# CONCEPTUALIZATION OF POSITIVE PREGNANCY EXPERIENCE WITH THE INTEGRATION OF MOBILE HEALTH TECHNOLOGIES

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submitted by **ASLI GÜNAY** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Industrial Design Department, Middle East Technical University** by,

Prof. Dr. Gülbin Dural Ünver
Dean, Graduate School of **Natural and Applied Sciences** _____

Prof. Dr. Gülay Hasdoğan
Head of Department, **Industrial Design** _____

Prof. Dr. Çiğdem Erbuğ
Supervisor, **Industrial Design Dept., METU** _____

**Examining Committee Members:**

Assist. Prof. Dr. Naz A.G.Z. Börekçi
Industrial Design Dept., METU _____

Prof. Dr. Çiğdem Erbuğ
Industrial Design Dept., METU _____

Assoc. Prof. Dr. Yeşim Aydın Son
Health Informatics Dept., METU _____

Assist. Prof. Dr. Aydın Öztoprak
Industrial Design Dept., TOBB ETU _____

Assist. Prof. Dr. Armağan Karahanoğlu
Design, Production & Management Dept.,
University of Twente, The Netherlands _____

**Date:** 07/09/2017

**I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.**

Name, Last name : Aslı Günay

Signature :

## ABSTRACT

### CONCEPTUALIZATION OF POSITIVE PREGNANCY EXPERIENCE WITH THE INTEGRATION OF MOBILE HEALTH TECHNOLOGIES

Günay, Aslı
Ph.D., Department of Industrial Design
Supervisor: Prof. Dr. Çiğdem Erbuğ

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Traditional health management issues are being redefined with diverse mobile technologies, and smartphones and applications have taken the lead. Particularly, increasing numbers of pregnancy applications have entered the market with far-reaching benefits; yet, they fall short to be integrated into daily lives of pregnant women, which implies that mobile health (m-health) technologies should not be merely information providers, decision makers, or problem solvers. In fact, they should go beyond by making pregnant women feel happy and enhancing their wellness holistically. Certain benefits of and trends about m-health use during pregnancy have been exemplified in literature; however, detailed characteristics of them have not been identified.

This dissertation identifies the changes in daily experiences of pregnant women, in general, and characteristics of mobile pregnancy technologies that can enhance their wellness and happiness, in specific, with a user research conducted with pregnant women in three different trimesters. The study involved the usage of a pregnancy application during six weeks, accompanying with multiple in-depth interviews with each pregnant woman. The results have shown that needs and expectations change

according to different trimesters and pregnant women types. Correspondingly, positive user experience dimensions with mobile pregnancy technologies and their conceptual relationships, as well as content, interaction, appearance, and function related characteristics and scopes of mobile pregnancy technologies have been revealed paying attention to wellness dimensions during pregnancy. Moreover, feeding from the results of the study and positive psychology literature, design descriptions have been delivered that would focus on the wellness and happiness of different pregnant women.

Keywords: Mobile Health, User Experience, Positive Design, Positive Psychology, Pregnancy

# ÖZ

## MOBİL SAĞLIK TEKNOLOJİLERİNİN ENTEGRASYONU İLE OLUMLU HAMİLELİK DENEYİMİNİN KAVRAMSALLAŞTIRILMASI

Günay, Aslı
Doktora, Endüstri Ürünleri Tasarımı Bölümü
Tez Yöneticisi: Prof. Dr. Çiğdem Erbuğ

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Mobil teknolojilerle birlikte geleneksel sağlık yönetimi ve hizmetleri ile ilgili konular yeniden tanımlanmaya başlamıştır ve akıllı telefonlar ile uygulamaları bu noktada başı çekmektedir. Özellikle sayısı hızla artmakta olan hamilelik uygulamaları geniş kapsamlı yararlarıyla birlikte piyasaya sunulmakta; ancak, bu uygulamaların hamilelerin yaşamlarına pürüzsüz şekilde entegrasyonu sağlanamamaktadır. Bu durum, mobil sağlık (m-sağlık) teknolojilerinin sadece bilgi sağlayıcı, karar verici ve problem çözücü olmalarının yeterli olmadığına işaret etmektedir. Aslında, m-sağlık teknolojileri bu durumun ötesine hamilelerin mutlu hissetmelerini sağlayarak ve iyilik hallerini bütünsel olarak arttırarak geçebilir. Hamilelik döneminde m-sağlık kullanımıyla ilgili bazı eğilimler ve faydalar literatürde örneklendirilmiştir. Yalnız, bu teknolojilerin niteliklerinin nasıl olması gerektiği detaylı tanımlanmamaktadır.

Bu tez, hamilelerin gündelik yaşamlarındaki değişiklikleri ele almakta ve bu çerçevede özel olarak mobil hamilelik teknolojilerinin iyilik hali ve mutluluğu destekleyecek özelliklerini, hamileliğinin farklı üç aylık dönemlerinde (üç trimester) bulunan hamilelerle yapılan kullanıcı araştırmasıyla tanımlamaktadır. Çalışma temel olarak her hamilenin altı hafta süresince mobil hamilelik uygulaması kullanmasını ve bu süreçte

her hamileyle yapılan çoklu röportajları kapsamaktadır. Sonuçlar ihtiyaçların, beklentilerin ve amaçların trimesterlara ve hamile tiplerine göre değiştiğini göstermektedir. Paralel olarak ve hamilelikte öne çıkan iyilik hali boyutları göz önünde bulundurularak, mobil hamilelik teknolojilerinde olumlu kullanıcı deneyimi boyutları ve ilişkileri, bunun yanı sıra, bu teknolojilerin içerik, etkileşim, görünüm ve fonksiyonla ilişkili özellikleri ve kapsamları ortaya koyulmaktadır. Ayrıca, çalışma sonuçlarından ve pozitif psikoloji literatüründen beslenerek, farklı hamilelerin iyilik hallerine ve mutluluklarına odaklanan tasarım tanımları sunulmaktadır.

Anahtar Kelimeler: Mobil Sağlık, Kullanıcı Deneyimi, Pozitif Tasarım, Pozitif Psikoloji, Hamilelik

To our precious memories, moments, and dreams

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| **BAN** | Body Area Network |
| **BIT** | Behavioral Intervention Technologies |
| **CIA** | Cross-Impact Analysis |
| **DRM** | Day Reconstruction Method |
| **ECG** | Electrocardiogram |
| **EHR** | Electronic Health Record |
| **EMR** | Electronic Medical Record |
| **ESM** | Experience Sampling Method |
| **FGI** | Focus Group Interview |
| **FWBA** | Functional Well-Being Approach |
| **GDP** | Gross Domestic Product |
| **GNH** | Gross National Happiness |
| **GPRS** | General Packet Radio Service |
| **GPS** | Global Positioning System |
| **HCI** | Human-Computer Interaction |
| **HIT** | Health Information Technologies |
| **ICT** | Information and Communication Technologies |
| **iHCI** | Implicit Human-Computer Interaction |
| **iOS** | iPhone Operating System |
| **LMIC** | Low and Middle Income Country |
| **MDG** | Millennium Development Goal |
| **M-Health** | Mobile Health |
| **M-Sağlık** | Mobil Sağlık |
| **MS** | Multiple Sclerosis |
| **NA** | Negative Affect |
| **NASA** | National Aeronautics and Space Administration |
| **OWB** | Objective Well-Being |

| | |
|---|---|
| **P&P** | Paper and Pen |
| **PA** | Positive Affect |
| **PDA** | Personal Digital Assistant |
| **PHR** | Personal Health Record |
| **PWB** | Psychological Well-Being |
| **RFID** | Radio-Frequency Identification |
| **RMNCH** | Reproductive, Maternal, Newborn, and Child Health |
| **SMS** | Short Messaging Service |
| **SPANE** | Scale of Positive and Negative Experience |
| **SWB** | Subjective Well-Being |
| **SWLS** | Satisfaction with Life Scale |
| **TEC** | Technology Enabled Care |
| **TL** | Turkish Lira |
| **TRI** | Technology Readiness Index |
| **TRY** | Turkish Lira |
| **UNICEF** | United Nations International Children's Emergency Fund |
| **UX** | User Experience |
| **WHA** | World Health Assembly |
| **WHO** | World Health Organization |

# CHAPTER 1

# INTRODUCTION

## 1.1 PROBLEM BACKGROUND

It goes without saying that health care is one of the most important issues in human life. Pursuing a healthy life can be counted as the utmost aim of most people, as the life quality of people highly relates to it.

Women's and children's health occupy an important place among all other health care issues regarding the crucial role they play in development (Ki-Moon, 2010). Especially, the health of mothers is of considerable prominence, as motherhood is one of the essential issues in life (Balaam et al. 2013). Over and above, the health of women during pregnancy should be handled well, since this period can be considered as one of the most critical times due to the fact that a woman's body becomes a resource for two lives. In addition to the self-evident importance of maternal health, it is also an important human rights issue, and prenatal care—health care during pregnancy—is a key element in facilitating a safe pregnancy and maternal health (Amnesty International, 2010).

In this section, firstly, reasons about the necessity of focusing on health care and wellness during pregnancy; and the role of mobile technologies during pregnancy experiences are revealed. While doing as such, problems in accessing and delivering proper pregnancy care are explained, and after, endeavors to overcome these problems especially with personal and mobile health (m-health) technologies are explained. Essentially, a short description of m-health is given right after. In the subsequent sections in this chapter, the significance of this dissertation is discussed predicating on

the gaps in literature and practice, and by widening the viewpoint beyond mother's and child's health. Then, scope of the dissertation is shown by demarking the research context and presenting the research's aim and questions. Finally, structure of the dissertation is shown.

### 1.1.1 Barriers in Pregnancy Care

Notwithstanding the main aim of maternal care about eliminating or at least minimizing maternal mortality and maternal morbidity, every year hundreds of women suffer or die due to pregnancy and childbirth complications which can be preventable (Ki-moon, 2010; Megalingam, Boopathi, Sarathkumar, Sreedevi, & Vishn, 2013; mHealth Alliance, 2012; Zero Mothers Die, 2014). Other than physical implications, prenatal depression continues to be as much prevalent as postpartum depression, impinging directly upon babies' health and posterior development stages (Field, 2011; McCallin, 2012). Certain barriers hinder women from receiving proper maternal services; these can include personal, economic, bureaucratic, educational, and other barriers.

First of all, personal barriers relate to women's health conditions and how they perceive and cope with them. Most pregnant and childbearing women have new and sometimes continuous health concerns (Childbirth Connection, 2009) because bearing a child and becoming a mother alters a woman's entire life in distinct ways. Physical changes in women's bodies and psychological changes during pregnancy can create a barrier against them receiving the care they require. They tend to feel physically exhausted, emotionally weak, and solitary (Barclay, Everitt, Rogan, Schmied, & Wyllie, 1997). It is even more challenging if they are experiencing the first childbirth. All of these factors may result in a woman seeking maternal care information in the wrong place or at the wrong time. To clarify, pregnant women might resort to inaccurate knowledge passing from one to another (Maniam, Ken, & Chenapiah, 2007), or they might demand care merely in the last stages of pregnancy. Thus, deficiency can occur in care, even though continuous care is of great significance from pre-pregnancy to the postpartum period (Peyton, Poole, Reddy, Kraschnewski, & Chuang, 2014a).

Secondly, expenses related to maternal care exceed charges of many other health care conditions (Childbirth Connection, 2009). Financial circumstances pose a significant challenge, especially in developing countries and rural areas. Women in such places are more prone to pregnancy related risks regarding economic barriers to receive proper and timely care (mHealth Alliance, 2012).

Thirdly, bureaucratic issues create a barrier. For instance, troublesome and expensive documentation procedures, in-person communications, administrative requirements, and insufficient care providers can hinder women from accessing prenatal care and maintaining a healthy pregnancy (Amnesty International, 2010).

Moreover, a lack of education and awareness can negatively impact pregnancy management. Most women are not aware of the importance of early prenatal care, and even though they have to receive support and education even in the first trimester[1] of the three-trimester pregnancy period, they tend to visit doctors more frequently in the final trimester (Peyton et al., 2014a).

Furthermore, other barriers exist such as location and language barriers. These are also mostly discussed in the literature in relation to the women living in developing countries and rural areas, as it is typically hard for them to access international resources due to technology literacy and language problems (Loxton et al., 2007).

### 1.1.2 Endeavors to Enhance Pregnancy Care

Despite the barriers, women's pregnancy experiences and lots of things related to the childbirth have started to change (Leggitt & Ringdahl, 2013). This is in parallel with the changes in internet, and information and communication technologies (ICT) that have altered the lives of entire people in the world (Maniam et al., 2007). Now, technologies have an increasing role in pregnancy and motherhood (Balaam et al., 2013). According to the United Nations International Children's Emergency Fund (UNICEF), strategic use of technologies can eliminate many barriers and solve diverse problems related to time, distance, and coordination in the delivery of maternal health

[1] A pregnancy trimester is an approximately three-month term during an overall 40-week or nine-month pregnancy period, which is identified by particular embryonic and fetal developments (American Pregnancy Association, 2016).

services (mHealth Alliance, 2012; Unicef Stories, 2012). Hence, the human–computer interaction (HCI) discipline has been questing for novel technologies in supporting pregnancy and has been trying to understand those technologies' role in motherhood (Balaam et al., 2013).

Hereby, certain trends and devices come into prominence looking at the application areas of diverse health care technologies in practice. Linking patients, health care professionals, and other people together; offering tailored information; and providing mobility are some of the general trends in health care (Bental, Cawsey, & Jones, 1999; Britze, 2005; Dodero, Gianuzzi, Coscia, & Virtuoso, 2001), which have affected the trends in maternal care, as well. Such trends address personal health care, mobile devices, and m-health that seem to have great potential to escalate improvements in pregnancy issues worldwide (Ki-moon, 2010; mHealth Alliance, 2012, WHO, 2011). Also, the World Health Organization (WHO, 2011) sets m-health technologies forth as one promising approach to pregnancy management, training, education, and interventions. With reference to the WHO guidelines, personal health care and m-health can also bridge the gap in care between the medical and domestic situations during pregnancy.

Among diverse personal health care and mobile technologies, smartphones and smartphone applications (apps) have taken the lead as they are already indispensable parts of our daily lives. Currently, there are billions of mobile and smartphones around the world even including the rural areas. In addition, more than 100 countries have consulted to m-health in order to attain better care (Ki-moon, 2010). Increasing numbers of smartphone applications have also started to pervade ubiquitously into people's lives as health care and management tools (mHealth Alliance, 2012). Ever increasing numbers of health care applications in smartphone application stores is an indication of the significant role of m-health in health care. Pregnancy is one of the prominent health topics that gets the attention of application developers (Johnghorban & Shirali- Shahreza, 2013; Peyton et al., 2014a).

Consulting to m-health in maternal care has far-reaching benefits apart from the briefly aforementioned opportunities to transcend the health care barriers. Primarily, m-health technologies can be available to every person regardless of location or time. This can

minimize the psychological pressure and stress on pregnant women because m-health can provide solutions to sudden pregnancy-related complications which might be critical both for the women's and the children's health. This ease of access can promote pregnancy awareness and education everywhere including the rural and poorest areas, because such technologies are getting more and more cost-effective and affordable (Ki-moon, 2010; Maniam et al., 2007; mHealth Alliance, 2012; Zero Mothers Die, 2014). Moreover, m-health can provide convenience also regarding the diverse set of options and possibility of tailored applications considering diverse characteristics of people and diverse needs during pregnancy (Balaam et al., 2013; Bental et al., 1999; Maniam et al., 2007). To illustrate, different information and care attention is needed during different stages of the pregnancy (CenterSite, 1995-2007) and mobile phone applications can provide the required flexibility, portability, and personalization (Johnghorban & Shirali-Shahreza, 2013). This is also more beneficial and convenient than accessing widely available generic and complicated information in printed form (Maniam et al., 2007). Furthermore, providing better preparation for childbirth, keeping better track of both babies and women (Balaam et al., 2013), supporting social connectivity and sharing experiences (Enquist & Tollmar, 2008; Hui, Ly, & Neustaedter, 2012), and even stimulating pregnancy and better pregnancy management in others (Kosaka, Misumi, Iwamoto, Songer, & Akita, 2011) can be counted as the other possible benefits.

### 1.1.3 Characterization of M-Health

Given the endeavors to enhance pregnancy care and the suggested emphasis on m-health in literature, a significant percentage of this dissertation is pertinent to mobile and personal health care technologies. Therefore, although a specific chapter (see Chapter 3) is devoted to the detailed explanation of these concepts, their backgrounds, and their utilization in pregnancy care; a very brief synopsis of the meaning of m-health concept is beneficial to be made at this point, as well, to delineate the subsequent content and facilitate reading.

The WHO (2011) defines m-health as the promotion and assistance of public and individual health with the employment of mobile technologies, like mobile phones, personal health care monitoring and tracking devices, and many other wireless

technologies. It encompasses both the basic and advanced features of mobile phones, which ranges from call and message functions to miscellaneous mobile applications. The functionalities of m-health are unceasingly escalating, with the improvements in mobile devices, wearable technologies, and mobile applications. Those improvements are escalated by the entrance of renowned technology companies, like Google Inc. and Apple Inc., and pharmaceutical firms into the health market; and thus, by more widely publishing health care applications (Talor, 2015). Vital to m-health in the current era and to the scope of this dissertation, mobile applications are defined as:

> "A software application that can run on a mobile platform (i.e. a handheld commercial off-the-shelf computing platform, with or without wireless connectivity) or a web-based software application that is tailored to a mobile platform but is executed on a server." (Talor, 2015)

Covering an interdisciplinary and a multi-sector venue, m-health raises opportunities which have stayed out of the health care domain till now. Very recently, roles of diverse stakeholders who are responsible for health practice have been in transformation and reorganization, indicating more responsibility and empowerment for individuals (Dahdah, Du Loû, & Meadel, 2015). This surfaces distinctive ways about how and for what individuals actually interacts with m-health technologies, rather than the exact technological capabilities or limitations of these technologies.

### 1.1.4 Gaps in the M-Health Literature

Although maternal care and pregnancy related issues are key focus for m-health studies and implementations worldwide (Peyton et al., 2014a), there is a gap in literature regarding the use of mobile health care technologies for pregnancy. Published m-health and pregnancy literature concentrate mostly on the least developed countries. More specifically, some of these studies attract attention to the significance of educating women about pregnancy in the least developed countries (e.g. Maniam et al., 2007; mHealth Alliance, 2012; WHO, 2011) and others demonstrate real cases, initiatives, and projects about utilizing basic mobile services like free mobile information services and short message service (SMS) consultations as part of government actions and national health agendas (e.g. Ki-moon, 2010; Megalingam et al., 2013; Tamrat & Kachnowski, 2012; WHO, 2011). Peyton et al. (2014a) highlighted the excessive focus of pregnancy related literature on the least developed

and developing countries, which overlooks the need for pregnancy care in developed countries. On the other hand, a few researchers assert the opposite, claiming that pregnancy related information is mostly concentrated on the western world. Furthermore, most of the studies and existing applications ignore the role of the spouse (Peyton et al., 2014a). During pregnancy, fathers' experiences are also valuable and even though they can overlap with the experiences of the pregnant women to a certain extent, they are mostly distinct. It should be remembered that pregnancy is not solely demanding for pregnant women, but it is also equally stressful for the spouses (Maniam et al., 2007). Besides, there is a lack of information about the needs and related support during the first trimester of the pregnancy; although accurate pregnancy management should start at the early stages (Peyton et al., 2014a).

As the most important gaps, users' expectations from these pregnancy related mobile technologies, their needs, concerns, and characteristics and possibilities of these technologies have not been studied holistically or systematically, yet. Thus, in spite of unceasing efforts and escalating numbers of pregnancy related mobile solutions and applications, and in spite of indispensable place of mobile technologies in today's world, pregnancy related mobile applications still fall short of being smoothly integrated into the daily lives of pregnant women. Therefore, it is valuable to concentrate on the ways to realize the smooth integration of mobile pregnancy applications into the daily lives of pregnant women.

## 1.2 SIGNIFICANCE OF THE STUDY

Design takes an active place at this point because mere technological push and problem oriented approach cannot be sufficient for the successful integration of pregnancy related solutions in pregnant women's lives. In fact, it is hypothesized that, these solutions can enter and pervade in pregnant women's daily lives smoothly and seamlessly only when what increases their wellness beyond health problems and gruntles them is understood. That is to say, design has the power to go beyond a simple needs assessment and corresponding technological solutions, and to bring about possibilities that would increase the wellness of pregnant women and make them happy. When products and systems are started to be perceived as opportunities to

enhance quality of life, human innovation paradigm would be internalized (Desmet & Hassenzahl, 2012).

In terms of personal benefits, focusing on wellness and well-being is naturally invaluable. People with high well-being are healthier; they have stronger immune systems and longer lives (e.g., Danner, Snowdon, & Friesen, 2001; Dillon, Minchoff, & Baker, 1985; Ostir, Markides, Black, & Goodwin, 2000; Pressman & Cohen, 2005; Stone et al., 1994). They are also more at peace with themselves and others, and are more outgoing, gratified, constructive, and productive (e.g., Harker & Keltner, 2001; Marks & Fleming, 1999; Okun, Stock, Haring, & Witter, 1984; Staw, Sutton, & Pelled, 1995). Furthermore, they tend to achieve many successes and rewards in diversified domains of life (e.g. Bao & Lyubomirsky, 2013).

In terms of collective benefits, this can also build stable, peaceful, and productive societies and future generations (Ki-moon, 2010; Philbrick, 2012). Increasing investment apparently has many benefits like increasing productivity and economic development, decreasing poverty, as well as realizing primary human rights (Ki-moon, 2010).

It is important to keep in mind that each pregnancy is actually unique. Each person might have various needs, values, expectations, knowledge, and practices related to this period. Even the same woman can experience entirely different pregnancies in her first and other pregnancies. Hereby, consideration of pregnant women in different pregnancy trimesters and comprehension of diversified experiences can make a huge contribution. By this way, thorough identification of the superficially touched and problem oriented characteristics of mobile pregnancy technologies in m-health literature—as revealed in the former sections such as minimizing psychological stress, enhancing pregnancy awareness and knowledge, providing tailored features, supporting social connectivity, and stimulating better pregnancy management (see Section 1.1.2)—is to be achieved. During this attempt to identify the characteristics of such issues, extensive positive user experience dimensions with mobile pregnancy technologies and relationships between multifarious main and sub-criteria which can increase the wellness, happiness, and life qualities of pregnant women with diverse

possibilities are to be revealed as fundamental design descriptions and also as design contribution with the guidance of positive psychology and positive design literature.

Ultimately, designers, application and technology developers, researchers, and other related stakeholders in the field of prenatal and maternal care system can consult to this dissertation as an information source while designing and improving mobile pregnancy applications in specific, and personal health care technologies in general. They can comprehend diverse patterns among pregnant women in different trimesters and related dimensions, and come up with various design and interaction possibilities beyond mere problem focus benefiting from provided positive design directions and descriptions in this dissertation.

## 1.3 SCOPE OF THE STUDY

### 1.3.1 Research Context

Placing user experience with personal health care technologies in center intrinsically demarks the borders of this dissertation's scope within human-computer interaction and health fields. As users, their needs, expectations, and so on, are involved, these borders are tangent to psychology discipline, too. At this juncture, the potential of supporting the wellness and happiness of users has been found important, which intensifies the attention on positive psychology area beyond diseases and problems. This effects the focus on consequent design side, as well, emphasizing the possibilities as design descriptions and recommendations rather than only problems. Hence, positive design is another actor in this research context.

Given the breadth of the research context, it is necessary to note again that after exploring the broad picture with personal health care technologies, mobile phone applications for pregnancy is pinned down as the exact target. Figure 1 depicts the key issues in the research context.

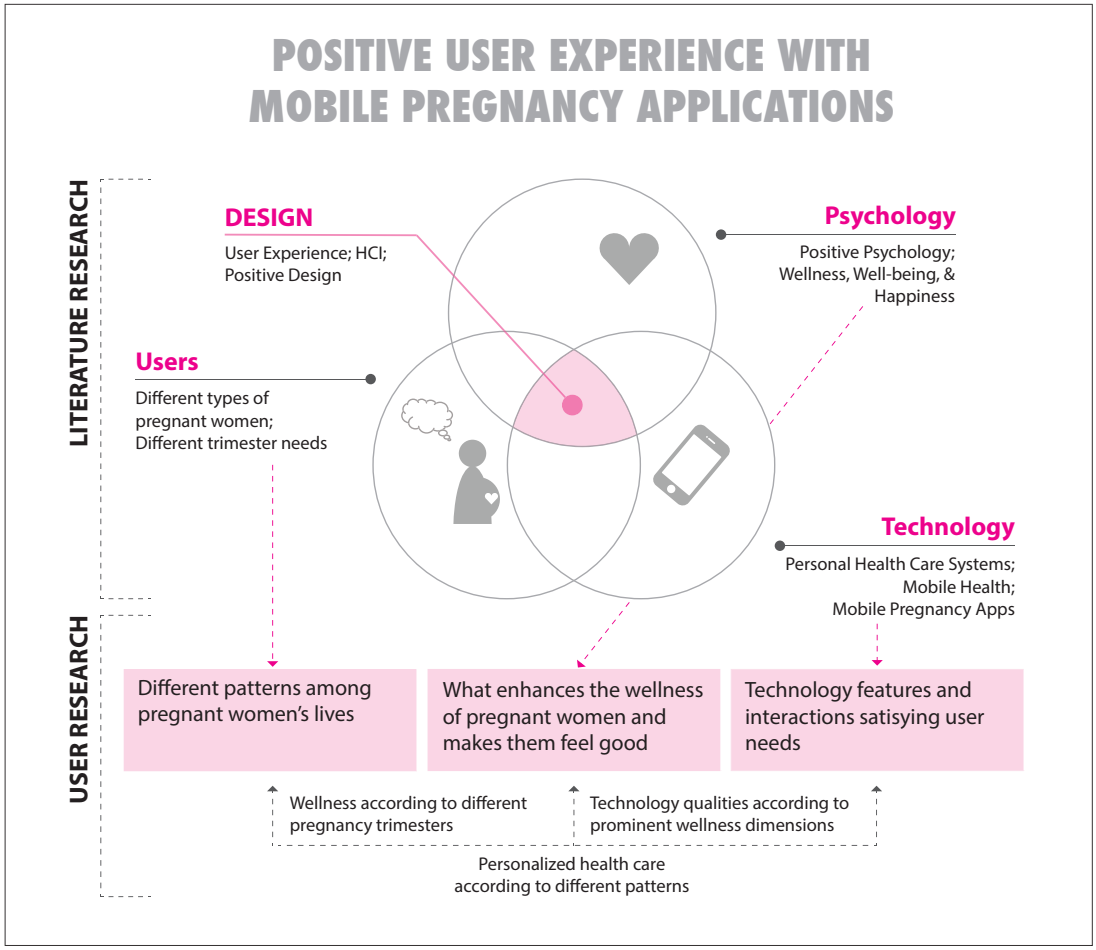



**Figure 1.** The research context

### 1.3.2 Research Aim and Questions

The ultimate aim of this dissertation is to comprehend and convey how a positive pregnancy experience can be characterized with the utilization of mobile pregnancy technologies and to bring about design descriptions paying regard to different pregnancies and trimesters, which would support and enhance the wellness and happiness of different pregnant women.

Pertinent to this aim, two broad main research questions and related sub-questions of the study are as follows.

- What is the characterization of a positive pregnancy experience?
  - About which conditions/issues do pregnant women want to feel good?

- How can design of mobile pregnancy applications contribute to wellness and happiness of pregnant women?
    - Do needs, expectations, and user experience dimensions change according to pregnancy period?
    - What can be the characteristics of mobile pregnancy applications generating a positive pregnancy experience?

As can be implied from the main research questions, it is important firstly to understand the meaning of a positive and happy pregnancy experience and secondly to dwell on the role of design features and interaction qualities.

## 1.4 STRUCTURE OF THE DISSERTATION

This dissertation is composed of six chapters. In order to better orient the readers of the dissertation, initial three chapters are designated for the comprehensive exploration of the study's background. Chapter 1 explores the problem area and introduces both current barriers and attempts in pregnancy care. Then significance of a study in the problem area is highlighted and the scope of this dissertation is defined by explaining the research context, aim, and questions. In Chapter 2, historical and conceptual backgrounds of positive psychology discipline are presented, which is of great significance due to shaping current design literature and the user research in this dissertation. Chapter 3 continues with general health concept, but focusing on personal health care issues. The motivational and conceptual background of personal health care systems are explored in literature; and subsequently, the current state in the practice of these technologies, recent transformations, and methodological issues in user experience (UX) literature are investigated.

Chapter 4 is allocated for the detailed explanation and justification about the methodology of the user research conducted in the scope of this dissertation. Data collection steps and data analysis methods are discussed.

In Chapter 5, the main findings of the user research are revealed. Positive user experience dimensions with mobile pregnancy technologies, qualities of these technologies regarding their components and subjects, as well as changes in and

wellness throughout daily life during pregnancy are demonstrated. Besides, prevalent relationships within and across these aspects are discussed in detail.

Chapter 6 builds upon entire chapters involving the literature and major user research findings. Conclusion is made by revisiting the research questions, conveying related design possibilities and descriptions for mobile pregnancy applications, and discussing the dissertation's contribution, prevalent limitations, and further study suggestions.

# CHAPTER 2

# POSITIVE PSYCHOLOGY

It has been anticipated in order to realize the acceptance, adoption, and smooth integration of technologies into daily lives of pregnant women that pregnancy-related technologies should not be merely information-providers, decision-makers, or problem-solvers; but, they should go beyond by making pregnant women feel good. Accordingly, it is assumed that pregnant women's experiences with mobile pregnancy technologies should affect them positively and enhance their wellness. Therefore, the broader picture about good life, a hypernym about multifarious values which are significant in individual's life (Hayron, 2008), was investigated initially during the literature review, considering both the historical and the conceptual backgrounds as follows.

A cautionary note is needed at this point that embarking on a journey about good life means encircling denotive terms like happiness, well-being, wellness, and so on. Although nuances between the related terms are to be discussed in detail later-on in this chapter, "good life" or "happiness" terminologies are preferred mostly while demonstrating the historical roots in the initial section as there were no clear, precise, established, and conscious distinction between all these terms during early times. Thereby, in order not to misguide readers and cast their mind with exact terminologies before dwelling onto specific terms under dedicated sections later-on, it is advisable to approach such divergent terminologies as a generic positive life concept in the initial section.

## 2.1 HISTORICAL TRACES OF GOOD LIFE

The achievement of good life is a longstanding issue. From the very beginning of the history, people have always been in pursuit of good life. Different conceptions have taken a turn considering the portrayal of good life throughout the history and before the modern psychology.

### 2.1.1 Hedonism versus Eudaimonism

The initial notable period was the ancient Greek period because age-old definitions of good life could be traced back to Greek philosophers. There were several approaches that came into prominence in that period regarding the conceptualization of good life (McMahon, 2008). The first one was about the sole hedonism. Aristippus of Cyrene (c. 435-350 BCE)[2], a student of Socrates (c. 470-399 BCE) and the founder of Cyrenaic school around the third century BCE, is known for coining hedonism, which denotes the ethic of pleasure (Encyclopædia Britannica, 2017). It can be said that hedonism in this approach was in the extreme form (Tatarkiewicz, 1976) as the ultimate good in life was seen as the immediate attainment of pleasure and avoidance from pain. This approach equated happiness to over-all transient pleasures; i.e. to the totalization of momentary satisfactions (Watson, 1985). The second approach had a softer hedonic stance. Though Aristippus is mentioned to be the introducer of the philosophy of hedonism, the most widespread associations of hedonism have been made with Epicurus (341-270 BCE). Epicurus stated that the objective of life should not be increasing the momentary and transient pleasures; rather it should be increasing the pleasures in life holistically (Niedenthal, Krauth-Gruber, & Ric, 2006). So, his version of hedonism was more expanded and moderate; but still, physical gratification was the point (Huta, 2013). The third approach differentiated from the initial ones by associating the realization of good life with the detachment from emotional life. Put forth by Zeno of Citium (c. 334-490 BCE), stoicism defended that living a life compatible with nature was the upmost virtue (Hergenhahn & Henley, 2014). Stoicism gave importance to virtue, wisdom, inward self-sufficiency, self-knowledge, and self-

[2] All specified biographical dates of the famous philosophers and influential figures are mentioned to form an estimate of the historical timeline and all were retrieved from Blackburn (1996) otherwise mentioned.

cultivation (Georges, 1995; Inwood, 1985). As the focus was on virtue rather than pleasure, stoic philosophy is considered to be a source of eudaimonic taught rather than of hedonistic (Huta, 2013). The last and the most commonly embraced perspective was Aristotle's (384-322 BCE) view of happiness. Aristotle discoursed that the foremost goal of human was to attain happiness (Seligman, 2012) by pursuing virtuous activities (McMahon, 2008). According to him, happiness grounding on meaningful goals was the basis of a life worth living (Snyder & Lopez, 2007; Waterman, 1993). The term eudaimonia was popularized and started to be frequently used to represent happiness then, exact definition of which was good spirit (Miao, Koo, & Oishi, 2013; Nussbaum, 2000).

The above mentioned philosophical terrain of good life during ancient Greek period shows that a distinction can be made between two fundamental approaches that dominated the philosophical trajectory during those times: hedonism and eudaimonism. The etymologies of these two words are actually the reflectors of their content. Hedonia was stemmed form the ancient Greek word "hedone", which was derived from another word meaning "the sweet taste of honey" (Berridge & Kringelbach, 2015) and implying pleasure (Stanford Encyclopedia of Philosophy, 2013). Eudaimonia was originated from two Greek words "eu-" meaning "well" and "daimon" meaning "spirit", together which indicating good spirit and living well (McMahon, 2006). That is to say, hedonia corresponds to presence of pleasure and absence of pain or displeasure; whereas, eudaimonia represents improving the best in thyself and flourishing in compliance with a person's deeper principles and true self (Huta, 2013).

### 2.1.2 Utilitarianism

After clarifying the meaning of two fundamental approaches, it is high time to mention about the other outstanding period related to good life before modern psychology, which was the utilitarianism of the nineteenth century. One of the most famous utilitarianist Jeremy Bentham (1748-1832) stated that (Bentham, 1789):

> "By utility is meant that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness, (all this in the present case comes to the same thing) or (what comes again to the same thing) to prevent the happening of mischief,

> pain, evil, or unhappiness to the party whose interest is considered: if that party be the community in general, then the happiness of the community: if a particular individual, then the happiness of that individual."

As can be interpreted from the above presented quote, utilitarianism also emphasized the significance of pleasure and happiness by adopting a hedonic stance. Yet, in utilitarianism the maximum amount of happiness was important for the maximum amount of people (Brulde & Bykvist, 2010). In short, maximizing happiness and minimizing pain for as many people as possible was the point for achieving the greatest good. Bentham even conceived a "felicific calculus" for identifying the circumstances and dimensions of a pleasure's or pain's value (Veenhoven, 2013). John Stuart Mill (1806-1873) was another noteworthy advocate of utilitarianism; nevertheless, he oscillated between the Bentham's one-dimensional happiness reductionism and Aristotle's distinction among higher and lower pleasures, and moralism grounding on pursuing right activities and achieving one's potentials (Nussbaum, 2007). Mill attached credence to the one-dimensional happiness definition of Bentham and thought that various pleasures would be summed to form a single dimension following a judgmental course. So, rather than considering pleasure as a state, he considered it as an evaluation (Stanford Encyclopedia of Philosophy, 2017; Sumner, 1996).

### 2.1.3 Other Historical Approaches about Good Life

Apart from the Greek philosophers and utilitarianists questioning what the good life is and how happiness can be achieved, philosophers in the East, such as Confucius (551-479 BCE), also dealt with the same questions. Actually, not only great thinkers, but also theologians and remarkable figures in diverse religions questioned the meaning and achievement of good life (Peterson, 2006). What's more, the pursuit of good life and happiness was the topic of proclamations and was even declared as a human right in the America's Declaration of Happiness (Lyubomirsky, Sheldon, & Schkade, 2005; Snyder & Lopez, 2007). In the America's Declaration of Happiness (Jefferson, 1776) all citizens were mentioned to have a right to pursue happiness. Indeed, only after the enlightenment all people were considered to have a right to pursue happiness (Miao, Koo, & Oishi, 2013) because according to most Greek philosophers it had been hard to attain happiness out of the exclusive and propertied people (Vittersø, 2013).

It should be added that most philosophers in ancient Greek period believed that human nature was positive and social. Nonetheless, some philosophers of the age of Enlightenment started to have negative opinion about the human nature. To illustrate, Thomas Hobbes (1588-1679) proposed a doctrine which saw humans as basically bad and selfish, and thought that it was hard to do something about that (Hobbes, 1651). He was the first to assert about such a view (Jorgensen & Nafstad, 2004), which was sometimes referred as egoistic hedonism (Huta, 2013). Jean-Jacques Rousseau (1712-1778) came up against this view and mentioned that human nature had a potential for goodness as they were moral beings (Blackburn, 1996; Jorgensen & Nafstad, 2004).

The brief summary of historical traces of good life shows that good life was excessively associated with happiness and pleasure in the past, but mostly outside of a scientific frame. For instance, although good life was tried to be more socially and statistically articulated by Bentham (Huta, 2013), predecessors of happiness thinking, including the timeline from Aristotle to Bentham, were not rigged with adequate knowledge to comprehend the functions of and differentiations between happiness, instantaneous pleasure, satisfaction, and feelings (Vittersø, 2013). The advancement of historical bases and their reflections on today's understanding of good life are discussed in the ensuing sections. As good life has shown itself among diversified concepts, the most prevailing concepts related to good life are explained individually in detail.

## 2.2 EXPLORATION OF THE POSITIVE INGREDIENTS OF LIFE

The achievement of good life is also a lifelong pursuit of each individual. Hence, there is abundance of research about what good life means, why it should be achieved, who can achieve it, and how it can be achieved. Moreover, there are multiple concepts and terms regarding good aspects of the life such as happiness, wellness, well-being, health, quality of life, life satisfaction, and so on. Nonetheless, although these concepts differ from each other to a certain extent, there is an ambiguity in their definitions since some of them are used interchangeably both in the literature and in colloquial language. As a result, there is no worldwide use, common language, and clear classification of the concepts related to good life.

Pertinent to the aim of this study, it is utmost important to comprehend the abovementioned concepts and to locate "wellness" among them. Thus, the subsequent sections try to map the conceptual space, keeping track of the most prominent terms in the modern psychology.

### 2.2.1 Positive Psychology

Although the roots of good life reach back to the early times, the study of good life and the related concepts constitutes a respectively novel scientific and applied research area. Positive psychology is one of the most recent and promising fields in psychology discipline dealing with aforesaid issues.

In essence, psychology used to have three fundamental goals which were treating mental diseases, increasing happiness of relatively less troubled people, and promoting genius and talent (Seligman, Parks, & Steen, 2004), which emphasized both negative and positive aspects related to people. Nonetheless, if we swing back the pendulum to the first half of the twentieth century, we could encounter with a different situation in the world of psychology. Giving a very brief summary about the preponderant approaches in psychology in the twentieth century; i.e. touching upon the more contemporary roots in addition to the previous presentation of the historical roots of good life, would be beneficial to picture the onset of the juvenile positive psychology field towards the end of the twentieth century. This is also crucial to make sense of the ensuant transformations in other disciplines, one of which is design.

#### *2.2.1.1 From Pessimistic Side of Psychology*

In the early twentieth century, there were two main waves in psychology: *behaviorism* and *psychoanalysis*, both of which appeared as an objection to psychology's intense focus on introspection and consciousness (Matson, 1971). The former term, behaviorism, was coined by John Broadus Watson (1878-1958) in 1914 (Watson, 1914); yet behavioral researches, like using rats and animals to perform certain things and to report their performances, had been conducted almost a quarter century before the term was coined exactly (Dewey, 2007). Behaviorism addressed a psychology based on study of behavior and on rejection of dealing with mind and mental processes

(Epstein, 1987). Famous radical behaviorist Burrhus Frederic Skinner (1904-1990) mentioned that explanation of behavior did not require mental events and that behaviors of people could be manipulated even by punishments and rewards (Skinner, 1953). Watson also believed that merely the observable and measurable things should be studied by scientific ways, which hinted the controllability of the human behavior when conditioned (Lundin, 1983). One of Watson's (1913) famous quotations well demonstrated this:

> "Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select - doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations and the race of his ancestors."

The latter term, psychoanalysis, was boosted by Sigmund Freud (1856-1939) who believed that people's behaviors and experiences were driven by internal urges, biological instincts, and unconscious motives (Hall, 1954; Hamachek, 1987). Accordingly, all behaviors, feelings, and thoughts were thought to be already predetermined (Coon & Mitterer, 2010).

Alongside those intense pessimistic views of human nature in these two main waves of the psychology, there were also many scientists in other social sciences believing in the negativity of the human nature, as asserted before by Hobbes (1651) and as mentioned in the previous section. Accordingly, people were seen as being continuously concerned with exploiting the material and social environment for achieving the best possible physical and psychological conditions for themselves (Jorgensen & Nafstad, 2004). Fiske (1992) deduced that egoistic and self-interested approach has formed the core human nature aspects in theoretical psychology.

Apart from the prevailing approaches in psychology in the first decades of the twentieth century, the World War II had a great influence on the course of psychology and on the intended positive aspects in the main goals of psychology. After the World War II, psychology started to neglect two of its goals, which were the most positive ones, and to focus merely and extensively on the negative one, curing damage. No wonder, this was due to huge amount of psychologically damaged people after the war and also the largest budget spared to support research on mental diseases (Linley,

2009; Seligman & Csikszentmihalyi, 2000). Moreover, with the foundation of the Veterans Administration in the late 1940s, psychologists realized that they could earn by curing mental diseases (Seligman & Csikszentmihalyi, 2000). Besides, with the foundation of National Institute of Mental Health at the same period, psychologists made great endeavors to handle mental problems following a theoretical framework of fixing wrecked minds, motives, dispositions, and childhoods (Seligman, 1998).

It goes without saying that the two major waves in psychology, though considered pessimistic, provided strong and crucial contributions to the conception of human beings (Hamachek, 1987). Likewise, the excessive focus on the diseases after the World War II yielded more accurate understanding and classification of symptoms, and also paved the way for more reliable assessments and solutions which had been hard to discover or achieve before (Seligman et al., 2004). On the other hand, besides the great progress made about repairing damaged people, a great downside appeared in this disease model. It was seen that so little was known about what was good in people and how the lives of people could be enhanced (Seligman & Csikszentmihalyi, 2000). Being problem, damage, and pathology oriented has not drew psychologists even near to the prevention of critical disorders (Seligman, 1998).

#### *2.2.1.2 Towards Humanistic Side of Psychology*

After the heavy focus on all negative sides of people, except from some individualistic efforts related to the positive sides of people, humanistic psychologists started to argue that psychology overlooked what were the most important aspects in people since they had concentrated too much on the presumed reasons of people's behaviors. A complete and whole perception of human beings started to come into existence around 1950s at the nexus of the reductionist approaches of behaviorism and psychoanalysis, due to either being conditioning, response, and environmental determinism focused; or being unconscious forces, instinct, and biological determinism focused (Coon & Mitterer, 2010; Hamachek, 1987). Thereby, the focus in psychology started to shift from mechanical reasons and problems towards basic questions about meaning in life and existence (Peterson, 2006). That is to say, humanistic psychology appeared as a "third force" (Dewey, 2007; Hamachek, 1987) and went beyond the clinical and behaviorist approaches as it lighted the way for positive issues in people, such as health (in contrast

to diseases), creativity, self-expression, self-actualization, free will, voluntary choices, and so on (Aanstoos, Serlin, & Greening, 2000; Coon & Mitterer, 2010).

One of the foot stones of the humanism is "self-actualization" concept referring to cultivating self potential, fully improving oneself, and growing into the best possible self (Hamachek, 1987). Named by Maslow (1954), self-actualization was the ultimate need in Maslow's renowned "Hierarchy of Needs" pyramid, which would pave the way for self-transcendence as an actual ultimate motivation level by using the skills and potentials of the self (Koltko-Rivera, 2006). More specifically, self-actualization includes making selections related to self-consciousness, self-responsibility for actions, and growth. It also brings about peak experiences, during which one can feel very intense (Maslow, 1968). Additionally, Maslow (1954) brought forward the term "positive psychology", putting emphasis also on creativity and self-actualization while studying personality and motivation. However, he renamed it as "health-and-growth psychology" (Maslow, 1962). Also, he is referred by some researchers as the first psychologist to investigate the excellence for identifying the limits of people's potentials (Lambert, Passmore, & Holder, 2015). Another important figure in humanism was Rogers (1961) who spoke of "fully functioning person", thinking that full functioning state is inherent in people and occurs when they are self-actualizing, and that it is receptive to both positive and negative experiences. Additionally, he opposed the psychoanalysis' view of therapist as an expert and advocated the client-centered view. Carl Gustav Jung (1875-1961) and Gordon Allport (1897-1967)[3] are worth-mentioning, as well. Jung (1933) concentrated on individuation, which means being aware, autonomous, integrated, and so, being fully thyself. Allport (1955) dealt with being psychologically well and individually mature, considering self-expression, relation to others, possession of personalized conscience, etc. Some researchers mentioned that he is the one who coined the "humanistic psychology" concept in 1930 (DeCarvalho, 1991).

[3] Retrieved from Encyclopædia Britannica (2017).

### *2.2.1.3 Characterization of Positive Psychology*

Long after, Seligman highlighted the necessity of increasing the bar for human functioning and giving equivalent value to studying what is right with people, rather than studying only what is wrong with people. During his presidency of American Psychological Association in 1998, he named the relevant field as "positive psychology" (Peterson, 2006; Seligman et al., 2004). Nonetheless, the period prior to that date is entitled as "psychology as usual" by positive psychologists, not as "negative psychology" as positive psychology has occasionally been criticized for (Hefferon & Boniwell, 2011). Additionally, positive psychology did not appear as a completely new and revolutionary field. In fact, it constituted an umbrella role for divergent research and theories. It praised the authenticity of studying goodness in people and life, instead of perceiving goodness as a secondary issue or as an epiphenomenon compared to diseases and disorders. To be more precise, positive psychology is not about setting the bar from minus to zero, which concerns with "languishing"; instead, it is about raising the level from zero to plus, which concerns with "flourishing" (Figure 2).

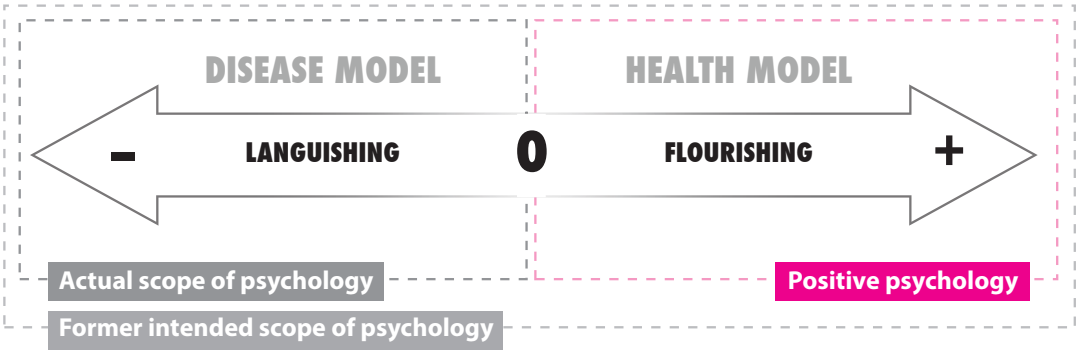



**Figure 2.** Positive psychology (Adapted from Hefferon & Boniwell, 2011; Travis & Ryan, 2004)

Positive psychology is operationalized in three levels: subjective, individual, and group levels (Boniwell, 2006; Hefferon & Boniwell, 2011; Positive Psychology Center, 2017). The former one, *subjective level*, encompasses the positive states and experiences, such as happiness, satisfaction, well-being, etc. Thus, feeling good is in the focal point, not being or doing good. The *individual level* intends to define the ingredients providing a good life and the personal traits making a good person, like

wisdom, resilience, determination, relationship capabilities, integrity, talent, creativity, etc. The final level, *group level*, is also known as community level because it concentrates on the factors enhancing the progress of communities. Civic virtues, altruism, work related virtues, positive institutions, etc. epitomize the factors covered herein. All these levels demonstrate that positive psychology does not concentrate merely on the self. It aims to foster the best in individuals, all citizens, and societies (Hefferon & Boniwell, 2011).

It goes without saying that, positive psychology has encountered with many criticism, too. As very shortly touched upon above, positive psychology was blamed for creating a negative perception about the prior psychology and its efforts. Indeed, positive psychology values what has done before and highlights that as very significant successes have been achieved by dealing with negative aspects, it is time to fill the deficiency about the positive aspects and achieve successes alike (Gable & Haidt, 2005; Hefferon & Boniwell, 2011). Furthermore, positive psychology has been criticized for playing the glad game by neglecting the real problems, pains, and grieves in life. In fact, positive psychology does not attempt to overlook and wipe out what has been learned till now; but it does intend to complement what has been attained with the works on illness, pathology, and problems; and to build on this by progressing on the less examined aspects about what makes life worth living. Clearly saying, positive psychology finds it crucial to embrace the whole scope of people's experiences with a scientific approach, ranging from illness and problems towards aspects of good life (Linley, Joseph, Harrington, & Wood, 2006; Positive Psychology Center, 2017). This scientific approach is also the most noticeable decomposition point of positive psychology from the humanistic psychology. Even though their spheres of interests have very much in common, humanistic psychology has discredited the effectiveness of scientific methods for comprehending humankind and its intricacy (Boniwell, 2006).

Despite the encountered challenges, positive psychology keeps it accelerating pace in its second decade after being established as a novel scientific research area in psychology discipline. Foundation of positive psychology institutions, centers, and networks; development and increase of many undergraduate classes, graduate

programs, and courses; organization of conferences; and publication of journals and books are indications of the rigorous attempts and the outgrowing research area (Hefferon & Boniwell, 2011; Linley et al., 2006; Positive Psychology Center, 2017). Nonetheless, whether positive psychology is and will be a completely detached discipline is a matter of debate. Figure 3 shows the possible position of positive psychology among other disciplines of psychology as usual (Hefferon & Boniwell, 2011).

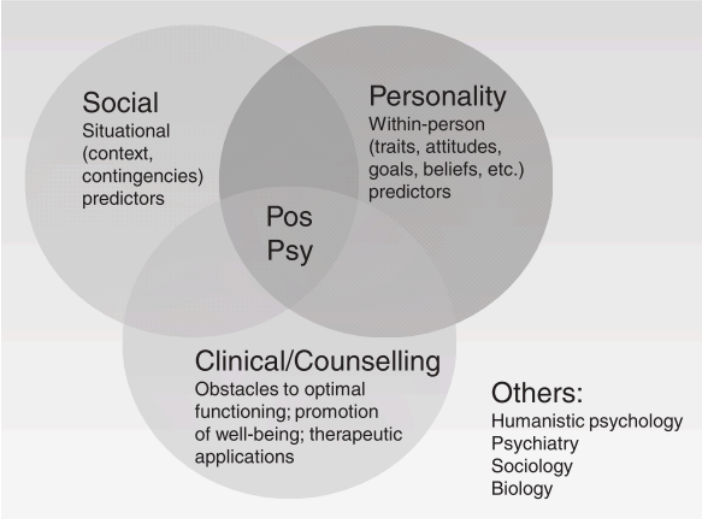



**Figure 3.** Positive psychology's relationship with diverse disciplines of psychology as usual (Hefferon & Boniwell, 2011)

### 2.2.2 Happiness

Lately, popular media has presented happiness as the common and central consequence of positive psychology studies (Snyder & Lopez, 2007). So, it is used excessively for every positive experience and referred as a synonym for distinct concepts appeared within positive psychology. That's why it has lost its meaning and become almost a scientifically unworkable concept (Seligman, 2012).

Actually, although quest for explaining and attaining happiness dates back to early times, scientific research of happiness and good life related concepts is a relatively novel scientific area as just explained (Bao & Lyubomirsky, 2013). Furthermore, happiness does not constitute the central part of positive psychology; it is just one aspect of positive psychology (Snyder & Lopez, 2007).

Happiness research stands at the junction of certain progresses. These can be listed as the advancement of positive psychology, onset of positive organizational scholarship which has fueled organizational studies, better comprehension of positive emotions due to progress in affective and biological fields, and the manifestation of Gross National Happiness (GNH) Index by Bhutan which has underscored the inadequacy of economic indices such as Gross Domestic Product (GDP) (David, Boniwell, & Ayers, 2013).

Happiness has many connotations. From the widest perspective it is sometimes used to mean general quality of life; whereas, from the narrowest perception it is preferred to address momentary pleasures and bliss (Veenhoven, 2013). Currently, the most valid and accepted denotation of happiness is the immediate reflections of positive and negative feelings during people's experiences (Snyder & Lopez, 2007). It is also used to refer to self-reports of emotions and thoughts (Seligman, 2002).

One of the most noteworthy theories about happiness, the "Authentic Happiness Theory" (Seligman, 2002), says that the major topic of positive psychology is happiness and it is assessed by life satisfaction. Therefore, the objective of positive psychology is to augment life satisfaction. In order to do so, happiness is investigated into three elements: positive emotion, engagement, and meaning, which are respectively about pleasant life, engaged life, and meaningful life (Seligman, 2002). These elements are also handled while defining paths to happiness (Seligman et al., 2004). *Positive emotions* are what people feel like warmth, pleasure, joy, contentment, etc. Thus, the primary path to happiness is about augmenting positive emotions. Virtually, when people talk about happiness in colloquial language, they mostly imply this hedonic path. Engagement, i.e. flow, is the loosing track of self-consciousness when conducting an absorbing activity. *Engagement* is seen as contrary to positive emotion since people usually do not feel anything during flow. This is due to the consumption of emotional and cognitive resources while reaching concentrated attention. Furthermore, there are quick ways to achieve positive emotions; whereas, no shortcuts exist for experiencing flow. Diverse personal strengths support engagement (Seligman, 2002). Due to enabling full engagement, gratification is considered as the second path to happiness. It is important to point out that gratification

does not have to involve positive emotion, too (Seligman et al., 2004). *Meaning* appears as a result of serving to a bigger reason than one's own self. It is inevitable that all people seek meaning in life. Moreover, each of them makes a contribution to well-being and is followed for its own sake (Seligman, 2002). The other path which provides meaning is utilizing personal strengths for contribution to what would be beyond the self, examples of which can be justice, relationships, intellectuality, or spiritual power (Seligman et al, 2004). The last two paths are fed more from the eudaimonic aspects of the good life. All three elements of happiness are exclusive so that they can be handled and assessed independently.

### 2.2.3 Well-Being

As mentioned above, the main issue of positive psychology was considered as happiness at the outset. Very recently, it has been understood that the main topic is actually well-being. Also, it is accepted that the objective is not augmenting the life satisfaction; rather it is increasing flourishing (Seligman, 2012). Flourishing means "a state of positive mental health; to thrive, to prosper and to fare well in endeavors free of mental illness, filled with emotional vitality and function positively in private and social realms" (Michalec et al., 2009). The absence of these; i.e., the opposite condition of flourishing, is called languishing (Keyes, 2002) (see also Figure 2). So, well-being is assessed by flourishing, which accompanies five elements: positive emotion, engagement, (positive) relationships, meaning, and accomplishment. Seligman (2012) named this as the "Well-Being Theory" and abbreviated the included elements as PERMA. These dimensions are linked with mental health, as well (Seligman, 2008).

Well-Being Theory is the improved version of the Authentic Happiness Theory (Seligman, 2002). Since the Authentic Happiness Theory is one-dimensional with an over-focus on happiness, it has started to approach dangerously to monism and to be understood only as if it is happiology. On the other hand, the Well-Being Theory is multidimensional, and happiness becomes one of the five constitutional elements, denominated as positive emotion (Seligman, 2012). As can be seen, three elements have been kept, but positive relationships and achievement have been added because the initial elements were not able to consume all the elements that people select for their own sake (although the Authentic Happiness Theory has three of these elements,

it is one-dimensional because the measure of happiness is not these three dimensions in the initial version, but life satisfaction).

As happiness is an element, it can be seen as a thing. It constitutes the well-being with other elements, each of which is a different thing. Well-being is a construct, created by the combination of these diverse things. Hence, the well-being construct, not the happiness or life satisfaction thing, is the major topic of positive psychology (Seligman, 2012).

In the Well-Being Theory, all elements of PERMA are underpinned by various human strengths; whereas, the human strengths are thought to endorse only engagement element in the Authentic Happiness Theory. Therefore, it has been comprehended that the utilization of the highest strengths not only paves the way for engagement, but also for all the other elements and well-being (Seligman, 2012).

Well-being has been frequently resolved under hedonic and eudaimonic descriptions, as well (Keyes et al. 2002; Ryan & Deci 2001; Waterman 1993; Westerhof & Keyes, 2010). Hedonic descriptions to well-being are usually appeared in the literature as pleasure-centric and hedonic approaches of well-being (David, Boniwell, & Ayers, 2013), or as hedonic well-being (Deci & Ryan, 2008; Ryan & Deci, 2001; Waterman et al., 2010). Also, these are sometimes referred as emotional models and emotional well-being (e.g. Diener, 1984; Diener, Suh, Lucas, & Smith, 1999; Keyes, 2005, 2007; Snyder & Lopez, 2007; Westerhof & Keyes, 2010) and they are about the conceptions of the avowed feelings and thoughts (Snyder & Lopez, 2007). *Subjective well-being (SWB)* is the most prominent conception in positive psychology literature, which is covered under the hedonic approaches. SWB is a multidimensional construct in itself. It is about the people's appraisals of their own lives regarding affective and cognitive aspects (Andrews & Withey, 1976; Campbell, Converse, & Rodgers, 1976; David et al., 2013; Veenhoven, 1984). The affective component of the SWB encompasses the feelings that a person experiences; that is to say, it is about positive and negative affects (David et al., 2013; Pavot & Diener, 2013). That's why, this component is sometimes used in place of happiness (Diener, 1984, 2000; Diener, Oishi, & Lucas, 2009) and sometimes mentioned as the hedonic component (Pavot & Diener, 2013). The cognitive component of the SWB covers the people's assessments of the controversy

between their aspirations and accomplishments (Campbell et al., 1976; Pavot & Diener, 2013). In other words, it is about how people perceive their lives considering their current situation and their ideal standards. This cognitive component correlates with and also named as life satisfaction (David et al., 2013). In epitome, either being affective or cognitive, SWB has three main components in total: positive affect (PA), negative affect (NA), and life satisfaction. This tripartite construction is not acknowledged worldwide; but, it has gained great recognition (Arthaud-Day, Rode, Mooney, & Near, 2005). A shift has been observed towards a four-component version, which separates the cognitive component into two as life satisfaction and domain satisfaction (Diener, Scollon, & Lucas, 2004). Additional domain satisfaction sub-component examines specific domains in life such as work, marriage, health, and so on. Yet, this version has not been accepted globally, too.

Eudaimonic descriptions of well-being encapsulate psychological well-being and social well-being (Lambert et al., 2015; Westerhof & Keyes, 2010). *Psychological well-being (PWB)* is the attainment of person's whole psychological potential (Carr, 2003) and engagement with the challenges related to existence (Lindley & Joseph, 2004). In other saying, it stands for positive functioning of a person via self-realization (Westerhof & Keyes, 2010). Ryff (1989) put forth the PWB model with its six dimensions: autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and self-acceptance. Very briefly, autonomy is about the self-dependence in line with behaving and taking responsibility on behalf of the self. Environmental mastery is being able to draw upon internal and external resources to conceive, shape, manage, and select suitable contexts for needs and growth. Personal growth relates to improving and cultivating own potential by coping with challenges. Positive relationships implicate a person's competence for affection and empathy. Purpose in life correlates with setting objectives to achieve a thorough meaningful orientation in life. Self-acceptance, the final PWB dimension, is recognizing, approving, and above all liking the self.

*Social well-being* is about being on good terms with and being of positive value to other individuals and community; and thus, functioning good in social life (Keyes, 1998; Keyes & Shapiro, 2004; Snyder & Lopez, 2007; Westerhof & Keyes, 2010).

Social well-being also consists of several social challenges which constitute its dimensions: social acceptance, social actualization, social coherence, social contribution, and social integration (Keyes, 1998). Social acceptance can be observed as the equivalent of self-acceptance in a social frame. That is, the one who demonstrates social acceptance recognizes other people and their hardships, demonstrates positive approach towards them, and believes in them. Social actualization pertains to the assessment of the course and potential of the society. Social coherence is being aware and making sense of what is going on in social life and society. So, it relates to a sensation about social mechanism, composition, and quality. Social contribution is about the assessment of a person's worth and vitality to the society. As the last social well-being dimension, social integration encompasses feelings of commonality and belongingness which a person has towards his or her society.

More recently, Vittersø (2013) has given utterance to *functional well-being approach (FWBA)* by articulating the need of consideration of plans and goals to make sense of the feelings and evaluations about an experience. Accordingly, optimal functioning has been proposed to elucidate the meaningful processes related to the creation of the plans, abiding by those plans, attaining authentic goals, and meeting fundamental needs. To put it another way, FWBA encapsulates optimal functioning, as well as the positive feelings and evaluations. Therefore, function refers to two issues at this point: functions related to the feelings and evaluations, and the concept of optimal functioning.

If we are to piece all those well-being aspects together, it can be said that SWB and PWB are the most commonly uttered well-being types. Although flourishing in a wider scope encompasses social well-being in addition to SWB and PWB, and although all of them together convey a more thorough depiction of mental health (Keyes, 1998, 2002, 2005, 2007; Keyes & Lopez, 2002; Westerhof & Keyes, 2010; WHO, 2005), social well-being sometimes seems to be a supplement to other well-being types that are about functioning well (Lambert et al.; Snyder & Lopez, 2007).

Over and above, all of these well-being aspects are sometimes distinguished according to subjective and objective descriptions and components (Snyder & Lopez, 2007).

Notwithstanding, what have been incorporated in subjective-objective comparison in the literature is nebulous. To illustrate, according to Snyder and Lopez (2007) subjective descriptions overlap with the hedonic tradition; whereas, objective descriptions are associated with psychological and social well-being; i.e. with eudaimonic tradition. On the other hand, subjectivity and objectivity categorization has been made mostly referring to the type of research, research measures, and well-being indicators. For instance, subjective approach is said to define and investigate well-being by consulting to individuals' subjective evaluations about life and happiness; while, objective approach is said to explain well-being and its indicators with regard to pecuniary resources (such as income, employment, dwelling, etc.) and social aspects (such as family, relation networks, spare time, education, health, etc.) (see Alatartseva & Barysheva, 2015; Guillén Royo & Velazco, 2006; Smith & Clay, 2010; Western & Tomaszewski, 2016). So, *objective well-being (OWB)* is viewed in relation to the fulfillment of external and universal criteria for pursuing a good quality of life. In spite of not always being sine qua non, OWB is among the influencing factors of SWB (Desmet & Pohlmeyer, 2013).

As a final clarification before closing this section and passing on other concepts, Figure 4 portrays the most recent and prevalent depictions about well-being and happiness concepts. As can be seen, SWB and PWB are the two most fundamental and confronted well-being conceptualizations though they are not actually dichotomous. Yet, according to the prevalent disputes in well-being literature, SWB is mostly associated with feeling good; and hence, asserted to be emotional and hedonic. Meanwhile, PWB is explained as functioning well and tackled as being functional and eudaimonic. Apart from these two dominant conceptions of well-being, social well-being is a complement to good functioning and an important aspect of positive mental health. To shed light on conceptual confusion about well-being and happiness, happiness is sometimes handled as a generic concept about all the good; i.e. as the equivalent of overall well-being (Veenhoven, 2013). The most frequent association of happiness is with SWB (Diener et al., 2010). However, with a more specific focal point, it is sometimes equated with the affective part, i.e. positive affect, of SWB (see Diener, 1984, 2000; Diener et al., 2009; Seligman, 2012; Snyder & Lopez, 2007). Given the basic well-being scheme, it is crucial to append that there are no strict

borderlines between and exact definitions about each concepts and their scope. Besides, all these conceptualizations nurture each other.

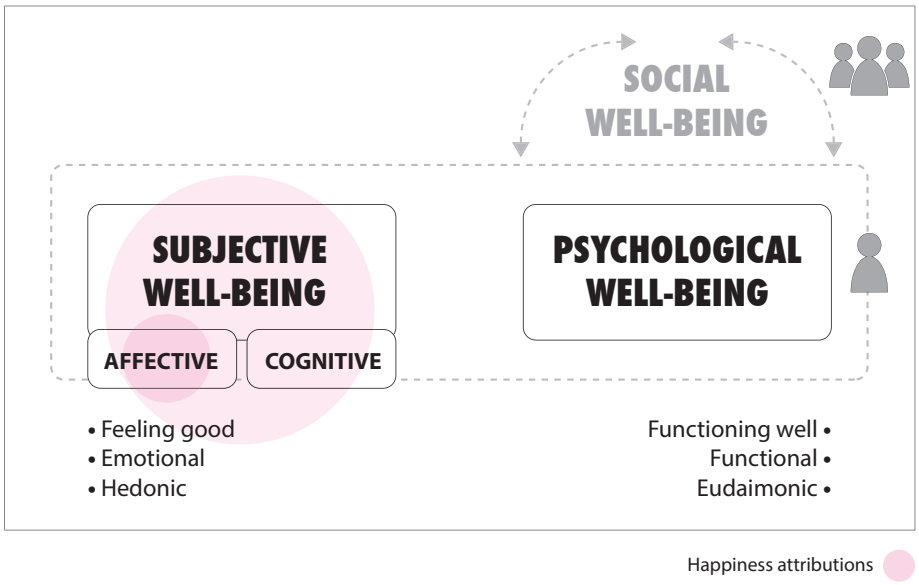



**Figure 4.** Well-being and happiness concepts

#### *2.2.3.1 Theories of Well-Being and Happiness*

Albeit hedonic and eudemonic traditions play an important role in the understanding and categorization of good life related literature and concepts, the categorization of the breadth of concepts and their components are not limited to these. Outside the philosophic traditions and the aforementioned main theories to construe the concepts such as happiness and well-being, variety of theories and their taxonomies do exist.

One notable categorization of SWB and happiness theories rests upon bottom-up versus top-down distinction (see Lambert et al., 2015; Pavot & Diener, 2013). This categorization considers the parts and the totality of the overall experience. *Bottom-up approaches* assert that well-being and happiness of a person is the cumulative sum of affects related to ongoing momentary or daily experiences. *Top-down approaches*, on the other hand, claim that people evaluate their life experiences as a whole and their SWB is influenced by already inherited and long-lasting inclinations to experience life in a certain way. Several factors can account for the entire, almost constant, affective manner in the top-down approaches, such as personality traits and cognitive processes.

Accordingly, even if a person is affected from temporal daily experiences, they have a propensity to turn back to a "set point" (Headey, 2008). So, personality has both a straight forward impact on SWB as an overall affective level and an unstraightforward implication by shaping the daily experiences and events of people (Magnus, Diener, Fujita, & Pavot, 1993). The most famous explanation for the almost stable SWB level is done by "Hedonic Treadmill Theory" (Brickman & Campbell, 1971) which states that the first influence of people's experiences and daily events might be intense; yet, this influence turns back to a neutral level shortly after because of accustomedness and adaptation (Headey, 2008). This neutral level conception has modified into a set-point conception in time as researchers think that this point might be different for each person with different temperament. Besides, the "SWB Homeostasis Theory" claims that SWB is controlled and sustained at a stable point by a genetically determined homeostatic system (Cummins, 2013; Tomyn & Cummins, 2011). Thus, SWB is mostly regarded as a biological or a psychological trait for the top-down approaches; whereas, it is a state according to the bottom-up approaches. This also indicates that SWB in the bottom-up approaches can more easily fluctuate depending on daily experiences and corresponding positive or negative affects; while, it is more stable and non-transitory in the long run even considering the affective changes in short term. Actually, SWB of a person can encapsulate the mutual interaction of both bottom-up and top-down influences (Pavot & Diener, 2013).

Considering what makes people happy, theories can be categorized into three: need/goal satisfaction, process/activity, and genetic/personality predisposition theories (Diener et al., 2009). *Need/goal satisfaction theories* claim that people become happy as they attain their goals. *Process/activity theories* emphasize that happiness is achieved when people are engaged in specific life activities. Csikszentmihalyi (2008) supposed that people are more apt to be happy when they engage in arousing activities that challenge or comply with their skills during daily life. "Flow Theory" is of high prominence in SWB and happiness literature which specifically explains that when a person is conducting challenging activities in line with his/her abilities, a state called "flow" occurs. This state refers to the intense engagement and involvement of a person in those activities (Csikszentmihalyi, 2009). Nonetheless, subjectivity of engagement is in a retrospective state since when a person is in flow, feelings and thoughts are

generally absent due to great absorption. But, merely in a retrospective way they are recalled (Seligman, 2014). *Genetic/personality predisposition theories* perceive happiness as stable, grounding happiness on personality or biological traits. Typically, neuroticism and extraversion have been referred as the most correlated traits with SWB and happiness (McCrae & Costa, 1990). Thus, genetic/personality predisposition theories differ from the initial two categories, since the need/goal satisfaction theories and the process/activity theories perceive happiness as a changing issue depending also on external factors and life conditions. Therefore, as shown in the upper paragraph, the genetic/personality predisposition theories can also be associated with top-down theories of SWB; whereas, the need/goal satisfaction theories and the process/activity theories are more related to bottom-up theories of SWB.

These categorizations are not entirely exhaustive. Diener and Ryan (2009) has compiled multitudinous well-being and happiness orientations under six headings, involving some of the above mentioned ones: telic theories, top-down/bottom-up theories, cognitive theories, evolutionary theories, temperament and personality theories, and relative standard theories. Nonetheless, they noted that a detailed relationship among those theories and scientific research is still required. As some of these are already discussed, the unmentioned ones are explicated here. *Telic theories* correlate the attainment of happiness to the realization of a need or goal (Diener, 1984). PWB (Ryff & Singer, 1996) and the "Self-Determination Theory" (Ryan & Deci, 2000) is an example for need theories, according to which people strive for satisfying connatural needs to attain SWB. Goals can emerge from these needs or other factors. Goal theories think that people attain SWB when they realize their goals which they consciously go behind (Emmons, 1986). It can be observed that these theories correspond with the need/goal satisfaction theories shown in the categorization of Diener, Oishi, and Lucas (2009). *Cognitive theories* concentrate on the cognitive processes while describing SWB. To illustrate, people who perceive or remember experiences better than the actual event might have higher SWB (Diener & Ryan, 2009). Cognitive theories can be also handled under top-down approaches to SWB and happiness. *Evolutionary theories* touch upon the value of SWB and emotions in human beings' survival. To exemplify, emotions result in certain behaviors and reactions towards a threat (Frijda, 1986; Lazarus, 1991; Levenson, 1994) narrowing down the

attention to a certain event and resulting action. Alternatively, the "Broaden-and-Build Theory" (Conway, Tugade, Catalino, & Fredrickson, 2013; Fredrickson, 1998, 2001, 2004;) suggests that emotions widen the concentration and cognitive flexibility in the short term, which can provide long term development. *Temperament and personality theories* are similar with genetic/personality predisposition theories included in the categorization of Diener, Oishi, and Lucas (2009). To say over, inherited characteristics have a greater impact on SWB even if environment may shape the incidence of genetics (Diener & Ryan, 2009). According to *relative standard theories*, a person's comparison between different standards, considering time frame, social context, goals, etc., determine the SWB level of that person. For instance, the "Multiple Discrepancy Theory" (Campbell et al., 1976; Michalos, 1976, 1985) tells that individuals tend to contrast their current conditions with several standards and the "Social Comparison Theory" says that individuals compare their ideal and actual conditions, as a result of which their SWB is effected from the perceived discrepancies. Also, habituation theories, like the "Adaptation Theory", are sometimes covered under this heading considering the comparison between the past and now even though they emphasize the decreased intensity of the affects during time. Some researchers address address relative standard theories as *discrepancy theories* (see Cummins, 2009, 2013).

Putting on established theories and manifold approaches, the "3P Model" explicate the components of SWB within a timeframe of past, present, and prospect (Durayappah, 2010). Actually, the temporality of people's experiences has already been emphasized in positive psychology discipline at a subjective level considering satisfaction about the past, pleasure and flow in the present, and hopefulness for the future (Seligman & Csikszentmihalyi, 2000). The more recent 3P model also highlights the temporality because people want to support already obtained happiness (related to the past), experience affective states currently (related to the present), and aspire for future happiness (related to the prospect). Moreover, it connects the top-down and bottom-up approaches to SWB.

### 2.2.4 Positive Health

The WHO changed its definition of health in 1946 by stating that "Health is a state of complete physical, mental and social well-being and not merely the absence of disease

or infirmity" (WHO, 1946). This definition implied the importance of going beyond the traditional health concept as an absence of disease, which is touched upon frequently in the previous sections and which has not been put into practice up till now. Moreover, sociological characterizations of health have underlined that people cannot be seen as solely biological things; in fact, they have social and psychological aspects that are shaped under social, cultural, political, spiritual, and such contexts, all of which affect how they think and proceed in their daily lives (Schuster, Jauregul, & Blanks, 2004). Therefore, a paradigm shift has been occurred from survival to disease-free survival, then to functional competence and performance in daily activities, and finally to life quality and well-being. "Positive health" has gained its reputation and has started to take shape as a discipline after the positive psychology initiative in the last decade (Peterson, 2006; Seligman et al., 2010). While positive psychology's focus is mostly on the mental health and psychological issues, positive health encapsulates also the positive physical health which is no wonder highly related to the psychological health. So, the focus in positive health is more holistic and contains diversified health assets.

More precisely, positive health is the study and identification of the health factors supporting longer lives, better quality of life, and more accurate prognosis about diseases, in addition to fewer diseases and less health-related expenditures (Seligman et al., 2010). In order to study health beyond traditional risk factors and diseases, health assets are classified into three measures: biological, subjective, and functional.

*Biological measures* are about the positive physiological functioning and anatomical structures. Health assets like heart rate, blood pressure, and cholesterol levels can be given as examples. Moreover, health assets specific to certain diseases such as coronary heart disease, diabetes mellitus, and osteoarthritis are examined hereby (Seligman, 2008). These are measured objectively (Seligman et al., 2010).

*Subjective measures* cover diverse psychological states, quantifying the relationship between mental and physical health. Thus, subjective measures of positive health supplement the benefits of positive psychology. The psychological states include having positive physical well-being during which vitality and energy are experienced, lacking of inconveniences, feeling of confidence regarding the body, feeling of health-

related control, having optimism, life satisfaction, meaning and engagement (Seligman, 2008). These states are investigated mostly with subjective measurements (Seligman et al., 2010).

*Functional measures* attempt to comprehend how well people are functioning by focusing on positive physical abilities, i.e. functional performance, and people's fit to their environments. There should be a good fit between people's bodily functioning and positive physical needs that their lifestyles entail (Seligman, 2008). When good match appears between lifestyle demands and physical abilities with a high subjective state, the functional measure approaches more to the positive mental health (Seligman, 2002). Having the ability to conduct the intended work, being able to have sufficient speed or reaction time, having purposeful work, maintaining intimate relationships, and such examples can be counted under functional health assets (Seligman et al., 2010). These are usually measured by self-reports as well as some laboratory measures like gait parameters and choice reaction assessments (Seligman, 2008; Seligman et al., 2010).

### 2.2.5 Wellness

The wellness term was coined firstly in 1950s when the ultimate limits in health were started to be investigated. Dunn (1959) utilized the wellness concept denoting the search of ideal well-being and a way of life. In his conceptualization, wellness was depicted as a continuum in stead of a constant state and as an overall perspective for health with a focus on an individual's potential and responsibility. As introduced in the positive health section, those were the times when traditional health concept was questioned and when the significance of going beyond the health concept as merely an absence of disease was uttered (WHO, 1946). Thus, the health concept has evolved into a wellness concept, as opposed to illness paradigm and treatment (Els & de la Rey, 2006; Miller, 2005), acknowledging that a person may not have an illness, yet meanwhile, may not have a full and satisfying life (Bishop & Aldana, 1999). That is to say, wellness concept has roots in health concept which has reached to a holistic point, perceiving the person as a sophisticated blend of physical, mental, emotional, social, and such other factors. This shows that contemporary notions of wellness are parallel with what is put forward with the positive health discipline (Rachele,

Washington, Cockshaw, & Brymer, 2013). After having acquired fame in 1950s with an emphasis on health promotion with active alterations in one's way of life, wellness concept gained even more pace in 1970s with wellness movement (Miller, 2005). A widely referred "Illness/Wellness Continuum" (see Figure 5) was devised in those times by Travis (1972), who was also the founder of the primary Wellness Resource Centre in the USA (Miller, 2005). This model of wellness highlighted that being in the neutral point; i.e. having no illness, might not mean the presence of wellness. Besides, as diseases could have several levels, wellness might have several levels, as well. It presented that rather than the treatment paradigm, wellness paradigm could help an individual to move beyond the neutral point towards the right end of the continuum, which is the high-level wellness. This resembles to the backbone structure of the positive psychology (see Figure 2, p. 22).

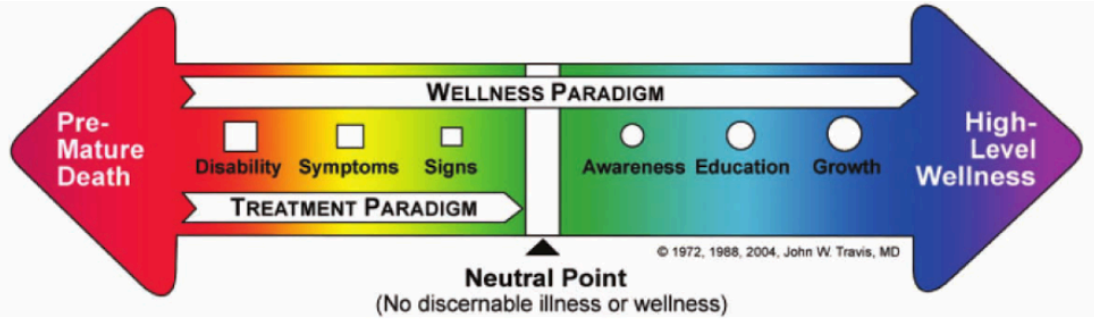



**Figure 5.** Illness/Wellness Continuum (Travis & Ryan, 2004)

Currently, wellness is characterized as a holistic and dynamic level of human functioning and as an evolving process directed towards promoting potential grounding on self-responsibility (Hales, 2011; National Wellness Institute, 2017; Rachele et al., 2013; Robbins, Powers, & Burgess, 2009; Rothmann & Ekkerd, 2007). This means that people should take more mindful and proactive roles in their health care by engaging in activities promoting diverse aspects in their lives (Snyder & Lopez, 2007). So, with the wellness concept, the only shift has not been observed about the integrality of health. In fact, there has occurred a shift from passive participation in health care towards active participation, in addition to a change from treatment towards prevention and promotion (Anspaugh, Hamrick, & Rosato, 2006; Bao & Lyubomirsky, 2013; Bishop & Aldana, 1999). The active participation includes

making healthy choices, maintaining regular exercises, having good nutrition routines, coping with stress, avoiding detrimental matters, sustaining good relationships, being sensitive to environment, and so on, all of which address a chosen way of life. Nevertheless, wellness cannot be reducible to fitness (Corbin & Pangrazi, 2001). On the other hand, according to some researchers, wellness should not be explained as a way of life, it should be seen rather as a state of positive health, which is associated with the possession of the positive component of health (Corbin & Pangrazi, 2001). That is to say, wellness is not equated with what people do, but what they actually are. Hence, it can be deduced that the definition and scope of wellness is still blurry in the literature to a certain extent. There are conflicts about whether health related choices and actions of people eventuate in wellness or they constitute the wellness concept itself. Yet, it is crystal clear that wellness has an emphasis on the role of the individuals.

Wellness is multidimensional. The views about the scope and number of its dimensions vary. The existing dimensions in wellness and health frameworks, as well as dimensions consulted in wellness centers and institutions, were compiled (see Appendix A) and it was seen that eight of the dimensions have been referred commonly: emotional, environmental, financial, intellectual, occupational, physical, spiritual, and social wellness (see Table 1).

All these dimensions are connected to each other and are in interplay in order to provide a sense of who one is and what one might become (Bishop & Aldana, 1999). The attainment of ultimate level of wellness demands continuous balance and sustainability of certain components (Anspaugh et al., 2006). This is explained with a "Balloon Theory" in which all the balloons are connected, so the movement of one balloon effects the movement of others, whether in an upward or downward direction (Bishop & Aldana, 1999). Even though all dimensions have an impact on each other, a wellness life can be achieved not by struggling to be excellent in all dimensions; but by tackling with several dimensions and fluctuations in such a manner as to increase the life quality and happiness (Bishop & Aldana, 1999; Rothmann & Ekkerd, 2007).

**Table 1.** The most common wellness dimensions (see Appendix A for the compiled and refined references)

| DIMENSION | DEFINITION |
|---|---|
| **Emotional Wellness** | Being able to identify, comprehend, accept, express, and coping with our own feelings; Maintaining a positive attitude towards the self and life |
| **Environmental Wellness** | Having awareness about the self-responsibility to conserve and enhance the quality of the environment and natural resources; Being sensible to live in harmony with the environment; Participating in socially responsible actions and projects |
| **Financial Wellness** | Having a good grasp of our own and external economic conditions; Being able to save, direct, and balance finances |
| **Intellectual Wellness** | Having an open mind to novel experiences, ideas, knowledge, and skills; Searching novel challenges; Actively engaging in mental activities and education to learn, internalize, and expand knowledge |
| **Occupational Wellness** | Being satisfied about the pursued vocation and career; Having an occupation compatible with personal skills, strengths, talents, desires, and goals; Being able to balance work and spare times; Seeking for occupational potentials, development, and enrichment |
| **Physical Wellness** | Pursuing healthy behaviors and healthy way of life to perform well in everyday life without and beyond physical problems; Taking self-responsibility for health care; Consulting to medical professionals and care not only when needed, but also to have regular check-up and guidance |
| **Spiritual Wellness** | Pursuing and having meaning, harmony, peace, and balance in life; Practicing self-reflection to identify and develop strengths, values, gratitude, hope, and so on |
| **Social Wellness** | Having positive and healthy relations with other people; Being aware of and making an effort for the mutual relationship and contribution between the social environment and self |

As mentioned previously, the definitions and relationships of the concepts related to the positive ingredients of life and positive psychology are not clear in the literature. Thus, separately tackled concepts in this chapter have tried to clarify these ambiguities. Figure 6 summarizes miscellaneous issues touched upon related to positive ingredients of life. What this review has also clarified for this dissertation is that, happiness can not be achieved only by focusing on problems and by aiming pleasure; and there can be manifold aspects of daily life to work on to enhance wellness and well-being. After gaining a general grasp on this current perception in psychology and health disciplines, it's consecutive reflections on health care systems and products are embraced in the following chapter.

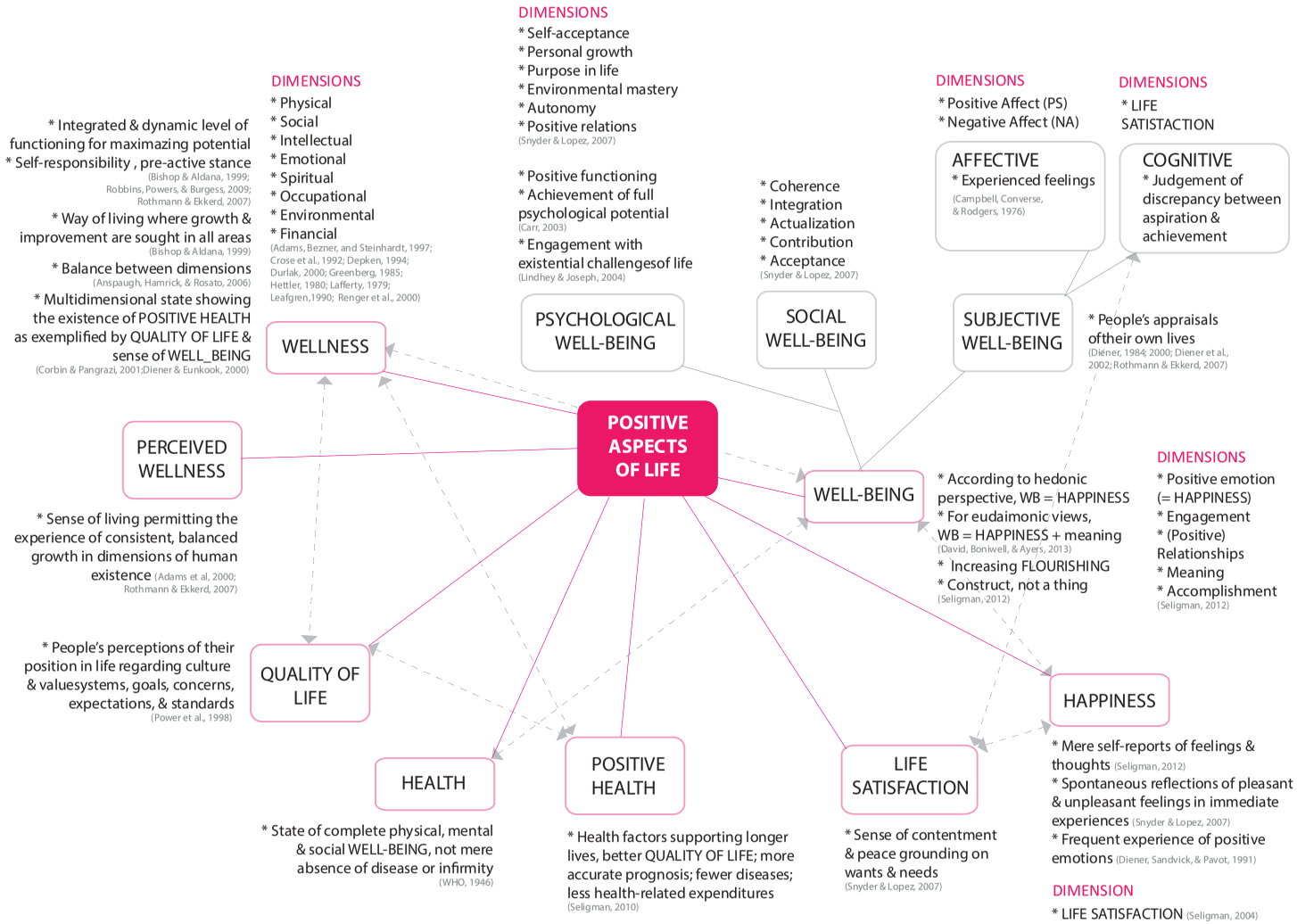



**Figure 6.** Positive ingredients of life and their relationships

# CHAPTER 3

# PERSONAL HEALTH CARE SYSTEMS

The previous chapter has demonstrated the changes in the understanding of health and wellness. The change in the understanding of health and wellness has triggered another change in health systems. Recently, there is a wide-scale transformation in health systems, accompanying a shift towards personalized health care, as noted in Chapter 1. This implies that users' experiences with related technologies are also being reshaped in tandem with personalized technologies. Actually, users' experiences with m-health are at the junction point of different arenas such as technology, design, and so on, in addition to health. Therefore, looking at this paradigm shift and changing experiences in conceptual and practical terms through the perspectives of different arenas is worthy to position the current situation of the pregnant users' experiences with m-health technologies.

In the subsequent sections of this chapter, major changes in technology and design literatures, which conjointly have taken form with health and medical literature, are shown by examining the background of m-health technologies initially. Afterwards, current utilization of m-health technologies formerly in health care and then in pregnancy care is explored. Finally in this chapter, orientation towards positive user experiences in design literature with an influence from positive psychology discipline is elucidated, also involving prominent methodological issues to comprehend and enhance users' experiences and to take the most appropriate decisions for formulating the current study.

## 3.1 THE MOTIVATIONAL BACKGROUND: EMERGENCE OF PERSONAL HEALTH CARE SYSTEMS

There is an unceasing effort in health and health-related domains to improve people's health, support their wellness and well-being, and enhance existing health care delivery solutions. Health care sector is now in a point where traditional medical approach and disease management issues are being redefined in parallel to the changes in the understanding of the health and good life, bringing about a shift from traditional reactive health care to proactive and personalized health care (Care Innovations, 2011). Health care paradigm has moved from the medical facilities like hospitals to the people's daily environments including not only their homes, but also entire places where they happen to pass their time (Rigby, 2007) with the help of personal health care products and systems. Thus, roles of the stakeholders in health care have been redefined; and individuals have more empowerment and engagement during their health decisions and management (Spielberg, 1998; Talor, 2015).

There are several major drivers which have necessitated the current shift in health care understanding. Primarily, aging population puts pressure on health care systems in all over the world as there is an excessive growth in the number of baby boomers and average life expectancy (Axisa, Schmitt, Gehin, Delhomme, Adams, & Dittmar, 2005; Bloom & Canning, 2005; Dearden, Wright, Bowen, Rahman, Cobb, & Wolstenholme, 2010; Leonhardt, 2006; Rigby, 2007). More specifically, 40% increase in aging population from 65 to 80 is estimated within the next 20 years (European Commission, 2007). Also, this is accompanied by increased age-related diseases, lifestyle-related complications, chronic disease conditions, and comorbidity (Arnrich, Mayora, Bardram, & Tröster, 2010; Bardram, 2008). This population demands to be treated at home with better lifestyle assistance and long-term care, and without frequent doctor visits and discomfort with the help of remote personal products (Axisa et al., 2005; Camarinha-Matos & Afsarmanesh, 2002).

Secondly, apart from the aging population, people with specific problems that hamper their reach to hospitals and access to care have been in consideration, too. To illustrate, some people are housebound because of agoraphobia or other mental problems, some

others cannot go out due to crime rates in their neighborhoods, without even taking into account the location or climate conditions (Maheu, Whitten, & Allen, 2001).

Thirdly, we are surrounded with a more health-conscious world when compared even to the previous decade. It has been understood that maintaining a healthy lifestyle is crucial to hinder the onset of future diseases and to attain a status of well-being and happiness (Lichtenstein et al., 2006) Thus, more people want to take more active responsibility during their health management nowadays (Kahn, 2013). Hereby, preventing problems beforehand, rather than curing them after encountering becomes significant, paving the way for a huge and still growing market regarding health, well-being, and fitness related products and systems (Dittmar & Lymberis, 2005).

Then, also in relation to the aforementioned reasons, there is a great demand for increased health care efficiency. Both for patients and healthy society at large, the improvement of health care quality in all possible contexts is becoming important (Lin, Lee, & Hsiao, 2008). Conventional monitoring, diagnosis, and treatment systems fall short to provide the demanded quality and positive experiences while managing health care. Hence, alternative solutions to the traditional hospital methods for disease prevention and continuous health monitoring become important to increase efficiency and comfort in health care.

Moreover, economic crisis, high health care costs, and increasing economic pressure in health sector result in seeking new solutions for preventing health risks and problems (Angelini et al., 2013; Kopp et al., 2009; Sneha & Varshney, 2009). High costs related to chronic diseases are aimed to be reduced by again a proactive approach consulting to personal health care systems serving the function of prevention and early diagnosis (Flemming & Brown, 2004; Haskell, 2003; Lindström et al, 2008).

Furthermore, and as a matter of course, advances in technology can be counted as another major catalyst of the paradigm shift in health care (Lo & Yang, 2005). Information and communication technologies expeditiously become prevalent in health care not only due to their availability regarding decreased costs, but also due to the benefits and opportunities they offer for creating new interactions and more positive experiences while managing health. Progress in informatics,

telecommunications, wireless networks, signal processing, microelectronics, power consumption, and so on, have paved the way for taking the advantages of personal and mobile technologies, which can accompany the users anywhere anytime as health care assistants (Axisa et al., 2005). With the advances in technology in both communication and medicine arenas, borders between these arenas are getting more and more blurry (Maheu et al., 2001).

All these key drivers hint both problems and possibilities to address during the paradigm shift in health care understanding and its practice. The overview about the motivational background of this shift and its substantial outcomes are summarized in Figure 7.

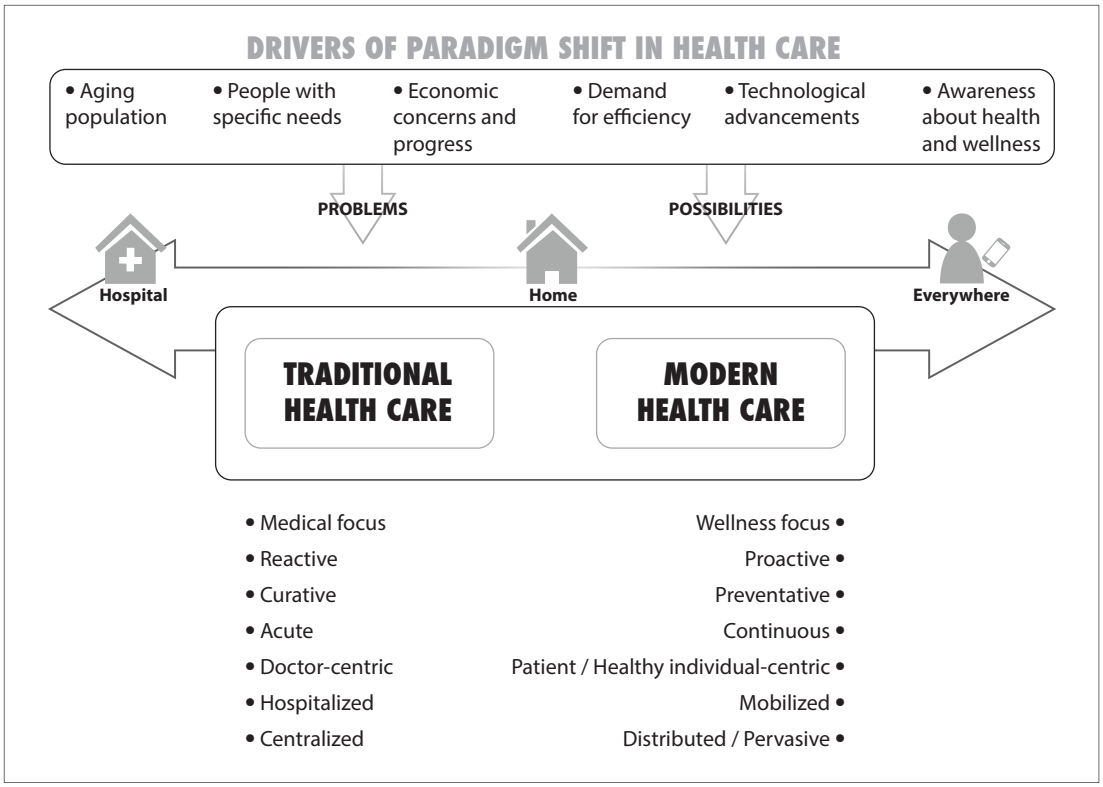



**Figure 7.** Paradigm shift in health care understanding and practice

To clarify, personal health care systems are technologies that help individuals—patients, disabled, elderly, or even healthy people—to manage their health and to pursue a healthy life. As health is considered as a total state of wellness (WHO, 1946), systems specific to fitness, sports, diet are also evaluated under personal health care

systems by some researchers (e.g. Angelini et al., 2013). Also, a few researchers include security systems and hazard detectors (smoke, flood, natural gas, carbon monoxide detectors) at home environment because they can hinder life-threatening situation (e.g. Stowe & Harding, 2010). So, they range from devices for monitoring vital signs (such as blood pressure monitors) to devices for monitoring actions (such as belt-worn devices for understanding the abnormalities in gait functions), to systems for determining the users' position and location for risky health-threatening situations (such as interlinked home-based monitoring), and to applications for reminding medications (such as a health care application on smartphones), and so on.

It is important to note hereby that personal health care is not an entirely new research field. Personal health care and remote care go hand in hand. Related concepts such as telemedicine, telehealth, telecare, m-health, etc. have been remarkable research subjects for some decades. Nevertheless, products and systems involved in former studies were primitive and restricted considering their goals and capabilities such as merely offering emergency phone calls, alarms, or video-conferencing (Stowe & Harding, 2010). Current personal health care products and systems are smart, mobile, and even wearable, supporting people in their daily lives by performing complicated measurement, monitoring, diagnosis, and guidance tasks (Leonhardt, 2006). With the adoption of more advanced technologies, health care has become more pervasive and ubiquitous (Wickramasinghe, 2013). Hence, personal health care systems in pervasive health care field has appeared as a novel research subject presenting new design issues, new user experiences, and new research questions (Bardram, 2008) although it stands at the junction point of other fields such as biomedical engineering, health informatics, computer science, and medicine (Arnrich et al., 2010).

This section has shown the current health care understanding and the underlying motivations behind it. The next section follows with the examination of the conceptual roots and relationships about health care delivery models. Also, it reveals the technological background behind these systems.

## 3.2 THE CONCEPTUAL BACKGROUND: CATEGORIZATION OF PERSONAL HEALTH CARE CONCEPTS

There are multiple terms in the literature that are used interchangeably to emphasize personal health care delivery models even though there are slight differences between them due to historical advances, underlying technologies, or related main research fields. For instance, telemedicine, telehealth, telecare, e-health (or ehealth), m-health (or mhealth), wireless health, personal health informatics, and so on, are usually used interchangeably to refer to the management of health in a personalized and remote way (Meier, Fitzgerald, & Smith, 2013). The most prominent and relevant ones in the scope of this dissertation are as follows.

### 3.2.1 Telemedicine

Telemedicine is accepted as one of the earliest and the most familiar terms related to the use of telecommunication technologies in health care (ATA, 2006; Koch, 2006). It refers to the delivery of health services, medical information, and education from afar, particularly utilizing telecommunication technologies (Maheu et al., 2001; Preston, 1993; Stowe & Harding, 2010).

Even during pre-television times, telemedicine technologies had been experimented and applied (Maheu et al., 2001). The very first recorded application of telemedicine was in 1906, which was the transmission of electrocardiogram (ECG) records via a telephone line (Strehle & Shabde, 2006). After the first quarter of the twentieth century, opportunities that a distant "radio doctor" could provide were in discussion (Field, 1996). Telemedicine was acknowledged as a field of knowledge in the 1940s (Duplaga & Zielinski, 2006). After, teleconsultations started to become commonplace especially in cardiology, radiology, and psychiatry when health professionals are located far from the patient (Hailay, Roine, & Ohinmaa, 2002). Yet, it was the 1970s, when it was named exactly as "healing at a distance" putting emphasis on the use of information and communication technologies (ICT) to have an easy access to medical information and care (Strehle & Shabde, 2006). Through long ages, the National Aeronautics and Space Administration (NASA) played a key role during the initial progresses and subsequent distribution of telemedicine technologies (Maheu et al.,

2001) with its projects on observing vital indications of astronauts (Bashshur & Lovett, 1997), providing medical attention to them (Fuchs, 1979), and ensuring coordination and connection during natural disasters even when entire local communication channels had been damaged (NASA Satellite, 1985). Other examples can also be given, but the early attempts were mostly related to individual technical innovations; hence, all conducive steps and key actors are not included within this scope. Despite the increased efforts, the interest in telemedicine showed a descending trend towards the end of 1980s, mostly due to lack of financial support (Maheu et al., 2001), until the tremendous improvements in digital technologies at the late 1990s and afterwards. In 1990s, firstly, developments in videoconferencing with the availability of better data compaction, higher quality visual digitization, and higher bandwidth rather than costly satellites opened a road for more affordable systems; and thus, for further interest and actions in telemedicine projects. Next, widespread use of Internet, well-accepted use of mobile technologies, and variety of possible electronic transactions gave birth to new telemedical systems, accompanied by the concept of e-health which is also touched upon in the following sections (Duplaga & Zielinski, 2006; WHO, 2010).

Telemedicine types can be categorized under two main headings: *synchronous* and *asynchronous* (Duplaga & Zielinski, 2006; Maheu et al., 2001). The former one is realized in real time; and thus, interactive in nature. Videoconferences can be an example. The latter one is also called store-and-forward telemedicine because it is not live and it involves the transfer of already recorded and stored data when it is needed or when it is convenient. That's why asynchronous telemedicine is not mostly feasible for emergency conditions. For instance, X-rays, magnetic resonance imaging (MRI) scans, and e-mails with different medical content can be sent and received.

### 3.2.2 Telehealth

Telehealth term is also used to refer to health care at a distance (Mayo Clinic, 2017). For this reason, it is typically used as a synonym with telemedicine. More specifically, telehealth term is used as a tool for monitoring patients proactively and for responding to acute complications immediately during long-term health care management. Usually, users need to be trained to interact with a device that perform physiological measurements like ECG, blood pressure, pulse, temperature, and blood oxygen

saturation (Anliker et al., 2004; Geer, 2006). Apart from these physiological data, they can manually enter subjective information like weight, height, or responses to certain questions. All the data are transferred through a telephone line to another platform from which health care professionals can reach the relevant data (Stowe & Harding, 2010). Traditionally, this version of health care delivery is said to include a hub; i.e. the main health care center, and several satellite health care centers. The main health care center is full-fledged with 24-hour available health care personnel; whereas, satellites may only include junior doctors, practitioners, and counsellors. In case needed, satellites can reach to main hospitals or clinics with telecommunication technologies to receive specialized support (Maheu et al., 2001). Actually, even though this model is valid for telemedicine as well and even though telehealth is used frequently as replacement of telemedicine, the telehealth term is preferred rather than telemedicine by researchers who want to emphasize its inclusiveness compared to the dominant medical focus in telemedicine (Mitchell, 1999). More up-to-date discussions in the literature have shown that telehealth is not merely related to curative health care and restricted to hospitals. In fact, it is about the inclusion of telecommunication technologies in the health protection and promotion.

In a nutshell, telehealth can be seen as an evolution from telemedicine with a wider scope encapsulating not only disease prevention, but also all other clinical, educational, and administrative services like health promotion, consumer outreach, early discharge, distant prescription, remote education, research, and so on (ATA, 2006; California Telehealth Resource Center, 2012; Eysenbach, 2001; GlobalMed, 2013; Karen, 2015). That is to say, telemedicine deals with mostly clinical services (WHO, 2010), whereas telehealth deals also with non-clinical services (HealthIT, 2013). Moreover, telemedicine addresses mainly physicians, but telehealth points at other stakeholders such as pharmacists, educators, and all other people involved in health care provision (Australian Government Department of Health, 2015; WHO, 2010). Thus, telehealth incorporates telemedicine considering all the content, context, practice, and stakeholders.

### 3.2.3 Telecare

With the accelerating growth of telehealth, many other terms have started to be ascribed to it and telecare is one of the frequently uttered ones. The use of ICT to deliver health care and social care is called telecare. This term does not include the information exchange for consultancy and diagnosis merely between health care professionals (Barlow, Singh, Bayer, & Curry, 2007). It is referred as a tool to provide remote support to patient or healthy people from health care professionals (Stowe & Harding, 2010). The main differentiation point from the other terms is that telecare incorporates the regular remote monitoring of people in their living environments to follow the changes in lifestyle and to respond to the real-time emergency situations (GlobalMed, 2013; Karen, 2015). So, it aims to support people to deal with broad range of risks related to independent living. In short, it does not focus only on health-related circumstances, but also deals with safety and security-related situations such as safety alarms, security devices in home entry, and automatic electricity or gas shut-off systems (GlobalMed, 2013; Go Telecare, 2015). In the last decades, some of the countries have started to take governmental actions to implement these services in their national health systems. For instance, Norway, being the first to take such an action, deployed an official payment schedule and made certain telecare services refundable by its national health system (Stowe & Harding, 2010). This reveals the change in health care understanding in a national scale, as well.

### 3.2.4 E-Health

At the end of the twentieth century, e-health term sprang (McLendon, 2000). It has been in the forefront of WHO's agenda since 2005 following the adoption of a related resolution (resolution WHA58.28) by the World Health Assembly (WHO, 2016):

> "eHealth is the cost-effective and secure use of information communication technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research."

This definition of e-health may seem as the facsimile of telehealth at the first sight. In fact, e-health can be perceived as a more modern phase of telehealth because it is mostly about the Internet-mediated delivery of health care services and systems

(McLennon, 2000). At the beginning of 1990s, it was understood that the use of "tele" technologies were not sufficient enough to cover entire information technologies in health care, and so, e-health was coined as a newer term to explain the joint use of electronic communication technologies with information technologies in health care (Mitchell, 1999). In other words, e-health involves the electronic transmission and distribution of digital data and health related services worldwide, thanks to Internet-enabled, connected, and networked technologies. As a foregone conclusion e-health becomes less and less professional-centric, giving great authorization to patients and other health service consumers. Also, e-health literature mentions as another inevitable ending that the e-health concept would ultimately be utilized for entire "tele" concepts (Maheu et al., 2001) because many applications might be carried out with the help of Internet infrastructure and related technologies.

E-health functionalities range from accessing health care data, to entering patients' electronic medical records (EMRs) and electronic health records (EHRs), managing personal health records (PHRs), conducting remote clinical applications, monitoring patients or even healthy people for health promotion or prevention, receiving payment information, storing medical information on Internet, using e-business to enhance training, education, and management (Maheu et al., 2001; Varshney, 2009). When health care procedures are digitized in e-health concept, they are usually entitled as e-records, e-billing, e-prescription, e-visits, and so on (Varshney, 2009).

### 3.2.5 M-Health

As briefly introduced in Chapter 1 due to taking the lead in this dissertation, m-health is the spread and utilization of wireless, innovative, and mobile systems to enhance health care services, health outcomes, and health care research (WHO, 2011). Up till now, it has not had a commonly recognized definition. For instance, some researchers mention that it is an umbrella term to encapsulate all technologies from videoconferencing to remote and mobile monitoring; whereas some others embrace a narrower description adhering merely to mobile health applications.

It can be said looking at the term's history that it implicitly appeared as unwired electronic medicine (Istepanian, Laxminaryan, & Pattichis 2000), shaping the health

care domain in parallel with the improvements in wireless network technologies (Jovanov et al., 2003; Pattichis et al., 2002). During its earliest implementations, m-health concept was associated mostly with wireless biomonitoring involving physiological parameters. The miniaturization of technologies, increased availability of wireless networks, enhanced performances and data rates have widened the application range of m-health, and have accelerated the acceptance and adoption of the mobile systems in health care domain. Recently, it also encompasses the monitoring of physical activities to track behaviors, actions, locations, and falls (Budinger, 2003; Istepanian, 2004). Moreover, m-health systems can be standalone applications or parts of a Body Area Network (BAN) (Boulos, Wheeler, Tavares, & Jones, 2011). BANs typically involve sensors on different parts of the body to conduct physiological and/or physical parameter measurements, the result of which is transferred firstly to the personal health care device and then to the remote health care professionals' systems to respond to the related health care situation properly (Jovanov, 2005; Varshney, 2009). Furthermore, other most commonly referred application of m-health is the usage of mobile phone's diversified properties and functions such as Bluetooth, third and fourth generation (3G and 4G) mobile telecommunication technologies, global positioning system (GPS), and general packet radio service (GPRS) in addition to mobile phone's fundamental capabilities such as short messaging service (SMS) and voice calls (WHO, 2011). Besides, health care applications in smartphones that can also function with special attachments and sensors are increasingly encountered (Weinstein et al., 2014).

So, although there is no strict definition until now, it can be implied that the earlier health care concepts do not necessitate mobility while providing remote health care services; yet, m-health is almost about whole mobile and wireless systems, products, and applications such as personal digital assistants (PDAs), smartphones, other mobile electronic devices (MEDs), and wearable systems (Congdon, 2013; Free at al., 2010; Istepanian, 2004).

### 3.2.6 Health Informatics

Health informatics is a scientific discipline at the crossroads of medicine, information science, and computer science and is also referred as health care informatics, medical

informatics, clinical informatics, or biomedical informatics (Varshney, 2009). It is responsible for health information retrieval, storage, and communication consulting to the technologies in information sciences (Mitchell, 1999). These health information technologies (HIT) are the main constituents of distant delivery of health services in telemedicine and other remote care concepts. That is to say, remote health care concepts highly depend on health informatics (ATA, 2006; GlobalMed, 2013). However, although remote health care concepts are dependent on it, health informatics has a narrower focus since it does not involve the delivery of actual care (Varshney, 2009).

EMRs and EHRs of patients, administrative applications, decision support systems, and medical information exchange protocols can be counted as components of health informatics (ATA, 2006; Varshney, 2009).

As a final note in this section, all of the above discussed terminologies collectively connote technology enabled care (TEC) and connected health, wellness, and social care sectors (Karen, 2015). Looking at the variety of health care concepts, one may still find it hard to exactly distinguish the differences in each one at the first glance. As aforementioned briefly, this is due to that fact that there are no definitive and common definitions in literature. Actually, there are even more concepts in health care associated with personal health care systems and remote health care delivery models; but, merely the most significant and relevant ones are handled in this chapter in order to avoid further confusion. It can be beneficial to keep in mind that, each of these concepts were introduced to explain almost similar health care delivery approaches; yet, they involve nuances in their coverage and technological ingredients. These nuances and richness of various health care concepts show the dynamic and incessantly evolving nature of the field (Bashshur, 2000). Figure 8 depicts the relations between fundamental personal health care delivery models.

Given the definitions and extent of personal health care delivery models, the subsequent section deals with the current state of personal health care systems. It firstly classifies different personal health care systems. Later, it positions personal health care systems for pregnancy among the big picture and conveys information about the state-of-the-art pregnancy-related personal technologies.

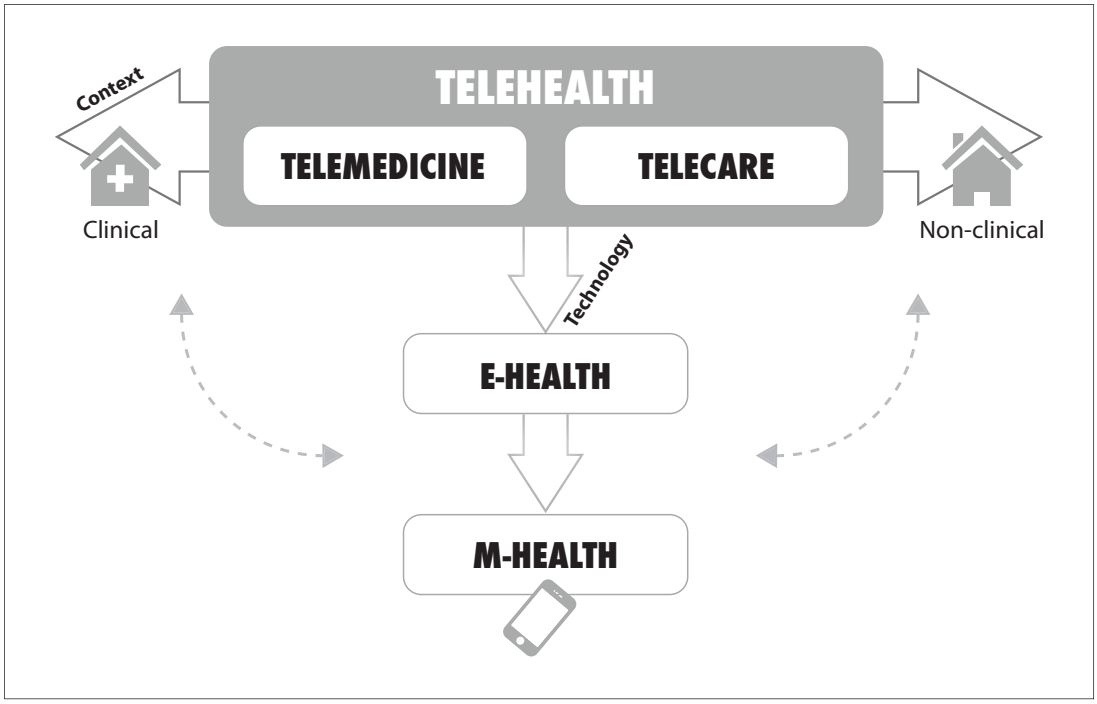



**Figure 8.** Fundamental personal health care delivery models

### 3.3 CURRENT STATE OF PERSONAL HEALTH CARE SYSTEMS

The realization of diverse health care concepts and personal health care systems in those concepts has become possible by the emergence and widely adoption of certain technologies, such as the miniaturization and availability of certain hardware, software, and communication technologies as briefly touched upon in the preceding sections. Researchers in many domains such as medical engineering, computer science, and networking have been struggling to render the grand vision of people-centric smart health care possible (Alemdar & Ersoy, 2010). As a matter of course, many interdisciplinary technological concepts and components get involved in. Especially, "pervasive computing" has rapidly accepted as a sine qua non issue in many disciplines. Health domain is one of the pioneers to implement pervasive technologies, resulting in better access to health care services both by patients and health care professionals, enhanced efficiency in processes, and newer experiences accompanied by diversified opportunities for care (Kern & Jaron 2003; von Lubitz et al. 2006).

Pervasive computing is highly associated with and sometimes used as a substitute for "ubiquitous computing" which was introduced by Weiser (1991) indicating the post-desktop era. In other words, ubiquitous computing is a name representing the current era of modern computing technologies. The initial eras were about main frame computer and personal computer referring respectively to one large shared computer by many people and one computer owned by one user (Want, 2009; Wickramasinghe, 2013). More specifically, pervasive and ubiquitous computing terms address technologies that are embedded extensively, seamlessly, and unobtrusively in everywhere in people's daily lives (Want, 2009; Weiser, 1991. Diverse core properties of pervasive computing have been adopted by different researchers. To exemplify, Poslad (2009) defined the characteristics of pervasive computing as distributed, networked, unobtrusive, context aware, autonomous, and intelligent; Aarts and Marzano (2003) explained the key features as context aware, embedded, personalized, anticipatory, and adaptive; and Endres, Butz, and MacWilliams (2005) put emphasis on intelligence, augmented reality, and distributed mobile properties. Among all, the mostly accepted properties were being distributed, implicit HCI (iHCI), context-aware, intelligent, and autonomous. Pervasive technologies are distributed since they are composed of networked ICT devices which can be accessed remotely or locally. Human-computer interactions with these devices are implicit; i.e. unobtrusive and not easily noticeable as they can understand the properties of the context (physical, human, and ICT context) and can optimize the reactions and required services autonomously and accordingly. Intelligence enables these autonomous responses in pervasive technologies as a result of which they can act proactively and humanely (Poslad, 2009). As a matter of course, the implicitness of the technologies is highly related to how user friendly they are during interaction and how easily users can get familiar with them.

One of the initial aims to use pervasive technologies in health care is to assist elderly, disabled, and ill people at home or other social environments, which had been previously done in hospitals by frequent patient visits (Doughty et al., 2007). Hence, distant care has brought about convenience, self-sufficiency, and independent living to people with remote autonomous self-monitoring and diagnosis systems (Friedewald & Raabe, 2011). This distant care model matches with the "telecare" concept.

Pervasive health care at distance addresses also the terms “ambient intelligence”, “context awareness”, and ‘‘ambient assisted living”; and supports the vision of “smart space” and “smart home”, the common denominators of which are making the environments sensitive to people (Bricon-Souf & Newman, 2007; Cook, Augusto, & Jakkula, 2009; Friedewald & Raabe, 2011). The pervasive environments can intrinsically embody more than one people, contradicting with the “personal” health care issue. Although homes are private environments, there can be more than one household with different health status, needs, and expectations. So, even though pervasive environments might incorporate health care systems for personal use, the overall settings are usually not personal. Apart from the homes, hospitals are sometimes exemplified under smart and pervasive spaces to emphasize the embedded, context aware, and collaborative computer systems in hospitals for professional use and clinical work support (Bardram, 2008; Brown & Adams, 2007). Hence, pervasive hospital settings do not include personal health care systems, too.

Increasing utilization of mobile sensors and devices inevitably extends the scope of the care environment beyond the home setting which mostly involves stable embedded sensors. Varshney (2009) summarized all these related pervasive health care contexts as: smart space, smart home, and smart wearables. Now, wearable systems actually constitute the certain part of the big picture of pervasive computing (Friedewald & Raabe, 2011; Varshney, 2009) because they can be also encountered in other pervasive contexts like smart spaces and homes. Moreover, they play a central role in the aforementioned m-health and personal health care concepts as enabling technologies, as well.

Some researchers accept only clothes, textiles, and accessories as wearable computing technologies (e.g. Ariyatum, Holland, Harrison, & Kazi, 2005). In fact, wearable technologies ground on computers embedded into ambulatory devices, smart clothing and into anything that people carry with themselves, accessorize or cover their bodies (Axisa et al., 2005; Dittmar & Lymberis, 2005; Poslad, 2009). They can be even implanted on body (Codagnone, 2009). Hence, mobility is incorporated naturally. The underlying motivation behind using wearable computing technologies is benefiting from the common and accustomed places on body for mobility since people already

wear accessories and watches, or carry other modern devices such as mobile phones, which is an important factor for user acceptance (Angelini et al., 2013; Axisa et al., 2005). That's why, they can pervade much more easily and unobtrusively in people's daily lives, without hindering their activities (Anliker et al., 2004). Many such applications in health care match with the "m-health" concept.

Most personal health care systems have similar architecture and backbone structure with pervasive and wearable systems (Isern, Sánchez, & Moreno, 2010). These systems are composed of distributed components and stakeholders. Firstly, sensors and devices are utilized by patients or healthy people to measure and monitor specific signals and processes. Usually, these systems can blend data coming from physiological and physical sensors with the environmental, social, and cognitive factors for more accurate results (Roggen, Arnrich, & Tröster, 2007). Then, the collected data are transferred automatically to a remote center. When anomalous conditions are detected, the system triggers an emergency alarm after which remote health care professionals can intervene (Axisa et al., 2005; Leonhardt, 2006). If the health status of the monitored people is not changing radically; i.e., if there is not an emergency situation, the important part of the transmitted data can be stored for further analysis and for observing the changing health and disease status over time, which can be discussed in future doctor visits. Also, remote health care professionals can give feedback to the users whenever necessary apart from the emergency situations. In some cases, even the personal health care system can infuse drugs according to the measured health parameters or preset schedules (Leonhardt, 2006) or provide a life-saving treatment till health care professionals respond (Clifford & Bishop, 2011). Therefore, they play a crucial role in the prevention of diseases and in the persuasion of pursuing healthy life-styles.

### 3.3.1 Taxonomies of Personal Health Care Systems

There is a wide range of studies in literature about personal health care systems although they represent a completely novel phase integrating all previous conceptual and technological components. As they have appeared in the recent decades, the studies about personal health care systems are scattered in literature with no clear focus. Most studies deal with many different personal health care examples at a time

without showing any relations between each system. Only few studies reveal basic categorizations of personal health care systems according to their properties and functions (e.g. Codagnone, 2009; Isern & Moreno, 2016; Isern et al., 2010). Therefore, further categorizations are made below according to different criteria regarding personal health care systems' focus, functions, target groups, measured parameters, and so on. Table 2 summarizes these categorizations.

**Table 2.** Different categorizations of personal health care systems

| According to: | EXPLANATIONS | CATEGORIES | | | |
|---|---|---|---|---|---|
| **USER** | Target stakeholders of a personal health care product/system | Patient / Healthy Individual | Health Care Staff | Organization / Institution | Other Care Givers |
| **SCOPE** | Clinical and non-clinical focus; and broader aim of a personal health care product/system | Lifestyle Management | Independent Living Assistance | Chronic Disease Management | Other Specific Health Conditions |
| **SERVICE** | Delivery model of a personal health care product/system | Proactive | | Reactive | |
| **CONTACT** | Nature of implementation and application of a personal health care product/system | Direct | | Indirect | |
| **PARAMETER** | Types of measured and/or collected data by a personal health care product/system | Physiological Data | Physical / Mechanical Data | Psychological / Subjective Data | Contextual Data |
| **POSITION** | Location and use model of a personal health care product/system | Stationary | Portable | Implantable | |
| **INTERACTION** | Interaction style between user and a personal health care product/system | Automatic | | Manual | |
| **TIMING** | Interaction time and data transmission style between stakeholders | Synchronous | | Asynchronous | |

Firstly, the most outstanding categorization is observed regarding different stakeholders involved like health care receivers at one side, which are usually the main targets; and health care providers on the other side. ***User*** group can be categorized

more specifically within itself as patient/healthy individual, health care staff, health care organization/institution, and other care givers. *Patients* may involve different people with certain diseases, and disabled. Also, specific user groups such as elderly and children are targeted. For instance, due to increasing chronic health complications, patients with different diseases prefer personal health care systems frequently. The most frequently observed chronic and critical conditions are about cardiovascular diseases like tachycardia, respiratory diseases like asthma, as well as diabetes (Codagnone, 2009). In most independent living solutions and telecare systems, elderly people and/or disabled people are targeted (Angelini et al., 2013). Child patients are also at target, especially the ones which need to continuously manage their health and/or disease conditions such as children with diabetes (e.g. Franklin, Waller, Pagliari, & Greene, 2006). Apart from people with health problems, general wellness, lifestyle management, and fitness solutions fit to *healthy individuals* which can be either healthy people at risk or health conscious people (Axisa et al., 2005; Codagnone, 2009; Handel, 2011). In addition to health care consumers, people and institutions which are in the role of health care providers constitute the other user groups. *Health care staff* and *health care institutions* can be on the other side of the personal health care system to provide required action and information anytime and anywhere without patients' hospital visits (see Isern & Moreno, 2016; Mosa, Yoo, & Sheets, 2012; Varshney, 2014; Ventola, 2014; WHO, 2011). These users are apparently more active in telecare systems, as well as in health care monitoring, decision making, diagnosis, education, simulation, and training as a part of telemedicine and e-health. Furthermore, though not always explicitly addressed, *other care givers*, care consumer managers, and social intermediaries such as families, relatives, and friends are included (see Codagnone, 2009).

Secondly, ***scopes*** of the systems differ. Most of the personal health care systems function as *lifestyle management* assistances. As not only ill or elderly people, but also healthy people are interested in different ways for managing their lifestyles, systems for lifestyle management and wellness are considerably widespread. Lifestyle monitoring systems for both health and safety for elderly people with cognitive impairments (Stowe & Harding, 2010) or ambient assisted living applications (Boulos et al., 2011) can be counted as examples for such systems. Also, considerable amount

of them serve the function of *independent living assistance*. Living independently is especially a challenging issue for elderly and disabled people, so these systems are mostly utilized by them usually in their home environments. Watches facilitating the activities of elderly by providing various functionalities (Angelini et al., 2013) are examples for health care systems which support independent living. *Chronic disease management* systems deal with specific chronic conditions. Devices specific to diabetes, cardiac, renal or respiratory problems, can be investigated under this scope (Codagnone, 2009). Holter devices for monitoring biomedical signs (Jovanov, Gelabert, Adhami, Wheelock, & Adams, 1999) are frequently encountered examples. Apart from these, personal health care systems for other *specific health conditions* and periods, which are not in the scope of disease or lifestyle management issues, exist. Exemplary technologies can be mobile applications for fertility, preconception care, and prenatal care (e.g. Moglia, Nguyen, Chyjek, Chen, & Castaño, 2016; Tripp et al., 2014).

Thirdly, dependent on their scopes, these systems can provide proactive, reactive, or both ***services*** at the same time. *Proactive* services are highly related to monitoring users, tracking their health status and detecting changing health patterns so as to intervene much before serious health problems occur. Almost all personal health care devices pursue this goal. *Reactive* ones are about treatment. When emergency condition occurs, some systems provide an initial therapy before the remote medical center responds. Also, as aforementioned, systems can even infuse drugs medication especially in chronic diseases (Dittmar & Lymberis, 2005). To illustrate, insulin pumps attached to the body of users with diabetes infuse insulin when glucose level in the blood changes (Agency for Healthcare Research and Quality, 2012). Such pumps either have interface on the pump part or have separate interface to access and transmit data. The reactive systems usually provide proactive services, as well.

Highly related to the proactivity and reactivity of personal health care services, but not precisely overlapping with them, another categorization is made about the directness of ***contact*** with health care implementations, applications, and professionals (see Varshney, 2014). *Direct personal health care* involves direct contact with health care, implementation, and/or health care professionals. Hence, it is mostly human assisted;

but, there could be also direct interference of a personal health care technology without the need of a health care provider, as in the case of mobile diabetes management system with automated insulin injection function. Other examples can be counted as mobile robotic surgery, mobile access to health care professional, telemedicine, and telecare. *Indirect personal health care* encompasses the situations when the health care provision does not directly bound up with a health care profession or interference. Wellness diaries, mobile health tracking applications, mobile access systems to drug information, appointment and drug reminders, and mobile prenatal care systems can be given as some examples hereby.

Moreover, according to the goals of the system, measured ***parameters*** differ. Most of the personal health care systems ground on collecting physiological data automatically. *Physiological data* is about vital signs like heart rate, ECG, blood pressure, or other bodily parameters such as skin temperature, respiration, and oxygen saturation. More than one parameters are measured generally to provide more accurate results (e.g. Anliker et al., 2004; Arnich, Mayora, Bardram, & Tröster, 2010; Axisa et al., 2005; Bardram, 2008; Dittmar & Lymberis, 2005; Leonhardt, 2006; Orwat et al., 2010). Biomonitoring sensors are needed to collect such data. Systems which aim at understanding the users' behaviors, functioning of the autonomous nervous system, or controlling the cognitive functions need to collect *physical/mechanical data*. Devices and systems that monitor users' actions such as gait parameters, posture, movements, and even speech collect such data (e.g. Arnich et al., 2010; Axisa et al., 2005; Orwat et al., 2010). Those systems incorporate accelerometers, motion and acceleration sensors. *Contextual data* is sometimes collected in addition to the physiological or physical parameters to support other measurements and understand the situation holistically (Arnich et al., 2010; Axisa et al., 2005). Exosensors are used in users' environments, not directly on users' body, to collect contextual data. In some cases, *psychological/subjective* data is collected. Hereby, users manually enter data or answer certain questions to convey information about their complaints, moods, etc (Orwat et al., 2010). Again, this information is complementary information for user-specific solutions.

Another most outstanding categorization is observed regarding the personal health care devices' or systems' ***positions***. Codagnone (2009) touched upon this issue by focusing on the stable and ambulatory use models. This category can be branched out as being stationary, portable, and implantable. The *stationary* personal health care systems are completely detached from the user's body and used when certain measurements are needed to be done at certain times. Thus, they do not provide continuous monitoring and they usually measure a single parameter such as blood pressure. The *portable* ones refer to the portable and movable personal health care systems as the name implies. They involve personal medical devices such as continuous blood pressure measurement devices, smartphones with health care applications, wearable devices such as a belt-worn gait parameter measurement device (Orwat et al., 2010) and a smart watch for monitoring elderly people's health status (Angelini et al., 2013). As they can be carried on the body all the time, they usually monitor the users continuously. Also, mobile phones and mobile health care applications are widespread portable health care resources (Boulos et al., 2014). The *implantable* health care systems ground on sensors implanted on the body, which is a rarer application. In this case, the collected data may be transferred directly to a remote medical center without involving any user interface considering the patient side (Codagnone, 2009).

***Interaction*** style between users and personal health care products and systems can generate another category. During users' interactions with personal health care systems, some of the personal data is generated *automatically*. This type of interaction can be seen in most clinical or non-clinical personal health care services. Exemplary products and systems include devices extracting physiological data about users' vital signs, such as heart rate, blood pressure, and skin temperature; or collecting contextual data about the environment's conditions; as well as pedometers and mobile applications tracking users' amount of physical activity and spent duration (see Choi, Oh, Park, & Woo, 2008; Cook & Zong, 2009). In such cases, different technological components are incorporated, like wireless connectivity, sensors, GPS, GPRS, radio-frequency identification (RFID) tags, accelerometers, microphones and multichannel sound acquisition systems, video cameras, etc., depending on the aim. Conversely, while interacting with some personal health care systems, user need to log data

*manually*. Particularly, lifestyle management assistances aimed at tracking users' daily physical activities, and choices, such as wellness and diet diaries can be included hereby (see Mattila, 2010; Mattila et al., 2010; Yu, Sealey-Potts, & Rodriguez, 2015). Actually, many such products and systems have both automatic and manual interaction. For instance, while users' steps and route are tracked, and calories burned are calculated automatically for walking and running activities; users might need to enter time spent for other types of activities, current weight, or food intake manually in the same product or system (see Nafus, 2013).

***Timing*** can be another criterion for the categorization of personal health care systems. This refers to the interaction times and data transmission styles between the stakeholders. The collected data can be either transmitted synchronously or asynchronously. *Synchronous* data transmission is about the real-time transfer of the measured parameters; whereas, *asynchronous* refers to the situations when the data is stored or analyzed first, and then forwarded to the other systems and health care professionals (GlobalMed, 2013; Warren, Yao, & Barnes, 2002; WHO, 2010).

These were the general depiction and categorization about personal health care technologies. The exact target of this dissertation, mobile health care technologies for pregnancy are compiled and explained in the next section.

### 3.3.2 State-of-the-Art Personal Health Care Systems for Pregnancy

Personal health care systems for pregnancy has started to attract explicit attention and continued to escalate especially in the last decade by virtue of global efforts and initiatives to ameliorate "reproductive, maternal, newborn, and child health (RMNCH)". The efforts are in line with the Millennium Development Goals (MDGs) about fighting infant mortality (Goal 4) and supporting women's health (Goal 5) (UN Millennium Project, 2005) and WHO's (2011) promotion of mobile technologies as a pivotal actor in maternal care.

There are many studies in literature showing the deployment and effects of m-health in undeveloped and developing countries—or low and middle income countries (LMICs)—as well as other low-resource contexts and rural areas. There are specific

initiatives, pilot and exploratory projects in those contexts, mostly related to the utilization of m-health for acute and serious conditions (mHealth Alliance, 2012) or to detect and fight with serious diseases which affect RMNCH, such as HIV/AIDS and malaria (Philbrick, 2012). Actually, some solutions in the literature for these contexts are not directly used by pregnant women. Rather, the target is health care personnel, who are responsible for maternal care, with the aim of enhancing their collaboration, coordination, and transportation, and of enabling them to have special consultations from other health care specialists when needed by using the basic functions of mobile phones, PDAs and walkie-talkies (e.g. Chib, 2010; Chib, Lwin, Ang, Lin, & Santoso, 2008; Cole-Ceesay et al., 2010; Mechael & Dodowa Health Resarch Center, 2009; Musoke, 2002; Shinde et al., 2014; Vital Wave Consulting, 2009). When pregnant women and their families are targeted as direct users of mobile technologies and m-health services, basic SMS, voicemail messages, and call functions of mobile phones are employed dominantly to increase awareness about family planning and maternal care, educate women, track appointments, and provide urgent advice and action when required during pregnancy (e.g. Kaewkungwal et al., 2010; Labrique, 2010; Philbrick, 2012; Vital Wave Consulting, 2009). Sometimes voice-based interactions are preferred rather then textual interactions in m-health implementations due to language and literacy barriers (mHealth Alliance, n.d.). Moreover, basic m-health services are sometimes connected to a broader health informatics system and PHRs to collect data for measuring the effectiveness of m-health implementations, identifying prime development indicators, incorporating them in further decision making processes, and devising policies (Kaewkungwal et al., 2010; Labrique, Vasudevan, Kochi, Fabricant, & Mehl, 2013; Philbrick, 2012; Vital Wave Consulting, 2009).

Understanding and acknowledging the significance of the global attention on and struggles for RMNCH in undeveloped and developing countries, diverse obstacles that pregnant women encounter in also developed countries while trying to reach m-health solutions have been discussed as being overlooked bethinking urban poverty, women's social status, gender differences, and other conditions (Dahdah, Du Loû, & Meadel, 2015; Jennings et al., 2015; mHEalth Alliance, 2012; UN Millennium Project, 2005; Peyton et al., 2014a; Urrutia et al., 2015). According to some researchers, pregnant women with low-income and low-literacy consult Internet resources less frequently

because of not having access, enough skills, and self-confidence (Urrutia et al., 2015). On the other hand, a few other studies show that those pregnant women utilize mobile phones and mobile applications more frequently (Jayaseelan, Pichandy, & Rushandramani, 2015). Nonetheless, though many factors had an impact on the use of e-health and m-health during pregnancy, in all cases, Internet, web pages, social media, mobile phones, and mobile applications are increasingly consulted particularly for information seeking, social sharing, and tracking by majority of women in childbearing age considering the facts that extended families have been in decline, pregnant women need to cope with and share their concerns about emotional and physical changes, and they demand more empowerment (Peyton et al., 2014a, 2014b; Tripp et al., 2014; Urrutia et al., 2015).

Regarding the general Internet use, most frequently searched topics by pregnant women have been compiled as pregnancy periods, symptoms, fetal growth, medication use, medical procedures, physical activities, and nutrition during pregnancy (Urrutia et al., 2015). Mobile applications have been referred as incorporating wider usage areas since they are not only more readily accessible and informative, but they are also interactive and can serve the function of diverse medical tools (Tripp et al., 2014). The most outstanding services of mobile applications in the market are seen as tracking, interaction, and social support, in addition to provision of information and advice (e.g. Johnghorban & Shirali-Shahreza, 2013; Osma, Plaza, Crespo, Medrano, & Serrano, 2014; Tripp et al., 2014). Tracking features can be categorized in relation to pregnant women or babies. Weight, physical activity, nutrition, due data, and contraction tracking features are more related to the expectant mother or general pregnancy experience; whereas, kick counter is more specific tracking feature about the baby. Such applications are usually interactive too to track data either automatically or manually. In addition, as a part of interactivity, they sometimes send reminders and notifications to pregnant women. Besides, they incorporate features to share information on social media, forums, clubs, and so on. Apart from addressing diverse features, some researchers have selected one major focus while discussing mobile health applications for pregnancy, such as depression during pregnancy (e.g. Haga, Drozd, Brendryen, & Slinning, 2013; Osma, Barrera, & Ramphos, 2014; Osma et al., 2016) or gamification of motherhood (e.g. Lupton & Thomas, 2015).

In addition to plain mobile applications, there are also accessories that are attached to mobile phones or devices for enhancing their capabilities and for retrieving pregnancy related information. For instance, “My Baby’s Beat” (Figure 9) mimics a stethoscope as it enables the user to hear, save, and share the heartbeats of the baby by attaching a regular headset in the older versions of iPhone models or by directly placing the embedded microphone on the belly without an additional accessory. Another example is “Bellabeat Shell” (Figure 10), which is advertised as “the most advanced baby heartbeat listener” (Bellabeat, 2017). It works with a special accessory to amplify the baby’s heartbeat when put on the pregnant woman’s belly. The hearable sound can be recorded and shared. Such devices also make a note that they are reliable and cannot cause any harm to the baby as they do not use waves to perform their functions.

**Figure 9.** Snapshots from My Baby’s Beat (retrieved from http://www.mybabysbeat.com)

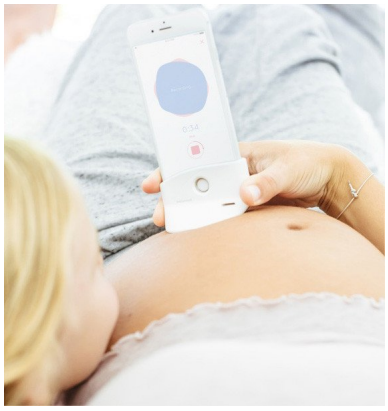


**Figure 10.** The Bellabeat’s Shell application (retrieved from https://webshop.bellabeat.com)

Very recently, other types of mobile solutions, wearable devices, and sensors has started to come forth. “Modoo” (Figure 11) is announced to be the smallest fetal monitoring patch that can be used twenty-four-seven (Modoo Med, 2015-2016). It has also left the ultrasonic radiation behind to provide entirely safe mode to listen and record the baby’s heart rates. Additionally, it counts the baby’s movements automatically. Collected data can be used to trace and diagnose the health condition more precisely. Furthermore, by being a part of a healthcare cloud platform, the user can connect to health care professionals via an online call for one-to-one communication. Also, grounding on the collected health data, the user can receive tailored lifestyle tasks, like practicing yoga.

**Figure 11.** Using Modoo patch during different moments of a day (retrieved from https://www.indiegogo.com/projects/modoo-the-smallest-pregnancy-wearable-device#/)

Apart from hearing babies' heartbeats, there are projects to follow, record, and visualize babies' kicks. "MammiBelli" tracks both the baby's kicks inside the belly and the parent's touches outside the belly with the help of a belt worn display. Then, it visualizes all these movements locations and counts either on this display or on a web interface (Hui et al., 2012).

Above demonstrated examples are mostly for monitoring and listening the baby. There are also products and services such as "Bellybuds" (Figure 12) that enable parents to send music or other recorded sounds inside the tummy, by adhering speakers on the belly (WavHello, 2017). The "Nuvo Ritmo Advanced Pregnancy Audio Belt" (Figure 13) provides different solution and interaction with a similar same aim. That is, it plays music to the baby by wearing a belt (BabyCenter, 2017). The "Babypod" serves a similar function with an intravaginal part for the baby and external earphones for the user to hear what the baby listens to (see Babypod, 2015).

**Figure 12.** Bellybuds portable speaker system (retrieved from https://wavhello.com)

**Figure 13.** Nuvo Ritmo Pregnancy Audio Belt (retrieved from https://www.babycenter.com)

Wearable solutions do exist for tracking pregnant women, apart from being mere baby centric, as well. To illustrate "BloomLife" (Figure 14) is a sensor that can be attached

by a strap on the belly to follow the contractions in the user's uterus automatically. It can be worn daylong. The data can be recorded and sync with its mobile application. Nonetheless, as contractions are at issue, it is especially for the last trimester.

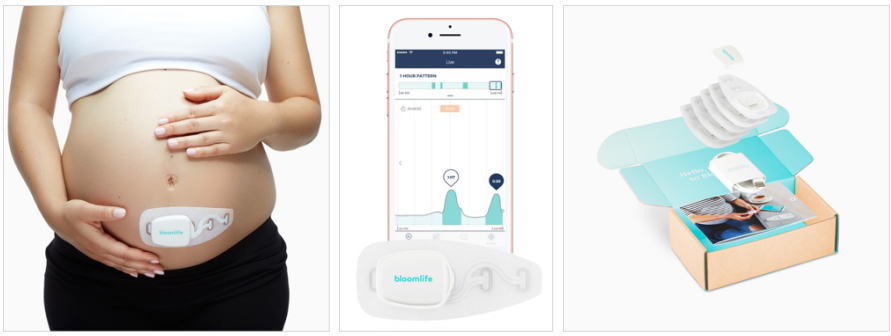



**Figure 14.** Bloomlife contraction tracking system (retrieved from https://bloomlife.com)

Some mobile devices and systems are targeted for medical professionals, rather than individual use of pregnant women, in order to ease the transportation of health care devices to remote settings. The "MobiUS" (Figure 15) is an example for a small ultrasound scanner (Mobisante, 2017). It immediately gives a scanned visual on the display of the mobile device and can transfer it via a wireless or mobile network.

**Figure 15.** Smartphone Ultrasound: The MobiUS (retrieved from http://www.mobisante.com)

Simply put, aforementioned examples are not exhaustive and they constitute a backdrop for forming an estimate of novel pregnancy experiences with pregnancy related personal health care systems. Due to the scope of this dissertation, merely the most influential and prominent ones are demonstrated. It is important to note that other lifestyle and activity tracking systems that are not specific to pregnancy period are also suggested and adopted for healthier pregnancies (see Penders, Altini, van Hoof, & Dy,

2015). As they are not specific solely for pregnancy period and as they are mostly specific to a certain activity or issue, they are out of the scope of this dissertation, as well. Hence, their examples are not depicted in detail hereby.

To sum up this section, considering the previously presented taxonomy for general personal health care systems (see Table 2, p. 57), personal health care systems for pregnancy are mostly targeted for pregnant individuals. Yet, there are cases during which the exact users are health care professionals, especially in remote areas. Also, both pregnant women and health care professionals can be parts of a larger health care system at the same time, as observed in continuous maternal care initiatives in LMICs. The scope of personal health care systems for pregnancy mainly encompasses lifestyle management issues. Nevertheless, personal health care technologies are sometimes for disease management during pregnancy, like gestational diabetes. The services are usually proactive and the contact with health care services and professionals can be either direct or indirect. These services are provided majorly with portable devices and most particularly with mobile phones and applications. Multitudinous parameters can be tracked and related data can be collected by automatic or manual interaction. Thus, timing of interactions and data transmissions might be both synchronous and/or asynchronous.

## 3.4 TOWARDS POSITIVE USER EXPERIENCES

The act of shifting focus from the negative to the positive in psychology discipline has started to echo in diverse disciplines like economics, education, philosophy, HCI, and design. In particular, the concepts of "positive design" (Desmet & Pohlmeyer, 2013), "positive technology" (Riva et al., 2016), and "positive informatics" (Calvo, Vella-Brodrick, Desmet, & Ryan, 2016) have come into prominence in HCI and design disciplines only very recently. Design for enhancing persons', communities', and environment's well-being is interpreted as "slow HCI" (see Interfaces, 2012).

In reality, the holistic user experience perspective, which highlights the significance of hedonic experiences as much as pragmatic experiences, has dominated the design discipline for more than a decade (Desmet & Hekkert 2007; Hassenzahl & Tractinsky 2006; Schifferstein & Hekkert 2008). Earlier, products had the central role in

interactions. If we are to look very quickly to the journey of shift in foci, it is observed that the most dominant concept was “ergonomics” in 1940’s and “usability” in 1970’s. The usability term involves “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO 9241-11). The introduction of usability, and soon after, the emergence of the HCI field corresponded to the times when vendors of the computing systems were obliged to cope with manifold inconveniences and problems (Nielsen, 1993). Thereby, the focus was on comprehending how the actions of users restricted the usability of the computers (Carroll & Campbell, 1989). Nevertheless, approaching to the millennium, the definition and content of usability had been criticized many times as being very superficial and shallow (see Blythe, Overbeeke, & Monk, 2003; Dillon, 2001; Frøkjær, Hertzum & Hornbæk, 2000; Jordan 2000, Jeng, 2005; Kuijk et al., 2007). The deficiency of traditional usability approaches in perceiving products as tools to carry out definite tasks, and so, the essentiality of developing a holistic vision about users’ interactions with products was propounded (Jordan, 2000). In accord, various needs, goals, expectations, as well as emotions were started to be considered as crucial influencers of the emergent “user experience (UX)” concept. Affective and hedonic benefits of the products have been in consideration then, instead of the mere pragmatic issues (Jordan, 1999, 2000).

UX has gained accomplishment in providing affective experiences and has been mature enough to advance forward (Pohlmeyer, 2012). Very recently, by effecting from the positive psychology movement, achieving positive experiences rather than dealing with negative experiences in those holistic experiences has become the major objective in user experience studies (Hassenzahl & Tractinsky, 2006). In parallel, general change from materialistic vision to a post-materialistic vision in many societies have shown the significance of experiences and personal values that products mediate rather than their exact material values or luxury qualities in achieving happiness (Desmet & Pohlmeyer, 2013). This broadens the horizons of products’ roles and design’s value as a resource for well-being and happiness, and of users’ actions and behaviors to take active roles in managing their wellness.

In this section, this nascent approach in design is introduced more in detail first. Then, after giving both theoretical and practical knowledge in the preceding parts of this dissertation, methodological issues, concerning particularly personal health care domain, and then necessity of considering long-term user experiences in related user researches are discussed.

### 3.4.1 Positive Design and Positive User Experiences

Positive design aims at promoting positive psychology by design (Pohlmeyer, 2012). It is also referred to as "design for happiness" because it requires designers to dwell onto how people can be made happier (Desmet & Hassenzahl, 2012). Being in close proximity with positive psychology discipline, positive design does not also underestimate or reject what has been done before in design discipline, which has been mostly about problems. Currently, design tries to divert the attention more towards the positive side and promises—possibilities—in designed products and systems, and accompanied activities (Figure 16). So, it does not aim at bringing the experiences from minus to zero; but, at improving them beyond zero and bringing them to plus (see also Figure 2, p. 22). This should help users to flourish. Hereby, design literature utilizes happiness, well-being, and SWB terms interchangeably.

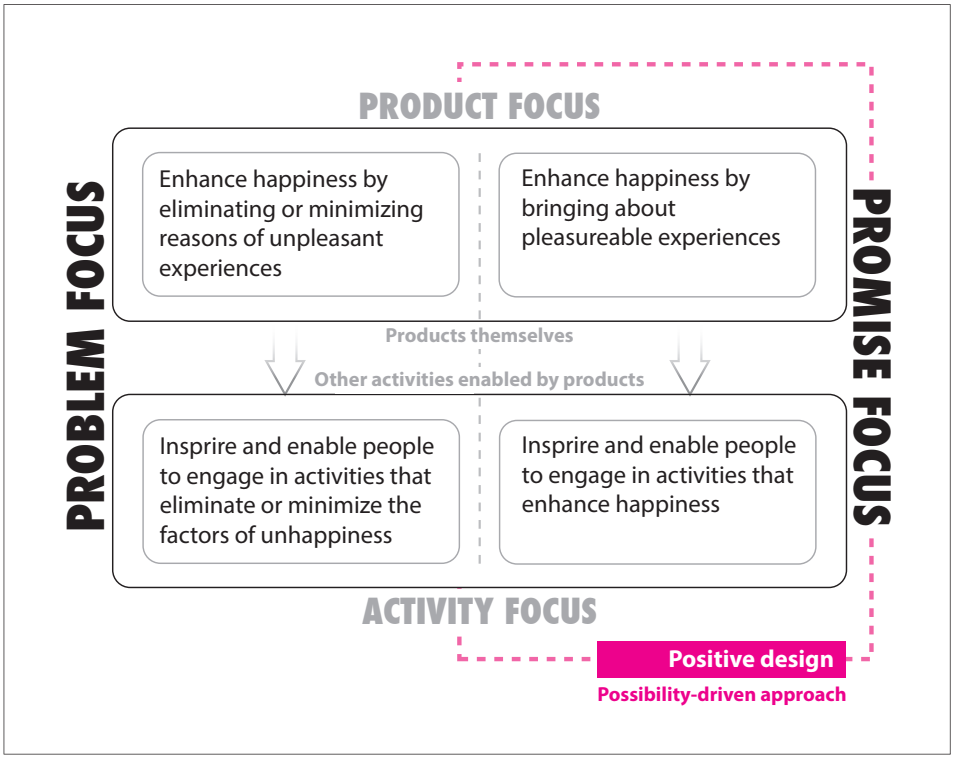



**Figure 16.** Focus of positive design in relation to products/systems and accompanied activities (Adapted from Ruitenberg & Desmet, 2012)

No wonder, it is expected that all technological advances and design solutions should have positive outcomes. Yet, in the nascent positive design area, creating solutions that enhance wellness, well-being, and happiness is the central objective at the onset, not a positive side-effect. That's why different from the conventional approaches in design and HCI that see problems as a starting point, these areas define possibilities and opportunities as a starting point, then purposefully utilize suitable methods and tools. This forms the basis of "possibility-driven design" approach (Desmet & Pohlmeyer, 2013). Therefore, possibilities form the main paths to reach the target¬¬—happiness. Though not being a mobile or another type of personal health care product or system as defined in the scope of this dissertation, the "Cheetah Flex-Foot", which is a carbon fiber prosthetic blade not resembling to a biological leg, can be an illuminating example from general health domain (see Össur, 2017). It is a possibility-driven outcome focusing on the possibility to examine new materials and technologies, whereas conventional leg prosthetics is a problem-driven design solution focusing on the absence of legs (Desmet & Hassenzahl, 2012).

As many newly booming areas are doomed to, positive design lacks a common language about the content of happiness for design and established frameworks, methods, and tools to investigate, understand, and improve positive user experiences. The common efforts arise from "human-centered" attitudes in design to bring about humane resources for users, not just materialistic and pragmatic ones. Two main frameworks are proposed very recently: "Design Well-Being Matrix" (Pohlmeyer, 2012) and "Positive Design Framework" (Desmet & Pohlmeyer, 2013).

The Design Well-Being Matrix (Figure 17) grounds on the "Well-Being Theory" in positive psychology and its five elements—PERMA: *positive emotion (P), engagement (E), (positive) relationships (R), meaning (M),* and *accomplishment (A)* (see p. 26 for the details about PERMA). It combines these elements with crucial roles of design: being a direct *source* for pleasure; representing a *symbol* as an indirect impact of design; being an *enablement* for diverse experiences, performances, and events again as an indirect role of design; and providing strategies and guides to *support* happiness augmenting thinking and acting.

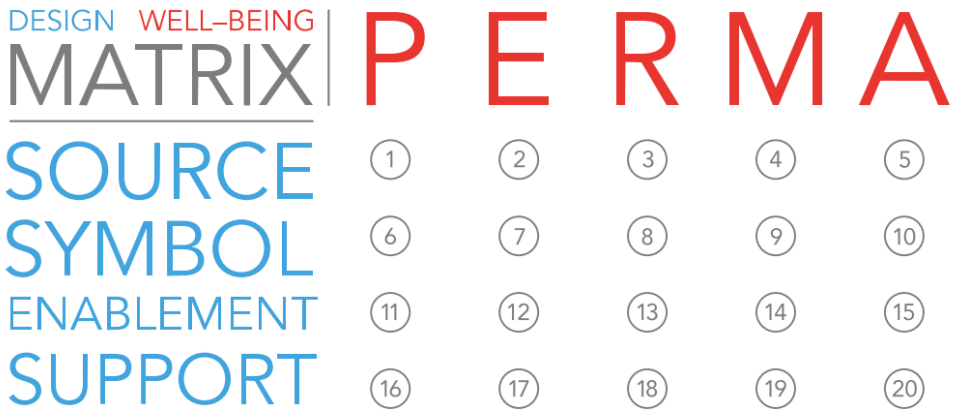



**Figure 17.** The Design Well-Being Matrix (Pohlmeyer, 2012)

Each cell in each column or raw of the above matrix is suggested as take-off point while designing for happiness. To illustrate, the intersection of source and relationships (cell 3) tells that a design solution can be a source for relationships. Another cell to exemplify can be the intersection of enablement and engagement (cell 12) which suggests that a design solution can enable engaging experiences.

The Positive Design Framework (Figure 18) conceives *pleasure, virtue,* and *personal significance* as the three main elements of SWB and utilizes them as content of positive design. So, positive design is about designing for pleasure, virtue, and personal significance; which respectively grounds on experiencing positive emotions, becoming a good person, and seeking personal objectives.

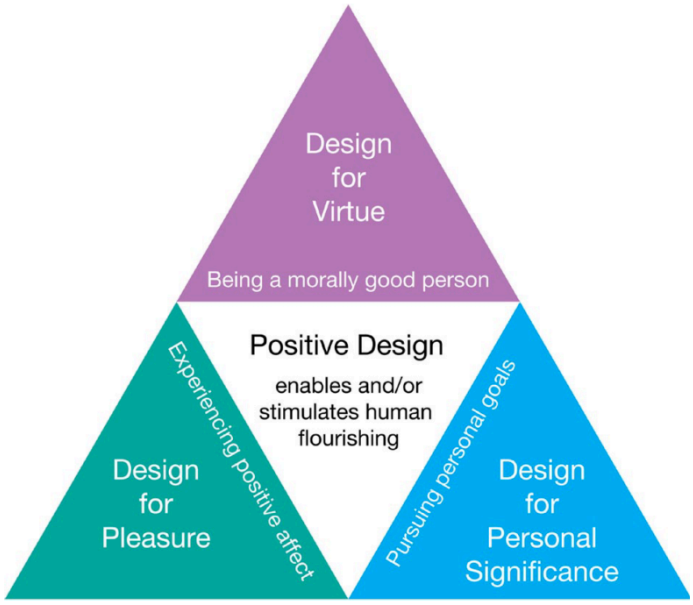



**Figure 18.** The Positive Design Framework (Desmet & Pohlmeyer, 2013)

This framework highlights that design cannot be just related to diminishing unhappiness or increasing pleasure. Accordingly, while taking this framework as a departure point in design, designers and researchers can focus on combination of these ingredients at a time. Though it is not crucial to embrace all of them, two of these can be selected. Likewise, one of them can be more dominant and apparent, incase it does not influence the other ingredients negatively.

These frameworks are beneficial not only to design from scratch, but also to investigate, understand, and improve how current products and systems inspire and enhance happiness in relation to the frameworks' ingredients (e.g. Desmet & Pohlmeyer, 2013). Nevertheless, as these are the initial attempts to provide a common approach and method in design for happiness, they are not established yet; many

empirical studies are necessary to comprehend and validate the impacts of design on happiness (Pohlmeyer, 2012).

Instead of these frameworks, structured steps to collect people's happy moments and conceiving a design proposal based on these possibilities might be followed. Jimenez, Pohlmeyer, Desmet, and Huzen (2014) describes such a procedure which has five phases. Firstly, anecdotes are gathered from the target population by interviews or diary studies. Secondly, consulting literature on well-being and happiness in positive psychology, the anecdotes need clustering. These grouped insights prepare the ground for choosing possibilities to be utilized in the design phase. In the third phase, picked anecdotes are examined in detail to come up with common patterns among the experiences. In the next phase, defined patterns feed design ideation. Finally, discussion is made considering evaluation issues.

Zuthem (2014) pays regard to different requirements that should be focused on while designing for communities' happiness rather than that of individuals or group of users. Needs of a community range from existence towards persistence. Framework in Figure 19 identifies these needs, which should be considered while designing for the well-being of the communities. The potential steps during design for community happiness are getting to know the target community and its current and ideal organization by interviewing various community members and other related people in the neighborhood, involving in community gatherings, exploring communication channels of the community such as Internet platforms, websites, etc. The community needs framework is used to evaluate the target community. This phase is realized together with the community itself. In the next phase community members are active too and they participate in diverse collaborative design activities and co-design sessions (for "co-design", see Lee, 2008; Sanders & Stappers, 2008). The designed concept would be implemented in the final phase, after several prototyping iterations.

**Figure 19.** Community needs framework (Zuthem, 2014)

Beside these frameworks and approaches that are targeted mostly for designers and researchers, a few toolkits and guides are introduced for users to practice happiness, which is also in relation to the introduced frameworks. An exemplary project is "Tinytask" system (Figure 20) with its tokens on a key that suggest happiness enhancing assignments to its users with captions stamped on these tokens, such as "Savor lunch", "Visit a museum", and "Barefoot" (Ruitenberg & Desmet, 2010). Such design applications to help people manage their behaviors and align them with the ones of flourishing people is interpreted among "behavioral intervention technologies (BITs)" and named specifically in design as "design-driven positive interventions" (Desmet & Sääksjärvi, 2016).

**Figure 20.** The Tinytask project (Ruitenberg & Desmet, 2012)

This section has naturally involved certain methodological issues while designing for positive user experiences. In the next section, methodological issues are purposively inquired in order to address high-potency ones to be utilized in user researches with special user groups, like pregnant women, and to be able to understand their experiences; and thus, to gather rich insights which can serve as possibilities for improving both users' interactions with the target technologies and their happiness and wellness.

### 3.4.2 Methodological Issues

Studies aiming at understanding users' experiences ground on user research methods, techniques, and tools. Too many criteria; and thus, too many questions do exist while determining the most proper user research procedure. A compilation of classification types is demonstrated in Table 3.

**Table 3.** Classification of user research methods (Töre Yargın, Günay, & Süner, 2016; based on Töre Yargın, 2013)

| | CLASSIFICATION CRITERIA | CATEGORIES | | | SOURCES |
|---|---|---|---|---|---|
| **WHY? What is the purpose of the research?** | Phases of the design process | Research Need Identification | User Insight Generation | Idea Evaluation | (Stappers & Sanders, 2005) |
| | | Generative | Evaluative | | (Stappers & Sanders, 2005) |
| | | Formative | Summative | | (Rosson & Carroll, 2002) |
| | | Discovery | Definition | Evaluation | (Squires, 2002) |
| | | Front-End Analysis | Testing and Evaluation | | (Wickens, Gordon, & Liu, 2004) |
| **HOW? Which approaches will be adopted by the researcher while conducting the research?** | Type of research activity based on the focal problem | Clinical | Applied | Basic | (Buchanan, 2007) |
| | | Experimental | Empirical | Theoretical | (Strickler, 1999) |
| | Theoretical approach in the area | Reductive | Holistic | | (Blythe, Hassenzahl, Law, & Vermeeren, 2007) |
| | | Measurement Models | Structural Models | | (Law & van Schaik, 2010) |
| | Origins of methods | Traditional | Adaptive | Innovative | (Hanington, 2003) |
| | Participation degree of the user | Consultative | Representative | Consensus | (Carmel, Whitaker, & George, 1993) |
| | The way of application | Direct – Undisguised | Indirect - Disguised | | (Hudlicka, 1996; Malhotra, 2007) |
| **WHAT? What kinds of data will be gathered through research?** | Characteristics of the user information | What People Say / Think | What People Do / Use | What People Know /Feel / Imagine | (Sanders, 2002; Sleeswijk Visser, Stappers, & van der Lugt, 2005) |
| | | Attitudinal | Behavioral | | (Rohrer, 2014) |
| | | Conceptual | Procedural | | (Melican, 2000) |
| | Type of data | Qualitative Data | Quantitative Data | | |
| **WHEN? What will be the time frame for the research?** | Time – Duration of the study | Longitudinal | Cross-Sectional | | (Ruspini, 2002; Flick, 2007) |
| **WHERE? Which contexts are appropriate for conducting research?** | Research setting | Naturalistic | Contrived | | (Akin, 1979) |

When we glance at user researches in personal health care domain, before giving details about the conducted researches in literature, it would be beneficial to summarize the recent situation. It is seen that most researches are either experimental or empirical with a purpose of evaluating health care devices. As the aim is evaluation about how users would use these devices and how much effective the care provided with those devices would be, generally researches are direct, reductive, and undisguised. What users say and how they use the products are usually tried to be understood. Thus, types of data are both quantitative and qualitative. Apart from these, longitudinal studies are sometimes carried out because such personal health care technologies have to be used during certain period. Also, researches are done in both contrived and naturalistic settings.

To give more details, many studies are based on the implementation of a prototype either in *contrived*—lab settings—or *naturalistic environments* (e.g. Anliker et al., 2004; Bardram, 2008; Corchado, Bajo, & Abraham, 2008; Isern et al., 2010; Orwat et al., 2010). However, they are not usually fulfilled by the participation of real-user groups in the experiments (Arnich et al., 2010). So, "clinical-proof-of-concept method" is suggested, which involves the incorporation of a working prototype by a sample of real target groups during adequate period of time (Bardram, 2008). By doing as such, the systems' potentials can be ascertained before broad-scale clinical tests are required. Healthy individuals are sometimes incorporated as well as the patients in order to have healthy control group information for more accurate results (e.g. Orwat et al., 2010). Nonetheless, such studies are usually *quantitative* and *experimental*.

Essentially, gathering data where technology appears promising in fulfilling its specific aim should be intrinsically qualitative (Arnich et al., 2010). With pervasive health care, the domain of health and medicine has become broader in focus, considering management of entire lifestyle aspects and diversity of users involved. In addition, technologies are more user-centered. That's why, research methods to be used hereby have to be user-centered and *qualitative*, too. Hence, interviews, focus group sessions, questionnaires, observations, and the combinations of some of them have started to commonly appear as appropriate methodologies in personal health care domain.

The usage of prototypes or commercially available products by users is usually followed by *interviews* conducted with those participants to understand their experiences or to validate the findings (Angelini et al., 2012; Arnich et al., 2010; Peel, Douglas, & Lawton, 2007). Generally, semi-structured interviews are performed with a more limited number of participants to collect in-depth information. For instance, Orwat et al. (2010) conducted semi-structured in-depth interviews with multiple sclerosis (MS) patients, after conducting an initial clinical study which involved the actual use of a belt-worn health care device by MS patients for a week. In Bardram's (2008) study, home-based hypertension monitoring devices were given to the patients to be used for several times a day and then interviews were carried out. Also, interviews are frequently preferred even without the actual use of the systems. Especially, patients' experiences not only about health care solutions, but also about general disease or health specific experiences can be questioned (e.g. Lawton, Parry, Peel, & Douglas, 2005). In addition, interviews are conducted with experts for consultation, apart from the users (e.g. Codagnone, 2009). Furthermore, depending on the aim, interviews can be conducted in one go as a cross-sectional research or they can be longitudinal in order to comprehend the changing experiences in relation to the progress of the health condition over time. For example, Lawton, Parry, Peel, & Douglas (2005) conducted qualitative panel study with newly diagnosed diabetes patients during one year to understand the progression and change in their experiences. Appertaining to studies about pregnancy, generally semi-structured interviews have been preferred subsequent to other methods such as observations (e.g. Gibson & Hanson, 2013), focus groups (e.g. Fleming, Vandermause, & Shaw, 2014; Peyton et al., 2014a), and surveys (e.g. Haga et al., 2013); but usually consisted of a few participants from the initial sample (such as changing from two to six participants) to elaborate on the former findings and concepts. To clarify, more specific issues under investigation in these studies were respectively as follows: the role of technologies in supporting first-time mothers; the meaning and practice of self-preparation for the birth time in hospital with the help of electronic media; the perceptions of pregnant women and new mothers about current and possible mobile applications; and perceived reliability, unobtrusiveness, usability, and usefulness of a web-based intervention for postpartum depression. Rarely, interviews without any combination

with other types of user research methods have been conducted to examine the experiences of pregnant women with technologies. In an exemplary study, interviews were conducted with pregnant women to comprehend how they would retrieve information from the Internet about certain issues related to their conception, prenatal, and delivery experiences; and what would be the significance of medical history and social status during these experiences (Song, West, Lundy, & Smith Dahmen, 2012).

Moreover, *focus group* sessions are also valuable to collect diverse in-depth information from different stakeholders. To exemplify, Rahimpour, Lovell, Branko, Celler, and McCormick (2008) conducted ten focus group interviews (FGIs) with people having chronic obstructive pulmonary disease and congestive heart failure. The sample was constituted from people with diverse ethnic backgrounds to achieve cultural diversity. Certain discussion topics were defined to comprehend the factors impacting on their perceptions of home telecare systems. During 90-minute two sessions, a video involving the functionalities of a telecare system and a prototype were demonstrated to comprehend the participants' perceptions. For the analysis, audio-recorded data is transcribed first, after which main categories and sub-categories were identified. In another example, Orwat et al. (2010) conducted two focus group sessions, to understand the perceived medical benefit of a MS monitoring system and user acceptance issues. Within the scope of pregnancy studies, FGIs have been carried out, too. As aforementioned in the previous paragraph, they have been mostly combined with interviews (e.g. Fleming et al., 2014; Peyton et al., 2014a). However, participants in those studies were not just pregnant women. In Fleming et al.'s (2014) study, three FGIs were conducted with childbirth educators, obstetric providers, and labor and delivery nurses in order to give idea to researchers about their perceptions of pregnant women utilizing electronic media while preparing for the birth.

Sometimes, *questionnaires* and *surveys* are preferred to understand users' impressions about certain health care systems. To illustrate, Demiris, Speedie, and Finkelstein (2000) devised questionnaires to understand the diffusion and acceptability criteria of home telecare systems. Orwat et al. (2010) also used questionnaires as a supplementary tool for the aforementioned interview and focus group studies. Some questionnaire studies have been conducted in large scales. Lin, Lee, and Hsiao (2008) conducted a

questionnaire survey by distributing thousands of questionnaires in order to examine the approaches of the relatives of elderly people towards pervasive health monitoring systems and to reveal the factors which can influence the interest of the public about utilizing such health care systems. Within the pregnant women's technology experience frame, both cross-sectional and longitudinal questionnaires and surveys have been highly preferred to gather both qualitative and quantitative data (e.g. Bakhireva, Young, Dalen, Phelan, & Rayburn, 2011; Bert et al., 2013; Gao, Larsson, & Luo, 2013; Haga et al., 2013; Jayaseelan et al., 2015; Lagan et al., 2010; Larsson et al., 2009; Lee & Moon, 2016; Song, Cramer, McRoy, & May, 2013; Osma et al., 2016; Wallwiener et al., 2016).

*Observations* can be advantageous for evidence-based medicine. Observations can have a stronger value as proof than case reports, opinions of experts, and testimonials of patients (Bardram, 2008). However, observations can also involve inherent biases. There are several examples in the literature which have preferred direct observations to examine users' experiences with personal health care systems (e.g. Orwat et al., 2010). It is important to note that observations in those studies have been also done along with other research methods like interviews, questionnaire, etc. For instance, in an attempt to understand the impact of technologies on new mothers' experiences, Gibson and Hanson (2013) consulted observation method as the first step of an overall methodology with different ethnographic methods.

It can be deduced that though quantitative studies are frequently used in personal health care domain to measure the effectiveness of personal health care technologies and performances, qualitative user researches are also of great importance to understand users and their insights, and to design products and systems that can meet both pragmatic and hedonic needs of users, as also shown in design and UX literature. However, as mentioned at the introduction chapter of this dissertation and as can be implied from the brief methodological overview about personal health care systems in this section, users' expectations from pregnancy related personal health care systems and mobile pregnancy technologies; more importantly, possibilities in different users' experiences with those technologies; and qualities of these technologies that can enhance users' wellness and happiness have not been studied holistically, yet. Since

holistic user experiences should be at issue during pregnancy, which is also a definite longitudinal period in itself, it is substantial to touch briefly on the temporality of experiences. Next section touches upon the significance of measuring longitudinal user experience, which is not only beneficial to understand experiences holistically, but also to expand possibilities.

#### *3.4.2.1 Significance of Investigating Longitudinal[4] User Experience*

Although longitudinal studies are common among personal health care studies, they have mostly quantitative nature to measure the effect of a health care solution on the course of a health condition or to understand the feasibility of the health care solution, by comparing the initial and latter conditions (e.g. Haga et al., 2013). However, understanding longitudinal experiences of users are important beyond these issues.

Measuring a single experience might not be highly credible for comprehending real daily experiences and for interpreting the effects of a design solution. In fact, collecting diverse evidence about how a person's interaction with a product or a system changes in the course of time is of great significance (Kujala, Roto, Väänänen-Vainio-Mattila, Karapanos, & Sinnelä, 2011). As design and UX literatures highlight frequently, experiences of users are affected not only by the moments of exact contact point. In fact, user experiences are holistic and dynamic because they spread over time and encompass entire periods of pre-usage, usage, and post-usage (Karapanos, Zimmerman, Forlizzi, & Martens, 2009). User habits, inclinations, and expectations due to prior experience or inexperience shape their current interactions. Thus, pre-usage experiences are as important as recent ones. Focusing on recent usage experiences is beneficial to understand ongoing, fresh, and momentary experiences. In post-usage stage, users' experiences may evolve divergently because users might adopt different perceptions and evaluations after passing through many stages and

[4] In this dissertation, the focus is not on user experiences over time with diverse anticipation, orientation, incorporation, and identification stages (see Karapanos, 2013), that may accompany shift in experiences involving attachment, sustained usage, disposal, and so on. Pregnancy is a special episode related to health with an almost definite duration, unless complications occur. It has three different trimesters and an end, i.e. the birth, which makes it different from open-ended health conditions and user experiences spanning across uncertain time. Acknowledging that similar issues can emerge in a nine-month period, it is crucial to keep in mind that each three-month trimesters has diverse dynamics, differentiating this study area from other long-term user experience studies.

being able to interpret preceding periods entirely and cumulatively (Karapanos et al., 2009; Roto et al., 2011).

In parallel to the significance of long-term user experiences, design and UX literature have proposed several methods, most of which have been adopted from sociological or psychological studies.

*Diaries*, referred also as journals, are tools that guide and enable individuals to frequently keep records of their daily moments, interactions, diverse processes, and so on (Alaszewski, 2006; Bolger, Davis, & Rafaeli, 2003). So, they convey more realistic and considerate depictions of a person's life. Also, as the recordings are—ideally—done freshly after the occurrence of an experience, they can minimize memory biases (Nicholl, 2010; Polit & Beck, 2006). Even though traditional diaries were paper and pen (P&P) based, augmented paper diaries, electronic and online versions are available with the advances in technologies and with the objective of overcoming certain problems encountered with P&P types (Bolger et al., 2003). These problems mostly emerge from participants' forgetting to document experiences on the required time and their reproduction or fabrications of the uncompleted dairy information, which is in contradiction with the major advantages of the diaries about collecting more realistic information and reducing memory problems. Actually, diaries have been known since a long time and have been adapted in diverse ways by people from different disciplines like biographers, psychologists, marketers, and health care researchers (Toms & Duff, 2002). Diaries can be kept either by researchers or by other people from whom researchers want to gather data (Snowden, 2015). The very early purpose to log was keeping a journal of the self; but later on, diaries started to be used mostly for other research purposes (Toms & Duff, 2002). For instance, psychologists have been using it to remind their patients to keep track of their daily details in a structured way (Lewis, Sligo, & Massey, 2005). In health and nursing areas, patient diaries have been sometimes used by researchers to record investigation processes about health conditions, interventions, actions, reflections, appointment times, etc. (Snowden, 2015). Diaries as a data collection method is intensively utilized by designers and design researchers, as well, for understanding certain interactions, patterns and/or changes about users' experiences (Martin & Hanington, 2012). Furthermore, diaries

can be used as a part of cultural probes and co-design sessions; or although not very frequent, they can be even utilized in usability studies, to sensitize participants or to gather feedbacks, depending on the research aims (Martin & Hannington, 2012; Mattelmäki, Lucero, & Lee, 2016). Also, diary studies are mostly followed with an interview to probe and expand on the details of the diary entries (Flaherty, 2016). Diaries can be interval-, signal-, or event-contingent (Wheeler & Reis, 1991). In the former one, participants are asked to provide information about their daily lives and experiences within general pre-established durations (e.g. at the end of each week, over three-week intervals). In the signal-contingent type, participants are prompted to record data on a signaled time, the schedule of which can be random and/or fixed (e.g. a beeper sending prompts during different times on each day of a week). In the event-contingent diaries, participants are informed to report predefined incidents.

*Cultural probes*, i.e. probes or design probes, are collection of research assignments and tools which are devised, packed, and provided to participants to gather inspirational self-documentations about their experiences, feelings, and ideas; and so, to enable them to actively involve in user-centered design process (Gaver, Dunne, & Pacenti, 1999; Mattelmäki, 2005, 2006). The content of a cultural probe package can involve diaries, postcards, maps, camera, stickers, pens, and so on, to realize provocative assignments, to initiate a dialogue between the participants and researchers, and to supply input for design ideation and conceptualization (Gaver et al., 1999; Sleeswijk Visser, 2009). Cultural probes are flexible and beneficial to elicit rich and authentic insights; however, assignments might be burdensome for the participants, which can effect the participant rates negatively.

The *Experience Sampling Method (ESM)* is another method to retrieve longitudinal information about daily experiences and contexts of these experiences. Though emotions can be retrieved from diaries, ESM is advantageous in gathering subjective data (Hektner, Schmidt, & Csikszentmihalyi, 2007). The ESM incorporates a device that send stimulus signals to participants on mostly computationally determined random times in order to ask them give very brief reports on certain questions. Hence, the ESM can collect in-situ—real time, real place, natural setting—experiences and affective states, eliminating information distortions due to memory problems.

Nonetheless, it is crucial to keep in mind that as the ESM interrupts the ongoing experiences and actions of people during certain time, these prompting frequencies and the length of the queries should be appropriate (Csikszentmihalyi & Larson, 1987; Hektner et al., 2007). Additionally, some important episodes and experiences of a day might be missed due to gathering reports on signaled durations.

The *Snippet Technique* was presented regarding the drawbacks of diary studies which are filled in by participants during active and on-the-go conditions (Brandt, Weiss, & Klemmer, 2007; Lallemand, 2012). As it might be infeasible or displeasing for people to allocate time to complete extensive diaries on such conditions, merely "snippets", which could be very brief notes, images, or voice messages, are required to be recorded at the moment of a certain experience in this technique. Recorded snippets are immediately send to a server by participants in the format of basic messaging services of mobile phones. Mobile phones are suggested particularly because of their extensive usage and instant availability for communication. After, when participants have time, they visit an internet site to look over what they have captured and to elaborate on those snippets for making a more comprehensive diary entry.

Moreover, considering the shortcomings of the ESM, the *Day Reconstruction Method (DRM)* was introduced (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). In this method, participants focus on the experiences of the previous day by episodically reviving and sequentially reconstructing them (Kahneman et al., 2004; Karapanos, Martens, & Hassenzahl, 2010). It can be said that the DRM aims to elicit similar data with methods used for sampling experiences in real time and context, and meanwhile it tries to avoid memory biases of and burdens on participants as much as possible (Kahneman et al., 2004). Information about long-term experiences and product adoption phases, involving feelings, behaviors, activities, events, contexts, or circumstances, can be retrieved in a retrospective manner by implementing this method (e.g. Karapanos et al., 2009).

For supporting participants to retrospectively remember their previous experiences, certain tools have been devised, too. *iScale* is an online survey tool which enable participants to draw a curve representing the changes in their experiences with a product from the time they bought it until their current experiences (Karapanos et al.,

2010; 2012). The *UX Curve* method has the same purpose; yet, it is more suitable for face-to-face studies rather than online platforms (Kujala et al., 2011). The UX Curve template consists of two main regions divided by a horizontal axis. While participants draw the changes in their experiences with a product, this axis acts as a time dimension. The vertical movements of the sketched experience graph in these two regions correspond to the intensity of the experience. To guide participants, the template has vertical axis at the starting point of the horizontal axis, as well, marked with positive and negative signs. Besides, there is a row field to add personal notes.

In brief, the picture that come in sight from the methodological overview is that user research is a prerequisite for getting a better grip on users' experiences in both design and health care literature. Significantly, exploring longitudinal user experience and utilizing longitudinal experience sampling methods emerge as powerful paths to have a more realistic grasp about frequentative patterns in and changing nature of these experiences, to retrieve in-depth and authentic insights; and hence, to establish stronger empathy with users. Nevertheless, each method has different advantages and disadvantages as shown above. Therefore, while devising a study, trade-offs should be considered and different methods and tools should be harmonized depending on the research aims, users, context, and limitations.

#### *3.4.2.2 Reflections of Methodological Issues on the Formulation of the Current Study*

In the current attempt for holistically understanding pregnant women's experiences, for coming up with positive user experience dimensions related to interactions of pregnant women with mobile pregnancy technologies, and for throughly identifying and defining characteristics of these technologies that can enhance their wellness and happiness, certain key consideration points have emerged to decide on and formulate the methodology.

Placing both user experience and pregnancy in conversation necessitates the utilization of appropriate longitudinal user research methods, which should reveal the dynamics of pregnant women's experiences with mobile pregnancy technologies during an episodic long-term period, with the consideration of three different trimesters.

Understanding their experiences with mobile pregnancy technologies also requires comprehending the context; i.e. the scope of their daily life which is highly affected by pregnancy related changes. Nevertheless, the intrinsic shortcomings of methods aimed at sampling daily experiences aggravates with a pregnant user group, because pregnancy itself puts diverse physical, psychological, cognitive, etc., limitations on participants even when realizing their normal daily routines. Thus, recruiting and keeping them active during a study necessitates manifold methodological considerations and adaptations, which should not demand too much effort and time from them. Also, as prompting, motivating, and guiding participants to a certain extent are useful for the continuity of a regular longitudinal study, these issues are point of greater consideration in this study with pregnant women, who are already prone to pregnancy related temporal mnemonic impairments. All of these considerations and detailed discussions are put in the center in the next chapter.

# CHAPTER 4

# METHODOLOGY

Preceding chapters have indicated the necessity of a new point of view towards personal and mobile pregnancy technologies that would support the wellness and happiness of pregnant women holistically and positively, which would in return realize the smooth integration of mobile pregnancy technologies in daily lives of pregnant women. Methodology of the study, as well as the research questions, was fed from and shaped by HCI, design, positive psychology and pregnancy literature. This chapter concentrates on the methodology of the study. Decisions about the methodology are explained section by section. Those decisions were the revised and ultimate versions after a pilot study. In order not to create confusion, the pilot study is not explained in detail; but, necessary explanations are made in related places referring to the pilot study.

## 4.1 DATA COLLECTION

### 4.1.1 Procedure

The study was composed of three main phases: pre-usage stage, usage stage, and post-usage stage (Figure 21) because experiences of users are influenced not only by the moments of direct interaction. In fact, user experiences are holistic and dynamic, extending over time and encompassing the entire periods of pre-usage and post-usage (Karapanos et al., 2009; Vermeeren et al., 2010), as also explicated in the previous section (see Chapter 3, Section 3.4.2.1). User habits, concerns, and expectations that occur due to prior experience or inexperience have impact on actual interactions. Thus, pre-usage experiences are as much important as the recent ones. Consulting recent usage experiences is beneficial to comprehend ongoing, immediate, fresh, and so,

more clearly remembered experiences. Besides, in post-usage stage, users' experiences might proceed divergently because users might possess different perceptions and evaluations after passing through many stages and being able to observe preceding periods entirely and cumulatively (Karapanos et al., 2009; Roto et al., 2011).

Multiple—longitudinal—semi-structured interviews with each pregnant woman constituted the basis of the methodology throughout these three stages in order to retrieve in-depth information from pregnant women and in order not to put too much burden and pressure on them with complicated procedures. Native language of the participants was Turkish as the study was conducted in Turkey, so the study was in Turkish. The detailed set-up of the study both in Turkish and in English can be found in Appendix B and in Appendix C respectively. The highlighted parts in the set-up demonstrate the changes made after the pilot study.

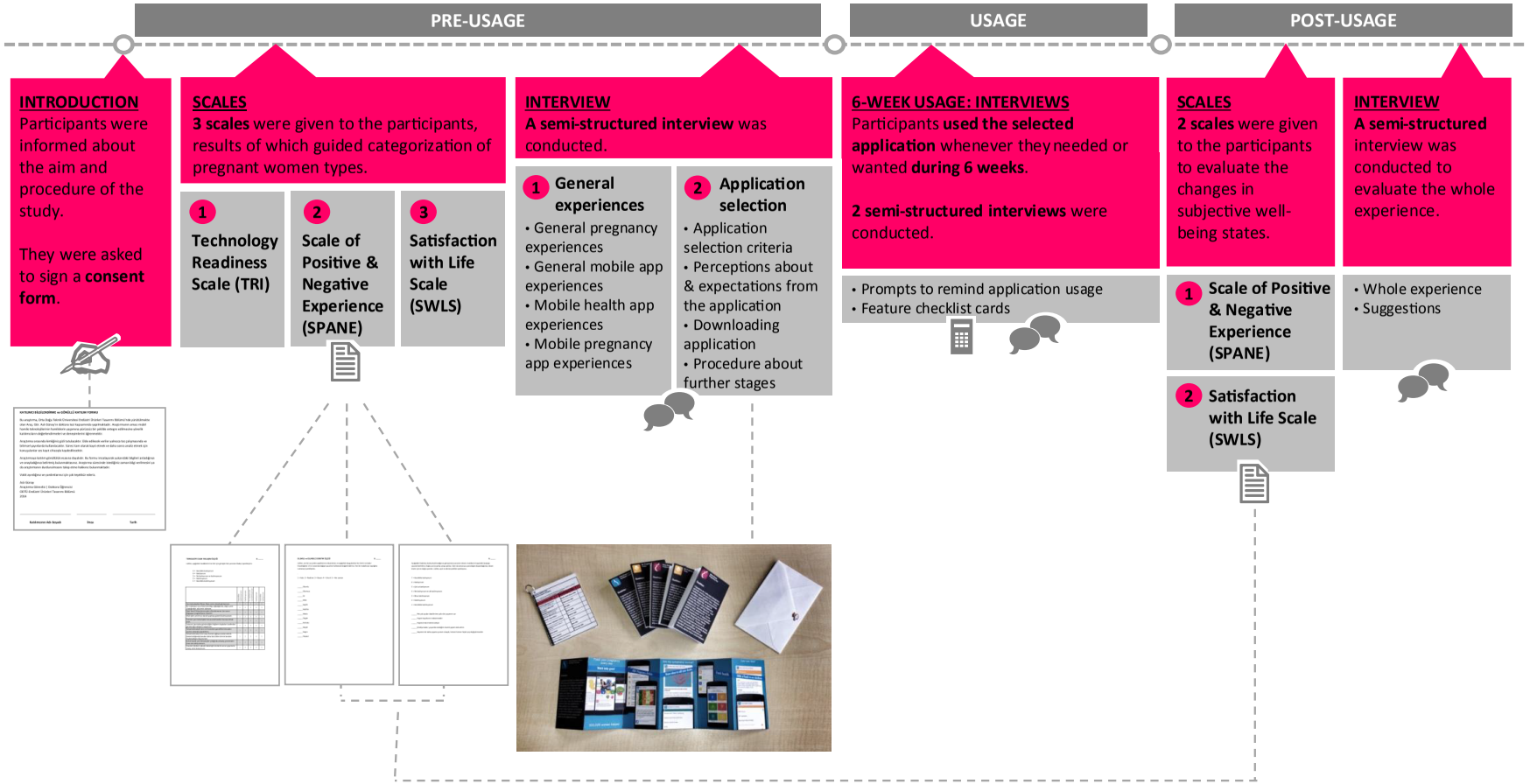



**Figure 21.** Structure of the methodology

#### *4.1.1.1 Pre-Usage Stage*

The first stage of the study was comprised of two sections, in addition to an introduction. At the beginning of the study, participants were informed about the aim and procedure of the study and asked to sign a consent form for participating in the study. Later, three scales were given to the participants to gather initial data about their background, their general well-being states, and their relations with technology; and therefore, to draw an initial frame that might differentiate pregnant women types (see Appendix D for the Turkish and Appendix E for the English version of the scales). After the participants filled in the scales, a semi-structured interview was conducted involving questions respectively about daily pregnancy experiences, experiences with general mobile applications, experiences with general mobile health applications, and experiences with mobile pregnancy applications. Then, three application cards (Figure 22) were presented to them, which demonstrated the features of three pre-determined pregnancy applications with supportive snapshots taken from online app stores (iTunes Store or Google Play Store). They were asked to look over the applications and to select one to use for 6 weeks. After the selection, the reasons of selection and expectations from the applications were questioned shortly. Finally in this stage, the selected application was downloaded to prevent possible problems while downloading and the procedure about the next stage was explained by providing the necessary tools to be used. These tools involved feature checklist cards (Figure 23) on which participants might note down the application features they would use, their interaction time, and interaction frequency. To note again, as human memory could be mistaken and there could be missing and inaccurate parts while reporting the experiences later on (Nielsen, 2010), and as interactions could be repetitive in the course of daily life; personal notes, documents, and diaries constitute one of the fruitful tools that researchers consult to (Intille et al., 2003). For providing portability and ease of use, both printout and digital alternatives of these cards were given to the participants. For the printout version, one participant was given several cards attached together with a key ring to facilitate carrying in daily life (see Figure 21).

**Figure 22.** Application cards: *BabyBump Pregnancy Pro, Ovia Pregnancy Tracker, My Pregnancy Today*

#### *4.1.1.2 Usage Stage*

In the second stage, participants used their selected applications whenever they needed or wanted during 6 weeks. During this period, they were contacted by phone every 2 weeks to learn their experiences with the application. Between these weeks, short messages, i.e. prompts, were sent to the participants from a media they preferred (SMS, WhatsApp, e-mail), to remind about the application usage and upcoming interviews. Meanwhile, they were asked to send the feature checklist cards (see Figure 23) that they had filled in. To do so, if the printout version was preferred, they were asked to take a quick photo of each card whenever they would fill in. If the digital version was

preferred, then the participants were asked to fill it in digitally (e.g. *Skitch* application, which provides a quick and easy way to tick or note down, was a suggestion) or to take snapshots from the phone screen. However, utilization of the checklist cards was non-obligatory in order not to overwhelm the participants with workload during 6 weeks in an already challenging pregnancy period; yet, participants were constantly encouraged to utilize the cards. Those checklists just served the function of remembering certain things during the phone interviews and the final interview which is explained below. During the semi-structured interviews that took place in this usage stage, questions about both pregnancy-related daily changes and experiences related to application usage were asked. Positive psychology, positive design and HCI literature formed the groundwork for the questions to comprehend the application features that would provide happier experiences and enhance wellness.

**Application usage date:**
**Application usage time(s):**

Below, please check the feature(s) which you have recently used. You can also note down how many times you have used the checked feature(s) on this day.

| FEATURE / CONTENT | ✓ | FEATURE / CONTENT | ✓ |
|---|---|---|---|
| **Pregnancy information** (Baby development, bodily changes, etc.) | | **Contraction timer/ tracker** | |
| **Countdown/ Due date calculator** | | **Kick counter/ tracker** | |
| **Pregnancy Management** (Checklist,to-do list, reminder, notification, birth plan, etc.) | | **Weight tracker** | |
| **Diary/ Journal** | | **Exercise tracker** | |
| **Forums/ Communities/ Clubs** | | **Nutrition tracker** | |
| **Sharing** (Facebook, Twitter, E-mail, etc.) | | **Medication tracker** | |
| **Baby names** | | **Sleep tracker** | |
| **Store/ Shop** | | **Mood/ Emotion tracker** | |
| **Other feature(s)** (Please specify): | | | |

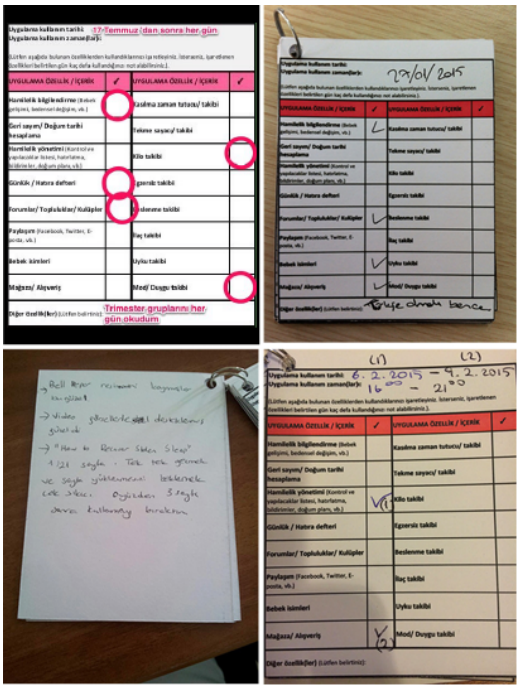


**Figure 23.** The feature checklist card (Turkish version was given to the participants as seen in the right side, which can also be found in Appendix F, Figure 39)

#### *4.1.1.3 Post-Usage Stage*

In the final stage, after 6 weeks, semi-structured interviews were conducted again to evaluate the whole experiences. Depending on the participants' locations, interviews were tried to be conducted in a face-to-face format. However, when required or

demanded, interviews were carried out via Skype. Hereby, questions investigated whether the participants would prefer to further use the applications, how the applications would make them feel better and happier, and what could be their suggestions about application and interaction qualities to improve such pregnancy applications. Furthermore, two of the scales, which had been utilized in the first stage, were given again in order to explore whether changes in the well-being of the participants could be supplemented by these.

All of the interviews were voice-recorded (with *Olympus VN-4100PC Digital Voice Recorder* and *iPhone's Voice Memos*) to be transcribed later-on.

### 4.1.2 Sampling

Participants were selected according to purposive sampling, which represents recrution of potentially well-informed participants considering specific criteria and restricted resources (Patton, 2002). Also, quota sampling was used by deciding to recruit 10 pregnant women for each of the three pregnancy trimesters (30 pregnant women in total). The study was finalized with 33 pregnant women since two of the participants had early labor, and one of the participants did not give sufficient quality responses. Even though almost all stages of the entire 6-week procedure was completed with these participants, three more participants were recruited.

In parallel with the applications utilized in the study, participants were either iPhone operating system (iOS) or Android operating system-based smartphones users and they had adequate English knowledge to interact with the selected applications. As the target user profile and sampling criteria already constituted a limitation for the prospective participant amount, participants were also recruited according to availability sampling and snowball sampling. The study was announced via diverse channels. Pregnancy bloggers, gynecology associations, prenatal yoga centers, pregnancy education organizations, and other non-pregnancy related local organizations were contacted in addition to using social media and friend contacts. Most of the returns came from pregnancy blogs, social media, and friend contacts. Snowball sampling, which is consulting to the referrals of existing participants about other people and information rich cases to be included in the study (Bogdan & Biklen,

2007; Miles & Huberman, 1994), was also highly beneficial since it was observed that pregnant women had a widescale pregnancy network to share this period and to support each other.

The ages of the participants ranged from 25 to 40. Moreover, 25 out of 33 participants were first-time moms and 8 of them were multigravida (i.e. who had been pregnant more than once). Before the pilot study, it was thought that the sampling criteria should involve pregnant women experiencing merely their first pregnancy. Nevertheless, it was comprehended that incorporating all pregnant women regarding their previous pregnancy experiences would yield diversified and rich information both about the pregnant women types and related design interventions. Additionally, 7 participants had doctoral degree, 12 participants had master's degree, 12 participants had bachelor's degree, and 1 participant had associate's degree. Figure 24 demonstrates the pregnancy weeks and study durations of the participants. Numbers on the figure depicts the participants' pregnancy numbers. Detailed participant information including ages, educational background, occupation, application choices, pre-pregnancy application usage information can be found in Appendix G. Summary of the participant distribution based on trimesters, age range, and pregnancy numbers, as well as initial scale averages, can be seen below (Table 4).

**Table 4.** Summary of trimester specific participant distribution

| | Participants | | | | Scales | | |
|---|---|---|---|---|---|---|---|
| | Age Range | Total # of Participants | First Time Mothers | Multiple Time Mothers | TRI | SPANE | SWLS |
| 1st Trimester | 26-35 (*M*=31) | 10 | 9 | 1 | *M=37.50, SD=3.57* | *M=10.30, SD=3.62* | *M=28.00, SD=4.62* |
| 2nd Trimester | 25-40 (*M*=31) | 12 | 10 | 2 | *M=38.00, SD=2.92* | *M=8.00, SD=5.86* | *M=28.25, SD=1.96* |
| 3rd Trimester | 25-40 (*M*=33) | 11 | 6 | 5 | *M=34.91, SD=4.01* | *M=11.36, SD=4.41* | *M=27.55, SD=4.23* |

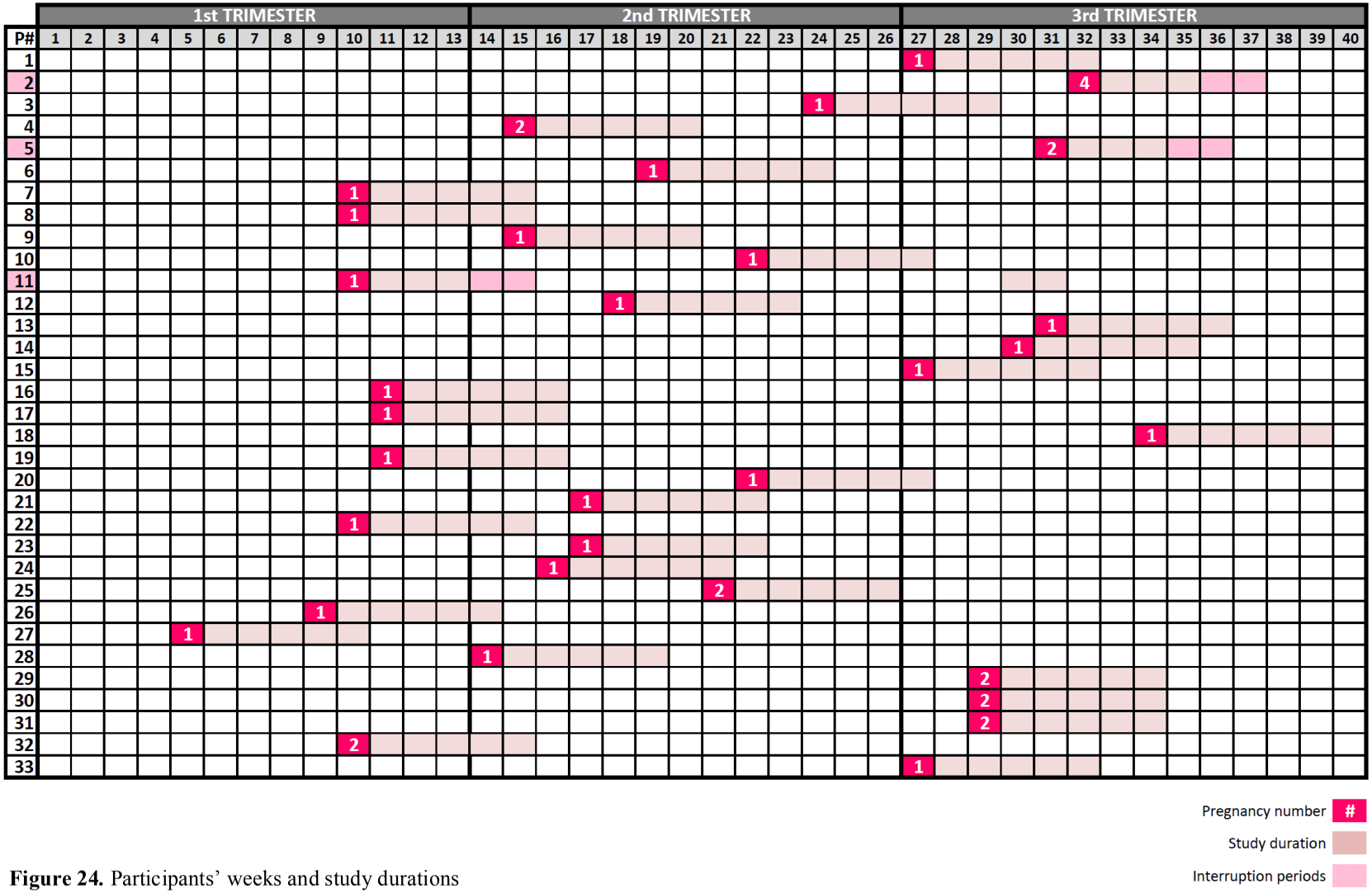



**Figure 24.** Participants' weeks and study durations

### 4.1.3 Study Location and Communication with Participants

Participants from Ankara, Turkey, were preferred at the beginning of the study considering face-to-face interviews as it was the researcher's home city. Nonetheless, participants from other cities (1 Istanbul, 1 Izmir, 2 Samsun) were also recruited in time as it became necessary. Face-to-face interviews were conducted in places wherever the participants desired, which were majorly their offices. For the participants living in other cities, the pre and post-usage interviews were conducted through Skype and phone. E-mail, SMS and WhatsApp communication were also carried out for arrangements and methodological procedures. All the interviews were recorded by voice-recording and note-taking.

### 4.1.4 Tracking

Pregnant women in each of the three pregnancy trimesters were tracked during 6 weeks approximately although one trimester is composed of 3 months roughly. This decision was made since most women do not know their pregnancy, or do not want to announce it, after several weeks pass in the first trimester. Moreover, in the final trimester, the exact birth date is usually unknown and it is not efficient to continue with the study because pregnant women can be highly focused on their birth date, which can make it a burden for them to finalize the required tasks. That's why in order to standardize the duration for each trimester, 6 weeks was found appropriate. However, it was thought that, whenever possible and whenever participants wanted to keep on using the application, they could be contacted again to learn further experiences, as well. All of the participants finalized the study in 6 weeks, without providing extra information about the further experiences.

As stated above, during the entire 6-week tracking period, main contact intervals with the participants for the interviews, apart from the prompts and messages, were biweekly (Figure 25). This decision about the durations between the interviews was made also after the pilot study. There were both 1-week and 2-week intervals in the pilot study. In the case of 1-week intervals, frequency of the interviews was found too much due to several reasons. Firstly, data started to repeat and became saturated. Secondly, too many interviews created extra responsibility and burden for the pregnant

women. In addition, they mentioned that there were not too many changes in their lives worth reporting if the interviews were conducted weekly.

As can be seen in Figure 24, and also as foreseen, 6-week tracking period transcended the borders of the related trimesters in some cases, especially in the first trimester since most pregnant women usually learn their pregnancy after several weeks or they do not want to announce it in the first semester due to risky conditions as aforementioned. Nevertheless, this did not affect the collected data as durations of pregnancy trimesters are also determined slightly differently, with 1 to 3 week variations, in diverse resources.

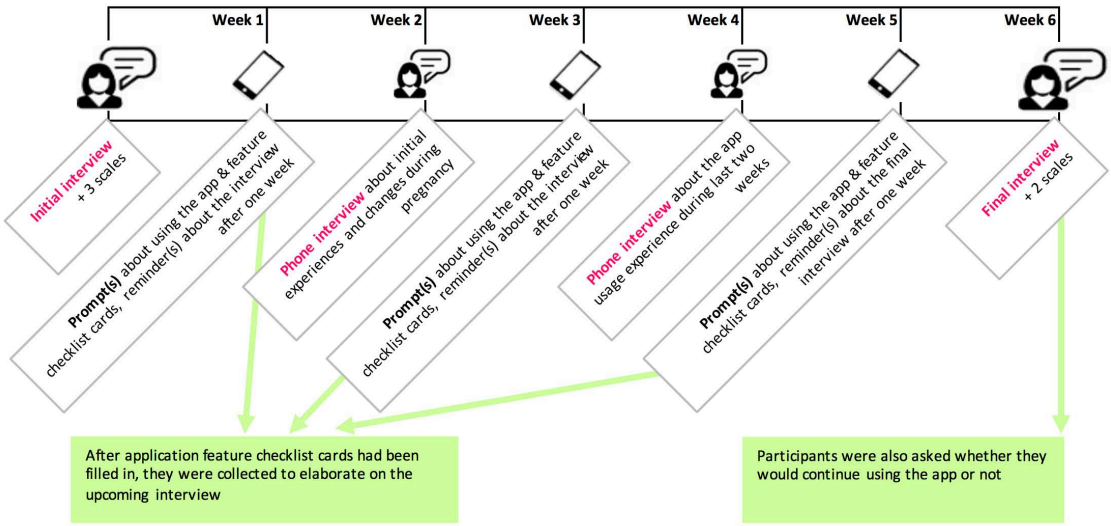



**Figure 25.** Participant tracking period

### 4.1.5 Selection of the Applications

Three smartphone applications were selected to be utilized in the study: *BabyBump Pregnancy Pro, Ovia Pregnancy Tracker,* and *My Pregnancy Today*. The selected applications had versions compatible with both iOS (iPhone) and Android operating systems. Although there were small differences among the interfaces for different operating systems, the overall interaction and content were almost identical.

Before deciding upon these three applications, a wide range of pregnancy applications were examined. In the very first examination, the latest ratings of the pregnancy applications in application stores (Apple App Store for iOS operating system and

Google Play Store for Android operating system) and best pregnancy application reviews of popular technology and pregnancy websites were gathered. Among these, applications compatible with both iOS and Android operating systems were listed and the application number was reduced to 35. Subsequently, those applications were re-examined in detail considering their features and related wellness dimensions that they could address and support (Appendix H[5]). It was seen, with no wonder, that almost all applications aimed at supporting physical wellness first, which was inherently accompanied by intellectual wellness to expand pregnancy-related knowledge. Nonetheless, when the applications addressed more than two wellness dimensions, they were incorporated herein. Figure 26 summarizes the selection criteria of all apps.

All three apps had upgraded versions and those upgraded, some of which were paid, versions were utilized in the study in order to eliminate any problems that participants would encounter in the free versions. Also, upgraded versions included more diversified features which would be beneficial to collect more insights. In the case which the selected applications were not free, these were the *BabyBump Pregnancy Pro* apps for iOS and Android, participants were refunded with the required amount of money.

As the study spread over many weeks, certain unplanned changes occurred regarding the applications. *My Pregnancy Today* application stopped working in the midst of one participant's study (P11). The application developer was contacted to notify the problem and to find a solution. However, as the application did not start working after few weeks, other pregnancy applications in both Apple Store and Google Play Store were considered to be used in the place of the problematical one in order to maintain the continuity of the entire study. As Figure 26 demonstrates*, I'm Expecting Pregnancy* app was chosen which comprised of similar selection criteria with *My Pregnancy Today*. Clearly saying, it had the most approximate features such as weekly pregnancy videos, selfie snaps, to-do list, etc. Correspondingly, a new set of application card was prepared to be presented to the participants (Figure 27).

[5] The application reviews were till the end of 2014, as data collection started in December 2014.

Another change during the course of the study was about the cost and compensation of the paid application, *BabyBump Pregnancy Pro*. At the beginning of the study the application was $3.99 in Apple Store and 6.60TRY in Google Play Store, so the participants who had selected this app were compensated with these amounts (10TL). Nonetheless, afterwards the application became free in both stores. To inform, during the study of 5 out of 9 participants who selected this application, the application was paid.

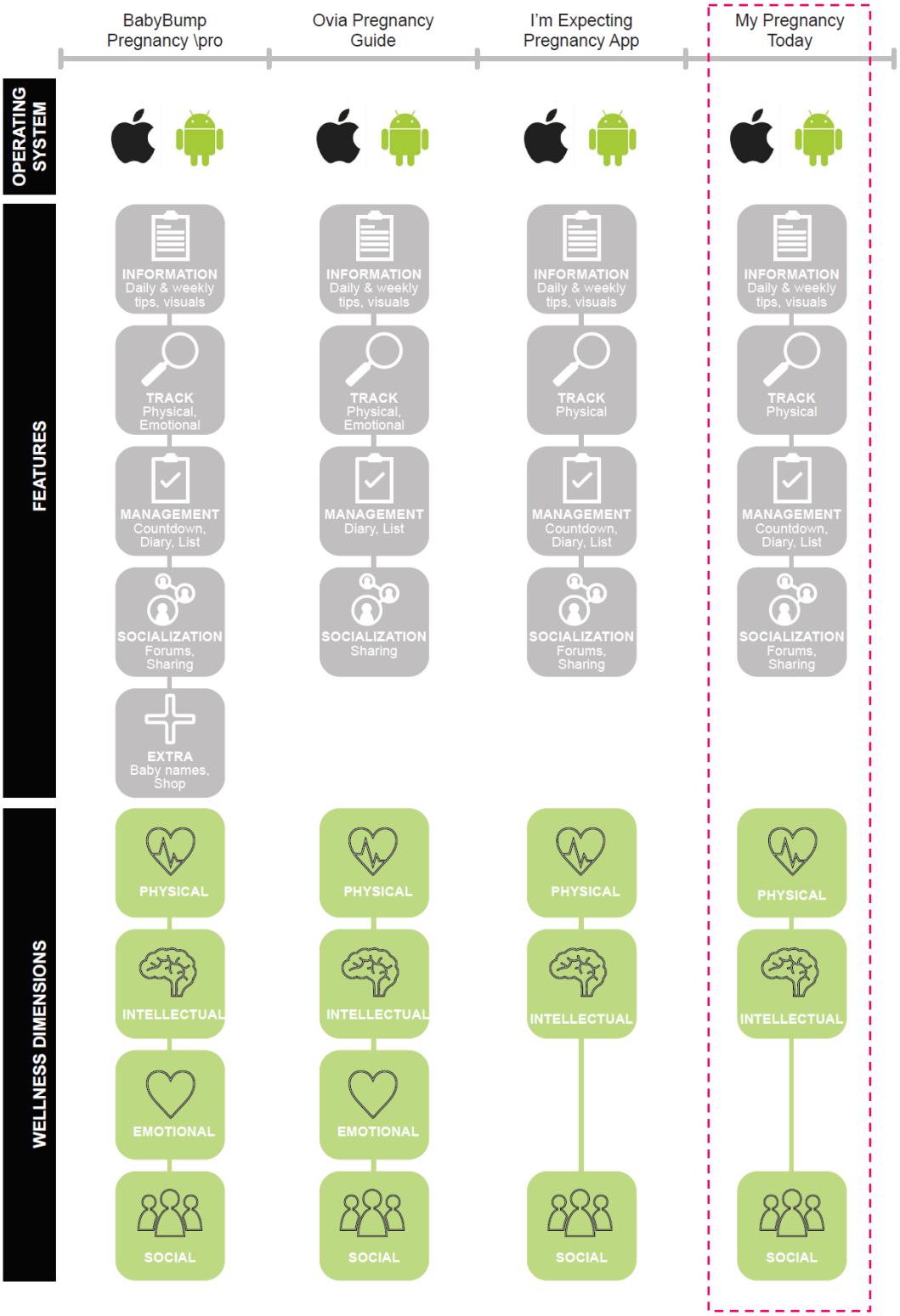



**Figure 26.** Selection criteria of the applications showing also the substitute for the nonworking application

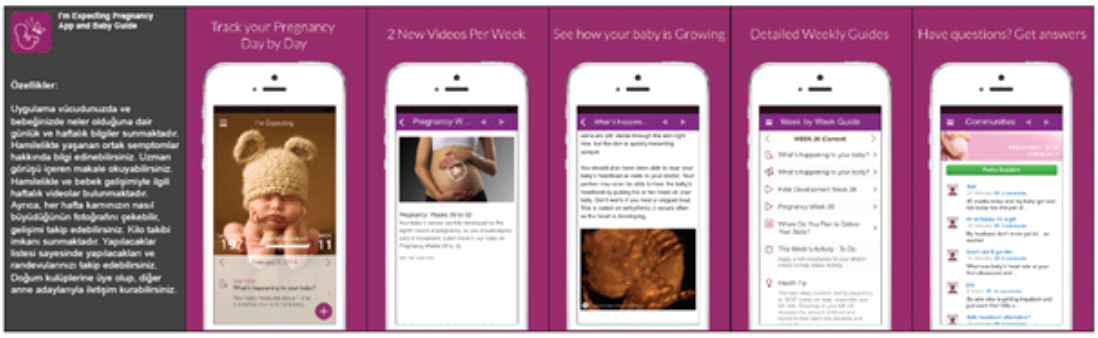



**Figure 27.** Application card: *I'm Expecting Pregnancy* application

### 4.1.6 Measurement Instruments

As above mentioned, in total three different scales were used in the first and last stages of the user research for understanding the participant's propensity to use technological products and their current well-being states (see Appendix D for the Turkish and Appendix E for the English version of the scales). It is important to highlight that scales were not central in the methodology. They were used as a supportive exploratory tool to better comprehend and interpret the collected data—if they would be applicable and beneficial—not to determine participant profile or to pursue quantitative analysis as a main data analysis method. All of the three scales, namely Technology Readiness Index (TRI), Satisfaction with Life Scale (SWLS), and Scale of Positive and Negative Experience (SPANE), were used in the first stage to draw an initial frame that might differentiate pregnant women types. From all three scales, SWLS and SPANE were included in the final stage to find out whether there occurred a change in the well-being of the participants.

#### *4.1.6.1 Technology Readiness Index (TRI)*

Abbreviated version of the TRI was utilized to understand the propensity to adopt, embrace and use new technologies. The TRI intends to represent a gestalt of cognitive enablers and prohibitors that collectively determine the participant's propensity to use cutting edge technologies (Parasuraman, 2000). Parasuraman indicates that the scale has powerful psychometric qualities and can segment participants into distinctive categories.

The original full item scale has 36 items and the measurement is done on a 1-5 Likert scale (1-strongly disagree, 5-strongly agree). Subsequently, Parasuraman, & Colby (2001) condensed the TRI into ten items which involve 1-7 Likert scale (1-strongly disagree, 7-strongly agree). The abbreviated version was preferred in the scope of this dissertation considering its unified convenience, effectiveness, and relevance as a supportive tool in this study.

The original language of the abbreviated TRI was in English, so its translated version in Turkish was given to the participants.

#### *4.1.6.2 Satisfaction with Life Scale (SWLS)*

Apart from the scale to understand the participant's relation with technological products, other scales were used to comprehend their wellness conditions. Actually, as there is no single and acknowledged definition of wellness and related concepts such as well-being and happiness, there are multitudinous scales to understand and measure diverse concepts in positive psychology literature. However, as well-being is mentioned to be a multidimensional and quantifiable concept, and as it is significant to consider both cognitive and affective aspects, two different scales aiming at measuring those cognitive and affective aspects were utilized hereby.

Firstly, SWLS was chosen because it measures the global life satisfaction, i.e. the overall evaluation of the person's life, which was the cognitive component of subjective well-being (Diener, Emmons, Larsen, & Griffin, 1985). Hence, it implicates a judgmental procedure depending on participants' own authentic criterion group (Shin & Johnson, 1978). As it is the overall evaluation, it does not indicate specific issues in life like economic status or health status; yet, it lets participants weigh and incorporate diverse issues as a whole (Pavot & Diener, 1993). In addition, it has outstanding features compared to other subjective well-being scales as it is able to retrieve reliable data merely with few statements (Pavot et al., 1991). Approximately just a minute is enough to fill in the scale (Diener, 2009). Being short and practical was also important in this study, in addition to its reliability, due to not create too much burden for pregnant participants.

More in detail, the scale is composed of five statements about which participants mention how much they agree or disagree by giving points on a 1-7 Likert scale (1-strongly disagree, 7-strongly agree). So, resulting scores can range from 5 to 35. The higher scores refer to higher life satisfaction.

The original version of the SWLS is in English; but, it has translated and validated version. Hence, Turkish version was used in the study (Durak, 2009a).

#### *4.1.6.3 Scale of Positive and Negative Experience (SPANE)*

Though cognitive components of subjective well-being are in close relation with affective components, the SWLS results cannot be directly used on behalf of measures related to emotional well-being. Pavot and Diener (2009) emphasize that the SWLS should be used as an adjunct to other scales that measure affective components of subjective well-being. Therefore, second scale, namely SPANE, was incorporated to evaluate participants' well-being. In short, whereas the SWLS focuses on the cognitive component of subjective well-being, the SPANE deals with the affective component of subjective well-being. The SPANE provides overall affect balance score as well as measuring positive and negative affects separately (Diener et al., 2009).

More specifically, the scale is composed of 12 items. Six of these refer to positive feelings and the other six items refer to negative feelings. Among positive and negative item sets, three of each are generic such as negative, positive, good, bad, pleasant, unpleasant; and three are more specific such as happy, sad, afraid, joyful, angry, and contented (Diener, 2009). Those generic items are powerful to evaluate whole diversity of positive and negative experiences, even the particular feelings in different cultural contexts. In addition, the scale embodies other conditions such as engagement and flow, too (Diener et al., 2009). Each of the 12 items is assessed with a 1-5 Likert Scale (1-never, 5-always). Total positive score (SPANE-P) and total negative score (SPANE-N) may be between 6 and 30. The overall affect balance score (SPANE-B) is calculated by deducting the negative form the positive one. Hence, the SPANE-B can be between -24 and 24, the minimum representing the possible unhappiest situation and the maximum showing the possible highest affect balance (Diener & Biswas-Diener, 2009).

The original version of the SPANE is in English (Diener et al., 2009); but, it has translated and validated version. Hence, Turkish version was used in the study (Durak, 2009b).

## 4.2 DATA ANALYSIS

This section conveys the procedures followed for the analysis of the study. As comprehending positive user experiences thoroughly is of top priority, qualitative data analysis formed the backbone of the analysis.

### 4.2.1 Grounded Theory and Content Analysis

Data analysis started with the transcription of the interviews all of which had been voice-recorded. As there were 33 participants and 4 interviews for each, approximately 132 interviews (considering a drop-out solely in the last interview due to early labor) were transcribed in total into Microsoft Excel sheets. Grounded Theory fed and content analysis underpinned the qualitative analysis of these transcribed raw data.

Grounded Theory is a methodology introduced in social sciences by Glaser and Strauss (1967) to inductively derive theory from the systematic analysis of data. Contrary to traditional and positivist approaches where an already existing theoretical framework is the departure point of the research and where data is collected to test and demonstrate how the initial theory applies to the studied phenomenon; Grounded Theory starts with a simple research question and the collection of qualitative data. While examining the data, codes are assigned to repetitious thoughts and statements. By continuing to collect data and re-examining the collected data several times, codes are grouped into concepts and categories. Finally, categories become the grounding of a new theory; in other words, a new theory grounds on the data collected (Backman & Kyngäs, 1998; Glaser & Strauss, 1967; Strauss & Corbin, 1998).

Content analysis is also a method to systematically analyze and code data in order to achieve coherent, valid and replicable interpretations and inferences through huge volumes of qualitative data (Bogdan & Biklen, 2007; Jupp & Norris, 1993; Krippendorf, 2004). It resembles to Grounded Theory; but, it can be both inductive and/or deductive. While analyzing data, if the codes are not taken from an existing

theory or literature and emerged from the data, it has an inductive nature. Nevertheless, if the codes are implemented from an existing theory or literature, it has a deductive nature.

In this study, transcribed qualitative raw data were analyzed considering Grounded Theory and content analysis. To manage chunks of data during content analysis, as suggested by Bogdan and Biklen (2007), the gathered data was firstly read through to identify the recurring patterns. After this close reading, meaningful segments were focused on and codes were assigned to them. This process was followed by thematizing which was generating themes; in other words, higher level of codes, out of these initial codes. In short, all these codes constituted the concepts, or namely dimensions, retrieved out of the participants' comments. Specifically, recurring patterns and meaningful segments in data were scrutinized bethinking possibility driven and positive experiences. These meaningful segments constituted the main positive user experience dimensions with m-health technologies for pregnancy. General scheme and inductive coding were used since there were no exact pre-determined codes in the literature about positive user experiences and pregnancy related experiences; yet, certain codes had been familiar from the general user experience and HCI literature. The process was iterative and cyclical. While the coding process was ongoing and new dimensions were appearing, a glossary of terms table, compiling relevant design qualities and constituting exact coverage of each different dimension, was prepared to achieve coherency and reliability in the assigned codes (see Appendix I). At the end of this content analysis, 2220 statements and 3421 dimensions were retrieved. Statements refer to the participants' comments.

Besides, the analysis was relational. Dimensions were coded keeping the cause-effect chain. That is to say, not merely one-level conceptual analysis was performed; in fact, it was sought to go beyond individual dimensions in order to make sense of data and in order not to lose rich underlying meanings. These dimensions were started to be organized in a way to answer the research questions of the study without losing the relationships in the collected data. Among the total 3421 dimensions, 2402 dimensions were in mutual relationship (1201 affecting + 1201 affected) and 1019 dimensions stood alone without being in any cause-effect relation.

Different Excel sheets were devised with slightly different coding structures regarding research questions with diverse focal points. Concordantly, participants' raw comments about pregnancy technologies and applications were written and content analyzed in the first sheet involving coding categories about technologies and applications that participants were talking about, their features, affecting dimensions that affected other dimensions and dimensions that were being affected from other dimensions, and positivity and negativity of these features. These comments were retrieved mostly from the answers for the questions about application usage experience, expectations, and suggestions. Moreover, trade-offs between dimensions were highlighted with red when available (Table 5). This initial content analysis yielded the major positive user experience dimensions with these technologies as mentioned above.

**Table 5.** Coding example about dimensions of positive user experience with pregnancy technologies and applications

| P# | Raw Data | Mentioned Feature | Affecting Concept | Affected Concept | Pos./ Neg. | Technology |
|---|---|---|---|---|---|---|
| P32 | First of all, it should reflect its trustworthiness properly because I can get the information from various places anyway. Also, lots of research is being done and with just a single study a very well-known cliché information can suddenly become invalid and untrustworthy. May be it may ground its content to scientific researches rather than generic verbiage. For instance, doctors can enter information. | Scientific quality of the provided information, Being reliable | Being scientific | Reliability | (+) | Pregnancy applications (General) |
| P22 | Besides, the provided information hits the mark, at least on me. When something sticks to my mind and when I am thinking whether it is normal, a notification comes saying that I can encounter such things and that those are very probable and normal. It is relieving. I do not imagine the worst when I encounter those symptoms. As I heard, lots of people become anxious regarding these symptoms. | Parallel progression of symptoms with the provided information, Being relieving | Consistency with pregnancy | Relieving quality | (+) | Ovia Pregnancy Guide App |
| P33 | They put the photos of babies in which they are very diminutive and also their small hands and feet are on a drip. Of course, you become sad and anxious when you see a baby as such because you feel as if that baby is yours. It would be less negatively effective and more beneficial if they had provided negative information about premature babies without any photos. | Providing visuals for negative content, Having negative influence | Visuality | Relieving quality | (-) | Ovia Pregnancy Guide App |

Then, components of pregnancy technologies and applications which had taken part in those experiences were elaborated on. On this closer inspection, different components and related subjects were uncovered and coded in relation to the positive user experience dimensions (Table 6). To make it clear, primary components appeared as

content, interaction, appearance, and function. What these components were about constituted the subject part; which appeared as baby, mother, socialization, nutrition, organization, diary, shopping, exercise, birth, postpartum, medication, and miscellaneous diversionary topics, in addition to the general pregnancy topic.

**Table 6.** Coding example about detailed components of pregnancy technologies and applications

| P# | Raw Data | Mentioned Feature | Component | Subject/ Topic | Affecting Concept | Affected Concept | Pos./ Neg. | Technology |
|---|---|---|---|---|---|---|---|---|
| P32 | First of all, it should reflect its trustworthiness properly because I can get the information from various places anyway. Also, lots of research is being done and with just a single study a very well-known cliché information can suddenly become invalid and untrustworthy. May be it may ground its content to scientific researches rather than generic verbiage. For instance, doctors can enter information. | Scientific quality of the provided information, Being reliable | Content | Pregnancy | Being scientific | Reliability | (+) | Pregnancy applications (General) |
| P16 | I liked Ovia because it has some features about diet and nutrition. I think I saw this application before, but did not download it most probably because it does not have too many visuals. This is so plain like a book. It can present visuals about nutrition. | Not providing visuals about nutrition | Appearance | Nutrition | Visuality | | (-) | Ovia Pregnancy Guide App |

In another Excel sheet, participants' comments about changes in their daily life after pregnancy were analyzed involving coding categories about the mentioned change, resulting change, positivity and negativity of the change, and related pregnancy period (Table 7). These comments were received mostly as an answer for the questions about daily life changes after pregnancy. Thereby, content analysis in this final Excel sheet revealed the substantial change types according to pregnant women in different trimesters, which may imply qualities of wellness during specific trimesters. Regarding the content analysis of changes (separate from the number of the major dimensions), 875 statements and 1445 dimensions of change were obtained. Among these total 1445 change related dimensions, 1140 were in pairwise relationship (570 affecting + 570 affected) and 305 of them stood alone without being a cause or effect of any other change (see Appendix J).

**Table 7.** Coding example about changes in daily lives of pregnant women

| P# | Raw Data | Affecting Changes | Affected Changes | Pos./ Neg. | Pregnancy Period |
|---|---|---|---|---|---|
| P11 | Another interesting thing, my belly has started to grow in the last week. Similarly, my breasts've enlarged too much. I'm feeling as if I'm a little girl entering puberty. I really need to go to a psychologist. I'm constantly trying to cover my belly. I am aware that it's a strange and unnecessary concern, but I'm in a different pschology. | Physical (Belly and breast grow) | Emotional (Psychological support need) | (-) | 1.trimester |
| P17 | Sleep is very compulsive. That is, the urge to sleep very early and state of waking up too early… There is such a change in my sleeping routine. This affects my daily life because when we are with our friends, suddenly I feel drowsy, then I stand up and go home no matter where I am. | Physical (Sleep need, Change in sleeping hours) | Life Style (Social life changes, Interruption of social activities) | (-) | 1.trimester |
| P21 | It also affected my work performance. When I am working, I even forget a very simple computer tool that I am using regularly. | Cognitive (Memory impairment) | Work life ( | (-) | 2.trimester |
| | | | | | 1st pregnancy |

### 4.2.2 Hierarchy Ranking

In addition to principal qualitative analysis, quantitative analysis approach to qualitative data was designated for evaluating, interpreting, and communicating findings from immense and dense qualitative data.

After content analysis, frequencies of the codes pertaining to positive user experience dimensions, components of technologies, demanded topics, and so on, were counted and put in a hierarchy order. They are presented throughout the following chapters and sections with related visualizations (e.g. Figure 28, 31, 32, and 33).

### 4.2.3 Network Analysis

As mentioned in the foregoing ‘Content Analysis’ section, the analysis was relational and involved cause-effect relations. The content analysis was beneficial to uncover

pairwise relations. In the meantime, resulting dimensions were sometimes reasons of the other dimensions; i.e. some causes were also effects of some others. So, most dimensions were actually in multidimensional relations. Multidimensional relations were investigated with the NodeXL open source network exploration, analysis, and demonstration tool (Smith et al., 2010).

The NodeXL works as an add-in to Excel and augments its capabilities by bringing functions about analysis and demonstration to a conventional spreadsheet (Smith et al., 2009). After entering dimensions in the NodeXL as pairs, it analyzes their frequencies as a network and creates network graphics which not only reveal multidimensional relations, but also visualize entered dimensions' frequencies, relations' strengths, and so on, with line and shape thicknesses, sizes, and if desired with proximity relations. In this study, it was used to provide a holistic understanding about positive user experience dimensions with mobile pregnancy technologies by putting forth the broad picture (see Figure 29). In the visual output, the sizes of the circles represent the related dimensions' frequencies. In a fashion similar to this, the thickness of the lines represents the frequencies of the corresponding relationships. Since there were numerous relationships, cut-off value of 5 was applied, not including the relationships when they had been mentioned less than five times. Each of these dimensions is explained in the next chapter.

### 4.2.4 Cross-Impact Analysis

The Cross-Impact Analysis (CIA) is a method focusing on relations between pairs of instances/factors, which was introduced by Gordon and Helmer in 1966 with the aim of speculating about future scenarios and minimizing uncertainty about how the future situations would look like, and thus, to be well-prepared for them (Gordon, 1994). As there are pairwise factors, relations are causal, too. In the CIA, conventionally, experts and decision makers are inquired about probabilities of variables that create scenarios, which are then operated to understand the scenarios' probabilities (Villacorta, Masegosa, Castellanos, & Lamata, 2014). Lately, the CIA has been utilized for answering diverse range of research questions either as a stand-alone method or as an embedded method that can integrate diverse qualitative and quantitative methods (Gordon, 1994). Application areas of the CIA method has pushed back the frontiers of

future forecasting scenarios and has covered various areas such as collaborative risk mitigation (Bañuls, Turoff, & Hiltz, 2012), aviation, military intelligence, strategic decision making by using game simulations (Duin, 2007), design and user research (Kuru, 2015).

An impact matrix helps to do calculations and evaluations systematically, which is called the Cross-Impact Matrix. To put in a nutshell, in order to create a Cross-Impact Matrix, a list of variables is identified initially. Then, those variables are listed both from top to down on the left-side column of a matrix and from left to right on the top row of this matrix. After, probability of the impact of one variable on the other is written in each cell which is the intersection point of rows and columns regarding the variables in paired relationships.

In this dissertation, required steps to conduct Cross-Impact Analysis in design discipline for analyzing qualitative user research data were followed by consulting to researches of Töre Yargın (2013) and Kuru (2015). Accordingly, affecting dimensions and dimensions that were being affected, which were obtained at the end of the content analysis, were counted by keeping the cause and effect chain. Within this context, aforementioned variables correspond to the main positive user experience dimensions with m-health technologies for pregnancy. Also, values written in the cells correspond to the number of relations between the dimensions; in other words, numbers in the cells of the cross-impact matrix are equal to the frequencies of the related paired dimensions. These cause and effect relation calculations were performed on a matrix in Excel (Appendix K).

After filling in the matrix, frequencies of the dimensions involving stand-alone dimensions which did not have impact on other dimensions were converted into percentages to prevent data reduction and to achieve accurate data distribution. Converting frequencies; i.e. number of statements, into percentages brought about more reliable results because all values were aligned in the same standardized level. Using these percentages, a grid was formed to understand and convey the centrality of the dimensions during these relationships (Figure 30). The grid has four areas: critical, active, passive, and buffering (Kuru, 2015; Töre Yargın, 2013). The critical area normally consists of dimensions which are both affecting other dimensions and are

being affected by them. In other words, dimensions that fall in this area are both ways to achieve other things and end goals to attain a satisfactory experience. The active area is about the dimensions which have major impact on the others. While affecting others, they are less affected by them. They constitute the ways to realize a satisfactory experience. On the contrary, the passive area involves the dimensions which are influenced by the others; thus, they can be inferred as the end goals. Lastly, the buffering area is composed of the dimensions which are minimally affecting and are being affected from the others. It is crucial to underline that this does not connote the insignificance of the dimensions falling in this area. Actually, they are also important and have to be kept in mind to attain a satisfactory experience; yet, their impact on the perception of the interaction is not too high. They might be both end goals and/or ways to achieve other things.

All emergent relations are presented in the succeeding chapter.

### 4.2.5 The Design Well-Being Matrix

In addition to the aforementioned main analysis methods, the Design Well-Being Matrix (see Figure 17, p. 72) in positive design literature, which is explained in Chapter 3, Section 3.4.1, was utilized at the end of the entire analysis to interpret and demonstrate the featured design possibilities in a communicable way as happiness inspiring design descriptions (see Figure 37, p. 187).

# CHAPTER 5

# POSITIVE USER EXPERIENCE DIMENSIONS WITH MOBILE PREGNANCY TECHNOLOGIES

This chapter presents the major findings of the study based on the conducted analyses. Primarily, qualities of mobile pregnancy technologies are revealed by focusing on positive user experience dimensions and their conceptual relationships based on hierarchy, multidimensionality, and centrality. Also, in addition to positive user experience dimensions, mobile pregnancy technologies' components and subject matters are explained. Secondly, changes in pregnant women's daily lives, which characterize prevailing qualities of wellness during pregnancy are shown. To note, daily life related findings are given after introducing the dimensions, technology components, and subjects in this chapter in order to prepare a substructure and initial understanding while matching those daily life changes with positive user experience dimensions and other issues. Conclusive interpretations of and implications about the findings are done in the next chapter, by answering the research questions.

## 5.1 QUALITIES OF MOBILE PREGNANCY TECHNOLOGIES

As mentioned in the data analysis section of the foregoing chapter (Chapter 4, Section 4.2.1), all data were examined thoroughly in order to prevent data loss and reduction, to keep every meaningful and rich inference, and so, to go beyond the limited and problem oriented characteristics of mobile pregnancy technologies in m-health literature. To remind, 2220 statements and 3421 dimensions were retrieved in total with content analysis, which were based on the frequencies of the participants' statements. Herewith, underlying all these data, 35 different dimension categories were elicited as main positive user experience dimensions with m-health technologies for

pregnancy. Definitions of the dimensions are explained in detail in Appendix I, with the purpose of not impairing the integrity and flow of the dissertation with elongated explanations.

In the related sub-sections, Figure 28 reveals the very short equivalent evocative definitions of the 35 dimensions while presenting their hierarchy ranking. Figure 29 demonstrates the overall multidimensional relationships. In Figure 30, criticality of the dimensions is delivered.

### 5.1.1 Results of the Hierarchy Ranking

The hierarchy ranking in Figure 28 reveals the statement amount of each of the 35 dimensions sequentially with respect to frequency order from the most frequently mentioned one to the lowest.

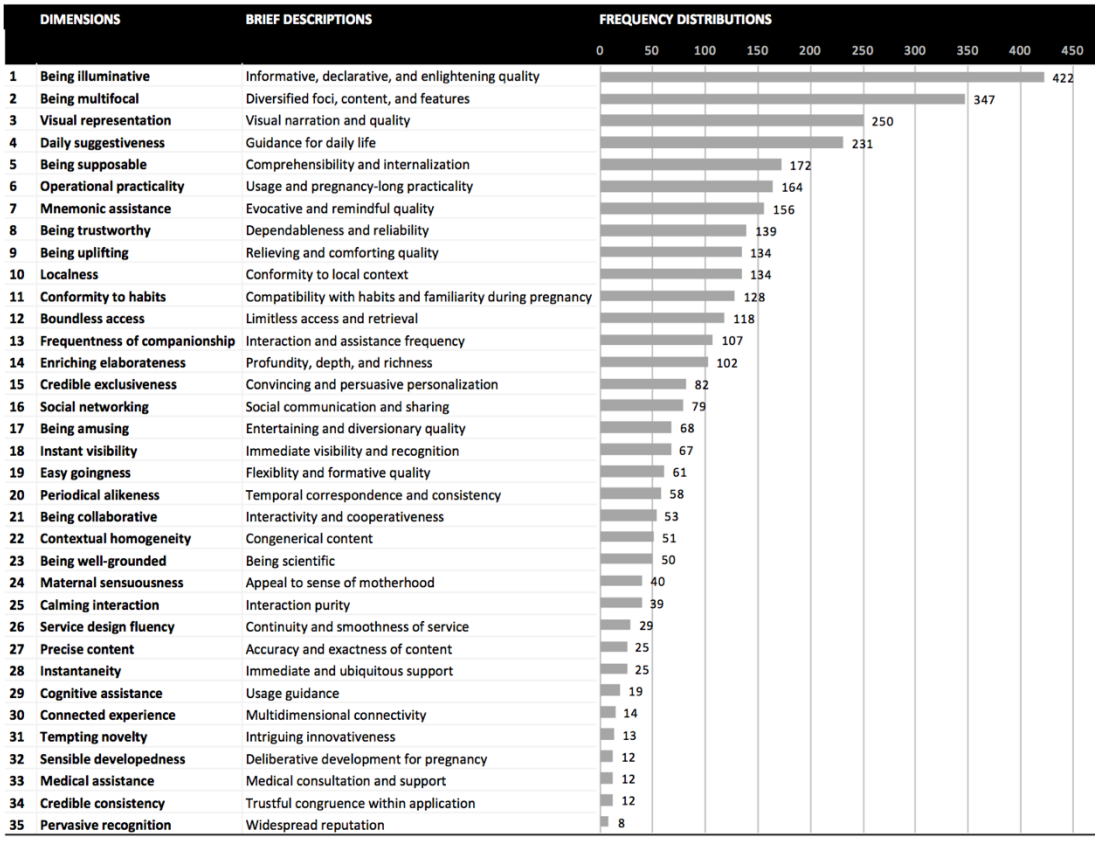



**Figure 28.** Hierarchy ranking of the positive user experience dimensions based on their frequencies

This ranking is clearly self-explanatory and conveys an initial idea about the dominancy of each dimension. Following sections also include explanations about the most dominant dimensions, apart from the explanations in Appendix I, and prominent relationships; hence, relevant relational explanations are treated below.

### 5.1.2 Results of the Network Analysis

As explained in the 'Data Analysis' section of the 'Methodology' chapter (Chapter 4, Section 4.2), binary data; i.e. dimensions in cause-effect relationships, which had been obtained at the end of the content analysis were investigated as a network with NodeXL to see their multidimensional relationships. Figure 29 reveals the relationships of all dimensions with each other. In the figure, as the sizes of the circles represent the frequencies of the dimensions, they are parallel with the findings demonstrated in Figure 28. Hence, the frequencies of the dimensions are not explained hereby; distribution of them and the strength of the bonds between them, which is visualized in Figure 29 as line thicknesses, are touched upon. Due to intricate and outnumbering relations, the most remarkable ones are discussed in this section.

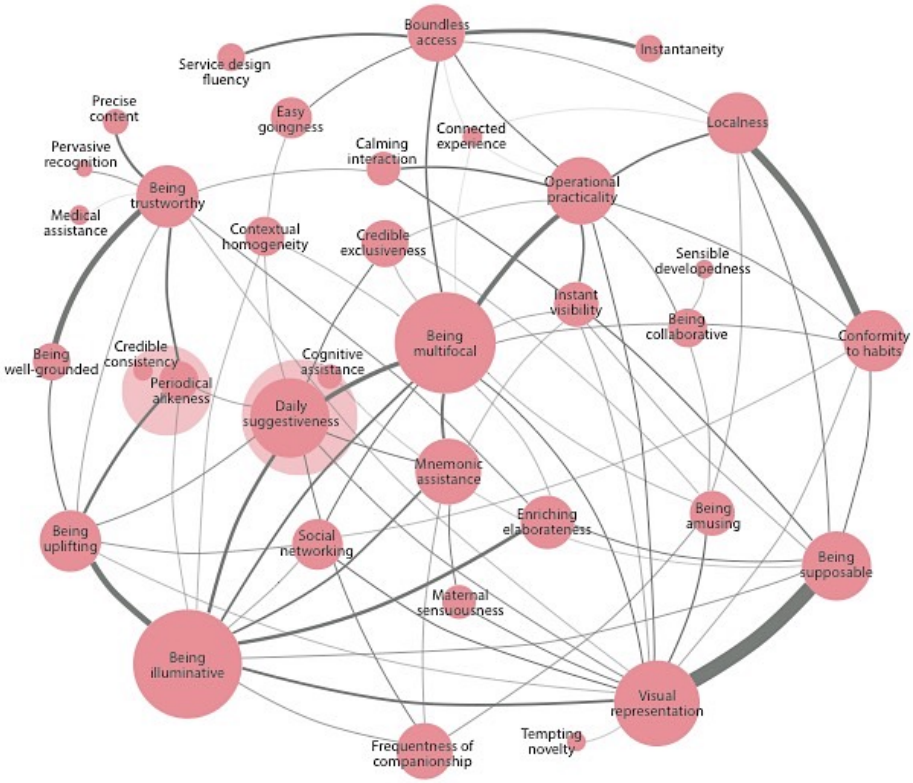



**Figure 29.** NodeXL map demonstrating the relationships between the dimensions

The most powerful relation appeared between the **visual representation** and **being supposable** dimensions. Those dimensions were also among the most frequently mentioned dimensions. This finding is meaningful since proper presentation of visuals considering their style, quality and quantity was expressed to make the provided features and content more supposable; that is, to carry them beyond being comprehensible and to help their internalization process. There were some nonidentical dimensions which affected or were affected from each of them; but, were in relation with certain prominent dimensions: **being illuminative, conformity to habits,** and **instant visibility**.

Second most eye-catching relation was observed between **localness** and **conformity to habits**. Local features and content were crucial for the participants to be able to apply those in their own pregnancies. To illustrate, when the provided information about nutrition and menu suggestions were specific to other cultures, it was not possible either to find those food on their local market, to cook with their current knowledge, or even to taste due to not finding it compatible with their usual practices. Another example could be given about medical procedures. When participants encountered warnings and suggestions related to doctor control, medication intake, etc., that were not local, they found them again as not conforming to their habits and hard to perform in their cultures. All these hindered the integration of the given information and the application in daily lives of the participants. As can be seen in Figure 29, both localness and conformity to habits were in relation with **being supposable** and **operational practicality** dimensions. When mobile pregnancy technologies were local and conformed to habits, they were perceived as more supposable and practical.

Another strong bond emerged between **operational practicality** and **being multifocal**. Participants asserted that mobile pregnancy technologies involved more than one focal point both as content and means for utilizing certain features, it became more practical to find a proper way to understand the content and conduct the desired action. Hence, these two dimensions facilitated not only their experiences with mobile pregnancy technologies, but also enhanced their life quality during pregnancy by lessening their effort allocated to learn and apply new things in the unfamiliar

pregnancy period and by providing versatility in novel daily routines. Each of these dimensions was also among the most frequently requested dimensions because of being in relation with many other dimensions as Figure 29 demonstrates. Similar dimensions that were in either cause or effect relationship with operational practicality and being multifocal dimensions were **conformity to habits, boundless access,** and **instant visibility**. All of these dimensions were fundamental to facilitate information retrieval and applying the information in daily life.

**Being illuminative** and **being uplifting** had a strong connection, as well. When participants' awareness increased with enlightening information, they felt relieved. **Daily suggestiveness** was highly in relation with both of these dimensions, because when mobile pregnancy technologies supplied daily tips and suggestions apart from factual and descriptive information, it raised their awareness and boosted their morale.

Last but not least, **being well-grounded** and **being trustworthy** were highly linked. Being trustworthy was a crucial dimension for the participants considering mother and baby health. When mobile pregnancy technologies convinced pregnant women about providing scientific information by referring to doctors and grounding on theoretical information, they gained trust. **Precise content, medical assistance,** and **pervasive recognition** were other dimensions which should be mentioned to achieve trustworthiness though they were not mentioned directly linked to being well-grounded dimension.

### 5.1.3 Results of the Cross-Impact Analysis

After looking at the multidimensional relationships, centrality of the dimensions was examined and demonstrated on a grid, which can be seen in Figure 30.

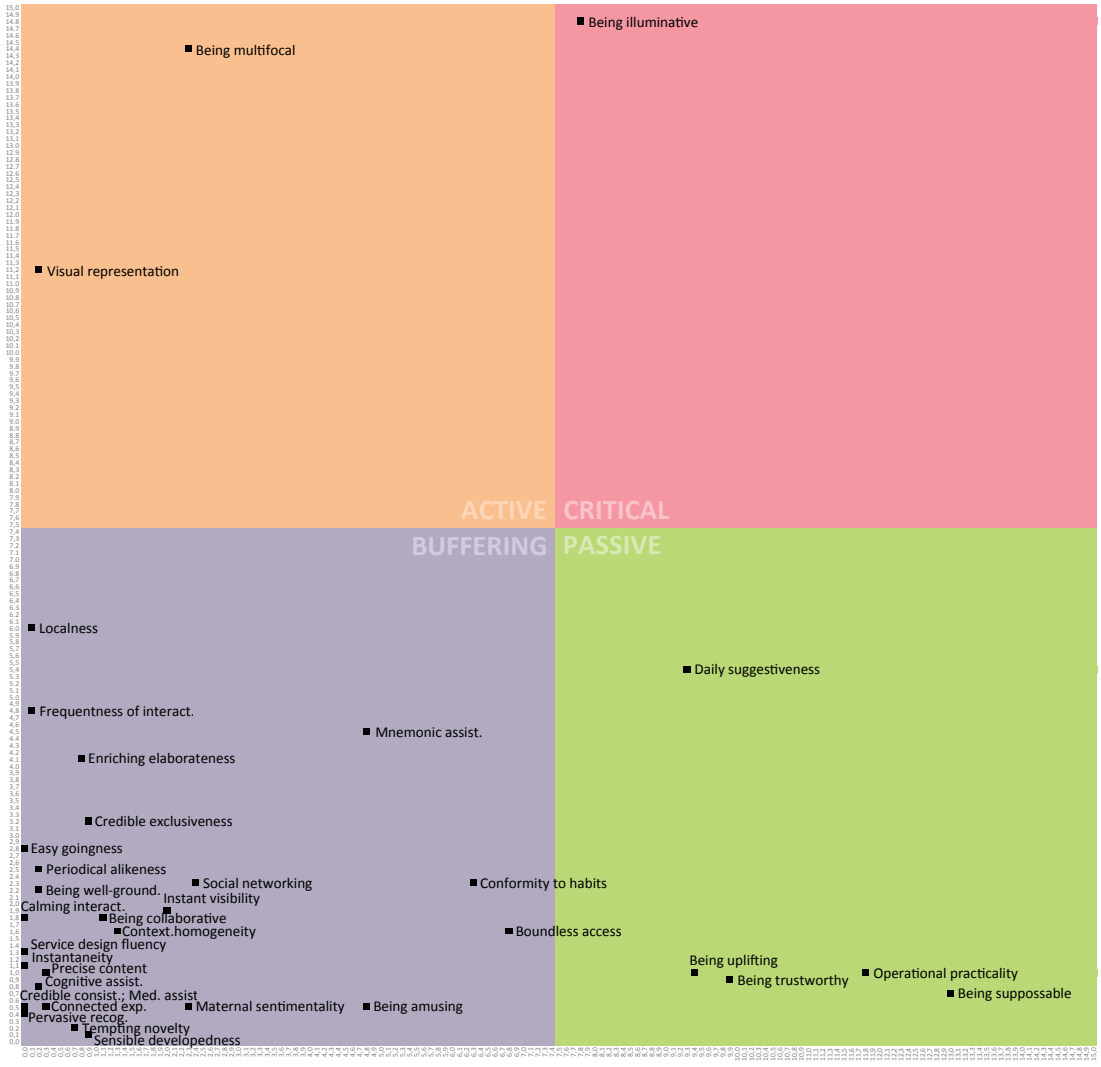



**Figure 30.** CIA grid demonstrating the centrality of the dimensions

## Critical area

By taking into account the dimensions which were both affecting other dimensions and were being affected from the others, the most critical dimension showed up as **being illuminative**. This is in parallel with the hierarchy ranking of the dimensions based on their frequencies. No wonder, as pregnancy is a critical period pertaining to mother and baby health, participants were in need of being fed intellectually from many resources to enhance their knowledge and awareness. Despite the fact that the prior support was demanded from participants' own doctors and other resources were used as supplementary and secondary sources, most of the participants mentioned that mobile pregnancy applications were crucial and advantageous for information flow

during daily life. They highlighted that although they trusted their doctors, the durations of and intervals between the doctor controls sometimes remain insufficient to obtain detailed information and also they sometimes felt uncomfortable to raise certain questions to their doctors. However, it should be noted that being illuminative was not a stable dimension bethinking the nature of the critical area in the cross-impact grid. As this area involved dimensions which were both affecting the other dimensions and were being affected by the others, the being illuminative dimension was prone to impact and fluctuation. Hence, this dimension should be handled carefully and unconditionally by the designers and content generators of the mobile pregnancy technologies.

**Active area**

Looking at the active area it can be said that the **being multifocal** and **visual representation** dimensions were the major influencer concerns. Yet, they were less affected from the other dimensions. There were several underlying reasons. First of all, the visual language as well as diversification in features, content, and interaction were the most easily noticeable and perceived qualities; thus, their perceptions were the cause of many other dimensions. Although participants used their selected application for weeks and their comments were not just about a single initial experience, those qualities affected how they interpreted their entire experiences, because as aforementioned participants usually gathered information from diverse resources and those qualities highly made distinction among other resources. Considering the prolonged usage weeks, being multifocal responded to diverse and dynamic needs of pregnant women (information retrieval, tracking, sharing, and shopping about diverse topics with diverse interactions) in different trimesters. Moreover, as pregnancy is not related only to mother, but also to baby, participants were in need of qualities regarding those two entities, which positioned the being multifocal dimension in the active area of the cross-impact grid. Furthermore, as pregnancy and the growth of a baby in mother's body were emphasized as a disparate, unusual, and intangible experience, visual representation of the pregnancy concept and pregnancy related issues were of great significance, affecting the perception of the other dimensions.

**Passive area**

**Being supposable, operational practicality, being trustworthy, daily suggestiveness,** and **being uplifting** fell in the passive area of the cross-impact grid. This means that they were greatly affected by the other dimensions and were dependent on the realization of other dimensions during experience with mobile pregnancy technologies. These were situated in this area as they could be directly or indirectly associated with assorted means of how information was retrieved, understood, internalized, and used during pregnant women's daily life.

**Buffering area**

Buffering area constituted the most crowded area in the grid. As previously mentioned, although dimensions in this area were minimally affecting and being affected by the others, they were noteworthy blinks that should be considered to raise the importance of mobile pregnancy technologies. This increment in the number of dimensions was partially due to the fact that some extensive dimensions had been divided into smaller dimensions during the content analysis to better understand the underlying values behind the experiences and to guide the design of mobile pregnancy technologies prolifically; even though this means sacrificing from higher-level compact dimensions. That is to say, diversified prosperous issues rather than some generic dimensions were of great importance to generate possibilities considering the aforementioned issues and to make those mobile pregnancy technologies more indispensable. Many dimensions were situated too close to each other; nevertheless, **localness, mnemonic assistance, conformity to habits, boundless access, frequentness of interaction,** and **enriching elaborateness** appeared slightly distinct from the others. When priority should be given among the dimensions in the buffering zone, those could be considered.

### 5.1.4 Relations between Positive User Experience Dimensions and Components of Mobile Pregnancy Technologies

After dwelling on positive user experience dimensions with m-health technologies for pregnancy, these dimensions were analyzed considering the related components of the

technologies. Components which took part in those experiences were coded and categorized as content, interaction, appearance, and function. Figure 31 presents the distribution of positive user experience dimensions among each component according to the number of statements. In the subsequent section, after explaining each component, outstanding dimensions are expanded on and exemplified in relation to the component in question.

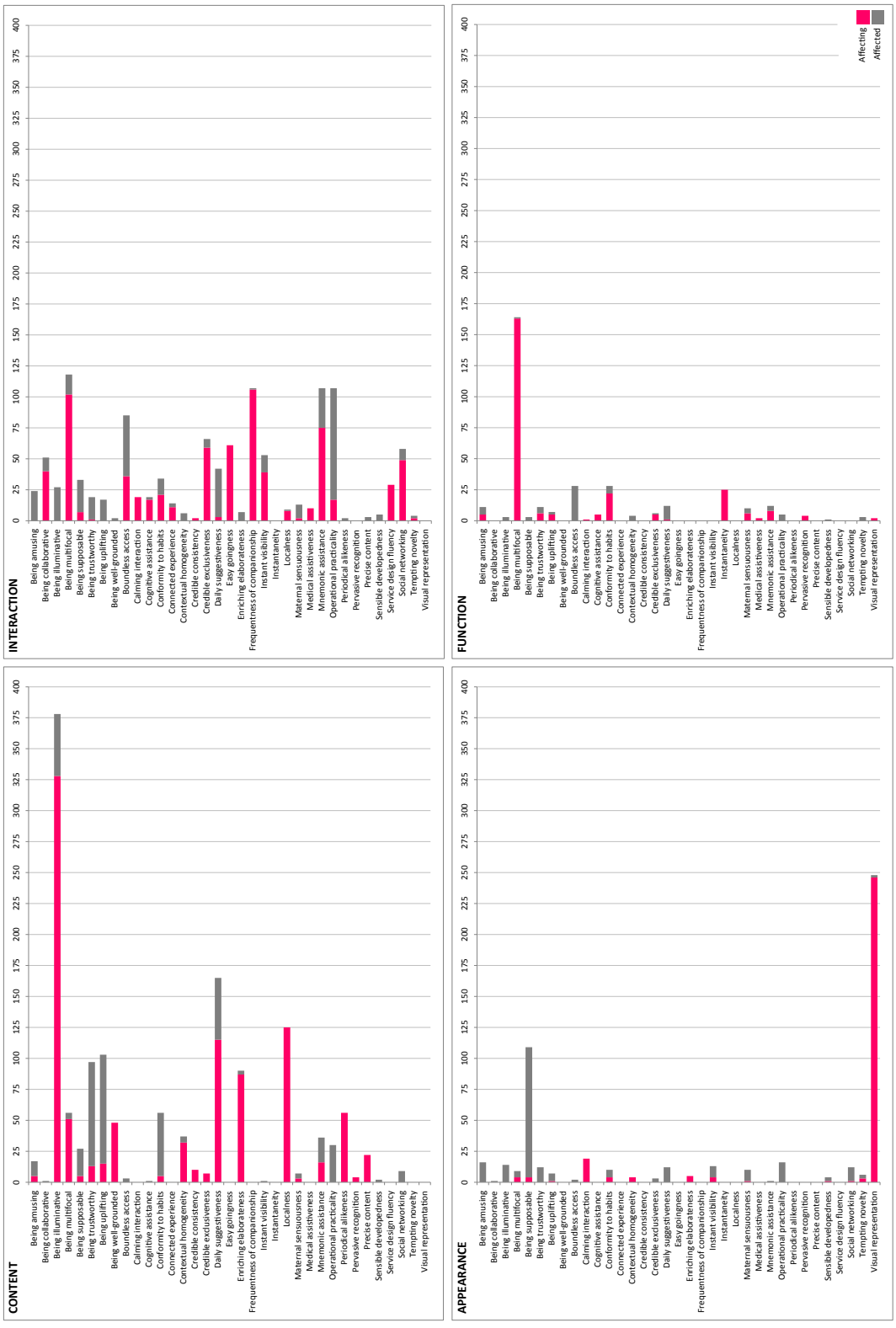



**Figure 31.** Distribution of dimensions among the components of mobile technologies, depicting cause-effect proportions of individual dimensions

#### *5.1.4.1 Explanations of the Components*

**Content**

As can be inferred from the component names, content encompassed contextual and informative qualities of the mobile pregnancy technologies. Contextual qualities were the most frequently mentioned ones. There were 1388 dimensions related to contextual needs, expectations, and suggestions.

Meaningful and illuminative information about diverse topics such as nutrition, exercise, pharmaceuticals, pregnancy changes, symptoms, baby development, shopping, fraternal relationships, and so on, were demanded most frequently as content. It is no wonder the contextual qualities were not solely about the subject of the content. In fact, how information was transferred, understood, and felt were also of great significance, which enclosed the mode of articulation, phraseology, and expression style. As can be seen from Figure 31, apart from **being illuminative, daily suggestiveness, localness, being uplifting, being trustworthy,** and **enriching elaborateness** were highly noteworthy dimensions in providing satisfaction with the application content.

**Interaction**

Interaction was about the overall qualities and experiences regarding how pregnant women interact with the mobile pregnancy technologies. Interaction related statements were outstanding, too. There were 1153 dimensions concerning how pregnant users used application functions, menus, content, etc., and how they navigated through all these qualities. Particularly, **being multifocal, frequentness of companionship, mnemonic assistance,** and **operational practicality** dimensions should be taken into consideration for having more positive interactions.

**Appearance**

As it might be guessed, appearance was about mobile pregnancy technologies' qualities related to visual appeal. In all, 533 dimensions belonged to appearance. The presence or absence, quality, and appropriateness of visuals were uttered for visual

appeal. Dominantly the **visual representation** dimension, followed by the **being supposable** dimension were consideration points for visual appeal.

**Function**

Function category was about the presence/absence of certain or multitudinous functions, their capabilities, and potentials. 347 dimensions were directly about the functions. The **being multifocal** dimension received the greatest attention from the participants in regards to the functions of the mobile pregnancy technologies. Although not as prominent, **boundless access, conformity to habits,** and **instantaneity** were other leading dimensions to develop more pleasing functions.

#### *5.1.4.2 Subjects of the Components*

All of these components revolved around particular subjects. Frequency of participants' comments about different topics, be it a content, interaction, appearance, or function related component, are presented in Figure 32. Out of total 2220 statements that also included general pregnancy or experience issues without subject specifications, 1282 of them had specific subject matters as follows: baby, mother, socialization, nutrition, organization, diary, shopping, exercise, birth, postpartum, miscellaneous, and medication.

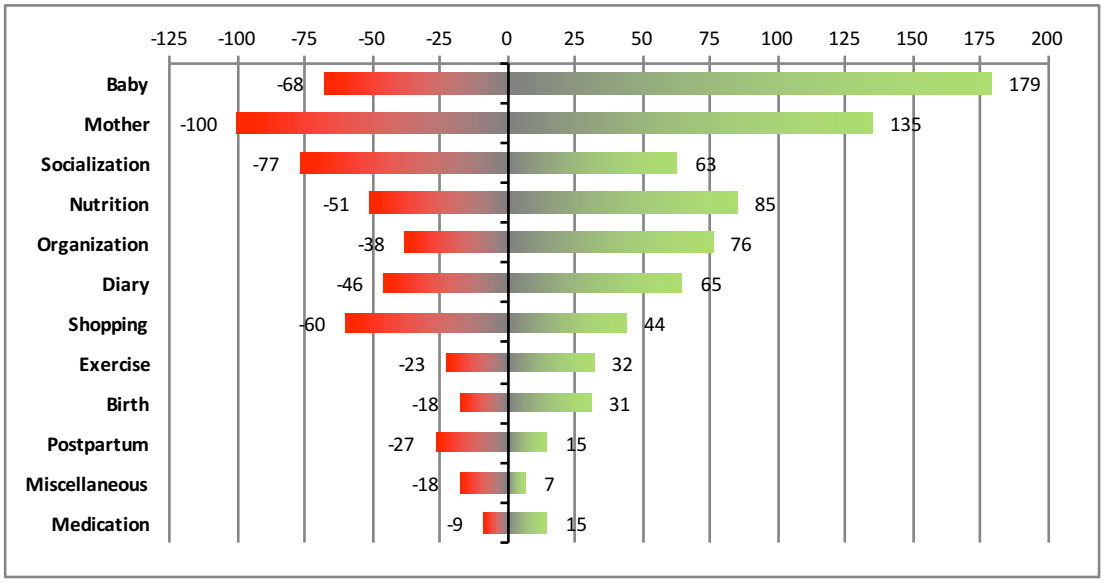



**Figure 32.** Participants' comments about the subjects of all components

Below, components of mobile pregnancy applications and their relationships with pregnancy related subjects are scrutinized as they harbor design implications about the characteristics of mobile pregnancy applications generating happier pregnancy experience. Hence, outstanding positive and negative issues are exemplified in succession with inspiring and envisioning quotes from the participants.

**Baby**

Among the total 2220 statements, 247 were specifically baby-centered. This implies that participants mostly paid attention to baby development issues. 179 out of these 247 statements were favorable comments and 68 were unfavorable.

- In the matter of **content**:

Presence of information about monthly, weekly, or daily baby development and baby size was of great significance, which was perceived positively by all pregnant women. Especially for the first-time mothers, frequentness of baby-centered information provided in the first trimester was highly crucial. Also, doctor controls were not enough to follow changes in baby. Hence, such information was advantageous for following the growth and feeling relief. Besides, baby related information strengthened the bond between mothers and babies. Apart from these, analogies used for describing baby movements took positive comments because of forming a clearer estimate in mind.

> "You always want to go to the hospital to see how your baby is, but of course this is impossible. In this respect, following information from here puts your mind at ease. You can check his/her phases… But, as there is an incessant curiosity as you cannot see inside of your tummy; you want to see that information weekly, daily, and even as soon as you wake up every day. Daily baby information is good in this sense. You do not have to wait for a week. It is like learning new things every day." (P27)

> "A doctor told me to remind myself three times in a day that I am pregnant. It is realized by the baby related information given from this application. I am pregnant, a baby grows inside me, there is a living thing in me; but, I cannot see. But, information given by this application says that the baby squeezes his/her palm, blinks his/her eyes, hiccoughs, and yawns; and it creates the perception that you are pregnant. I mean, you start to think that it is a fetus; yet, in time, with such growth phases and movements, it will become a human. According to me, it intensifies the bond with the baby." (P24)

> "It describes the baby movements. For instance, it refers to butterfly movements and mentions about twitching muscles. It makes you rethink. It is good in that sense." (P16)

However, frequency, subject, and depth expectations from baby related information were changing depending on participants' trimesters and unique pregnancy experiences. Due to getting familiar with many things as time passed by and feeling more relieved and confident after getting over the most unfamiliar and risky first trimester, participants were not in need of continuous daily information about changes in their baby. Hence, after a time, some participants got bored of detailed developmental information, though they still remained curious about their current baby size. Nonetheless, as their birth approached, some of them were again in need of a little more baby developmental information. Other negative comments were about imprecision in information about baby measurements.

> "The thing I have noticed about pregnancy periods is that your interest in such programs dwindled away as time progresses. Excitement and curiosity at the beginning starts to change. Also, as baby growth is the fastest in the first period, you want to follow that period more frequently… At the very first information I felt so excited. It was a very sensational issue at that period. But now, it does not arouse the same feeling." (P26)

> "Baby information, weights, heights, etc. are a bit contradictory. They are not very reliable, but they more or less give an idea." (P03)

- With respect to **interaction**:

Positive and negative comments on baby focused interaction qualities addressed mostly the presence or absence of monotonous, mostly passive, interaction qualities. Participants wanted to interact with baby related features, visuals, and content in a more interactive way, such as playing with baby visuals to retrieve more information and being able to change and personalize themes, colors, and frequencies of the baby-specific content depending on the baby's gender and growth or the mother's current mood. Besides, interactive tracking features for baby kicks, which recorded the amount and frequency of the kicks by clicking on a button, were mentioned to facilitate counting, documenting, monitoring, and sharing them with doctors compared to writing them on a paper. Nonetheless, the kick counter was used by several pregnant women in the third trimester as baby kicks were more perceivable and frequent towards birth, and when doctors found following kicks critical mostly in risky cases.

A few other participants in the prior trimesters tried and found its interaction easy and pleasing, too.

> "Instead of static photographs demonstrating a baby in a mother's womb, articulation points are added on these photos. A point is added on brain and when you press on that point it gives detailed information such as 'This percentage of brain development has finished, your baby can hear and see now'. Other points are added on arms and stomach. When you touch on those points it says 'Your baby's bones have developed and more calcium intake is being observed nowadays'. This interaction is very nice. We have looked at those pictures with my husband. We played with them and amused ourselves… The images can be clicked, zoomed, and interacted. I wish there could be such enjoyable interactions in other places, too." (P11)

> "Baby sizes are shown with reference to fruit images as a default setting. I have just noticed the 'pick a theme' button and then started to play with it by changing themes frequently. For example, there are unfamiliar and interesting animals or sweets and cakes from pastry shops. I find it very funny and humorous to change the baby size theme." (P16)

> "I do not use the kick counter now, but tried it once to learn how I can use it when necessary. Directly after clicking on it, it marks and displays the kick's time, date or specifies intervals and frequencies. Its interaction is quite easy and pleasing… I can use it comfortably in my last trimester." (P27)

Besides interactivity, more flexibility in interaction was expected instead of being restricted to access desired feature or content only on current pregnancy weeks. It was expressed that being able to compare baby development in different weeks would facilitate the comprehension of the progress. Participants also wanted to hide certain baby related features and content which might demoralize them or which were too specific for or unrelated to their pregnancies or trimesters (e.g. twins, premature babies, gender specific features and information, etc.). Furthermore, generic feedback and notifications about babies were disliked by a few participants. Especially in the first pregnancies and trimesters, participants propounded feedback and notifications as if they were coming from their own babies, triggering maternal sensuousness. Considering the last trimester, although several women appreciated recording baby kicks with just clicking on a button, a few participants did not find manual entry of the kicks practical and logical, even with a single button, especially when counting kicks were not crucial for their pregnancies and their doctors did not ask them to do so.

> "You can see baby development from the first week to the end. Yet, each week is separate. You have to click every week one by one; there is no other way of interaction. Once, I clicked on the back button by mistake and it started from the very first week. This means that whenever you give a break and want to pick up where you left off, it

> is impossible… You have to do one by one from the start. Also, it works very slowly and transitions between each week are very slow. That's why, it freaks me out. I can't immediately reach the week I want." (P17)

> "It can send me a notification saying 'Hello mom, now I grow this much', which would wake me up cheerfully. During new pregnancies you usually forget your pregnancy. Especially at the time you wake up, you don't think that you are pregnant; after time passes you start to think about it. Now everybody wakes up with an alarm and uses his/her mobile phone as soon as waking up. So, it would be a happy start to a day if I see a message coming from my baby telling his/her daily progress." (P27)

> "Interaction with the kick counter is not practical and logical. I cannot open the application and count the kicks every time I feel my baby's kicks. Firstly, I do not want to spare neither my physical nor mental effort to record it. Secondly, I may feel the kicks during work or when my phone is not near me. So, how can I use it?" (P06)

- In regard to **appearance**:

Suitable visual references to familiar and pleasing things attracted the attention of the participants and helped them to form an estimate of what was happening to the baby inside their bodies. To illustrate, demonstration of weekly baby size with reference to fruits, vegetables, animals, bakery, and games were appreciated. Especially, being able to visualize the baby's weekly hand size in womb compared with the hand size of a 9 months old baby was found intelligible, interesting, and innovative. As mentioned while explaining the indirect social networking dimension (see Chapter 5, Section 5.1.1), such visuals aroused the interest of fathers and friends, too, which seemed to increase their attention, participation, and help during pregnancy. Except for baby size designation, realistic three dimensional graphics, ultrasound images, and videos demonstrating baby development and position in womb were perceived more positively in comparison with caricaturized and schematic visuals.

> "The application shows as which animal size your baby has grown every week. I definitely take its photo, send it to my husband, and share how much our baby has grown. Immediately, I search it in Google to learn what kind of animal it really is. Searching such curiously is really enjoyable and I adore those visuals… It's good to share it with him." (P24)

> "My husband has developed a great interest in this application very recently when he saw different visuals of the baby size. He keeps looking at the visuals carefully. He is now really curious about such things in my pregnancy." (P11)

> "As the baby grows, the small pink hand will fill in the final hand size. I really like the idea behind it. Seeing any baby's hand measurements would not normally make too much sense; but, seeing its gradual increase visually inside an outlined reference frame is very creative. I like that creativity. It is really different than other baby size

> information. That visual implementation makes me think that the application is innovation oriented." (P32)
>
> "Three dimensional baby story shows different states of a baby inside mother's womb week-by-week. Actually, I do not see my baby in that much detail even in my ultrasound controls and even my doctor zooms in. Here, I can retrieve information at least about the formation of a baby's fingers, etc. Those visuals give more detailed information and I can understand better." (P17)

Negative comments on the baby topic in regard to appearance of mobile pregnancy technologies were mostly about the absence of good quality and aforementioned visuals; or about the presence of incomprehensible, disproportional, and ugly visuals. Improper appearance affected the understandability, legibility, pleasantness, and professional perception of mobile pregnancy technologies. Sometimes very realistic bare embryo pictures influenced participants negatively, especially during the first trimester. Also, though color usage was generally requested to ameliorate dense textual information, only proper versicolored interfaces with baby visuals were found trustworthy and convincing.

> "I don't like the visuals used for weekly baby progress because to tell the truth that baby seems very yellow and is depicted like an alien. It looks bizarre and ugly. If they want to use realistic visuals, they can use pretty and real images. I mean, there can be any other more proper visuals. If it is hard to find something, ultrasound images can be suitable. As I said, both the colors and shapes are problematical. The tone of the yellow is very bad." (P22)
>
> "Baby images make me sick. At this time [during the first pregnancy, the first trimester] it is like that. Thinking about birth does the same thing, too... Considering baby images, I am not interested in baby health now. I mean, I read about the Down syndrome and such; but, what I constantly wonder about is what will happen to me weekly." (P11)

- About **function**:

A few participants touched upon new baby-centered functions in addition to plain baby information. Additional apparatus and sensors to augment functionalities of mobile phones were suggested to collect or show baby's conditions, which might accompany new content, appearance, and interactions, as well. Among the suggested functions were hearing the heartbeats and seeing the current condition and position of a baby.

> "I wish there could be a function showing my baby's current state… It can be a more novel technology than present technologies. Actually, there are sensors that are attached to mobile phones which can measure a person's blood pressure. There could

be such additional sensors or small ultrasound devices... Besides, those measurements could be saved and received as an output. Also, it would be nice if explanations could be integrated about those findings." (P24)

**Mother**

235 out of 2220 statements were specialized to changes in pregnant women. Majority of mother-specific statements were about tracking physical and psychological changes in the self. 135 statements were positive; whereas, 100 statements were negative. Information and monitoring features about weight, symptoms, contraction, sleep, and mood were included herein as they are directly related to the physical and psychological changes in pregnant women.

- Appertaining to **content**:

Majority of the participants articulated that information about pregnancy related changes and symptoms was among the most frequently needed content. When they read about what was happening to their body and also to most pregnant women, they were relieved from most of their concerns because of normalizing what was unfamiliar to themselves. This appeared to be important even in multiple pregnancies as participants emphasized forgetting the details of what they had lived in their preceding pregnancies. Yet, more significantly, knowledge from prior pregnancies could be updated and disconfirmed in health literature due to continuous researches and novel medical findings. Moreover, rather than reading solely factual and descriptive information about mother related changes, participants were pleased with being guided by directive information which involved suggestions about how to cope with those changes, behave in accordance with them, and feel more uplifted. Furthermore, information presented as a result of collecting personal data and tracking mother-specific changes, in addition to contents of feedbacks, supported the positivity of participants' experiences when they were able to make sense of it. So, for mother-specific tracking features, pregnant women demanded directive and suggestive information rather than numerical or descriptive data, as well, which would serve the function of a personal coach.

"I like tracking changes in my body considering both my and my baby's weight because I become too self-conscious while gaining weight. I constantly want to do

> something in case I gain too much or too little. The application gives information about my weight. But most importantly, it guides me about necessary things I should beware of and about their consequences after gathering and analyzing my data." (P01)
>
> "Daily information about changes in me is enough. Although this is my forth pregnancy, information about what would happen to me slips my mind. When it says 'Now you can encounter cramp-like symptoms which are normal in these weeks, I feel that everything is going fine. It is good to remember such information because two years have passed since my last pregnancy and I do not remember these things… Also, medical information is continuously and expeditiously being updated; thus, what I knew before might be disproved now." (P02)

In a similar fashion, contents of mobile pregnancy technologies were not liked when they gave general information without a coherent, causal, and conclusive inference. Therefore, poor qualities of mother related content, such as deficiencies in causality relationships, flow, comprehensiveness, and congruousness of the provided content, negatively affected participants' interactions with mobile pregnancy technologies.

> "I would never enter my symptoms one by one. I am not such a person. There might be other people who would do, but I am too lazy to… May be, I would use if I know which purpose it serves. It can deliver information imparting cause and effect relationships. For instance, it can refer to symptoms firstly, and then can explain what I have done, and so, what has ensued. Let's assume that I had a stomachache and I did something to recover, as a result of which I recuperated. In such circumstances, it can give me conclusive information about what happened to me, what I did, and how it ended up. It would be very logical; but, there is nothing like that now." (P16).
>
> "It gives information about what is happening to me, but it is not sufficient. Let's assume that I have a headache and the application gives information about headaches in these weeks; this is okay, but what should I do now? It does not give information to mothers about how to overcome mother related changes. I still need to consult other resources." (P29)

- Considering **interaction**:

Majority of the comments about mother-specific issues were related to tracking; and hence, naturally addressed interaction qualities. Positive utterances varied around divergent interaction qualities. Firstly, data input to mobile pregnancy technologies carried those technologies beyond being passive information resources in the eyes of most participants. In other words, when participants collaborated with technologies about changes in their physical and psychological states, they felt more active during management of their pregnancies. Being active made interactions more enjoyable and game-like, as well. In addition, tracking features made participants think that utilized technologies were exclusive to them and ultimately they elicited more trust. Secondly,

feedback took the center stage during interactions with tracking features. Tracking features were found more meaningful when feedbacks were given as an alarm or sent as a notification to warn pregnant users if mother related changes crossed or were close to the borders of reference ranges. Concordantly, participants were able to be more attentive to these changes or took required actions to deal with risky or undesired situations. On the side, feedbacks acted as a reminder for not forgetting data input. In consequence, data collected by tracking features constituted a pregnancy archive, about which most of the participants were satisfied. Participants highlighted that collected data could be very useful particularly during doctor controls to elaborate on raised issues when necessary, or during next pregnancies to remember or compare personal changes. Similar to the comments about baby-specific tracking features, tracking features related to mothers were mostly perceived practical and pleasurable when one click on a mobile phone's screen was sufficient to enter data, such as interaction with contraction timers that were targeted for the final weeks of pregnancy.

> "This application [BabyBump Pregnancy Pro] seems to be the most developed one. I think it is more active because you enter certain information. May be, others have active features, too; but, what I feel is that the others present more general and descriptive data." (P03)

> "It becomes more enjoyable [with entering personal data and tracking it]. I mean, even weight tracking action becomes amusing. Weighing each day is at issue, and typing your weight in an application and seeing it converts it to a game." (P31)

Negative remarks about interaction qualities of tracking features were also about data input, feedback, and retrieval. Considering data input, participants wanted more flexibility and personalization in entering or selecting more detailed information unique to their pregnancies, and designating the most meaningful and pleasing icons or themes for them. Besides, tracking features were found useless when they did not let data entry about passed dates and give any feedback. Moreover, failure in reaching archived data left a very negative impression. Lastly, transmission of the tracked data and its conclusive results to doctors in critical incidents, and even to spouses in daily life, was uttered as a lack by few participants.

> "I liked the visualization of symptoms with icons and colors with a calendar, but I cannot make classification about different types of cramps. For instance, cramp in the calendar is about vaginal cramps, but I frequently have cramps in my feet. When necessary, I should personalize the readily provided categories. Also, I cannot add

very distinct symptoms which are not very typical for other women. It can be more flexible, so I can feel that this application is more special for my pregnancy." (P23)

"I did not like the restriction of data entry to the exact week. I started to write my weight later on because I noticed that function lately. I tried to add my initial weights as I was keeping their records in Excel, but it did not let me to do. I really wanted to write it here and felt sad because it could have been like an archive. Excel might be deleted sometime; yet, I could have kept the information here." (P14)

"A warning could be nice. Let's say I am overweight. When I gained more weight than normal weight gain range, I could receive an automatic warning notification indicating certain measures that I would take. That is to say, it could send me a notification as both a warning and information. This notification could be either seen on the phone screen or sent as an e-mail depending on its extensiveness…" (P13)

"When there is a critical change in my body and health, the application can automatically send my data to my doctor. Then, if there is a really adverse condition, my doctor may contact me and guide me to take the necessary actions…" (P24)

"I was using the mood tracker at the beginning, but then gave up. I do not find it logical since it does not send the changes in my mood to my husband. It could be more beneficial and meaningful if it sends how energetic or bad I feel on that day to him. So, he can understand me. For instance, if we have a fight, he might understand that I am feeling touchy today…" (P21)

- With regard to **appearance**:

Visualization of tracked data was beneficial to easily notice changes and interpret ongoing trends regarding mothers' bodily and mental changes. Graphical displays, visual categorizations, overview diagrams, and synoptic calendars got positive reactions from the participants. Qualities related to appearance affected participants' perceptions and trust towards mobile pregnancy technologies.

"Weight tracker is nice. It enables weight management… Figures used in the Baby Bump application are more contemplated and well-conceived because weight graph and other graphical representations give an impression that the application carries out an analysis in the background. It seems logical. I mean, I like these visuals." (P12)

"Visualization of the entered symptoms on a calendar is very nice. There are different symbols and colors for different symptoms. When symptoms accumulate, I can see everything and notice each symptom's density on a single calendar. Seeing how many red circles or purple stars would be more pleasing than reading a written report." (P23)

Congruently, negative comments about the appearance of tracking features referred the absence of comprehensible and conclusive graphical representations.

"It does not deliver any graphics after entering data. It could have been meaningful if it created a graph with the data I had entered. Graphical representations are beneficial

> to see the progress. Seeing what I have done can motivate me. It would be possible to make interpretations about myself. I like such things because a pregnant woman encounters with utterly different experiences about her body. That's why, every single clue can help her to make interpretations. Graphical representations can facilitate the association of information with the self. The purpose of entering personal data is making observations and interpretations about the self at the end." (P16)
>
> "It is now just like reporting mood. If it had provided a graphical visualization of my mood, I would have used it. It would have attracted my attention if a graphic was demonstrating the increase in my happy moments, then decrease in my fearful situations, fluctuations related to my excitement, or again increase in my fears towards the birth… It would have been really enjoyable to see all my feelings and their changes. Think that fear hits the peak point on a graph, it could have been funny. But now, it is just textual names of the feelings…" (P08)

- Regarding **function**:

Paying regard to the sea change that pregnant women pass through—not even bethinking the diverse trimesters, but even focusing on a snapshot in their weeks—almost all participants expressed their pleasure when mobile pregnancy technologies incorporated multiplicity of functions targeted at diverse changes within themselves. Along with specific functions for pregnancy-long changes in women, inclusion of supplementary functions for general state of mother's health was remarked for the purpose of compactly keeping and readily reaching whole mother-specific information in one archive-like place.

> "There are many functions both for finding new things and evaluating current things. In the mornings, I use several features to receive information about myself and at nights, I use it to document and evaluate my day such as what I did, what I lived… I like that the application does not focus just on one aspect on me. It serves many functions like informing me, tracking me, supporting me, evaluating me… Also, there are both physical and psychological support functions for mothers, all of which works together as a great maternal archive, too." (P33)
>
> "We bought a blood pressure monitor. There is a space in the application to type blood pressure measurements so that we can now write my measurements there. At least, it is neat and compact. I can recall and talk over crucial issues more accurately when I see my doctor." (P07)

On the other hand, a few participants criticized the existence of psychology related tracking functions. Apart from that, some participants suggested enhancements on their mobile phones with an attachment of specific sensors for mothers; and hence, novel functions for physical changes in mother's bodies, which would support their psychology, as well. Novel functions were said to be about detecting pregnancy

symptoms and identifying their reasons. Furthermore, as mobile pregnancy applications did not usually contain more extensive functions related to general health, some participants pointed out potential developments with the comprisal of pulse and blood pressure measuring devices, and other general health related functions in mobile pregnancy technologies.

> "I do not usually like application functions about tracking mood. It tells me to write how I feel now, it is so tacky and nonsense. Why would I write my feelings? What of it? Although it hardly matters, it depends on the meaning a woman assigns to her pregnancy. Some women are more emotional, but I am not a very emotional person. I prefer more rational functions rather than capturing emotions with such technologies." (P01)

> "An additional sensor could detect what is happening to my body. Sometimes I have aches, it would be marvelous if it can detect the causes of those aches. It might give information about my situation. Now functions are not that advanced." (P24)

**Socialization**

There were 140 statements about socialization, 63 of which were positive and 77 were negative. When participants referred to socialization topic, they were generally mentioning about social networking issues via pregnancy forums, clubs, and groups. The comments were revolving around content and interaction. Hereby, there were no statements in regard to appearance and function.

- With respect to **content**:

Even though negative comments were more dominant about socialization subject in mobile pregnancy technologies, majority of the participants who favored it touched upon diversification of content about lived experiences. Advices and guidance of other pregnant women who had recently passed through similar stages were found valuable because certain advices were not found in any other resources. They were found more practicable, as well, as they grounded on real life experiences rather than medical resources. In addition, instances from pregnant women with various backgrounds and countries were found attention grabbing, impressive, and diverting.

> "Reading other women's experiences relieves my mind because firstly I know that other pregnant women live very similar things. Thus, I feel less desperate. Secondly, I can learn alternative opinions. On top of it, solutions of ordinary people like me and you, rather then that of professionals, seem more realistic. In other saying, what

> specialists say can sometimes be very academic or bookish. Yet, other people's comments ground on their own practices and convey different point of views. There can be issues that I might never think of. That's why I like socialization aspects. In addition, I feel them more close to myself because they are women around same age group and they are living similar things. Of course, what specialists say are credible, but performing them in real life is not always feasible. Information in social groups in those technologies are more inside the life, more practicable." (P31)

> "I always read forums to see what diverse women from different places do. It is pleasing because people share their hands-on experiences. In addition to receiving direct medical information from other features of the application, information shared in forums can be more impressive. Even though I merely read what others write, social parts divert me." (P17)

However, the very same qualities about content also appeared to be the fundamental reasons why many participants harshly criticized the socialization issue. A vast majority of the participants harped on about the accumulated experience in social features of mobile pregnancy applications, which created information pollution and consequential worries. Also, information by pregnant women from various countries and cultures sometimes made most of the content irrelevant to the participants.

> "Accumulation of the experiences is beneficial on the one hand, but on the other hand it causes information pollution. You can panic as you see even the extreme cases." (P01)

> "This groups are for making pregnant users communicate with others and socialize… But, I do not find the shared information efficient. Even if I can read English, people from different countries have different cultures, life-styles, and perceptions. So, the information is not very relevant." (P05)

- About interaction:

Favorable statements about interaction related to the socialization topic encompassed the possibility of both active and passive involvement of the users whenever wanted and enablement of interacting with a specified group of pregnant women depending on the selection of an age range, pregnancy period, etc. Many pregnant women uttered that they felt less lonely and more relieved when they shared their own experiences with the others. Several participants emphasized the importance of being able to pose or search a question in a group in an asynchronous way, without chatting synchronously, due to feeling more confident. Apart from directly signing in a social group via an application, e-mail notifications about the latest or the most prominent topics got credit from a few pregnant women, too.

> "Being able to chat with other pregnant women in a reliable platform is very important because during pregnancy you feel lonely. Besides, it is really hard to pass time, so by chatting with others I can feel better. Such pregnancy groups and interacting with humans make such technologies less artificial and more humanized. Even when I was not pregnant I hated artificial intelligence issues and now it is more irritating. Pregnancy is an emotional period." (P21)

> "You can select your community according to your age range. It is not necessary to register if you do not chat actively. I use these communities to read certain questions and other women's answers when something comes to my mind. Especially when being close to the birth, I can retrieve more information from social communities in the application rather than the application's standard briefing about pregnancy periods, because I am now more interested in birth and postpartum issues, not in pregnancy weeks." (P31)

> "E-mails are like summaries of the hot topics and conversations. If I am in front of my computer, I can read them without opening the application." (P16)

In parallel to the aforementioned positive comments about the presence of interactive forums, absence of them received negative comments. In the applications where a few women share their experiences like a single-acting blog, interaction was found deficient. When the interaction was blog-like, it was suggested that the application could be connected to diverse pregnancy blogs on the web and users could rank, grade, and sort those compiled blogs. According to a pregnant woman's interest, the application could notify her when there would be a new entry on the outer blogs. Furthermore, several participants who were joining in pregnancy forums did not like restrictions about sharing content with only specified themes and formats, even though they underlined the significance of certain restrictions due to security and information accuracy. A few participants felt insecure while interacting with other people via the applications.

> "Instead of being like a blog, it could be more dynamic and interactive. For example, I would chat with new mothers and take their recommendations." (P20)

> "It would be more stimulating if it was connected to other blogs on the web. Social features are not connected to outer blogs now. There could be links in the application. Depending on the most favorable ones or the most frequently followed ones, it could give notifications about the interesting issues. It might notify me when there would be a new entry on my pre-selected blogs." (P31)

> "It lacks more stimulating interactions. It does not let me share or search for visuals. If it was like the Pinterest, allowing me to reach content with diversified themes and visuals, I would follow other pregnant women's posts similar to my changing interests… Or if there were two-person dialogues, I would use it more." (P20)

> "I do not want to talk with other women. They have very shallow and ridiculous conversations, like a gossip forum. I do not write anything; but, to tell the truth, I sometimes read only..." (P32)

**Nutrition**

136 out of 2220 statements revolved around nourishment issues. Out of these, 85 statements got positive remarks and the remaining 51 statements got negative judgments.

- In regard to **content**:

Incorporation of content about pregnancy nutrition, safe and unsafe foods, and diet portions was highly outstanding for pregnant women. Nonetheless, as this information was easily retrieved from other pregnancy resources, participants appreciated information which added more on this general information. Information about the reasons for the necessity to (or not to) consume certain types of foods, nutrients' impact on babies' health, and amount of nutritional value in different foods rather than solely mentioning generic nutritional requirement for daily food intake were the mostly admirable dietary information. With such information, pregnant women became more conscious about their dietary actions and also felt more self-confident and sufficient about doing the right thing for their babies, particularly when the provided content grounded on scientific resources. Also, detailed and causal information about nutrition enabled participants to better engage in their current environment. Moreover, dietary information about specific cases, such as during nausea, acid indigestion, stomach bloating, aversion for specific types of foods, etc., was found essential.

> "It gives tells me about which foods contains magnesium, how much I should consume it, or how much I need it daily." (P11)

> "This application [Ovia] says I need iron. The good thing is it also explains what iron makes to my baby. It is good to know which food is useful for what… Of course, I do not claim that I ate a certain thing as a result of which my baby's blood values change in certain way; but, being able to feel supplying the necessary things for my baby's growth relieves me psychologically." (P32)

> "It does not only say only harmful or not for the foods. It gives its reasons. This is important because when I want to eat something at work or in a restaurant, I usually do not have too much time to think, because there are other things going around me

> apart from my own small world. I have to see all these to quickly evaluate whether it is worth eating or not and to continue with the ongoing conversation. (P32)

> "This food safety part in the application serves well for me. I trust it because it refers to scientific explanations. It also gives logical explanations. For instance, it does not say do or do not eat cheese. It tells that soft cheese is risky because it is more suitable for bacterial reproduction. It sometimes specifies cheese names, too. This is great because I sometimes do not remember which cheese is soft. After reading its name and related explanations, I remember." (P32)

> "It is good to know what I can eat when I have nausea. Certain fish types make me worse and even they can be more dangerous for pregnant women, like bottom fish due to heavy metals…" (P22)

Corresponding to the above presented positive comments, negative opinions about the nutrition related content was principally about insufficient information about daily amount of required nutrition and absence of food suggestions in some of the applications. Information deficiency about foods and their corresponding nutritional values in food tracking feature was mentioned, too. Besides, majority of the participants touched upon unsuitability and inapplicability of the the dietary recommendations in their own cultures, bethinking availability of some ingredients in local market, cultural food habits, and religious concerns. Likewise, when they were checking up the safety of local food in from the application, they were not able to find information about some of them. Additionally, one of the participants in the last trimester expressed the inessentiality of dietary information towards the birth even though she was positive about having such content in general.

> "Food content is complicated. When I drink milk, I actually consume both calcium and protein. I have to enter each of them one by one, then I got confused. I found it meaningless. May be, it could be more understandable and meaningful if there was a brief information about which type of food was involved in which category." (P16)

> "It is mentioning about dairy products, protein, etc. As I am working in this domain, I know what each denotes. However, not every one can be familiar with these terminologies. All in all, we know that cheese contains protein, milk also does; but, what the application means by protein is meat and by cheese is dairy products. Egg also contains protein and a pregnant woman can be confused about writing it under the meat category. What else, I know what the application intends to mean by one portion, but other women may not… There should be more explanation about these. For instance, it could say a palm sized meat is one portion, etc." (P24)

> "As it is a global application, I cannot check the safety of every food in our culture. 'Raw meatball [çiğ köfte]' is an example. I wanted too eat it the other day. Of course, I know that the one with the real meat is dangerous; but I wondered about the one without real meat. I thought that even though there was no meat, there might be

bacteria in it. I was not able to find any information about local foods in the application. I had to search it from the Internet for hours." (P32)

"I am not happy about some recipes. There is a salad recipe made with specific ingredients in America. How come I can do that salad?" (P19)

"I find the information about food safety very successful. However, around the seventh month, we know approximately what to eat or not. In fact, we sometimes knowingly consume what we are warned about." (P13)

- Referring **interaction**:

Majority of the positive statements about interaction issues related to the nutrition subject addressed the presence of interactive information retrieval and nutrition tracking features. Almost all women in three different trimesters were pleased with the availability of nutrition tracking. In fact, even though contrary to the aforementioned comment about the decreased necessity of dietary information in the third trimester (see the 'Nutrition' subject, negative comments about the 'Content', P13), a few other pregnant women in the same trimester asserted the significance of frequent dietary tips due to rapid growth of the baby towards the birth. Interaction qualities while accessing, logging, and following nutrition information were crucial to make positive inference. Provision of dietary information in the form of frequent notifications, particularly piece by piece rather than making users read a full text at once; incorporation of links to other resources when appropriate; and offline access to food safety database were the prevailing recommendations about the ways to reach dietary information. Suggestions for data entrance while tracking personal diet was mainly about ticking, selecting, or marking the food and drink intake on a special page, such as marking the consumed food and portion on a pre-designed scale, instead of writing everything one by one.

"Last three months are very critical for nourishment. Now the baby grows very rapidly. Thus, I do not want to skip anything about nutrition. It is beneficial to take frequent notifications and tips…" (P33)

"Actually all dietary information exists in the Internet or other applications. But all information is presented as a whole and I need to pick over. This application [Ovia] sends information piece by piece. When I read and practice the initial advice, then, the second comes. It is more easy to perform and internalize when each information is performed step-by-step." (P24)

"It is good to be guided to other expository websites where relevant. When it is mentioning about calcium, it provides a link directing me to a website about food

> recipes with calcium. If I do not prefer, I do not have to click. But, it extends the information borders in a more selective and trustful way. Directly using Internet search is not the same because there is a mass of misinformation." (P11)

> "Having offline access to the food safety part is very beneficial. It is kind of an always available database near me. Whenever I need to check whether something is risky or not, I use it." (P32)

> "The interface for entering food and drink intake is well-designed. To enter the amount of protein, grain, calcium, water, fruit, etc. consumption, you can easily move a slider on a ruler-like scale. Each interval corresponds to one portion… You do not have to write what you have eaten one by one…" (P24)

Most of the participants asserted that nutrition subject in mobile pregnancy technologies would be more meaningful to maintain a healthy pregnancy when they received feedbacks, reminders, and warnings. Those interactions would make pregnant women perceive mobile technologies as personal coaches and motivators for pregnancy. Pertinent to this, personalization of the nutrition content bethinking individual differences, dietary habits, medical history, specific diseases, present locations, and so on, was found inadequate. Standard dietary notifications brought about feelings of guilt when participants were not able to realize it due to personal conditions.

> "Okay, I can enter what I have eaten, but it should warn me when something remains insufficient. Then, it can tell me about how much more I should eat. The application will serve its dietary purpose when it does all of these." (P25)

> "It can provide nutritional support by explaining what and in which period I should eat rather than being a simple diet plan. Besides, it does not motivate me. For instance, I do not want to eat meat, so I do not enter any meat intake. It can motivate me to eat meat when I do not log any information. Similarly, if I report too much bread, then it can firstly warn me about excessive carbohydrate consumption, and secondly it can persuade me to minimize it by sending well-conceived notifications." (P21)

> "Diet is a very personal issue. I have started to eat unhealthy things during pregnancy which I even do not consume in normal life. When some people or some technologies dictate me what to eat or not, I feel guilty. It blows my top when they warn me about coke consumption during pregnancy, because coke is the only remedy that settles my stomach and enables me to continue my day. There should be options to specify my personal situation and limitations, according to which it can guide me. It should not be that much standard, sharp, and strict." (P02)

> "While entering personal information to sign up at the first usage, applications should ask more detailed questions to provide more customized and special guidance… Everybody has a different story; some women drink alcohol, smoke a cigarette, or have very bad dietary habits, frequently dine out, etc. But, I do not have extra

> conditions to worry… I do not have to regulate certain things. I need different advices. I wish I could personalize it." (P19)

- Appertaining to **appearance**:

Utilization of icons, symbols, and color codes while presenting nutritional information in mobile pregnancy applications was found eye-catching, cognizable, and professional. Diversification of the content by visual alterations appeared to be more critical while presenting information about food safety and giving warnings about insufficient nutrition intake while self-tracking.

> "In the food safety part of the Ovia application, certain texts are colored in red and contain red icons and exclamation marks next to them. It directly catches my interest. If it was plain, it would be more boring and less eye-catching. It is more important to see the forbidden things during pregnancy and without such visual changes, it would be more difficult to check everything one by one. Such visual emphases in specific parts, distinction between texts, paying special attention to visual quality, and adding visuality reflect more professionalism in mobile applications." (P32)

> "I think they tried to simplify food logging by adding food icons on the scale. It is easier to detect food type and their portions with visual references." (P16)

On the other hand, visuals such as graphics and videos were expressed to be missing or lacking inferential quality. Among the recommendations were provision of overview charts, analysis maps, and trend graphics to demonstrate personal dietary progress as a result of tracked data. Moreover, videos related to dietary habits during pregnancy were requested apart from general pregnancy videos.

> "Trend graphs remunerate for your daily loggings. They provide you an analysis of the changes and your progress. With trend graphs and maps, such applications could be very beneficial and assistive. Yes, there are simple graphs to track nutrition herein, but their visual representations are not very successful to make inferences about myself." (P16)

> "Rather than videos in which doctors give general pregnancy briefings, there should be more videos about nutrition and diet issues during pregnancy. Those videos should be enriched with various visuals and content, as well." (P23)

- In the matter of **function**:

Opportunity to track nutrition and availability of food safety indices, in addition to solely draw information, were interpreted as extra functions and almost all participants approached positively to their existence—not considering the above discussed

interaction issues related to them. Tracking function was found substantial for ensuring weight control during pregnancy, as well.

> "There is a nutrition emphasis in the Ovia application with exclusive functions about nutrition. It does not just give information. It is attractive because I have an obsession about gaining weight. Tracking function is effective for weight gain, too." (P01)

> "I love the food index. Such function does not exist anywhere. Rather than searching information from different Internet sites for different food types, I have used the index for smoked salmon, shrimp, sushi, diverse herbal tea, and many other things." (P32)

Although admiring food tracking function, majority of the participants addressed the lack of special calorie counting, water tracking, and daily or weekly menu programming functions. Particularly, water tracking was found very critical throughout entire pregnancy as it is mentioned to be forgotten and to have various influences in different trimesters on pregnancy symptoms, placenta movement, and even labor. In addition to these common suggestions, one participant suggested that mobile pregnancy applications could serve the function of a barcode scanner specific to pregnancy, demonstrating necessary information about nutrition.

> "Apart from tracking the nutritional intake and necessary portions, another functionality could be involved exclusive to calorie intake. I try to keep my calorie calculations in other places like Excel." (P14)

> "I did not notice, but my doctor said in my last ultrasound control that I had not drunk enough water. My doctor saw that my baby was squeezed and was pushing his placenta or amniotic sac. Although I had been drinking water, he warned me to increase its amount to 4,5 liters. This means that water tracking is critical and could be integrated in an application." (P21)

> "Normally, I am not a picky eater; I can eat spaghetti or hamburger each and every day. However, I have to think about what to eat and so what to cook during pregnancy. It is very hard for me to ponder upon what I should eat every day. It is upsetting that those technologies do not offer any function about programming, planning, and suggesting menus. It can make a plan for me for the next day saying that "Now we are in the fishing season and your baby currently needs phosphorus; so, you can prepare this menu for yourself tomorrow… I can also do my planning and shopping accordingly." (P33)

> "Nothing exists like a barcode scanner that is special for pregnancy. It would be great if I could scan an item in the market with my phone and it could provide information about how beneficial a certain item is, how much calcium it contains, how good it is for my baby…" (P31)

**Organization**

There were 114 statements about the organization; i.e. planning and management, subject among the total 2220 statements. Out of these 114 statements, 76 were positive and 38 were negative comments. This subject involved organizations pertaining to medical issues and procedures, and corresponding preparations in social life.

- About **content**:

Many participants felt appreciation owing to information about weekly and/or monthly medical procedures such as routine controls, tests, and scans throughout the whole pregnancy period. Approaching to the third trimester, participants were happy to read advices about hospital choices and policies for the labor, even though they had doctors. Heading towards the birth, content about birth plan, things to ask doctors, and hospital bag preparation was admired. Alongside medical preparations, information about daily life organizations were welcomed, which concurred with medical procedures and phases. Exemplary suggestions were about the special days and inspirational activities, such as baby shower, which took place considering the pregnancy calendar and due date. Considering all medical and social organizations, presence of to-do list and instructions about the remaining days were found valuable, even during the posterior pregnancies, to raise awareness for and assist during process planning and management.

> "It firstly tells my current week and how many days are left. Then, it gives information about what I should do this week, such as 'You are now 21-week pregnant and you have to be vaccinated for the tetanus, have the triple test, etc.' It is good to know when to have these tests and what they are for." (P24)

> "I already have a to-do list from my first pregnancy. I will use it again, but I will also check the one in the application to control and add what is missing. There are lots of things to do especially in these weeks [week 29 and onwards], like preparing the hospital bag, deciding on what to tell to doctor for the birth, and so on." (P31)

When an application did not encapsulate content about medical and daily life organizations, it was criticized negatively because participants asserted that they were not able to learn everything from their doctors and did not want to skip anything. Furthermore, the suitability of the organizational information to the local practices was in consideration.

> "There are lots of things to plan such as periodic controls, detailed ultrasound scans, glucose tolerance test, blood tests, etc. This application [Baby Bump] does not provide information about all the necessary controls. Rather than searching lots of diverse resources, it is convenient to learn them from an application. I should not skip any critical thing." (P12)

> "In Turkey, preparations for pregnancy and labor are different than medical procedures in the USA, UK, or other countries. We have frequent ultrasound scans here, but pregnant women abroad have maximum two or three scans during their entire pregnancies. Observing me and my friends who have already had birth, I can say that we usually find our doctors and select a hospital accordingly, or we think about issues related to insurance and then decide on the hospital; but, organization of these can be different abroad. Also, doctor visits are more frequent and our doctors tell us to do almost all types of tests. However, foreign applications tell me not to necessarily have certain tests." (P19)

- In regard to **interaction**:

Interaction qualities of mobile pregnancy technologies appeared to be highly significant for the preparation and management of diverse events and processes because organizational issues are abundant, diverse, dynamic, and mostly unfamiliar during pregnnacy. Bethinking such issues as well as momnesia, pregnant women wanted to record their planned events, important notes, questions to be asked to doctors, and other to-do or finalized things. Thus, being able to enter notes by categorizing them according to different organization types, managing medical and social schedules, and receiving reminders on specified dates via the application's interface or other communication channels such as e-mail or SMS, were favored. Nonetheless, even though emphasizing many advantages of organization tracking, one of the participants in the third trimester mentioned the decreased usage of related features towards the birth due to the increased weekly doctor visits, and hence, increased possibility to remember them.

> "I frequently look at the to-do lists and checklists. I put a check mark on the things I have already done and easily see the remaining things." (P06)

> "In order not to forget, I enter my doctor appointments and write questions that I want to ask him. It is pleasing because when I click on 'add note' part, I am provided with a bullet list to select different types of notes among them. For example, there are bullets for questions to ask doctor, regular note, things to arrange or buy, etc. This categorization simplifies the organizational issues while both entering and checking things." (P24)

> "You can mark your doctor visits or other special events on a calendar. It warns you on that day. It is good to remember and meanwhile to archive all the planned events.

> However, at the end of the third trimester, frequency to note down doctor visits can decrease. As doctor visits become very frequent, almost every week, it can be more easily remembered." (P30)

Although visual calendars were found both attractive and useful, not being able to interact directly with the calendar, and manipulate and add plans in a more flexible way were mentioned as several drawbacks. In addition to a dedicate menu for managing the calendar, a direct shortcut alternative to a calendar and its icons was expected. Moreover, not being able to filter various categories about medical and social programmes was found inefficient. Apart from these, a few participants discussed the format of note-taking for doctors' responses to their questions. Their suggestions were being able to tick the asked questions, categorize the answers, and arrange them according to priority, which would facilitate their further arrangements. One of the participants' recommendations involved the provision of information about medical and social organizations after an initial test. Personal test scores might base on criticality of certain medical procedures and meaning of some other daily life organizations for that person, according to which advices and warnings could be given.

> "There could be a direct interaction with the calendar. When I click on the calendar, I would like to see a place to enter information or to receive more details about the marked dates. Of course, I can reach them from other menus, but as the calendar contains diverse plans, milestones, notes, appointments, special days, etc., it would be more practical to directly manipulate them." (P24)

> "It is hard to remember all the answers of my doctor. I carry a notebook to note down the things that I should do. It would be more convenient if I could tick the questions I asked or which have lost their validity. Then, I would like to categorize answers; filter, sort, and arrange them considering their priorities. In this way, it might be much easier to organize necessary procedures or events. By the way, these questions and answers, and the things I plan accordingly might be beneficial in my next pregnancy, too." (P16)

- In terms of **appearance**:

Visualization of the to-do things or accomplished plans on an overview visual gratified users. To illustrate, an overview calendar with icons or symbols representing doctor appointments, planned tests, scheduled activities, and so on, made pregnant women to see and interpret all important and planned things at a glance, and not to skip or confuse anything without checking every information in detail. Another desirable visual implementation was the depiction of the entire process and important dates on a visual countdown meter on the homepage of mobile pregnancy applications. These kinds of

visuals seemed well-arranged, appealing, enjoyable; and hence, motivating. There were no negative comments about the visual qualities related to the organization issue.

> "Ovia has a calendar and visuals, like dots, plus signs, squares, etc., on it. Actually, it is a kind of coding the written information. It beautifies the application. Also, I can immediately comprehend on which day I have gone to my doctor, or when I should schedule my other activites based on it. I do not have to read a full text about it and check every details." (P16)

> "There is a countdown meter as a progress calendar on the homepage, depicting me how much days are left. Also, changing baby visuals over time foster its visuality. I can directly understand where I am during my pregnancy. It is really pretty and motivating." (P13)

> "It has a calendar with a very simple, clean, neat, and understandable look. When I want to check where I am in my pregnancy or when my maternity leave will start, I can easily notice." (P30)

- With respect to **function**:

Some of the participants interpreted the planned and recorded schedules about medical and daily life organizations as generating an extra function about archiving. Although some applications had diaries (see the subsequent 'Diary' subject) specifically provided to keep daily notes and memories, organizational records, calendars, and marked to-do lists served a similar purpose for some pregnant women.

> "When you enter your appointments, doctor visits, or other special days, meanwhile, you actually record and archive the process." (P30)

Alongside logging to-do things and plans on a calendar, uploading necessary documents related to these logs, such as test results and images, was referred as a function that can be offered by mobile pregnancy technologies. In addition to tracking gaps in plans and managing further arrangements, uploading documents as a part of organization topic would work like an archive or a diary, too, which might help pregnant women to compare certain issues in their different pregnancies.

> "Those technologies can be enhanced by letting users upload their test results or other documents on calendar or next to to-do lists. This can be very logical because I can use them as an archive. I can follow my progress and also make comparisons between my test results in my different pregnancies if I want to have more children…" (P16)

**Diary**

Among the total 2220 statements, 111 were about diary; i.e. memoirs about pregnancy moments. There were 65 affirmative opinions and 46 adverse comments. Hereby, none of these comments was about the content. A great majority of the statements were about interaction and function.

- About **interaction**:

Participants touched mainly upon being able to record their memories in different ways, by writing their unique and meaningful moments, and capturing and keeping the photos of their belly shots. Even though some of them had also been using the usual photo galleries of their mobile phones or other professional cameras, they highlighted the advantage of such mobile pregnancy technologies' dedicated pregnancy galleries, without the mixture of miscellaneous photos. These special photo diaries for pregnancy belly shoots were found beneficial and enjoyable because users were able to see all pregnancy photos consecutively as a slide show and make comparisons easily about their bodily changes. Beside this, many participants reacted positively to be receiving reminders about taking belly shoots in regular intervals, which made photo shooting more meaningful for them. Related to this, the flexibility to upload photos from other platforms was liked, especially when participants were not using such applications since the very beginning of their pregnancies and they wanted to complete the missing photos of the prior weeks. Apart from these, most participants favored keeping special notes for their babies as a separate script, such as what they had done for their babies, to share in the later years. Considering the diary access for capturing and uploading new moments, some of the participants gave great importance to have a direct reach at the bottom part of the homepage, so that they might not be demotivated with lots of tasks during interacting with diverse menus. For reading and browsing the recorded memoirs, they appreciated filter options in order to see the preferred ones conveniently among other types of pregnancy content and to personalize the pregnancy feed like a social media account. This made pregnant women feel special.

> "When I saw the application, I thought that I would never use the photo diary. However, after I started to capture a few photos via the application, I regretted not having uploaded them since the very beginning of my belly's growth. Still, I have tried

> to compile and categorize all my previous photos from other places. Now, I can see the week by week growth by looking at the consecutive photos in its special gallery and I love it. At the end, I can see the entire journay." (P10)

> "I capture photos every week because it is very easy. It is at the bottom of the first screen and just by a single click I can do it." (P21)

> "The filter option is good. After noticing it, it became more meaningful to keep my photos in here. Rather than seeing all generic pregnancy information, articles, and photos in the same feed, I can use filter and see solely my own photos. Now I am planning to use this as a diary by capturing photos and uploading my other documents and personal notes." (P16)

On the other hand, several participants thought that frequent reminders about photo shooting and direct access to shooting button at the homepage were not very necessary. Some of the participants suggested the flexibility to write a caption near captured or uploaded visuals or documents, and to personalize other predetermined captions about milestones during pregnancy. Besides, receiving the e-mail version of the diary was demanded by a few participants considering its permanence.

> "I become irritated with the frequent reminders and notifications about photo shooting. When I click on 'my belly' to have a look at my previous photos, a question pops up asking me whether I want to take photo." (P16)

> "It is necessary to personalize the predetermined milestones. For instance, it mentions about the first moment that a pregnant user felt the kick, but I do not have such a moment or I am not sure if I will have. Some moments that the application refers are a bit absurd." (P16)

> "The application could e-mail my notes to me later on. It would be better for tracking and recalling what I have lived. May be the application might not be available in the future, but I could reach my diary from my e-mails." (P11)

- In relation to **appearance**:

There were a few comments about the appearance of the diary, all of which were negative. Some pregnant women felt that logging personal memories in such technologies decreased their spirituality because they do not have any resemblance to traditional notebooks. Also, poor quality of thumbnails which depicted the uploaded visuals and lack of a graph representing the milestones in the diary were addressed.

> "It is possible to add personal notes, but it is not like a real notebook. It could look more like a traditional paper with its layout and visual organization. It should be more spiritual, emotional, and motivational." (P19)

"I hardly understand from the thumbnail which photo it is. Its quality and cropped section make it hard to understand without opening in real size." (P16)

"I wish I could see all the special moments on a special graph. I would like to see the baby's first movement or other things. It could be a beautiful memory." (P11)

- About **function**:

All function related statements were about the negative aspects. Some participants mentioned that the presence of belly photo function as a visual journal was not really demanded both in the first trimesters due to not feeling the baby and seeing the belly growth; and after the first pregnancies due to being familiar to many things during their first pregnancies, and thus, loosing interest. Moreover, a very few participants found the memory keeping functions too romantic. Other recommended functions were about keeping a personal memory blog and being assigned certain tasks like writing a birth story which would redound on positive thinking.

"There are functions which make it a pregnancy diary. But I think that those functions can be used after more feeling the baby. I hardly find things to write now. Shall I write 'My nausea is not that much strong today'? Diary functions can be more meaningful in the later weeks." (P17)

"Photo capturing and uploading functions became unnecessary after my first pregnancy. Okey, women feel shocked and enthusiastic at the first one; but after, growth of the belly does not sound so interesting." (P32)

"Reminders about writing or capturing pregnancy moments do not annoy me; but, beside interacting with them, the presence of such functions with or without the reminders is too romantic. As I said, may be I am not such a emotionalistic pregnant. I do not put it in the center of my life." (P01)

"There can be a blog function, as well. It can be both an archive and a post to my baby or other women." (P10)

"There could be assignments which would facilitate positive thinking. I suggest this because during one course that I participate as a part of pregnant women training programme, we were asked to imagine our best birth story and then to write it. It was so emotional. They cautioned that if we start with fear, we would encounter problems; and if we start positive thought, the universe would realize our scripts. I felt relieved after writing my dream scenario." (P10)

**Shopping**

Out of 2220 statements, 104 statements revolved around the shopping subject. There were 44 favorable and 60 unfavorable comments. None of these comments were about

the appearance; and they were dominantly about the content, followed by interaction and function.

- In the matter of **content**:

Majority of the participants in the third and second trimesters reacted positively when extensive information and to-buy lists about diverse shopping items to be used both during pregnancy and after birth—like hospital bag items, baby items, strollers, baby room furniture, safety equipments, and breast feeding products—was available. Even participants in their next pregnancies valued such information due to not remembering all of the required items or due to newly emerged needs, products, or changing knowledge between years even if they were keeping their initial shopping lists or some products from their other children. Whether shopping from the applications was the point or not, participants gave importance to this content with the intention of examining the market, determining the exact necessitas, taking inspiration, and verifying what they heard from other people, resources, or even from own to-buy lists of the shops.

> "There are lots of things that you can forget to buy ranging from feeding bottles to week-specific items or a certain cream for mothers. Even if I may not buy all the suggested things, I still look at the application's suggestions to get an other opinion." (P07)

> "It is good to see differet types of products at a one place. There are baby care products, furniture… At least, I need information about breast feeding or safety products. Of course, looking at an extensive list is a bit frustrating because I have started to think if I should really buy that many things. Every product requires a separate thinking process and I need to do a preliminary investigation. However, seeing everything all together might be useful to facilitate this process. Also, I sometimes find it easier to ask what I should buy to other people; but, I can verify their suggestions from here, too." (P16)

The absence of the aforementioned shopping information or their incompability with local practices were among the most criticized aspects. Among the suggestions were the presentation of shopping information considering local brands, price ranges, store locations, child bearing traditions, and daily life practices. Also, several pregnant women mentioned that although being extensive, information about shopping would be optimized, as all applications, Internet sources, people, and shops tend to advertise

and market a variety of non-essential products. Besides, a few participants uttered deficiency about pregnancy clothing.

> "Shopping information does not pertain to Turkey. I wish mentioned products were more frequently used things in our country. Mothers have different child nurturing practices in different countries and reading information about them can be confusing." (P07)

> "Making a preliminary research is necessary. We created an optimized shortlist from the Internet and such applications can have similar thing, as well. For instance, we checked various types of products and furniture, their price ranges, possible brands and shops' locations before going shopping. We sometimes make shopping from the Internet; but, when we decide to buy from the regular shops, it is really exhausting to look around each and every shop without any prior information." (P28)

> "Usually, there is not any information about pregnancy clothing in the compiled lists. I want to see more information about pregnancy clothes, when and where I can buy them, and their prices." (P01)

- With respect to **interaction**:

Being able to rate, write or review others' comments for shopping items and branded products was found favorable by many participants. Emphasis was laid on having experienced parents' advices about certain brands and models so that new parents could feel trust more easily and make a decision more quickly.

> "I used to be a bit biased about the shopping section at the beginning. Now, we want to buy a stroller and we found one; but, I am thinking about looking at the reviews about it. I am curious about the brands and models that people have liked. Other people's comments about theproduct in mind can be a guidance." (P01)

Apart from the interaction with other people on the shopping subject, and thus, incorporation of related interactive features into the applications, a few participants mentioned that the direction of people's comments from external websites to the application or direction of application users to external websites via links in appropriate places could have enriched the alternatives and information in a reliable way, as it would connote the applications' approval for those sites. Additionally, other interactive features such as filtering and comparing products were suggested to personalize or facilitate shopping. Also, personalized budgeting was put forward by responding to a brief survey. Some participants drew attention to the absence of reminders to buy certain things before a specific period, because there might not be sufficient time later on.

> "When I want to buy something for my baby it may direct me to different shopping websites… When I enter my needs to the application, it could show me where to find them. It would be nice if it could make price and product comparisons according to my budget and needs. Or else, it would be very interesting and useful if the application could pull people's comments from other websites and present them." (P30)

> "In my opinion, the shopping section can start with a brief survey by asking what kind of expenses we may encounter. I saw an internet site like that, which was asking questions like 'Will you have a caretaker or not?', 'How will you feed your baby during the first three months, breast feeding or formula feeding?', 'If you are planning to start formula feeding, how often may you buy it?', 'Which model will you prefer for the baby stroller?', or 'Which equipments are you planning to use at home?'. Mobile pregnancy applications could do the same. They might ask questions to determine budget items and calculate an estimate overall budget according to personal conditions." (P19)

> "Let's say that I am 21-week pregnant. In addition to sending reminders about medical procedures, such as 'You should be vaccinated for tetanus", it could send me reminders to buy the important things, such as 'It is better to start looking for baby strollers', before the birth as there will not be any time later on." (P24)

- In regard to **function**:

In this regard, purchasing was interpreted as an extra function alongside shopping information and more active interaction qualities of the application. Although some of the participants reacted positively towards and wanted to purchase products via mobile pregnancy technologies as can be seen in the above sections, some of the participants, especially the ones experiencing their first pregnancies, found such purchasing function unreliable because of not being able to touch the material and dye of the baby products bethinking babies' health, or try and see the maternity clothes up close bethinking changing body sizes, symptoms like edema, and comfort. Moreover, unavailability of swaping, selling, and buying second hand articles via pregnancy applications was discussed.

> "I actually do not want to buy without seeing. I need to try whether its fabric is comfortable… Your body changes enormously. For instance, I bought one size bigger soft leather flat shoes to wear during pregnancy, but it is impossible. It is difficult to buy for the baby, too. I do not know why, but purchasing from technological products raises doubts. I want to investigate the fabric, dye, material, etc. in detail." (P06)

> "It would be more effectively used if second hand purchasing was integrated in the application. I might not use it, but there would be many people preferring it. Circulation of the second hand articles between women as swapping could be very interesting." (P01)

**Exercise**

Exercise topic received 55 comments. 32 of these comments were positive and the rest 23 were negative.

- In concern with **content**:

Most participants, even the ones who were not physically active in their daily life, were satisfied with the inclusion of information about exercise during pregnancy. More specifically, motivational information about the essentialness of exercise during pregnancy, safe activity advices in parallel with pregnancy periods, and detailed workout instructions were talked over.

> "With presenting information about the necessity of exercise during pregnancy and corresponding activity suggestions, the application motivates and directs you to pursue a healthier gestation. Even though I think I am a more conscious and experienced mother and I have been already walking and practicing yoga, I still find the incorporation of exercise related information positive." (P28)

> "Workout information is important to stay fit during pregnancy… I want to know which activities I can do safely in different periods, at which pace I should walk, how I can avoid from harming my baby's health, how I can stay healthy, etc." (P22)

> "I have started to do pilates with my pregnant friend. Actually we have talked to go to a pilates course before; but, my doctor actually suggested walking in those times, saying that the baby was very small. Very recently, he suggested me to do yoga or pilates considering my increased backache. His suggestion coincided with the applications suggestions about doing yoga or pilates. So, I have started with my mind at peace and it reduces my pain." (P07)

> "It gives workout instructions and special explanations for movements. I also go to yoga training; but whenever I do it at home, I try to follow that information." (P10)

Concordantly, when an application did not contain information and advices related to exercise, participants were dissatisfied, particularly after the risky first trimester and when they felt more ready and energetic. Apart from that, a lack of briefing about what would happen when users enter data about their activities was articulated by one participant as a shortcoming to feel motivated.

> "Information about exercise during pregnancy would be nice because in this period [the second trimester] pregnant women have energy and need to do exercises. It would be pleasant to read different exercise advices each morning." (P21)

> "I do not practice too often, but disregarding that exercise part of the application does not seem very meaningful and motivational. There is not any information about what will happen if I use that part and if I enter data to track myself. It would be more meaningful if there was an explanation." (P16)

- About **interaction**:

There were a few affirmative statements about interaction with exercise tracking features. Retrospective data entry provided flexibility to complete forgotten entries. This was important to track personal exercise trend accurately.

> "I try to record my activities regularly, mostly in the evenings. Also, even if I forget, it is possible to enter exercise data in a retrospective way. So, there is no missing data that may affect the accuracy of tracked progress." (P19)

Negative statements about interaction related to exercise topic were multifarious. While entering personal data, inflexibility to customize predefined activity types of the application, unless it is kind of a precaution for entering harmful activity types during pregnancy; as well as absence of automatic data entry after an automatic activity tracking, instead of manual entry, were uttered as negative issues. Integration of, or connectivity and automatic synchronization with other applications, fitness products, and health systems were a few participants' suggestions to both eliminate manual data entry and enhance various data input which would be significant to capture a more holistic picture of users' health. Related also with the data entry, but more with corresponding exercise notifications, most of the participants indicated the impossibility to see personalized exercise information based on an initiatory test about personal specifications and subsequent data entries while tracking data. For maintaining exercises, absence of reminders and diverse types of feedback, such as a baby cry to remind the walking time for women who placed emphasis on maternal sensuousness, was remarked.

> "Firstly, I was much more negative because I was not able to enter my bicycle activity. Then, I noticed that cycling is not suggested for pregnant women; so, it was okey. Buts still, it could be more flexbile to add or delete activity types because these predefined categories may differ for different pregnancies. Or at least I want to delete the unused ones." (P19)

> "These kinds of pregnancy applications should track pregnant women automatically. For instance, they can work like a pedometer specific to pregnancy and notify women about how much they have walked. All in all, pregnant women are not like average people without any health problems. Thus, a pregnancy application can work as a

combination of different applications. I do not want to open the application to write that I have walked for 10 minutes. I have lots of things to think about and do." (P32)

"I see my daily walking data on another programme called 'Moves'. As that data is already recorded in that programme, synchronization of a pregnancy application with it would be more meaningful… Because if I am an active mobile phone user, it means that I may have lots of different applications for health. They can be connected. The pregnancy application might extract data from different exercise applications and interpret how much exercise I have done. Then, it could tell me 'A pregnant woman should do this much exercise and you have accomplished this percent of the limit, well done!'. Then, I would not have to enter data each time. It would be much easier and very motivating." (P16)

"It would have been an added value if the pregnancy application worked with compatible sport equipment. I have an obsession with weight gain, so it could have been easier to track myself during pregnancy." (P30)

"It would be more pleasing if it asks more detailed questions while signing up in order to give more customized and personal exercise information. They frequently emphasize to do exercise, but I am 40 years old and do not have the energy of a 26-year-old woman. Besides, I have other children… Thus, too standard warnings make me feel guilty. It should give more personalized advices." (P02)

"There should be more motivating reminders. It could bloat maternity feelings up so that I would not be too lazy to go to the gym. For example, its alarm could mimic a baby's cry…" (P31)

- In terms of **appearance**:

Qualities related to the appearance were not mentioned hereby. Only one of the participants touched upon a deficiency about visuals and videos about exercise, otherwise which would be more comprehensible, guiding, and engaging.

"There should be guiding visuals and videos about exercises such as visual explanation of breathing exercises in regular yoga applications or videos in YouTube. Following them is more comprehensible and engaging." (P16)

- In relation to **function**:

Like other tracking options, tracking of exercise data was generally considered as a special positive function except merely reading exercise information or receiving advices—not considering the above mentioned interaction issues related to them.

"I find this application [Ovia] positive because it has an extra function. It is pleasing to follow how often I move in a certain week. This function creates an impression of keeping personal statistics." (P19)

A few participants did not feel the need to track their exercise data either because of a disallowance of the doctor to do physical exercise considering personal pregnancy issues or unwillingness to exercise considering unathletic characteristic.

> "I cannot use functions such as exercise tracking because exercising is forbidden for me." (P17)

**Birth**

There were 49 statements about birth, 18 of which were positive and the rest 31 were negative. Content related to birth was at the forefront, followed by a few statements concerning interaction and appearance. None of the statements were about function.

- Relevant to **content**:

Content received negative comments since participants at the final stages of their pregnancies referred to the absence or superficiality of the birth related information. Among the suggestions were the presence of detailed and alleviative information about the methods of delivery, such as normal delivery, caesarean section, and epidural anesthesia, as well as their presentation with sophisticated sub-headings. Also, briefing about pregnant women's rights about potential situations during the birth was expressed by a few participants.

> "Barrenly, there is not too many things to motive me to use the I'm Expecting app at this period [towards the mid of the third trimester]. It is not detailed; in fact, it is superficial. Information should be more sophisticated with sub-headings. If a seven and a half months pregnant woman goes through her first delivery, she may naturally have varied concerns about the birth. So, the application could give information about how a caesarean delivery would be, in what aspects it is favorable, in which cases a normal delivery should be preferred, and so on…" (P29)

> "There are worries about normal or caesarean delivery especially at the final periods. The application can explain these and also provide information about the methods that can minimize anxiety…" (P31)

> "Although it may not be universally valid, it can convey information about pregnant women's rights during the birth, such as their rights about having an epidural operation, changing doctor incase of a critical condition, etc. Certain choices can be women's rights; however, they may not be aware of the decisions to be given as their doctors may not tell them…" (P33)

- Referring **interaction**:

Possibility of carrying out interactions based on recorded birth date and preferences was well received. In other words, personalization of pregnancy applications with regard to personal birth information was found more convenient and meaningful to some pregnant women as all included content and interactions could adapt to the final date and make pregnancy applications more special corresponding to unique birth expectations.

> "Some programmes and internet sites require users to enter their birth dates and choices in every time they perform a certain action, without recording their birth preferences and dates. Interactions in this programme [Baby Bump] directly revolve around personal birth information and most things in the programme are pertinent to this information. Thus, it does not demand a lot of effort each and every time. Besides, everything is related to you, so it can be perceived as special…" (P27)

When an application persistently questioned a pregnant woman about whether the baby was born or not according to the recorded delivery date, some participants approaching to their delivery dates felt confused about the later actions of the application such as starting all over again or directing her to a postnatal application with reserving all recorded pregnancy information. In other respects, a few participants felt scared thinking that affirmation of such a question might also connote and remind miscarriage in the early phases of the pregnancy.

> "It frequently asks me if my baby has arrived. I assume that it will delete all the things and start from the scratch, or it may write something like 'Welcome to your new life!'. Once, I wondered about what will be the next steps and clicked on it. But, it asked me whether I was sure, so I did not venture to proceed. I mean, it is a confusing and also a radical question as if it warns me about not to click accidentally…" (P29)

> "What about the question asking me whether my baby has been born? Does it mean affirming my baby was born if I affirm this question? Why this birth oriented question is active in the early weeks of the pregnancy period? It is ridiculous; but even worse, it is scary to see this question in an improper week because it can imply or remind a miscarriage…" (P16)

- About **appearance**:

There were not many birth related videos in all applications; but, when included, their presence was pointed out as a favorable aspect by pregnant women. Particulary, first-

time mothers were curious about birth videos as they felt stranger to the birth incident. Nevertheless, those who espoused the presence of birth related videos underlined the inadequacy of their presentation styles and depth. Recommendations under this topic were the presentation of elaborated visual animations, yet with simplified terminological explanations, about birth phases. Distinct from this, availability of birth videos came rarely fore as being frightening.

> "There was a very short birth video, which is good, but it was lasting only four seconds. It could be expanded on. I think that birth phases could be explained more in detail visually. As it will be my first birth, it is a mystery for me. May be I would not need it if it was my second or third birth, but it is important for me now to know what I will encounter. Meanwile, these videos could be simplified terminologically because we are not masters in medical issues as doctors." (P18)

> "There are a few videos about birth. I hardly look at them since looking at birth videos are frightening." (P01)

**Postpartum**

There were 42 statements about postpartum, which is a period after the birth. Among these, 15 statements were about pleasant and the rest 27 statements were about unpleasant cases. Almost all of the comments were content related. Just few comments were made about appearance, interaction, and function.

- In the matter of **content**:

Presence of content about the postpartum period was demanded mostly by pregnant women in their third or last half of the second trimesters, considering the fact that there would not be sufficient time after the birth to learn essential information about postnatal issues and prepare the self for later. Apart from that, some participants raised concern over asking all the questions to doctors or other people due to probability of giving a bad mother impression. Hence, content about postpartum was valued, which ensured the usage frequency of pregnancy technologies towards the birth and might made them meaningful and indispensable even after the birth when necessary.

> "Baby Bump prepares you for the postpartum period rather than solely giving information about the birth day... There is a comprehensive plan about what should be done from now for the period after the birth and information about what kind of things we would encounter. I find it pleasing…" (P21)

However, as postpartum information was not generally included in pregnancy applications, comments about the content were majorly negative. In particular, first-time expectant mothers seemed to be in quest of content about infant development, infant care, breast feeding, bathing the baby, what to do when a baby cries, and postpartum depression. Experienced mothers were also interested in infant care and development, though not as much as first-time mothers, bethinking forgettable information and changes in infant care knowledge over time. Additionally, mothers who had other children were more curious about sibling relationships, sibling rivalry, and so on. Apart from these, presentation of all types of information, such as special care for premature babies, to every pregnant women was found frightening by a few participants as risky conditions might not be valid for usual mothers.

> "Instead of being a temporary programme, which will be deleted after the birth, it can contain motivational and indispensable content for the time after the birth. But now [towards the end of the second trimester], when I delete this programme [I'm Expecting], I would not lose anything. May be there might be information about the postpartum period and the first year of my baby… It might connect mothers more tightly to such programmes." (P20)

> "It is time for heading also towards infant development. I have started to be curious about what would happen after the birth. Those applications can start to gradually blend postpartum information in because in these times [after the second half of the second trimester] a pregnant woman starts thinking about the next stages. I may not have time after the birth, so there can be information beforehand about breast feeding, nurturing, etc. Besides, I do not have my initial motivation about pregnancy related topics; I am more into child rearing…" (P23)

> "Now my interest is more on sibling relationships and rivalry, rather than what would happen to me in this week. But of course, time changes and so does acquired knowledge about baby care, used products, their materials, and so on…" (P25)

> "It is written as 7 months have passed that, the baby can now survive by himself even if he is born. Thus, there are many writings about what may happen and how to give a special care to a premature baby. It can be informative for some people, but I do not want to read them because it frightens me." (P33)

- With respect to **interaction**:

A few participants were critic about not being able to personalize the frequency and scope of postpartum information. Being able to receive optional notifications about infant care and infant development, in addition to advices about physical and psychological issues during pastpartum period were suggested.

> "These programmes can combine pregnancy and postpartum issues. What I have observed is, we extremely focus on pregnancy that we feel like a fish out of water after the birth because we do not what to do. As I am at the beginning of my pregnancy I may forget what I read about further stages, but in the forthcoming months optional information about infant care and development, recommendations for physical and psychological issues, and so on, would be useful. I would be happy to determine such information's intervals or content depending on my month or week." (P26)

- Appertaining to **apperance**:

A few negative comments were made hereby. Demonstration of unhealthy and desperate new born baby pictures influenced participants negatively, particularly during the third trimesters.

> "They put the photos of babies in which they are very diminutive and also their small hands and feet are on a drip. Of course, you become sad and anxious when you see a baby as such because you feel as if that baby is yours. It would be less negatively effective and more beneficial if they had provided the negative information about premature babies without any photos." (P33)

- Referring **function**:

There were a few negative comments about the absence of diversied functions related to postpartum period. Similar to the positive influence of postpartum related content on the descending usage frequency of pregnancy applications towards and after the birth, participants suggested the supplementation of extra functions—though not being able to specify the exact content, appearance, and interaction types—to be used during the last stages of the pregnancy and first stages after the birth. Some of the participants underscored the significance of routinizing the track of infant development by mobile pregnancy applications, which they became familiar with in their pregnancies. Among the suggestions was recording the track of chidren over different ages by note taking.

> "This application [I'm Expecting] would be more effective at the beginning because there are several functions about the progress in pregnancy, such as information about the time course, photos, etc. I can drive more pleasure and need to use it more frequently at the initial stages, but there are not many functions for the last stages of the pregnancy and other stages after the birth... Postnatally, I would like to track and compare my children's development in different ages, by functions such as note taking, or I do not know…" (P31)

**Miscellaneous**

25 statements revolved around multifarious peripheral issues which were not pivotal, yet related to pregnancy applications. 18 of these statements were negative and 7 were positive. Essentially, diversionary features like baby names, games, advertisements, and other entertaining features were addressed. At this subject, none of the statements were in reference to visual appearance.

- In relation to **content**:

Incorporation of diversionary content into pregnancy applications usually got positive reactions. Particularly, encapsulation of informative advertisements within pregnancy application menus, i.e. deliberative advertisements as a natural part of applications, conveyed a professional impression and grabbed the attention of participants for further use of present or other related mobile applications after the birth.

> "Towards the end, when the entire content is about to finish, it began to give information about another application for babies. It wants to say that this pregnancy phase will be over soon and a new phase will start. It enriches the content…" (P01)

> "In the application menu on the left side of the screen, there are adds for four other applications… I guess that they are the extensions of this Baby Bump application. These adds do not look like a spam. In fact, information about them continuously attract my attention and arouse curiosty with their deliberate and professional integration in the application." (P21)

Even though information about baby names and their meanings was touched upon as being both an entertaining and useful content, exclusion of information about local baby names hampered the advantages of such content according to many participants.

> "The content about the baby names is very nice, but unfortunately I cannot benefit from it… It would be fun to look for local names." (P03)

- About **interaction**:

In line with the above mentioned comment about harmonious integration of advertisement within pregnancy applications, participants did not welcome the provision of extra notifications, promotional pop-up reminders, and frequent mailshots. Too many advertisements created a bad image and an unprofessional look, as well as annoying users.

> "The good thing in My Pregnancy application is that I do not have to interact with frequently interrupting advertisements. I am fed up with promotional e-mails and reminders of maternal websites…" (P02)

Not having language and country alternatives to examine either local and authentic, or more global and extensive baby names restricted users' interactions with that feature. In some cases, local baby names existed; yet, local content was expressed to be extremely limited. As a suggestion, flexibility to select baby name repositories from diversified countries and even to add own babies' names; and hence, possibility to create a dynamic and progressively expanding name database was expressed by a few pregnant women.

> "The name list in the application is not Turkish and none of the existing names would be proper in my culture. If only that list would contain a wide range of universal names as a database and I could adjust the country or language…" (P08)

> "I understand that it may not be manageable for application developers to include a great number of countries for the baby names. At least users can add names. For instance, mothers can input names and that list can be updated weekly. Then, pregnancy applications can also propose the most popular names of that week. Therefore, even if an application has a foreign origin, it can work as a pool developed and extended by its users. It would be more useful..." (P22)

- In terms of **function**:

A few negative comments brought forward hereby, all of which emphasized the lack of edutainment features, such as educative games. Pregnancy related games surfaced as a motive to engage users with pregnancy applications, which could serve as awareness-rising and illuminating functions meanwhile helping pregnant women to pass more enjoyable time during a nine-month pregnancy period.

> "If only application developers and designers embed more engaging functions like simple games… However, games should be didactic and fun concurrently. In this way, increased usage and engagement can be ensured, too. I am not sure what these games may contain exactly, but people can firstly open the applications to use general functions and then they can play games…" (P31)

**Medication**

In 24 of the statements the focus was on drug usage before, during, or after pregnancy, as all of these stages influence mother's and baby's health, and other issues such as breast feeding. The distribution of positive and negative comments was respectively

15 and 9. Among these statements about medication, appearance of mobile pregnancy applications did not generate a great concern for the participants.

- In regard to **content**:

Most pregnant women were in need of information about harmless and harmful pharmaceuticals, vitamins, and even cosmetics during pregnancy. Provision of medication classifications and their compatibility with local markets and practices were appreciated.

> "Ovia classifies different drugs considering whether a pregnant woman can use them or not. It gives information about dangerous and risky usage cases, which is really good. I also quickly checked the included drug names; most of them are appropriate to be used in Turkey…" (P19)

Correspondingly, unfamiliar drug names in local context, even if they were perceived as equivalent drugs in global scale, created hesitation for pregnant women to receive and apply required medication information from pregnancy applications.

> "Drugs could be local. I am not able to find familiar names. This morning, I wanted to look at my vitamins, but I was not able to match my vitamins' information with the information given by the application. This is my unfavorable point… Of course, application may present information about equivalent drugs, but I cannot know which one is the equivalent of mine…" (P25)

- In the matter of **interaction**:

Possibility to track personal drug usage times and frequencies, set alarms, and receive reminder notifications, messages, and e-mails was also favored by several pregnant women apart from solely reading information about medication. Interactive usage of medication content was valued due to the fact that supportive medications and drugs, such as folic acid and vitamin complexes, were generally prescribed by pregnant women's doctors, which added extra responsibilities to remember and apply in daily lives.

> "It sometimes sends messages warning me not to forget taking my prenatal drugs on time. I opened my application upon receiving messages because it also works as a reminder for me to look at the application…" (P31)

Correspondingly, lack of possibility to set reminders and receive warnings about medication in some pregnancy applications faced criticism. Besides, when local and

accustomed drug information did not exist, flexibility was demanded for adding own drug names.

> "I'm Expecting does not send any reminders about medication, which is very important for me. My husband frequently reminds me to take my drugs… It can also send recommendations and warning about categories of my drugs because, as far as I know, drugs have categories such as A, B, C, and D. It would be very useful to be warned when I type a drug name falling in a risky drug category…" (P17)

> "I have trouble in recording my own drugs. For example, Parol is common in Turkey, but the list to select and record drugs in application are all foreign. No wonder, drugs in Turkey are not available; however, there can be an option to manually write and add other names. As I am not able to add my drugs in Ovia, it compels me to use the regular notes section of my mobile phone to track my drugs. It is an extra burden in addition to scattered information everywhere…" (P22)

- Appertaining to **function**:

Medication track was generally perceived as an extra function. Several participants experienced disappointment when such a function was absent and tried to use other functions of their mobile phones for recording and tracking their drug intake.

> "Similar to mobile phones regular alarms, pregnancy applications should have their own medication tracking and reminding features special to pregnancy. I look for functional qualities both in my life and in such applications, and this may be a very useful feature…" (P06)

Thus far, a nuanced investigation of the relationships between main components and subjects of mobile pregnancy applications' is put forth with concrete examples from the interviews for a comprehensive and in-depth understanding of the current and prospective qualities of pregnant women's experiences with those applications. Actually, there were also a few excluded comments due to occasional assertion times and scope. To jot down, functions related to preconception were suggested to be incorporated in pregnancy applications for tracking menstrual cycle, determining the most fertile days, and planning pregnancy.

## 5.2 QUALITIES OF WELLNESS DURING PREGNANCY

As a result of the content analysis specific to daily life changes during pregnancy (see Chapter 4, Section 4.2.1), it was observed that diverse dynamics in each of the three trimesters and pregnant women types influenced both daily and product experiences. By extension, expectations and possibilities about positive user experience

dimensions, as well as about components and subjects of mobile pregnancy technologies were altering. As a result of this content analysis, 8 main categories emerged, respectively considering frequency of mention as: physical, psychological, life-style, occupational, organizational, medical, intellectual, and cognitive changes. Most of the changes were interwoven and in cause-effect relationships (see Appendix J). Figure 33 presents the total number of statements (including both the affecting change and the affected change as total) for each type of change in each trimester. As participants sometimes referred certain changes without being limited to a certain trimester; i.e. spreading over the period, they were kept as general changes. Those categories pertaining to the most prevalent daily life changes are important to address qualities of wellness during pregnancy and give hints about qualities of m-health technologies to support wellness during pregnancy.

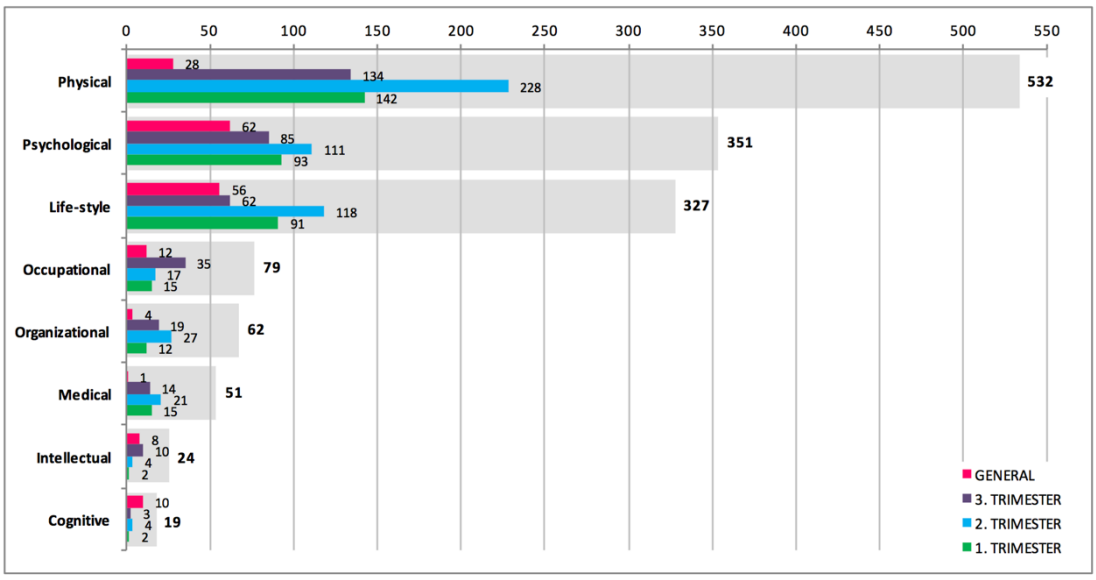



**Figure 33.** The most prevalent changes during pregnancy

### 5.2.1 Explanations of Daily Life Changes with Pregnancy

Changes in daily life brought with them the fundamental aspects to invent while supporting the wellness of pregnant women. As can be seen, names of some change categories were given directly parallel with the names of the wellness categories in literature, such as physical, psychological (emotional), occupational (vocational), and intellectual changes (see Chapter 2, Section 2.2.5; and Appendix A). Life-style,

organizational, medical, and cognitive changes came into the picture as pregnancy specific wellness issues. The later issues were also in relation with wellness dimensions in the literature, like the resemblence of life-style changes to social wellness; yet, their scopes were not precisely matching, and thus, entitled distinctly. All of the changes and wellness aspects are unclosed below in relation to supportive positive user experience dimensions.

**Physical changes**

It goes without saying that physical changes in both mothers and babies fell into this category and that those changes were the inevitable corollary of pregnancy. Hence, looking at the totality of all daily changes, as it might be expected and as physical changes were the most explicit and direct ones, physical changes remained in the forefront in each of the three trimesters. Actually, physical changes are also typically handled in the medical literature; yet, participants in this study explained that physical changes were generally the cause of other changes. By investigating changes holistically in this way; i.e. in cause-effect relation and in daily life context provided more meaningful and rich information to better support wellness in pregnancy. So, going into particulars, it can be emphasized that physical changes in the first and last trimesters, in terms of pregnancy symptoms and prominently changing body size and shape, had mostly negative impact on other wellness dimensions. In Figure 33, the escalating number of comments about physical changes in the second trimester was due to the positive physical changes in the second trimester, in terms of decreasing symptoms, newly appearing bump, and augmenting sensation of baby and baby movements, which made the second trimester "honeymoon period of pregnancy" (e.g. P21; see also Parenting, 2017). In the last trimester, negative physical changes got on the stage again, in connection with increased weight, body size; and hence, newer symptoms such as edema, more strain, problems related to rearranged organs, etc.

There are many dimensions that should be considered in supporting physical wellness, such as **periodical alikeness, being illuminative, daily suggestiveness, medical assistance, instantaneity, boundless access, frequentness of companionship, connected experience, being supposable,** and **being trustworthy**.

**Psychological changes**

Psychological changes were about the changes in affective and emotional situations. The dominance of psychological changes in each trimester was parallel to the above stated physical changes. In addition to the negative psychological influences of the physical changes in the first and last trimesters, participants elicited diversified emotions due to their daily experiences. Sometimes, they had general concerns as their life started to change irrevocably in distinct ways. In addition, trimester-, week-, and even day-specific changes showed up. To illustrate, they had more fears, concerns, and stress in the first trimester due to tackling with a new—usually unbeknown—pregnancy term and shouldering the responsibility to protect the baby; and in the last trimester due to speculating about birth and expecting a new start in life after the birth. In the second trimester, they felt comparatively more positive because of coming throught the first trimester and feeling on track. On the other hand, as physical limitations lessened in the second trimesters, some of the participants had more time ruminating about themselves and their lives, which made them touchier about other people's and spouse's attitudes, feel lonelier, and in need of recreation and divertion. Furthermore, participants also associated emotional fluctuations sometimes with hormonal changes, in addition to other changes. Shortly, pregnant women were generally in need of emotional support considering worries and feelings.

Positive user experience dimensions that are supportive of psychological wellness are **being uplifting, calming interaction, maternal sensuousness, social networking,** and **being amusing.**

**Life-style changes**

Life-style changes involved changes about life-style habits, behaviors, routines, preferences, activities, and responsibilities on diversified issues such as diet, exercise, traveling, responsibility sharing, and social interaction. Those changes had a close connection to social wellness, but also to physical wellness bethinking changes about dietary and exercise habits. Nevertheless, all these reflect alterations in participation and life tempo, and thus, embraced as life-style changes. From the onset of pregnancy, various life-style changes occurred usually in parallel to other trimester-specific

changes. For example, due to physical changes like nausea and acid indigestion in the first trimester, some dietary habits changed. Also, pregnant women's and their partners' social lives, friend meetings, activities, and so on, became restricted with such stomach problems, chronic tiredness, sleepiness, etc., as well as self-preservation considering risks, unfamiliarity, and being unaccustomed to the new course of life. In the last trimester, as pregnancies progressed, belly growth and weight gain increased, and physical capabilities decreased, so as the pace of life due to not being able to do everything. This negatively affected their psychological wellness, as they felt deficient and less able to do things independently. However, in the meantime, pace of life had to increase compulsorily towards the end of pregnancies, too, because of diminishing time for birth. Especially, the second trimester got many positive comments about positively changing life-styles bethinking restored energy, alleviated symptoms, and resumed activities. So, participants started to intensively consider tracking their activities and daily issues.

Considering all, in order to facilitate pregnancy through different life-style changes and to support life-style related wellness, m-health technologies should consider positive user experience dimensions like **being multifocal, being illuminative, daily suggestiveness, localness,** and **conformity to habits**.

**Occupational changes**

Occupational changes emerged regarding work performance, attendance, and continuity. Physical and cognitive changes negatively affected participants' work performance most notably in the first trimester. Some of the participants were on maternity leave on the last trimester and reported certain changes due to ceasing work. Apart from these, most participants complained about not being able to take care of organizational issues and shopping due to working, especially in the second and third trimesters. Actually, continuing to work not only affected the organizational issues, but also challenged physical and psychological conditions of pregnant women, and vice-versa.

In order to support pregnant women throughout occupational changes and to enhance occupational wellness, **cognitive assistance, mnemonic assistance, being illuminative,** and **being collaborative** dimensions could be kept in mind.

**Organizational changes**

Organizational changes were about organization, preparation, and management related to pregnancy, birth, and post-partum periods. Most organizational changes occurred during the second and third trimesters. Organizational changes stepped forward after eluding the first trimester's risks and following through the medical procedures, which juxtaposed organizational and medical changes. Nonetheless, organizational issues had broader scope and still detached from the medical changes. Starting mostly with the second trimester, participants were struggling to manage and complement organizational issues and preparations before the birth. For instance, they wanted to make spatial changes at home and buy furniture and clothes for the baby in the second semester. Experienced mothers also checked their earlier checklists and revised already possessed products from the prior pregnancies. Hospital procedures, bag preparation for hospital, maternal leave preparations, etc. remained usually to the third semester. Some of the organizations were able to be finished only when pregnant women had started their maternal leave, in spite of physical constraints heading towards the birth. Both in the second and third semesters shopping need emerged also about maternity clothing and other specific items due to increasing belly size and formation of edema in feet. Apart from these, special organizations, such as baby shower before the birth, made several participants feel happier and connected with their social circle. It can be observed that organizational changes were in relation with psychological and social wellness; and also with, although not being directly and prevalently, the financial wellness category in the literature.

To facilitate organizational changes and to support organizational wellness, the **being illuminative, mnemonic assistance, localness, conformity to habits,** and **social networking** dimensions are highly helpful.

**Medical changes**

Medical changes were related to the participants' statements when they highlighted doctor controls, medical treatments, results of medical examinations, scans, and analysis. Some routine medical controls were coded even under medical changes heading when they affected their life, plans, other routines, and feelings. Thus, although medical issues have a very close rapport to physical wellness and some organizational aspects, this category mostly appeared as a dividual consideration during pregnancy. To illustrate, some participants were waiting doctor visits enthusiastically to learn about their babies' progress and gender or to get affirmation from their doctors about certain topics. Conversely, a few parents were tired of frequent medical checks or were in anxiety state while waiting for the next visit to hear about certain test results, and so, to initiate certain organizational issues.

Examples of positive user experience dimensions to support pregnant women during medical changes are **being well-grounded, being trustworthy, periodical alikeness, being illuminative, enriching elaborateness, localness, being collaborative, connected experience,** and **boundless access**.

**Intellectual changes**

Intellectual changes pertained to alterations in knowledge, consciousness, and awareness. Commonly, there were differences between first pregnancies and subsequent pregnancies. Besides, apparent changes occurred between the first trimester and the later ones. However, even though knowledge was accumulated in the subsequent pregnancies and towards the end of each pregnancy, participants still felt unready and insufficient considering what they had learned. Even if they had already learned many things as they headed towards the birth, they were in need of different information in each time period. To illustrate, they were more interested in information about pregnancy symptoms, and dos and don'ts in the first semester; whereas they dealt with information on management, shopping, and organizational issues in the second. Nevertheless, in the last trimester, towards the end, they were in search of information about the birth and post-partum periods as also addressed in the previous

section. Apart from these, expecting women who had other children wondered about issues related to siblings.

Hereby, m-health technologies can promote intellectual wellness. To realize this, positive user experience dimensions such as **being illuminative, being uplifting, enriching elaborateness, being well-grounded,** and **daily suggestiveness** may play a critical role.

**Cognitive changes**

Cognitive changes were about the changes in mental functioning and performance. For instance, impairments in memory, perception, concentration, and comprehension were observed during pregnancy. Several participants expressed that they started to forget even the most frequent and familiar things that they had done in their daily lives, which then struck their daily patterns, work lives, social relationships, organizations, self-perceptions, feelings, etc. Hence, cognitive changes underlied diverse wellness aspects, such as intellectual, occupational, organizational, and life-style. Pregnant women were in need of cognitive support before encountering or when encountered with related conditions.

Bethinking m-health technologies, **cognitive assistance, daily suggestiveness, mnemonic assistance, easy goingness, instant visibility,** and **operational practically** are some of the prominent dimensions that can support such cognitive changes and promote cognitive wellness.

To sum up this section, explanations of daily life changes and their relations with positive user experience dimensions are conveyed, considering also the interplay between outstanding wellness dimensions and featured subjects. As delineated within these explanations, it is essential to bear in mind while reading Figure 33 that mentioned statements included both positive and negative inclinations to comprehend the grand scheme of changes and to foster wellness categories. Equally important, given that the inherent criticality of pregnancy period as a resource for two lives and concomitant changes like physical alterations as obvious health related demands, the preponderance of certain wellness dimensions can be more articulable. Considering

the very same reason, certain issues might also denote problems alongside possibilities. Nonetheless, as manifested in the positive psychology literature (see Chapter 2, Section 2.2.5), the achievement of ultimate level of wellness requires balance between related components. Hence, all changes and fluctuations, even the seemingly problem related ones by pregnany's nature, should be inspected as opportunities to augment happiness and wellness of pregnant women.

# CHAPTER 6

# CONCLUSIONS

Thus far, in advance of ultimate conclusions of the study and thorough assembler interpretations about the dissertation, extensive findings of the study have been presented. This chapter builds on the major conclusions of the study and harmonizes them with the anchor points in the literature in order to fulfill the aim of this dissertation and answer the research questions.

In the proceeding sections, firstly, a reflection back on the research questions is made. Secondly, contributions of the dissertation are subsumed. After, embodied limitations are discussed, and finally, issues for further research are enclosed.

## 6.1 REVISITING THE RESEARCH QUESTIONS

This dissertation explores the major characteristics of a positive pregnancy experience and the corresponding characteristics and role of design in user experience with mobile pregnancy technologies. With an attempt to expand on and go beyond non-exhaustively mentioned benefits and problem oriented characteristics of mobile health care technologies in m-health literature, the particular aim of this dissertation has emerged as identifying positive user experience dimensions with mobile pregnancy technologies by putting pregnancy applications in the center, revealing various conceptual relationships, and providing corresponding design descriptions that would be beneficial not only to transcend the barriers for receiving proficient pregnancy care, but also to enhance happiness and wellness of different pregnant women. With the guidance of positive psychology literature, which has also been reshaping the current understanding in health care, design, and user experience literatures, the longitudinal

and in-depth user research in the scope of this dissertation responded the following inquiries related to the research questions.

### 6.1.1 Characterization of a Positive Pregnancy Experience

The interview questions in the user research related to general daily experiences of pregnant women and their content analyses substantiated the significance of seizing the meaning of a positive and happy pregnancy experience, which then established a base for possibilities about how mobile pregnancy applications could contribute to wellness and happiness of pregnant women. Daily life changes during pregnancy and corresponding wellness dimensions depicted in Chapter 5 enframes the overall picture about the characterization of a positive pregnancy experience. The basic roundup that emerges at this point shows that (see Figure 34) pregnant women in the study were highly enthusiastic about their pregnancies at the beginning; and relatedly, they were more patient and tolerant for the idea of waiting through many months till the birth and for the pregnancy related incidences such as symptoms, even if they had concerns and worries in the first trimester. Concordantly, they were also more enthusiastic and curious about learning about pregnancy and receiving intellectual support from diverse sources. Despite the more explicitness and vitality of this situation in first-time mothers, second or multiple time pregnant women also had more motivation at the onset to remember their prior experience and knowledge, and to add on it. Generally, as trimesters passed and pregnant women approached the end, what they had sought and learned accumulated; and thus, they started to feel more knowledgeable about pregnancy. Furthermore, they became accustomed to their pregnancies and to the thought of parenthood. Inversely, knowledge accumulation and adaption to pregnancy period brought with them boredom and intolerance for being on the wait state and for many other things. Nonetheless, correspondingly, they became more selective for information exposure.

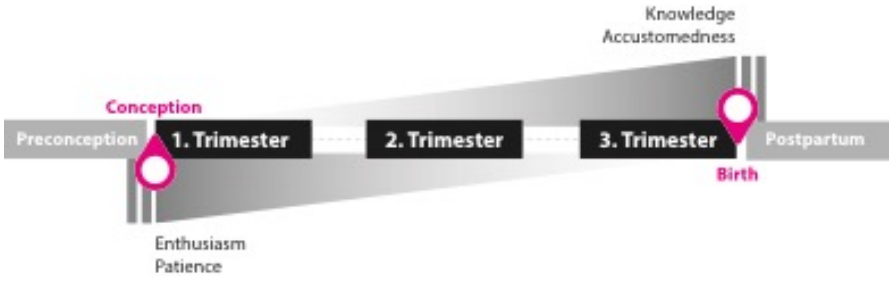



**Figure 34.** The basic picture of pregnancy process

Figure 34 illustrates that characterization of pregnancy experience cannot be stationary. There are both positive and negative alterations in each of the three trimesters. A positive pregnancy experience conforms to the changing nature of pregnancy, apart from mere physical changes and particular fetal developments that denominated each three-month term.

More in particular, in order to provide positivity, happiness, and wellness, pregnancy experiences should match as much as possible to unique needs, values, expectations, knowledge, and practices of pregnant women, bethinking specialness of each pregnancy, trimester, and individual. Figure 35 maps distinctive characterizations of each trimester, bearing different pregnant women types in mind.

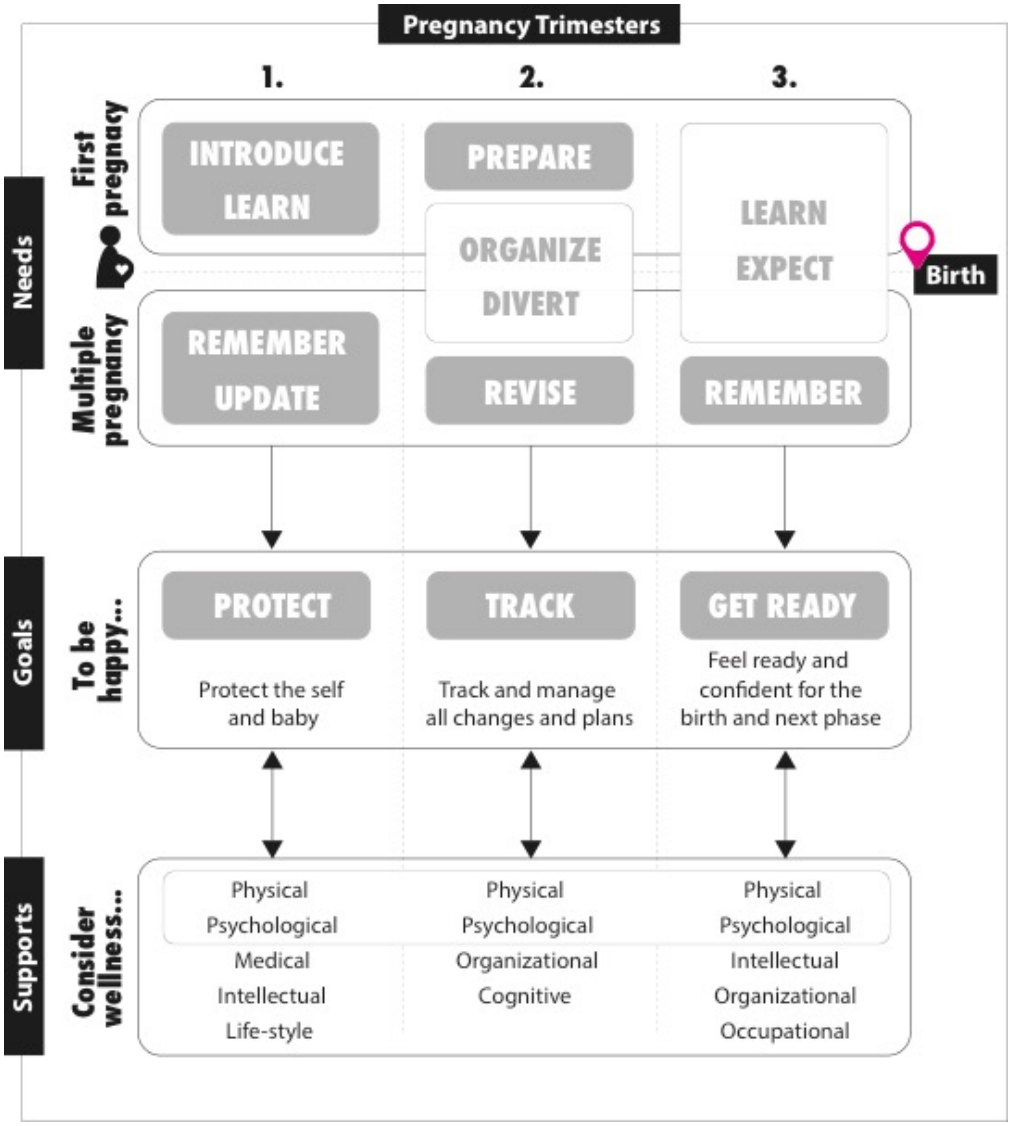



**Figure 35.** Distinctive characterizations of each pregnancy trimester

### The first trimester

In the figure above, attention to the first trimester depictures elaborately that first-time and multiple time pregnant women had variant needs. In first-time pregnancies, the first trimester needs were gathered around *introduction* to an unknown pregnancy period and *learning* entirely new issues, even having observed pregnancies of other friends or relatives previously. In second or more time pregnancies, pregnant women needed to *remember* their prior experience and *update* it considering the processive and changeable nature of available knowledge in literature and practice.

The most preeminent goal in this trimester was to *protect* the self and the baby. It is irrefutable that this goal was abiding in the entire period; yet, as the initial 12 weeks generally involved the highest risk for growing fetus and miscarriages (Medical Online, 2013), which was combined with the just mentioned inexperience of women, generated excessive focus on protection at this point. Therefore, a positive pregnancy at the first trimester directly associated with being able to protect the self and the baby.

To support this, *physical* and *psychological* wellness should be considered as sine qua non characters of this trimester. *Medical, intellectual,* and *life-style* wellness dimensions would be supportive to bring about positive experiences in this unknown and unaccustomed episode.

**The second trimester**

In the second trimester, both divergent and common characteristics were observed between pregnancies of first-time mothers and already experienced ones. In this trimester, in line with the alleviation of physical and psychological pressure as explained in Chapter 5, pregnant women started to shift their attention and energy on diversified things related to both their pregnancy and general life issues. Thus, they had desire to *divert* and amuse themselves, and to start *organize* manifold issues. Hereby, women in their first pregnancies needed to *prepare* everything from scratch; whereas, women going ahead in their second or other pregnancies began from *revising* what they had preserved and what was missing. As a result of expanded focus beyond protection and increased capabilities with decreased symptoms; they became more able to track changes of different type, such as exercise, other activities, and organizations.

This connotes that their goals altered from *managing* health related issues as a matter of sole priority towards *managing* and *tracking* also various issues and plans in daily life.

Nevertheless, *physical* and *psychological* wellness remained at the core invariably; followed by the supportive role of *organizational* and *cognitive* wellness.

**The third trimester**

Approaching to birth, all pregnant women entered into an *expectation* state. They were in need of finalizing everything, including intellectual sufficiency in addition to organizational arrangements, to be ready for the baby and new life. Hence, all women were in need of *learning* new things for the postpartum period. Even the experienced mothers required to learn issues about caring multiple children, handling sibling relationships, bearing child considering the specific dynamics of that generation, and so on. However, as an additional condition, experienced mothers also wanted to *recall* certain issues, such as birth, feeding, etc.

So, it can be deduced that the utmost goal in the third trimester was *feeling ready* and *confident* to welcome the birth and the next phase.

Besides the constant significance of considering *physical* and *psychological* wellness, embracing *intellectual, organizational,* and *occupational* wellness could be beneficial to augment positivity and happiness during this trimester.

#### *6.1.1.1 Issues that Make Pregnant Women Feel Good*

To piece together, daily life experiences of pregnant women showed that (see Chapter 5, Section 5.2) they wanted to feel good about *physical, psychological, life-style related, occupational, organizational, medical, intellectual,* and *cognitive* changes.

Even though some changes became more dominant in certain times as previously mentioned, it is crucial not to bypass that all these changes were interrelated. It is also of great significance not to forget that there is a delicate connection between seemingly problem related health conditions and wellness and/or happiness during pregnancy concept. The latter ones should be beyond problems and illness as discussed in the positive psychology literature (Chapter 2); yet, due to the nature of pregnancy, pregnant women wanted primarily to be free from health problems. In other words, several wellness aspects were essential for the overall wellness, only after pregnant women feel good about the ensured safety of the baby.

Vital to general inferences from the study is the propensity that all pregnant women felt good when they sensed the speciality of support they received both from their social sphere and technological resources in compliance with the speciality and uniqueness of their experiences. Furthermore, it is important to note that as socialization is a very contentious point bethinking the trade-off between sharing the pregnancy experience and receiving misinformation and misguidance, it appeared as a topic to handle cautiously. Though social aspects were covered under life-style related wellness, pregnant women feel good when they were able to share their unique experiences and feel the support and intimacy of other people throughout the whole period.

### 6.1.2 Design's Role for a Positive Pregnancy Experience with Mobile Health Technologies

The global picture of a positive pregnancy experience shows that there are many parameters to focus on while designing a mobile pregnancy technology to support the happiness and wellness of pregnant women. It is observed that design offers a wide repository of possibilities that consider both divergent and common needs and goals of pregnant women; and that can support the daily life changes during pregnancy and related wellness aspects that are disclosed in Chapter 5, Section 5.2.1 and discussed in the section above.

On a basic level, it can be connoted that a thoughtful design takes into account both the characteristics of the designed product/system and pregnancy-long daily life issues. 35 positive user experience dimensions and their multidimensional relationships among each other and with content, interaction, appearance, and function related characteristics and scopes of mobile pregnancy technologies have been revealed in detail throughout Chapter 5. In order to achieve positive user experiences with those technologies in specific and positive pregnancy experience in general, the 35 dimensions would be resolved as depicted in Figure 36.

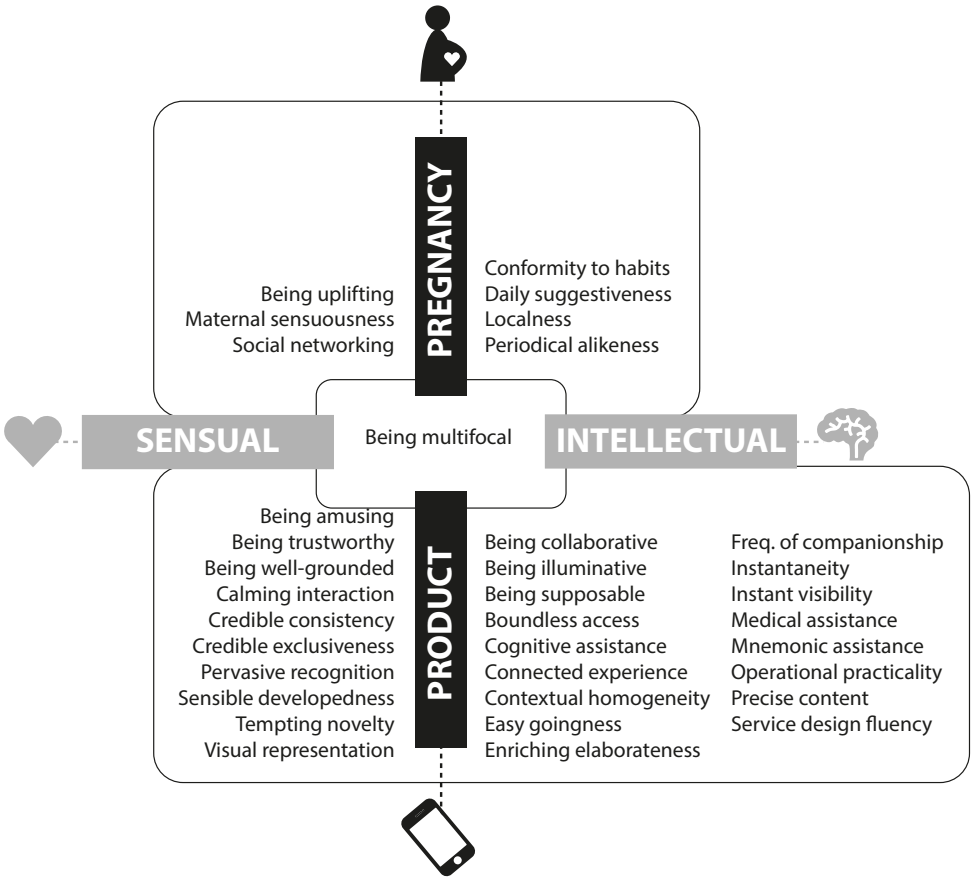



**Figure 36.** Positive user experience dimensions to provide sensual and intellectual support regarding both the product/system itself and the pregnancy

#### *6.1.2.1 Characteristics of M-Health Technologies Generating a Positive Pregnancy Experience*

It is seen that general pregnancy experience, pregnant women's needs and expectations; and therefore user experience dimensions change according to three different trimesters. Besides, prior pregnancy experience has an impact on the current experience, as well (see Figure 35). Therefore, a design solution and its characteristics should stem from the consideration of altering dynamics in different trimesters. Chapter 5, Section 5.1.4 presents in-depth descriptions, relations, and instances about design qualities related to components and scopes of mobile pregnancy technologies. All these interrelated, multidimensional, and intricate conceptual layers are simplified and matched with the Design Well-Being Matrix as a final interpretive analysis procedure (see Chapter 4, Section 4.2.5) to make the promising findings and recommendations of the participants more communicable and workable (Figure 37).

To clarify, while fulfilling various expectations and supporting pregnancy-related daily changes and wellness aspects, design possibilities can be handled and expanded at the junction point of several design roles and elements of well-being. Figure 37 conveys the overall map about changing design characteristics and attributes in parallel with the design roles as source, symbol, enablement, and support for positive emotion, engagement, positive relationships, meaning, and accomplishment. Following this map, descriptions of design characteristics are made, addressing encompassed positive user experience dimensions in addition to critical dimensions and trade-offs to bear in mind. Since take off point of these descriptions bases on major findings and participant's suggestions, some of them are more general, whereas some are more specific even mentioning the design component and pregnancy subject. Hence, the descriptions should not be perceived as solely prescriptive outcomes; in fact, they should be seen as inspiration sources to bring about a variety of positive design outcomes.

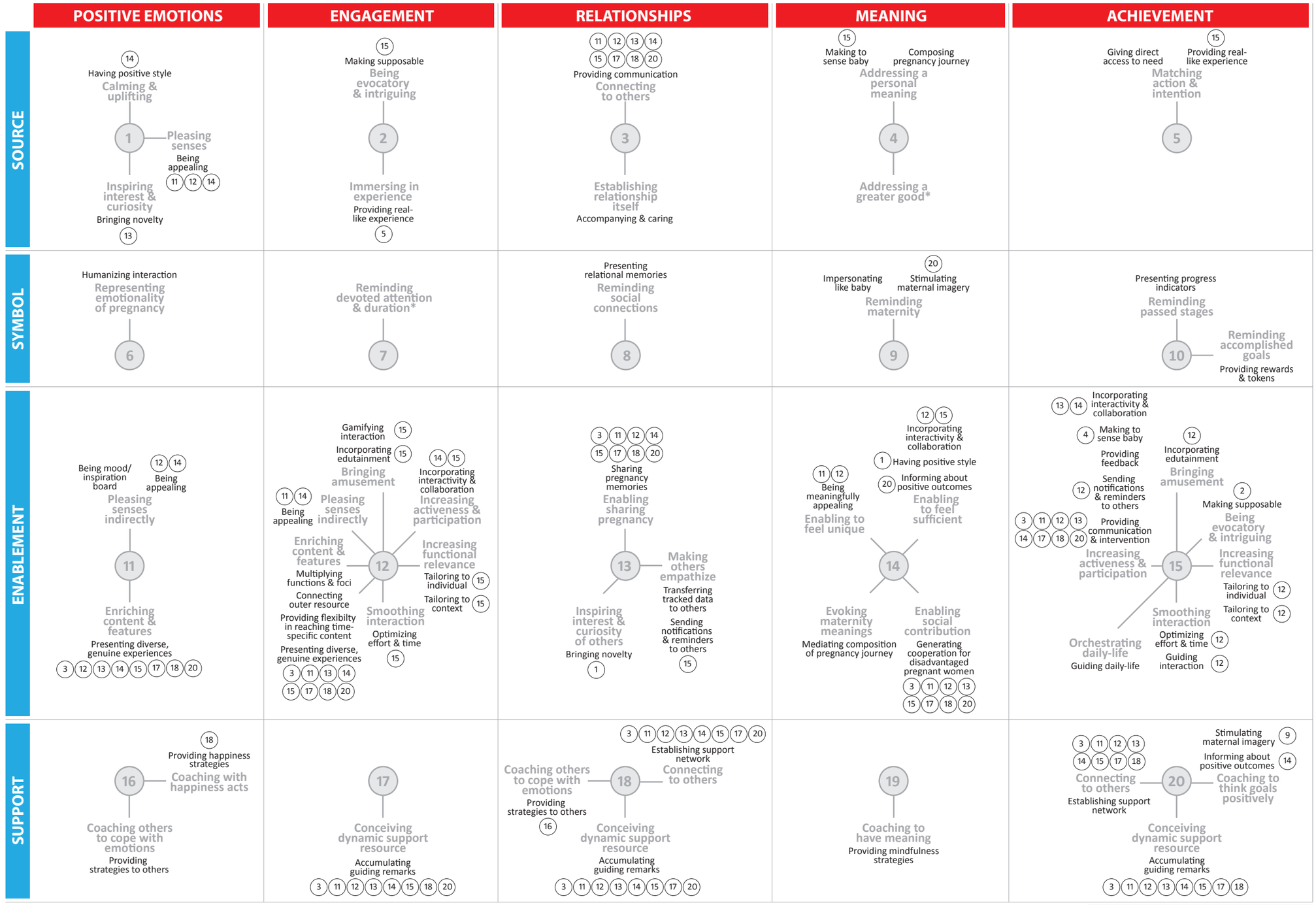
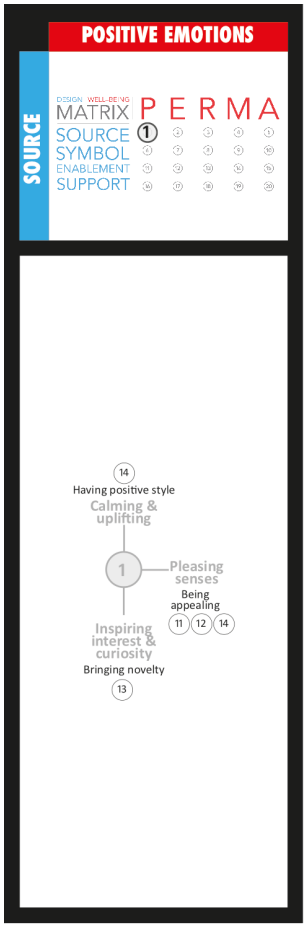



**Figure 37.** The Design Well-Being Matrix for pregnancy




**Design can be a direct source of positive emotions and pleasure for a pregnant woman with its superior functional or aesthetic attributes.**

**Being appealing to the individual, trimester, and pregnancy:**

1. 2. 3. trimester

**Incorporating various settings in general for personalization of appearance, interation, content, and function** makes an app more appealing and pleasing depending on unique pregnancy, trimester, and personality preferences.

- Being amusing, Credible exclusiveness, Easy goingness
- Operational practicality

1. 2. 3. trimester

**Providing flexibility in changing themes related to weekly baby size with reference to fruits, vegetables, animals, bakery, games etc.,** makes an app pleasurable, funny, humorous, and playful.

- Being amusing, Credible exclusiveness, Easy goingness, Tempting novelty, Visual representation
- Being supposable

**Bringing novelty in app features, interaction, and presentation styles:**

1. 2. 3. trimester

**Visualizing a baby's weekly hand size in womb compared with the hand size of a 9 months old baby** is found intelligible, interesting, and innovative.

- Being amusing, Sensible developedness, Tempting novelty, Visual representation

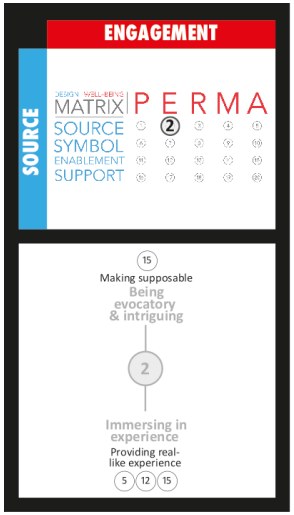
**Informing with a positive style:**

1. 2. 3. trimester

**Providing information with a positive, relieving, and humorous phraseology, language, and expression style** relieves a pregnant woman and elicits positive emotions.

- Being amusing, Being uplifting

**Figure 38.** Descriptions of the cell contents in the Design Well-Being Matrix for Pregnancy




## Design can intrinsically make a pregnant woman engage in the usage of the design and conducted activity.

**Providing an evocatory and intriguing experience:**

3. 2. 1. trimester

**Presenting training demos, tutorials, and virtual or augmented reality simulators about birth and baby care in postpartum period, such as nurturing, breast feeding, formula feeding, bathing, etc.,** can immerse a pregnant woman in related experiences.

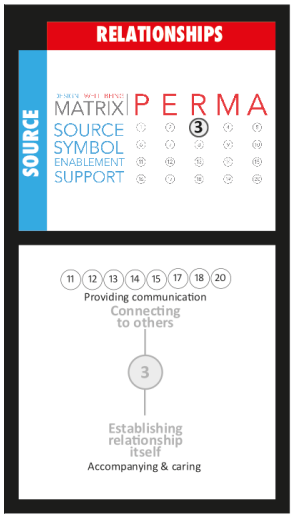
Being amusing, Being collaborative, Being supposable, Visual representation

**Immersing a pregnant woman in a product and/or pregnancy experience:**

3. 2. 1. trimester

**Integrating augmented reality shopping features** can enable a pregnant women immerse in and visualize how maternity clothes would look on their changing body or how specific pieces of furniture would look inside newly decorated baby room.

Being amusing, Being collaborative, Being supposable, Visual representation




## Design can literally be a source of relationship for a pregnant woman.

**Connecting a pregnant woman to others:**

3. 2. 1. trimester

**Providing deliberate and suitable platforms and forums enabling communication with other pregnant women and doctors when necessary** makes a pregnancy app a communication source.

Medical assistance, Social networking

Being trustworthy

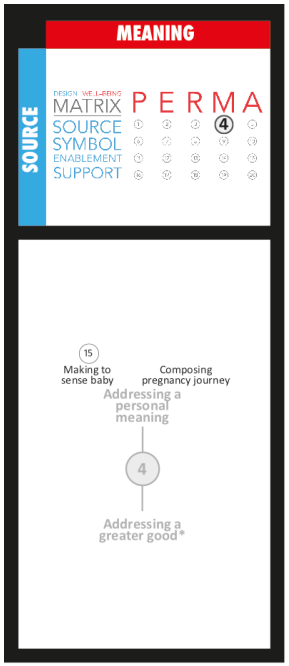
**Establishing a relationship with a pregnant woman:**

3. 2. 1. trimester

**Accompanying and caring a pregnant woman without being artificial and/or making a pregnant woman give care, especially in the second trimester when expectation about diversion starts increasing,** can grow an interaction itself.

Medical assistance, Social networking

Maternal sensuousness




## Design can intentionally and directly be a source of meaning for a pregnant woman.

**Composing a pregnancy journey on purpose:**

3. 2. 1. trimester

**Having dedicated features as a diary, for writing unique and meaningful moments of pregnancy,** is a direct source to memories.

- Maternal sensuousness

3. 2. 1. trimester

**Capturing and keeping photos of belly shots when the bump appears and gradually grows** is a direct source for keeping a visual diary for pregnancy.

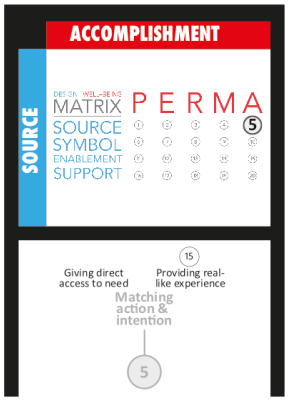
- Maternal sensuousness

**Making pregnant woman sense the baby to feel maternity:**

3. 2. 1. trimester

**Integrating specific sensors or accessories enabling a pregnant woman and/or couple to listen the heartbeats and see the current condition of the baby to generate an emotional bond** addresses maternal sensousness and parenthood.

- Maternal sensuousness
- Being trustworthy




## Design can function as a source of accomplishment related to pregnancy.

**Giving direct access to a need:**

3. 2. 1. trimester

**Integrating specific sensors or accessories dedicated to specific subjects** can provide better measurements and direct and precise information about a need.

- Instantaneity, Operational practicality, Precise content
- Being trustworthy

1. 2. 3. trimester

**Integrating a barcode scanner specific to pregnancy into mobile pregnancy apps, which demonstrates necessary information about nutritions in packed food** can be a direct source for learning beneficial foods to consume during pregnancy.

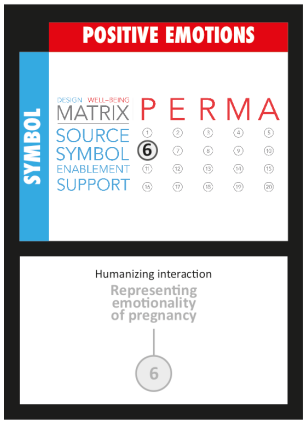
Instantaneity, Precise content

**Providing a real-like experience:**

1. 2. 3. trimester

**Integrating augmented reality shopping features to understand and buy the well-matched maternity item, furniture, etc.,** can serve as a direct source for a pregnant woman to accomplish her organizational goals especially during the second trimester when the risky first trimester passes and also when belly starts growing.

Being supposable, Precise content, Visual representation




## Design can symbolize positive emotions and pleasure for a pregnant woman.

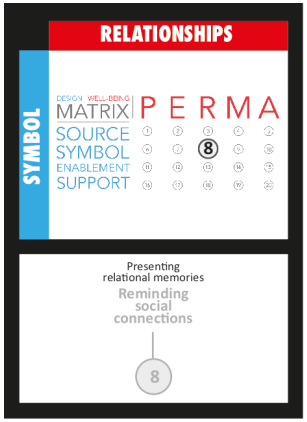
**Humanizing the interaction with the technology:**

1. 2. 3. trimester

**Comprising suitable platforms and forums enabling communication with other pregnant women and doctors** symbolizes the emotionality and humaneness of the pregnancy period as it feels more humanized, less artificial; and hence, more pleasing.

Maternal sensuousness, Social networking

Being trustworthy




## Design can symbolize a pregnant woman's relationships with and connections to others.

**Presenting relational memories with family and/or social circle:**

trimester: 1. 2. 3.

**Enabling a pregnant woman to upload and use the photos of pregnancy moments with family and social circle like a wallpaper or in other proper places, without impairing the visibility of fundamental contents,** can remind relational memories and bonds with others and supports from them.

- Social networking, Visual representation
- Instant visibility

## Design can symbolize the motherhood or other pregnancy related meanings as an indirect effect of other functional or aesthetic attributes.

**Impersonating app features, interaction, and presentation styles like a baby:**

trimester: 1. 2. 3.

**Presenting pleasing baby images as wallpapers of apps' homepages** reminds and represents motherhood in each login, especially during the onset of pregnancy.

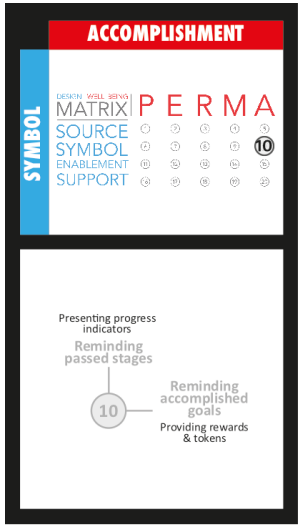
- Maternal sensuousness, Visual representation
- Instant visibility

**Stimulating maternal imagery:**

trimester: 1. 2. 3.

**Sending intentional, yet optional, feedback and notifications as if they are coming from own babies, such as a baby cry or child speech,** triggers maternal sensuousness even when baby movements are not felt and pregnancy state is still unaccustomed.

- Maternal sensuousness




## Design can symbolize the achievements of a pregnant woman.

**Presenting progress indicators related to passed pregnancy stages and goals:**

1. 2. 3. trimester

**Demonstrating a progress meter with icons that represent attained pregnancy milestones, goals, benefits, and skills, rather than merely showing the remaining time as a countdown meter which can generate extra pressure,** can remind a pregnant woman her achievements during this period and towards being a mother.

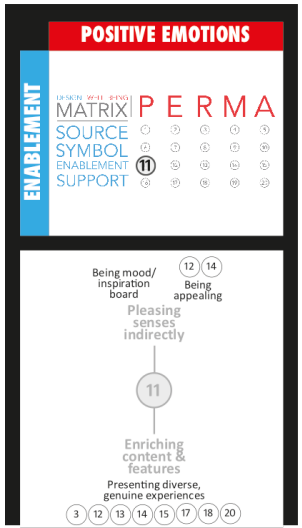
- Maternal sensuousness, Visual representation
- Being uplifting

**Providing rewards and/or tokens for accomplished pregnancy goals:**

1. 2. 3. trimester

**Accomplishment messages and/or rewards after carrying out daily requirements, such as drinking enough water, eating sufficiently even when disliking or having problems, walking certain kilometers, etc.,** can symbolize a pregnant woman's achievements during this period and towards being a mother.

- Being uplifting, Maternal sensuousness, Visual representation




## Design can indirectly enable pleasure for a pregnant woman.

**Being a mood and inspiration board:**

1. 2. 3. trimester

**Presenting content as a mood and inspiration board; i.e. as a "Pinterest-like" platform, which allows a pregnant woman to dynamically share, reach, organize, and expand content with diversified themes and visuals according to personal interests,** can generate pleasure and inspiration.

- Being amusing, Being collaborative, Being uplifting, Credible exclusiveness, Enriching elaboratedness, Social networking
- Being trustworthy

**Being appealing to a pregnant woman:**

1. 2. 3. trimester

**Providing flexibility to personalize icons in an app which are mainly intended for differentiating specific instances during pregnancy, such as icons in calendar,** makes an app's interface more appealing and pleasing.

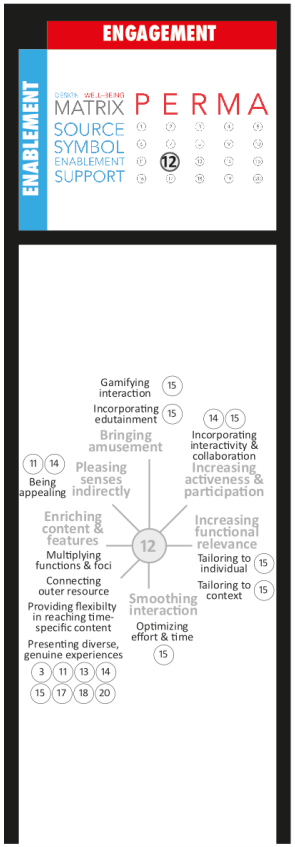
- Being amusing, Credible exclusiveness, Easy goingness, Visual representation
- Being supposable

**Presenting diverse and genuine pregnancy experiences beyond theoretical information:**

1. 2. 3. trimester

**Comprising suitable platforms and forums providing information about other women's pregnancy and postpartum experiences, especially about the ones who are in the same age group,** elicit pleasure as they ground on genuine pregnancy experiences; and thus, are felt more close to the self and more inside the life.

- Being multifocal, Enriching elaboratedness, Social networking
- Being trustworthy, Being uplifting




## Design can indirectly enable a pregnant woman to engage in the usage of the design and conducted activity.

**Being appealing to a pregnant woman while fulfilling another activity or goal:**

1. 2. 3. trimester

**Incorporating various settings in general for personalization of appearance, interation, content, and function** makes an app more appealing, pleasing, and meaningful; and thus, promotes engagement.

- Being amusing, Credible exclusiveness, Easy goingness, Maternal sensuousness
- Operational practicality

1. 2. 3. trimester

**Providing flexibility to personalize icons in an app which are mainly intended for differentiating specific instances during pregnancy, such as icons in calendar, makes an app more appealing and pleasing.** make an app more appealing and enhances engagement.

- Being amusing, Sensible developedness, Tempting novelty, Visual representation
- Being supposable

1. 2. 3. trimester

**Providing flexibility in changing themes related to weekly baby size with reference to fruits, vegetables, animals, bakery, games etc.,** makes an app pleasurable, funny, humorous, and playful.

- Being amusing, Credible exclusiveness, Easy goingness, Tempting novelty, Visual representation
- Being supposable

**Incorporating edutainment features:**

1. 2. 3. trimester

**Incorporating pregnancy related edutainment features, such as educative games and competitions,** surface as a motive to engage couples with an app, which acts as an awareness-rising and illuminating function meanwhile helping the pregnant woman to pass more enjoyable time during the nine-month period.

- Being amusing, Being illuminative

**Gamifying the interaction:**

**Making features, visuals, and content interactive, such as adding playful articulation points on baby visuals to retrieve more information,** creates curiosity, fun, more active involvement, and engagement.

trimester: 1. 2. 3.

Being amusing, Being illuminative

**Recording the amount and frequency of baby kicks by a single click** gamifies counting, documenting, and monitoring the kicks, and sharing the results with doctors.

trimester: 1. 2. 3.

Being amusing, Operational practicality

**Incorporating interactivity and collaboration:**

**Enabling collaboration with an app with data input and tracking features makes a pregnant woman feel more active, special, and engaged during management of her pregnancy.**

trimester: 1. 2. 3.

Being collaborative, Credible exclusiveness

Being trustworthy, Operational practicality

**Tailoring functional support to the dynamics of pregnancy and trimester:**

**Conducting a brief questionnaire during the first sign up to collect various personal information (demographics, medical history, exercise and dietary habits, budget, etc.) and to provide more personalized features,** can make an app more suitable and give the feeling of being developed for unique pregnancies and being well-conceived; and thus, can be highly preferred throughout pregnancy.

trimester: 1. 2. 3.

Conformity to habits, Credible exclusiveness, Easy goingness, Periodical alikeness

Being trustworthy, Cognitive assistance

**Providing flexibility to personalize interaction frequency and content visibility by keeping the relevant and pleasing ones active depending on unique pregnancy, trimester, and personality preferences,** enables retrieving more proper and instant information; and thus, provides more engagement during changing dynamics.

trimester: 1. 2. 3.

Credible exclusiveness, Easy goingness, Frequentness of companionship, Instant visibility

Operational practicality

**Tailoring features and content to the contextual practices:**

**Compatibility of features and content with local practices and knowledge makes better use of not only the intended features but also the retrieved information in practice.**

trimester: 1. 2. 3.

Conformity to habits, Credible exclusiveness, Localness, Precise content

**Easing effort and optimizing time for conducting a certain action:**

**Having connectivity with other medical devices, health and sports equipments and automatic retrieval of the necessary information from them** eliminates extra efforts from a pregnant user; and thus, foster engagement and continuity in use.

trimester 1. 2. 3.

Being collaborative, Credible exclusiveness

Being trustworthy, Operational practicality

**Involving multitudinous and multifocal functions:**

**Multiplicity of alternative but proper functions** provides different resources for different dynamics in different trimesters, which sustains demand for an app's usage.

trimester 1. 2. 3.

Being multifocal, Enriching elaboratedness

Instant visibility, Operational practicality

**Having connections to outer resources:**

**Establishing connections to outer resources, such as the most frequently visited, favorite, or popular blogs and websites; and niching links or notifications when a new post (or a post in preselected content) is published,** add richness and stimulates usage of an app.

trimester 1. 2. 3.

Being multifocal, Enriching elaboratedness

Being trustworthy, Precise content

**Providing flexibility in reaching and discovering time-specific content:**

**Having flexibility in interaction in terms of giving access to desired feature and content on any pregnancy week; i.e. not being restricted to only current pregnancy week,** enriches content, satisfies curiosity about further weeks, and increases engagement.

trimester 1. 2. 3.

Boundless access, Enriching elaboratedness

**Presenting diverse and genuine pregnancy experiences beyond theoretical information:**

**Compiling diverse and genuine pregnancy experiences from pregnant women with various backgrounds and from different countries** diversifies the content and makes an app interesting, diverting, and intriguing to follow.

trimester 1. 2. 3.

Being multifocal, Enriching elaboratedness, Social networking

Being trustworthy, Being uplifting

## Design can mediate relationships of a pregnant woman.

### Incorporating sharing function for diverse pregnancy related features:

1. 2. 3. trimester

**Enabling the post of captured belly shots and pregnancy photos via a pregnancy app's platforms or on social media** enhances sharing and communicating.

- Social networking
- Being uplifting

### Transferring preferred tracking information to desired people:

1. 2. 3. trimester

**Transferring mood or other physical condition related notifications to the father when authorized** can increase the understanding and empathy of him towards the current state and behaviors of a pregnant woman.

- Social networking
- Being uplifting

### Sending notifications and reminders to others:

1. 2. 3. trimester

**Sending notifications and reminders both to a mother and father** increases attention, participation, and help of fathers during pregnancy.

- Social networking

### Bringing novelty in app features, interaction, and presentation styles:

1. 2. 3. trimester

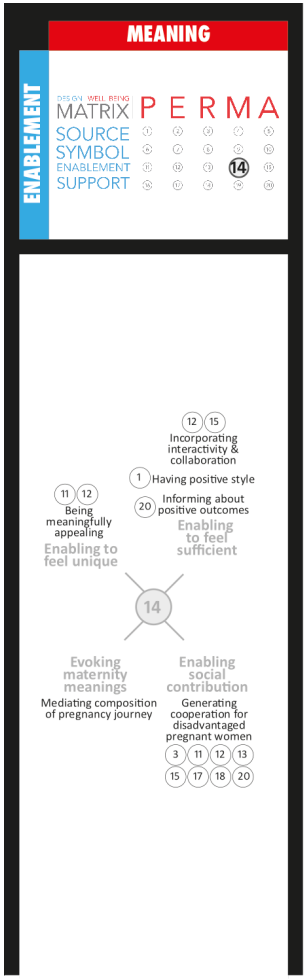
**Demonstration of weekly baby size with reference to fruits, vegetables, animals, bakery, and games** is found novel and interesting by other people; arises the interest of the spouse; and thus, increases their attention, participation, and help during pregnancy.

- Being amusing, Social networking, Tempting novelty, Visual representation
- Being supposable

1. 2. 3. trimester

**Providing novel content that is not encountered in other pregnancy resources and new pregnancy videos at the beginning of each pregnancy week** initiates a ritual and deeper communion for a couple, such as watching the new week's video together as soon as waking up.

- Frequentness of companionship,, Social networking, Tempting novelty




## Design can indirectly enable a meaningful experience for a pregnant woman.

### Being meaningful to the individual while fulfilling another activity or goal:

1. 2. 3. trimester

**Incorporating various settings for personalization of profile, baby name, theme, content, etc., in parallel with own baby (gender, name, test results, etc.) and preferences** makes a a pregnant woman think that the app is special to her baby and pregnancy and feel the uniqueness of her motherhood.

- Credible exclusiveness, Easy goingness, Maternal sensuousness, Sensible developedness

### Incorporating interactive and collaborative features:

1. 2. 3. trimester

**Incorporating individualized and collaborative features, such as tracking,** makes a pregnant woman think that the app is exclusive to her and that the speciality of her pregnancy is valued, as well as giving her a sense of being in control of herself, independence, and autonomy.

- Being collaborative, Credible exclusiveness, Maternal sensuousness, Sensible developedness
- Operational practicality

### Informing with a positive style:

1. 2. 3. trimester

**Conveying information with a positive and relieving style** relieves a pregnant woman (rather than using a sharp and factual expression without considering individual differences, which makes a woman blame herself about unrealized responsibilities) and makes her think that she is doing right and capable of managing maternity.

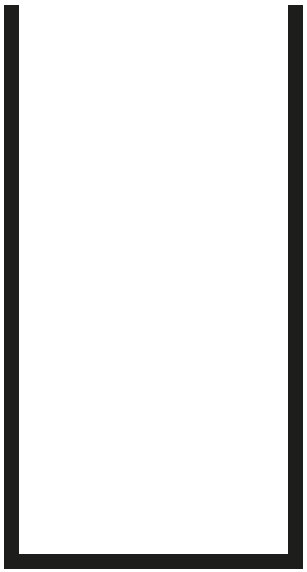
- Being uplifting, Maternal sensuousnesss

### Providing information about the positive outcomes:

1. 2. 3. trimester

**Providing information about nutritional values and benefits of foods for baby, in addition to information about mere harmful, harmless, or necessary food types and portions,** makes a pregnant women feel more conscious about her actions and that she doing beneficial things for her baby's health and becoming a good mother.

- Being illuminative, Maternal sensuousness



**Generating coordination, cooperation, and support among pregnant women:**

1. 2. 3. trimester

**Availabiliy of swaping, selling, and buying second hand articles, and even donating goods via a pregnancy app** can enable financially disadvantaged families to complete their maternal preparations.

- Social networking
- Being trustworthy

1. 2. 3. trimester

**Availabiliy of a network and donation pool** can support financially disadvantaged families and even pregnant women in developing/underdeveloped countries and who needs help.

- Social networking
- Being trustworthy

**Mediating the composition and recall of the pregnancy journey:**

1. 2. 3. trimester

**Records and inventories related to baby, mother, nutrition, exercise, medication, and organization tracking features** automatically, yet indirectly, constitute an archive of a pregnancy journey with all memories, decisions, activities, procedures, etc.

- Being collaborative, Maternal sensuousness

ACHIEVEMENT

ENABLEMENT

MATRIX PERMA
SOURCE
SYMBOL
ENABLEMENT
SUPPORT

# Design can facilitate and enable achieving personal goals of a pregnant woman.

## Incorporating interactivity and collaboration:

1. 2. 3. trimester

**Interactive collaboration with an app for data input and tracking** helps a pregnant woman keep better track of her pregnancy and behave correspondingly while managing her pregnancy and daily life, in addition to making her more active, engaged, and clung to her goals.

- Being amusing, Being collaborative, Being supposable, Visual representation
- Being trustworthy, Operational practicality

## Making pregnant woman sense the baby:

1. 2. 3. trimester

**Integrating specific sensors or accessories that allow a pregnant woman and/or couple to listen the heartbeats and see the current condition of the baby** can provide understanding about the course of the pregnancy and the health of the baby.

- Being illuminative, Being collaborative, Being supposable
- Being trustworthy

## Giving suitable and meaningful feedback:

1. 2. 3. trimester

**Presenting coherent, causal, and conclusive inferences, rather than solely providing factual and descriptive information, as a result of collected and tracked personal data** improves making sense out of the given information; and hence, facilitates reaching personal goals and healthy pregnancy.

- Being collaborative, Being illuminative, Being supposable, Daily suggestiveness

1. 2. 3. trimester

**Sending regular reminders and warning a pregnant woman with alarms and notifications when she crosses or is close to the borders of critical reference ranges regarding the results of tracked personal data,** makes her more attentive to the related changes and triggers her to take more preventive actions.

- Being collaborative, Daily suggestiveness, Mnemonic assistance
- Being uplifting, Being trustworthy

## Sending notifications and reminders to others:

1. 2. 3. trimester

**Sending notifications and reminders both to a mother and father when authorized** ensures realization of the most accurate actions at the most accurate time.

- Being collaborative, Being illuminative, Mnemonic assistance
- Being trustworthy

**Providing communication and intervention:**

**Transferring the tracked data and its conclusive results to doctors in critical incidents** enables on time decisions, actions, and interventions.

trimester: 1. 2. 3.

Being collaborative, Being illuminative, Medical assistance

Being trustworthy, Being uplifting

**Incorporating edutainment features:**

**Incorporating pregnancy related edutainment features, such as educative games and competitions,** can better engage a pregnant woman to seek continuous information and support as it acts as an awareness-rising and illuminating function meanwhile helping her to pass more enjoyable time.

trimester: 1. 2. 3.

Being amusing, Being illuminative

**Making the content/data supposable:**

**Presenting concrete, realistic 3D graphics, ultrasound images, and videos that demonstrate baby development and position in womb, in comparison with caricaturized and schematic visuals,** facilitates comprehension and having a realistic image in mind.

trimester: 1. 2. 3.

Being supposable, Visual representation

Being uplifting

**Using analogies and metaphors, i.e. visual references to familiar things,** helps to form an estimate of the given information; and hence, to comprehend and realize them in daily life.

trimester: 1. 2. 3.

Being amusing, Being supposable, Visual representation

**Visualizing tracked data with graphics, visual categorizations, overview diagrams, relation charts, and synoptic calendars** is beneficial to easily notice the changes, interpret ongoing trends, and behave in parallel.

trimester: 1. 2. 3.

Being supposable, Visual representation

**Presenting training demos, tutorials, and virtual or augmented reality simulators about birth and baby care in postpartum period, such as nurturing, breast feeding, formula feeding, bathing, etc.,** can bring a pregnant woman closer to the real experience and improve parenting knowledge and skills.

trimester: 1. 2. 3.

Being amusing, Being collaborative, Being supposable, Visual representation

**Tailoring fundional support to the dynamics of pregnancy and trimester:**

**Conducting a brief questionnaire during the first sign up to collect various personal information (demographics, medical history, exercise and dietary habits, budget, etc.) and to provide more personalized features,** can better support the wellness of a pregnant woman throughout her pregnancy.

trimester: 1. 2. 3.

- Conformity to habits, Credible exclusiveness, Easy goingness, Periodical alikeness
- Being trustworthy, Cognitive assistance

**Providing flexibility to personalize interaction frequency and content visibility by keeping the relevant and pleasing ones active depending on unique pregnancy, trimester, and personality preferences,** enables retrieving more proper and instant information about the desired issue.

trimester: 1. 2. 3.

- Credible exclusiveness, Easy goingness, Frequentness of companionship, Instant visibility
- Operational practicality

**Allowing data and document input in a retrospective way; i.e. letting entry about passed dates,** ensures more thorough documentation and track of the pregnancy process by fitting to personal schedules and feasibilities regarding pregnancy and daily life changes.

trimester: 1. 2. 3.

- Boundless access, Conformity to habits, Easy goingness

**Tailoring features and content to the contextual practices:**

**Compatibility of features and content with local practices and knowledge** makes better use of not only the intended features but also the retrieved information in practice.

trimester: 1. 2. 3.

- Conformity to habits, Credible exclusiveness, Localness, Precise content

**Easing effort and optimizing time for conducting a certain action:**

**Offering label, tag, categorize, filter, and sort options** fosters navigation, information retrieval, and comprehension.

trimester: 1. 2. 3.

- Easy goingness, Instant visibility

**Possessing multimodal input and output, such as text, video, audio, gestures, etc.,** provides flexibility in choosing the most suitable modality considering different personal, context, and pregnancy related issues and especially capabilities delimited by individual pregnancy related changes; and thus, facilitates following, comprehending, and applying the information.

trimester: 1. 2. 3.

- Compatibility to habits, Easy goingness, Operational practicality

1. 2. 3. trimester

**Enabling automatic data input or requiring merely simple and quick actions, such as ticking, selecting, marking, dragging icons, moving sliders, etc.,** enhances tracking processes during pregnancy.

- Conformity to habits, Credible exclusiveness, Easy goingness, Periodical alikeness
- Being trustworthy, Cognitive assistance

1. 2. 3. trimester

**Providing flexibility to personalize interaction frequency and content visibility by keeping the relevant and pleasing ones active depending on unique pregnancy, trimester, and personality preferences,** enables retrieving more proper and instant information about the desired issue.

- Credible exclusiveness, Easy goingness, Frequentness of companionship, Instant visibility
- Operational practicality

1. 2. 3. trimester

**Working as a distributed system in different personal computers** facilitates access considering specific personal, context, and pregnancy related issues.

- Conformity to habits, Easy goingness

1. 2. 3. trimester

**Having connectivity and automatic synchronization with other health devices and sports equipment** conveys more holistic and accurate image of the course of the pregnancy.

- Conformity to habits, Credible exclusiveness, Localness, Precise content

**Guiding daily life with plans, orientations, suggestions:**

1. 2. 3. trimester

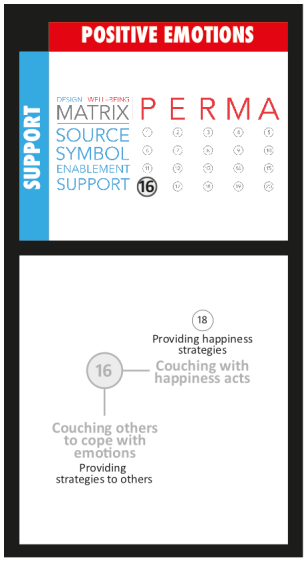
**Guiding pregnant women like a personal coach by directive and suggestive personal feedback and information as a result of collected and tracked personal data** eases sticking to personal goals.

- Conformity to habits, Credible exclusiveness, Easy goingness, Periodical alikeness, Precise content

1. 2. 3. trimester

**Daily or weekly food menu programming suggestions based on personal and contextual dynamics** help couples to prepare and consume healthy foods, as well as to plan their daily or weekly shopping schedules accordingly.

- Credible exclusiveness, Easy goingness, Frequentness of companionship, Instant visibility




## Design can provide supervisory support to elicit positive emotions in a pregnant woman.

**Providing happiness strategies to a pregnant woman:**

1. 2. 3. trimester

**Assigning small daily thinking and behaving tasks to a pregnant woman, based on personal preferences and daily activities,** can initiate and maintain happiness enhancing routines and help her become more optimistic.

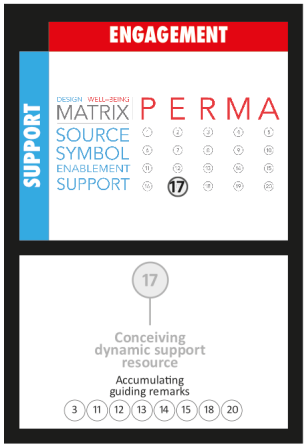
- Being uplifting, Daily suggestiveness

**Providing strategies to people around a pregnant woman:**

1. 2. 3. trimester

**Sending brief notifications to predefined people around a pregnant woman for couching them about the best ways to handle and adapt to the changes during pregnancy; and for helping them about how to support the pregnant woman in more skillful ways,** can boost positive emotions both in the pregnant woman and those around her.

- Being uplifting, Daily suggestiveness, Social networking




## Design can provide supervisory support to foster engagement of a pregnant woman.

**Accumulating and presenting guidance from different stakeholders:**

1. 2. 3. trimester

**Conceiving a dynamic and an increasingly growing pool of positive comments and advices from other pregnant woman, doctors, and psychologists** can promote engagement.

- Being uplifting, Medical assistance, Social networking
- Being trustworthy

## Design can provide supervisory support addressing the relationships of a pregnant woman.

### Providing strategies to people around a pregnant woman:

1. 2. 3. trimester

**Sending brief notifications to predefined people around a pregnant woman for couching them about the best ways to handle and adapt to the changes during pregnancy; and for helping them about how to support the pregnant woman in more skillful ways,** build better comprehension, intimacy, and positive relationships.

- Being uplifting, Daily suggestiveness, Social networking

### Accumulating and presenting guidance from different stakeholders:

1. 2. 3. trimester

**Conceiving a dynamic and an increasingly growing pool of positive comments and advices from other pregnant woman, doctors, and psychologists** can build social connection and intimacy.

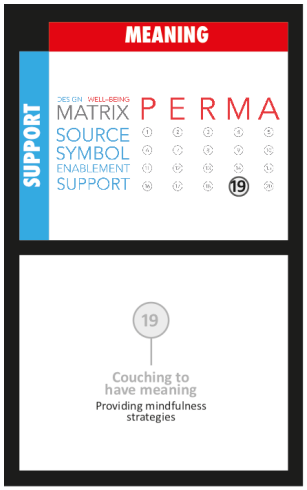
- Being uplifting, Medical assistance, Social networking
- Being trustworthy

### Establishing a support network:

1. 2. 3. trimester

**Establishing a pregnant women network as a part of food and activity tracking and sharing system, in which pregnant women reinforce each other,** can build social connection and intimacy while motivating each other.

- Being uplifting, Social networking
- Being trustworthy




## Design can provide supervisory support about meaningfulness and mindfulness to a pregnant woman.

**Being appealing to the individual, trimester, and pregnancy:**

1. 2. 3. trimester

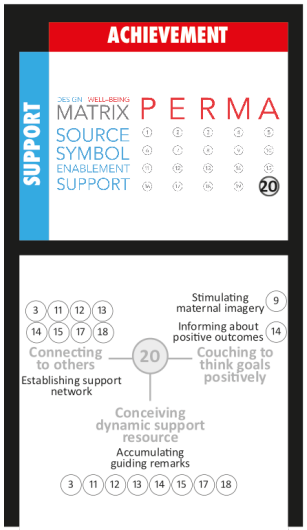
**Couching a pregnant woman (or couples) by sending prompts to abandon negative cognitive and behavioral habits during changes in her daily life and to employ uplifting strategies** can make her feel that she has a direction and she is doing the right things while bringing child into the world.

- Being uplifting, Daily suggestiveness, Maternal sensuousness

2. 3. trimester

**Presenting optional exercises about imagining and practicing the best possible parents, as well as identifying and fostering personal strengths,** can support the sense of optimism, gratitude, and conscientiousness; and thus, can give a sense of purpose, control, and confidence.

- Being uplifting, Maternal sensuousness




## Design can provide supervisory support to help a pregnant woman achieve her goals.

**Establishing a support network:**

1. 2. 3. trimester

**Establishing a pregnant women network as a part of food and activity tracking and sharing system, in which pregnant women reinforce each other,** can increase motivation and adherence to better nutrition intake and exercise.

- Being uplifting, Social networking
- Being trustworthy

Stimulating maternal imagery:
Making a pregnant woman keep a personal memory blog by assigning small tasks without creating a burden, such as positively imagining and writing a birth story, can redound on positive thinking and realizing easier labor.
trimester
1. 2. 3.
Being uplifting
Providing information about the positive outcomes:
Motivating and persuading a pregnant woman by sending well-conceived notifications and related strategies about the positive outcomes of her actions based on tracked data can increase her motivation to keep being mindful for her diverse actions.
trimester
1. 2. 3.
Being illuminative, Being uplifting
Accumulating and presenting guidance from different stakeholders:
Conceiving a dynamic and an increasingly growing pool of positive comments and advices from other pregnant woman, doctors, and psychologists can increase motivations and expand diverse capabilities.
trimester
1. 2. 3.
Being uplifting, Medical assistance, Social networking
Being trustworthy

## 6.2 CONTRIBUTIONS OF THE DISSERTATION

Foundationally, this dissertation uncovers pregnant users' expectations from and experiences with mobile pregnancy technologies by holistically and longitudinally investigating both their usage experiences and general daily life experiences. The main contribution is grounding on positive psychology and positive design literatures to carry mobile pregnancy technologies beyond being mere technological solutions and direct answers to problems, which might be even more crucial in such a vulnerable period.

Revealed positive user experience dimensions, their relations with technology components and pregnancy themes, and design descriptions that consider different pregnancy trimester can be adopted by designers in order to decide on key design and interaction characteristics to be used in their cases. Furthermore, the Design Well-Being Matrix and design descriptions can be used as guiding possibilities and inspiration resources to be employed during the design process of m-health technologies for pregnancy.

Furthermore, designers, application and technology developers, researchers, and other related stakeholders in the field of prenatal and maternal care system can consult to this dissertation as a condensed source for related literature and real-life cases with rich quotations to realize empathetic interpretation and to enhance life qualities of pregnant women. All these can support the integration of m-health technologies in daily lives of pregnant women by addressing a positive pregnancy experience and happiness of pregnant women.

## 6.3 LIMITATIONS OF THE DISSERTATION

There were several limitations in the study, mostly due to natural characteristics of the targeted period.

Firstly, as articulated in Chapter 4, Sections 4.1.2 and 4.1.4, two of the participants had early labor even though such instances had been foreseen and tracking periods in the longitudinal study had been determined accordingly. This did not have an effect on the collected data and their interpretations as the study was formulated in a

qualitative way to gather rich and in-depth insights. Nonetheless, future researchers should take probable drop-outs in a longitudinal study into account, especially with such vulnerable user groups.

Secondly, one of the applications crashed, which had to be compensated with a substituent one. Thus, one of the most appropriate applications was selected bethinking the initial application determination criteria as shown in Chapter 4, Section 4.1.5. Though being the most approaching one to the crashed application, the latter application's interface was different regarding the colors, visual styles, and so on. Similar to the articulation in the above paragraph, as the study was qualitative and exploratory, this did not pose a critical problem to collect data. Resembling to this limitation, applications and technologies in longitudinal studies can be upgraded with major variations. In this study, this aspect was continuously followed and did not pose a treat because of only minor alterations. Nonetheless, in experimental or quantitative studies, all these might pose a major treat. Thus, when employing technologies in longitudinal studies the methodology and back-up plans should be determined at the onset of the study.

Thirdly, applications utilized in the study were in English considering more advanced features, better performances, and better comformance with different operating systems. Although the selected applications were global, sample group in the study was Turkish. The presence of localness dimension in the study findings is meaningful and valuable to inform design; yet, it also implies that global tools with local participants might have an influence on the results. In relation, participants in the study had to be literate not only to know English, but also to be able to use a smartphone. Thus, education level and socio-economic class of the sample group can have a direct effect on pregnancy awareness and experiences, as well as the understanding of positive aspects of life.

Finally, as positive design domain is in its infancy, well-established and tested frameworks do not exist yet; which hardened the formulation of a study about positive design for already health symptoms and pressures involved pregnancy period. Nonetheless, it is important to note that the Design Well-Being Matrix in Figure 37 diversifies the design possibilities and strengthens the design's role, which is of great

significance to make distinction and provide higher level benefits among rapidly evolving technologies and emerging solutions in practice.

## 6.4 FURTHER DIRECTIONS

As initial further research directions, three separate follow-up studies can be conducted to evaluate the outcomes of the study. Firstly, applications utilized in this study would be re-given to some of the participants again and they would be asked to evaluate those applications based on positive user experience dimensions and major relational outcomes of this study, which would be briefly presented to them. Secondly, newly released pregnancy applications would be evaluated and/or explored with pregnant women grounding on the outcomes of the study in this dissertation. This would be beneficial since mobile technologies evolve very rapidly and nonexisting design solutions which had been uttered as recommendations by the participants in the study have started to emerge even during the course of the study—as also continually updated literature review in this dissertation might imply in Chapter 3, Section 3.3.2. Thirdy, the Design Well-Being Matrix specific to the pregnancy can be utilized, evaluated, and further developed as an inspirational guide and resource within a design process.

Besides, some limitations in the study automatically constitutes other directions for further research. Another user research similar with the one in this study can be conducted with participants having the language and local practices similar to the utilized applications.

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## APPENDIX A. COMPILATION OF WELLNESS DIMENSIONS

**Table 8.** Initial compilation of the most common wellness dimensions

| | Career | Coping | Creative | Cultural | Economic | Emotional | Environmental | Essential | Financial | Intellectual | Mental | Occupational | Physical | Psychological | Spiritual | Social | Vocational |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adams, Bezner, and Steinhardt, 1997 | | | | | | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Anspaugh, Hamrick, and Rosato, 2011 | | | | | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Ardell, 1997 | | | | | | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Corbin and Pangrazi, 2001 | | | | | | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| Crose, Nicholas, Gobble, and Frank, 1992 | | | | | | ✓ | | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| Depken, 1994 (in Roscoe, 2009) | | | | | | | | | | | | | | | | | |
| Dolan et al., 2008 | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Durlak, 2000 (in Roscoe, 2009) | | | | | | | | | | ✓ | | | ✓ | | | ✓ | |
| Eberst, 1984 | | | | | | ✓ | | | | | ✓ | | ✓ | | ✓ | ✓ | ✓ |
| Edlin, Golanty, and McCormack, 2000 | | | | | | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Fair, 2002 | | | | | | | | | | | ✓ | | ✓ | | | ✓ | |
| Greenberg, 1985 | | | | | | ✓ | | | | | ✓ | | ✓ | | ✓ | ✓ | |
| Gregor, 2010 | | | | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Hales, 2005 | | | | | | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Hales, 2011 | | | | | | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Helliwell, 2005 (in Miller and Foster, 2010) | | | | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | |
| Hettler, 1976 | | | | | | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Lafferty, 1979 | | | | | | ✓ | | | | ✓ | | | ✓ | | ✓ | ✓ | |
| Leafgren, 1990 (in Roscoe, 2009) | | | | | | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| National Wellness Institute, 2017 | | | | | | ✓ | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| May, 2007 (in Miller and Foster, 2010) | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| Montague et al., 2002 | | | | | | ✓ | | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| OSU Student Wellness Center, 2017 | ✓ | | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | |
| Rachele, Washington, Cockshaw, and Brymer, 2013 | | | | | | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| Renger et al., 2000 | | | | | | ✓ | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | |
| Ryan and Deci, 2001 (in Miller and Foster, 2010) | | | | ✓ | | ✓ | ✓ | | | | | | ✓ | | ✓ | ✓ | |
| Ryff and Singer, 2006 (in Miller and Foster, 2010) | | | | ✓ | | ✓ | ✓ | | | | | | ✓ | | ✓ | ✓ | |
| Swarbrick, 2006 | | | | | | ✓ | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | |
| Sweeney and Myers, 2003 | | ✓ | ✓ | | | | | ✓ | | | | | ✓ | | | ✓ | |
| Travis and Ryan, 2004 (in Miller and Foster, 2010) | | | | | | ✓ | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| UH Wellness, 2017 | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | |

This initial compilation was not only from the established frameworks, but also from several reliable resources like university websites and well-known institutions in the field, to understand and show the diversity of the wellness dimensions. Actually, more recent wellness dimensions started to appear in the literature, yet these are either the synonyms or the broader definitions of the former ones, such as mental wellness, medical wellness, material wellness, and relational wellness. Therefore, they are not

included. The collected dimensions were merged and refined in the following step to reach a common and recent understanding of wellness (see Table 9).

**Table 9.** Merged and refined wellness dimensions

| | Creative | Cultural | Emotional | Environmental | Financial | Intellectual | Occupational | Physical | Spiritual | Social | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adams, Bezner, and Steinhardt, 1997 | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | * Emotional = Psychological |
| Anspaugh, Hamrick, and Rosato, 2011 | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | * Emotional = Coping, Spiritual = Essential |
| Ardell, 1997 | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | * Emotional = Psychological |
| Corbin and Pangrazi, 2001 | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | * Emotional = Mental, Occupational = Vocational |
| Crose, Nicholas, Gobble, and Frank, 1992 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | * Occupational = Vocational |
| Depken, 1994 (in Roscoe, 2009) | | | | | | | | | | | |
| Dolan et al., 2008 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | * Economic = Financial |
| Durlak, 2000 (in Roscoe, 2009) | | | | | | ✓ | | ✓ | | ✓ | |
| Eberst, 1984 | | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | * Emotional = Mental, Occupational = Vocational |
| Edlin, Golanty, and McCormack, 2000 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Fair, 2002 | | | ✓ | | | | | ✓ | | ✓ | * Emotional = Psychological = Mental |
| Greenberg, 1985 | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | * Intellectual = Mental |
| Gregor, 2010 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | * Economic = Financial |
| Hales, 2005 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Hales, 2011 | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | * Emotional = Psychological |
| Helliwell, 2005 (in Miller and Foster, 2010) | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | * Economic = Financial, Emotional = Psychological |
| Hettler, 1976 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Lafferty, 1979 | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | |
| Leafgren, 1990 (in Roscoe, 2009) | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| National Wellness Institute, 2017 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| May, 2007 (in Miller and Foster, 2010) | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Economic = Financial, Emotional = Psychological |
| Montague et al., 2002 | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | * Occupational = Vocational |
| OSU Student Wellness Center, 2017 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | * Career = Occupational |
| Rachele, Washington, Cockshaw, and Brymer, 2013 | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | * Emotional = Psychological |
| Renger et al., 2000 | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | |
| Ryan and Deci, 2001 (in Miller and Foster, 2010) | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | * Emotional = Psychological |
| Ryff and Singer, 2006 (in Miller and Foster, 2010) | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ | * Emotional = Psychological |
| Swarbrick, 2006 | | | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | |
| Sweeney and Myers, 2003 | ✓ | | ✓ | | | | | ✓ | ✓ | ✓ | * Emotional = Coping, Essential = Spiritual |
| Travis and Ryan, 2004 (in Miller and Foster, 2010) | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | * Emotional = Psychological |
| UH Wellness, 2017 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

# APPENDIX B. SET-UP (TURKISH VERSION)

**KATILIMCI BİLGİLENDİRME ve GÖNÜLLÜ KATILIM FORMU**

Bu araştırma, Orta Doğu Teknik Üniversitesi Endüstri Ürünleri Tasarımı Bölümü'nde yürütülmekte olan Araş. Gör. Aslı Günay'ın doktora tezi kapsamında yapılmaktadır. Araştırmanın amacı **mobil hamile teknolojilerinin hamilelerin yaşamına pürüzsüz bir şekilde entegre edilmesi**ne yönelik katılımcıların değerlendirmeleri ve deneyimlerini öğrenmektir.

Araştırma süreci üç ana aşamadan oluşmaktadır. İlk aşamada yüz yüze yapılacak yaklaşık yarım saatlik görüşmede size sorulacak sorulara cevap vermeniz beklenmektedir. İkinci aşamada ise bir mobil hamile sağlığı uygulamasını altı hafta boyunca kullanmanız ve bu altı hafta boyunca iki defa yapılacak olan yaklaşık on beşer dakikalık telefon görüşmelerinde sorulacak sorulara cevap vermeniz istenecektir. Çalışmanın son aşamasında ise yine yüz yüze yapılacak yaklaşık yarım saatlik görüşmede çalışma sürecinde uygulama kullanımı ile yaşadığınız deneyim hakkında sorulacak sorulara cevap vermeniz beklenmektedir.

Araştırma sırasında kimliğiniz gizli tutulacaktır. Elde edilecek veriler kimliğiniz anonim bir şekilde yalnızca tez çalışmasında ve bilimsel yayınlarda kullanılacaktır. Süreci tam olarak kayıt etmek ve daha sonra analiz etmek için konuşulanlar ses kayıt cihazıyla kaydedilecektir.

Araştırmaya katılım gönüllülük esasına dayalıdır ve katılımcılar açısından herhangi bir tehlike ve özel yaşam ihlali oluşturmamaktadır. Bu formu imzalayarak yukarıdaki bilgileri anladığınızı ve onayladığınızı belirtmiş bulunmaktasınız. Araştırma sürecinde istediğiniz zaman bilgi verilmesini ya da araştırmanın durdurulmasını talep etme hakkınız bulunmaktadır. İstediğiniz takdirde aşağıda verilen bilgilerden araştırmacıya ulaşarak çalışma hakkında daha fazla bilgi alabilirsiniz.

Vakit ayırdığınız ve yardımlarınız için çok teşekkür ederim.

Aslı Günay
Araştırma Görevlisi | Doktora Öğrencisi
ODTÜ Endüstri Ürünleri Tasarımı Bölümü
Tel: 0312 210 42 20
E-Posta: agunay@metu.edu.tr

| **Katılımcının Adı-Soyadı** | **İmza** | **Tarih** |
|---|---|---|

**Katılımcı İletişim Bilgileri:**

**Ad Soyad:** ……
**Tel. No.:** ……
**E-Posta:** ……

**Yaş:** …….

**Hamilelik günü/haftası:** …….

**En son elde edilen akademik derece:**
□ Lise □ Lisans □ Yüksek Lisans □ Doktora
□ Diğer (Lütfen belirtiniz): ……

**Meslek:** …….

**Kimle yaşıyorsunuz?** ……
□ Yalnız □ Eş/Partner □ Ebeveyn
□ Diğer (Lütfen belirtiniz): ……

**Telefon türü:**
□ iPhone □ Android

*[Katılımcıların mutluluk/iyi oluş durumlarını ve teknolojik ürünleri kullanma eğilimlerini ölçen üç ölçeğin Türkçe versiyonları katılımcılara verilecek:* ***Olumlu ve Olumsuz Deneyim Ölçeği*** *(Positive and Negative Experience Scale - SPANE),* ***Yaşam Doyumu Ölçeği*** *(Satisfaction with Life Scale - SWLS),* ***Teknolojiye Yakınlık Ölçeği****.]*

**İlk görüşme soruları:**
- Hamilelik ile birlikte günlük hayatınız nasıl değişti?
- Telefonunuza uygulama indiriyor musunuz?

| | | | | |
|---|---|---|---|---|
| Hiçbir zaman (1) | Nadiren (2) | Arasıra (3) | Sık sık (4) | Her zaman (5) |

- Ne tür uygulamalar? (Hangi amaçla bu uygulamaları kullanıyorsunuz?)

- Hiç sağlıkla ilgili uygulama kullandınız mı? Eğer kullandıysanız, hangi tür uygulama(lar)?

- Kullanmayı düşündünüz mü/ düşünüyor musunuz?

| | | | | |
|---|---|---|---|---|
| Hiçbir zaman (1) | Nadiren (2) | Arasıra (3) | Sık sık (4) | Her zaman (5) |

- Hiç hamilelikle ilgili uygulama kullandınız mı? Eğer kullandıysanız, hangi tür uygulama(lar)?

- Kullanmayı düşündünüz mü/ düşünüyor musunuz?

| | | | | |
|---|---|---|---|---|
| Hiçbir zaman (1) | Nadiren (2) | Arasıra (3) | Sık sık (4) | Her zaman (5) |

- (Hamilelikte kullanılan teknolojilerle ilgili) Gereksiniminizi biraz anlatır mısınız? Neden kullanma gereksinimi duydunuz/duyarsınız? Hangi özellikler olsun istersiniz?

*[Üç uygulama temel özelliklerini gösteren kartlar katılımcıya tanıtılacak.]*

- Gösterilen üç uygulamadan hangisini seçmek istersiniz?
- Neden bu uygulamayı kullanmak istersiniz? (Neden bu uygulamayı seçtiniz?)
- Bu uygulamayı ne amaçla kullanmak istersiniz?
- Bu uygulamadan ne gibi özellikler beklersiniz?

*[Mülakattan sonra katılımcılardan seçtiği uygulamayı yüklemesi ve uygulamaya hızlıca göz atması istenecek.* ***Baby Bump Pregnancy Pro*** *ücretini –AS $3.99/GP 6.60 TRY- kapsayan 10TL tutarını içeren zarflar katılımcıya verilecek. Sonra, üç aylık hamilelik trimestresi boyunca 6 hafta süreyle uygulama kullanmayı içeren bir sonraki aşama için bilgi verilecek.]*

Şimdi seçtiğiniz uygulamayı yüklemenizi isteyeceğim.

Bundan sonraki aşamada, **6 hafta** boyunca, ihtiyacınız olduğu ya da istediğiniz zaman uygulamayı kullanmanızı isteyeceğim. İlk haftadan sonra, daha sonra da her iki haftada bir uygulama hakkındaki deneyimlerinizi öğrenmek için sizi kısaca arayacağım. Yani, toplamda **2 defa telefonda ve en son yüzyüze** görüşeceğiz. Bu süreçte size ara sıra, tercih ettiğiniz ortamdan (SMS, Whatsapp, E-posta, vb.), uygulama kullanmayı hatırlatma amaçlı kısa mesajlar göndereceğim. Ayrıca, uygulamayı kullandıktan sonra hangi özellikleri kullandığınızı not almanızı istiyorum. Bunu kolaylaştırmak için, uygulamayı her kullandıktan sonra bana kısa bir mesajla haber verirseniz size işaretleyeceğiniz ya da not alacağınız bir liste göndereceğim. (İşaret koymak ve not almak için bunu hızlıca ve kolaylıkla yapmanızı sağlayan *Skitch* uygulamasını kullanabilirsiniz.) Bazı zamanlarda telefondan bilgi girmeniz zor olursa diye listenin yazılı çıktısından da 10 tane veriyorum, istediğiniz zaman çıktılarından daha fazla da verebilirim. Yani format ve nasıl doldurduğunuz hiç önemli değil. Bu liste sadece telefon mülakatlarında ve en son yüz yüze yapacağımız mülakatta deneyimlerinizi hatırlamayı kolaylaştırmak için kullanılacak.

Yorum ya da sorularınız var mı?

Tekrar katılımınız ve yardımlarınız için çok teşekkür ederim.

**İlk telefon görüşmesi soruları:**

- Geçtiğimiz hafta yaşamınızda hamilelikle ilgili ne gibi değişiklikler/ gelişmeler oldu?
- Hamilelik ile ilgili duygularınız genel olarak nasıldı?
- Hangi konularda kendinizi iyi hissettiniz? Hangi konularda kendinizi daha iyi hissetmek isterdiniz? Neden?
- Hamilelikle ilgili beklentileriniz ve ihtiyaçlarınız nasıldı? Neden?
- Hamilelikle ilgili sizi olumsuz etkileyen bir şey oldu mu? Neden?

- Uygulamayla ilgili her şey yolunda mı? Uygulama kullanımı nasıl gidiyor?
- Ne kadar sıklıkla uygulamayı kullandınız?
- Hangi zamanlarda uygulamayı kullanmayı istediniz/ düşündünüz? Neden?
- Hangi özellikleri kullandınız? Neden?
- Uygulama hakkında ilk düşünceleriniz neler? Neden?
- Hamilelik ile ilgili bu uygulamayı kullanmak neler hissettirdi? Neden?
- Uygulamada en çok beğendiğiniz şeyler neler? Neden?
- Sorun yaşadığınız/beğenmediğiniz yerler var mı? Varsa nelerde sorun yaşadınız/ neleri beğenmediniz? Neden?

**- Uygulama kullanımının hamilelik sürecine nasıl bir etkisi olduğunu düşünüyorsunuz? Neden?**
**- Bu haftaki uygulama deneyiminden sonra ilerideki haftalar için uygulamadan ne gibi beklentileriniz var? Neden?**
**- Bu tür uygulamaların hamilelerin hayatında daha olumlu etkisi ve rolü olması için ne yapılabilir? Neden?**

**İkinci telefon görüşmesi soruları:**

- Geçtiğimiz hafta yaşamınızda hamilelikle ilgili ne gibi değişiklikler/ gelişmeler oldu?
- Hamilelik ile ilgili duygularınız genel olarak nasıldı?
- Hangi konularda kendinizi iyi hissettiniz? Hangi konularda kendinizi daha iyi hissetmek isterdiniz? Neden?
- Hamilelikle ilgili beklentileriniz ve ihtiyaçlarınız nasıldı? Neden?
- Hamilelikle ilgili sizi olumsuz etkileyen bir şey oldu mu? Neden?

- Uygulamayla ilgili her şey yolunda mı? Uygulama kullanımı nasıl gidiyor?
- (Son görüşmemizden sonra) Ne kadar sıklıkla uygulamayı kullandınız?
- Hangi zamanlarda uygulamayı kullanmayı istediniz/ düşündünüz? Neden?
- Hangi özellikleri kullandınız? Neden?
- Uygulama hakkında düşünceleriniz değişti mi? Nasıl değişti? Neden? (Şimdi uygulama hakkında düşünceleriniz neler?)
- Hamilelik ile ilgili bu uygulamayı kullanmak (yeni) neler hissettirdi?
- Uygulamada beğendiğiniz yeni şeyler oldu mu? Varsa neleri beğendiniz? Neden?
- Sorun yaşadığınız/beğenmediğiniz yerler var mı? Varsa nelerde sorun yaşadınız/ neleri beğenmediniz? Neden?

**- Uygulama kullanımının hamilelik sürecinize etkisi hakkında düşünceleriniz değişti mi? Etkisi hakkında neler düşünüyorsunuz? Neden?**
**- Geçtiğimiz haftalarda yaşadığınız uygulama deneyiminden sonra ileriki hafta(lar) için uygulamadan ne gibi beklentileriniz var? Neden?**
**- Bu tür uygulamaların hamilelerin hayatında daha olumlu etkisi ve rolü olması için ne yapılabilir? Neden?**

**Final görüşmesi soruları:**

- Uygulama kullanımınızın son haftasında yaşamınızda hamilelikle ilgili ne gibi değişiklikler oldu?
- Hamilelik ile ilgili duygularınız genel olarak nasıldı?
- Hangi konularda kendinizi iyi hissettiniz? Hangi konularda kendinizi daha iyi hissetmek isterdiniz? Neden?
- Hamilelikle ilgili beklentileriniz ve ihtiyaçlarınız nasıldı? Neden?
- Hamilelikle ilgili sizi olumsuz etkileyen bir şey oldu mu? Neden?

- Uygulama kullanımı genel olarak nasıl gitti?
- (Son görüşmemizden sonra) Ne kadar sıklıkla uygulamayı kullandınız?
- Hangi zamanlarda uygulamayı kullanmayı istediniz/ düşündünüz? Neden?
- Hangi özellikleri kullandınız? Neden?
- Uygulama hakkında düşünceleriniz değişti mi? Nasıl? Neden? (Şimdi uygulama hakkında düşünceleriniz neler?)
- Hamilelik ile ilgili bu uygulamayı kullanmak (yeni) neler hissettirdi?
- Uygulamada beğendiğiniz yeni şeyler oldu mu? Varsa neleri beğendiniz? Neden?
- Sorun yaşadığınız yerler oldu mu? Varsa nelerde sorun yaşadınız? Neden?

**- Altı hafta boyunca tüm uygulama kullanım deneyimlerinizi düşünürseniz uygulama kullanımının hamilelik sürecinize etkisi hakkında ne düşünüyorsunuz? Neden?**
**- Hamileliğiniz bundan sonraki aşamasında da uygulamayı kullanmaya devam etmeyi düşünür müsünüz? Neden?**

| | | | | |
|---|---|---|---|---|
| Hiçbir zaman (1) | Nadiren (2) | Arasıra (3) | Sık sık (4) | Her zaman (5) |

**- Bu uygulama sizi nasıl daha mutlu edebilirdi?**
**- Bu tür hamilelik uygulamalarının daha olumlu ve faydalı hale getirilmesi için önerileriniz nelerdir?**

*[**Olumlu ve Olumsuz Deneyim Ölçeği** (Positive and Negative Experience Scale - SPANE), **Yaşam Doyumu Ölçeği** (Satisfaction with Life Scale - SWLS) ölçekleri tekrar verilecek.]*

Çalışmamız bu kadardı, katılımınız ve yardımlarınız için tekrar çok teşekkür ederim. Söylemek ya da sormak istediğiniz bir şey var mı?

# APPENDIX C. SET-UP (ENGLISH VERSION)

**PARTICIPANT INFORMATION and CONSENT FORM**

This study is conducted within the scope of a doctoral dissertation which is carried out in Middle East Technical University, Department of Industrial Design by Res. Asst. Aslı Günay. The aim of the research is to comprehend participants' evaluations and experiences regarding the **smooth integration of mobile pregnancy technologies in daily lives of pregnant women.**

The study period is composed of three main stages. At the first stage, you are expected to respond certain questions in an approximately half-hour face-to-face interview. In the second stage, you are requested to use a mobile pregnancy application during six weeks and to respond questions in an approximately fifteen-minute two phone interviews during this six-week period. In the final stage, you are expected to answer questions about your experiences with the application usage throughout the study, again in an approximately half-hour face-to-face interview.

Your identity will be kept confidential during the study. Findings will be used anonymously and merely in the dissertation and scientific publications. Interviews will be voice-recorded to keep track of and analyze the entire process.

Participation in this study is voluntary and does not cause any hazards and violation of privacy. Upon signing this form, you certify that you have understood and confirm the abovementioned information. You have the right to request information or to leave the study at any time. If you require further information about the study, you can contact the researcher from the information provided below.

Thank you very much for your time and help.

Aslı Günay
Research Assistant | PhD Candidate
METU Department of Industrial Design
Phone: 0312 210 42 20
E-Mail: agunay@metu.edu.tr

| _____ | _____ | _____ |
|---|---|---|
| **Participant Name-Surname** | **Signature** | **Date** |

**Participant Contact Information:**

**Name Surname:** ……
**Phone:** ……
**E-Mail:** ……

**Age:** …….

**Pregnancy day/week:** …….

**Highest degree/level of education completed:**
□ High School □ Bachelor's degree □ Master's degree □ Doctoral degree
□ Other (Please specify): ……

**Occupation:** …….

**With whom do you live?** ……
□ Single □ Spouse/Partner □ Parents
□ Other (Please specify): ……

**Phone type:**
□ iPhone □ Android

*[Turkish versions of three scales will be given to participants which measure happiness/well-being states of the participants and their propensity to adopt, embrace, and use new technologies:* ***Scale of Positive and Negative Experience*** *(SPANE),* ***Satisfaction with Life Scale*** *(SWLS),* ***Technology Readiness Index****.]*

**First interview questions:**
- How has your life changed with pregnancy?
- Do you download applications on your phone?

| | | | | |
|---|---|---|---|---|
| Never (1) | Rarely (2) | Sometimes (3) | Often (4) | Always (5) |

- Which types of application(s)? (For which purposes are you using those applications?)

- Have you ever used health related applications? If so, which types of application(s)?

- Have you thought / Are you thinking about using health related application?

| | | | | |
|---|---|---|---|---|
| Never (1) | Rarely (2) | Sometimes (3) | Often (4) | Always (5) |

- Have you ever used pregnancy related applications? If so, which types of application(s)?

- Have you thought / Are you thinking about using pregnancy related application?

| | | | | |
|---|---|---|---|---|
| Never (1) | Rarely (2) | Sometimes (3) | Often (4) | Always (5) |

- (Considering technologies used during pregnancy) Can you please explain your needs? Why you are in need of using these technologies? Which features do you want from these technologies?

*[Cards demonstrating the main features of the three applications will be presented to the participant.]*

- Which application would you select from the presented three applications?
- Why do you want to use this application? (Why did you select this application?)
- For which purposes would you use this application?
- Which types of features would you expect from this application?

*[After the interview, the participant will be asked to download the selected application and to have a quick look at the downloaded application in order to prevent possible problems during downloading and initial encounter. If the participant selects the **Baby Bump Pregnancy Pro** app, she will be compensated with 10TL, which covers the application's price in both Apple Store ($3.99) and Google Play Store (6.60 TRY). After, she will be informed about the next phase of the study, which involves 6-week app-usage during a specific pregnancy trimester.]*

Now, I would like you to download the application you have selected. In the next phase, I want you to use this application whenever you need or want. After the first week and then biweekly, I will call you briefly to learn your experiences with the application. That is, we will have **2 phone interviews** and 1 final **face-to-face** interview. During this period, I will send you short messages from a media you prefer (SMS, Whatsapp, E-mail, etc.) to remind using the application. Besides, I want you to note down the application features you use. To facilitate this, if you notify me after each interaction with the application, I will send you a feature checklist card on which you can take a note. (To check off or take a note, you may use the *Skitch* application which enables you to this with a quick and easy way.) In case you have difficulties to enter information via phone, I am also giving 10 print-out feature checklist cards and whenever you need I will supply more. In short, which format you prefer and how you fill it is not important. These cards will be used only to help you remember your experiences on the phone calls and in the final face-to-face interview.

Do you have any comments or questions?

Thank you very much again for your participation and your help.

**First phone interview questions:**

- What kind f changes/developments occurred in your daily life regarding pregnancy during last week?
- How were your overall feelings?
- About which issues you felt yourself good? About which issues would you like to feel better? Why?
- How were your expectations and needs regarding pregnancy? Why?
- Were there any issues that affected you adversely? Why?

- Is everything going well about the application? How is application usage going?
- How often did you use the application?
- When did you want to use/think about using the application? Why?
- Which features did you use? Why?
- What are your initial thoughts about the application? Why?
- How did the pregnancy related application make you feel? Why?
- What were your favorite features/qualities in the application? Why?
- Were there any issues that you had problems /disliked? If so, what were those issues? Why?

**- What are you thinking about the effects of using a pregnancy related application on pregnancy?**
**- After your experiences with the application during last week, what are your expectations from the application for the upcoming weeks? Why?**
**- What can be done to make such applications have a more positive impact and role in the lives of pregnant women? Why?**

**Second phone interview questions:**

- What kind of changes/developments occurred in your daily life regarding pregnancy during last week?
- How were your overall feelings regarding pregnancy?
- About which issues you felt yourself good? About which issues would you like to feel better? Why?
- How were your expectations and needs regarding pregnancy? Why?
- Were there any issues that affected you adversely? Why?

- Is everything going well about the application? How is application usage going?
- (After our last interview) How often did you use the application?
- When did you want to use/think about using the application? Why?
- Which features did you use? Why?
- Did your thoughts about the application change? If so, how did it change? Why? (What are your current thoughts about the application?)
- How did the pregnancy related application make you feel (newly)? Why?
- Were there any issues that you like newly? If so, what were those issues? Why?
- Were there any issues that you had problems /disliked? If so, what were those issues? Why?

**- Did your thoughts about the effects of using a pregnancy related application on pregnancy changed? What are you thinking about the effects of using a pregnancy related application on pregnancy? Why?**
**- After your experiences with the application during last weeks, what are your expectations from the application for the upcoming weeks? Why?**
**- What can be done to make such applications have a more positive impact and role in the lives of pregnant women? Why?**

**Final interview questions:**

- What kind of changes/developments occurred in your daily life regarding pregnancy during the last week of your application usage phase?
- How were your overall feelings regarding pregnancy?
- About which issues you felt yourself good? About which issues would you like to feel better? Why?
- How were your expectations and needs regarding pregnancy? Why?
- Were there any issues that affected you adversely? Why

- How did overall application usage go?
- (After our last interview) How often did you use the application?
- When did you want to use/think about using the application? Why?
- Which features did you use? Why?
- Did your thoughts about the application change? If so, how did it change? Why? (What are your current thoughts about the application?)
- How did the pregnancy related application make you feel (newly)? Why?
- Were there any issues that you like newly? If so, what were those issues? Why?
- Were there any issues that you had problems /disliked? If so, what were those issues? Why?

**- Considering the entire 6-week application usage period, what are you thinking about the effects of using a pregnancy related application on pregnancy? Why?**
**- Would you like to continue using this application in your upcoming pregnancy weeks? Why?**

| | | | | |
|---|---|---|---|---|
| Never (1) | Rarely (2) | Sometimes (3) | Often (4) | Always (5) |

**- How this application would have made you happier?**
**- What are your suggestions to make such applications have a more positive impact and role in the lives of pregnant women? Why?**

*[Positive and Negative Experience Scale – SPANE and Satisfaction with Life Scale - SWLS will be given again.]*

This is the end of our study, thank you very much again for your participation and help. Do you have any comments or questions?

## APPENDIX D. SCALES (TURKISH VERSIONS)

**TEKNOLOJİYE OLAN YAKLAŞIM ÖLÇEĞİ (Kısaltılmış)** **K: …….**

Lütfen, aşağıdaki maddelerin her biri için görüşlerinizi yansıtan ifadeyi işaretleyiniz.

5 = Kesinlikle katılıyorum
4 = Katılıyorum
3 = Ne katılıyorum ne katılmıyorum
2 = Katılmıyorum
1 = Kesinlikle katılmıyorum

| | Kesinlikle katılmıyorum | Katılmıyorum | Ne katılıyorum ne katılmıyorum | Katılıyorum | Kesinlikle katılıyorum |
|---|---|---|---|---|---|
| Yeni teknolojileri fikren ilham verici olarak görüyorum. | 1 | 2 | 3 | 4 | 5 |
| Bir makineye veya İnternete bilgi sağladığımda, doğru yere ulaştığından asla emin olamam. | 1 | 2 | 3 | 4 | 5 |
| İşleri kendi ihtiyaçlarıma göre düzenlememe izin veren bilgisayar programlarını severim. | 1 | 2 | 3 | 4 | 5 |
| Mali işleri çevrim içi olarak yapmayı güvenli bulmuyorum. | 1 | 2 | 3 | 4 | 5 |
| İnsanlar yeni teknolojiler konusunda benden tavsiye almak ister. | 1 | 2 | 3 | 4 | 5 |
| İnternet üzerinden gönderdiğim bilgilerin başkaları tarafından görüleceği endişesini taşıyorum. | 1 | 2 | 3 | 4 | 5 |
| Yüksek teknolojili ürün ve hizmetleri genellikle kimseden yardım almadan çözebilirim. | 1 | 2 | 3 | 4 | 5 |
| Yüksek teknoloji ürün veya hizmet sağlayıcısından teknik destek aldığımda benden daha fazla bilen birinin benden faydalandığını düşünürüm. | 1 | 2 | 3 | 4 | 5 |
| Genel olarak yeni teknolojiler çıktığında arkadaş çevremden önce ona sahip olurum. | 1 | 2 | 3 | 4 | 5 |
| İnsanlar izlerken yüksek teknolojili ürünlerle sorun yaşamamı utanç verici buluyorum. | 1 | 2 | 3 | 4 | 5 |

**OLUMLU ve OLUMSUZ DENEYİM ÖLÇEĞİ** **K: …….**

Lütfen, **son bir ay** içinde yaptıklarınızı düşününüz ve aşağıdaki duygulardan her birini ne kadar hissettiğinizi 1 ile 5 arasında değişen puanları kullanarak değerlendiriniz. Her bir madde için seçtiğiniz numarayı işaretleyiniz.

.

1 = Asla 2 = Nadiren 3 = Bazen 4 = Sık sık 5 = Her zaman

_____ Olumlu

_____ Olumsuz

_____ İyi

_____ Kötü

_____ Keyifli

_____ Keyifsiz

_____ Mutlu

_____ Üzgün

_____ Korkulu

_____ Neşeli

_____ Kızgın

_____ Hoşnut

**YAŞAM DOYUMU ÖLÇEĞİ** **K: …….**

Aşağıdaki ifadelere katılıp katılmadığınızı görüşünüzü yansıtan rakamı maddenin başındaki boşluğa yazarak belirtiniz. Doğru ya da yanlış cevap yoktur. Sizin durumunuzu yansıttığını düşündüğünüz rakam bizim için en doğru yanıttır. Lütfen, açık ve dürüst şekilde yanıtlayınız.

7 = Kesinlikle katılıyorum

6 = Katılıyorum

5 = Çok az katılıyorum

4 = Ne katılıyorum ne de katılmıyorum

3 = Biraz katılmıyorum

2 = Katılmıyorum

1 = Kesinlikle katılmıyorum

_____ Pek çok açıdan ideallerime yakın bir yaşamım var

_____ Yaşam koşullarım mükemmeldir

_____ Yaşamım beni tatmin ediyor

_____ Şimdiye kadar, yaşamda istediğim önemli şeyleri elde ettim

_____ Hayatımı bir daha yaşama şansım olsaydı, hemen hemen hiçbir şeyi değiştirmezdim

## APPENDIX E. SCALES (ENGLISH VERSIONS)

**TECHNOLOGY READINESS INDEX (Abbreviated)** **P: …….**

Lütfen, aşağıdaki maddelerin her biri için görüşlerinizi yansıtan ifadeyi işaretleyiniz.

5 = Strongly agree
4 = Agree
3 = Neither agree nor disagree
2 = Disagree
1 = Strongly disagree

| | Strongly disagree | Disagree | Neither agree nor | Agree | Strongly agree |
|---|---|---|---|---|---|
| I find new technologies to be mentally stimulating. | 1 | 2 | 3 | 4 | 5 |
| If I provide information to a machine or over the Internet, I can never be sure it really gets to the right place. | 1 | 2 | 3 | 4 | 5 |
| I like computer programs that allow me to tailor things to fit my own needs. | 1 | 2 | 3 | 4 | 5 |
| I do not consider it safe to do any kind of financial business online. | 1 | 2 | 3 | 4 | 5 |
| Other people come to me for advice on new technologies. | 1 | 2 | 3 | 4 | 5 |
| I worry that information I send over the Internet will be seen by other people. | 1 | 2 | 3 | 4 | 5 |
| I can usually figure out new hi-tech products and services without help from others. | 1 | 2 | 3 | 4 | 5 |
| When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do. | 1 | 2 | 3 | 4 | 5 |
| In general, I am among the first in my circle of friends to acquire new technology when it appears. | 1 | 2 | 3 | 4 | 5 |
| It is embarrassing when I have trouble with a high-tech gadget while people are watching. | 1 | 2 | 3 | 4 | 5 |

**SCALE of POSITIVE and NEGATIVE EXPERIENCE** **P: …….**

Please think about what you have been doing and experiencing during the **past four weeks**. Then report how much you experienced each of the following feelings, using the scale below. For each item, select a number from 1 to 5, and indicate that number on your response sheet.

.

1 = Very Rarely or Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Very Often or Always

_____ Positive

_____ Negative

_____ Good

_____ Bad

_____ Pleasant

_____ Unpleasant

_____ Happy

_____ Sad

_____ Afraid

_____ Joyful

_____ Angry

_____ Contented

**SATISFACTION WITH LIFE SCALE** **P: …….**

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

7 = Strongly agree

6 = Agree

5 = Slightly agree

4 = Neither agree nor disagree

3 = Slightly disagree

2 = Disagree

1 = Strongly disagree

_____ In most ways my life is close to my ideal

_____ The conditions of my life are excellent

_____ I am satisfied with my life

_____ So far I have gotten the important things I want in life

_____ If I could live my life over, I would change almost nothing

# APPENDIX F. A FEATURE CHECKLIST CARD (TURKISH VERSION)

**Uygulama kullanım tarihi:**
**Uygulama kullanım zaman(lar)ı:**

(Lütfen aşağıda bulunan özelliklerden kullandıklarınızı işaretleyiniz. İsterseniz, işaretlenen özellikleri belirtilen gün kaç defa kullandığınızı not alabilirsiniz.).

| UYGULAMA ÖZELLİK / İÇERİK | ✓ | UYGULAMA ÖZELLİK / İÇERİK | ✓ |
|---|---|---|---|
| **Hamilelik bilgilendirme** (Bebek gelişimi, bedensel değişim, vb.) | | **Kasılma zaman tutucu/ takibi** | |
| **Geri sayım/ Doğum tarihi hesaplama** | | **Tekme sayacı/ takibi** | |
| **Hamilelik yönetimi** (Kontrol ve yapılacaklar listesi, hatırlatma, bildirimler, doğum planı, vb.) | | **Kilo takibi** | |
| **Günlük / Hatıra defteri** | | **Egzersiz takibi** | |
| **Forumlar/ Topluluklar/ Kulüpler** | | **Beslenme takibi** | |
| **Paylaşım** (Facebook, Twitter, E-posta, vb.) | | **İlaç takibi** | |
| **Bebek isimleri** | | **Uyku takibi** | |
| **Mağaza/ Alışveriş** | | **Mod/ Duygu takibi** | |
| **Diğer özellik(ler)** (Lütfen belirtiniz): | | | |

**Figure 39.** A checklist card in Turkish

# APPENDIX G. DETAILS ABOUT THE PARTICIPANTS

**Table 10.** Sample demographics

| Participant No. | Age | Pregnancy Day/Week | Pregnancy Trimester | Preg. No. | Academic Achievement | Occupation | Phone Type | Selected Application | Previous Pregnancy App Experience |
|---|---|---|---|---|---|---|---|---|---|
| **P01** | 35 | 27 | 3 | 1 | PhD | Academician (Architecture) | iPhone (Android) | MyPregnancy | Y (WebMD) |
| **P02** | 40 | 32 | 3 | 4 | Undergraduate | Store Director | Android | MyPregnancy | N |
| **P03** | 40 | 24 | 2 | 1 | PhD | Architect | iPhone | BabyBump Pregnancy Pro | N |
| **P04** | 32 | 15 | 2 | 2 | Undergraduate | Bank Employee | Android | BabyBump Pregnancy Pro | Y (I'm Pregnant) |
| **P05** | 34 | 31 | 3 | 2 | Graduate | Officer | Android | BabyBump Pregnancy Pro | N |
| **P06** | 27 | 19 | 2 | 1 | Graduate | Biomedical Engineer | iPhone | MyPregnancy | Y (One in the Womb) |
| **P07** | 28 | 10 | 1 | 1 | Undergraduate | Dentist | Android | BabyBump Pregnancy Pro | Y (Hamilelik Rehberi) |
| **P08** | 33 | 10 | 1 | 1 | Graduate | Nurse | iPhone | BabyBump Pregnancy Pro | N |
| **P09** | 29 | 15 | 2 | 1 | Undergraduate | Medical Manager/ Doctor | iPhone | Ovia | N |
| **P10** | 29 | 22 | 2 | 1 | Graduate | Chemical Engineer | iPhone | MyPregnancy | Y (Bebeğim) |
| **P11** | 34 | 10 | 1 | 1 | Undergraduate | TV Programmer | Android | MyPregnancy | N |
| **P12** | 31 | 18 | 2 | 1 | Graduate | Research Assistant (Information Systems) | Android | BabyBump Pregnancy Pro | Y (**My Pregnancy Today**, Hamilelik) |
| **P13** | 34 | 31 | 3 | 1 | Undergraduate | Environmental Engineer | iPhone | I'm Expecting | Y (What to Expext, Hamilelik) |
| **P14** | 25 | 30 | 3 | 1 | Associate Degree | Officer | Android | I'm Expecting | N |
| **P15** | 30 | 27 | 3 | 1 | Graduate | Lawyer | Android | I'm Expecting | Y (Bebeğim, Preg. Companion, Pregnancy+) |

**Table 10.** Sample Demographics (Continued)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **P16** | 33 | 11 | 1 | 1 | PhD | Academician (Industrial Design) | Android | Ovia | Y (Pregnancy+, What to Expect, Period Tracker's Pregnancy App) |
| **P17** | 29 | 11 | 1 | 1 | Graduate | Industrial Designer | iPhone | I'm Expecting | Y (Hamilelik Rehberi, Sprout, Huggies) |
| **P18** | 29 | 34 | 3 | 1 | Undergraduate | Architect | Android | BabyBump Pregnancy Pro | Y (Gebelik Takibi, Hamilelik Rehberi) |
| **P19** | 33 | 11 | 1 | 1 | Graduate | Specialist | Android | Ovia | Y (Other) |
| **P20** | 29 | 22 | 2 | 1 | Graduate | Research Assistant (Grafic Design) | Android | I'm Expecting | Y (Gebelik Rehberi) |
| **P21** | 25 | 17 | 2 | 1 | Undergraduate | Industrial Designer | iPhone | BabyBump Pregnancy Pro | Y (Other) |
| **P22** | 35 | 10 | 1 | 1 | Undergraduate | Bank employee | Android | Ovia | Y (Other) |
| **P23** | 33 | 17 | 2 | 1 | PhD | Research Assistant (Info. Systems) | Android | I'm Expecting | Y (**My Pregnancy Today**) |
| **P24** | 30 | 16 | 2 | 1 | Graduate | Research Assistant | Android | Ovia | N |
| **P25** | 33 | 21 | 2 | 2 | Graduate | Computer Engineer | Android | Ovia | Y (Other) |
| **P26** | 26 | 9 | 1 | 1 | Undergraduate | Customs and Trade Inspector Assistant | Android | I'm Expecting | Y (Other) |
| **P27** | 27 | 5 | 1 | 1 | Undergraduate | Customs and Trade Inspector Assistant / Chemical Eng. | iPhone | BabyBump Pregnancy Pro | Y (Hamilelik, Other) |
| **P28** | 35 | 14 | 2 | 1 | Graduate | Engineer | iPhone | Ovia | Y (**My Pregnancy Today**, What to Expect, Other) |
| **P29** | 36 | 29 | 3 | 2 | PhD | Academician (Interior Arch.) | Android | I'm Expecting | N |
| **P30** | 36 | 29 | 3 | 2 | PhD | Industrial Designer | Android | Ovia | Y (**My Pregnancy Today**) |
| **P31** | 35 | 29 | 3 | 2 | PhD | Academician (Psychology) | iPhone | I'm Expecting | Y (Diğer, **My Preg. Today**) |
| **P32** | 34 | 10 | 1 | 2 | Undergraduate | Industrial Designer | Android | Ovia | N |
| **P33** | 30 | 27 | 3 | 1 | Graduate | ARGE Specialist | iPhone | Ovia | Y (**Baby Bump**) |

# APPENDIX H. ANALYZED 35 MOBILE HEALTH CARE SYSTEMS AND APPS

**Table 11.** Preliminary refinement about the selected 35 m-health systems and apps

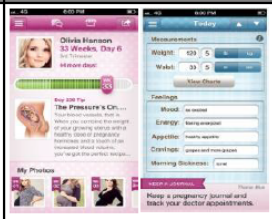
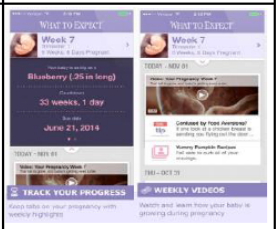
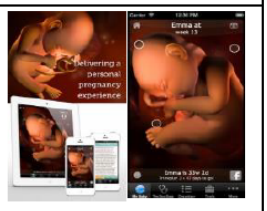
| Applications / Products | Aims / Functions | Wellness Related Qualities | Wellness Dimensions | Example Images |
|---|---|---|---|---|
| BabyBump Pregnancy Pro | * To **countdown** exactly where the pregnant woman is in her pregnancy<br>* To update weekly about the **baby's development**<br>* To **capture moments** by a daily journal (mood, energy, appetite, morning sickness, etc.) and weekly belly picture tracking (FB & Twitter integration)<br>* To connect to a **community** (user forums)<br>* To **count/track kicks**<br>* To **time contraction**<br>* To keep a pregnancy journal (measurements, feelings)<br>* To **track doctor appointments**<br>* To **shop** specially curated products for pregnancy | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking<br>* Social Wellness -> Establishing relationships with others by connecting a community; sharing experiences & moments<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Understanding & coping with own feelings<br>* Financial Wellness -> Managing budget, incomes & expenditures | * Physical<br>* Social<br>* Intellectual<br>* Emotional<br>* Financial |  |
| What to Expect | * To **countdown** -daily tracker<br>* To show **baby's development** measured in fruit sizes<br>* To give **personalized content**/tips based on the due date<br>* To give access to **latest parenting news and health information**<br>* To connect to active and supportive **community** of other expectant moms and parents for support and advice (symptoms, emotions, advices, photos, meet-ups)<br>* To give **emotional support** in a personalized, daily feed with fresh curated content including pregnancy tips, **reasons to smile every day**, health news, and passionate stories from real parents<br>* To **capture moments** by a photo journal (sync content with other devices)<br>* To **track other children** and pregnancy in one place | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking<br>* Social Wellness -> Establishing relationships with others by connecting a community; sharing experiences & moments<br>* Intellectual Wellness -> Expanding knowledge, receiving required and latest information<br>* Emotional Wellness -> Feeling positive, sharing & understanding feelings | * Physical<br>* Social<br>* Intellectual<br>* Emotional |  |
| My Pregnancy Today \| BabyCenter | * To **countdown**<br>* To track **baby's development** (videos, fetal development images)<br>* To **manage pregnancy related tasks** (remind appointments, decisions -> pregnancy checklist)<br>* To **register baby & to provide checklist**: to discover the needs for baby's arrival and to personalize the registry checklist<br>* To connect to a commmunity<br>* To guide about **nutrition** | * Physical wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking, maintaining good nutrition<br>* Social Wellness -> Establishing relationships with others by connecting a community; sharing experiences<br>* Intellectual Wellness -> Expanding knowledge, receiving required and latest information<br>* Emotional Wellness -> Sharing & understanding feelings | * Physical<br>* Social<br>* Intellectual<br>* Emotional | |
| Sprout Pregnancy | * To count/track kicks (record and announce on FB)<br>* To time contraction<br>* To track weight<br>* To manage pregnancy related tasks (to-do list, check off the completed items; create a lst of questions for your doctor, track doctor appointments, record answers -> doctor visit planner; hospital bag checklist)<br>* To track pregnancy (timeline about when tests and procedures occur) | * Physical wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking & checklists<br>* Social Wellness -> Establishing relationships with others; sharing progress<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Sharing & understanding feelings | * Physical<br>* Social<br>* Intellectual<br>* Emotional |  |

**Table 11.** Preliminary refinement about the selected 35 m-health systems and apps (Continued)

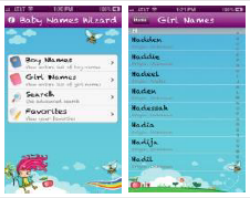
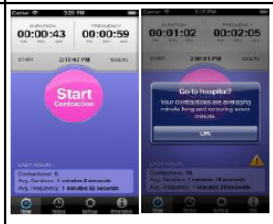
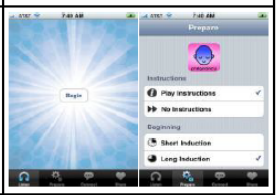
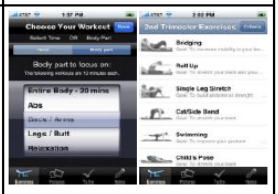
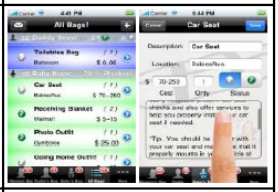
| | | | | |
|---|---|---|---|---|
| Baby Names | * To browse boy and girl names<br>* To learn detailed information about each name (origin, meaning, pronunciation and popularity)<br>* To share favorite baby names via email or Twitter | * Intellectual Wellness -> Expanding knowledge<br>* Social Wellness -> Establishing relationships with others via social media | * Intellectual<br>* Social |  |
| Contraction Master | * To **time contractions** (automatically keeps track of the start time, duration, strength, and frequency of each contraction)<br>* To **alert** when contractions are close enough together and long enough -> alert that it's time to go to the hospital / display a button to be tapped to call Obstetrician/Gynaecologist<br>* To give an overview about contraction history<br>* To **connect to a doctor** -> to share contraction history with a doctor/nurse | * Physical wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual |  |
| Positive Pregnancy | * To relax and focus on a positive and succesful pregnancy by a guided **mediation** audio program | * Emotional Wellness -> Feeling positive, coping with stress<br>* Spiritual Wellness -> Establishing peace & harmony | * Emotional<br>* Spiritual |  |
| Pilates for Pregnancy | * To help pregnant women **exercise** (explanations & benefits of poses, appropriate & personalized trimester workout)<br>* To **capture moments** with a photo diary of the pregnancy (to have fun)<br>* To **manage pregnancy related tasks** and plan pregnancy (to do list and notes) | * Physical Wellness -> Minimizing unwanted consequences, adopting healthful habits, maintaining regular exercise, minimizing unwanted consequences by managing pregnancy<br>* Intellectual Wellness -> Expanding knowledge, receiving detailed information about exercise details & benefits<br>* Emotional Wellness -> Feeling positive by keeping fun moments | * Physical<br>* Intellectual<br>* Emotional |  |
| My labor bags | * To help pack the **labor bags** -> to keep tabs on what you have and what you still need to get for your hospital bags (must have lists) | * Physical Wellness -> Minimizing unwanted consequences, preparing for safe & healthy birth<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual |  |
| mPregnancy (for men) | * To update about **baby's development** using a language and references that men are interested and that make sense to them (e.g. Beer cap, football, or other man-friendly item sizes)<br>* To **offer tips** fot the men to make pregnancy easier | * Intellectual Wellness -> Expanding knowledge | * Intellectual | |
| My Baby's Beat | * To **hear baby's heartbeat** -> To listem, record, and share the baby's heartbeat using only iPhone microphone and a standard headset. (The app imitates a medical stethoscope, by amplifying the sound of the baby's heartbeat -> Switching to airplane mode is necessary to cut off transmission of all mobile/Internet communications) | * Physical Wellness -> Minimizing unwanted consequences by tracking heartbeat<br>* Social Wellness -> Establishing relationships with others by sharing recordings<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Enabling a bonding experience with the baby | * Physical<br>* Social<br>* Intellectual<br>* Emotional | |

**Table 11.** Preliminary refinement about the selected 35 m-health systems and apps (Continued)

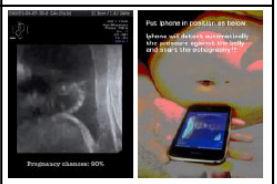
| | | | | |
|---|---|---|---|---|
| Foods to Avoid When Pregnant | * To make menu planning and daily **diet** -> It categorizes foods and drinks by type | * Physical Wellness -> Minimizing unwanted consequences, maintaining good nutrition<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Baby Pool | * To **invite friends to make guesses** (like gambling) about the baby's birth weight, length, and whatever else you like and to link to FB and email to make it easy for everyone to exchange their bets (fun & exciment for expecting parents) | * Social Wellness -> Establishing relationships with others via a name game<br>* Emotional Wellness -> Feeling positive by having fun moments | * Social<br>* Emotional | |
| Menstruation and Ovulation Calendar | * To **track the menstrual cycle** length and dates to know when to expect your period by the menstruation calendar<br>* To input the body temperature to **predict when you are ovulating** by the ovulation calendar<br>* To **track symptoms like cramping and migraines** and protect all private info with a passcode | * Physical Wellness -> Minimizing unwanted consequences & maintaining healthy conditions for pregnancy by tracking dates body temperature, symptoms, etc.<br>* Intellectual Wellness -> Expanding knowledge, calculating & predicting dates. | * Physical<br>* Intellectual | |
| MobiUS (ultrasound scanner) | * To provide **instant scan image** on the mobile device's screen (ultrasound scanners are usually fairly large, expensive and situated in hospitals and clinics, which could be a long distance away from the people who need them in poorer countries. (Pregnancy confirmation/Dates, Viability, Placenta, Fetal presentation, Ectopic pregnancy, Amniotic Fluid Assessment)<br>* To **transmit images** over a mobile network or WiFi | * Physical Wellness -> Minimizing unwanted consequences by tracking baby development<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Enabling a bonding experience with the baby | * Physical<br>* Intellectual<br>* Emotional | |
| Sonography Enquiry (Ultrasound Research) Offline App by Fraunhofer IBMT | * To compute the whole processing chain of an ultrasound device in the mobile platform software | * Physical Wellness -> Minimizing unwanted consequences by tracking baby development<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Enabling a bonding experience with the baby | * Physical<br>* Intellectual<br>* Emotional | |
| Baby Ultrasound | * **Ultrasound examination system**, with facebook connect and email support -> Put against the belly | * Physical Wellness -> Minimizing unwanted consequences by tracking baby development<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Enabling a bonding experience with the baby<br>* Social Wellness -> Establishing relationships with others by sharing ultrasound picture | * Physical<br>* Intellectual<br>* Emotional<br>* Social |  |
| OvuView | * To **track multiple fertility signs** like basal body temp, and to predict fertile days based onprevious inputs. (If you add the app's Pro features, a detailed widget shows where you are in your cycle graphically, including how many days are predicted until ovulation, fertility, and your period) | * Physical Wellness -> Minimizing unwanted consequences & maintaining healthy conditions for pregnancy by tracking fertility signs<br>* Intellectual Wellness -> Expanding knowledge, calculating & predicting dates | * Physical<br>* Intellectual | |
| Pregnancy & Medication Safety | * To access **medical information**, such as likely risks associated with the meds and relevant studies conducted with them<br>* To access medication prescribing information | * Physical Wellness -> Minimizing unwanted consequences & maintaining healthy conditions by giving medication information<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |

**Table 11.** Preliminary refinement about the selected 35 m-health systems and apps (Continued)

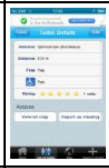
| | | | | |
|---|---|---|---|---|
| Pregnancy Diet Calculator | * To **track nutrition** -> Input all the foods you've eaten each day and gives you feedback on how you're doing and what you can improve. | * Physical Wellness -> Minimizing unwanted consequences, maintaining good nutrition<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Nutrition Facts Pro | * To give data on everything from a **food**'s water content to its level of tryptophan. The app includes dietary reference intakes (DRIs) specific to pregnant women and calculates what percentage you're getting with each food. (Database of more than 7,000 foods covering every food anyone can think of, from dried agave to Mexican baking chocolate, and even rarely heard ones like Agutuk caribou Alaskan ice cream) | * Physical Wellness -> Minimizing unwanted consequences, maintaining good nutrition<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Toilet/Bathroom Finder | * To find a public restroom during a urgent need | * Physical Wellness -> Maintaining daily activities without unwanted conditions | * Physical |  |
| Happy Pregnancy | * To keep a weekly journal to **track moods** and other notes<br>* To **track weight** with a calendar and chart of the weight gain, and a constantly updated prediction of the delivery weight<br>* To **countdown** to the due date<br>* To **count kick**<br>* Time **contraction**<br>* **Connect to forums**<br>* To access **weekly pregnancy information** | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking<br>* Social Wellness -> Establishing relationships with others by connecting a community<br>* Intellectual Wellness -> Expanding knowledge<br>* Emotional Wellness -> Understanding feelings by tracking moods | * Physical<br>* Social<br>* Intellectual<br>* Emotional | |
| Pregly Pregnancy Ticker | * To give quick-reference **nutritional guide** (divided into a simple "No" list and "Yes" list, the guide serves as a handy reminder of which foods are safe and which to avoid)<br>* To give **weekly development information**<br>* To **countdown** to due date<br>* To **join community** forums<br>* To provide straightforward, alphabetical list of **baby names** *<br>To give **weekly tips for dads-to-be** | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking, maintaining good nutrition<br>* Social Wellness -> Establishing relationships with others by connecting a community<br>* Intellectual Wellness -> Expanding knowledge, receiving required and latest information<br>* Emotional Wellness -> Feeling positive, sharing & understanding feelings | * Physical<br>* Social<br>* Intellectual<br>* Emotional | |
| Contraction Calculator | * To **count contraction**<br>* To keep a running log of the length of each contraction, plus the intervals between them, and give an average of the last five contractions and the last five intervals, as well as the option to note when your water breaks | * Physical wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking contraction<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Daddy511 | * To **time contraction**<br>* To show progress bar estimating how far along your labor has come *<br>To store **information** about the due date, hospital, directions, and primary doctor | * Physical wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking contraction<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |

**Table 11.** Preliminary refinement about the selected 35 m-health systems and apps (Continued)

| | | | | |
|---|---|---|---|---|
| Name Dropper | * To suggest possible **baby names** when gender of the baby name (girl, boy, unisex) and how popular you'd like it to be are mentioned (to see how its popularity has changed over time, get a list of similar names to tweak creativity, mark one as a favorite, or share it) | * Intellectual Wellness -> Expanding knowledge | * Intellectual | |
| Birth Plan Checklist | * To create a **birth plan** (noting preferences on everything from pain management to whether you plan to circumcise your son)<br>* To set priorities and alarms | * Physical Wellness -> Minimizing unwanted consequences, preparing for safe & healthy birth<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Baby Kick Count | * To keep track of **baby's movement** (tap a button every time you feel movement, and the app keeps a running list of the dates and times. A history tab lets you see previous kick-count sessions, and you can have the counts emailed to you) | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Instant Heart Rate | * To **measure heart pulse**<br>* To share on Twitter & FB<br>* The American Congress of Obstetricians and Gynecologists recommends regular exercise at a moderate level throughout your pregnancy | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking<br>* Intellectual Wellness -> Expanding knowledge<br>* Social Wellness -> Establishing relationships with others by sharing data | * Physical<br>* Intellectual<br>* Social | |
| Baby Checklist | * To give a list of everything anyone can need – sorted into categories – and to check off items after being acquired | * Physical Wellness -> Minimizing unwanted consequences, preparing for safe & healthy birth<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |
| Prenatal Lullabies | * To offer soothing, gentle **melodies, peaceful moments** (some with a tempo similar to a woman's resting heartbeat) as well as Mozart's piano sonatas (stimulate auditory-nerve functioning and enhance brain development of a fetus)<br>* To help **relax** and get to **sleep** | * Emotional Wellness -> Feeling positive, coping with stress<br>* Spiritual Wellness -> Establishing peace & harmony<br>* Physical Wellness -> Adopting healthful habits, getting adequate amounts of sleep | * Emotional<br>* Spiritual<br>* Physical | |
| Gender Predictor | * To **predict whether it's a boy or a girl** based on Chinese birth charts * To have fun | * Emotional Wellness -> Feeling positive by having fun moments | * Emotional | |
| Pregnancy Companion | * To show what limb is what by **ultrasound images**<br>* To present **week-by-week pregnancy guide**<br>* To show a list of **baby names** and their meanings<br>* To show a **drug safety list**<br>* To teach **prenatal yoga poses**<br>* To show acupressure points<br>* To count hydration<br>* To give **healthy recipes** | * Physical Wellness -> Minimizing unwanted consequences, getting regular medical checkups/ controls by tracking, maintaining healthy habits, exercise, nutrition, etc.<br>* Intellectual Wellness -> Expanding knowledge | * Physical<br>* Intellectual | |

# APPENDIX I. POSITIVE USER EXPERIENCE DIMENSIONS WITH M-HEALTH TECHNOLOGIES FOR PREGNANCY

**1. Being illuminative**

According to participants, being illuminative was the most crucial dimension involved in providing a positive user experience. Being illuminative is not only about the presence, but also the enlightening quality of information provided by mobile pregnancy technologies. Thus, providing an illuminative experience carries those technologies beyond being simply informative; it makes them eye-opening, awareness rising, and revelatory. Though participants were in need of explanations regarding risky and harmless situation; they wanted illuminative information about diverse issues related to pregnancy and postpartum stages (changes in pregnant women, baby development, symptoms, nutrition, exercise, medication, drugs, shopping, etc.).

**2. Being multifocal**

Being multifocal was highly significant for the participants. Having diversified foci propounds different possibilities for pregnant women, considering both the individual pregnant woman and different pregnant women with unique pregnancy experiences. Being multifocal has more positive attributes than being multifunctional as it is more than providing many functions. It comprises diverse features and content in mobile pregnancy technologies with different focal points on mother, baby, and other people such as father, which elicit sophistication and versatility for pregnant women and their daily lives. Not being merely baby- or mother-focused; offering extra features and content not existing in generic applications (such as tracking features, indexes, etc.); being able to conduct a certain task in different ways such as via either application or e-mail; having language, display (scroll, full text, pages, video, mail, theme), note-taking (voice, text), filter (alphabetical, week-by-week, photo, personal vs. generic information), content (default vs. user-added), unit of measurement alternatives; and so on, appeared as the manifold of ways to make mobile health pregnancy technologies multifocal.

**3. Visual representation**

Visual representation was also among the most frequently mentioned dimensions. Presentation of visuals, images, photos, graphics, and videos in application features were categorized under this dimension. Participants did not demand numerous visuals to support and enhance their experiences; in fact, they highlighted the significance of the suitability, quality, and quantity of the presented visuals. Sound visual narrative appeared important for concretizing and making all abstract, intangible, medical, and even sometimes worrisome information more friendly and pleasing.

**4. Daily suggestiveness**

Guidance of pregnant women in their daily life pertains to daily suggestiveness. Apart from solely receiving factual and descriptive information, participants wanted the content and features of mobile pregnancy technologies to guide them throughout, and even after, the pregnancy period. They wanted suggestions and tips about both general pregnancy problems and other possible issues in their daily lives. It was mentioned that those suggestions and tips could act as a daily assistance and make them feel ready and confident to face diverse situations during and after pregnancy. Thus, daily suggestiveness supports pregnant women cognitively in their daily decisions and enables them to pursue their daily activities in comfort.

**5. Being supposable**

Being supposable dimension was prominent covering both the comprehensibility and internalization of the provided features and content. In essence, comprehensibility was not sufficient for the participants to attain positive experiences. Participants wanted to achieve easy and satisfactory interactions by comprehending, picturing, and internalizing the retrieved information. Interfaces, menu structures, visualization and communication styles of mobile pregnancy technologies played a central role in enabling participants to match the provided information with themselves, which aided them to grasp the changes in their bodies and babies.

**6. Operational practicality**

Another commonly mentioned dimension was operational practicality. Despite appearing as a pragmatic dimension, operational practicality was necessary to ease the pregnant women's actions and lives. Participants' remarks about being able to use mobile pregnancy technologies easily without any struggles, interacting with practical and convenient features and content which would decrease their effort and thus, would ease their actions and life were categorized hereby. Different from the conventional interpretation of practicality, operational practicality appeared parallel to pregnancy-long practicality. This hints at a processual quality, indicative of not being obliged to learn new things for a definite and temporary period; and of being able to adapt quickly retrieved information into daily life easily.

**7. Mnemonic assistance**

Application features and content serving the function of reminding diverse requirements and to-do things during pregnancy were uttered highly. Participants also touched upon the evocativeness of pregnancy stages, too. To achieve this, sending notification and alerts, as well as providing right information in right place were mentioned. Thus, warnings and reminders were stated to be highly important notably considering momnesia, which is the temporary memory impairment during pregnancy period. Momnesia affected daily actions of the participants, as well as the great number of things to be done during pregnancy. Therefore, mnemonic assistance eliminated or at least minimized the necessity to keep everything in mind; which otherwise would have caused even severe health related problems related to medication intake, critical medical procedures, and so on.

**8. Being trustworthy**

Being trustworthy was of great significance, especially because health was the point in question. Trustworthy application and information resulted in reassurance of many pregnancy concerns and worries. Apart from just overcoming negative thoughts, this perception about applications made pregnant women have confidence in their own decisions and actions that they took based on the guidance of the applications.

**9. Being uplifting**

One of the most important hedonic qualities appeared as the uplifting quality of the mobile pregnancy technologies. Being uplifting was highlighted excessively because pregnancy causes worries even in normally underestimated small issues in regular lives of people. That's why, as the pregnancy alters not only the physical condition of the pregnant women, but also affects the psychology of them, participants wanted mobile pregnancy technologies to relieve their worries and concerns. Actually, they wanted not only relieving and relaxing application features, but also calming language and expression style to feel uplifted. For instance, it was suggested that applications could emphasize the normality of encountered changes and symptoms and could express that those changes and symptoms can be befalling for every pregnant woman.

**10. Localness**

Localness was expressed considerably, too. This was in part due to the limitations of the study because, as previously mentioned (see Chapter 4, Sections 4.1.2 and 4.1.5), mobile applications used in the study were in English concerning predetermined criteria. Nevertheless, the localness dimension did not show up only in regards to the foreign language. Although all of the participants possessed English knowledge, incorporating country, city, and culture specific features and information was requested as local qualities. To illustrate, information about pregnancy courses in a certain city, country-specific food suggestions, local baby names, culture specific pregnancy procedures, and so on, were uttered. This foreshadows the vitality of feasible mobile pregnancy technologies in local context in order to foster the integration of those technologies in everyday life.

**11. Conformity to habits**

Compatibility of the provided application features with pregnant women's habits and previous experiences was evaluated under conformity to habits dimension. This dimension came into prominence when familiarity was the point in question since similar features to the previously encountered experiences influenced the current experiences. Mobile pregnancy technologies' features which conformed to the pregnant women's habits and lifestyles familiarized them to the novel and unfamiliar pregnancy period, too.

**12. Boundless access**

The boundless access dimension, which is about being able to access applications, application features, and content boundlessly whenever wanted, was also remarkable. Participants highlighted that the advantage of the pregnancy applications was the ability to access necessary information and receive support whenever and wherever desired, as most pregnant women had been already following various pregnancy resources.

**13.Frequentness of companionship**

As the name connotes, the frequentness of companionship dimension is about being a loyal companion by supplying information and interaction frequently. Nonetheless, there was a disaccord about frequentness. Some participants remarked that the applications should give information, send notifications, allow data input for weight daily rather than weekly or monthly, or they demanded belly photo shoot weekly rather than monthly. On the other hand, some participants, especially the experienced ones or even the ones towards the end of their first pregnancies, mentioned that less frequent information would be sufficient. Yet, it can be deduced that depending on the pregnancy conditions, personal issues, weight gain patterns, etc., the demand for frequent interaction with the applications changed.

**14. Enriching elaborateness**

The comments of participants when they talked about providing detailed, in-depth, and rich information were tackled under the enriching elaborateness dimension. Participants were usually not satisfied when applications provided too generalized and summary information. This was again due to the fact that they had been mostly reading other resources concurrently; therefore, they wanted m-health technologies to add something more or new to the already-read information.

**15. Credible exclusiveness**

Credible exclusiveness was another considerably asserted dimension particularly because each and every pregnancy is unique. That is the reason why participants wanted customizable interface, features, and content. Hereby, enabling user to enter personal data and track them, and giving personal information and suggestions appeared as important application features. However, credible exclusiveness was more than providing personalization and customization; it was way

more significant for the participants to feel exclusive in order to have more trust in m-health technologies.

**16. Social networking**

When participants mentioned creating networks and communicating with other pregnant women, other people and their spouses, their comments were categorized as social networking. This dimension showed up in both a direct and indirect nature. When applications incorporated explicit and intentional features to bring about more interaction between pregnant women and other people, these features were interpreted as direct social networking. To exemplify, pregnancy forums, e-mail notifications and tips sent to spouses were direct features. On the other hand, certain visuals and pregnancy information showed up as indirect means to demonstrate, explain, and share the pregnancy period. In those cases, pregnant women shared those visuals and information with others which had not been actually targeted for them. In other words, indirect social networking involved other people who were not intended and targeted in application features; yet, which had a part in communication. For instance, when participants took the snapshot of a visual or information on applications and sent them to their husbands, or when they were sitting and chatting with their friends and opened the applications and showed certain content to their friends, they were coded as indirect social networking.

**17. Being amusing**

Participants talked about being amusing plenty of times. Some participants requested entertaining and amusing application features and content because receiving merely information seemed boring and ordinary to them. They propounded that incorporating amusement would make mobile pregnancy technologies more distinct from other pregnancy resources like books, websites, and pregnancy blogs as they found other resources excessively related to generic pregnancy information. Nonetheless, a few pregnant women were merely function- and goal-focused, so the entertaining qualities of the applications were not critical to them.

**18. Instant visibility**

Instant visibility relates to the statements of participants when they were or were not able to see certain application features, menus, and content without losing time. Not only the existence of demanded features, but also the instant visibility of them were stated as significant in order to easily notice, find, and use the required content. To illustrate, when the content remained out of sight due to gigantic visuals or due to inconsistent hidden menus, participants hardly recognized or reached their target.

**19. Easy goingness**

The easy goingness dimension refers to features which provided conformable, compliant, and formative interaction while accessing, editing, or navigating through application content. Being able to visit a desired pregnancy week; being able to modify, edit, upload, mark, or delete certain information; and being allowed to write or do certain things in a comfortable way were some instances. Though being a desired quality, this dimension occasionally led to a decrease in application use because participants were able to benefit from it at a single time by reading all the successive contents.

**20. Periodical alikeness**

Periodical alikeness is about parallel progression of the pregnancy changes and symptoms with the provided information. Participants underlined the importance of parallel information with the actual pregnancy week because of both counting on the information and realizing the provided suggestions in the mentioned pregnancy week or period.

**21. Being collaborative**

The being collaborative dimension consists of statements when participants did not use the applications passively. In fact, they demanded interactive features and content, permitting user input and track rather than solely receiving information. Furthermore, pop-up notifications, e-mails, and such interaction styles were also mentioned as enablers of collaborative use.

**22. Contextual homogeneity**

Contextual homogeneity appeared mostly as an undesired issue. As information overload sometimes occurred due to following diverse information resources such as internet, books, pregnancy websites and blogs, participants found most of the contents homogenous and similar in those diverse resources. Hence, repetition and prevalence of content were questioned by the participants, and heterogeneity was demanded from mobile pregnancy technologies.

**23. Being well-grounded**

Grounding information on scientific resources, medical professionals, theoretical information, encyclopedical information, and so on, were evaluated under being well-grounded dimension. It is important to note at this point that this dimension is slightly different from the medical assistance dimension; yet, they appeared to have cause-effect relationship in some cases. Though being informed by specialists and doctors could be related both to medical assistance and being well-grounded, it is not necessarily a dynamic conversation or communication hereby. This dimension is actually more content focused rather than interaction focused.

**24. Maternal sensuousness**

Some features of mobile pregnancy technologies were perceived as emotional and romantic by the participants. Especially, addressing sense of motherhood and maternity feelings, in addition to having feminine appearance and content were found pleasant by some of the participants; whereas, there were also participants who did not want such qualities. The ones who did not want emotional qualities asserted that they wanted to see rational, pragmatic, and functional qualities and found emotional qualities tacky and antipathetic. Qualities related to maternal sensuousness can be exemplified by mood tracking, receiving notifications from baby's mouth or with baby cries, having pregnancy journals, and so on.

**25. Calming interaction**

Calming interaction emerged as another dimension for facilitating and relieving interaction. Having a simple, plain, and clean interface and features, and so, not incorporating any complexity causing dissatisfaction or trouble were noteworthy. In order to feel calm, participants majorly suggested categorizations and logical flow of information with suitable visuals.

**26. Service design fluency**

Service design fluency is about issues about the flow of service design. Although technical issues that affected service design fluency were not of vital importance to participants, they touched upon receiving diverse services without having any obstacles in any steps.

**27. Precise content**

When participants talked generally about precise, accurate, and pure information and experiences, those statements were included in precise content dimension. Not having infollution and also not conveying nonsense information were important.

**28. Instantaneity**

Instantaneity; i.e. carrying m-health technologies to be able to interact wherever desired, was indicated several times. Instantaneity interpreted as an advantageous issue considering other pregnancy resources because when questions came to participants' mind and they were worried about certain pregnancy issues, they wanted to consult an information source.

**29. Cognitive assistance**

Cognitive assistance was also demanded to facilitate interaction and to efficiently use the applications. More clearly, this dimension is about directing users while using application features and content. A couple of suggestions were made, which were a step-by-step demonstration of the necessary information, provision of links directing users to other features, content, or websites, and the demonstration of tutorials after signing up and before beginning to use the applications. Such suggestions would support pregnant women cognitively while using mobile pregnancy technologies.

**30. Connected experience**

Connected experience was indicated a few times as suggestions to improve pregnancy applications in general. Those participants wanted to feel connected to other devices, health care products, scales, applications, stakeholders, and so on.

**31. Tempting novelty**

Recommendations which were related to the encapsulation of unprecedented effective features, presentation styles, etc., provision of a novel technology and interaction, and thus, not being conventional and classical were dealt with under the tempting novelty dimension.

**32. Sensible developedness**

Different from the tempting novelty dimension, sometimes participants expressed their perception about the applications' advanced look. Although it was not very significant, it could be an issue to consider in order to convey a positive impression.

**33. Medical assistance**

As aforementioned briefly, medical assistance dimension is about having contact to a doctor and being able to ask questions in a synchronous or asynchronous manner. A few of the participants demanded to be able to call a doctor or send a SMS, e-mail, etc., when they wanted to learn something and relieve their worries. They expressed that this could be their personal doctor or there could be multiple doctors, each of which could have different patients and pregnancy groups.

**34. Credible consistency**

Apart from the periodical alikeness dimension which indicates consistency between the provided information and its actualization in pregnant women's lives as mentioned previously; credible consistency of application features and content which reflects a sense of coherence, and thus, credibility within the applications was addressed by participants. To realize this dimension, utilization of same visual or expression style and maintenance of similar interaction styles for similar functions and menus were suggested.

**35. Pervasive recognition**

Pervasive recognition is about being a preferable, known, and recommended application. Also, the incorporation of other people's comments affected the perception of the applications as popular and reliable, which could serve as a justification to continue to use the applications.

**Others:**

So far, major dimensions that appeared from the findings of the study to consider while designing mobile pregnancy technologies and to foster integration of them into the daily lives of pregnant women have been explained. Beside these dimensions, **membership** and **payment requirement** of the applications were also talked about by very few people. However, they were not included in analysis due to their assertion amounts and their scope.

# APPENDIX J. MATRICES FOR DAILY LIFE CHANGES IN PREGNANCY

**Table 12.** Matrices for daily life changes

**1. TRIMESTER**

| | Cognitive | Intellectual | Life-style | Medical | Occupational | Organizational | Physical | Psychological | Stand-Alone | ActiveSUM+Alone | PassiveSUM | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cognitive/ Mental | | | | | 1 | | | | 1 | 2 | 0 | 2 |
| Intellectual/ Awareness | | | | | | | | 1 | 1 | 2 | 0 | 2 |
| Life-style/ Habitual | | | 1 | | | | 9 | 21 | 14 | 45 | 46 | 91 |
| Medical | | | | | | | | 7 | 6 | 13 | 2 | 15 |
| Occupational | | | | | | | 1 | 3 | | 4 | 11 | 15 |
| Organizational | | | | | | | | 1 | 3 | 4 | 8 | 12 |
| Physical | | | 39 | 2 | 9 | 6 | 10 | 28 | 28 | 122 | 20 | 142 |
| Psychological | | | 6 | | 1 | 2 | | | 23 | 32 | 61 | 93 |
| | | | 46 | 2 | 11 | 8 | 20 | 61 | 76 | 224 | 148 | **372** |

**2. TRIMESTER**

| | Cognitive | Intellectual | Life-style | Medical | Occupational | Organizational | Physical | Psychological | Stand-Alone | ActiveSUM+Alone | PassiveSUM | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cognitive/ Mental | | | | | 2 | | | | 1 | 3 | 1 | 4 |
| Intellectual/ Awareness | | | | | | | | 2 | 1 | 3 | 1 | 4 |
| Life-style/ Habitual | | | 1 | | | | 14 | 24 | 11 | 50 | 68 | 118 |
| Medical | | | 3 | | | 1 | | 12 | 3 | 19 | 2 | 21 |
| Occupational | | | 2 | | | 1 | 3 | 2 | 1 | 9 | 8 | 17 |
| Organizational | | | | | | | 2 | 6 | 9 | 17 | 10 | 27 |
| Physical | 1 | 1 | 58 | 1 | 5 | 6 | 32 | 40 | 33 | 177 | 51 | 228 |
| Psychological | | | 4 | 1 | 1 | 2 | | | 17 | 25 | 86 | 111 |
| | 1 | 1 | 68 | 2 | 8 | 10 | 51 | 86 | 76 | 303 | 227 | **530** |

**3. TRIMESTER**

| | Cognitive | Intellectual | Life-style | Medical | Occupational | Organizational | Physical | Psychological | Stand-Alone | ActiveSUM+Alone | PassiveSUM | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cognitive/ Mental | | | | | 2 | | | | | 2 | 1 | 3 |
| Intellectual/ Awareness | | | | | 1 | | | 4 | 4 | 9 | 1 | 10 |
| Life-style/ Habitual | | | 1 | | | | 3 | 15 | 5 | 24 | 38 | 62 |
| Medical | | | 2 | | 1 | 1 | | 7 | 2 | 13 | 1 | 14 |
| Occupational | | | 1 | | 8 | 2 | 1 | | 2 | 14 | 21 | 35 |
| Organizational | | | | | | | 1 | 7 | 7 | 15 | 4 | 19 |
| Physical | 1 | 1 | 30 | 1 | 7 | 1 | 24 | 21 | 16 | 102 | 32 | 134 |
| Psychological | | | 4 | | 2 | | 3 | | 22 | 31 | 54 | 85 |
| | 1 | 1 | 38 | 1 | 21 | 4 | 32 | 54 | 58 | 210 | 152 | **362** |

**GENEL**

| | Cognitive | Intellectual | Life-style | Medical | Occupational | Organizational | Physical | Psychological | Stand-Alone | ActiveSUM+Alone | PassiveSUM | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cognitive/ Mental | | | | | 1 | | | | 8 | 9 | 1 | 10 |
| Intellectual/ Awareness | | | | | | | | 2 | 4 | 6 | 2 | 8 |
| Life-style/ Habitual | | 1 | | | 1 | 1 | | 10 | 32 | 45 | 11 | 56 |
| Medical | | | | | | | | | 1 | 1 | 0 | 1 |
| Occupational | | 1 | | | | | | 3 | 3 | 7 | 5 | 12 |
| Organizational | | | | | | | | 2 | 1 | 3 | 1 | 4 |
| Physical | | | 6 | | 2 | | 2 | 4 | 12 | 26 | 2 | 28 |
| Psychological | 1 | | 5 | | 1 | | | | 34 | 41 | 21 | 62 |
| | 1 | 2 | 11 | | 5 | 1 | 2 | 21 | 95 | 138 | 43 | **181** |

**TOTAL STATEMENTS: (ACTIVESUM + STAND ALONE)**

| | 1. TRIMESTER | 2. TRIMESTER | 3. TRIMESTER | GENEL | TOTAL STATEMENTS |
|---|---|---|---|---|---|
| Cognitive/ Mental | 2 | 3 | 2 | 9 | 16 |
| Intellectual/ | 2 | 3 | 9 | 6 | 20 |
| Life-style/ Habitual | 45 | 50 | 24 | 45 | 164 |
| Medical | 13 | 19 | 13 | 1 | 46 |
| Occupational | 4 | 9 | 14 | 7 | 34 |
| Organizational | 4 | 17 | 15 | 3 | 39 |
| Physical | 122 | 177 | 102 | 26 | 427 |
| Psychological | 32 | 25 | 31 | 41 | 129 |
| | **224** | **303** | **210** | **138** | **875** |

**TOTAL CHANGE RELATED DIMENSIONS**

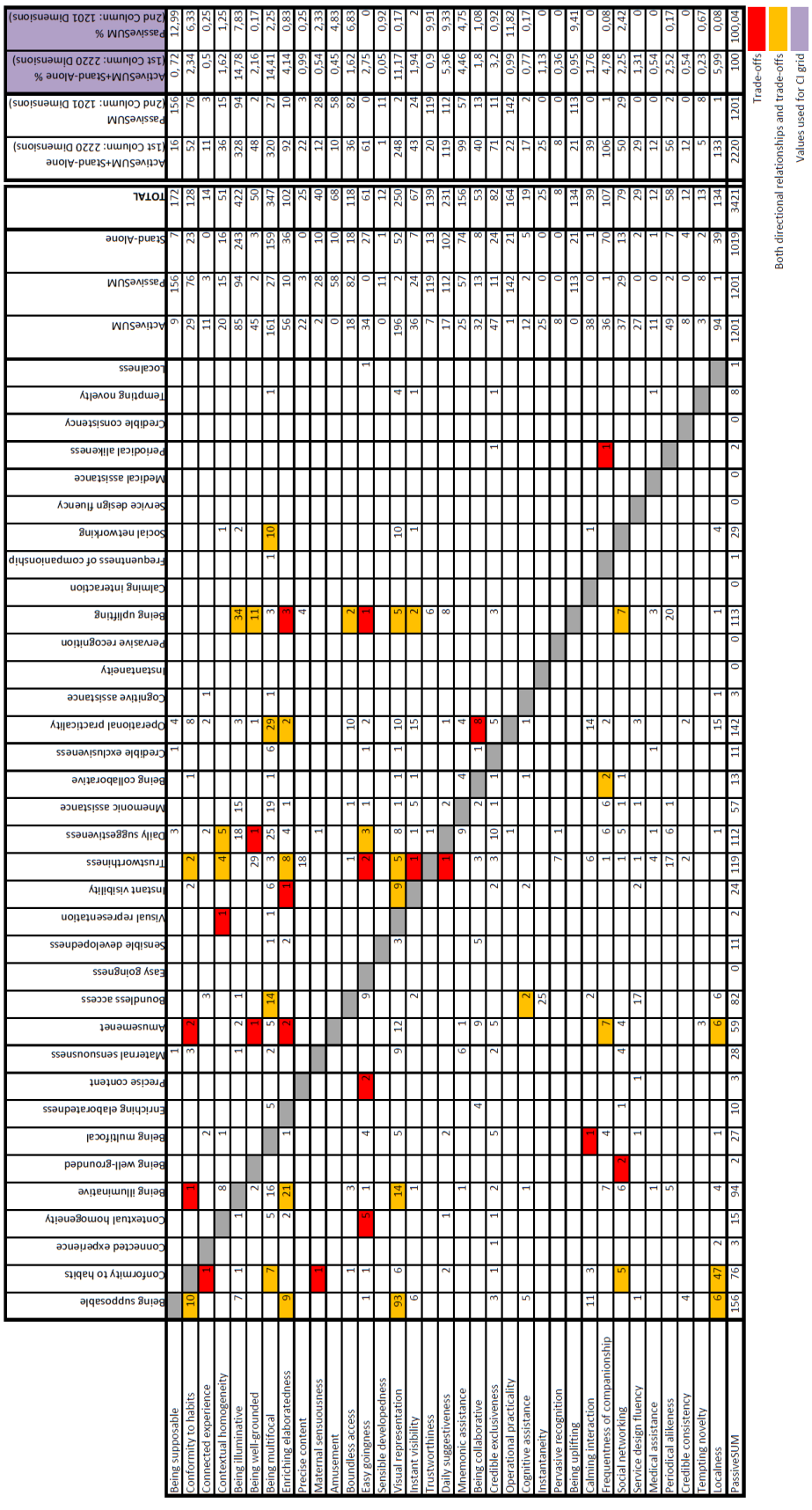
| | 1. TRIMESTER | 2. TRIMESTER | 3. TRIMESTER | GENERAL | TOTAL STATEMENTS |
|---|---|---|---|---|---|
| Cognitive | 2 | 4 | 3 | 10 | 19 |
| Intellectual | 2 | 4 | 10 | 8 | 24 |
| Life-style | 91 | 118 | 62 | 56 | 327 |
| Medical | 15 | 21 | 14 | 1 | 51 |
| Occupational | 15 | 17 | 35 | 12 | 79 |
| Organizational | 12 | 27 | 19 | 4 | 62 |
| Physical | 142 | 228 | 134 | 28 | 532 |
| Psychological | 93 | 111 | 85 | 62 | 351 |
| | **372** | **530** | **362** | **181** | **1445** |

** 875 statements and 1445 dimensions of change were obtained. Among these total 1445 change related dimensions, 1140 were in pairwise relationship (570 affecting + 570 affected) and 305 of them stood alone without being a cause or effect of any other change*

Negative effects
Mixed effects
Positive effects

# APPENDIX K. THE CROSS-IMPACT MATRIX

**Table 13.** The Cross-Impact matrix



## CURRICULUM VITAE

### PERSONAL INFORMATION

Surname, Name: Günay, Aslı
Nationality: Turkish
Date and Place of Birth: 16 October 1986, Ankara
email: asligunay.id@gmail.com

### EDUCATION

**Doctorate of Philosophy**, 2011-2017
Middle East Technical University, Department of Industrial Design

**International Joint Master of Science**, 2009-2011
Delft University of Technology, Department of Industrial Design Engineering
Middle East Technical University, Department of Industrial Design

**Erasmus Exchange Programme**, 2008
Politecnico di Milano, Department of Industrial Design

**Bachelor of Industrial Design**, 2005-2009
Middle East Technical University, Department of Industrial Design

### ACADEMIC EXPERIENCE

**Research Assistant**, 2011-Present
Middle East Technical University, Department of Industrial Design

**Researcher**, 2011-Present
Middle East Technical University, BILTIR-UTEST Product Usability Unit

### FOREIGN LANGUAGES

Advanced English, Intermediate Italian

## PUBLICATIONS

### Book Chapters

Günay, A. & Erbuğ, Ç. (to be published). Integration of Mobile Health in Daily Lives of Pregnant Women. In E. Sezgin, S. Yıldırım, S. Özkan Yıldırım, & E. Sumuer (Eds.), *Mobile Health: Adoption, Implementation and Use of Current and Emerging Technologies.* Springer.

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### Edited Books

Börekçi, N.A.G.Z., Özgen Koçyıldırım, & Günay, A. (Eds.). (2017). *Proceedings of UTAK2016 2. Ulusal Tasarım Araştırmaları Konferansı: Sorumluluk, Bağlam, Deneyim ve Tasarım, 21-23 September 2016.* Ankara, Turkey: METU Department of Industrial Design.

### Journal Articles

Günay, A. & Erbuğ, Ç. (2015). Eliciting Positive user experiences with Self-Service Kiosks: Pursuing Possibilities. *Behaviour & Information Technology, 34*(1), 81–93. doi: 10.1080/0144929X.2014.937459

### Conference Proceedings

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