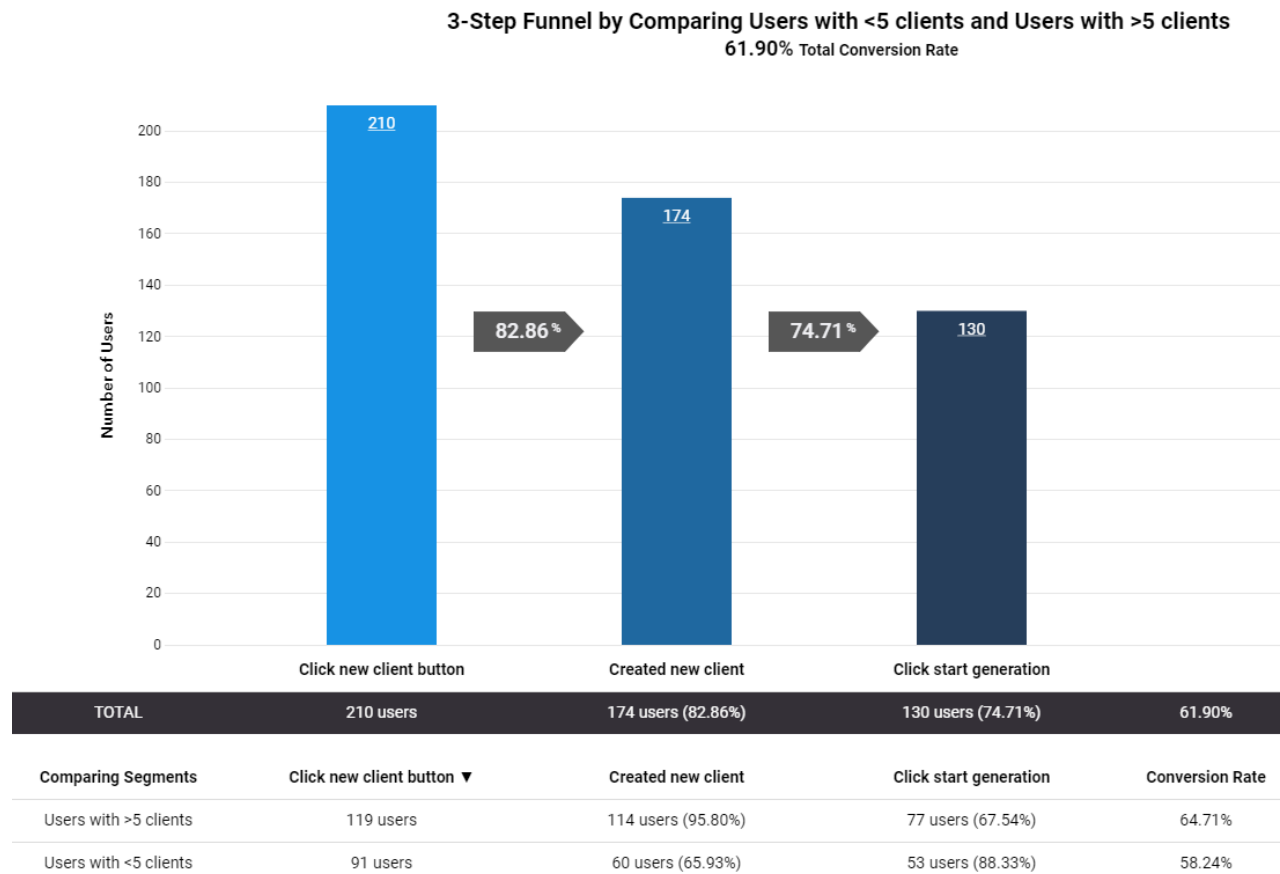

| PICTURE 20 HEATMAPS OF SCROLL | PICTURE 21 HEATMAPS OF CLICKS |

Funnel analysis

3-Step Funnel by Comparing Users with <5 clients and Users with >5 clients
61.90% Total Conversion Rate

Comparing Segments	Click new client button ▼	Created new client	Click start generation	Conversion Rate
TOTAL	**210 users**	**174 users (82.86%)**	**130 users (74.71%)**	**61.90%**
Users with >5 clients	119 users	114 users (95.80%)	77 users (67.54%)	64.71%
Users with <5 clients	91 users	60 users (65.93%)	53 users (88.33%)	58.24%

FIGURE 9 CREATING A CLIENT FUNNEL

The main process within the app is consisting of creation of a new client and generation of a nutrition plan for him/her. The results of funnel analysis (figure 9) showed that more than 95% of experienced users (users with more than 5 clients) complete the process of creation of a new client.

Less experienced users (less than 5 clients) complete the creation of a client in 65% of all cases. The less experienced users tend to start the generation of a nutrition plan within the same session in 88% of times. More experience users in less than 67%. The reason for this could be, that the more experienced users leave the funnel in order to modify a template or will wait for their clients to upload daily logs of their nutrition. The less experienced users tend to choose from predefined templates and proceed directly to nutrition plan generation.
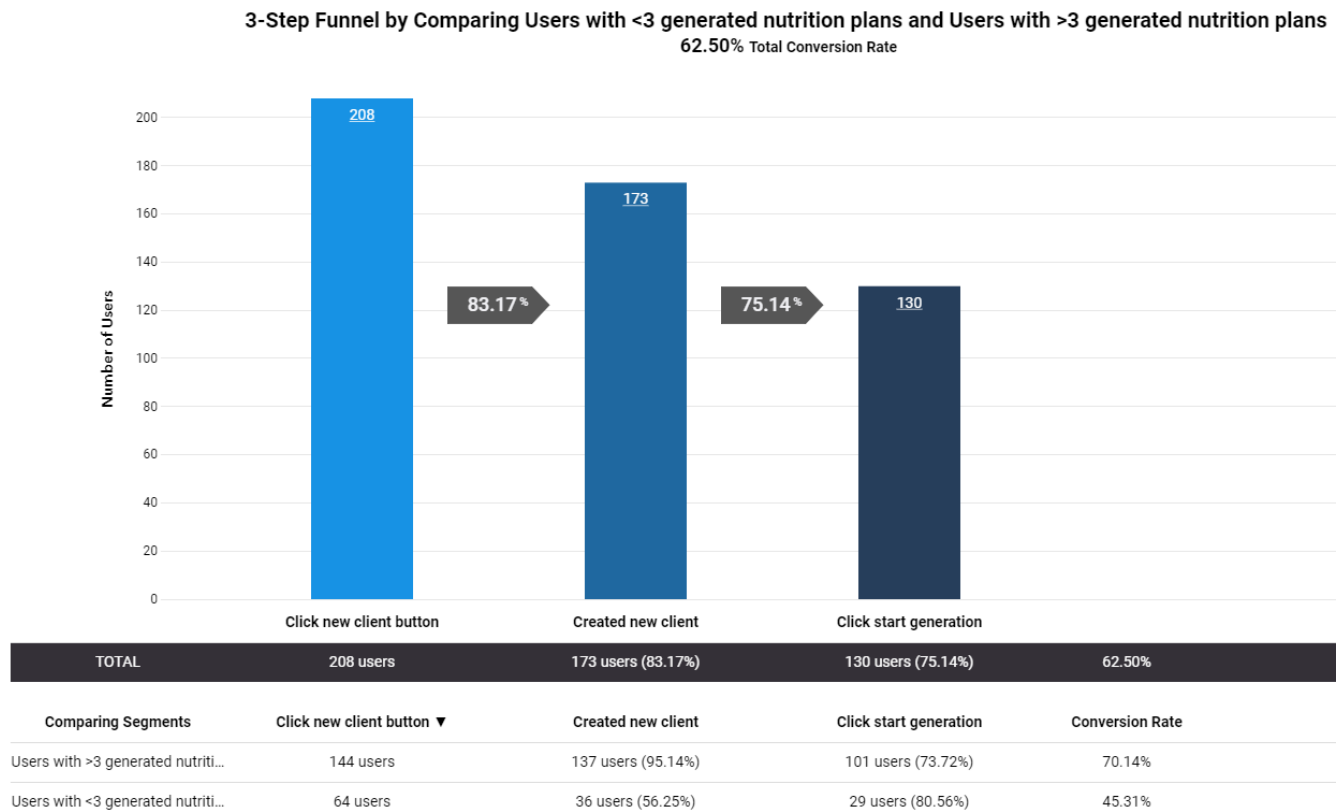
3-Step Funnel by Comparing Users with <3 generated nutrition plans and Users with >3 generated nutrition plans
62.50% Total Conversion Rate

	Click new client button	Created new client	Click start generation	
TOTAL	208 users	173 users (83.17%)	130 users (75.14%)	62.50%

Comparing Segments	Click new client button ▼	Created new client	Click start generation	Conversion Rate
Users with >3 generated nutriti...	144 users	137 users (95.14%)	101 users (73.72%)	70.14%
Users with <3 generated nutriti...	64 users	36 users (56.25%)	29 users (80.56%)	45.31%

FIGURE 10 CREATING A CLIENT FUNNEL

When analysing the same funnel with different segmentation (figure 10) of Users with more than 3 generated nutrition plans vs. Users with less than 3 plans, the differences between more and less experienced users remains the same. The experienced users are more successful when creating a new client (95% vs. 56%) and are less likely to start generation within the same session (73% vs 80%).

5-Step Funnel by Comparing Users with <5 clients and Users with >5 clients
62.77% Total Conversion Rate
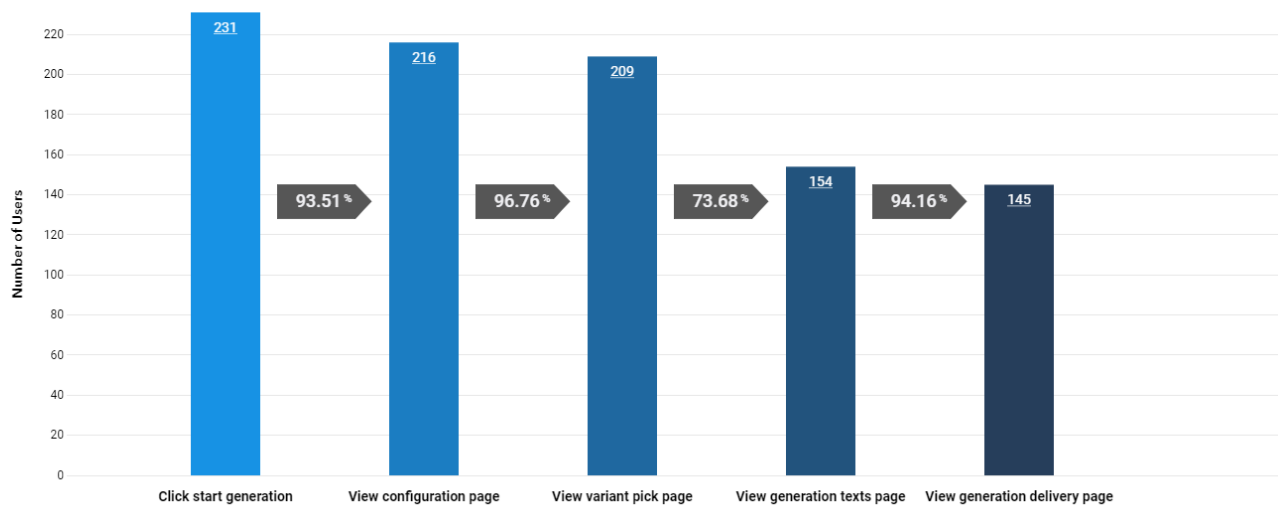
	Click start generation	View configuration page	View variant pick page	View generation texts page	View generation delivery page	
TOTAL	231 users	216 users (93.51%)	209 users (96.76%)	154 users (73.68%)	145 users (94.16%)	62.77%

Comparing Segments	Click start generation ▼	View configuration page	View variant pick page	View generation texts page	View generation delivery page	Conversion Rate
Users with >5 clients	119 users	115 users (96.64%)	113 users (98.26%)	79 users (69.91%)	75 users (94.94%)	63.03%
Users with <5 clients	112 users	101 users (90.18%)	96 users (95.05%)	75 users (78.13%)	70 users (93.33%)	62.50%

FIGURE 11 GENERATION FUNNEL

When comparing more and less experiences users within the generation of nutrition plan funnel (figure 11), the results showed that the two groups perform roughly the same until the page that allows picking of variants for the nutrition plan. 78% of less experienced users continue after this step, however, only 70% of more experience users continue to the text page. The process will then complete around 94% of the users which will result in the overall conversion rate on 63%.

5-Step Funnel by Comparing Users with <3 generated nutrition plans and Users with >3 generated nutrition plans
62.39% Total Conversion Rate

TOTAL	226 users	211 users (93.36%)	204 users (96.68%)	150 users (73.53%)	141 users (94.00%)	62.39%
Comparing Segments	**Click start generation ▼**	**View configuration page**	**View variant pick page**	**View generation texts page**	**View generation delivery page**	**Conversion Rate**
Users with >3 generated nutriti...	157 users	150 users (95.54%)	147 users (98.00%)	108 users (73.47%)	102 users (94.44%)	64.97%
Users with <3 generated nutriti...	69 users	61 users (88.41%)	57 users (93.44%)	42 users (73.68%)	39 users (92.86%)	56.52%

FIGURE 12 GENERATION FUNNEL

When segmenting users according their experience with generation of nutrition plan (figure 12), the same drop of percentage between 3rd and 4th step occurs. This may indicate that the users do not know what to do when the variants are generated and will leave prematurely.

Executive summary

The analysis of deployed analytics showed that in average 51,3 users go through the log in into the app every day. This however, does not count the users who opt in to stay logged in or never close their browser. The results showed that the nutritionists are the most active or the largest group of users, that the average age of the user is around 30 years and that it is 3 times most likely to be a woman than man. The analysis of heatmaps showed which sections of the app are used the most and in which sections users look for help or further explanation. Funnel analysis showed that between picking variants screen and finalisation of the generation process is approximately 23% drop of user. This gathered information will be used as a base for further investigation and also as a point of focus during creation of a mock-up and prototype.

6.4 Questionnaire results

Following results of the questionnaire's analysis (Appendix 12) are interpreted in consideration of nature of the sample in mind as described in section 5.5 Sample & Deployment.

From the results (graph 5) we can say that the every possible category is represented in among the participants. The participants distribution is representative from the perspective of a profession. As showed in table 6 in section 6.3 the most active group are the nutritionists, followed by personal trainers and doctors. It is also possible to conclude that the sample is representative from the age point of view since according to

Google analytics the most users are in age 25-36 which can mean that after finishing school (age 25-26, 28 for doctors in Slovakia) they have acquired 3-6 years of practice.

GRAPH 5 QUESTIONNAIRE SAMPLE DISTRIBUTION

Since the questionnaire was distributed to the participants of the PlanEat software trainings, all of them stated their participation (graph 7). 40% of the respondents didn't have enough knowledge for using the PlanEat app (graph 6). The used term *knowledge* refers to both technical operating of the app as well as nutrition field knowledge.
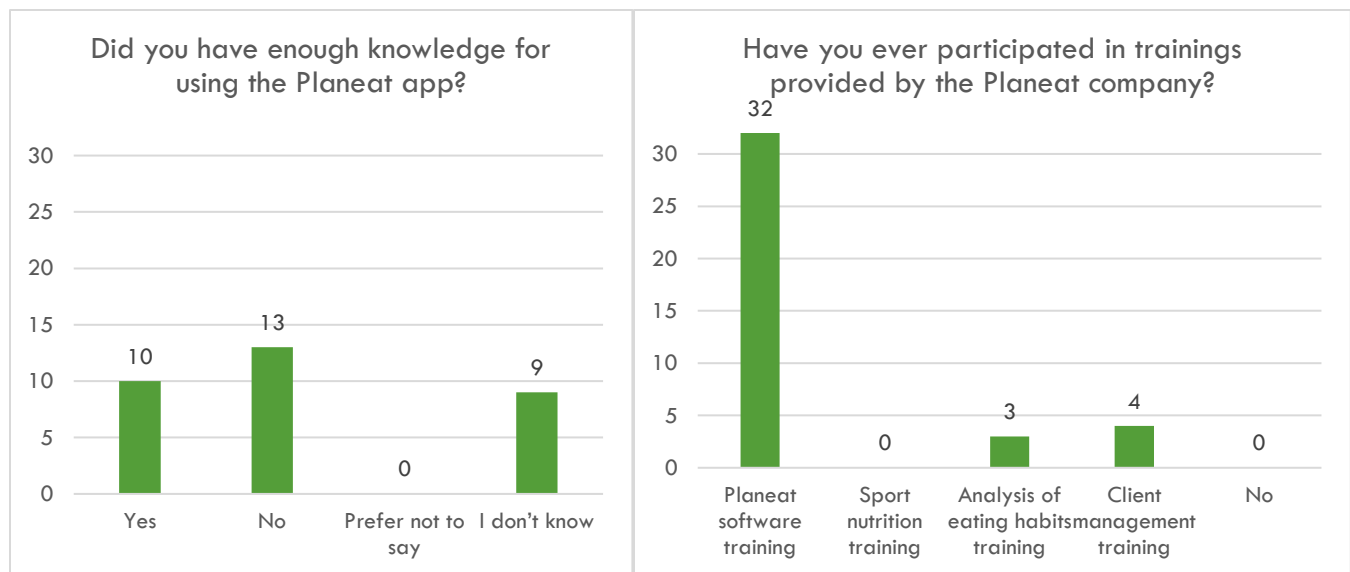
GRAPH 6 PLANEAT TRAINING PARTICIPATION

GRAPH 7 PLANEAT TRAINING PARTICIPATION

The results showed that approximately 19% of respondents uses the app multiple times a day, 22% on daily bases and 34% once a week (graph 8). Participants stated that they use the app mainly for time saving reasons and in order to produce clear nutrition plans for their clients (graph 9). Due to nature of the sample and the response rate it is not possible to draw conclusion regarding the use of the app. However, it is worth noting that the user's interaction with the app can be influenced by a number of his clients and their demands

for length of nutrition plan. The nutrition plan can be generated for 1 to 90 days, therefore taking care of the client does not require daily interaction with the app.
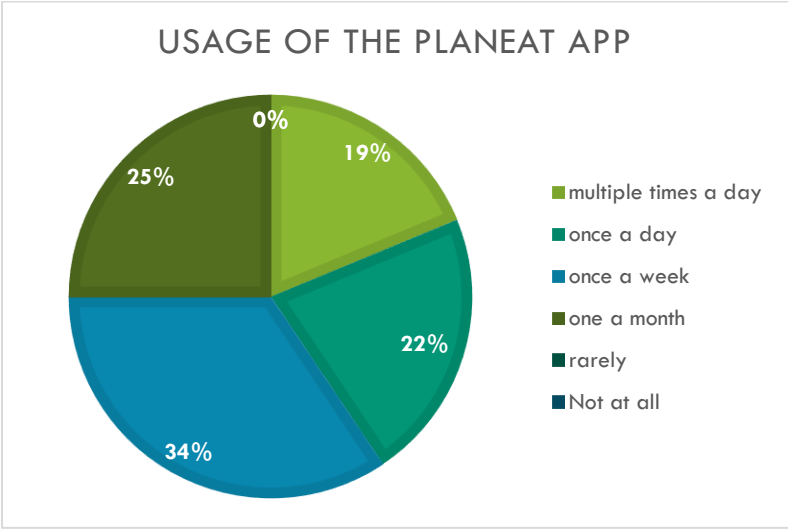
GRAPH 8
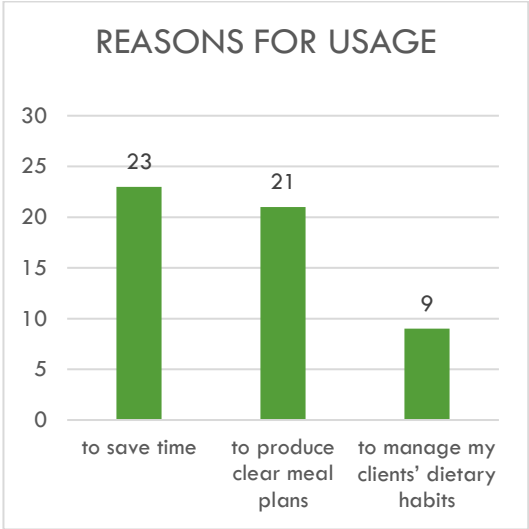
GRAPH 9

Results also showed that the most used feature within the PlanEat app is *creation of nutrition plans* (graph 10). Despite the fact that all respondents were also participants in software training, 34% of them still use tutorials. The least used features (graph 11)are *creation of templates* and *addition to the food database*. However, this results might not refer the actual use of the application considering the nature of the sample. During the PlanEat software trainings, participants go in detail over a production of the nutrition plan but do not cover templates or database.
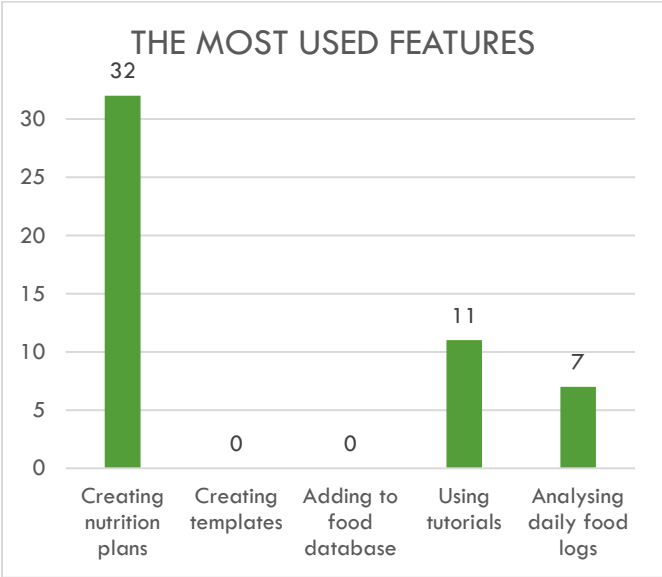
GRAPH 10
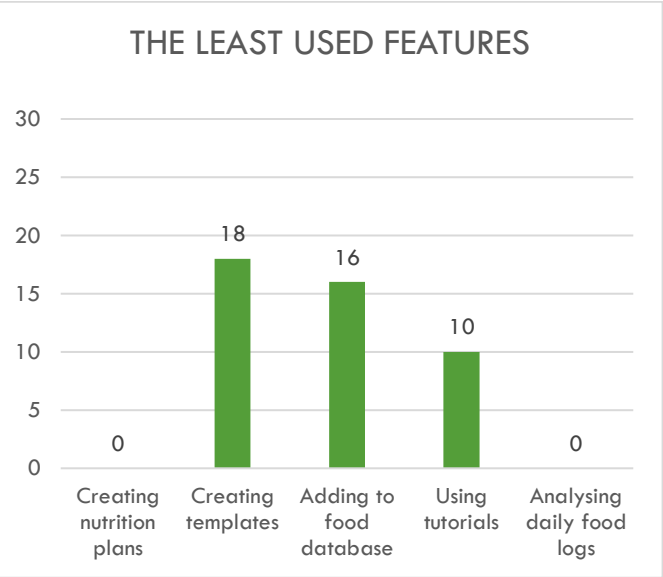
GRAPH 11

The overall opinion about the current PlanEat app (graph 12) is rather neutral as over 33% of all responses were marked as neutral. More than half of participants agreed that the used colour scheme is informative, language suits them and screen elements are understandable. Around 37% agreed that they know what is possible to do next within the app and that the overall app is attractive. On the other hand, more than 43%

of them disagree with the attractiveness of the app. Respondents also expressed disagreement with the app being intuitive (60%) and the information architecture making sense (50%). A strong disagreement was expressed in statement about the dashboard containing the information that the respondents need.

OPININONS ABOUT THE CURRENT PLANEAT APP

Legend: Totally disagree, Disagree, Neutral, Agree, Totally agree
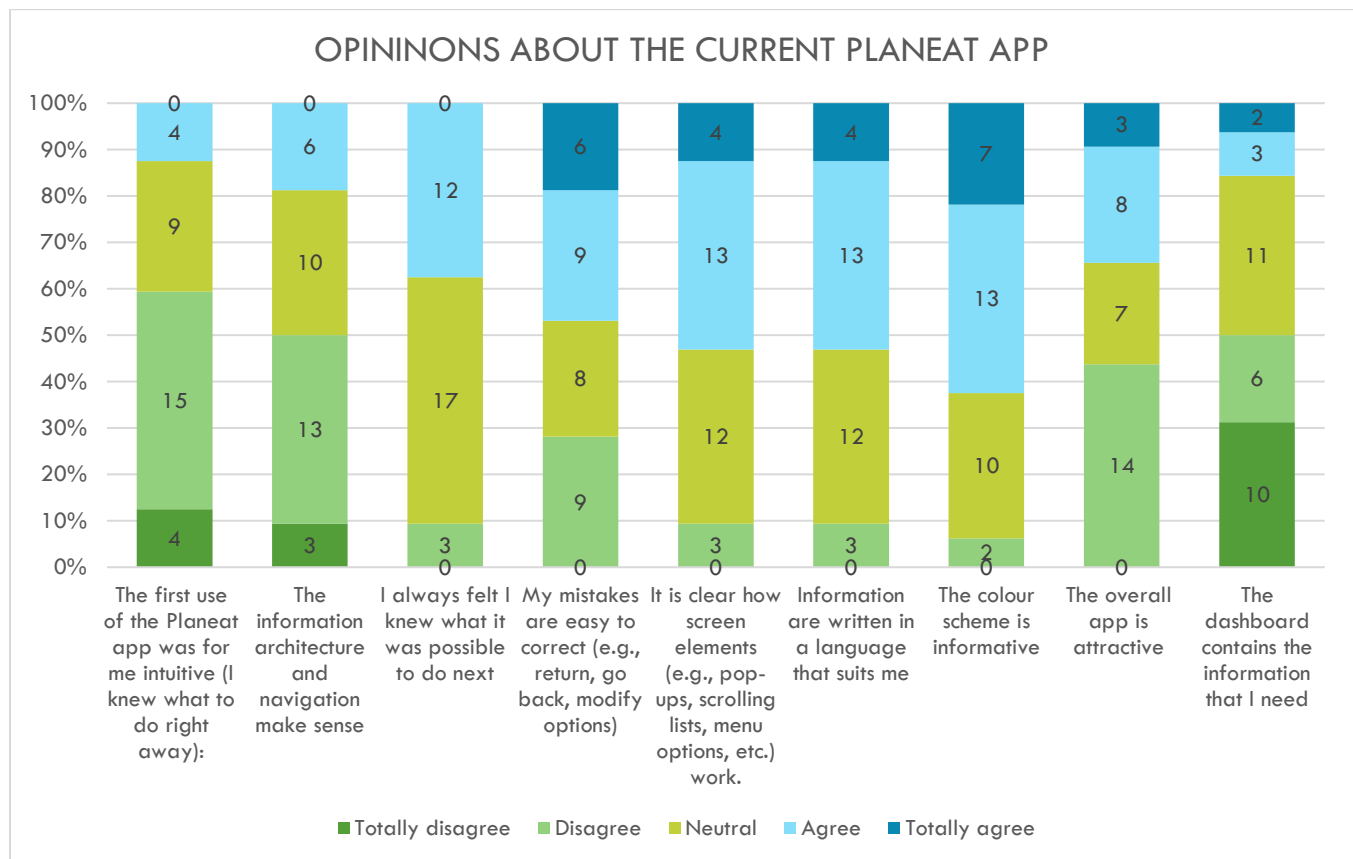
GRAPH 12

Executive summary

The questionnaire was developed in notion to acquire knowledge about the users' opinions about the current build of the app as well as about its use and reasons behind the use. Since the questionnaire was distributed only to a group of people that participated in the PlanEat trainings, the interpretation of the results needs to consider that. There is more disagreement (40%) than agreement (27%) with proposed positive statements about the current state of the app. However, it is not possible to tell if the respondents were describing the initial opinions about the app or if their opinions changed after the software training. The most disagreement was expressed towards the suitability of the dashboard, intuitiveness of the app and its information architecture. This served as a base for further investigation and also for the later prototype of the app.

6.5   Interview results

In this section are presented results from the coding analysis (Appendix 13) of the interviews and the textual requirements (green highlight) formulated from them.

Regarding the structure and the placement of functions on the default screen, participants pinpointed following issues. The default screen after logging in looks like it offers possibility of creating a new client

profile and all of the first-time users commented on this issue – "I thought that this is the pace where you can create a new client. It looks like you can fill up those information there." (ID-4) Experienced users expressed a need for different information on a default screen – "I would prefer there to be some kind of overview of the clients, or at least the last meal plan that I have started but not finished or something like that." (ID-7) Another participant said that "I would rather see like a little bit of information about all of the clients" (ID-8)

R1: The default screen should contain overview of users or templates.

Participants also suggested that the left sidebar with created clients should contain filter (ID-7 & ID-9), should make the "new button client more obvious" (ID-6) and that the client with expiring meal plan should be highlighted – ". And maybe if is like their meal plan expiring they could jump to the top" (ID-8).

R2: Clients section should contain filer

R3: Function for highlighting expiring nutrition plans.

R4: Buttons for creating new client should be more obvious.

When asked about the generation process, the participants were comprehensive about the steps of the process however stated that the "next" button was expected on the bottom of the screens (ID-5, ID-7). Participant ID-6 stated "it's a good idea to see the steps in the upper part but maybe the „next "button should be on the bottom of the page I know I was searching for it down there and then I realized that it was up there".

R5: The "next" button should be on the bottom of the page.

First-time user was overwhelmed by the amount of information on the first screen of generation – "ok there is a lot going on here (laughs)" (ID-5) and other one felt that this screen felt "chaotic, confusing and stretched out" (ID-4). They were also confused about the meaning of star icons on the first generation screen (ID-4, ID-5, ID-6) and pinpointed redundant information "but I don't know why I should enter again the weight of the client, didn't I filled it out in the profile?"(ID-5) and doubled information "well this is looks chaotic, there is like doubled the names for meals of the day on the left side, it's all stretched out." (ID-4)

R6: There should be no doubled information and information required twice.

Some first-time users where confused about the icons in the second screen – "But I don't know what that green plus means or the pencil, and there is also a pencil in the little frame, so I don't know" (ID-4). However, no experienced participant commented on any of mentioned icon issues which suggest that once the meaning is explained this is no longer an issue.

R7: The icons should have clear meaning, be descriptive.

All of the experienced participants commented on the fact that the generation process is not done when it shows 100% of generation completed – "sometimes it will write that its done and it's not done and when I go to lunches tab there is nothing there, so I need to wait some more" (ID-8) and ID-7 suggested that "just an estimate would be fine".

R8: The generation should include countdown and show 100% completion when its really done.

First-time users highlighted a good use of "tips for use" (ID-4, ID-5, ID-6), although the participant ID-7 found them annoying and repetitive. Experienced users highlighted functionality in the whole generation process,

especially in the multiple possibilities in 3rd, 4th and 5th screen of the generation (ID-7, ID-8, ID-9) Also first-time users mentioned that the meaning of buttons on these screens is straight forward (ID-4 and ID-6).

R9: Users should be able to hide tips that they have seen.

Regarding the templates and database sections, all participants seems to agree that the meaning of buttons available here are clear (ID-4, ID-5, ID-6, ID-7) and the they are easy to use (ID-7 and ID-9). ID-7 highlighted that the filter in the database should be more detailed.

R10: Filters should be more detailed

When asked about the overall thoughts about the app, reaction of the participants was negative in terms of visual and usage although ID-6 and ID-7 agreed that "it already looks better then all of the software that I have tried before" (ID-6). First-time users concluded that there are some confusing symbols and icons (ID-4, ID-5, ID-6), sometimes the information was "cramped together" and sometime "pretty loose" (ID-4). They felt like there is "a lot going on with the design" (ID-5, ID-6) and that "it kind of feels like it's not finished, I down know why, it just does" (ID-6). More experienced users agreed that the app was hard to use from the start (ID-7, ID-8, ID-9) but is easier to use then other older software (ID-7).

R11: The content should be well structured.

As for the functional improvements their suggestions revolved around creation of collaborative space for different reasons. ID-9 talked about creating templates in collaboration with her colleague by sending her notes via email and she was the one inserting them into the app. She suggested that "maybe for the future there could be some function that we could collaborate in the app instead of me sending her my part by email." (ID-9) Another participant described that she and her colleagues from fitness centre use the app but are not all capable of creating a specific template. She stated "if I could see what kinds of templates and meals he [colleague] created and I could use that. Because in the fitness centre there are like 6 or 7 that are using this [the app] and just yesterday a colleague finished the template for hockey players for the next season. I have no one like that among my clients but the other guys do, and they wanted to use it" (ID-8). Participant ID-4 expressed a need of an option for choosing which users to include in his version of the app "Like its ok if only I can see the food that I have added because it might be messed up from someone else, but If I know the guy and I trust him I would maybe like to use something that he added, you know?" (ID-4) He also suggested that the creation of other user should be clearly visible "make it available to see If someone created some kind of diet for when you have a sports season or something" (ID-4)

R12: The app should have a collaborative feature for sharing work on templates, sharing finished templates.

R13: The users should be able to see work of other chosen users.

 ID-6 is a coach of a swimming team and she would want to supervise the use of member of her team – "so maybe something collaborative where I would be able to see them and their updates and so on" (ID-6).

R14: The users should be able to see the daily logs and activity of their client.

One participant described the need for a responsive mobile version because "it would be nice to like fill out the client's information with the clients over the coffee or something and then at home do the rest on the computer. "(ID-8)

R:15 The app should be responsive.

When asked if they would use the app with proposed changes and recommend the app to their colleagues, all participants agreed in all cases. However, participant ID-7 mentioned this "… I don't want them to change it now too much, once I figured out how to use it (laughs)". This might be a sign of change aversion discussed in section 3.1

Executive summary

The analysis of conducted interview showed that participants think there are lot of a good functions within the app, but the visuals and placement of certain elements could be improved. In general, the first-time users commented more about the visual appearance of the app then the experienced users. There was also notable age difference within the two interviewed groups. It can be suggested that the students have higher demands on the interface and the whole user experience as they are more used to different kinds of apps competing for their attention. However, since we did not ask about the computer literacy and overall experience with digital technologies it's not possible to draw firm conclusion about this. From the results was possible to derive 14 textual requirement which will be considered in the redesign.

6.6   Think-aloud analysis

The observation and think-aloud analysis (appendix 14) confirmed some of the issues presented in the analysis of the interview and discovered number of new ones. Following analysis of the think-aloud tests is based on field notes from the session, audio recording and video recordings (Appendix 15).

One of the main areas that caused confusion to the participants was entering information into the app. In the first task (creating a new client), two participants started to correct the profile of the previously created client instead of clicking "new client" button and start from there. This confirmed a need for different screen displaying user's details and the initial screen or dashboard and therefore confirmed *R1: The default screen should contain overview of users or templates.*

Two participants also commented on an issue with entering their measurements – "There is the 0 in default and you need to delete it when you want to write something, it should disappear when you click in the field" (ID-4) and "it's annoying that I need to delete the zeros when I am entering my measurements" (ID-6)

R16: The default text should disappear when entering information into fields.

Two of the experienced users commented on the way of inserting food preferences – "well this [food preference] should be figured differently, it can maybe be default that you like those things and then you just delete those you do not like" (ID-8). There is also a possibility within the app to send the form to the client by email and import the entered data after return of the form. However, according to the ID-9 this is not an option for her and her patients – "I don't like this clicking, and I am doing this all the time with my patients, I cannot send them the form, they would never fill it right" (ID-9)

R17: Different organisation of section with food preference

Participants highlighted the importance of *R7: The icons should have clear meaning, be descriptive.,* as they were sometimes confused with their meaning – "sometimes I don't know if I should use the pencil in the small frame or in the big one, it should be just one when you are dealing with one variant anyway" (ID-9) or "there are a lot of icons that makes no sense I think, there is that star which is used also for determining locked distribution of nutrients and also for something else I don't know but I just saw in in the tips while generating the plan so I remembered that I don't know what the other star is for." (ID-7) Another participant suggested

replacing text with icons when executing task 4: "This is kind of cramped here, they should use those icons for energy, sugar and fat here." (ID-5). But another participant suggested the opposite "sometimes it should be like words instead of icons or at least make a description when you hoover over it." (ID-6)

Participants confirmed confusion about the "next" button in the generation process formulates in the requirement *R5: The "next" button should be on the bottom of the page* as two of them looked for it at the bottom page and one participant, knowing the button is in the upper section of the screen, got it confused with the "purchase" button.

Regarding comprehensiveness of used terms, four participants experienced no problems in understanding. Two first-time users stated that they did not understand terms for calculating caloric intake but highlighted thorough explanation of the terms when hovering on information icon.

Participants experienced minor issues when locating "new client" button in the right column. Otherwise they navigated fluently in the main upper menu.

During the generation process, firs-time users confirmed requirement *R8: The generation should include countdown and show 100% completion when its really done.* stated during interviews by experienced users. Participant ID-4 commented the process: "oh ok it looks like it is done, but the lunches are not done, oh they are now" and ID-5 concluded that "it showed that the lunches are done, and it is not done its still generating".

The overall experience with the app user commented as follows: "now that I tried it for the second time I like it even less, it feels overwhelming, there is too much going on, I get it that it's a complex process with a lot of variables but there has to be a way to make it right" (ID-6).

Similarly, to comment during the interview, also during think-aloud test were discovered possible symptoms of user's change aversion. ID-9 stated that: "I am using this app regularly but not to its full extent and I am aware of that, but it is enough for me as it is right now" (ID-9). This statement may suggest that the experienced user would prefer the current version before any interface change.

Executive summary

The analysis showed differences between first-time users and experienced users in execution of tasks within the app. First-time users identified more interface and design issues, however, more experienced users were able to pinpoint more overall problems with functionality. Participants experienced troubles mainly in the template sections in task 4 as only 2 participants finished the task properly. First-users confirmed the issue of similar default screen with the screen of client's details as 2 of them started to modify existing client instead of creating a new client. Newly discovered requirements were added to the list of textual requirements and are presented in following chapter.

7. REDESIGN

The redesign is based on general design principles presented in section 3.4 of Literature review and following list of requirements derived from interview and think-aloud analysis.

R1: The default screen should contain overview of users or templates.

R2: Clients section should contain filer

R3: Function for highlighting expiring nutrition plans.

R4: Buttons for creating new client should be more obvious.

R5: The "next" button should be on the bottom of the page.

R6: There should be no doubled information and information required twice.

R7: The icons should have clear meaning, be descriptive.

R8: The generation should include countdown and show 100% completion when its really done.

R9: Users should be able to hide tips that they have seen.

R10: Filters should be more detailed

R11: The content should be well structured.

R12: The app should have a collaborative feature for sharing work on templates, sharing finished templates.

R13: The users should be able to see work of other chosen users.

R14: The users should be able to see the daily logs and activity of their client.

R15: The app should be responsive.

R16: The default text should disappear when entering information into fields.

R17: Different organisation of section with food preference

Proposed requirements can be characterized as functional changes with possibility of interface representation. However, requirements R6, R10, R15 and R16 cannot be captured within the wireframe or mock-up.

7.1   Wireframe

The overall design idea was to preserve certain elements that users are already used to operate in stable positions with reorganisation of containing elements. The original distribution of component corresponded with users' expectation of components placement described in section 3.4. For this reason, the left column containing overview of clients was preserved as well as the position of the main menu. However, the information architecture and display of mentioned elements changed in order to accommodate users' requirements. Proposed wireframes in full resolution can be found in Appendix 16.

Following wireframe (picture 22) represents a default screen after users log in. The PlanEat logo and position of user's profile together with settings icon was preserved in the same position. The order of items in the menu was set according the actual use of app's functions derived from analytics analysis (section 6.3). The Dashboard is placed on the first position as it is the first screen users will see after they log in. This will be the starting point similar to the "Home page" which is usually place in the menu's first position. Following order of tabs Clients, Templates, Database and Tutorials, reflects the actual use of the app.

The left sidebar contains overview of user's clients with each client defined by their name and nutrition plan progress indicator. Each client contains two icons: plus icon "+" expands the client's overview and arrow "→" will take user to the detailed client's profile. Expanded clients profile contains his photo or chosen avatar, Body Mass Index (BMI), Nutrition plan name and progress indicator and buttons for "creating new diet" and "clients details". In the upper right corner is the minus icon "-" which shrinks the detailed view. Above this element is filter which allows user to order the clients in ascending or descending order according to date of creation or their name (accommodation of R2). The accommodation of R3 is indicated by thick frame around client's information, which means that his meal plan will expire in three days. The position of the "new client" button is placed on the top of this column in the area of Golden triangle as an accommodation of R4.

The central part of the screen contains dashboard with and overview of important parts of the application (accommodation of R1). It contains subsections of Recently created clients, recently created nutrition plans and Save & Unfinished work. All of the proposed subsections contain button that will take the user to the corresponding section.

The right sidebar contains "News" which will accommodate requirement R12. This section we be a live feed of new daily food logs inserted by clients (R13) and new templates created by chosen colleagues (R14). It will also show notification when new meal, ingredient or official template was created. User will be able to sort or filter news in "settings" section in the upper right corner of the sidebar. This section could also show notification when a client will not upload his daily log in 3 days in a row or when a certain meal plan is expiring, and the client needs user's attention. To support users' interaction in collaborative manner the News section will be accommodated in every screen.
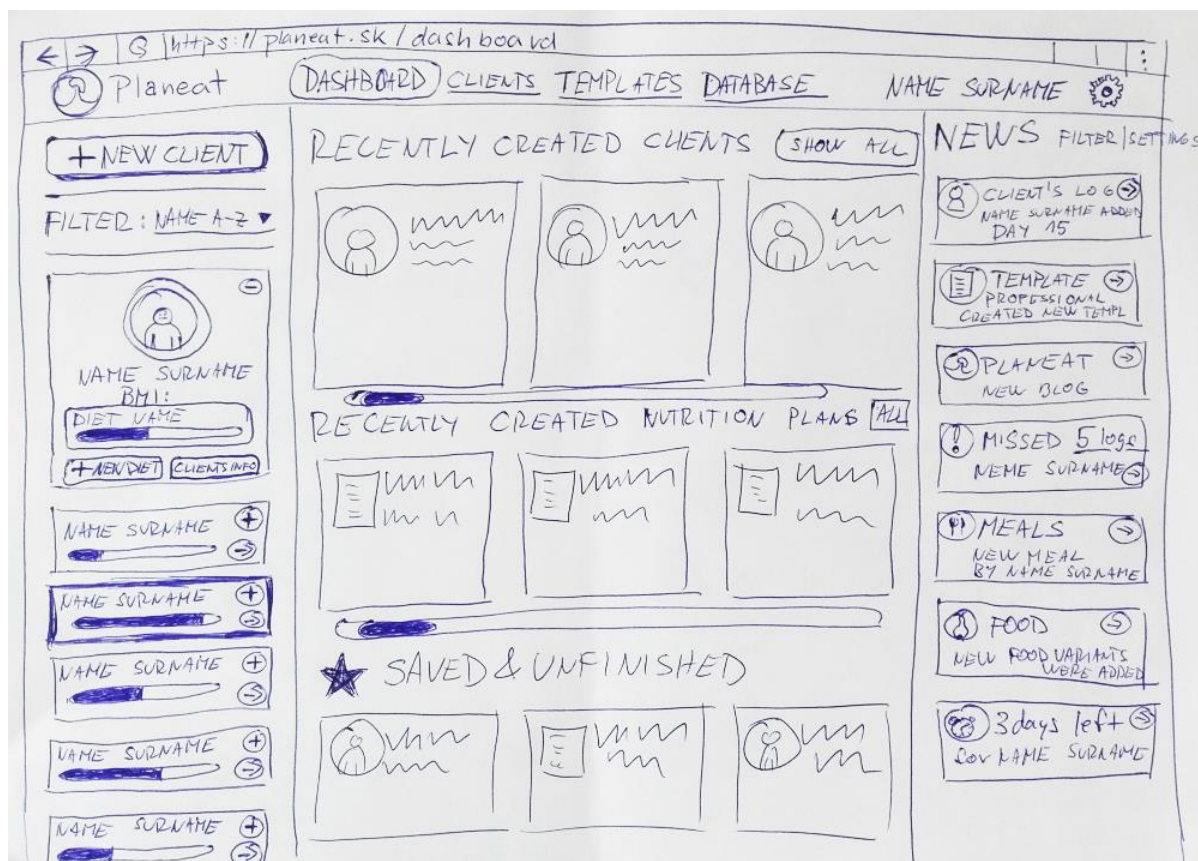
PICTURE 22 WIREFRAME DASHBOARD

The collaborative nature of R12 as well as requirement to see work of others R13 is captured also in the templates section (picture 23). In the left sidebar are clearly structured (R11) templates with sections "My templates", "Public" and "Colleagues". The later subsection also contains a button "+add" which will allow adding colleagues to this section. The layout of chosen template is preserved from the current version as participant did not express any concerns or issues about this section.
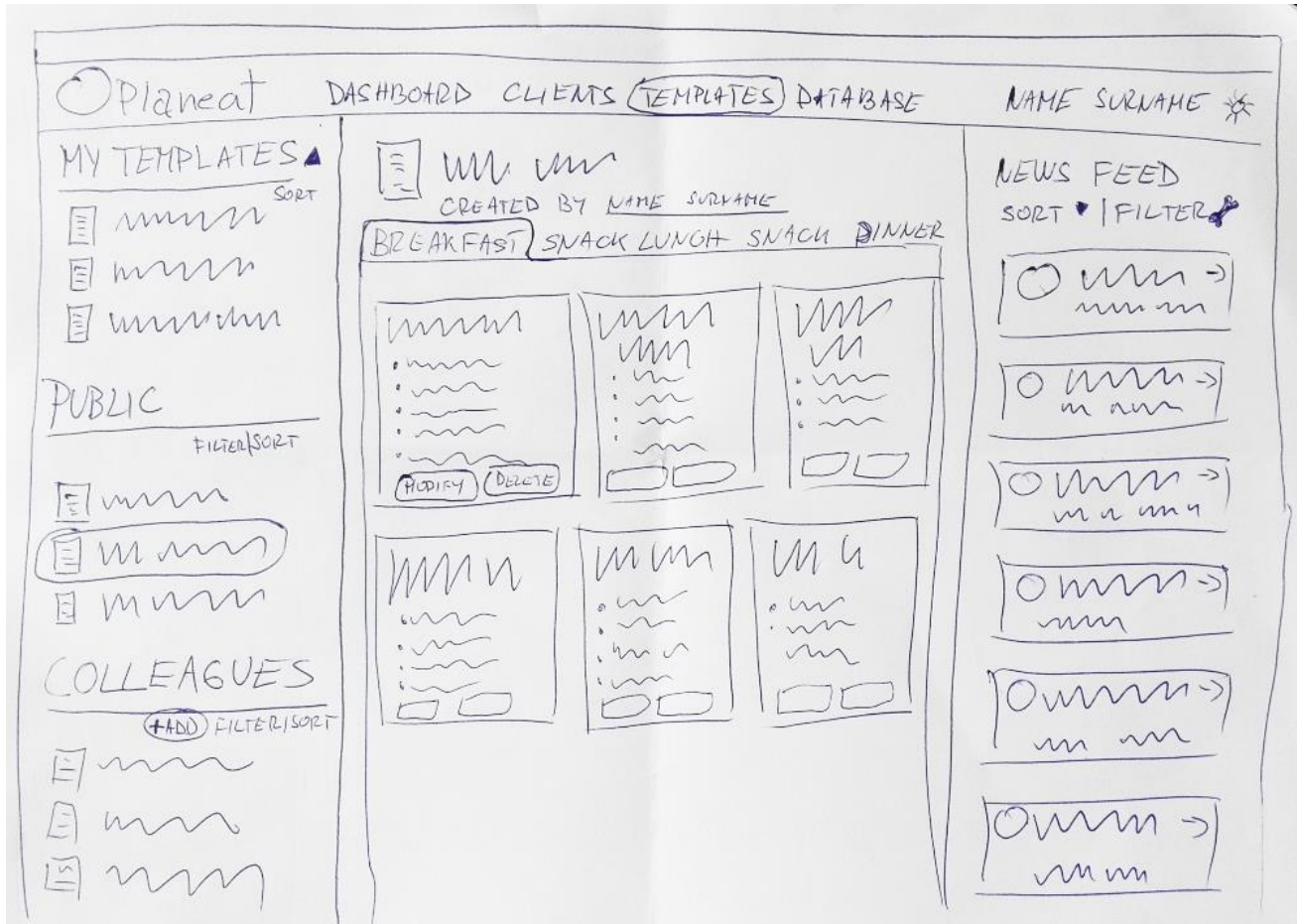
PICTURE 23 WIREFRAME TEMPLATES

Following wireframe (picture 24) represents the creation of a new client. The required information was divided into 5 sections and will be shown to the users after completion of each section. This will allow user to save even partially filled client's profile which was not possible before. The steps of the process are displayed on the top of the screen similarly to the display of steps of generation, however, the "next" or "continue" button is places on the bottom of the screen in order to accommodate R5 but also according to the rule of Reading gravity. Participants also expressed the requirement of different organisation of the Food preference section in the client's profile. The analysis of heatmap showed great distribution of mouse movements in this section which may also indicate incorrect layout of information in this section. Participant ID-8 proposed an idea that all of the displayed food should be "liked" by default and user will then mark only food that he dislikes. This organisation would save numerous clicks and therefore user's time. The new proposed distribution is sketched in picture 25.

PICTURE 24 CREATING A NEW CLIENT - STEP 1

PICTURE 25 CREATING A NEW CLIENT - STEP 2

The requirement R11 about clear organisation of information, guided the whole design however, was intended to improve the first screen of generation process (picture 26). Participants were confused about the layout of the configuration since the input fields were evenly distributed. According to the theory of proximity and similarity (chapter x) users assumed that the two configuration units are connected. Following design should help clearly distinguish which fields are calculated together.

PICTURE 26 WIREFRAME - GENERATION PROCES - STEP 1

During the interview participants identified the inaccuracy of percentage of generation completeness indicator (picture 27). They proposed an estimate in form of a countdown (R8) and highlighting sections as complete when they are really complete. Half of the participants appreciated tips for users during the generation process, the other half found them annoying because they already seen all of them. This requirement (R9) can be implemented with option of marking the tip as "seen" or allowing it to appear again with "remind me later". Proposed changes are implemented in following mock up.
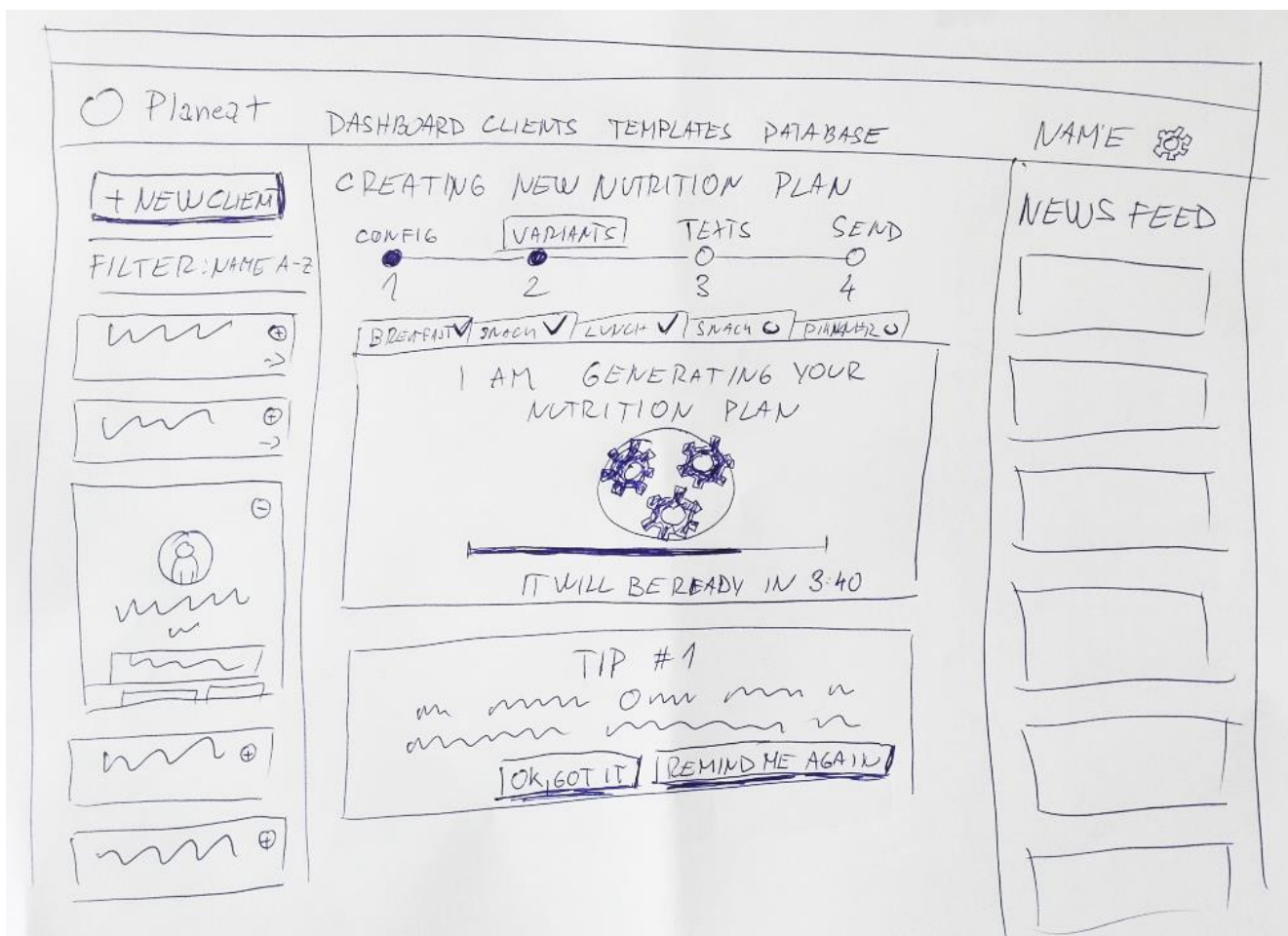
PICTURE 27 WIREFRAME - GENERATION PROCES - STEP 2

Participants also commented on a process of generation (picture 28) of nutrition plan and identified and issue of doubled icons with ambiguous meanings (R7). Through the whole generation process the button "next" that was addressed in requirement R5 was placed at the bottom of the screen, next to option for saving unfinished work and option to go back to the previous step.

PICTURE 28 WIREFRAME - GENERATION PROCESS - STEP 3

7.2   Mock up UI

Following design mock-ups were created in order to accommodate users' requirements that cannot be captured in the designed wireframe. The design was created in 960 – 12 column grid, described earlier in section 3.4. The colour scheme is based on the original design with replacement of the dominant blue colour for neon green defined by the company's brand identity.

Screen below represents the dashboard. Left sidebar contains overview of clients with highlighted client whose nutrition plan is expiring, and it needs user's attention. Minimalistic icons of magnifying glass with "+" and "-" are used for expanding and shrinking clients' information. Arrow pointing to the right will that user to the profile details. Right sidebar represents the News feed. Different icons should help user distinguish the nature of notification by the first sight, however, the type of notification is also written underneath the headline. Again, the right pointing arrow take the user to the detail of the notification. The left and right sidebar are preserved in the same place through the whole design. Middle section contains overview of user's activity and clients. Base on principles of proximity, similarity and continuity, the user profiles and nutrition plans were placed in frames, so users will clearly recognize information that belongs together. Horizontal lines were used in order to separate subsection and connect name of the section with button "show all" that will take users to different pages.
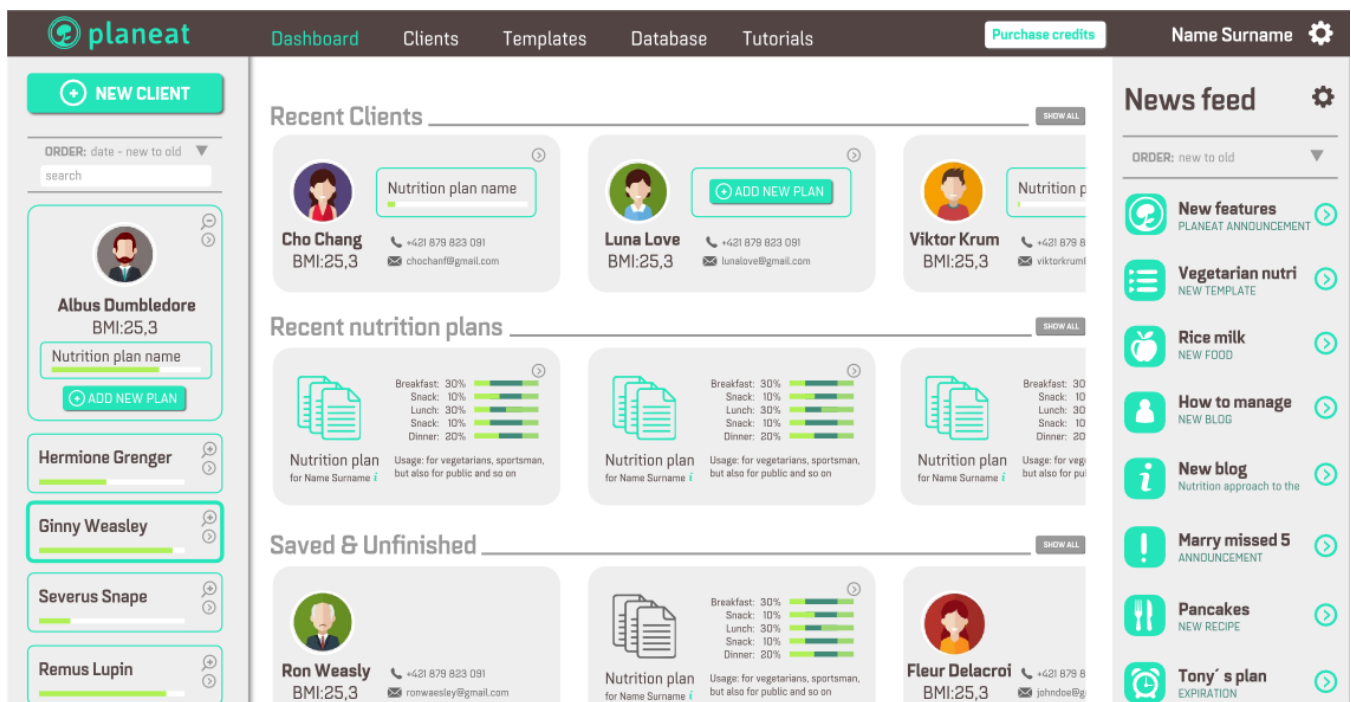
PICTURE 29 MOCK UP – DASHBOARD

Middle section of following design represents the first step in creating new client process. The element of a profile picture or possibility of choosing an avatar should contribute to a better ability to distinguish users. This should help avoid confusion with already created profiles, which participants experienced during think-aloud tests. The long page of client's details was broken down into four step process. When working on each step, the progress bar will highlight the active step. Navigational buttons are placed at the bottom of each step's window.
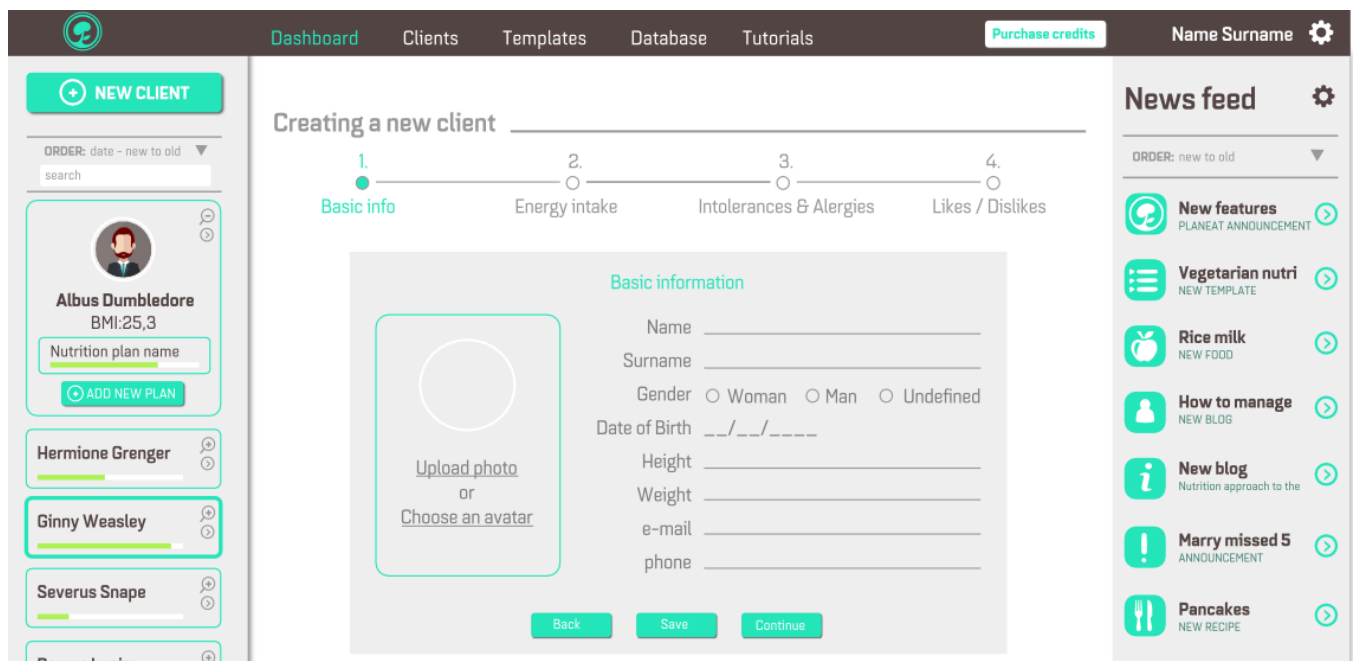
PICTURE 30 MOCK UP - CREATING A NEW CLIENT - STEP 1

Participants addressed the issue of poorly designed functionality when filling out food preferences. In this design (picture 31), each food is set to "liked" position and when users want to mark the item as "dislike", the icon will change.


PICTURE 31 MOCK UP - CREATING A NEW CLIENT - STEP 4

Following screens (picture 32) represent the generation of a nutrition plan. As in previous process, here are well is used a progress bar element which will show users how many steps are left until completion. Users were confused about the configuration screen in the first scree. In this design the different sections are divided by vertical line and also by colour.
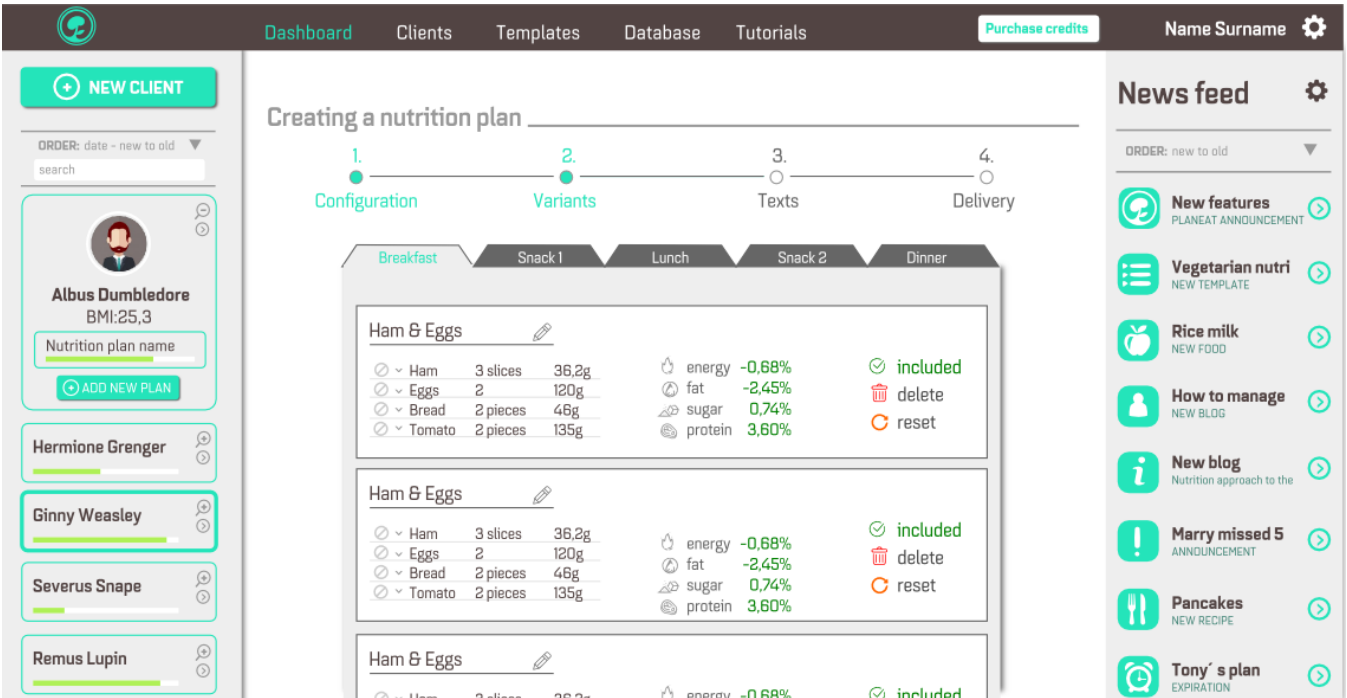

PICTURE 32 MOCK UP - GENERATION - STEP 1

The participants were divided in opinions about Tips during the generation process (picture 33). In this design are used buttons which allow user to dismiss the tip is the user already knows about it or allow it to appear again. This design also contains a countdown for the generation of variants, that users requested. In the previous design a progress line with number of percentage was used. Since users reacted sensitively on doubled information in the original design, the element of progress line was incorporated into the headers of meals. The idea is that the letter will change colour as the generation will progress and when the section will be finished the header will stay green, indicating that it is completed.
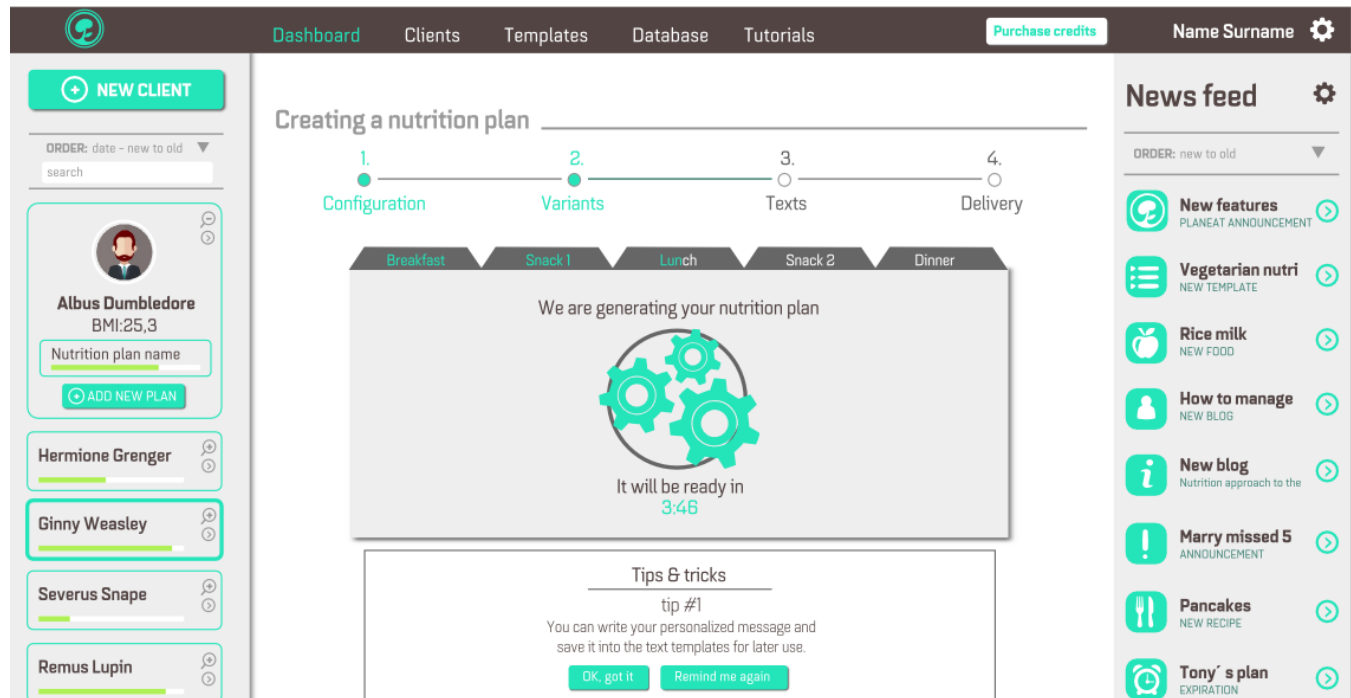

PICTURE 33 MOCK UP - GENERATION - STEP 2

The biggest confusion of icons was detected in the screen where users can choose and modify food variants (picture 34). Therefore, some to some icons were added word description (included, delete, reset) and an icon of pencil was moved closer to the caption of the meal since the name can be modified by it.

PICTURE 34 MOCK UP - GENERATION - STEP 3

The last set of changes concerned the templates sections (picture 35). The features of collaborative workspace can be seen in the right sidebar where are listed templated made by colleagues in special folder. The thick frame highlights folder that is active and contains template that is viewed in the central section. Users are also allowed to order the templates according to name or date of creation and search within the folder.
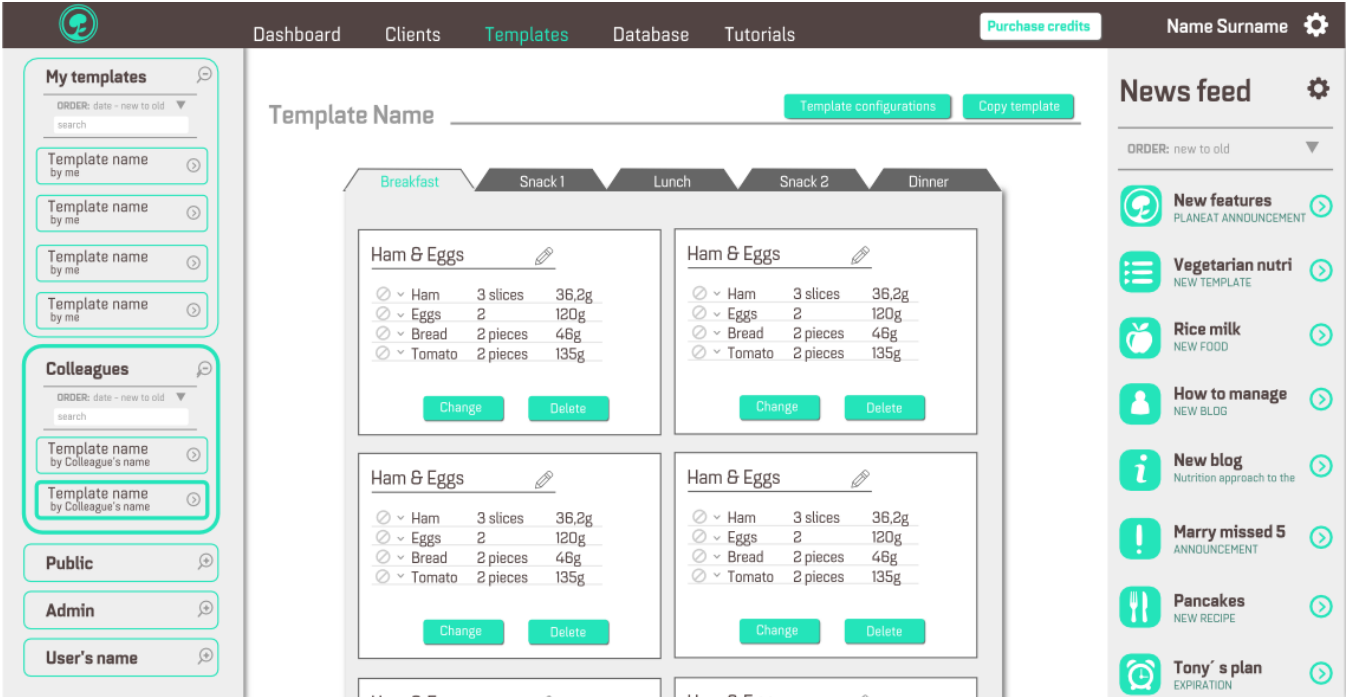

PICTURE 35 MOCKUP - TEMPLATES

Presented mock-ups can be found in full resolution in Appendix 17.

7.3   Feedback

To find out users' opinion about the proposed redesign, the second questionnaire was distributed to the participants that gave their consent for further collaboration in this research. The questionnaire was developed following methodology presented in section 5.5 and contained eight questions about four UI mock-ups. All 8 questions were in a Likert scale form with the same 5-degree scale from (left to right) *totally disagree* to *totally agree*.

Results (Appendix 18) showed that majority of participants totally agree that the two biggest changes in the interface (dashboard and news feed) would show them useful information. Almost 85% of participants agree or strongly agree that the new order of menu items is logical and 90% of them like the new color scheme. Majority of participants also think that is clear where to find and how to use included filters. The most neutral answers (30%) was market in question about understanding of templates distribution. This is however a question, that concerns more functionality than design and can be hard to judge only by the interface design.
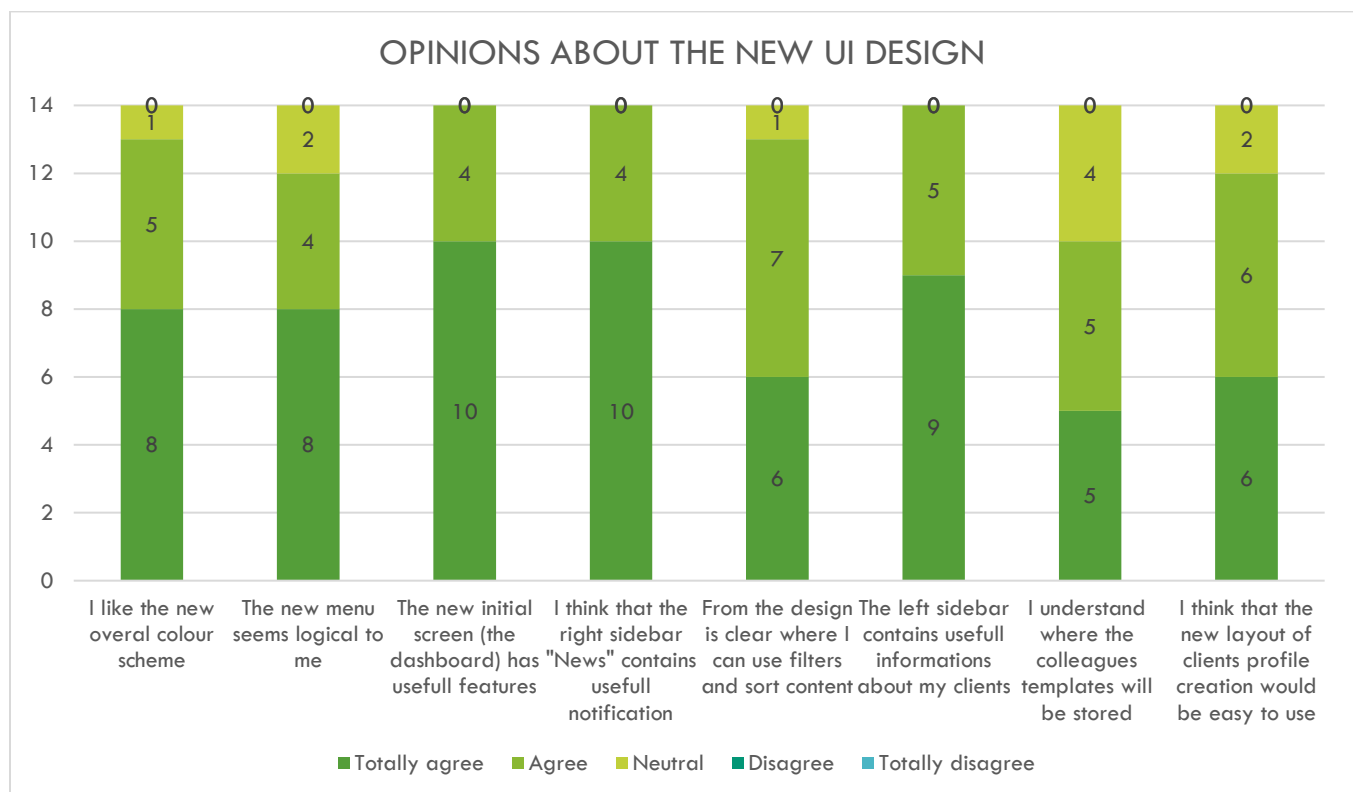
8. DISCUSSION

In retrospective I feel that this research could benefit from a greater number of participants mainly for interviews. Analysis of the interviews resulted in the list of requirements that had the most influence of the redesign. In my opinion the implementation of proposed collaborative features would have significantly pivoted scope of the application, encouraged collaboration of the users and eventually resulted in higher use. Since the idea of creating a collaborative space for users came from the users, I believe that interviewing more participants would have provided this research with more relevant propositions and requirements. Although, I have performed all of the methods and analysis in this research to the best of my ability, this research could benefit from a bigger team of researchers to administrate the interviews, following coding, analysis and interpretation of the results.

Regarding the questionnaire, I believe that a distribution of the questionnaire to a wider and more diverse sample would bring more relevant insight into the users' needs and requirements. Since the questionnaire was distributed only to a group of users that participated in the training, it was probable that all of them are using the app on regular basis. Although, I was able to investigate opinions of potential users (three first-time users for interview and think-aloud tests and one for pilot testing), this research still lacks opinions of users that tried the app, didn't like it and never came back. Including this group of stakeholders would probably allowed more detailed segmentation and investigation of different needs of stakeholder groups with different backgrounds.

Another issue that needs to be addressed is that all of the user-based investigations were conducted in Slovak or Czech language and afterwards translated to English. Although I have translated the questions to the best of my ability, the meaning of questions in Slovak might differ from its translation into English and this could influence the method's validity.

Another possible bias could occur during interpretation of analysis. Despite the fact that coding was conducted by two researchers, I was the only one that drew conclusions from presented results. Since I wanted to produce tangible results to include in this thesis but also to present to the representatives of the PlanEat company, possibility of bias is valid.

9. CONCLUSION AND FUTURE WORK

This chapter concludes the results of the investigation in relation to proposed research questions and problem statement. Possible directions of future work are discussed in at the end.

RQ1. Who are the users of the PlanEat application, and what is their current use of, and needs for, the app?

To answer this research question, stakeholder analysis, analytics audit, questionnaire, interviews and think-aloud tests were conducted. Stakeholder analysis proved, that the primary users – nutritionists, doctors and personal trainers will be in the centre of this investigation and will be affected by the redesign. The analytics audit showed that the more experienced user and less experienced users are interacting the app differently. Experienced users achieved higher conversion rate in examined funnels of creating a new client and generating nutrition plan. However, less experienced users tend to follow the whole process from start to finish in one session. The questionnaire analysis brought an overview of used features and users' overall opinions about the app's features and functionality. Users impression of the app was rather negative (40%) or neutral (33%) but divided on different features. They negatively reacted to the initial screen functionality, menu distribution and overall look and intuitiveness of the app. The results of interview analysis showed, that users recognize the room for an improvement of the app. They proposed several minor improvements, functionality change from initial screen to dashboard and couple of collaborative features that would allow them to share their work, take advantage of already created templates or manage their clients better. Think-aloud analysis confirmed some of the issue raised during the interviews and generated some new requirements. From think-aloud and interviews it was possible to generate a list of 17 requirements which served as a base for wireframe and mock-up development. Users were willing to share their thoughts, issues and participate in further research, however, during the interview and think-aloud, some users showed signs of change aversion.

RQ2. How could the app be improved in a redesigned prototype to better meet the user base?

In order to create a valuable prototype, there was a need to investigate an industry standards and situation in nutrition sector. There are couple of active nutrition apps on the Slovak and Czech market which, however, offers a fewer functions than PlanEat in less attractive design. Although, the app Kaloricke Tabulky surpassed other in terms of interface design and implementation of functions, its aimed for B2C segment and therefore, not a competitor for the PlanEat app.
Within the wireframe and mock up was possible to implement all of the users' requirements that could be capture by low-fidelity prototyping. The implementation was based on broad literature study of design principles, users' behaviour patterns and web development standards.

RQ3. How does the prototype meet the users' needs, and how can it iteratively be improved to meet the users' needs?

Due to the sample limitation, it was possible to acquire evaluation of proposed mock up only from a small number of users. However, their reactions were in more than 90% of cases positive. Participants liked the overall colour scheme, the new dashboard functions and also the collaborative features. They seemed to comprehend a new information architecture, use of icons and distribution of buttons.

By answering the research questions, it was possible to formulate and response to the problem statement.

> **How well does the PlanEat application currently support users' needs and how it can be improved in a redesign?**

The PlanEat app does not support all of its users' needs. As a result of this, users do not use the app to its full extent, which affects the quality of produced nutrition planes. There is a room for improvement in both functionality and design, which should be based on user-centered investigation as it proven to be valuable source of requirements.

The future work should focus on broader user-based research and proposed mock up should be tested with more diverse and numerous sample and the suggestions and raised issues should be again incorporated in following redesign.

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11.   APPENDICES

1. Appendix 1 – List of competitors

2. Appendix 2 – Preliminary interviews

      i.   Part 1 – Mgr. Michal Palenik, CEO and founder of PlanEat s.r.o

      ii.   Part 2 – RnDr. Barbara Sviezena PHD. Lecturer & consultant PlanEat s.r.o

      iii.   Part 3 – Mgr. Martin Filek, CXO and co-founder of PlanEat s.r.o

3. Appendix 3 – Questionnaire checklist

      i.   Part 1 – Survey check list

      ii.   Part 2 – Privacy & Confidentiality Quality Criteria

4. Appendix 4 – E-mail for Questionnaire pilot testing

5. Appendix 5 – Questionnaire

      i.   Part 1 – Corrected questionnaire

      ii.   Part 2 – Pre-pilot test questionnaire

6. Appendix 6 – E-mail for Questionnaire participating

7. Appendix 7 – Interview guide

8. Appendix 8 – COREQ checklist

9. Appendix 9 - Interview transcriptions

      i.   Part 1 – Interview with ID-4

      ii.   Part 2 – Interview with ID-5

      iii.   Part 3 – Interview with ID-6

      iv.   Part 4 – Interview with ID-7

      v.   Part 5 – Interview with ID-8

      vi.   Part 6 – Interview with ID-9

10. Appendix 10 – Coding schedule & Coding manual

11. Appendix 11 – Think-aloud checklist

12. Appendix 12 – Questionnaire results

13. Appendix 13 – Coded analysis of interviews

14. Appendix 14 – Think-aloud analysis

15. Appendix 15 - Think-aloud screen recordings

16. Appendix 16 – Wireframes

17. Appendix 17 – Mock-ups

18. Appendix 18 – 2nd Questionnaire results