EFFECTIVE COMMUNICATION OF USER RESEARCH OUTCOMES IN DESIGN FOR WELL-BEING: ADAPTATION OF THE DESIGN WELL-BEING MATRIX IN A PREGNANCY CASE

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INTRODUCTION

Design literature increasingly highlights the importance of effective communication of information because designers parlay diverse range of information during the design process, user research produces a huge amount of data, and the entire design journey involves communication points among diverse stakeholders (Goodman et al. 2006; Nickpour, 2017). In a sense, the design researcher and/or designer—depending on the involvement degree of the designer in the research phase—has to do double empathy with users and other stakeholders (team members, departments, disciplines, managers, clients). Empathy with users is crucial to provide meaningful input for design. Empathy with other stakeholders is necessary to communicate output from user research in an effective way with diverse objectives, such as better representing the users' worlds, taking decision, receiving support, persuading stakeholders, and so on (Holtzblatt and Holtzblatt, 2014; Roschuni et al., 2015; Wiegand and Li, 2017). Being aware of these dynamics and focusing on the needs of the designer, who has a key role in this information transfer and integration of research findings in design, can be even more crucial when introducing or utilising newly emerging research materials in nascent design fields. Since frameworks, models, and tools are actually mediums for communicating deeper information, effective communication of them would foster the development of a shared language and robust progression of the emerging field.

Design for well-being is one of the newly booming areas which is in quest of a common language and established frameworks, methods, and tools to examine and enhance positive user experiences. By definition, design for well-being aspires to promote positive psychology by design. It is also named as "possibility-driven design", "design for happiness", and "positive design" since it calls for designers to intentionally work on making people happier and healthier and to focus on positive outcomes

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from the very beginning of the design process (Desmet and Hassenzahl, 2012; Pohlmeyer, 2012; Desmet and Pohlmeyer, 2013). Accordingly, the components of well-being in the positive psychology literature have started to be translated into the design discipline to enable the operationalisation of the well-being concept in design.

This paper aims to provide insights and recommendations about effective communication of user research outcomes in design for well-being field. To do so, it both responds to the calls to test the newly introduced materials by adopting one of the most fundamental design for well-being frameworks in a case about user experience (UX) with digital healthcare technologies for pregnant women; and further develops and discusses it as a data analysis, synthesis, and communication tool by scrutinising and applying general needs of designers about communication of research outcomes (**1**).

Accordingly, the following sections firstly examine the big picture about dimensions of effective communication of user research findings in design and UX disciplines. Secondly, the focus narrows down on design for well-being field, how it has emerged in positive psychology and how design discipline interprets the well-being paradigm, for making better sense of effective communication of user research materials specifically in design for well-being field. Then, how user research findings about the characteristics of digital healthcare technologies that aim at enhancing the well-being of pregnant women were analysed and communicated with the adaptation of an existing framework—the Design Well-Being Matrix—is shown as a case, after very briefly touching upon the study method and rationale for selecting the aforementioned matrix. The paper concludes with discussions and conclusions on expandable potentials of such frameworks, tools, and materials in design for well-being field by augmenting the effectiveness of their communication.

HANDLING RICH WELL-BEING INFORMATION FROM USER RESEARCH: DESIGNERS' NEEDS

It has been a long time ago that discussions about the importance of effective communication of information among diverse stakeholders started in diverse areas of science (Bucchi and Saracino, 2016). These discussions are now more on the rise as researchers have easier and broader reach to more data in addition to persistently yielding different types of data (Allen, 2018). Especially design literature increasingly addresses dimensions of effective communication of information as design research usually produces a huge amount of data and as the entire design journey involves communication points among diverse stakeholders as aforementioned. Intentional production of relevant and consumable materials that communicate the data is regarded as a critical phase and skill in UX (Holtzblatt and Beyer, 2014). Examples of diverse user research deliverables are abundant in literature; nonetheless, three fundamental studies have holistically and systematically investigated the dimensions of effective communication of user research findings in design and UX disciplines.

Roschuni (2012) focuses on the relationship of communication with the principles of motivation and persuasion. She provides strategies for actionable user research deliverables and describes the dimensions of those deliverables. According to these major strategies for actionable user research deliverables, the "credibility" of the deliverables should be increased. This can be done by considering the relevancy of the provided

information to the needs of the designers and goals of the project, backing up information with evidence and reason, and creating a balance between the authenticity and polishing of rough materials. For making deliverables "engaging", surprise and humour, variety and novelty in communicated materials and communication mediums, and interactivity of the deliverables can be used as strategies. To reduce the "challenge level" while comprehending and integrating user research findings, provision of guidance, clarity and simplicity, and doable challenges are significant. According to the categorisation based on the dimensions of deliverables, descriptive communication (stories, quotes, photos) fosters independent conclusion, whereas prescriptive communication (guidelines, functional analogies) proposes actions to be taken. Experiential platforms (interactive games, simulation) embody interactive experience, whereas presentational platforms (reports, slides) broadcast insights. Tangible works (prototypes, embodied insights) enable physical contact and manipulation, whereas virtual ones (videos, websites) do not contain any physical substance. Finally, abstracted information (models) enables simplification, whereas detailed information (pattern languages) enables thorough descriptions and richness.

Töre Yargın (2013) has conceived a model of effective communication by considering the impacts desired as the outcome of user research activity. "Inspiration", "justification", and "guidance" are put forth as the core goals, as well as "empathy" and "having feedback" as major impacts. Diverse information qualities and system qualities (i.e. qualities of the platform/medium that delivers information) feed the achievement of these goals, which constitute the basis of delivery strategies and content strategies. Delivery strategies include representativeness of user and context, interpretability by being open-ended and avoiding fixation, concrete exemplification, informativeness and explanatoriness of the delivery system, prioritisation of findings, shareability of deliverables, accessibility of the intended information, and maintenance of conciseness in delivery. Content strategies are about multidimensionality, depth, credibility, persuasiveness, and sustainability of information.

Sleeswijk Visser (2009) deals with making rich user experience information, which is retrieved by researchers from everyday life of users, useful for designers at the fuzzy front end of the design process. She highlights that rich UX data is fragmented, layered, and ephemeral. Thus, representational forms and procedures should be well-conceived to successfully communicate UX data. The objectives of this communication process should be increasing "empathy" with users, giving "inspiration" for idea generation, and fostering "engagement" with rich information. Overall mechanisms to achieve these are interactivity while handling information, personification of information, immersion in users' worlds, connection with users and their feelings, imagination by forming a mental image, interpretation with suitable level of abstraction and codes, patterns, and diagrams, curiosity to discover data, motivation for commitment, and sense of ownership. Besides, operational means that are deployed for achieving these objectives with the above-mentioned mechanisms are categorised as content, form, and process plan. Content is about the actual information which can be conveyed with different levels of abstraction and in different amounts. Form relates to the format, components, and visual characteristics of the deliverables. Process plan involves organisation issues like activities, time, and people involved.
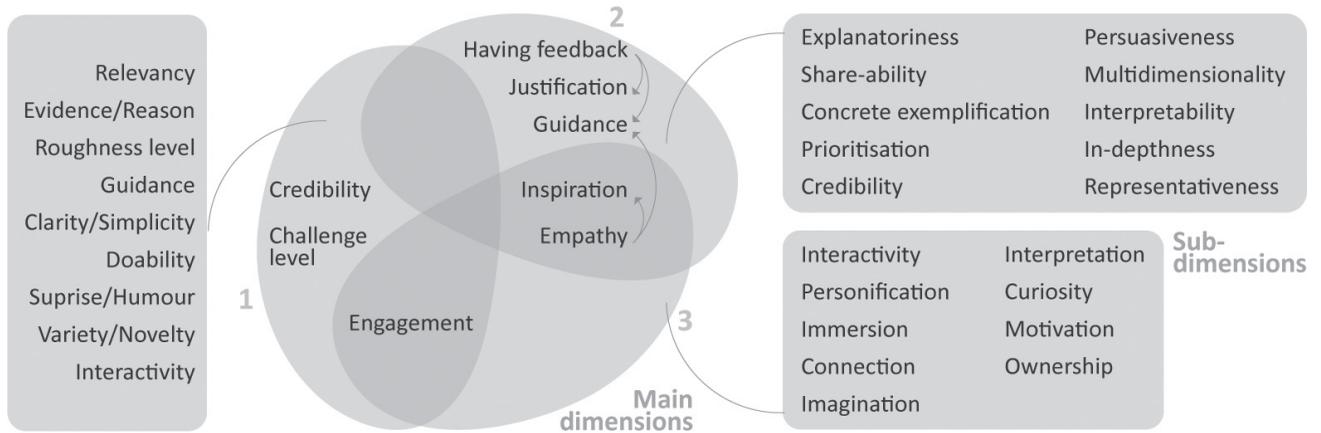
Relevancy		Having feedback		Explanatoriness	Persuasiveness
Evidence/Reason		Justification		Share-ability	Multidimensionality
Roughness level		Guidance		Concrete exemplification	Interpretability
Guidance	Credibility	Inspiration		Prioritisation	In-depthness
Clarity/Simplicity	Challenge	Empathy		Credibility	Representativeness
Doability	level				
Suprise/Humour				Interactivity	Interpretation
Variety/Novelty	Engagement			Personification	Curiosity
Interactivity				Immersion	Motivation
				Connection	Ownership
				Imagination	

2 1 3 Main dimensions Sub-dimensions

All three authors touch on strategies and qualities related to both research deliverables and delivery mediums. Mostly, all of them address similar or relational dimensions whether they are explained in different structure/hierarchy (i.e. the main dimension in one study appears as a sub-dimension—strategy or mechanism—in another one). Figure 1 summarises the major dimensions in these three studies. All of the studies highlight that actionable deliverables may combine different aspects from these, depending on the understanding about what actionable means for a specific project, design team and organisation. By paying attention to them, tools may be developed to achieve powerful impacts.

As can be observed in the intersection sets, it is of high priority that user research deliverables—artefacts, frameworks, tools, etc.—should enable designers to make "empathy" with users and "inspire" them. They should also provide "engagement" with research outcomes. The shared strategy for supporting empathy and inspiration is increasing interpretability by a suitable level of abstraction and open-endedness, by still providing rich and multidimensional information, and representing the user and UX so that designers can immerse in the users' worlds and feelings. The common strategy for making deliverables engaging is to provide rich and varied information, which can be supported by novelty, surprise, humour, and interactivity.

In addition to increasing emphasis about communication during the design process, another escalating emphasis is being observed in the focus of design discipline, which has spawned the design for well-being field. The rest of the paper presents the design for well-being approach and handles effective communication of user research materials specific to this field.

EFFECTIVE COMMUNICATION OF USER RESEARCH FINDINGS IN DESIGN FOR WELL-BEING

The theme the World Design Organisation (WHO) chose for the World Industrial Design Day 2018 was not a coincidence, "Good Health and Well-Being". The prominent term of the design discipline in the last decade, user experience (UX), has earned great success in reasoning experiential qualities and affective experiences. It is now mature enough to go forward (Pohlmeyer, 2012). More recently, with the reflections of the positive psychology movement in various disciplines, the value of pushing the limits of positive experiences in design studies and practices, beyond

diminishing the negative ones, has been understood (Hassenzahl and Tractinsky, 2006). At the same time, counter to the criticism raised against the materialistic gratification of designed products, a post-materialistic vision that highlights the magnitude of mediated values and experiences has become visible (Pohlmeyer, 2012; Desmet and Pohlmeyer, 2013). All these transformations have started to expand the horizons of the design discipline, as well as its value and roles as a resource for increased quality of life, health, and well-being. To put it another way, embracing design merely for overcoming problems would confine its wide-scale potentials because it is a discipline that has the power of shaping our environments and interactions in distinct ways (Jimenez et al., 2014). Besides, it has the power for effecting and mediating the actions of individuals and societies and giving them active roles in managing their health, well-being, and happiness.

Therefore, it is primarily important to comprehend well-being concepts in the positive psychology literature, because before making a correct translation and interpretation of well-being frameworks in design, it is crucial to understand how positive psychology literature handles them. Then, current discussions and materials about design for well-being can be addressed.

Understanding the Elements of Well-Being in Positive Psychology

Until very recently, happiness was thought to be the major affair of positive psychology; yet, it has been understood that the main topic is well-being. Now, it is also acknowledged that the purpose is not raising life satisfaction; rather it is increasing flourishing (Seligman, 2012). Flourishing is "a state of positive mental health; to thrive, to prosper and to fare well in endeavours free of mental illness, filled with emotional vitality and function positively in private and social realms" (Michalec et al., 2009). Flourishing addresses assessment of well-being with five elements: positive emotion, engagement, (positive) relationships, meaning, and accomplishment. Seligman (2012) denominated this as the "Well-Being Theory" and shortened the involved elements as PERMA. Happiness stands for one of the five basilar elements, which is denominated as positive emotion.

The concept of well-being is frequently unveiled under hedonic and eudaimonic descriptions. Hedonic descriptions majorly show up in the literature as pleasure-centric and hedonic approaches of well-being (David et al., 2013), or as hedonic well-being (Deci and Ryan, 2008; Waterman et al., 2010). At times, these are dealt as emotional models and emotional well-being, as well (Diener et al., 1999; Keyes, 2005; Westerhof and Keyes, 2010; Lopez et al., 2015), and they are related to the notions of the avowed feelings and thoughts (Lopez et al., 2015). The most outstanding conception covered under the hedonic approaches is multidimensional subjective well-being (SWB) construct. SWB is related to individuals' appraisals of their lives in recognition of cognitive and affective facets (Andrews and Withey, 1976; Campbell et al., 1976). Feelings that an individual has— positive and negative affects (PA and NA)—are encapsulated under the affective dimension of the SWB (David et al., 2013; Pavot and Diener, 2013). Accordingly, this affective dimension is also referred to as the hedonic component (Pavot and Diener, 2013) and sometimes named after happiness (Diener, 1984; Diener et al., 2011). Regarding the cognitive dimension of the SWB, individuals' judgments about dissimilarity between their ambitions and attainments are the point in question (Campbell et al., 1976; Pavot
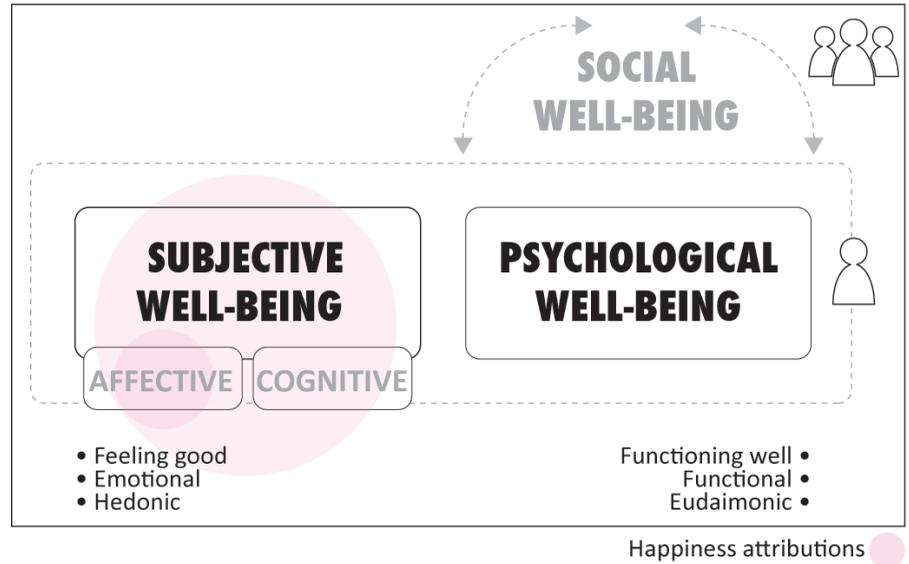
Figure 2. Well-being and happiness concepts.

and Diener, 2013). Thereby, the cognitive dimension is associated with life satisfaction (David et al., 2013). In sum, SWB has three major dimensions that are PA, NA, and life satisfaction. Besides this widely referenced tripartite composition (Arthaud-Day et al., 2005), a four-component interpretation also exists, which splits the cognitive dimension into two as life and specific domain satisfaction (Diener et al., 2009).

Explanations about eudaimonic well-being include psychological and social well-being (Westerhof and Keyes, 2010; Lambert et al., 2015). Psychological well-being (PWB) is pertinent to achieving whole psychological potency (Carr, 2011) while engaging with existential rigours (Linley and Joseph, 2004). Therefore, PWB symbolises favourable functioning through self-realisation (Westerhof and Keyes, 2010). The other eudaimonic view, social well-being, bases on building positive relationships, having positive value to others and positively functioning in the social domain (Westerhof and Keyes, 2010; Lopez et al., 2015).

Figure 2 summarises the most prevalent concepts about well-being, each of which nurtures the others.

Addressing the Elements of Well-Being in Design

With the reflections of the positive psychology movement, concepts in the positive psychology discipline have started to be encountered in the design discipline. Being in close relationship with the positive psychology discipline, the design for well-being approach tries to divert the attention towards the positive side and possibilities in designed products/systems and accompanying activities. Nevertheless, it does not underrate the heavy focus on pragmatic issues and problems in the traditional design approach. Now, the nascent approach struggles to bring users' experiences from zero to plus, rather than from minus to zero. This could enable users to flourish with the help of design. Herein, the design discipline interchangeably addresses positive psychology terminologies such as happiness, well-being, subjective well-being, and flourishing.

The design for well-being approach well-matches with an increasingly more health-conscious world, in which people play an active and proactive role during their health management. That's why, many technology

developers want to have a share in this grand and continuously growing market of happiness, well-being, and health-related products and systems (Dittmar and Lymberis, 2005). However, how these products and systems should be designed to effectively and seamlessly target well-being is important. Hereby, ingredients of well-being defined in positive psychology literature should be addressed.

Two prominent frameworks have utilised the ingredients of well-being in positive psychology. The first framework, The Design Well-Being Matrix (Pohlmeyer, 2012) bases upon the Well-Being Theory and its five dimensions mentioned in the previous section. It combines PERMA with specific roles of design. Design takes four specific roles as being a direct source for pleasure; representing a symbol as an indirect impact of design; being enablement for diverse experiences, performances, and events again as an indirect role; and providing strategies and guides to support happiness augmenting thinking and acting. The junctions of rows and columns in the matrix; i.e. design roles and PERMA components, present take-off points for design for well-being. To illustrate, the junction of enablement and engagement shows that enablement of engaging experiences can be considered as a design opportunity.

The Positive Design Framework (Desmet and Pohlmeyer, 2013; Pohlmeyer and Desmet, 2017) integrates pleasure, virtue, and personal significance as three major components of SWB in design. Thus, positive design appears as designing for pleasure, virtue, and personal significance, which are respectively related to experiencing positive emotions, becoming a good person, and pursuing personal objectives. It emphasises that design should not be associated only with reducing unhappiness or increasing pleasure. If designers and researchers are to take this framework as a departure point, they can concentrate on combinations of the components at a time. It is not required to cover all, providing that the selection does not negatively impact the others. Aside from these frameworks, few structured phases are discussed in the literature to understand individuals' happy moments, follow possibilities and reveal a design proposal (Jimenez et al., 2014).

Toolkits and guides can also be mentioned as materials introduced for individuals to practice happiness. An early example project is "Tinytask", which involves tokens on a key that suggest happiness enhancing assignments to its users (Ruitenberg and Desmet, 2010). Other toolkits have been introduced for designers, like the SIM toolkit that addresses symbolic meaning as a means to design for happiness with the incorporation of a card set and website (Casais et al., 2016).

Having primarily explored dimensions of effective communication of user research materials and then presented the major design for well-being issues, the rest of the paper merges these two subjects with a case study on digital healthcare technologies that aim at enhancing the well-being of pregnant women.

Related Work: The Design Well-Being Matrix for Pregnancy

The case presented in this paper takes root from a doctoral study (Günay, 2017) and goes beyond by building on branching opportunities that were observed especially while collating and communicating thick and multidimensional well-being related information to inform design. As the scope of this paper is further on analysing and synthesising user insights to cover conclusive interpretations and implications and on conveying them, detailed methodology and findings are not mentioned hereby.

Posterior explorations about the adaptation and expansion of usage possibilities of the Design for Well-Being Matrix (Pohlmeyer, 2012) as a tool to analyse, synthesise, and communicate user insights about digital healthcare technologies for pregnancy is put in the centre, after very briefly introducing the overall methodology below.

The actual purpose of the case study was exploring the characteristics of mobile pregnancy applications generating a positive pregnancy experience. Both daily-life changes of pregnant women considering three pregnancy trimesters and their experiences with mobile pregnancy applications were important. Hence, multiple in-depth semi-structured interviews were carried out with 33 pregnant women in different trimesters, supported by scales related to their well-being and technology readiness levels. More specifically, a study process with one pregnant participant involved the selection of one of the three presented mobile pregnancy applications by her and its usage for 6 weeks. Subsequent interviews were conducted biweekly; i.e. four interviews with each of the 33 participants (approximately 132 interviews due to one drop-out due to early labour), to track user experiences with mobile pregnancy apps and changes in daily life during pregnancy (see Günay, 2017 and Günay and Erbuğ, 2018 for the details and initial findings about the study).

After transcribing entire audio-recorded interviews, content analysis was carried out inductively (Bogdan and Biklen, 2007). Raw comments retrieved from different contents of the interviews, such as comments about general daily life experiences during pregnancy and comments about UX with mobile health technologies for pregnancy, were read through separately to explore meaningful patterns about positive UX dimensions (e.g. calming interaction, maternal sensuousness, mnemonic assistance), roles of different components of mobile pregnancy technologies (e.g. content, interaction, appearance) and topics in mobile pregnancy technologies (e.g. baby, mother, nutrition, exercise, medication), and changes in daily life of pregnant women considering main changes and subsequent changes that were triggered due to main changes (e.g. physical, cognitive, occupational, psychological).

To make sense of this dense and multi-dimensional data, data analysis and visualisation strategies with different focus and complexity were pursued. For communicating the relationships between positive UX dimensions, firstly as the most basic level, hierarchy ranking was used to demonstrate the dominancy of each positive UX dimension with a rank order according to frequency. Secondly, network mapping was used to present multidimensional relationships among all positive UX dimensions, going beyond pairwise relationships. The resulting network map also demonstrated the dominancy of each dimension (as represented with the hierarchy ranking); yet, added on that not only by visualising their relations, but also the strength of the bonds among them. Thirdly, Cross-Impact Matrix was created by Cross-Impact Analysis (CIA) to show the centrality of each dimension on a grid (Kuru, 2015). Then, for communicating the relationships between positive UX dimensions and different components of mobile pregnancy technologies, hierarchy ranking preserving the passiveness or activeness of the positive UX dimensions' role in each component was shown. Finally, dominancy of negative and positive comments related to prevailing pregnancy topics in mobile pregnancy technologies, as well as wellness dimensions related to daily life

changes during pregnancy were shown with basic level hierarchy ranking bar charts (**Figure 3**).

These analyses and visualisations were necessary to communicate and highlight specific findings about diverse issues related to pregnant women's both daily experiences and their experiences with pregnancy technologies. Although all of them were explained in detail and matched with participants' quotations, it was seen that there should be an overall analysis, synthesis, and visualisation to link diverse issues in the findings and demonstrate the featured design possibilities in a more communicable and workable way as well-being inspiring design descriptions. Therefore, in addition to the above-mentioned analysis methods and visualisation techniques, the Design Well-Being Matrix was utilised at the end of the entire analysis to conceive multifaceted design opportunities for the well-being of pregnant women around two main axes: diverse roles of design and major components of well-being in positive psychology literature (**Figure 3**).

The Design for Well-Being Matrix was selected not only because it is one of the two major well-being frameworks in design, but also its content explicitly addresses the elements of the Well-Being Theory (i.e. PERMA) and intersects them with clear roles of design. As the main objective of the case was firstly understanding the meaning of a positive pregnancy experience and dimensions of well-being during three trimesters of pregnancy, and then exploring design dimensions and attributes of mobile health (mHealth) for pregnancy; multiple dimensions about well-being, UX, and design had to be investigated in a longitudinal time frame also considering continuously changing dynamics of a pregnancy period. So, this added multidimensionality, depth, and complexity in already intricate UX concept favoured the utilisation of a framework with multitudinous but well-defined points to dwell on, rather than more abstract and broader components. Furthermore, it was seen that structural qualities of the matrix could provide flexibility, despite the guidance in categorisation, in adapting it for diverse use purposes during both analytic and synthetic phases of a design process. There could be rich potential in adapting the qualities of the matrix to match with the needs of designers from user research deliverables because such frameworks, models, and tools are actually mediums for communicating deeper information as discussed before.

The Design Well-Being Matrix in design literature provided the main structure and it was developed further and adapted by locating multiple design directions as branches of mini ego-centric network graphs in each cell. Each design direction involves possible design attributes that can be considered while designing digital technologies for pregnancy. In addition, some of these design attributes are sometimes useful to achieve other design directions in other cells (with another design role and/or well-being dimension). These relations are kept by adding the number of relational cell numbers near the mentioned design attributes (**Figure 4**). Keeping the multidimensional information about design directions and related attributes, which is important to support "inspiration"; but meanwhile simplifying them with visual links between data in different categories can facilitate interpretation of the related patterns, which is also crucial for "inspiration" (Sleeswijk Visser 2009; Töre Yargın 2013). Besides, they can guide designers to easily follow the relationships, and so, can reduce the "challenge level" for the designers (Roschuni 2012; Töre Yargın

DATA GATHERING

| | WEEK 1 | | WEEK 2 | | WEEK 3 | | WEEK 4 | | WEEK 5 | | WEEK 6 | |

Interview
Pregnancy
Apps in general
Health apps
Pregnancy apps
+
Presented apps

Prompts
Using the app
Filling in the cards
Next interview

Interview
Pregnancy
Selected app

Prompts
Using the app
Filling in the cards
Next interview

Interview
Pregnancy
Selected app

Prompts
Using the app
Filling in the cards
Next interview

Interview
Pregnancy
Selected app
+
Overall
suggestions

DATA VISUALISATION - SPECIFIC ISSUES

Pregnancy topics

Frequency order of
positive UX dimensions

Positive UX dimensions &
multidimensional relationships

Positive UX dimensions on
Cross-Impact Grid

Positive UX dimensions' relation with
different technology components

Wellness dimensions &
daily life changes
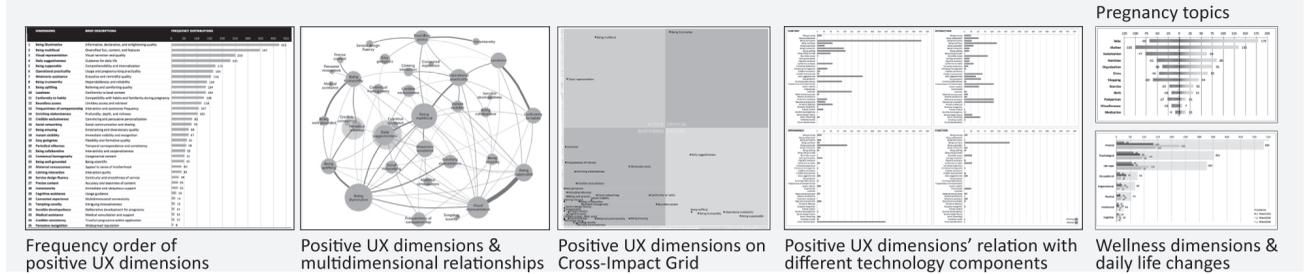
DATA VISUALISATION & COMMUNICATION - OVERALL ISSUES

The Design Well-Being Matrix for pregnancy

* No existing example   # Relational cell numbers   (#) Matrix cell numbers
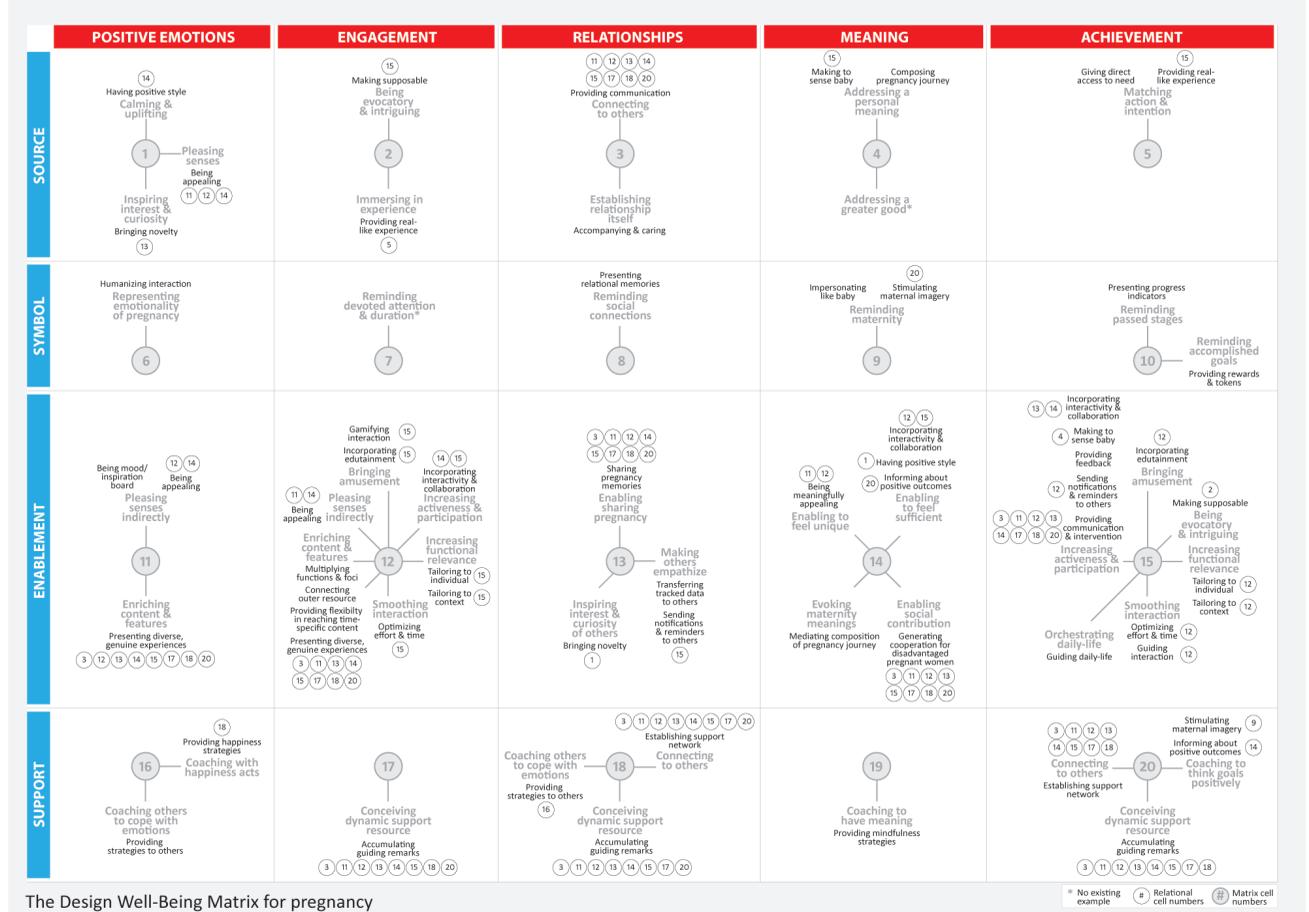
Figure 3. Major data collection, visualisation, and
communication steps in the methodology.
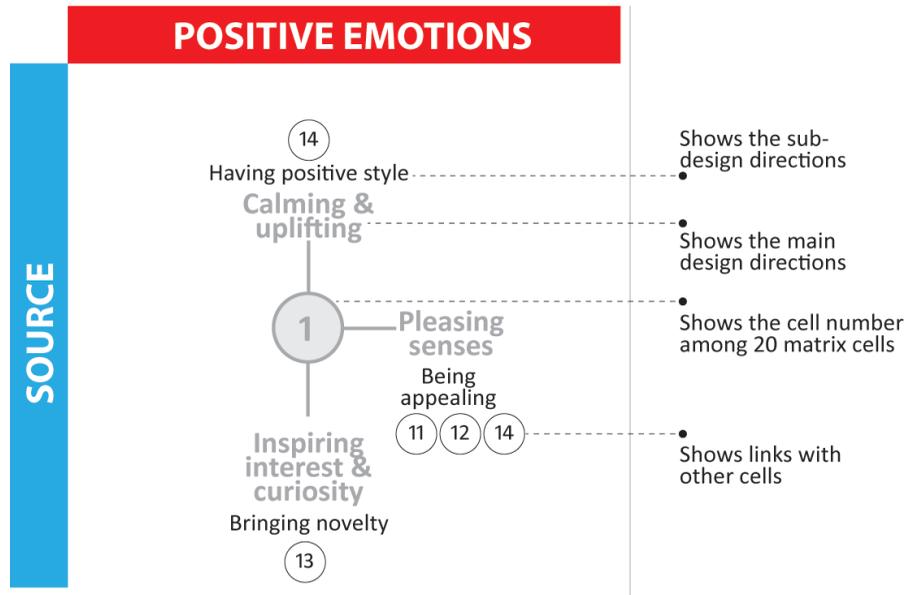
Figure 4. An example cell from the Design Well-Being Matrix for pregnancy (Matrix Cell 1).

2013). Adding such links may also provide interactivity even in passive information, which is important for "engagement" (Sleeswijk Visser 2009; Roschuni 2012).

The Design Well-Being Matrix for pregnancy can be seen as the macro-level visualisation of design opportunities for digital technologies for pregnancy. Design cards were also prepared zooming into each cell (**Figure 5**).

These cards can be seen as a summative description of each design opportunity and related design attributes within that matrix cell. The area in the left works as a navigation panel that shows firstly the position and number of the current cell among the other cells in the overall matrix and

Figure 5. An example design description card for one cell in the Design Well-Being Matrix for pregnancy (Matrix Cell 1).

then reminds the detailed ego-centric map in this cell, which are explained in the right part of the card one by one. Positive UX dimensions which should be taken into consideration while providing the mentioned design attribute and possible trade-offs are conveyed with tick and exclamation marks (**Figure 6**). To illustrate, if baby sizes are explained in pregnancy applications with reference to not well-known animals, this is usually found interesting by pregnant women, which also attracts the attention of other family members and friends. However, such visual representations can sometimes make the provided information more difficult to accurately comprehend or visualise in mind. Thus, although these visuals can enhance social networking, they are in trade-off with being supposable. These design attributes both in the main matrix and design cards, as well as positive UX dimensions highlighted in the design cards, are mainly based on the content analysis of the comments about interactions with mHealth technologies for pregnancy. Relevant pregnancy trimesters during which the mentioned attribute can be more significant are also highlighted. This trimester information is primarily retrieved from the content analysis of the general daily life experiences and changes during pregnancy. For instance, novel and engaging technology features are relevant for all three trimesters; yet, gamifying the interaction by providing a click-based kick counter feature may not be relevant for initial trimesters when babies are so small and it is not possible to sense the kicks.

These layers in research deliverables and concrete examples in different layers which are extracted in due course can be beneficial for communicating more in-depth explanations, without impinging upon designers' understanding in the macro-level visualisation. Therefore, it can also provide curiosity, surprise, and motivation to extract further information that is also significant for "engagement" (Sleeswijk Visser 2009; Roschuni 2012; Töre Yargın and Erbuğ 2017).

Figure 6. Details about the content of the cards.
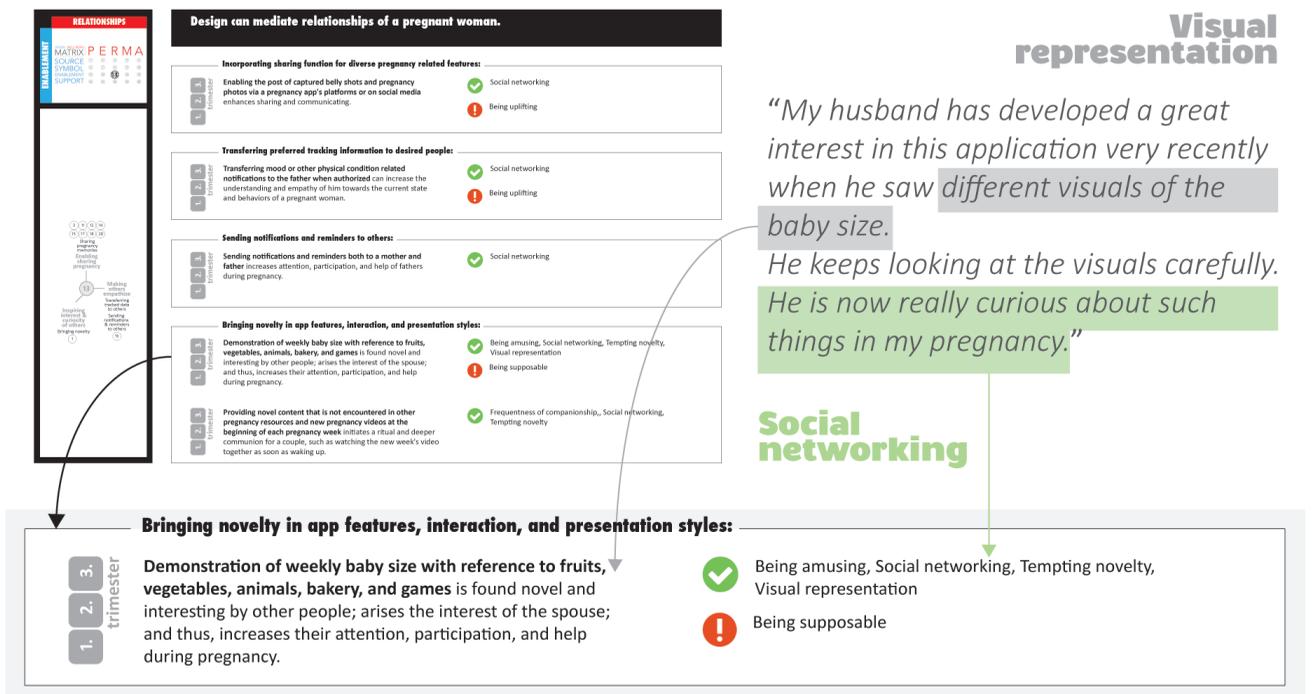
A few matrix cells are dwelled on below and participant quotations are provided to exemplify the content of the Design Well-Being Matrix for pregnancy. The numbers in the parenthesis indicate participant numbers.

Cell 1 in the matrix says that design can be a direct source of positive emotion. As the example design card shows, this can be achieved with pregnancy-related mHealth technologies by "being appealing to the individual, trimester, and pregnancy", "bringing novelty in the app features, interaction, and presentation styles" and "informing with a positive style". So, as one direction, technologies intended for pregnancy can intentionally offer customisation in appearance so that they can better fit individuals' preferences and changing mood during pregnancy.

> "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)

Cell 9 indicates that design can be a symbolic representation purposefully reminding certain meanings or virtues to users. According to the Design Well-Being Matrix for pregnancy, this can be interpreted as a design solution (to note, a solution can be a design opportunity, not just a direct response to a problem) can symbolise 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" and "stimulating maternal imagery" appear as design opportunities in the study.

> "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)

Cell 13 is the intersection of enablement and relationships, meaning that design can mediate relationships and enables the interconnection of people. Specific to pregnancy, a design solution can indirectly enable meaningful experiences for a pregnant woman with its features and attributes. "incorporating sharing function for diverse pregnancy-related features", "transferring preferred tracking information to desired people", "sending notifications and reminders to others" and "bringing novelty in the app features, interaction, and presentation styles" to attract the attention of other people to the pregnancy are prevailing design directions.

> "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 is. Searching such curiously is very enjoyable and I adore those visuals... It's good to share it with him." (P24)

As a final example, cell 16 shows that design can purposefully guide users to elicit a specific emotion by certain strategies. This cell in the Design Well-Being for pregnancy highlights that a design solution can provide supervisory support to elicit positive emotions in a pregnant woman. Design features related to "providing happiness strategies to a pregnant woman" and "providing happiness strategies for people around a pregnant woman" might be considered hereby.

"There could be assignments which would facilitate positive thinking. I suggest this because during one course that I participated as a part of the 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 with positive thought, the universe would realise our scripts. I felt relieved after writing my dream scenario." (P10)

DISCUSSIONS

Effective communication is essential during design processes to meaningfully interpret and transfer user research findings. Relatedly, effective utilisation of research and design tools as mediums of information transfer can be even more crucial in newly emerging design fields, one of which is design for well-being. Acknowledging that utilising previously introduced materials in a burgeoning field and reflecting upon them is very important for a shared and established language during communication, the Design for Well-Being Matrix has been selected and further developed like a visual toolkit in this paper. Introduction of new tools is also very valuable for this purpose; yet, a joint effort by transferring diverse insights about the already introduced ones and collaboratively discussing the ways of how these might be operationalised or augmented is equally valuable. Hereby, this is done by drawing upon designers' needs about qualities of user research outcomes. Certain arguments and recommendations are provided below concerning the flexible structure of the Design for Well-Being Matrix, diversity of use scenarios, and expandable opportunities and further research.

Effective Communication by Fluid Transformation of the Structure

In-depth user research usually generates thick, rich, and multidimensional qualitative data (Baxter et al., 2015; Harding and Whitehead, 2013). Also, design for well-being intrinsically involves multiple dimensions about well-being and UX with the product or system in question. In general, the qualitative tradition of inquiry highly entails the use of diagrams and figures for synthesising primary theoretical concepts/dimensions and their relationships; and matrices are beneficial to cross two or more dimensions related to the topic of interest (Verdinelli and Scagnoli, 2013). By intersecting the elements of Well-Being Theory in positive psychology discipline with specific roles of design in the form of a matrix, the Design for Well-Being Matrix (Pohlmeyer, 2012) provides a good start for researchers and/or designers to investigate and communicate multidimensional well-being and UX information. The framework structure and content provides specific guidance in categorisation so that it can become a structured repository of design opportunities and relevant attributes depending on designers' and researchers' aims to focus on either one cell or combination of multiple cells with different design roles and well-being dimensions.

Herewith, transforming matrix configuration and embedding ego-centric network graphs in each cell also show the possibility of approaching the framework/tool as a versatile canvas which can be adopted and tailored with different data visualisation techniques that can better serve the present need. Network graphs are powerful to visualise relationships between dimensions and sub-dimensions (Verdinelli and Scagnoli, 2013). Therefore, hybrid utilisation of matrices and networks would present both structured categories and intertwined relationships. In the context

of the pregnancy study, design possibilities in each cell of the matrix convey their links to other design possibilities and sub-design directions within the matrix, which can simplify and facilitate the interpretation of these information during the design process as suggested by Sleeswijk Visser (2009), Roschuni (2012), and Töre Yargın (2013). As a result, this can support "inspiration" by still keeping the multidimensionality but reducing its complexity, balance the "challenge level" for designers by providing guidance with links and categories in the matrix, and add a certain level of interactivity even in passive information by making designers actively follow the links and dig diverse themes and levels of information. It also provides flexibility to combine further hybrid information (text, visual; qualitative, quantitative; raw, edited) and be mould according to designers' needs from user research deliverables.

Besides the flexible transformation of the matrix, the macro- and micro-level visualisations address the flexible expansion of supplementary layers in the form of a toolkit; and hence need-based and interactive extraction of information, as exemplified with design description cards.

Effective Communication by Providing Rich Use Scenarios

It is seen that structural qualities of the matrix could also provide flexibility in adapting it for diverse use purposes during both analytic and synthetic phases of a design process. Specific to the Design for Well-being Matrix, Desmet and Pohlmeyer (2013) suggest that such frameworks are beneficial firstly to inspire design from scratch and secondly to investigate how current products and systems enhance well-being in relation to the frameworks' ingredients. Building on that, the current paper extends the use scenarios of this framework by utilising it as a data analysis, synthesis, conclusive interpretation, and communication tool in design for well-being projects.

Combining all these insights, possible use scenarios of the Design Well-Being Matrix can be pieced together as (1) providing directions for ideation in design process from scratch, (2) defining categories for examining and evaluating existing products, technologies and systems on the market, or components of a single solution (3) defining categories for reviewing and interpreting existing information and research in literature, (4) providing a structure and/or content for the content analysis of qualitative data, and (5) providing a structure and flexible platform to analyse and communicate the research insights.

Further Recommendations for Effective Communication and Limitations

Because the exemplified case is grounded on the dissertation, many quotations were given in relevant sections of it so that designers, application and technology developers, researchers and other related stakeholders in the field of prenatal and maternal care system can consult to this condensed information as a source for real-life cases with rich quotations to realise empathetic interpretation and to develop better strategies to enhance life qualities of pregnant women. These were located between thick descriptions, considering also the theoretical necessities of the dissertation and specific research questions. As this paper takes inspiration from the case study in the dissertation regarding the observations especially at the final stage of the dissertation and is structured around investigations after it, those quotations are not shown in the current visual toolkit. It can be suggested that the next step in practice would be to add another layer in the user research deliverables including

more selective quotations based on personification of pregnant women types in different trimesters, as well as other supportive media (photos, videos, snapshots) to increase connection with pregnant women's feelings, make designers' immerse into and imagine their pregnancy experiences, and hence, increase "empathy" and "inspiration" in design process. They would also function as reasons and evidence to support credibility, persuasiveness, and so, "justification" (Roschuni 2012; Töre Yargın 2013).

As a further strand, such tools and supporting materials as in the macro and micro visualisation of the Design Well-Being Matrix for pregnancy allow being easily transferred to digital mediums with different information layers and various starting points to follow, enabling these tools and their contents become more and more interactive and "engaging" as also extendable information repositories and archives (Töre Yargın and Erbuğ, 2017). So, different insights and evidence can accumulate within time, enhancing the triangulation and "credibility" of extended information in the digital repository. This layered interactive medium would be more novel and surprising (Sleeswijk Visser 2009; Roschuni 2012), accessible, shareable, and sustainable (Töre Yargın 2013), which are also important for "having feedback" apart from the aforementioned dimensions.

Presumably, one of the challenges of the proposed adaptation by keeping relationships in the matrix and details on supplementary materials, or embedding them in an interactive digital platform, would be related to the time and effort required to prepare appropriate layers even though it highly facilitates making sense out of complex data both for the researcher and the target audience during all data analysis, synthesis, and communication phases. However, hybridisation and layering of materials may also support collaborative design sessions (bigger cards, posters, etc.) and make them handier and more interactive depending on the use scenario. The visual design of the visual toolkit could be refined, too.

Besides, one major limitation of the paper is about the validity of the proposed visual toolkit. Although the proposed matrix and design cards are the result of a case study, as well as their exploration and interpretation in the light of relevant literature, the adaptation of this visual toolkit in actual design processes and retrieving feedback from researchers and/or designers about its applicability and usability is yet to be realised.

CONCLUSIONS

By providing first-hand experience and further reflections on the use of a design for well-being framework in the literature, this paper responds to the calls to test, understand, and discuss the effects of initial attempts in this domain, which is significant to advance a shared, yet iteratively improved language. Reflecting on the research experience about pregnant women's experiences with digital health technologies which aspire to support and enhance the well-being during pregnancy, it can be concluded that a visual toolkit is especially useful during research with vulnerable user groups because collected data is vulnerable, too, and should be handled very carefully to come up with correct and effective design implications. The well-being paradigm is multi-dimensional in itself and when combined with continuously changing dynamics of the pregnancy period and uniqueness of each pregnancy even regarding the same woman, the collected data becomes even more multi-layered, intertwined, and challenging to translate into simple design recommendations without

losing multi-parameters and richness, unless they are communicated effectively. The communication strategies proposed in this paper could also enable the incorporation of other prevalent issues in literature about mHealth for pregnancy or general well-being issues; such as social aspects beyond traditional pregnancy issues, roles of partners, information and support needs of different stakeholders, and longitudinal usage behaviours (Peyton et al., 2014; Wierckx et al., 2014; Mutsai and Coleman, 2019).

Another conclusion is that most existing tools in the domain can inspire researchers and designers to shape them according to their purposes (looking at the already existing solutions or projecting on future with new possibilities) or to harness them in different phases of the research (literature review, structuring data collection, analysis, synthesis, and communication). It is believed that fluid exploration and adaptation of research and design tools can be inspiring for future researchers and designers in this nascent domain (in addition to the ones in other areas), which is found important to foster a shared language meanwhile being still able to explore possibilities and customise them according to the requirements of the specific research and design cases. Finally, all of these would contribute to the realisation of the overarching aim of the domain, increasing the well-being and life-quality of individuals and communities by effectively communicating user research outcomes and informing design.

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**İYİ OLUŞ İÇİN TASARIM ALANINDA KULLANICI ARAŞTIRMASI
SONUÇLARININ ETKİLİ İLETİŞİMİ: TASARIM İYİ OLUŞ
MATRİSİNİN HAMİLELİK ÖZELİNDE BİR ÇALIŞMADA
UYARLANMASI**

Kullanıcı araştırması sonuçlarının etkili bir şekilde iletimi, tasarım
kararlarının etkili ve anlamlı bir şekilde bilgilendirilmesi açısından
tüm tasarım süreçlerinde kritik rol oynamaktadır. Araştırmanın
farklı aşamalarında, aslında bilgi iletim aracı olan teorik çerçevelerin,
modellerin ve araçların etkili iletişimi, özellikle yeni gelişmekte
olan alanlarda ortak ve yerleşmiş bir dil yaratımını ve bu alanların
güçlü bir şekilde gelişmesini destekleyebilir. Bu makale, kullanıcı
araştırması sonuçlarının etkili iletimini, giderek önem kazanan "iyi oluş
için tasarım" alanı özelinde incelemektedir. Makale, tasarımcıların kullanıcı
araştırmasına yönelik ihtiyaçlarını göz önünde bulundurarak, ilgili
alanyazında mevcut bir çerçevenin kullanılması ve geliştirilmesi
yoluyla, iyi oluş için tasarım odaklı araştırma sonuçlarının sunumuna
yönelik öneriler getirmektedir. Örnek çalışma, hamilelerin iyi oluş
seviyelerini arttırmayı amaçlayan dijital sağlık teknolojilerinin tasarım
özellikleri üzerine gerçekleştirilen bir araştırmada, Tasarım İyi Oluş
Matrisi'nin analiz, sentez ve iletişim aracı olarak kullanılmasını
içermektedir. Çalışma, tasarımcılar için iyi tanımlanmış hareket noktaları
sunan bu tür araçların esnek yapısının, zengin kullanım senaryolarının
ve de empati, ilham ve katılımı artıracak kullanıcı araştırması çıktılarına
yönelik boyutların kullanılmasıyla genişleyebilen olasılıkların önemini
göstermektedir.

**EFFECTIVE COMMUNICATION OF USER RESEARCH OUTCOMES
IN DESIGN FOR WELL-BEING: ADAPTATION OF THE DESIGN
WELL-BEING MATRIX IN A PREGNANCY CASE**

Effective communication of user research deliverables plays a crucial role
during all design processes to effectively and meaningfully inform design
decisions. As newly introduced materials, such as frameworks and tools,
in emergent fields are actually mediums for communicating information
in different phases of research, effective communication of them would
foster the development of a shared and established language, and thus,
robust progression of these fields. This paper investigates effective
communication of user research outcomes in rising "design for well-being"
field. Considering designers' needs from user research deliverables, the
paper provides recommendations about effective communication of design
for well-being focused research outcomes through further development of
an existing design for well-being framework. The example case involves
the utilisation of the Design Well-Being Matrix as an analysis, synthesis,
and communication tool in a study on characteristics of digital health

technologies that aim at enhancing the well-being of pregnant women. The case shows that the flexible structure of such tools, which still provide clear well-being focused take-off points for designers; diversity of use scenarios; and expandable opportunities by considering the dimensions of user research deliverables that would increase empathy, inspiration, and engagement are important.

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