Future Healthcare

ROAD MAP

Roadmap towards Future Patient Teleconsultation Experience

Master Thesis

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Executive Summary

During the pandemic, the advantages and broad prospects of teleconsultation have gradually entered the public eyes and gained recognition. However, for patient groups, seeing a doctor goes beyond just convenience and efficiency. When suffering from an illness, patients often experience significant anxiety at the same time, feeling lost and uncertain about their condition and future plans. Therefore, the future of teleconsultation should also take the vulnerability and emotional needs of patients into consideration.

Through a literature review on patients' anxiety status in the existing medical context and expert interviews, the influencing factors of patient anxiety were summarized in the second chapter. Meanwhile, the current development of teleconsultation was also studied to dive deeper into the research context. At the end of Chapter 2, an opportunity map that plays a key inspiring role for the subsequent strategy proposals was produced as the outcome based on the social support theory.

By conducting strategic trend research and future visioning, a desirable Future Vision was generated together with a matching design goal to guide the following user research and concept development procedure (Chapter 3).

The user research stage (Chapter 4) took the longest time. The procedure was divided into two parts in order to understand the current user experience as well as to elicit latent needs and expectations. Through thematic analysis of the current teleconsultation APP's user feedback and generative user interviews, four patient traits were defined, and patients' expectations were also differentiated and mapped out.

After all of the preceding research phases were completed, the project progressed to the development stage (Chapter 5). Eight strategy proposals were made and then plotted on the roadmap. The outcomes were assessed and iterated from multiple perspectives using evaluation booklets and interviews (Chapter 6). As a result, a final roadmap was created, along with the other important outcomes mentioned above to support the design of the online tooklit Revo (Chapter 7).

Content

01 Introduction

This chapter provides an overview of the background and overall plans for the graduation project. First, the Consultation Room 2030 will be briefly introduced as the inspiration for this project. The specific assignments will then be narrated in greater detail, eliciting the research question. Following deconstruction, several sub-questions will be raised. The design approach will be explained at the end of this chapter to give a systematic view of this project.

Background

In healthcare, the doctor-patient interaction is most commonly held in the Consultation Room, which hasn't changed much over the last few decades. However, new technologies such as virtual reality, artificial intelligence, speech-to-speech translation, and so on are available now. These developments provide new opportunities to support all processes in the consulting room, of which communication between doctor and patient is only one component, and may even set the stage to extend current processes, such as offering extra services to the patient outside the consulting room, such as consultation space on the way, home-based diagnosis, and monitoring, a new way of doctor-patient interaction, etc. ("About us | Spreekkamer 2030", 2022).

This project is part of the Consultation Room 2030 initiative, which seeks to investigate how the future of healthcare will change in the coming years. My personal interest lies in utilizing technologies to alleviate patients' anxiety during consultation journeys in telemedicine contexts. There are two main points I want to elaborate on further. On the one hand, people frequently feel tense and anxious during consultations due to various reasons: worry about disease, fear of death, unfamiliar with medical environments, feeling helpless due to lack of facilitation, etc. And, in remote scenarios, this situation may worsen due to a lack of knowledge, experience, and support. Telemedicine, on the other hand, has grown rapidly in recent years, particularly since the pandemic, and has the potential to be the future of healthcare. At present, telemedicine is mainly applied in rural areas where medical sources are lacking. But in the future, it also has the potential to be widely used in cities to further facilitate people's medical needs (Healthy Me PA, 2018). Therefore, tt leaves sufficient spaces for emerging technology applications and innovation in the consultation process.

Doctors, nurses, family members, and, in most cases, patients are the primary stakeholders. The target patients in this project should have sufficient somatic capability to complete the consultation process and communicate without barriers.

Assignment Introduction

Anxiety, defined as a negative emotion experienced by individuals as a response to an ambiguous threat (DIoPD, n.d.), is commonly seen in the medical context. Most people experience anxiety and stress in their daily life from time to time, but disproportionate anxiety emotion not only have the potential to cause anxiety disorders, but it can also negatively impact physical health and recovery from illness. Many studies have shown us that physical fitness and mental fitness are not independent of each other, psychological distress occurs more frequently among medical inpatients (Wilson-Barnett, 1976). At the same time, the extensivity of anxiety in medical environments might be more serious than expected. According to Tyrer et al. (2014), between 10% and 20% of all attenders in general hospitals have abnormal health anxiety, which is often undetected due to various reasons. Therefore, significant importance should be attached to the anxiety issues among patients during medical consultation and treatment.

In the teleconsultation scenario, the factors that may trigger patients' anxiety become more diverse due to new combinations of stakeholders and the inclusion of advanced technologies. Therefore, this project will explore how to alleviate patients' anxiety during teleconsultation journeys through the implementation of emerging technologies.

The research question could be divided into several sub-questions to structure the specific research goal:

- RQ: How to utilize technologies to alleviate patients' anxiety during the consultation journey in the teleconsultation context in 2030?
- SQ-1: What are the key influencing factors of patients' anxiety?
- SQ-2: How can technologies be used to alleviate anxiety? / Where do the design opportunities lie?
- SQ-3: How to align the technologies/ideas with the desired future vision?

In terms of outcome, this project intends to investigate opportunities in the research context and document them in a structured and systemic way. As a result, a strategic design roadmap that leads to a desirable future vision is required to guide people through the generated approach. This roadmap will be combined with other project outputs to form a design guidance toolkit, from which future designers or design students interested in patient anxiety can gain insights and develop ideas.

Project Approach

The final outcome of this project is envisioned to be a roadmap, therefore, the book Design Roadmapping written by Simonse et al. (2018) will provide great support for this project. At the same time, this project will still follow the underlying design logic of the Double Diamond Model, adopting the process of "Descover – Define – Develop – Deliver". As a graduation project of the SPD program, the kep point of problem defining will be achieved through the method of Future Visioning.

Figure 1.1 demonstrates the approach of this project, which has integrated the Design Roadmapping theory and Double Diamond Model. The whole process is divided into 5 stages:

- The first Stage aims to understand the research context, and a macro landscape will emerge through studying the anxiety of patients in the existing medical context. A literature review and expert interviews will be conducted to map out the patient journey and define innovation opportunities.

- The second stage is to discover future opportunities. It is future-oriented, dedicated to exploring what will be the cutting-edge technologies in 2030 and how will people's values and lifestyles evolve in the following decade. Methods of Strategic Trend Research, Technology Scouting, and Future Visioning from the book Design Roadmapping will be adopted to generate the desired future vision, which will serve as the end point of this stage.

- To achieve the goal of human-centered design, key user insights will be gathered in the third stage. Thematic analysis and Generative Design Research methods will be used to distinguish patient traits and future expectations, thereby to faciliatate the concept development.

- In the fourth stage, several design proposals will be presented and mapped out on the roadmap. Through evaluation, the roadmap and proposals will be iterated in a spiral way.

- The final stage is scheduled to complete all the deliverables and prepare for the final presentation. Reflections and additional instructions for this project will be considered and included.
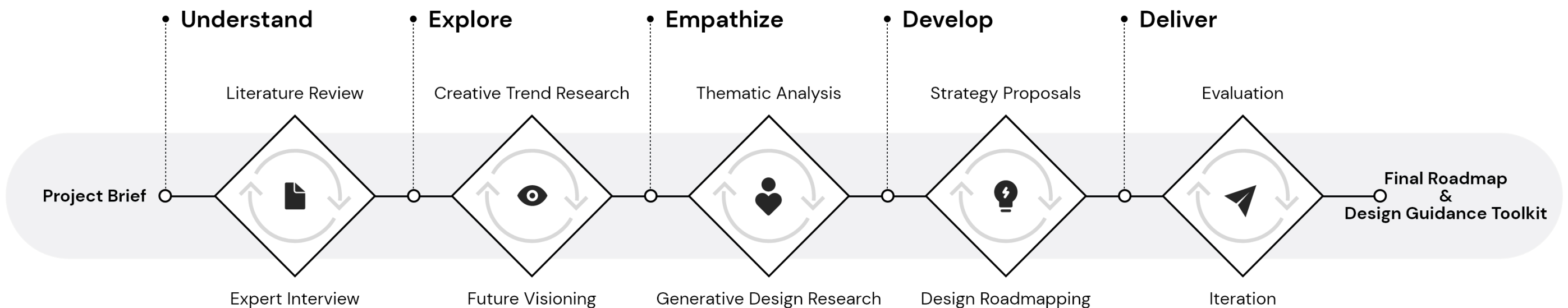
Figure 1.1 Project Approach

02   Understand the Context

This chapter demonstrates the project's initial research stage, which aims to develop a theoretical understanding of the research context. It starts with a thorough review of the literature to academically define the research problem. This session will cover two major topics: "Patient Anxiety" and "Teleconsultation." Following expert interviews and a brief case study, the research focus is narrowed and the problem is framed. All of the outcomes will be integrated into the Patient Journey Opportunity Map (Figure 2.13) at the end of this chapter, which will serve as an opportunity definition, deconstruct the research goal, and propose some strategy directions.

Literature Review

Literature Selection Structure

The research question of this project is: How to alleviate patients' anxiety during the teleconsultation journey in 2030? To capture information comprehensively, the research objectives are disassembled into four dimensions, and relevant literature is searched using this structure:

1. Current situation: anxiety in the medical context
2. Mechanism and influencing factors of anxiety
3. Development of Telehealth
4. Positive psychology theory

Figure 2.1 Literature Review Structure

To begin, studying the general anxiety state of patients in the existing medical environment is necessary to gain an in-depth understanding of the research con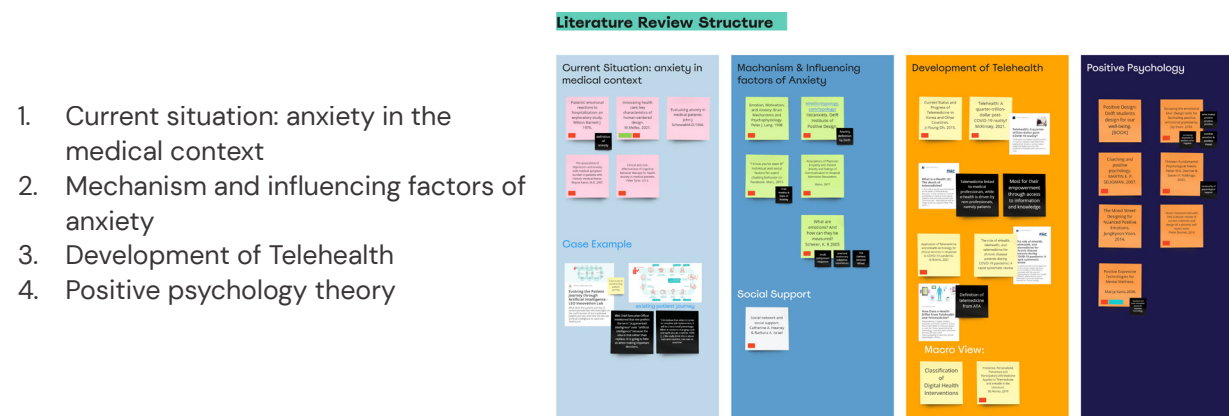text. Second, the mechanism of emotion generation and the factors that influence anxiety are studied from the perspectives of physiology and psychology in order to supplement background knowledge for the subsequent formulation of design strategies. At the same time, teleconsultation, as another key contextual factor in this project, necessitates a thorough and systematic contextual understanding via literature research. Last but not least, since the previous research on anxiety is often focused on the perspective of negative emotions and triggers, literature related to positive psychology is selected to gain knowledge on the relief of anxiety through positive emotion-empowered methods and theories.

To better clarify the literature research section, two research keywords are defined as "Anxiety" and "Teleconsultation". The following will introduce the results of the literature research from these two perspectives.

Topic 1: "Patient Anxiety"

The first part of research aims to understand the anxiety emotion from multiple perspectives and to research on existing methods for alleviating patient anxiety.

Topic 2: "Teleconsultation"

This part of the research aims at explore the existing telehealth context from the following aspects:

- Medical transformations in the big picture
- Distinguish the definition between Telemedicine, Telehealth, and eHealth
- Significance and promising future of Telehealth

What is Anxiety

Anxiety and Stress

In our daily life, most people experience feelings of stress and anxiety at some point, especially when they are facing some health-related issues. Usually, these two emotions are felt to be similar, but there are still some nuanced differences.

According to American Psychological Association (Alvord & Halfond, 2022), stress is defined as an emotional response that is typically caused by external triggers, while anxiety, on the other hand, is defined by persistent, excessive worries that don't go away even in the absence of a stressor.

Anxiety is first described as an emotion that comes from "fear of the unknown, as disproportionate to the threat involved, related to the future" by Wilson-Barnett (1976). From the Emotion Typology (2022) from TU Delft, anxiety is described as a "feeling when you think about bad things that could happen to you. You are on guard because you don't know what the threat is."

Based on the above theories, it is not difficult to see that it is objectively easier to relieve the patient's stress than to relieve the patient's anxiety. It is only necessary to remove the environmental factors that punish the stress at the technical level. However, the patient may already be in a state of anxiety at this time, and only optimizing the objective conditions will still have little effect on improving the patient's medical experience. Therefore, the focus of this project is how to alleviate anxiety, not reduce stress.

Anxiety and Fear

Meanwhile, the inseparable relationship between anxiety and fear was stressed out. These two words are often used interchangeably in everyday language. They both deal with uncertain events in the future, and they both put the person experiencing them in a state of readiness to deal with the threat.

But there is still an essential difference between anxiety and fear. Fear is evoked by concrete, immediate, and usually sudden threats (like a fast-approaching car), whereas anxiety is evoked by the uncertainty of potential and unidentified threats (such as the possibility to catch a nasty disease). Since there is no clear threat, there is nothing for people to get away from (Emotion Typology, 2022).

Generally, anxiety is a kind of emotion derived from the fear of the future, with no specific triggers, and usually can last for a long time.

Trait Anxiety and State of Anxiety

At the same time, anxiety itself can be further deconstructed into 2 types, which are:

- Trait Anxiety: It refers to the "tendency of a person to experience anxiety" and this depends on his/her personality, or the tendency to "perceive the world in a certain way and indispositions to react or behave in a specific manner with predictable regularity" (Mai, 2015).
- State of Anxiety: It refers to the emotional and physiological manifestations of anxiety that a person shows when he/she is subjected to a stressor (Mai, 2015).

These two kinds of anxiety are interrelated with each other. People with higher trait anxiety levels are more prone to enter a state of anxiety. We can say that the state of anxiety is an objective result of external observation, while trait anxiety is a subjective factor that varies from person to person.

Anxiety in the Medical Environment

Nowadays, with the continuous development of the healthcare level, many propositions about humanized medical treatment have been put forward, and anxiety and other emotions of patients in the course of medical treatment have gradually received more attention. In this project, the primary reasons for studying patient anxiety in the medical environment are as follows.

The Interdependency between Anxiety and Illness

Many studies have shown us that physical fitness and mental fitness are not independent of each other. According to an exploratory study conducted by Wilson-Barnett, psychological distress occurs not infrequently among medical inpatients. In fact, psychiatric disorders of effect occur more frequently among medical patients than in the general population (Wilson-Barnett, 1976). Also, the relief of the psychiatric aspect can benefit the recovery of the physical aspect. For instance, a reduction of patients' anxiety by an explanation of surgical and postoperative procedures was shown to be associated with a decreased need for postoperative analgesia (Hayward, 1975).

The Extensivity of anxiety in the medical context

On the other hand, the current state of patient anxiety in the healthcare context may be more severe than expected and needs to be addressed urgently. Health anxiety, together with its approximate synonym, hypochondriasis, is a common issue in the community (lifetime prevalence 5%), and in both primary and secondary care. It places a substantial burden on health services5 since the fear of having a serious disease leads to medical consultation, commonly followed by further investigations (Tyer, 2013).

Pathological health anxiety provokes substantial suffering but often goes unrecognized. According to Tyrer (2013), between 10% and 20% of all attenders in general hospitals have abnormal health anxiety, which is often undetected since many patients have a history of previous medical illnesses and their anxiety is seen as reasonable and proportionate.

How is patients' anxiety being managed now?

Up to now, there is very limited effective disclosure of this dilemma. Through interviews with doctors, we know that the current medical environment mainly relies on the medical team's empathy level and communication skills. However, not every doctor has the corresponding ability and willingness, so there is no guarantee that the patient's anxiety will be taken care of. Not only that, but sometimes the overly worried emotions shown by the patients will increase the workload of the medical team, thereby reducing their work efficiency.

In some large cancer hospitals, patient groups are set up to provide emotional support to patients. A patient group is an organized group that represents patients with a specific disease or condition, or a collection of diseases or conditions (Canada Drug and Health Technology Agency, 2020), it should have members that are patients, family members, or both.

Greater patient involvement in personal healthcare needs and also in the development of local and national healthcare provision is an important part of the future development of effective healthcare services (PatientView, 2021).

According to Tyrer (2013)'s exploratory study, psychological treatment in the form of cognitive behavior therapy delivered by expert therapists is effective for anxiety disorders and should be widely used. However, there are obstacles. Not only is the cost of this type of solution high, but the number of professionals available is also limited. As a result, achieving the goal of relieving patients' anxiety on a large scale is unrealistic.

Mechanism of Anxiety

To explore how to alleviate anxiety emotion, firstly we need to know the mechanism of how emotion is produced by our brain.
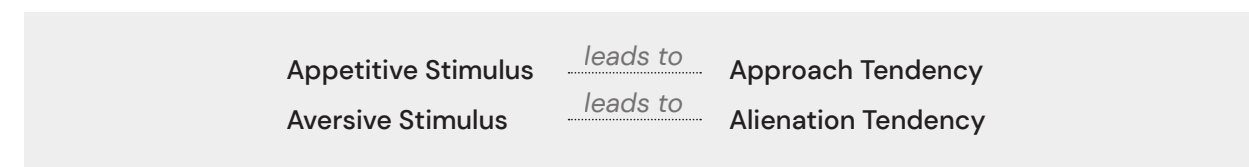
Biphasic Organization of Emotion

Patterns of emotional expression are highly varied. Theorists have compiled many lists of emotion classifications including 8 or more types of basic emotions (Plutchik, 1962). However, according to the research of Lang, Braddley, and Cuthbert (1998) on the brain mechanisms and psychophysiology, the evolutionary foundation of emotion has a simpler, two-factor motivational organization. That is, affects are organized by brain systems that adaptively respond to two basic types of stimulation: appetitive or aversive.

This kind of biphasic organization of emotion has been proposed by many theorists. For instance, Konorski (1967) has developed a model based on a typology of unconditioned reflexes and their biological, motivational roles, stating that exteroceptive reflexes were either preservative (e.g., ingestion, copulation, nurture of progeny) or protective (e.g., withdrawal from or rejection of noxious agents). Dickinson and Dearing (1979) further developed Konorski's dichotomy into two opponent motivational systems, aversive and attractive, each activated by a different, but equally wide range of unconditioned stimuli, determining perceptual-motor patterns and the course of learning.

This paper adopts the conclusions of Lang et al. (1998), which have merged the previous lines of theoretical development. It is postulated that two motivational systems exist in the brain, appetitive and defensive and that each can vary in terms of activation or arousal. This motive system determines the general behavioral strategy of people, defense, or appetitive acquisition. They also stressed that although emotions may come in many forms, shaped by genetics and learning to fit the demands of the local context, their fundamental organization is motivational. People's specific somatic and automatic patterns of affective responding are formed by the behavioral context. For example, when people feel uneasy and threatened, they will subconsciously want to escape or search for exits, which is actually in line with their motivation to protect their safety.

In general, the bi-directional motivational system could be simplified into the following model:

Appetitive Stimulus	*leads to*	Approach Tendency
Aversive Stimulus	*leads to*	Alienation Tendency

The Emotion Priming Model

In addition to organizing responding to specific affect eliciting input, the active motivational system exerts a modulatory effect on other processing operations in the brain. This means that memory associations, action programs, and other representations that are linked to the engaged motivational system are especially "primed." Priming is an automatic process (McKoon and Ratcliff, 1980). It can take place outside awareness, e.g., when priming stimuli are presented rapidly, below the recognition threshold. This mechanism may explain why negative, unpleasant associations are more probable in depressed individuals, or why anxious patients respond more rapidly to "threat" cues (Lang et al., 1998).

Figure 2.2 visualized the Startle Reflex Priming Model, which proved to be effective for testing the above hypotheses. Probe stimuli (acoustic, auditory, or tactile) have activated the pontine startle circuit, resulting in startle reflex output. When previous aversive unconditioned or symbolic stimuli activate the defense motive system, its direct projections to the startle circuit potentiate (augment) this reflex response. Alternatively, when the appetitive motive system is active, its projections to the startle circuit result in reflex inhibition (Lang et al., 1998). This explains how our brain modulates startle from a physiological aspect.
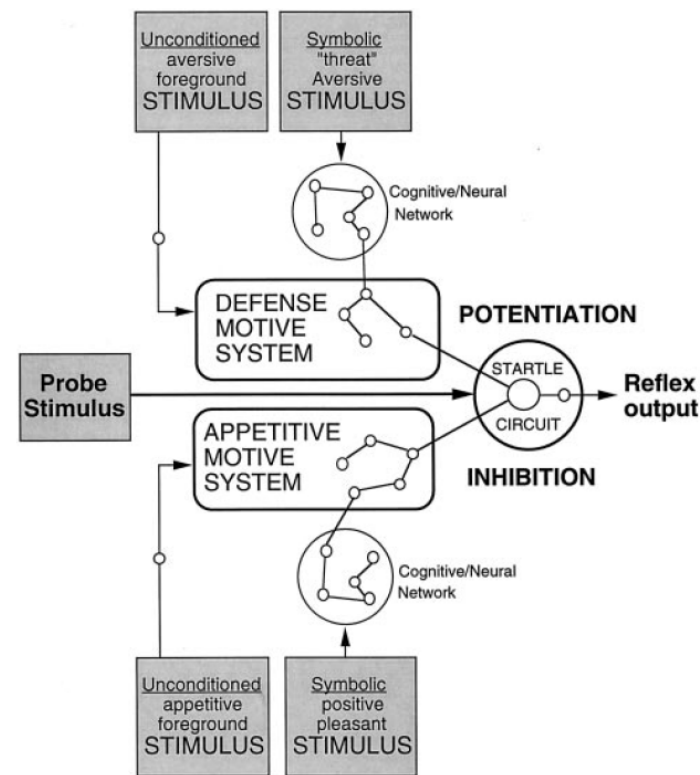

Figure 2.2 Startle Reflex Priming Model (Lang et al., 1998)

Relationship between Anxiety and Behavior Inhibition

To learn more about the behavior style of anxious people, we also need to understand the relationship between anxiety and behavioral inhibition. If people with high anxiety traits are indeed more prone to behavioral inhibition, it means that we have to switch our thinking when designing for such a group.

Behavior Inhibition is a temperamental predisposition, characterized by restraint in engaging with the world combined with a tendency to scrutinize the environment for potential threats and to avoid or withdraw from unfamiliar situations or people (APA, n.d.). This kind of temperament has been linked to the development of social disorder, it relates to the tendency to experience distress and to withdraw from unfamiliar situations, people, or environments. For a subset of children, behavior inhibition is a stable personality trait.

According to Fox et al. (2005), a growing body of research is dedicated to investigating the relationship between personality styles in childhood and the later onset of anxiety disorders. Behavioral inhibition is a personality style that has been proven to be associated with the development of anxiety disorders in adulthood, particularly social anxiety.

Meanwhile, many researchers explained the underlying brain mechanism which stops people from managing their emotions from a neuropsychological point of view. Usually, anxious people rely more on maladaptive strategies like suppression (trying to inhibit or hide emotional responses), and less on adaptive strategies like reappraisal (Rowlands, 2019). People with panic disorder also often take on avoidance behaviors to sidestep fearful thoughts, feelings of dread, and overall anxiety-related symptoms (Star, 2021). However, avoidance is never an effective way of solving anxiety. Avoidance coping causes anxiety to snowball because when people use avoidance coping, they typically end up experiencing more of the very thing they were trying to escape (Boyes, 2013).
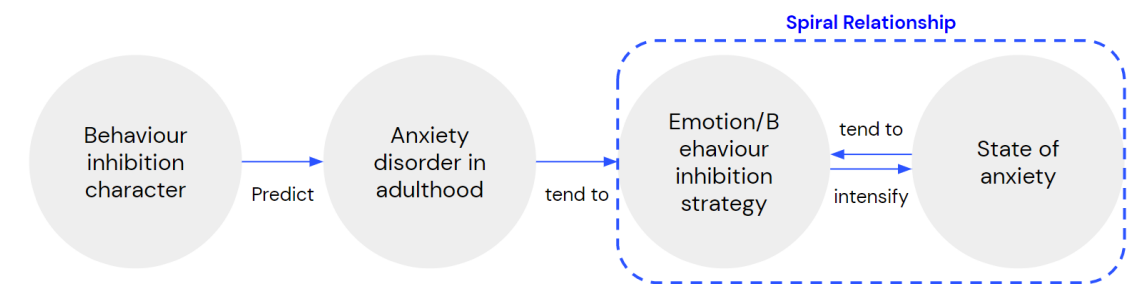
Figure 2.3 Relationship of Anxiety & Behavior Inhibition

The relationships between behavior inhibition character and anxiety are summarized in Figure 2.3. From a statistical standpoint, behavior inhibition character could predict the occurrence of anxiety disorder in adulthood as a stable personality trait in childhood. At the same time, people with anxiety disorders frequently use emotion/behavior inhibition strategies to suppress or hide their emotional responses, which exacerbates their anxiety. Once people enter the spiral relationship depicted in the dotted box, they are primed for a snowballing pattern of anxiety growth.

Social Support as a Solution

In order to find a breakthrough to alleviate patient anxiety during the medical consultation journey, it is necessary to look for channels that can directly affect the patient's emotions from the standpoint of human factors, in addition to reasonable consideration of the context's objective factors (such as medical instructions, software platform, guidance, and so on). Human actors primarily cover the following roles during the consultation journey:

- Patients
- Medical Teams
- Existing social networks (e.g., families and friends)
- Potential new social linkages (e.g., patient groups)

The medical team's impact on patient anxiety has already been demonstrated. However, due to the large workload of medical staff, it is not practical to propose to medical teams to shift much attention to patient anxiety at this stage in order to ensure work efficiency and the orderly operation of the medical system. As a result, in this section, I address my emphasis on other human-related influences that are also strongly associated with patient anxiety, such as existing social networks and potential new social linkages. At this point, two important concepts emerge gradually: "social network" and "social support." The following will explain what "social support" is and why it is important to focus on it.

What is Social Support?

Before cutting into the detailed definition of social support, some concepts and norms should be defined. Several key terms have been used in studies of the health-enhancing components of social relationships (Berkman et al, 2000).

- The term *social integration* has been used to refer to the existence of social ties (Heaney & Israel, 2008).
- The term *social capital* has been used to describe certain resources and norms that arise from social networks (Ferlander, 2007).
- The term *social network* refers to the web of social relationships that surround individuals. The provision of social support is one of the important functions of social relationships.
- Thus, to clarify the relationship between *social network* and *social support*: *social network* refers to linkages between people that may or may not provide *social support* and that may serve functions other than providing support (Heaney & Israel, 2008).

The term *social support* has been defined and measured in numerous ways. According to seminal work by House (1981), *social support* is the functional content of relationships that can be categorized into four broad types of supportive behaviors or acts:

- Emotional support involves the provision of empathy, love, trust, and caring.
- Instrumental support involves the provision of tangible aid and services that directly assist a person in need.
- Informational support is the provision of advice, suggestions, and information that a person can use to address problems.
- Appraisal support involves the provision of information that is useful for self-evaluation purposes—in other words, constructive feedback and affirmation.

Why focus on Social Support?

There are correlations between social networks and health, and many investigations of the effects of social relationships on health have focused on the provision of social support. There is increasing evidence that negative interpersonal interactions, such as those characterized by mistrust, hassles, criticism, and domination, are more strongly related to such factors as negative mood (Fleishman et al, 2000), depression (Cranford, 2004), risky health behaviors such as substance abuse (Oetzel, Duran, Jiang, and Lucero, 2007), and susceptibility to infectious disease (Cohen et al., 1997) that is a lack of social support.

According to Heaney & Israel (2008), social support may have positive effects on physical, mental, and social health. The relationship between social networks and social support and health outcomes is summarized in Figure 2.4 (Heaney & Israel, 2008). This model depicted a mutual influencing relationship: social network and social support serve as the starting point or initiator of a causal flow toward health outcomes, while on the opposite, health status will also influence the extent to which one is able to maintain and mobilize a social network.
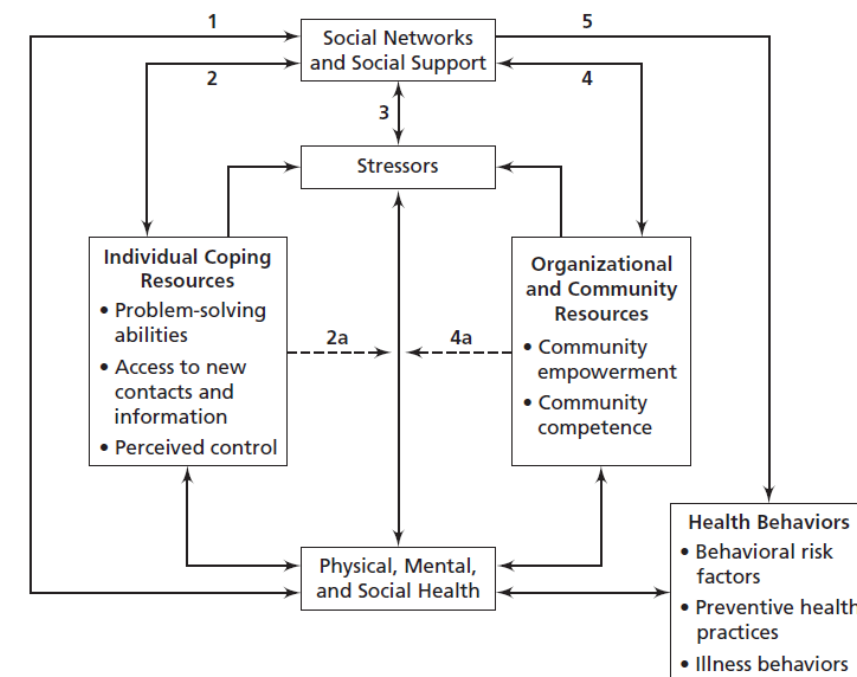

Figure 2.4: Concept Model for the Relationship of Social Networks and Social Support to Health (Heaney & Israel, 2008)

Generally, paying attention to social support is of significant importance for relieving anxiety. From the perspective of the relationship between social support and physical health, the provision of social support could enhance well-being and health regardless of stress level (Berkman & Glass, 2000), which is very applicable for patients with health anxiety. As pathway 1 represents in Figure 2.4, by meeting basic human needs for companionship, intimacy, a sense of belonging, and reassurance of one's worth as a person, social support will play a role in health outcomes. Also, as has been proved in some past social initiatives, social support could facilitate health behaviors such as medical regimens and smoking cessation. Last but not least, social support has had a positive impact on disease incidence and recovery.

On the other hand, from the perspective of the correlation between social support and the psychological aspect, it also shows a promising vision. First, social interactions defined the meaning people assigned to events (Berkman, Glass, Brissette & Seeman, 2000). Therefore, healthy and positive social interactions could help people gain meaning in life, thereby alleviating anxiety potentially. According to Cassel (1976), social support served as a key psychosocial protective factor that reduced individuals' vulnerability to the deleterious effects of stress on health. Thus, people's social network linkages may help them reinterpret events or problems in a more positive and constructive light (Thoits, 1995).

In conclusion, social support will be adopted as an important means of addressing patient anxiety in the project.
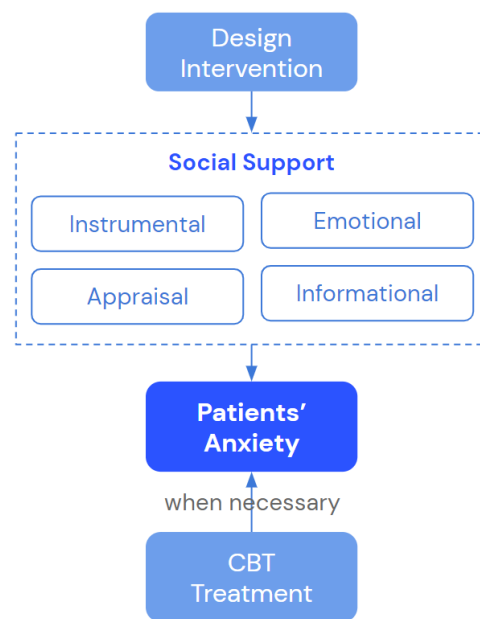

Figure 2.5 Problem Framing

Viewpoint from Positive Psychology

To reduce patients' anxiety, it is necessary to consider not only how to reduce negative emotions, but also how to facilitate positive emotions. The significance of positive psychology lies in shifting the focus of design from avoiding negative emotions to intentionally stimulating and sustaining positive emotional experiences (Yoon, 2018), which has provided a new angle to propose design proposals.

To understand how to facilitate positive emotion, it's necessary to figure out what elements make positive emotions positive from the root.

- First, the cognitive perspective is based on the proposition that emotions are elicited by an appraisal of a situation (Smith, Tong, & Ellsworth, 2014). Appraisal refers to a direct and immediate sense judgment of the significance of a stimulus (e.g., event, object, or thought) in relation to the person's well-being (Frijda, 2007). In this perspective, an emotional state can be defined as positive when the individual appraises the stimulus as being beneficial (or non-threatening). In contrast, negative emotions are evoked by stimuli that are appraised as being unbeneficial (Yoon, 2018).

- Second, the behavioral perspective emphasizes the behavioral effects of emotions, distinguishing positive from negative emotions according to two aspects (Watson, Wiese, Vaidya, & Tellegen, 1999). One is that the behavior incited by positive emotions involves 'approach' and those sparked by negative emotions yield 'avoidance'. The other, is that whereas positive emotions result in favorable (i.e., desirable or honorable) behavior (e.g., sharing one's resources), negative emotions result in unfavorable behavior (e.g., intimidating someone) (Averill, 1975).

- Third, the experiential perspective focuses on the experience of valence, a subjective sense of positivity or negativity accompanying the experience (Smith & Ellsworth, 1985); positive emotions are felt to be pleasant, and negative emotions are unpleasant.

- *It needs to note that emotion might fit in one of the three perspectives, but it doesn't mean that it has to fit in the others.

Figure 2.6 demonstrates the broaden-and-build theory of positive emotions. Positive emotions play an important role in promoting health. On the one hand, it can be used as a resource for building up personal well-being. At the same time, as shown in figure 2.6, positive emotions can help patients build a spiral model, thereby promoting a layer-by-layer transformation from resources to enhanced health, survival, and fulfillment (Fredrickson & Cohn, 2008).
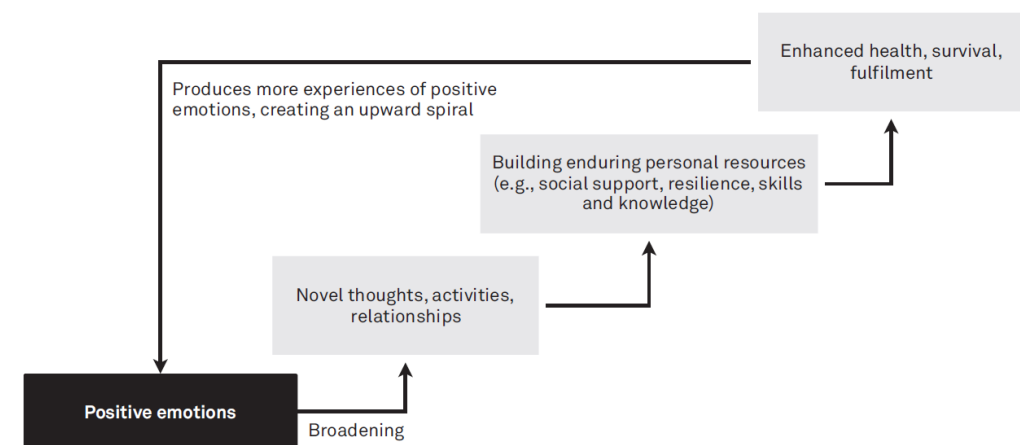

Figure 2.6 The broaden-and-build theory of positive emotions
(Fredrickson & Cohn, 2008)

Summary: Influencing Factors of Patients' Anxiety

As a result of the research on the first keyword "anxiety", seven influencing factors are summarized.
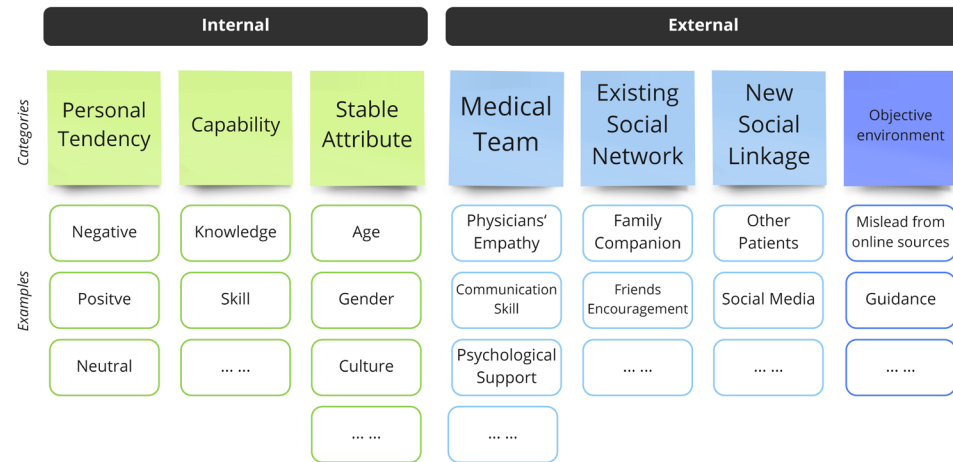

Figure 2.7 Influencing Factors of Patient Anxiety

The influencing factors could be first divided into two dimensions: the internal factors and the external factors. For the internal factors, three types of factors are defined:

- **Behavior Tendency:** it refers to which kind of strategy people adopt when facing anxiety: whether it is active coping, negative avoidance, or some kind of neutral state, which is highly dependent on personal traits.

- **Personal Capability:** it refers to the ability to cope with medical consultation-related issues, such as patient's knowledge about medical procedures and disease (in other words, health literacy), and skills required for operating the teleconsultation technologies.

- **Stable Attribute:** It refers to the background and attributes of patients that may affect the anxiety during the consultation, which are relatively more fixed and difficult to change in a short period of time, such as age, gender, cultural background, education level, etc.

For the external factors, factors are further clustered into sub-groups according to the source of anxiety.

From the objective sources (objective factors):

- **Objective environment:** influencing factors emerged during the whole consultation context, for example, in the before consultation stage, patients are easily disturbed by online information, thereby causing anxiety, and the influence of consultation guidance during the process.

From the human-related sources (human-related factors):

- **Medical Team:** refers to the Emotional influencers from the medical team, whether positive or negative, such as the empathy level of the medical team, the communication skills of professionals, the psychotherapy provision, etc.

- **Existing Social Network:** it refers to the influence of the patient's existing social network on their anxiety. For example, the company of family members and the support and encouragement of friends may alleviate the anxiety of patients, while the absence of these factors may aggravate the anxiety.

- **New Social Linkage:** it refers to the anxiety influencing factors that patients can acquire in new social relationships, such as encouragement from peers in patient groups, patient forums on social media, etc.

Medicine Transformation in the Big picture

To further understand the landscape of the medical industry, some concepts that are developing and widely disseminated in the medical field are explained here.

Human-centered Design in Healthcare

In recent years, new forms of patient care have been introduced to guarantee safe and high-quality care (Melles et al., 2021), many of which focus on organizational optimization and the needs and values of the stakeholders (Tsekleves & Cooper, 2017). Human-centered design (HCD), with its systemic humane approach and creativity toward change, can play an essential role in dealing with today's complex care challenges (Tsekleves & Cooper, 2017; Erwin & Krishnan,2016). The HCD characteristic can ensure that solutions fit the dynamics of the user's (complex) sociotechnical system (Melles et al., 2021).

Like the design industry, the healthcare field has also sharpened its focus on human needs. Recently, HCD has been gradually acknowledged as a valuable contributor when addressing today's complex healthcare challenges. Research studies are being transformed by human-centered design, which includes stakeholders throughout the process. Medical researchers are beginning to apply design principles and methods to ask better study questions, gain fresh insight, and study the effectiveness of medical interventions. The quantitative methods of medical researchers can intersect productively with the qualitative insights of designers (Ku & Lupton, 2020). In the British Medical Journal "Redesigning healthcare to fit with people", Erwin and Krishnan (2016) have described HCD's added value: "The key is to shift our focus from helping people to fit our care delivery system, to one where we design our care delivery system to fit people where they live, work, learn, play, and receive healthcare."

The key characteristics of HCD in healthcare mainly lie in the three aspects (Melles et al., 2021):

- First, the human-centered design (HCD) method emphasizes human needs, therefore, understanding people, how they think, how they behave, and how they are influenced by their environment is conditional before the actual development of intervention can start.

- Second, HCD should involve stakeholders early in the design and engage them on an ongoing basis. To fully grasp human behavior, underlying values, and motivations, the real user has to be studied in their real-life situation and actively involved in the design process.

- Last, HCD healthcare should adopt a systematic approach. A Healthcare organization can be seen as a complex socio-technical system in which people, technologies, and tasks interact with each other to perform functions (Carayon et al., 2020). Changes and optimizations at the micro-system level (e.g., humans using tools or performing single tasks) will influence the larger meso-systems and macro-systems. It is crucial to understand and address the interaction between different system levels in order to provide practical solutions.

Interpretation

HCD in healthcare is very instructive for thinking about future-oriented teleconsultation services. The key characteristics of HCD in healthcare should be taken into consideration during researching and concept building. In the future of 2030, technology might be the main force that shapes the healthcare and consultation form, human needs should still be put in the first place. At the same time, innovative solutions should be participatory and have the ability to continuously involve stakeholders, only in this way can a sustainable and dynamic medical ecosystem be built. The third characteristic of HCD in healthcare also put forward requirement on the researcher's design ability: consideration at the system level. Improving the individual patient experience will involve changes in the remote consultation service model, and this will further shape the macro-level landscape. How to come up with design propositions that are both innovative and practical will be a challenge for this project.

P4 Medicine

Another trend worthy of attention in the medical industry is P4 medicine, which describes a focus on systems that include predictive, personalized, preventive, and participative aspects (Jenkins & Maayan, 2013). It proposes the integration of numerous points of biological data, which include longitudinal molecular, cellular, and phenotypical measurements, as well as individual genome sequences, in order to better define the health or wellbeing of every person, predict transitions to illness, and orient medical interventions (Khoury et. al., 2012). Nowadays, the core elements of that vision are widely accepted and have been articulated in a series of reports by the US Institute of Medicine (Flores et, al., 2013).

P4 medicine is emerging from the convergence of three megatrends (Flores et, al., 2013):
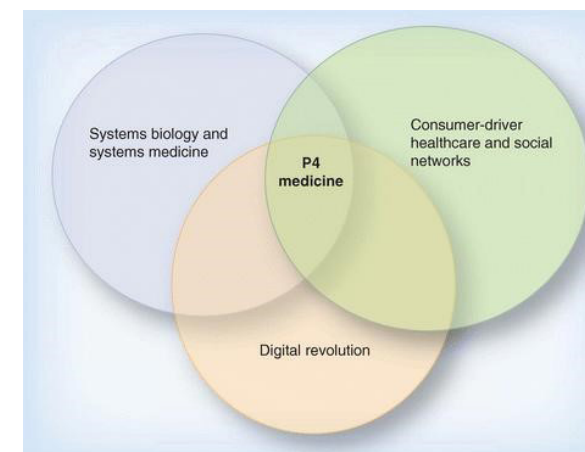
Figure 2.8 Three converging megatrends driving the transformation of healthcare (Flores et al., 2013)

- The increasing ability of systems biology and systems medicine to decipher the biological complexity of the disease.

- The digital revolution's radically enhanced capabilities for collecting, integrating, storing, analyzing, and communicating data and information, including conventional medical histories, clinical tests, and the results of the tools of systems medicine.

- Consumer access to information and consequent interest in managing their own health. Consumers are driving the transformation of healthcare by these megatrends.

The key character of P4 medicine is the wide application of computer technology in various domains in order to obtain a greater yield (Alonso et.al, 2019). For example, the application of portable devices and software for monitoring and warning could facilitate the development of preventive medicine.

The main value of P4 medicine is that it is the product of the interaction and development of the digital revolution, system biology, and systems medicine, and consumer-driven healthcare and social networks, so it can be said that the four key attributes of P4 medicine represent the future attributes that the medical industry should have.

The future of health services is centered on offering people a complete image of the many factors that affect their health (Alonso et.al, 2019). The real-time analysis enables doctors, researchers, and other interested parties to make the most informed decisions, at the same time offering patients greater control over their own medical attention (Green & Vogt, 2016). The development of cognitive computing, which is using computerized models to simulate the human thought process in complex situations where the answers may be ambiguous and uncertain (Gills, 2022), is enabling doctors, researchers, and other health professionals to personalize their service with greater diagnostic certainty (Ahmed et.al, 2017).

Future of Telehealth

Telemedicine, eHealth, and Telehealth

- *Telemedicine* – The delivery of health care and the exchange of healthcare information across distances (Wootton, 2017)
- *eHealth* – Refers to "cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, etc. (WHO, n.d.)
- *Telehealth* – Refers to "the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration" (HealthIT.gov, 2019)

The difference between the three is that telehealth is a broader term than telemedicine, it can demote both remote non-clinical services (such as administrative meetings) and remote clinical services, while telemedicine is only limited to remote clinical services (Bitar & Alismail, 2021). Telehealth is a more advanced and widely-adopted term. The Center for Connected Health Policy suggests the concept of telemedicine is slowly being replaced by the more commonly used phrase "telehealth" (Ortholive, 2018).

To limit the research scope and better frame the problem, the term "Teleconsultation" will be used in this report to refer to the design object.

Promising Future of Teleconsultation

From the advantages of teleconsultation itself, it has the characteristics of convenience and efficiency. Not only that, the popularization of teleconsultation can improve the availability of medical resources and solve the problem of uneven distribution of resources to a certain extent, which is why telemedicine is mainly used in remote areas at this stage. At the same time, the continuous advancement of technology can further empower the development of teleconsultation in the future, to optimize the existing function and experience, thus providing a more promising service.

On the other hand, from the perspective of exterior opportunities, teleconsultation is also ushering in a major development opportunity. According to Mckinsey's report on America's telehealth development (Bestsennyy et al., 2021), the willingness of using telehealth has increased a lot among both patients and healthcare providers. Telehealth utilization has stabilized at levels 38X higher than before the pandemic. Similarly, consumer and provider attitudes toward telehealth have improved since the pre-COVID-19 era, while some barriers, such as perceptions of technology security, still remain to be addressed.

Besides, Investment in virtual health continues to accelerate. Per Rock Health's H1 2021 digital health funding report (Krasniansky et al., 2021) the total venture capital investment into the digital health space in the first half of 2021 totaled $14.7 billion, which is more than all of the investment in 2020 ($14.6 billion) and nearly twice the investment in 2019 ($7.7 billion) (Figure 2.9).

Conclusion

- At this point, the development of teleconsultation is not perfect, and it primarily focuses on providing medical services to remote areas. However, all data indicate that it has a very high application prospect, and there are also many opportunities left in cities that will be developed in the near future.

Annotation

- The goal of this project is not to propose optimization suggestions on the existing teleconsultation model, but to analyze patients' emotions during the medical journey and the characteristics of teleconsultation from a macro perspective, and then to propose more **radical strategy proposals** that can be embedded in the future in **2030**.
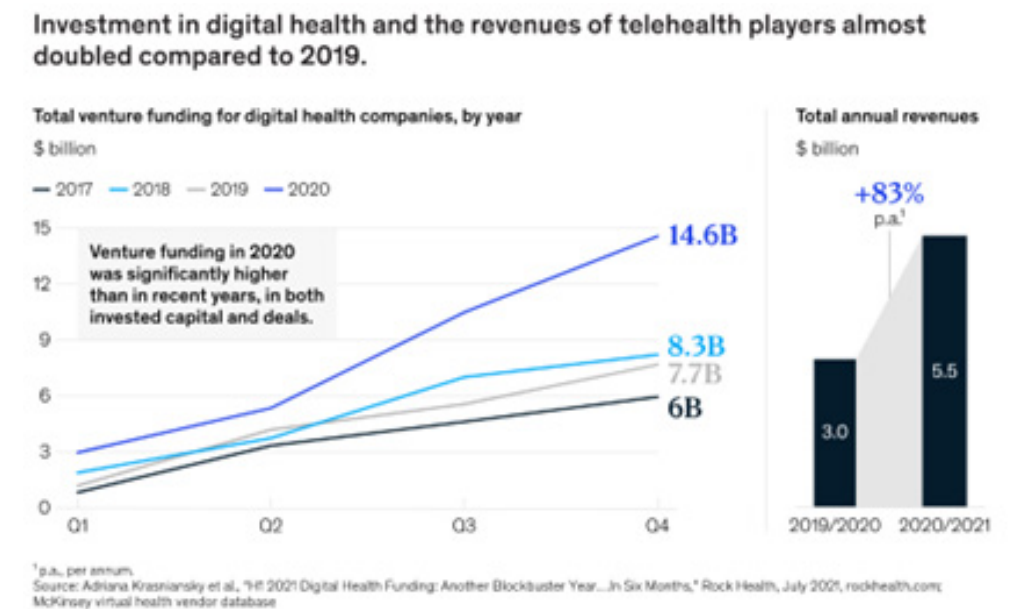

Figure 2.9 Total venture funding for digital health companies (Krasniansky et al., 2021)

Expert Interview

To better understand the existing medical context and to get in-depth insights from the professionals' perspectives, several semi-structured interviews with experts in the field of medicine and medical design are executed.

The interviews will relate to their own experiences with the patient's emotions, their perception and understanding of current telemedicine development, and their expectation and vision toward future healthcare. There is also room for the interviewee to provide feedback on recommendations and problems based on their own experiences. Among the four interviewees, two of them have a medical background and are currently working in the healthcare industry; two are academic researchers with rich experience in designing for medical-related contexts. To better understand their experience and insights, differentiated interview guides are drafted for experts from different backgrounds.

The interview is divided into two main parts. After self-introduction, the first part focuses on the personal experience of the experts. For experts from design backgrounds, the interviews are mainly to understand their past design experience in the medical context, difficulties encountered in the design process, and solutions. For experts from the medical industry, it is more about their job responsibilities, how they interact with patients, and how they understand patients' anxiety from a medical staff's perspective. The second part of the interview aims to explore the experts' visions toward the future healthcare landscape and their views on emerging technologies, such as the application of VR/AR technology in medical care, telemedicine, and teleconsultation, etc.

Experts Overview

Mengyu Xu	*Resident physician at Beijing Tongren Hospital*
Jesse He	*Arts plastic surgery (ANIOS) at Erasmus MC*
Armagan Albayrack	*Assistant Professor in Applied Ergonomics and Design TU Delft*
Meng Li	*Ph.D. in Applied Ergonomics and Design TU Delft*

Impact of anxiety

- Post-operative recovery is usually more difficult in patients with high anxiety levels
- Increase the workload of medical staff
- Not cooperating with treatment
- Anxiety disproportionate to disease severity can lead to non-compliance with treatment/check

Influencing factors

- Doctors cares much about the efficiency, usually don't spend more time communicating with patients
- The guidance in big hospitals is not clear may cause anxiety
- Although many hospitals provide guidance robots, patients still prefer to talk to medical staff
- Patients' anxiety level is related to educational level and health literacy
- People who are in between states of complete ignorance and detailed knowledge are most anxious
- Cancer in young people are more anxious than older adults

Solutions for anxiety

- Mostly rely on doctors' communication skills and patience, but not every doctor can manage it
- Physician's are working as psychologists sometimes
- Provide sleeping pills when necessary to prevent conditions such as high blood pressure
- Psychiatrists will be brought in for consultation in the cancer hospital
- Most time use questionnaires for time efficiency
- CBT treatment too time consuming, not widelt adopted yet
- Invite recovered patients as volunteers to leighten patients' anxiety

Attitude on telemedicine, etc

- The misdiagnosis rate of remote consultation is much higher than offline
- The current level of telemedicine is difficult to support physical examinations (such as patients taking pictures themselves)
- Remote consultation is more suitable for internal medicine departments
- Doctors generally have a positive view on telemedicine and emerging technologies
- Robotic surgery has attracted attention, but is expensive
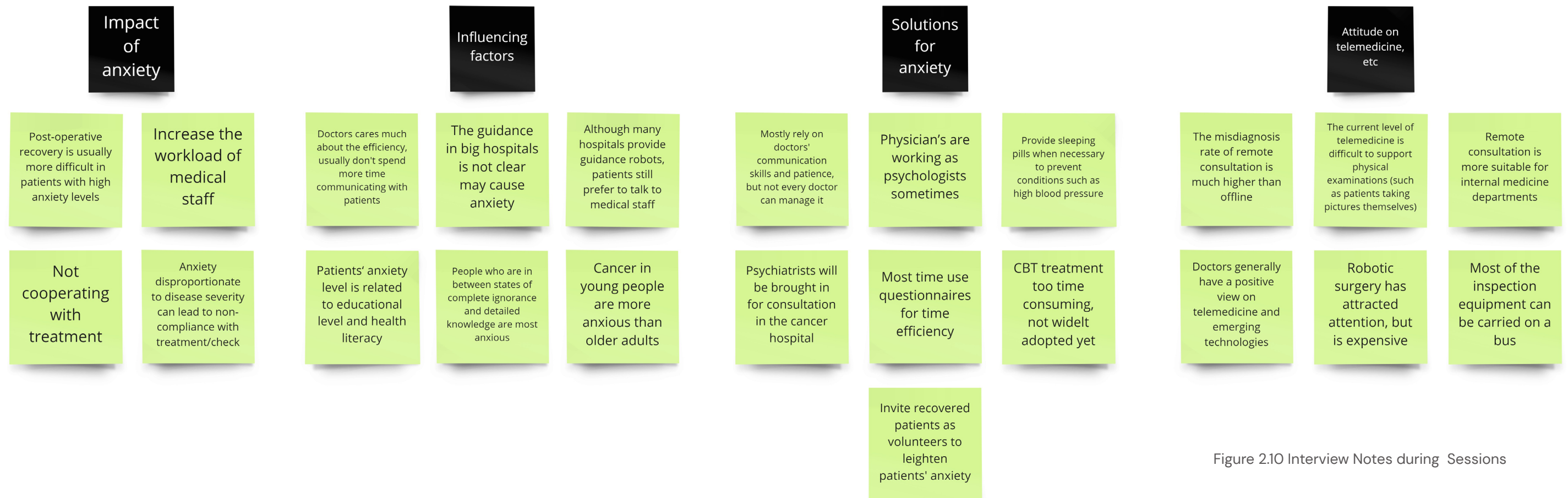- Most of the inspection equipment can be carried on a bus

Figure 2.10 Interview Notes during Sessions

Case Study
Evolving the patient journey through artificial intelligence

A case study was conducted at the beginning of this project to gain some insights on designing for teleconsultation from previous examples. The LEO Innovation Lab employs artificial intelligence to improve skin patients' consultation journeys (Bourlioux, 2018). Figures 2.11 and 2.12 showed the differences in the consultation journey before and after the evolution.

Why this Case?

- Similarities in the goal: both my personal project and this case are aiming to explore how health technology influences our lives and changes the way patients interact with the health system.
- Similarities in the focus point: both focus on the patient's consultation journey and human-centered experience.
- Involvement of artificial intelligence: which might inspire my project on the application of emerging technologies.
- Extract knowledge and experience: reference how they define the interaction touchpoint between patients, doctors, and technologies
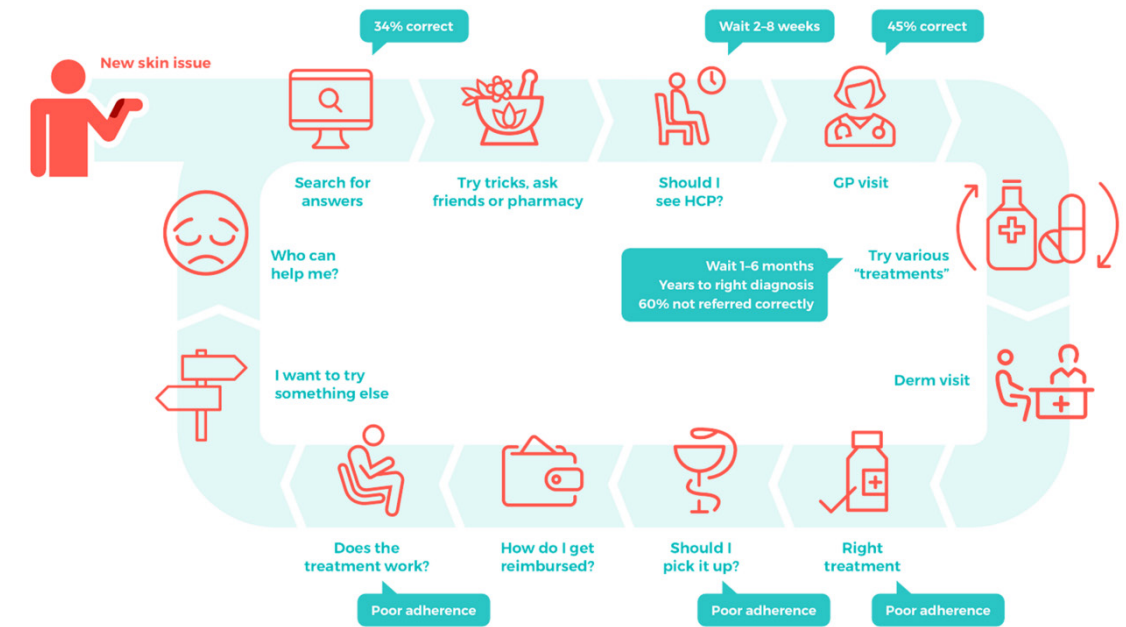
Strength	Weakness
• Provide multi-options for personalized health solutions. • More accessible for patients, don't need to wait for a GP. Instead, people can get a solution immediately. • Based on many applications in the eHealth field which demonstrated the benefit of using AI. • Have a deep insight into the current patient journey and pain points of patients. • Medical resource efficiency: freeing up time for healthcare workers to focus on patients who truly need a physical consultation. • Reduce the complexity of the system through the use of AI.	• Mainly focus on patients, missing other stakeholders in the big consultation context such as doctors, nurses, and family members. • Patient's insufficient ability to use smart devices and deal with AI. • Overlook the psychological needs of patients such as anxiety, patients can't get enough social support (especially emotional support) during the journey. • Cultural & language barriers • Revolution in the healthcare system is hard and time-consuming • Cost of software platform development and maintenance

Opportunity	Threat
• Humanizing artificial intelligence for a better patient journey getting more and more attention • Optimize the user journey experience by leveraging mobile devices and monitoring software • Patients become the co-manager of personal health, necessitating the importance to improve health awareness of patients, especially those with low health literacy. • Enable the incorporation of emerging technologies such as VR and speech-to-speech. • Expand the consultation scenarios due to the use of telemedicine.	• Too much reliance on the artificial intelligent solution. • The optimal treatment time might be missed due to misdiagnosis by AI at the first stage. • All patient-related information is shared online, data privacy issues should be considered. • Patients might lack trust in AI diagnoses. • AI needs to be very well trained to give precise diagnoses. • Doctors/ Healthcare workers' willingness to adopt the new solution.

Figure 2.11 The Traditional Patient Journey (Bourlioux, 2018)

Figure 2.12 The future of Patient Journey (Bourlioux, 2018)

Opportunity Definition

Based on the previous research, a general patient consultation journey is mapped out (Figure 2.13).

The first row split the entire journey into 3 stages: before, during, and after consultation. The second row lists some potential activities that might occur in the specific time scenario. It should be noted that the activities listed in the figure are for explanation only and do not mean that all patients must experience all events. For some patients, they may prefer to go directly to the specialist in the hospital directly, thus skipping the GP part of the journey.

The third row "Anxiety Level" demonstrated the general emotion change curve of patients, which includes 2 bifurcation points: The first bifurcation point is after the visit to the GP. If the patient's symptoms are relieved, the anxiety will decrease from then on, otherwise, the anxiety will continue; the second one occurs after the visit to the hospital, and the reason is the same. Below the curve, some pain points of patients from each stage are listed.

The lower part of the chart lists some potential social support needs. Emotional support and appraisal support are placed at the top as a goal to achieve. Information support is placed at the bottom, as a resource necessary to achieve the goals. Instrumental support is positioned in the middle, serving as a method to achieve the goal of emotional and appraisal support, which is also where the design intervention will function.

Patient Journey – Opportunity Map

	Before Consultation	During Consultation	After Consultation

Stages

Unaware of health issues | Aware of illness | Seeking for health support | Decision making | Make an appointment with GP | Visit a GP | Go to hospital | Follow the doctor's order | Recovery from illness

Patiens Activities

Person going about their lives → Experience symptoms → Decide to seek help → [Internet, Friends, Family, General Practitioner, Teacher, Community, Tricks, ...] → Consider from multiple aspects → Decide to see a GP → Wait for a few days → Confirm with the front desk → Wait in the waiting room → Join the consultation → Wait for a few days → Join the consultation → Get further checked and diagnosed → Get right treatment → Take medicine on time → Attend the follow-up consultations → Have a deeper awareness of personal health management

Not to seek help

Decide not to seek professional support
Due to emotional and contextual restrictions

symptoms getting better → Cancel appointment

Finish treatment afterwards / Terminate journey

low compliance → Terminate medication / Terminate consultation

Anxiety Level

High / Low

Take personal experience as example

- Being worried by the symptoms
- Symptoms persist anxiety deepens
- Scared by information from the Internet
- A little bit relief after making appointment
- getting nervous while waiting
- tiered and worried
- getting relief if there's no need for hospital
- nervously waiting for the diagnose results
- getting relief and assurance
- Repeated disease/ poor treatment effect

Concerns

- Patients checking their medical conditions by themselves online can lead to severe anxiety
- However, insufficient knowledge about their condition leads to worrying
- Suggestions from family, friends and some tricks might leads to misdiagnose or increase anxiety state
- Patients may give up searching for suppport due to low health literacy, considering it to be a hassle, etc, which are not good for personal well-being

- Lengthy process, symptoms and anxiety level may increase
- Multiple appointments to get an accurate diagnosis
- The patient is in a relatively tense state during the whole process
- Consultation with GP is not as "effective" as expected
- Personal psychological issues are not being cared
- Can't work / Daily routine being interrupted
- Fear of unknown & uncertainty

- The treatment is not as effective as expected
- Repeated symptoms leads to anxiety
- Patients may get burnout and terminate medication and treatment
- Limited access to talk to doctors immidiately
- Feel lack of support

Potential Social Support Needs

(Emotional)
assurance — To get a declaration about the disease intended to build confidence for next step action
emotion verify — To be aware of the excessive anxiety levels
emotion regulation — To handle dispropotionate anxiety status

(Instrumental)
platform for information sharing | patient group | accessibility of medical consultation
quick diagnosis | social linkage support | action guide
emotion self-assessment | anxiety level diagnosis
wearable equipment tracking physiological indicators
patient group | platform for information sharing | AI chatbot
social linkage support | physical companion and communication | Psychotherapy

(Informational)
reliable knowledge | peers' experience | instruction on what to do next
discover underlying emotion& feelings
peers' experience | supportive communication | positive psychological guidance

(Emotional& Appraisal)
assurance — To get a declaration about the situation intended to build confidence for next step action
emotion verify — To be aware of the excessive anxiety levels
emotion regulation — To handle dispropotionate anxiety status
effort verification — To provide constructive feedback and affirmation

clear patient journey guide | communication facilitator between experts and patients | assist with daily life arrangement
AI smart assistant | self-report facilitator | paraphrase doctors' orders | visualize symptoms and situation
AI indentify anxiety levels | wearable equipment tracking physiological indicators
medical team's communication skill | relaxing and soothing environment | extended reality through VR/AR
medical team's communication skill | social linkage support | Patient group
medical team's communication skill | AI smart assistant
Patient group | social linkage support

consultation instruction | effective and smooth communication with experts | treatment decision alignment
discover underlying emotion& feelings
supportive communication | positive psychological guidance
positive feedback on patients

(Emotional& Appraisal)
assurance — To get a declaration about the situation intended to build confidence
emotion verify — To be aware of the excessive anxiety levels
emotion regulation — To handle dispropotionate anxiety status
effort verification — To provide constructive feedback and affirmation

access to experts | patient group
AI smart assistant | platform for information sharing
emotion self-assessment | anxiety level diagnosis
wearable equipment tracking physiological indicators
patient group | platform for information sharing
AI chatbot | physical companion and communication
Patient group | social linkage support

self-care guidance | aspects suggestion
peers' experience | supportive communication | positive feedback on patients
discover underlying emotion& feelings
peers' experience | supportive communication
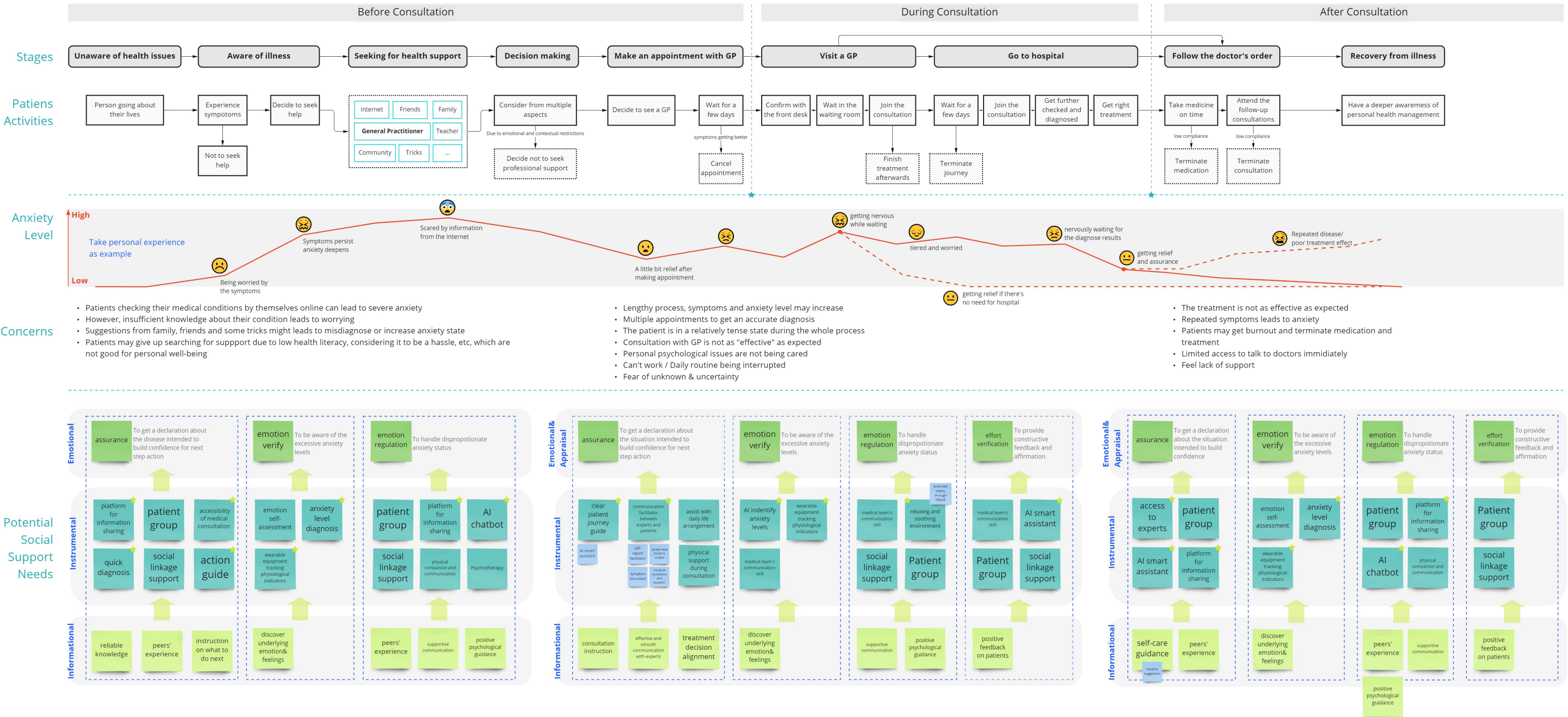positive psychological guidance

Figure 2.13 Patient Journey Opportunity Map

03 Explore the Future

This chapter aims to explore the future consultation experience and opportunity areas. The method of creative trend research is used to investigate the future context of teleconsultation, which scouts trends from four perspectives: healthcare industry, technology, demography, and society. The findings of the research are condensed into a future vision that points the way to a desirable destination. A personal interpretation of the future vision is provided, along with a narrowed-down design goal.

Method

Creative Trend Research and Future Visioning

To further explore the future of healthcare and teleconsultation, the methods of Creative Trend Research and Future Visioning from the course ID4337 Design Roadmapping are being applied since they are insightful methods to get an idea of possible future directions in line with relevant developments and trends within a specific rage of time. The creative trend research method "combines the designer's craft of intuitive observations with the strategic scanning of the environment" (Simonse, 2018). To creatively express the desired future destination, a future vision is made. The future vision statement "provides a strategic reference point– a focused direction that leads to stronger motivation. These visions imagine experiences of future innovations" (Simonse, 2018).

In order to achieve the goal mentioned above and lay a foundation for the next phase of design conceptualization, the research in this stage will be carried out according to the following process:

Figure 3.1 Method of Future Exploration

To begin, gathering trends from various aspects can provide a macro perception of future scenarios. The disparate trends in the four aspects will be clustered and summarized, yielding some key themes in each. Then, based on that, some potential opportunity areas will be mapped out based on the designer's intuition and the research findings thus far. By mapping and comparing these opportunity areas, the next step's design focus will be determined. Finally, a final future vision will be defined based on the preceding research, outlining an ideal blueprint for the future.

Trend Scouting

The trends are collected from four aspects, which are technology, healthcare, demography, and society (Figure 3.2).

First, trends emerging in the healthcare industry are being scanned and collected to take into account for researching the evolution.

Second, technology trends will be the main focus in this phase and will contribute most to the opportunity areas defining. The aim of technology scanning is to explore how these innovations could influence the healthcare sector in the future.

Third, trends from the demographic aspect are extracted to get an idea of the general human considerations.

Last but not least, trends from the social aspect are also considered. According to Simonse (2018), "studies on comparing groups of people in the social science gave rise to the term "behavior trend" that is used to refer to a pattern of collective, socially influenced behavior." Therefore, I incorporate social trends to detect more specific lifestyle and behavior patterns in the near future.
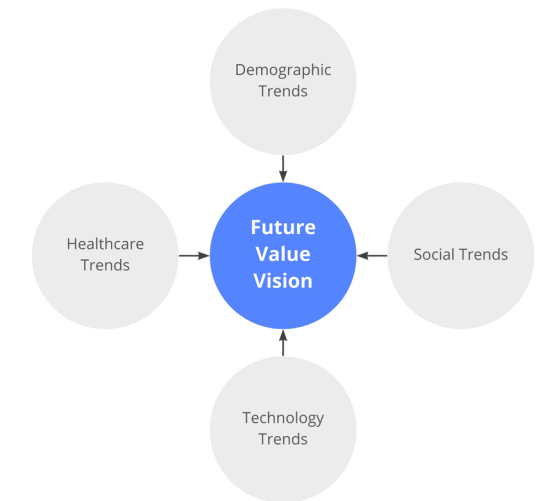
Figure 3.2 Searching Perspectives of Trend Research

Figure 3.3 Overview of Trends Scouting

Main Themes in each Aspect

Technology

- *Extended reality through VR&AR*

  VR and AR are useful in a variety of medical settings. One such example is Microsoft Hololens, a mixed reality headset designed for surgeons. It can provide head-up information to surgeons while allowing them to use their hands during surgery (Tsymbal, 2022).

  Meanwhile, VR and AR are also very promising in disrupting the future of interaction. Many predict that the line between thinking and acting will no longer be clear. The future vision of Ericsson is that advanced technology will enable a full internet of senses by 2025 and include the ability to digitally communicate thoughts by 2030 (Ericsson ConsumerLab, 2019).

- *Cloud services empower the remote care evolution*

  Telehealth, which has ushered in a huge development since the beginning of the pandemic in 2020, is expected to continue growing by 2026 (Tysmbal, 2022). Cloud services and digital storage technology have played a significant role in this development. Not only online meetings, but also location services, appointment management, secure messaging, healthcare provider reviews, and so on, have a lot of potential.

- *IOT creates a smart environment*

  The advancement of wearable technology is one of the most significant technological innovations in the recent healthcare field (Tysmbal, 2022). According to a Deloitte (Loucks et al., 2021) survey, 39 percent of users own a smartwatch. As consumer smartwatches gain popularity, their potential for use in healthcare applications merits consideration.

- *Artificial Intelligence for shared-decision making*

  During the global pandemic, A great deal of progress was made with machine learning advances in the development of vaccines ((Tsymbal, 2021). By now, AI has proved its value in the aspects of diagnosis & drug development, mental health treatment, and natural language processing (Tsymbal, 2021).

  Based on the above capabilities, AI also has broad prospects in assisting joint decision-making. According to the NEJM Group, Machine learning models can be used to support shared decision-making, help set realistic expectations among patients, and assist surgeons with patient selection (Zimlichman et al., 2021).

- *Consultation on the Go*

  The development of driverless cars makes room for mobile consultation. Considering the time efficiency brought by the driverless car trend, patients who previously found little dedicated time for therapy sessions could convert their daily commutes into time with therapists and analysts (Williams, 2020).

  There are currently numerous related application cases. During the pandemic, the German Ministry of Health used DB Medibuses (a kind of mobile clinics) to conduct large-scale vaccination campaigns (Thielmann, 2020). During the previous expert interview session, an ophthalmologist from Beijing Tongren Hospital also shared his experience of participating in mobile consultations by train aimed at providing medical services to remote areas.

Healthcare

- *Community-based Healthcare*

  Hospitals today are typically responsible for the largest portion of spending in health care, but it is expected that care will move from the hospital into the community and the home within 10 years (Catalyst, 2021). The growing hospital-at-home programs prove that the outcome could be improved with both low cost and higher patient satisfaction (Levine et al., 2020).

- *Personalization*

  On the one hand, personalized medicine will increasingly improve our ability to predict and prevent acute complications of chronic disease, thus preventing many hospitalizations(Zimlichman et al., 2021). On the other hand, since people's value propositions are becoming more and more diverse (Wellness in 2030, 2021), a more humane and personalized medical consultation experience is also required.

- *Evolution of market players*

  The recent growth in consumer-based, digital-first, retail-driven, and health/wellness-focused paradigms in healthcare has propelled nontraditional entrants into the arena Zimlichman et al., 2021). Big tech companies such as Apple, Google, and Microsoft are actively developing products and technologies to serve health systems and services. It remains to be seen how the new market players will disrupt traditional healthcare systems and create new landscapes.

- *Teamwork transformation*

  In the future, teamwork will become even more essential to ensure optimal outcomes from a plan of care. Clinicians will need to work together, rather than focusing on what has been their "traditional turf" (Zimlichman et al., 2021). Not only that, more actors may need to be involved in the process of patient consultation and care.

Demography

- *Urbanization*

  Meanwhile, according to the European Strategy and Policy Analysis System (Welcome to 2030: The Mega-Trends, n.d.), two-thirds of the world will live in cities by 2030. However, the number of megacities will not increase significantly, more people will live in mid-tier cities with populations between 100,000 and 1 million.

- *Shortage of employees in hospitals*

  The aging workforce may also lead to labor shortages. Nowadays, many hospitals are already struggling with a shortage of employees (Ligtvoet, 2019), this problem may intensify in the future and needs to be taken seriously.

Society

- *High Connection*

  By 2030, not only more people will be able to communicate over the internet, but also cars, homeware, and even our bodies will be connected. Connectivity is therefore not only virtual and digital, but also physical (Zimlichman et al., 2021).

- *Emphasize on well-being*

  According to McKinsey (2021), consumers are spending more on wellness than they ever have before. Wellness is now a $1.5 trillion market globally—and it's growing at a clip of 5 to 10 percent each year.

- *Diversive value proposition*

  People's value proposition will become more diverse in the future, which will be reflected in the pursuit of well-being. People will be focusing more on "wellness", not only "health" anymore, which could be deconstructed into six aspects: health, fitness, nutrition, appearance, sleep, and mindfulness (Mckinsey, 2021). Which calls for an innovative health solution.

- *Prefer self-management*

  More demanding and discerning consumers are opening doors for new entrants in healthcare provision. Consumers are taking advantage of unprecedented access to information to become more diligent and informed about their health. According to a consumer survey from PwC (n.d.), patients are accepting greater accountability for their health.
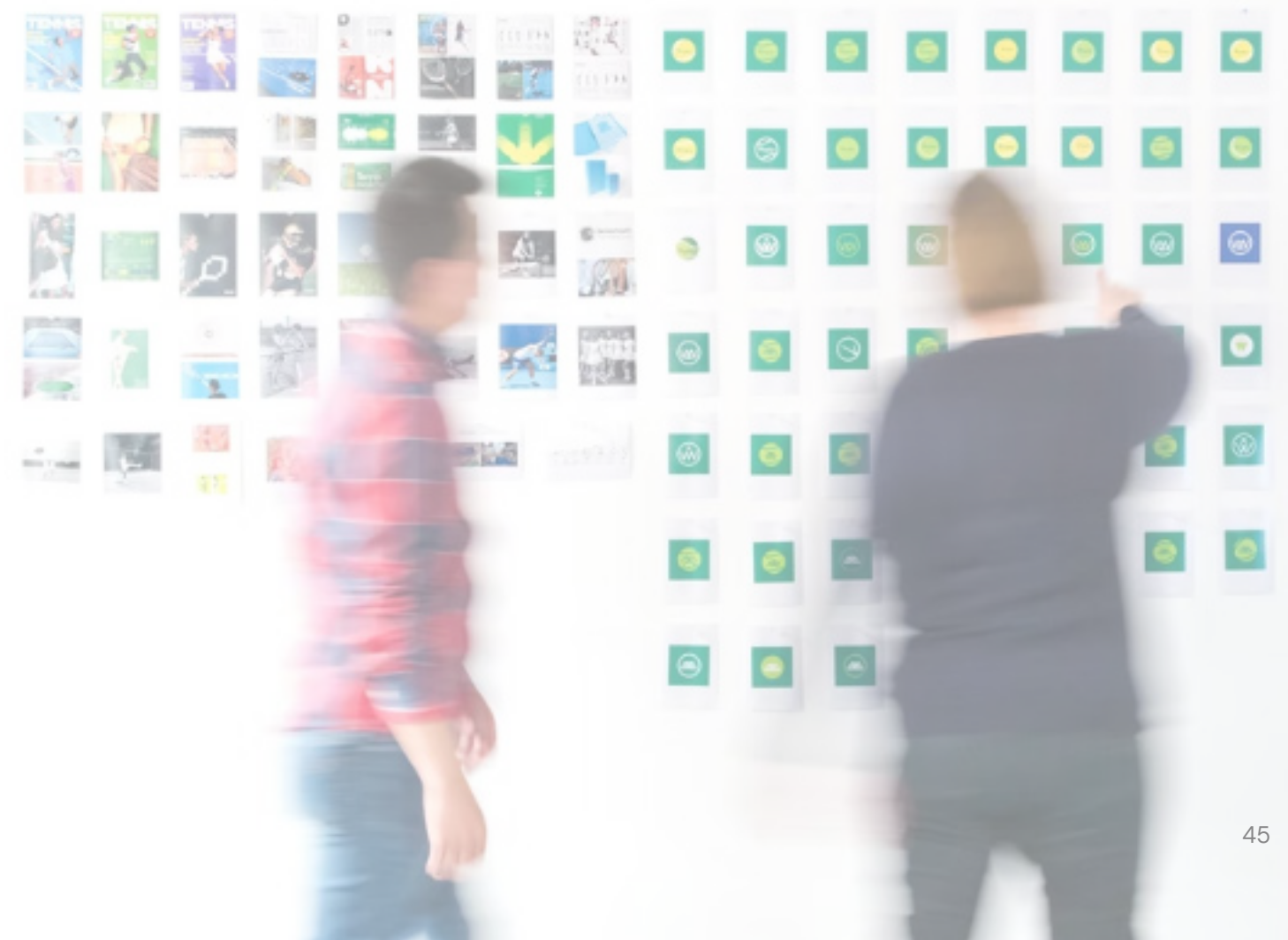
Opportunity Area

Following trend scouting, the information gathered is further clustered. Based on that, the following eight design opportunity areas are summarized (Figure 3.4). The yellow bubble represents technology/service, and the blue bubble stands for a model.

AI facilitate shared–decision making	Cloud service empower remote care evolution	AI eases staff shortage in healthcare system	Extended reality to relief mental stress
Consultation Room on the Go	Healthcare solution for urban aging population	IOT support health status track	Community–based healthcare solution

Figure 3.4 Eight Opportunity Areas

These eight opportunity spaces are promising design directions based on trend analysis, but not all of them will be covered by this project. Two evaluation indicators are set to assess the eight opportunity areas and filter out suitable ones, which are Value for alleviating anxiety status and Fit in the teleconsultation context. Opportunities with high value in both 2 indicators will be considered for inclusion in the following design.

From Figure 3.5, it's not hard to see that the most potential opportunity areas lie in the Community-based healthcare solution. Extended reality to relieve mental stress and AI facilitates shared-decision making are also highly relevant, therefore can be applied together with the target one. Consultation Room on the Go and IOT support health track are promising in the field of remote care, which can be used as a supplement to optimize the experience.

At the same time, an interesting point is that there is a gradual transition from atomic mode to distributed mode from left to right. Healthcare solution for the urban aging population undoubtedly requires a highly atomized service model, and AI eases staff shortage in healthcare systems is also a very critical issue. But in this project, these two opportunity areas will not be considered key points.
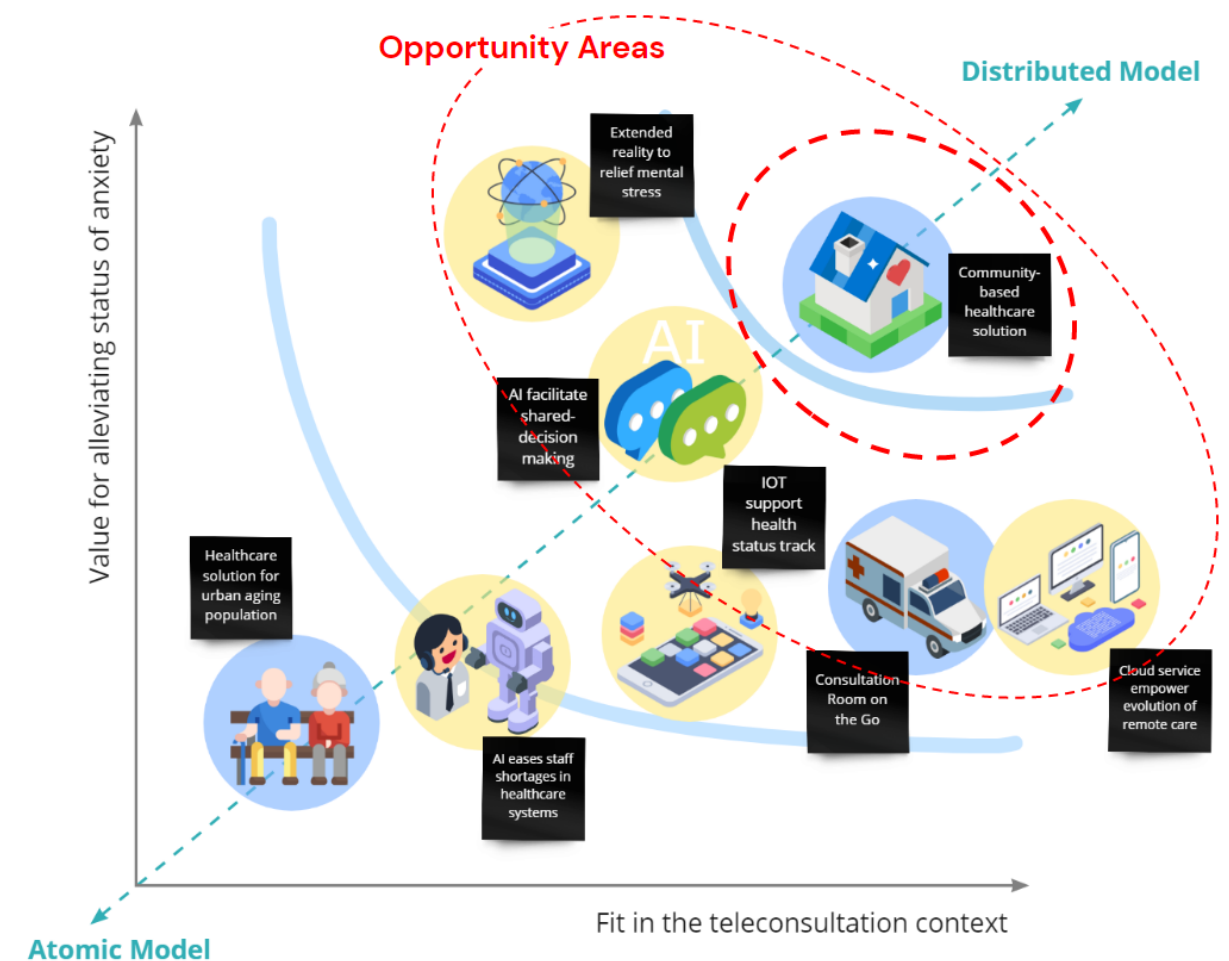
Figure 3.5 Comparison of Opportunity Areas

Future Visioning

"A future vision is an expression of a desired future where it provides a strategic reference point for actionable innovations."
Simonse, 2018

A future vision statement describes the end goal as an expression of the desired future on a roadmap. It should posess four distinguished properties.

Clarity:
The vision expression enables immediate understanding of what it would be like to experience the future innovation in the explicitly expressed desired end state.

Value:
Drivers capture the compelling benefits of value wishes: wherein the specific values fulfill an unmet need or solve a dilemma of a user target group in the future.

Artifact:
Materialize the imagined value wishes with images in 2D or 3D dimensions.

Magnetism:
Involves the desirability and attractiveness of the vision – 'the thing' the vision creators are truly passionate about in such a way that it potentially energizes others to direct their actions towards it.

Personal Interpretation of the Future

The future vision describes my personal view of the analyzed context in 2030 based on the previous trend research and literature analysis. According to the trend scouting and clustering, the properties of the future vision can be speculated, which refers to *personalization* and *high connection*.

Personalization – This term encompasses not only personalized treatment options but also the personalized consultation journey, which may include a number of value propositions. For example, we should maintain patients' autonomy in their treatment process and encourage them to actively participate in the process of shared decision-making.

Simultaneously, because patients' levels of health literacy differ, so does their ability to self-report symptoms and set reasonable health goals. As a result, I believe that an advanced healthcare system should take these factors into account and offer each individual a personalized healthcare solution that is tailored to his or her specific situation.

High Connection – On the one hand, with the rapid development of communication technologies and networks, enhanced connectivity will become a core trend in the following decade. On the other hand, high connectivity is of great significance for the evolution and optimization of the remote care system. I believe that in the future patients will not only be able to get in touch with their medical team more rapidly and efficiently (whether it's synchronized or unsynchronized), but also in seamlessly and easy way to connect with multiple other care providers such as family members, friends, and patient groups, thereby improving the overall operational efficiency of the system and providing patients adequate emotional support.

The main goal of the Consultation Room 2030 project is to explore what innovative opportunities the development of technology will bring to future consultations. Therefore, eight potential opportunity areas are summarized mainly from a technical perspective in the trend research. Based on the research from the Healthcare perspective, we can see that the medical team in the future will be more familiar with new technologies and digital operations than today. With proper training, we have reason to believe that the medical team in the future will be equipped with more advanced technologies.

Last but not least, based on the findings of the second chapter, social support can be used as an important means to achieve the goal of relieving patients' anxiety. This notion has also been confirmed in this chapter. According to the trend analysis, the community-based healthcare solution has a promising future, which is consistent with the previous conclusion: "to improve the patient's consultation experience through social support."

Future Vision of Teleconsultation

In the future, people will obtain a **highly connected**, yet **personalized** consultation experience through **community-based** remote care solutions that incorporate **social support** as an important tool, thereby **alleviating patients' anxiety** emotion during the consultation journey.

Design Goal

The design vision is to come up with design strategies **fitting in the community-based healthcare context**, which could **organically combine technology and collaboration** and provide patients with a more **humane consultation journey**, thereby alleviating anxiety.

04   Empathy with Patients

This chapter is about building empathy with end-users (in this context, patients), thus laying a solid foundation for the design process. The user research procedure is divided into two parts, and the reasons behind will be detailed at the beginning. Thematic analysis and generative design research are apartly used in the two parts research. At the end of the first part, an integrated framework is summarized as the conclusion og current user experience. In the second part, four patient traits are defined and a patient expectation map is presented.

User Research Plan

The user research stage is divided into two parts. The first part of the investigation is to look into the current experience of teleconsultation service users, identify some experience pain points, and look into which experiences can be changed or optimized. The second step is to gain a thorough understanding of the target audience and identify different patient characteristics in order to provide personalized strategies. Simultaneously, through generative design research, the future medical experience could be imagined and explored, allowing for a better understanding of what experiences can be created.

Part 1: Thematic Analysis on user feedback	Part 2: Generative Design Research
search teleconsultation APP from America/ UK/ Singapore & China	Hand out sensitizing booklet
extract 50-80 comments & experience from each (200-240 in total)	6-8 participants and generative interviews
cluster and generalization: summarize the existant experience & painpoint	provoke imagination and expectation towards future
What experiences need to be changed	*What experiences can to be created*

FigureFigure 4.1 Overview of User research Plan

Method

Thematic Analysis Approach

In this research context, it is used to identify and interpret patterns and themes derived from the user comments on teleconsultation APPs. Therefore further translate existing user experiences into valuable insights for strategy development.

This Part includes several steps: Data Collection, Coding, Clustering, and Integrating, a final integrated framework serves as the main outcome of this section.

Step 1: Data Collection	Step 2: Coding	Step 3: Clustering	Step 4: Integrating
Extract related user insights of existing teleconsultation Apps from Google Play and App Store, and import in the qualitative research software: Atlas. ti.	Assign "tags" to the collected data sentence- by-sentence. After going through the whole content, numerous "initial codes" emerged.	Cluster the "initial codes" in to "focused codes" according to their meaning and type. (subjective process)	Define and depict the interrelationships between all focused codes. Summarize into an Integrated Framework.
valuable current user insights	initial codes	focused codes	integrated framework & insights

Figure 4.2 Research Process of Part 1

Data Collection

Because the goal of this project is to propose some broadly applicable healthcare solutions on a global scale, rather than being limited to a specific region or country, data collection begins with a global overview of teleconsultation development levels.

Frontiers in Public Health(Bhaskar et al., 2020) has analyzed the existing telemedicine frameworks and policies of various countries/ regions and their implementation stage using Gladhart(Toledo, 2005) and Pan American Health Organization (PAHO/WHO) hat models. The existing telemedicine framework/s across various countries/ regions, the status or maturity of telemedicine implementation, and various developments or changes that have been adopted during COVID-19 have been summarized as a result. According to them, coronavirus disease 2019 (COVID-19) has accelerated the adoption of telemedicine globally, but there are still large gaps in the level of development between different countries and regions. Among all the countries, I finally determined four countries/ districts that deserve attention, which are Singapore, the United States, China, and Europe.

- **Singapore**

  Singapore takes a leading role in Asia in the aspect of telemedicine adoption and healthcare system efficiency. There are now about 11 outstanding start-ups, with platforms such as MyDoc and DoctorAnywhere experiencing significant improvement in use during COVID-19 (Yap, 2020). In April 2020, the Ministry of Health also announced that patients who qualify for Community Health Assist Scheme and MediSave, with a listed chronic disease, can now be covered to see their regular physicians through teleconference (Bhaskar et al., 2020).

- **United State**

  In the COVID-19 era, Medicare in the United States will now cover eligible telehealth consultations, and individual states are being encouraged to roll out Medicaid coverage for such services (Telehealth Insurance Coverage, n.d.). The relaxation of prior regulations also includes an expansion of covered telehealth services and allowing new patients to be treated through telemedicine rather than only those with a prior relationship (Dave, Seoudi, & Coulthard, 2020). to facilitate telemedicine, practitioners licensed out of state and in good standing are allowed to practice across state lines. Furthermore, the Federal Communications Commission recently launched a $200 million Coronavirus Telehealth program (Mazur et al., 2020). One of the challenges in the adoption of telemedicine has been the variations in uptake and differential policy frameworks across the different states.

- **China**

  Online healthcare platforms are projected to see drastic increases in market share in the coming years, particularly following COVID-19, with companies supplying direct-to-patient telehealth subscriptions such as Good Doctor, Alibaba, and Tencent experiencing growth (Wang, 2018). China is also breaking new ground in terms of contactless innovations, such as a Smart Field Hospital trial in Wuhan during COVID-19, in which patient care is delivered through robots and digital devices (Hornyak, 2020). One of the blocking factors may be the large disparity between urban and rural health care levels(Ali, Faisal, & Sorwar).

  At the same time, due to the huge population base, the currently applied remote consultation software has a very large user group, and a considerable amount of user feedback can be obtained, which is also one of the reasons for consideration.

- **Europe**

  The threat of COVID-19 in Europe has necessitated the need for telehealth platforms readily available to patients. Telehealth startups such as French Doctolib and Qare, Swedish LIVI, UK's Push Doctor, and Germany's Compugroup Medical SE have all seen considerable increases

in European download numbers. In Europe, telemedicine is considered both a health service and an information service. It is worth noting that the overall development level of remote consultation in Europe is not very high. Due to the lack of pan-European uniform medical liability and medical legislative regulations, a Europe-wide framework is far from being realized (Raposo, 2016).

Based on the findings, four remote consultation APPs from the above countries or regions were selected as the research target of Part 1.

The selection principle of APP is that they all have a large user volume, enough user feedback, and relatively high ratings. It is worth mentioning that the reason for choosing apps with higher scores is that these products generally provide a sound infrastructure, which avoids many common problems of low-scoring software: inability to connect to the Internet, unfriendly interaction, and low usability. At the same time, it can also help researchers discover some experience highlights, so as to gain inspiration for the project.

Figure 4.3 demonstrates the names of the APPs, the consultation format, score, and ratings on APP STORE (ios system) and GOOGLE PLAY (Android system), and other functions, etc.

WHITE COAT – Singapore & Indonesia
Consultation Form: Video Call
Rating & Score: 4.4/324 [APP Store]
4.0/741 [Google Play]

DOCTOLIB – France
Consultation Form: Video Call
Rating & Score: 4.9/104k [APP Store]
4.5/314k [Google Play]

MEDLINE – America
Consultation Form: Video Call
Rating & Score: 4.7/61.6k [APP Store]
4.5/8.0k [Google Play]

DR.CLOVE – China
Consultation Form: Video Call & Text
Rating & Score: 4.9/108 [APP Store]
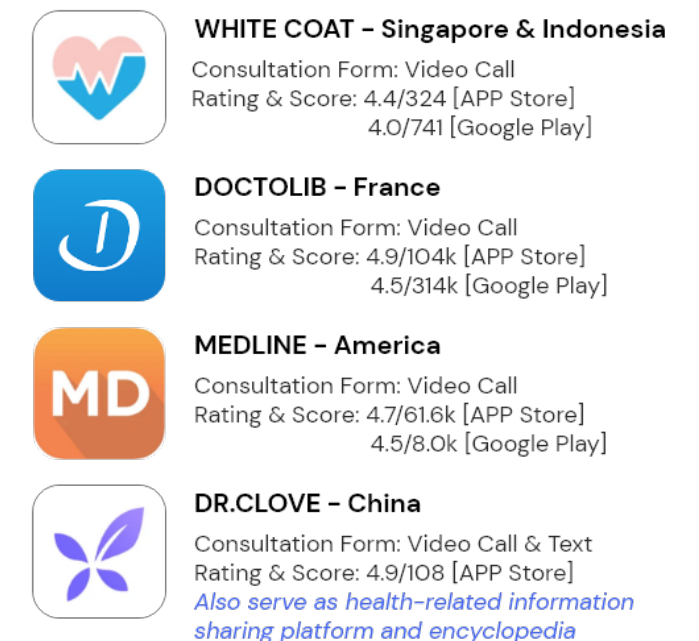*Also serve as health-related information sharing platform and encyclopedia*

Figure 4.3 Selected APPs of Part 1

To dive deep into users' experience of existing teleconsultation services, 200 user feedbacks in total (50 of each APP) on Google Play and App Store were collected and imported in Atlas.ti, dedicated software for conducting the grounded theory method. Comments that are not relevant to the topic have been excluded.
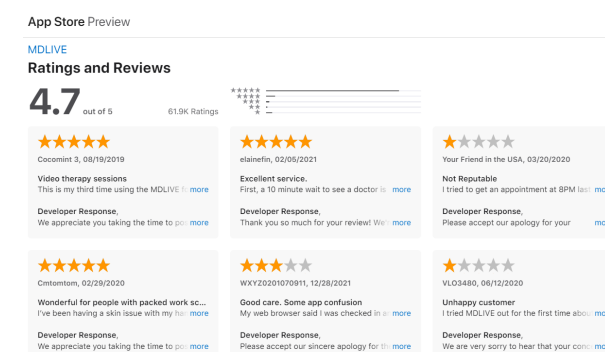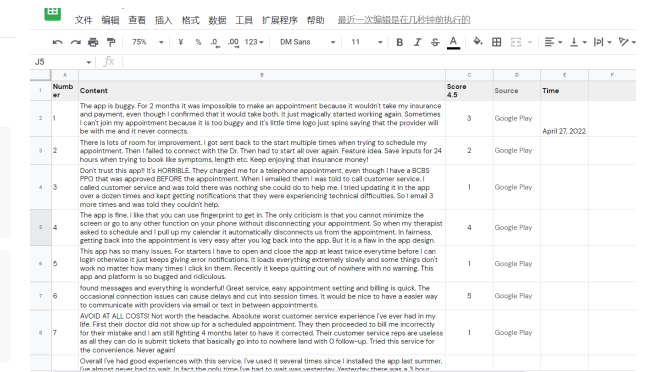

Figure 4.4 User Feedback on App Store

Figure 4.5 Summarized User Feedback

Coding

Coding is an analytic process in which researchers tag collected data on a sentence–by–sentence or paragraph–by–paragraph basis. The process is heavily reliant on the subjectiveness and understanding of the data of the researchers. These codes are useful for clarifying concepts and comparing similarities.

The coding process of this project was conducted in *Atlas. ti*. The collected user feedback is first organized into a document and imported into the Atlas software. Then, through a sentence–by–sentence summary of the paragraph, initial codes were generated.

For example, a user wrote in his/her feedback: *"In the new normal, I'm glad that there's an alternative to leaving my house for a doctor's appointment. Very satisfied with the level of professionalism of the team!"* This sentence was epitomized as *"prefer teleconsultation more than physical"*. Other initial codes include *"easy to use"*, *"high praise on doctor"*, *"long waiting time"* and so on.
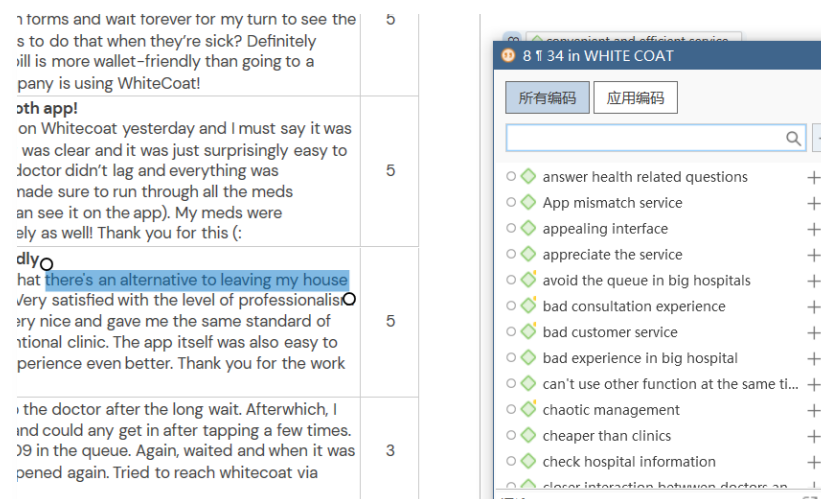
Figure 4.6 Coding Process in Atlas.ti
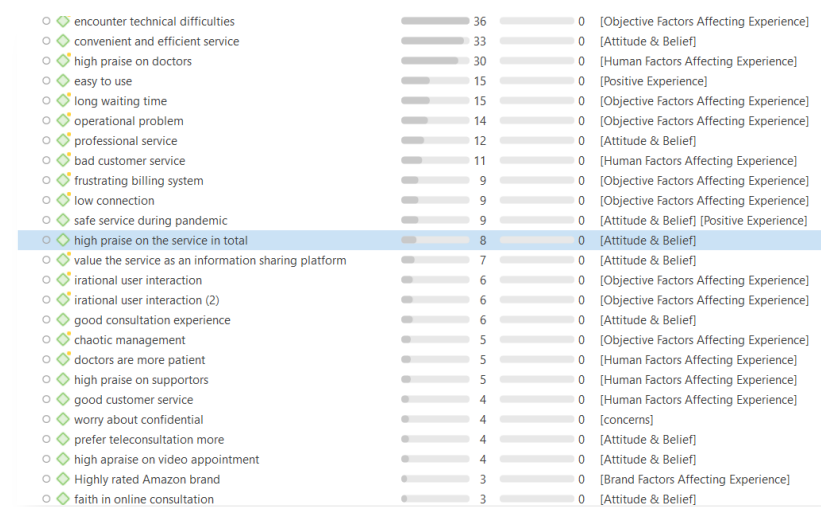
Figure 4.7 Initial Codes Overview

Clustering

After all user feedback has been walked through and coded, the initial codes were reviewed and clustered into focused codes. By browsing the initial code, some commonalities can be deduced. For instance, "long waiting time" and "low connection" all refer to negative experiences during the use of the application, and these experiences are all related to encountering technical problems. "Effortless" and "speedy medicine delivery" both point to positive experiences. Meanwhile, the "attitude and beliefs" of many users can be reflected in the feedback, such as "prefer teleconsultation more than physical clinics" and "willing to use again".

As a result, 10 focused codes were generated, which are:

- *Attitude and belief*
- *Positive experiences*
- *Negative experiences*
- *Objective factors affecting experiences*
- *Human factors affecting experiences*
- *Multipurpose platform for users*
- *Concerns of teleconsultation*
- *Limitations of teleconsultation*
- *Future expectation*
- *Brand factors affecting experiences*

Integrating (define the relationship)

Following the code clustering, the relationships between focused groups were further defined. Through analysis, it is not difficult to find that there is a causal relationship between users' past experiences("Positive experiences" and "Negative experiences") and their "Attitude and belief", and past experiences will greatly shape their attitudes and opinions. The limitations of existing teleconsultation can also lead to some negative experiences that affect user attitudes. On the other hand, positive/negative experiences can also be further divided into different types of influencing factors, "human-related factors", "objective factors" and "brand-related factors" constitute positive/negative experiences.

Results

Integrated Framework

After analysis and induction, the integrated framework was mapped out with four main parts: Past Experience, cognition & Attitude, Limitation & Concerns, and Future Expectation (Figure 4.8). These four parts are interconnected and causally related to each other. Patients' past experience will decide their cognition and attitude towards teleconsultation, this will thus influence their future expectation, and also leads to some specific limitation and concerns.
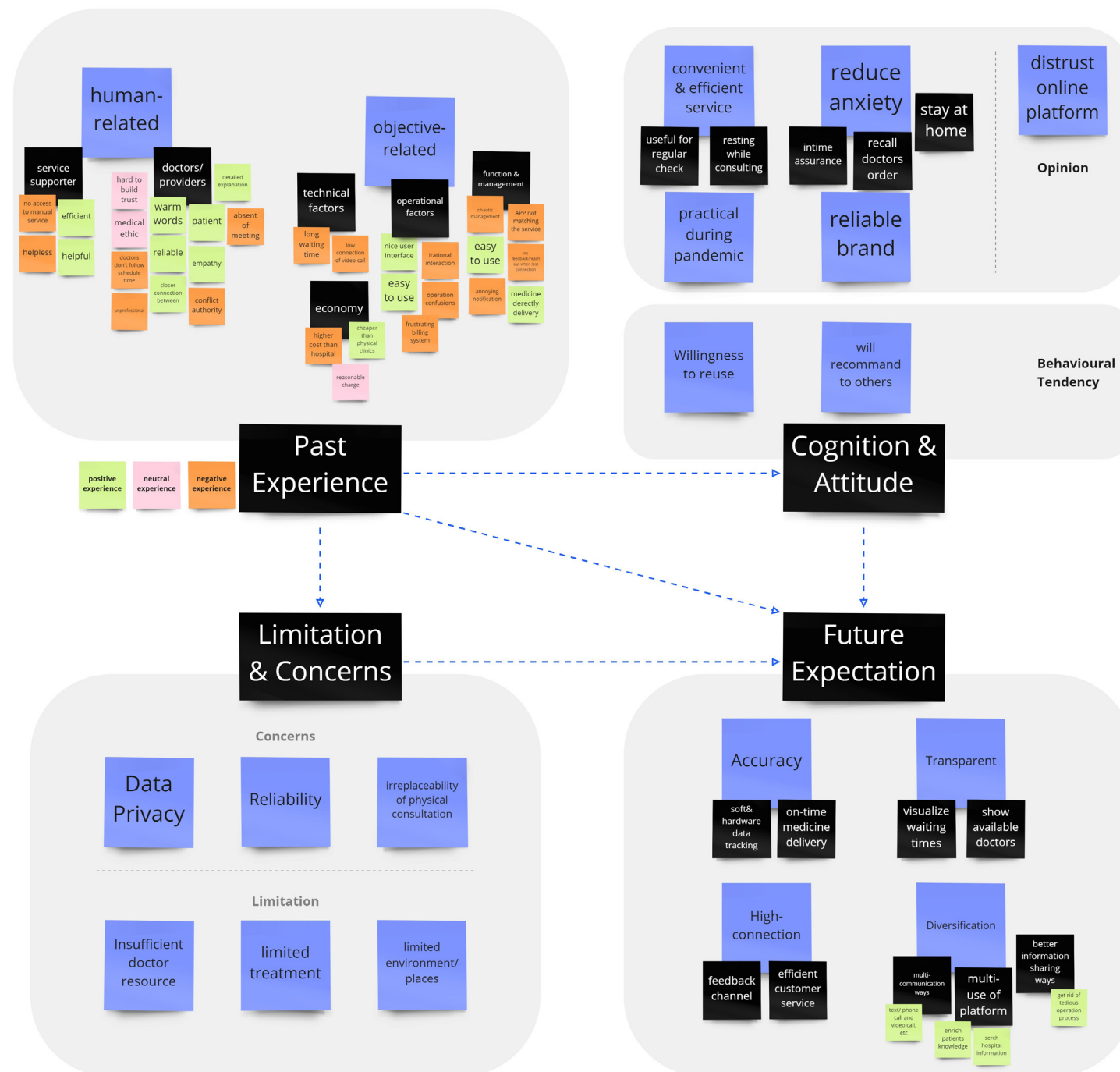
Figure 4.8 Integrated Framework of APP Feedback Analysis

Insights

- According to the findings from the user feedback, most users are satisfied with the teleconsultation service itself, the main obstacle to user experience lies in the **insufficient technical infrastructure**, for instance, low internet connection, unsmooth interaction, etc.

- Compared to other age groups, **young people (18–35 years old)** benefit most from teleconsultation services. On the one hand, they have sufficient knowledge of technologies and usually hold an open mindset towards new things. On the other hand, They have enough autonomy to choose the way of medical treatment independently and care more about patient authority and personal privacy than other groups.

- As the figure has shown, Past Experience can be influenced by 2 kinds of factors: **human-related factors** (such as medical team, software supporters, etc.) and **object-related factors** (such as technical issues, function, economic issues, etc.). Among the experiences reported by users, they mentioned more **negative experiences** (orange post-it notes) in **object-related experiences**, and relatively fewer **positive experiences** (green post-it notes) and **neutral experiences** (pink post-it notes). In **human-related experiences**, users mentioned significantly more **positive experiences**, such as reliable medical teams, warm doctors, etc. **Negative experiences** still exist but to a smaller percentage. This may suggest that **positive experiences derive from people** (whether from medical teams or customer service agents) **make users feel more impressed and are more willing to share.**

- However, this does not mean that as long as good human-related support is provided, users will have a good experience. At this stage, due to the imperfect development of remote consultation, user experience can be inhibited by **object-related factors** such as technical barriers, low internet connections, insufficient experts, etc.

- Since this project aims to provide an innovative experience for patients within the time horizon of 2030, I assume that technical issues related to infrastructure building will be resolved by 2030, which means that most of the object-related issues that plague users at this stage will be eliminated. Therefore, for this project, the greatest value of this part of the research is to clarify the importance of human-related influencing factors.

Method

Generative Design Research

Generative research is defined as a method of research that helps researchers develop a deeper understanding of users in order to find opportunities for solutions and innovation (Estes, 2020).

Generative design research is design–led and fueled by a participatory mindset. Generative design empowers everyday people to generate and promote alternatives to the current situation (Sanders & Stappers, 2012).

The significant value of generative research is that it's helpful for participants to be aware of and explain their anxiety emotion, and further envision a desirable experience. This part consists of 3 main activities:

- Participants Recruiting
- Sensitizing
- Interviewing
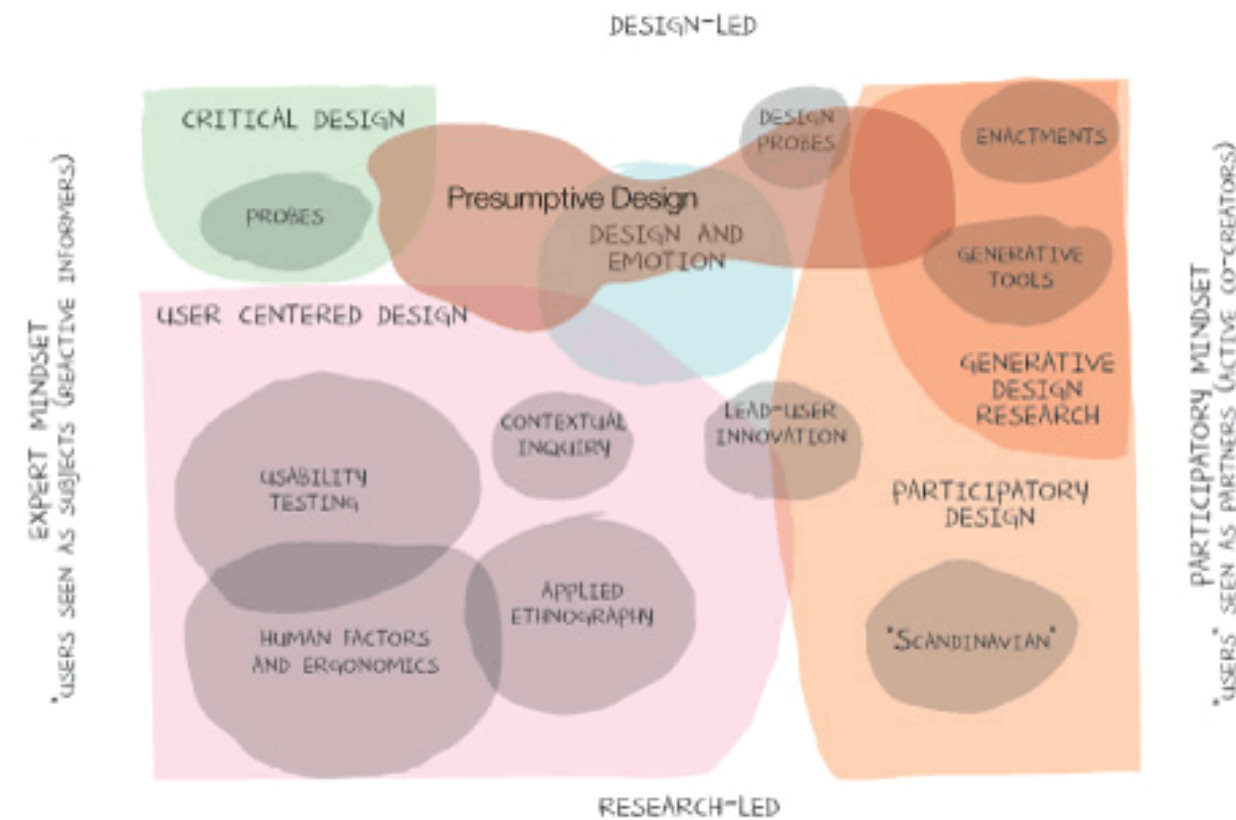
Figure 4.9 The emerging landscape of design research approaches and methods (Sanders & Stappers, 2012)

Recruiting

- Research in Step 1 shows that young people benefit the most from remote counseling services, give relatively high evaluations, and are more capable of accepting new technologies, so the young group (18 to 35 years old) was identified as target participants in the user generative design research.
- Also, it's vital that participants have basic knowledge about medical consultation, therefore, they must have participated in or accompanied others in the consultation.
- Finally, 8 participants aged from 18 to 35 years old with a recent or frequent medical visit were recruited.

Parcitipants Overview

Number	Age	Occupation	Location	Gender
1	24	Design Graduate	Netherland	Female
2	24	Design Graduate	Netherland	Female
3	25	Design Graduate	Netherland	Male
4	27	Design Graduate	Netherland	Male
5	27	Design Graduate	Germany	Female
6	26	Junior Designer	China	Male
7	24	Design Graduate	Netherland	Female
8	25	Product Manager	China	Female

Sensitizing

- About 3–4 days before the formal interview session, sensitizing booklets were sent to participants with a short introduction and guidance.
- All the participants answered the questions about their personal traits and shared their experiences with anxiety.
- Through this booklet, participants were triggered and motivated to think and reflect on themselves and their experience with anxiety in a medical context.
- The sensitizing tool is essential for preparing participants to share personal experiences before sessions, it has both leveraged the interview quality and improved the efficiency.

The Booklet Design

The booklet is designed to be streamlined and consists of 5 pages:

- Page 1 explains the purpose and main content of the booklet to the participants

- Page 2 mainly asks questions about the participants' personal traits, in which they are guided to complete an online anxiety personality test and share the results through screenshots.

- On Page 3, participants are encouraged to recall a previous experience with anxiety and reflect on what triggered the anxiety and how did the anxiety fluctuate and change in an open-ended question.

- Page 4 is about recalling a recent medical consultation experience. Participants are not required to fill in any questions on this page, but some open-ended questions were set to prepare participants to share their experiences and insights for the following interview

- Page 5 is the end page, reminding participants to contact the researcher after finishing the booklet
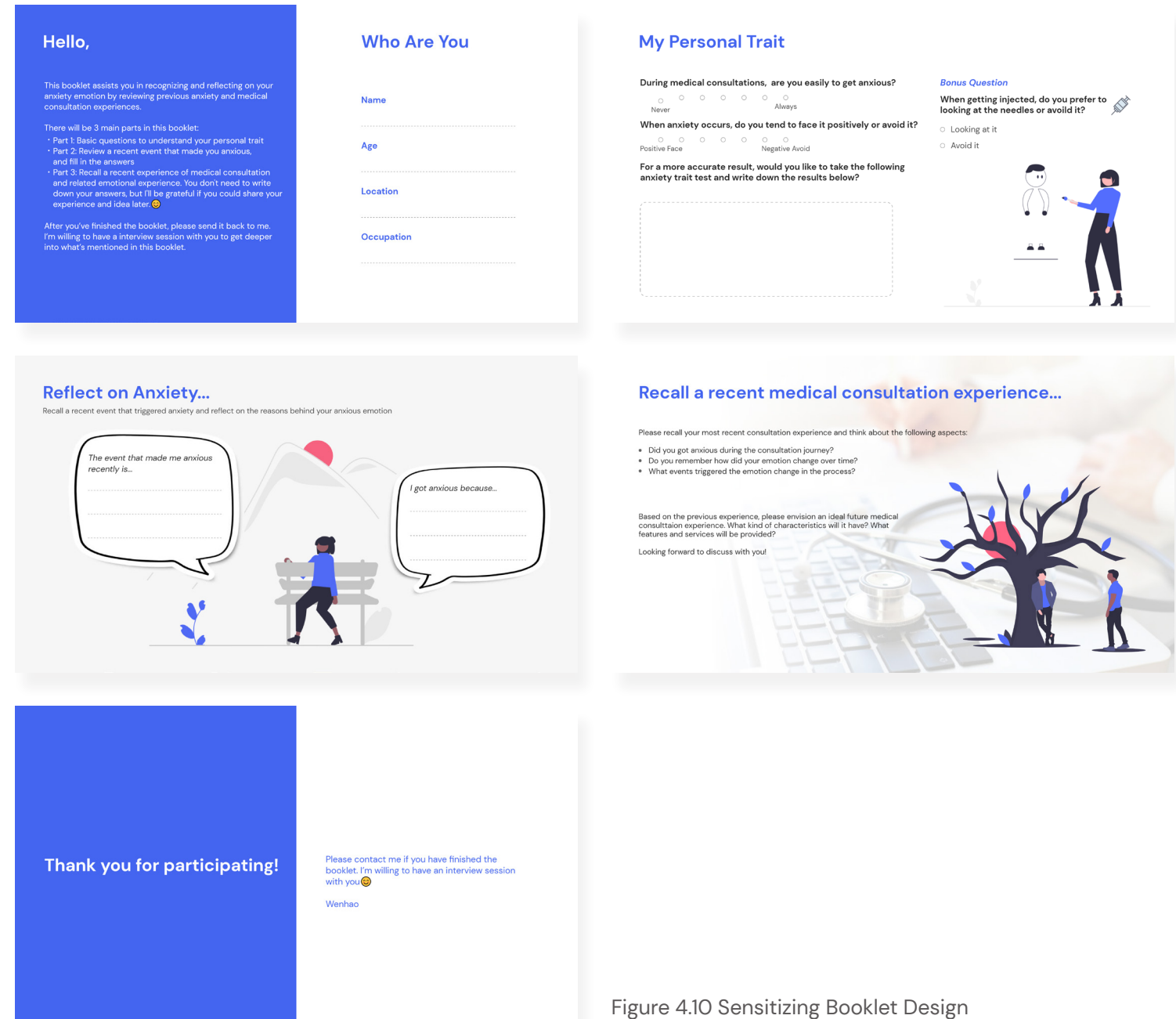
Figure 4.10 Sensitizing Booklet Design

Generative Interviews with Participants

Settings

•   A total of four sessions were held, each including 2 participants and 1 researcher. This setting is aimed at facilitating communication between participants, therefore sharing insights. Participants were arranged according to their health anxiety levels reflected in the booklet. Two participants with similar anxiety levels were placed in one group to participate in the activities based on the results of the Anxiety Personality Test (2021) responses.

Execution

•   2 of the sessions were conducted physically in the IDE faculty of TU Delft, and 2 sessions was conducted online through Miro and Zoom. Each session lasted about 90 mins. The sessions were recorded in audio format.

•   After participants have signed the consent form, I briefly introduced the goal of this session and my personal project and described the activities we are going to do.

Activity 1 | Discussing Personal Trait

The answers from the first 2 pages of the sensitizing booklet were discussed. Participants were asked to explain their answers. Based on this, the researcher will ask follow-up questions to learn more about the characteristics and traits of the participants.

Activity 2 | Reflecting on an Anxiety Event

In the booklet, participants were asked to reflect on an event that has caused anxiety and briefly describe the cause and process. In the second step of the interview, participants were asked to further reflect on that event: mapping out the anxiety-changing curve of that event and marking the key points of emotional change. 10-15 minutes were scheduled for participants to finish this assignment. Afterward, participants would take turns explaining their work.

Activity 3 | Reviewing Medical Consultation Experience

The third activity is to recall a recent medical consultation experience. Participants were asked to map out anxious events in each stage of the consultation journey (which are before consultation, during the consultation, and after consultation), and rate the anxiety level from 1 to 7. Another 15 minutes were scheduled to finish this assignment. After everyone had finished, the discussion would start.

Activity 4 | Envision the Future Consultation Experience

The last activity of the session is to envision an ideal and desirable consultation experience in the future. To make this part more relaxing as well as to stimulate the imagination of participants, not many restrictions and boundaries were set. Most of the participants put forward their own propositions based on the above-mentioned experiences, and a few put forward their wild imaginations. All the insights were recorded on the miro board designed for User Interview Sessions.
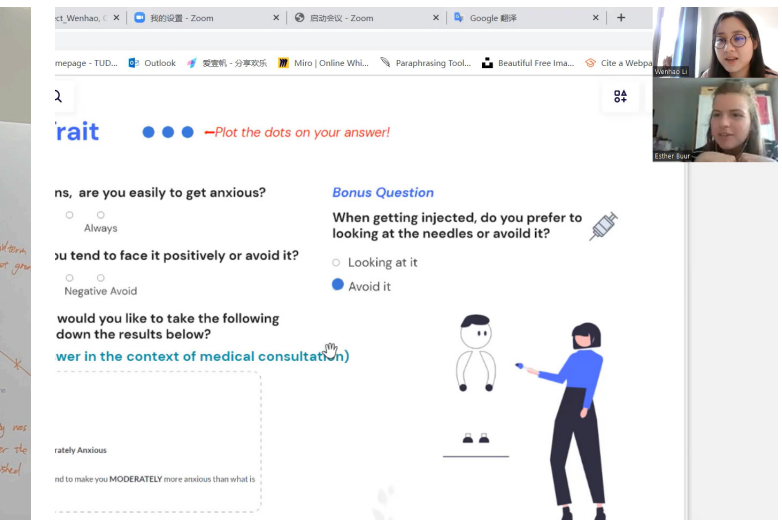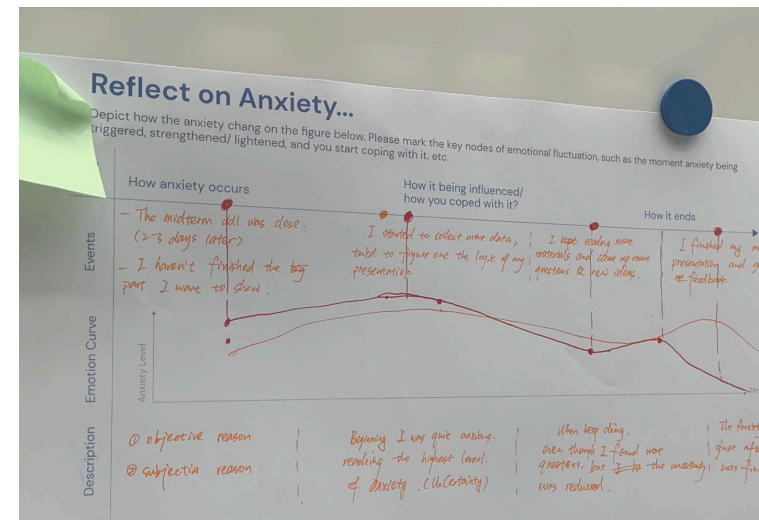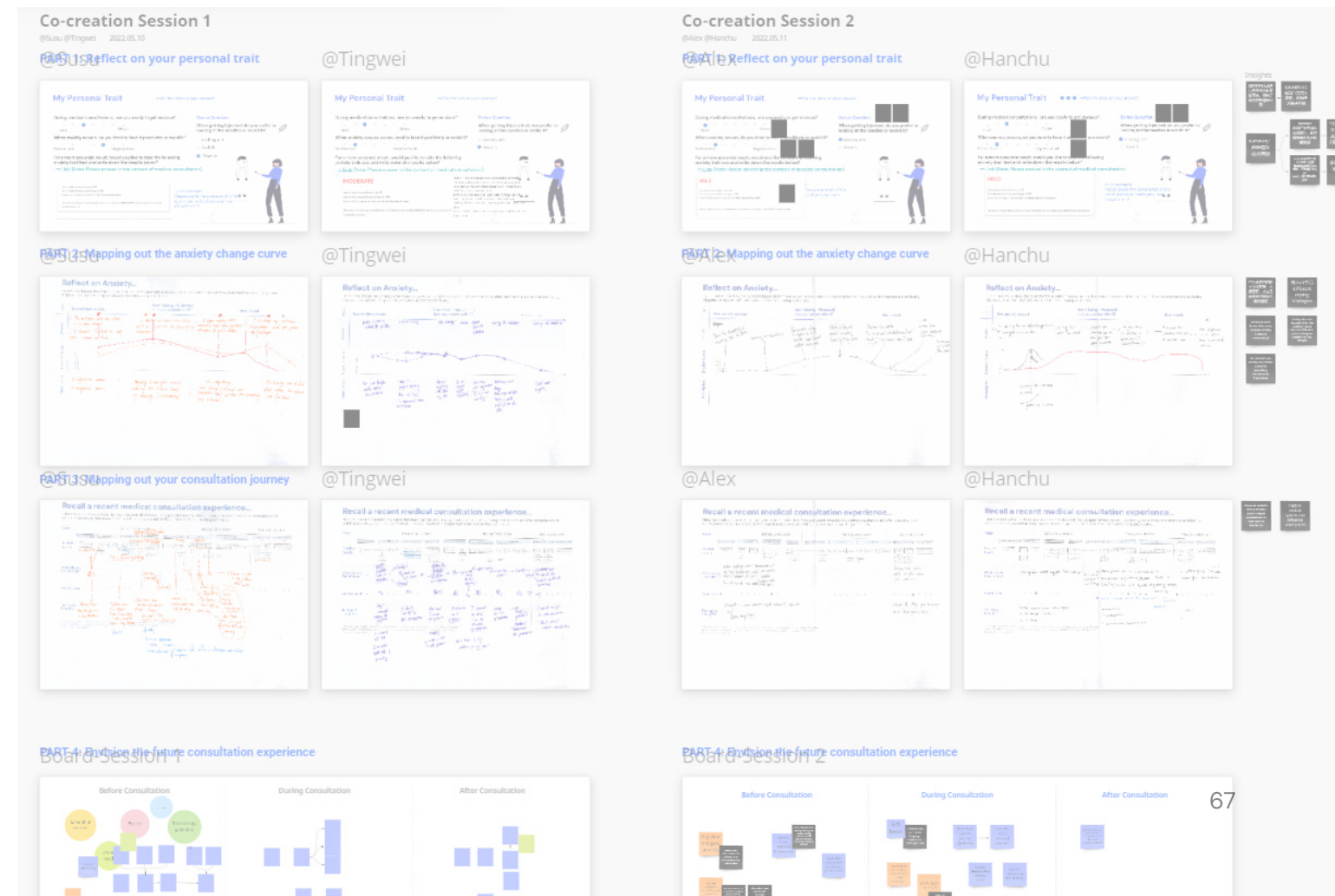

Figure 4.11 Participants Interview Sessions

Data Analysis

According to the book *Convivial Toolbox: Generative Research for the Front End of Design*, analyzing literally means picking apart, and typically involves interpreting the data, making comparisons to theories and to other data, searching for patterns and determining how well they fit, generalizing findings to a broader scope, and finding evidence to support your conclusions (Sanders & Stappers, 2012). For this purpose, researchers have found it helpful to frame them in a variation of the DIKW scheme (the letters standing for Data, Information, Knowledge, and Wisdom) (Ackoff, 1989), which distinguished levels of sense-making. Figure 4.12 demonstrates a variate model to guide analysis, based on Ackoff's scheme. As a result, the data gathered from user generative design research were analyzed in 3 levels: data level, information level, and knowledge level.
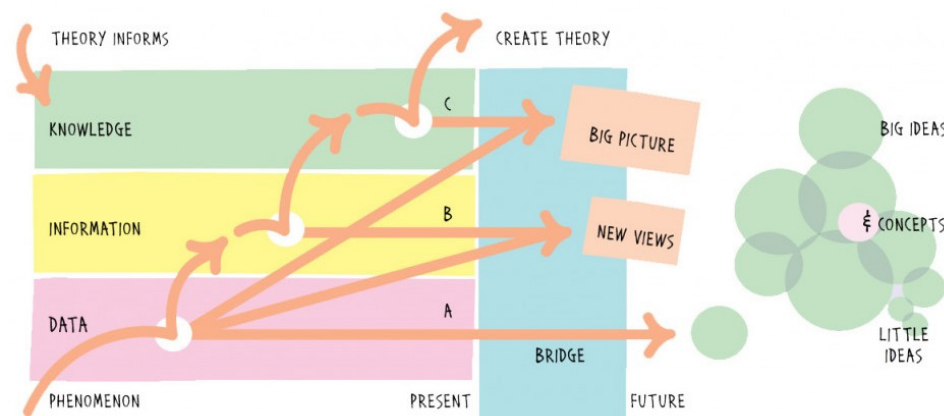
Figure 4.12 A variate model to guide analysis, based on Ackoff's DIKW scheme
(Ackoff, 1989)

Analysis on the level of data

Three generative design research have been conducted during the user research stage. The analysis on the level of data started right after finishing each one-to-two user session. There is evidence that starting the analysis as soon as the first data is gathered is considered critical to direct the next interview and observations. Analysis at this level aims to store and retrieve the materialized stuff and turn them into "information level" by choosing appropriate interpretations.

Analysis on the level of information

At this level, the interview transcript was read through and the relevant quotes were highlighted and noted. Some comments were made during reading. Since the goal of conducting user generative design research consists of 2 aspects: 1) to distinguish different patient traits; 2) to get inspiration for future teleconsultation, this step of the analysis is guided by the following two questions:

a. What is the difference between understanding and coping with anxiety among different traits of people?
b. What does the desired future of teleconsultation look like?

This method is very helpful to understand the different concepts and attitudes of different participants. For instance, during the first session, Participant A stated that "Either she has solved the anxiety, or she is on the way to solving the anxiety". When facing anxiety, she will always try to "find the trigger event", usually the anxiety is caused by some specific event, and then find solutions. However, Participant B holds a different attitude, she usually tends to avoid it. "I may also tend to adopt an attitude of avoiding anxiety in my daily life, akin to bypassing it. For example, if I am very anxious about my graduation project now, I will find something happy to do so that I will not be anxious for the time being. As for graduation, I think I will always pass, and I believe this matter will pass. So instead of addressing the anxiety at the source, I'm going to use another thing to relieve it from another angle." she said.

When talking about the expectations for the future consulting experience, participant A expressed the hope to acquire a more "reliable source for search information", she would like to "check the schedule of doctors or GPs" and "book a consultation by herself". Participant B envisioned a very technological future, in which she "will not need to get out of the home to finish consultation" and "don't need to wait anymore", after consultation, "all the medicines will be delivered to her at the correct time", therefore she will not have to make any efforts.

Analysis on the level of knowledge

All the information has been brought to a higher abstract level at this level of analysis. Patient traits were defined based on the evidence derived from the informational level. The expectations expressed by the participants for the future consulting experience are compared and analyzed together with the previous research results, and some characteristics and scenarios that an ideal consulting experience should have are epitomized.

Results

Distinguish patient traits

Patient traits are defined based on the Big Five Personality model (n.d.),

After analysis, four types of user traits are defined (figure 4.13v), and the classification is based on the Big Five Personality model (Tvtropes, n.d.). The initial model of it was advanced by Ernest Tupes and Raymond Christal in 1961(Tupes & Christal, 1961). In 1990, J.M. Digman advanced his five–factor model of personality, which Lewis Goldberg (1993) extended to the highest level of organization. These five overarching domains have been found to contain and subsume the most known personality traits and are assumed to represent the basic structure behind all personality traits (O'Connor, 2002).

Two dimensions from the Big Five Personality Model were extracted and applied to identify patient traits, which are Openness and Neuroticism. According to (Ambridge, 2014), Openness determines an appreciation for a variety of experiences, such as art, emotion, adventure, unusual ideas, imagination, curiosity, etc. A Cloud Cuckoo Lander(Wikipedia contributors, 2022) is likely to score high on Openness, whereas lower scorers prefer the traditional, the obvious, and the familiar. While Neuroticism, sometimes called Emotional Instability, measures how well you deal with adversity. People who score high on Neuroticism are easy to knock out of equilibrium; prone to anxiety, depression, stress, and so forth; and more likely to overreact to bad news. Some people may score very low on Neuroticism, however, it doesn't mean that they have more positive feelings. To be precise, they are more in a state of lack of feeling (Useful Notes/ Big Five Personality Traits, n.d.).

Based on the findings from the interviews and previous research, it has been found that the level of Openness and Neuroticism both play significant roles in forming people's way of coping with anxiety. Figure 4.13 demonstrates the mechanisms of anxiety generation and coping from the perspectives of neuroticism and openness, respectively.

Coping from the *Neuroticism* perspective   Coping from the *Openness* perspective
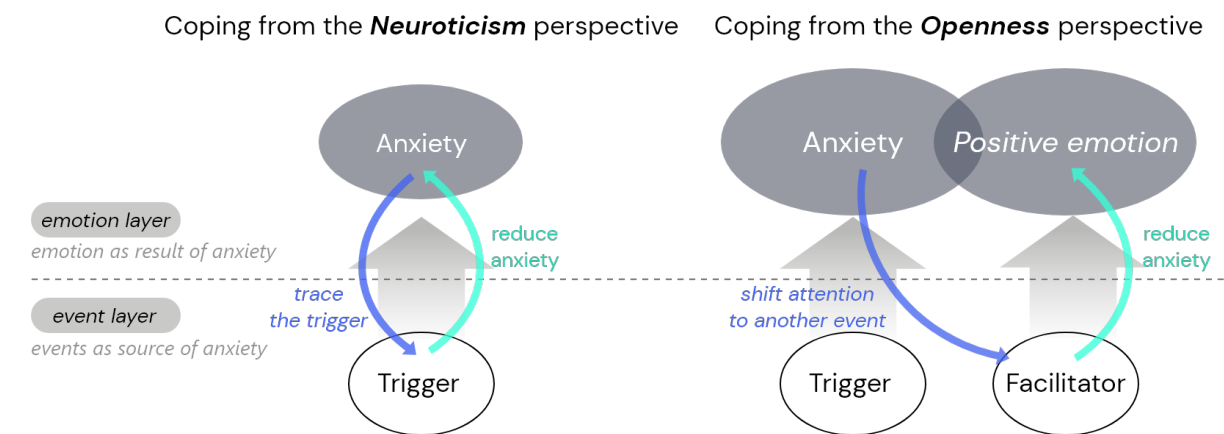
Figure 4.13 Two types of anxiety coping mechanisms

As in the left part of Figure 4.13, anxiety is caused by a specific or nonspecific trigger, and the level of neuroticism will decide whether one is easy to generate anxiety. The coping logic in this perspective is to trace back the "trigger" and solve it directly, thereby alleviating anxiety. This reflects a very direct coping strategy. In the right part, the level of Openness largely determines whether people can successfully shift attention and find alternatives to resolve anxiety. After anxiety has been triggered, some people with a high open mindset tend to shift attention to another event, which is called "facilitator" here, such as gaming, socializing, reading, etc, to facilitate another positive emotion. Only when these two mechanisms work together can the patient truly be in a positive and benign state. Since anxiety is often due to some long–standing and relatively abstract

factors, when the left–side mechanism dominates, the patients might lose balance in the process of coping. They might also overreact, or experience feelings of disappointment and resistance due to the lack of results in a short period of time. On the other hand, when the right–side mechanism dominates, although patients can experience positive emotions in a short period, since the trigger of anxiety is always there, when the immediate gratification passes, the anxiety will come back.
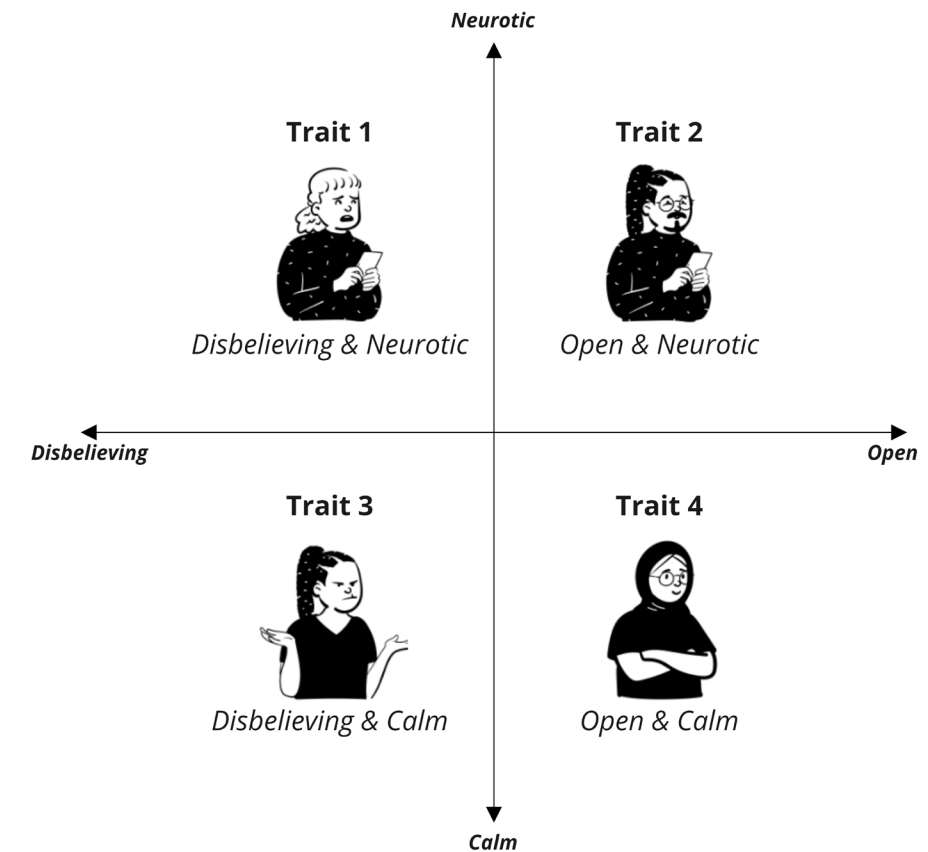

Figure 4.14 Four Patient Traits

As two independent personality dimensions, they are both reflected in varying degrees in each participant. Therefore, these two dimensions are merged together to form four patient traits in this context, which are:

• **Disbelieving & Neurotic Trait –** Patients possess a high level of neuroticism and a low level of openness. People with this trait are prone to anxiety and are accustomed to familiar, traditional coping methods, tending to resist new ideas and risk–taking behaviors.

• **Open & Neurotic Trait –** Patients possess both high levels of openness and neuroticism. People with this trait are also prone to anxiety, but willing to try new ideas to solve problems.

• **Disbelieving & Calm Trait –** Patients possess a low level of openness and a high level of neuroticism. People with this trait are usually very rational when faced with problems, less prone to anxiety, and skeptical of creative alternatives.

• **Open & Calm Trait –** Patients possess a high level of openness and a low level of neuroticism. This trait of people usually possess a more stable emotion status. They have lower anxiety levels, are open to new things, and are good at relieving anxiety.

- Based on the interviews and analysis, eight participants are positioned on the Patient Traits Axis. Participant 2, 5, 8 are positioned in Trait 1, Participant 1, 6, 7 are positioned in Trait 2. Participant 3 and 4 are positioned seperately in Trait 3 and Trait 4. From the figure, it can be seen that 6 out of 8 participants have a relatively higher neuroticism level, 2 are calmer toward health issues. On the dimension of openness, half participants have a higher level of openness.

- To elaborate more on that, both Participate 1 and 7 show strong openness during the interview, they are all willing to try new ideas and creative solutions. Participant 6 said that he would force his mind to think about something else when facing serious anxiety, but the overall openness level is perceived to be alittle bit lower than P6 and P7.

- Both Participants 5 and 8 expressed that they were very prone to anxiety, especially when dealing with health-related issues. And due to they are very cautious about their health, they prefer to adopt conventional solutions that have been verified by numerous previous patients. Participant 2 prefer to making plans for life and follow it strictly. But this will cause her to feel anxious when the results can't meet her expectation. She's now trying to regulate emotion, so the neurotic level is lower than P5 and P8. She also prefers conventional and mainstream solutions but is more open to new insights than 5 and 8.

- Both Participant 3 and 4 hold a calm attitude in relation to health-related issues. However, Participant 4 expressed that he still feels afraid and worried to some extent, yet Participant 3 said he would have little anxiety after scheduling a medical appointment. He thinks as long as he follows the instruction everything will be alright. At the same time, P3 holds a very skeptical attitude towards new things. In comparison, Participant 4 holds a more open attitude towards alternatives.
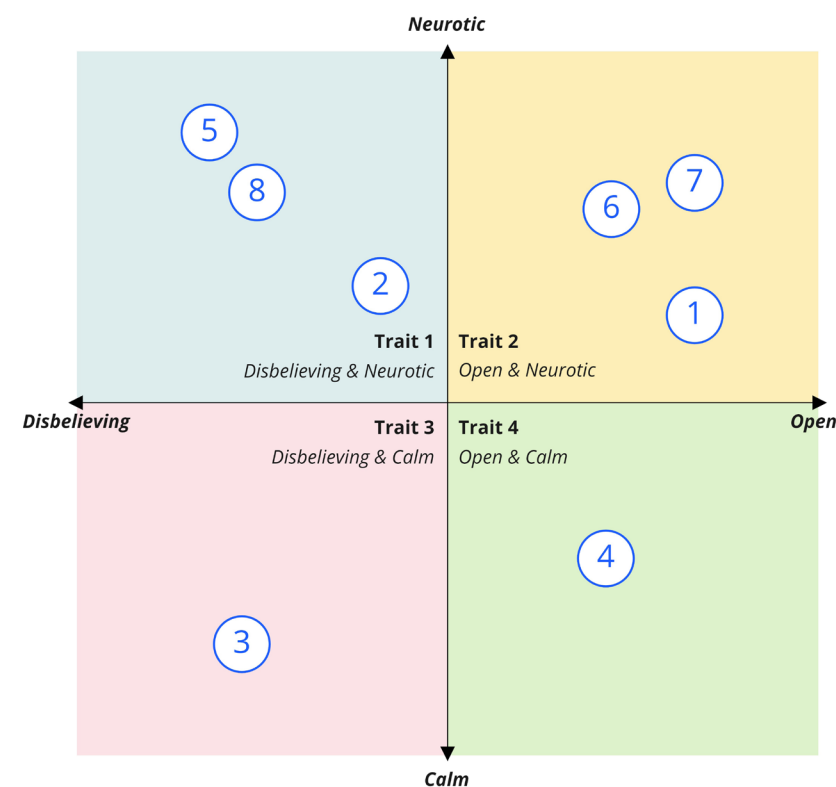

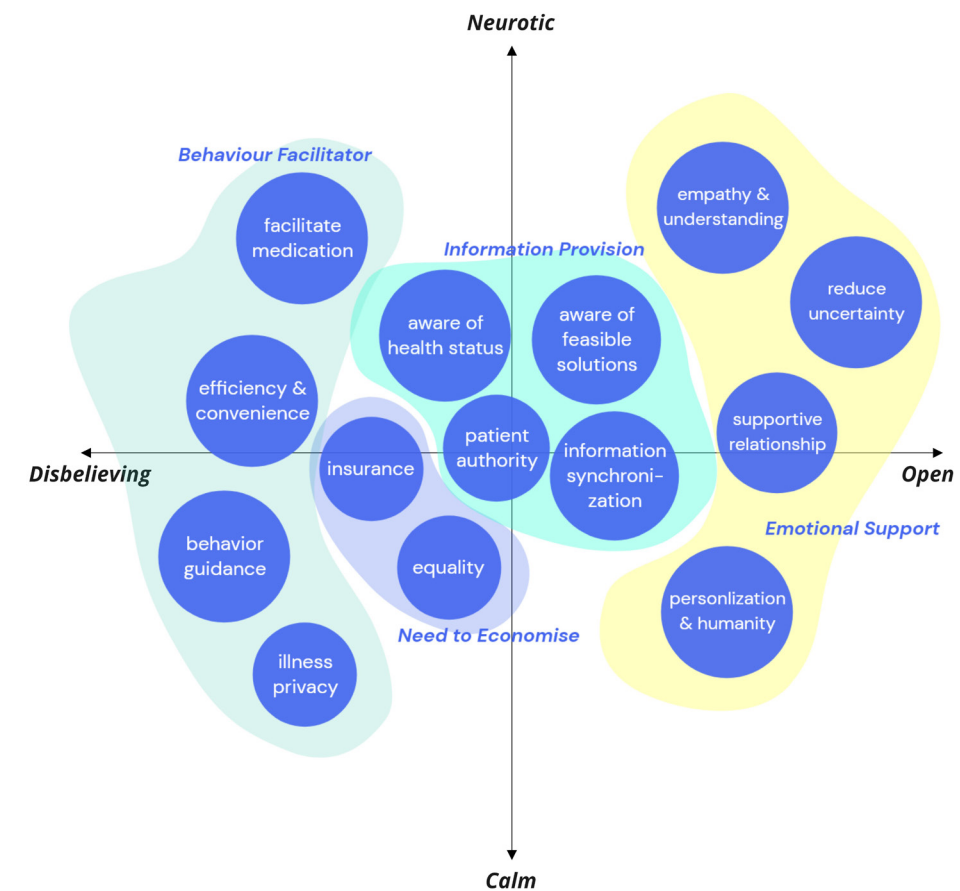Figure 4.15 Position Participants on Patient Traits

Figure 4.16 User Expectation Map

Users' expectations for the future focus on four areas: information, action, emotion, and economy. For further elaboration, each aspect mainly covers the following specific types of needs:

Informational Provision

- Aware of personal health status: Users want to know relevant information about their illness and health level, including agile preliminary diagnoses, health indicators detected by wearable devices, comprehensive disease introduction after diagnosis, etc.

- Aware of feasible solutions: After gaining a certain understanding of their health level, users hope to gain more comprehensive knowledge on how to seek medical help, such as consultation guidance, meditation manager/reminder, etc.

- Information synchronization: Communication barriers sometimes arise due to information gaps between physicians and patients. Users want to know the exact reasons why the medical team gives the medical plan and want the medical team to listen to more patient needs.

- Patient authority: such as the authority of viewing personal EPD, shared decision making for treatment, edit permissions for profiles, etc.

Behaviour Facilitator

- Behavior guidance: specific guide during the consultation, indicating actions, locations, and time, no unmeasurable waiting time anymore, to provide assurance and eliminate the uncertainty.

- Efficiency & convenience: the ideal future consultation experience should be time-saving, effortless, and seamless.

- Medication facilitation: during the sessions, many participants mentioned their difficulty with medication, and some related expectations were proposed such as "digital medication manager", "medicine reminder embedded in the calendar", and "automatic medicine delivery".

- Multiple choice: including but not limited to "diverse usage of the APP", "multiple choice of treatment", and "multiple choice of consultation format". They are applied to patients with high autonomy.

Emotional Support

- Personalization & humanity: customized consultation settings to cover diverse needs. Some participants reported the room size and the wall color have a deep influence on their anxiety levels.

- Empathy& Understanding: Participants wish the medical teams could be more patient and put themselves in the patient's shoes.

- Supportive relationship: Some patients want to be companies for the first-time consultation for emotional support.

- Reduce uncertainty: it is a relatively vague need expressed by participants, but critical for reducing anxiety.

- Illness privacy: Some patients want to get emotional support from others, but at the same time they don't want close people to know about their illness.

Need to Economise

- Insurance coverage: patients will get a lot of relief if they know all the costs will be covered by insurance, which may facilitate their actions in searching for medical help.

- Equality: future expectation toward value-driven instead of profit-driven healthcare. Everybody could get appropriate and customized care.

- Patterns:

- Participants with a low level of openness (disbelief) expressed more concern about the need for Behavior Facilitators and their authority during the consultation and shared decision-making. They trust themselves more than they trust others, and they hope to solve problems through their efforts, so they prefer supports that can help them with their autonomous behavior.

- Participants with a high level of openness expressed a desire for Emotional Support before and during the consultation, such as being listened to and having company.

- Different traits of participants have the same needs for Information Provision and Economize, these two kinds of help are considered as the infrastructure to achieve an ideal medical experience.

05   Concept Development

This chapter focuses on developing strategy proposals and matching them to the long-term vision. Following a brainstorming session, several selection criteria are established to screen the preliminary ideas. After iteration and optimization, eight strategies, as well as personalized consultation journeys targeting the four patient traits, are proposed. These results will be evaluated and aligned with the future vision in order to create the final roadmap. Time pacing strategy is used to define the three time horizons and future scenarios. In conclusion, this chapter will define all the critical elements, laying the groundwork for the final roadmap.

Ideation

Brainstorming

Based on the previous research findings, a brainstorm session is executed for ideation. Since the specific situation of patients will change as the consultation process progresses, so the ideas are mapped out according to the consultation journey stages, which are before, during, and after consultation. After brainstorming, some ideas and sub-ideas have emerged (Figure 5.1).
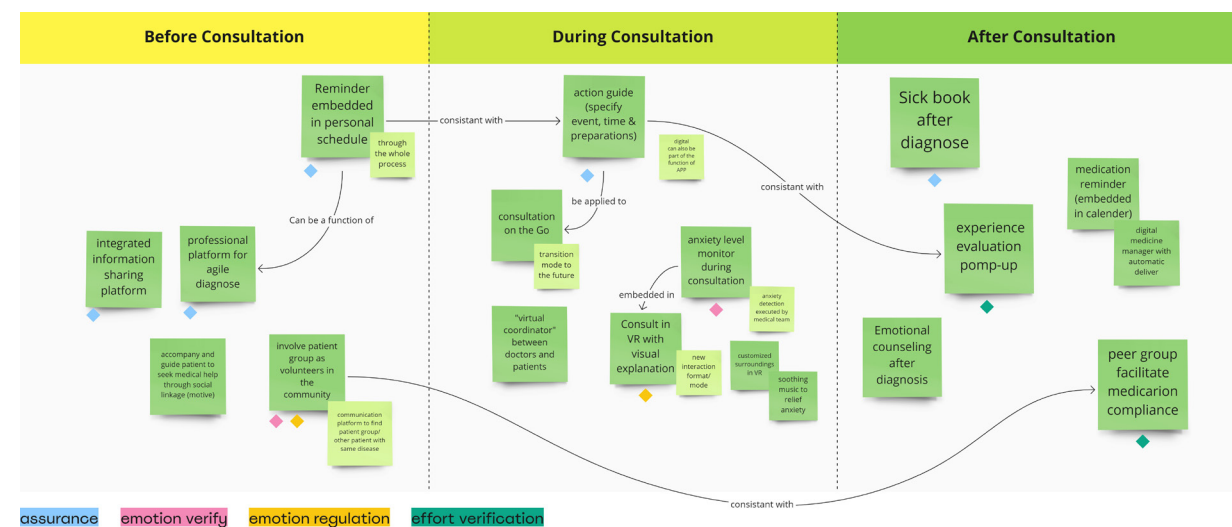
Figure 5.1 Brainstorming Process

Criteria of Strategy Selection

Must-Have (first priority)

- The solution should provide direct or indirect emotional/ appraisal support (Assurance, Emotion Verify, Emotion Regulation, and Effort Verify) to target patients
- The solution should be aligned with the future vision

Should-Have (second priority)

- The solution should consider the vulnerability and differentiation of patients

Could-Have (third priority)

- The solution should provide customizable options for patients
- The solution could combine people and technology seamlessly and organically

Strategy Proposal

Step-by-step Behavior Guidance

Provide patients with behavioral guidance that covers the entire consultation journey, thereby increasing the patient's sense of certainty and assurance. Through mobile applications or other means, necessary information and supplementary knowledge will be conveyed to patients, such as consultation procedures, equipment operation methods, and precautions before some physical examination items.

Before Consultation

During Consultation

After Consultation

Effectiveness

- Remind consultaion time
- Supplyment knowledge & information
- Facilitate use of technology
- Guide the consultation journey
- Predict waiting time during journey
- Tips & reminder for follow-up

Support Chain

Informational Support → Instrumental Support → Emotional Support

Consultation guidance → mobile application or other means → Create Assurance
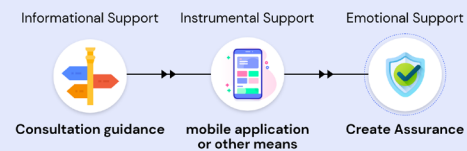
* By providing necessary information and guidance, patients will have a clear plan for their behaviour, have an overview of consultation journey, therefore to obtain a sense of being in control.

Involve Patient Group as Facilitators

There are already precedents in some tumor hospitals for providing emotional support and relieving patient anxiety through Patient Group. This strategy aims to broaden the range of Patient Groups' disease and context coverage. By incorporating patient groups into community-based healthcare solutions, Volunteers could compensate for the lack of emotional support in the medical process, share their experiences, and accompany new patients for consultations.
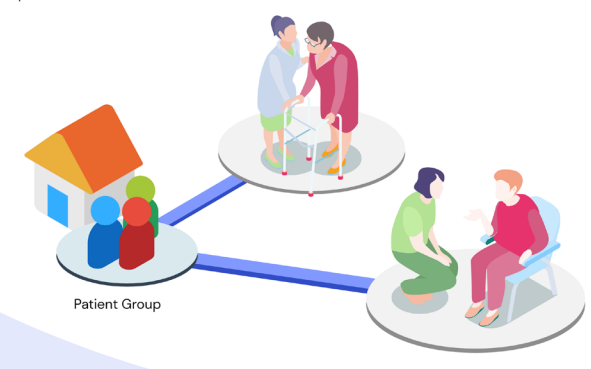
Patient Group

Effectiveness

- Share previous experience
- Provide emotional support
- Facilitate consultation journey
- Motivate medication and recovery
- Hold regular seminar sessions

Support Chain

Instrumental Support → Informational Support → Emotional Support

Patient Groups → Peers' experience & facilitation → Emotion Verify + Emotion Regulation
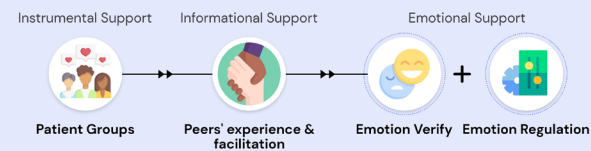
* Patient groups could assist neurotic people in validating their anxiety emotion and further regulating it by sharing their experiences with the disease and facilitating the consultation process for patients.

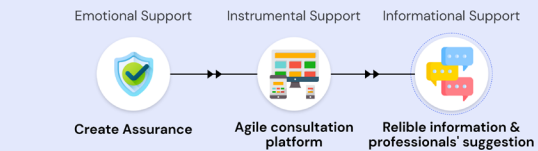
Agile Consultation & Information Query Platform

Build up an information query and agile consultation platform for patients to access reliable information when symptoms arise. Through agile consultation with professionals, a comprehensive understanding can be established to avoid panic. According to research, patients experience the most anxiety during the "before consultation" stage. This strategy aims to improve patients' comprehension of symptoms and certainty.

Reliable Information Query

Agile Consultation with Professionals
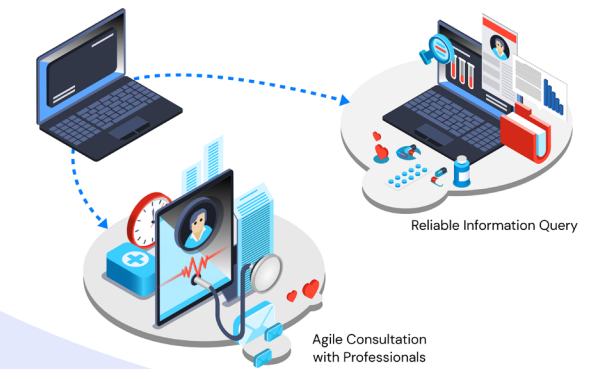
Effectiveness

- Access to reliable information and experiences
- Medical suggestions from experts through agile consultations
- Serve as a health knowledge sharing platform

Support Chain

Emotional Support → Instrumental Support → Informational Support

Create Assurance → Agile consultation platform → Relible information & professionals' suggestion

* Patients will receive emergency response plans for symptoms, avoiding the consequences of delayed treatment while increasing their sense of assurance, due largely to an integrated platform that supports agile consultation and information queries.

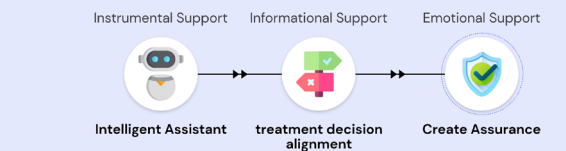## Intelligent Assistant Facilitate Communication

Intelligent assistants can be introduced into the communication process between patients and medical teams, participate in the joint decision-making of treatment, and propose customized plans as artificial intelligence advances. Due to the large information gap between patients and medical teams, intelligent assistants can supplement missing information to improve efficiency; on the other hand, intelligent assistants can assist patients in documenting conversations and doctor orders to relieve communication stress.

Patients

Intelligent Assistant

Medical Team
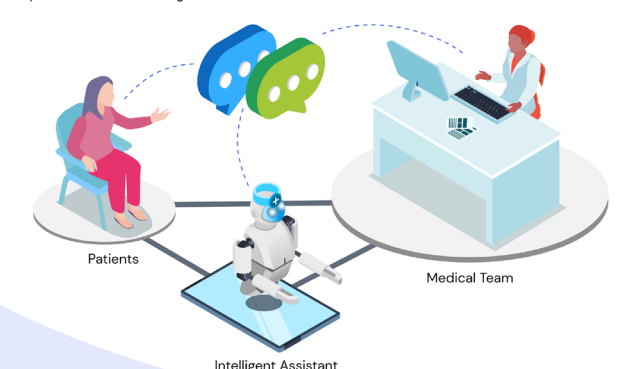
Effectiveness

- Supplement for missing information
- Document conversation and doctors suggestion
- Involve in shared-decision making process

Support Chain

Instrumental Support → Informational Support → Emotional Support

Intelligent Assistant → treatment decision alignment → Create Assurance

* Patients could focus on the conversation without worrying about missing information or other issues by incorporating the intelligent assistant into the shared-decision making for treatment alignment, creating assurance and certainty.

Strategy Proposal
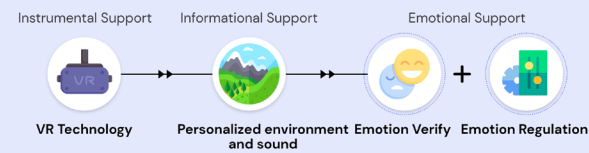
Personalized Environment in VR Context

In the future, teleconsultation could be carried out in a VR context, where all the environment and sound can be customized according to the patient's anxiety level. Through emotion recognition technology, the Intelligent Assistant will automatically switch VR scenes and play relieving music, so that patients can complete consultation and treatment decisions in a relaxed mood.

Virtual Reality

Effectiveness

- Emotion recognition
- Adapt and customizable VR environment
- Create relieving music

Support Chain

Instrumental Support → Informational Support → Emotional Support

VR Technology → Personalized environment and sound → Emotion Verify + Emotion Regulation

* The patient's anxiety level during the consultation is assessed using emotion recognition technology, and the environment and background sounds in the VR scene are automatically adjusted to reduce anxiety.
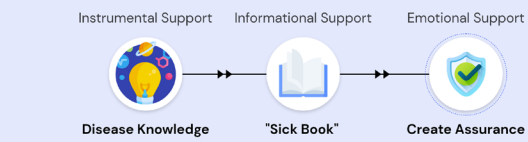
"Sick Book" after Diagnosed

Due to the heavy workload, medical teams usually do not have time to explain the disease in detail to the patient, but quickly give a treatment plan. This causes the patient can only passively accept the doctor's arrangement with uncertainty. By providing a "Sick Book", diagnosed patients can obtain a comprehensive understanding of their disease, as well as an overview of treatment methods together with their advantages and disadvantages.

Knowledge on the disease

Convey to ...

Patient

Professionals

Effectiveness

- Describe the disease in detail
- Provide overview of treatment options
- Improve patients' health literacy

Support Chain

Instrumental Support → Informational Support → Emotional Support

Disease Knowledge → "Sick Book" → Create Assurance

* By providing patients with booklets that comprehensively describe the disease, health literacy and awareness of the disease can be improved, avoiding unnecessary panic caused by a strong sense of uncertainty.

Mobile Consultation & Diagnose Room

With the rapid development of automotive vehicles, "Consultation on the Go" has become an optimizing trend. In the near future, patients could complete remote consultations and physical examinations in the mobile consultation room only after a simple appointment. This strategy can be applied as a transition plan before the accomplishment of the community-based healthcare center.

Effectiveness

- Arrive at patient's home according to the appointment time
- Teleconsultation on the go
- Quick physical examination

Support Chain

Instrumental Support → Informational Support → Emotional Support

Mobile consultation & diagnose Room → Short waiting time & Quick body ckeck result → Create Assurance

* By reducing pre-consultation waiting times and obtaining diagnostic results quickly, patients' anxiety during the "before consultation" can be reduced.

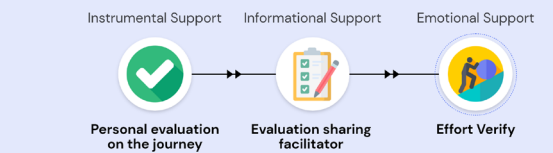## Consultation Experience Evaluation & Sharing

For new patients, feedback from previous patients is extremely valuable. When people search for experiences on a disease or surgery online, they are frequently met with terrifying stories that can cause serious anxiety.
While some diseases do have higher risks, this biases information for new patients because people who have had negative or unusual experiences are more likely to share. As a result, it is critical to facilitate the objective exchange of experiences and opinions for each patient. These findings could help to verify people's effort while also optimizing the Consultation Guidance in Strategy 1.

Journey Evaluation

Experience Sharing

Effectiveness

- Facilatate experience evaluation after consultation
- Applied to optimize the Behavior Guidance [Strategy 1]
- Published on Online Q&A site and applications for reference (e.g., Quora and Google Map)

Support Chain

Instrumental Support → Informational Support → Emotional Support

Personal evaluation on the journey → Evaluation sharing facilitator → Effort Verify

* By evaluating the consultation journey, patients could reflect on the efforts one's made to cure illness, therefore to get a sense of achievement and get a positive appraisal on oneself.

Personalized Teleconsultation Journey based on Patient Traits

Based on four patient traits summarized in the previous chapter, the 8 above proposals are strategically combined to provide a personalized teleconsultation journey. The principle of classification is based on user insights from user interviews.
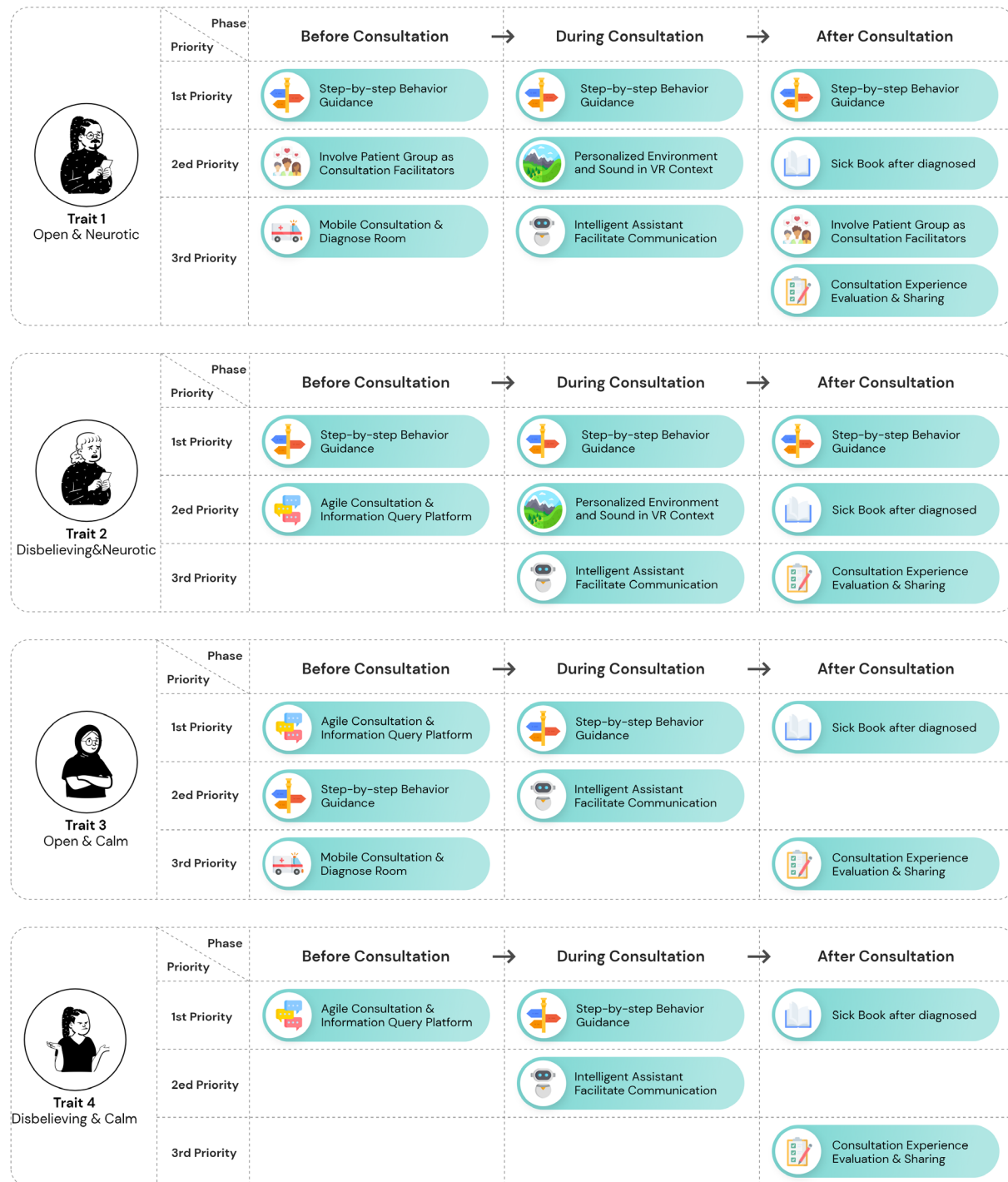

Figure 5.3 Personalized teleconsultation journey based on patients traits

Strategies Synthesis

Time Pacing Strategy

> "In history class, timelines are introduced to enhanced storytelling about development and evolution. In roadmapping, the timeline design has a similar purpose, but instead of concentrating on the historic past, the timeline addresses the future. The timeline on the roadmap allows designers to create stories about the development and evolution of future products and services."
>
> (Lianne Simonse, 2018)

3 horizons model

The future technique Three Horizon Model is of particular help in parallel storytelling (Simonse, 2017). This technique comprehends 3 parallel scenarios based upon 3 different life cycles of strategic business innovation. These lifecycles overlap, as modeled in figure 5.4, to create continuous innovation in the long term (Kerr & Phaal, 2015).

The time pacing strategy decides the design clock for the different types of innovation per horizon. According to the book "Design Roadmapping", the design clock for the "model tear change" is one year, for new platform generation is three years, and for radical innovation, it is about 10-12 years (Simonse, 2018).

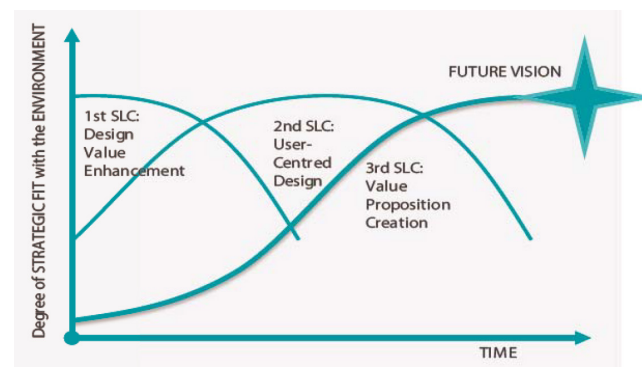In this project, the three horizons are each positioned at **2023**, **2026**, and **2030**.

Figure 5.4 Strategic Life Cycles model of Three Horizons (Sominse, 2018)

The time pacing strategy decides the design clock for the different types of innovation per horizon. According to the book *Design Roadmapping*, the design clock for the "model tear change" is one year, for new platform generation is three years, and for radical innovation, it is about 10-12 years (Simonse, 2018). In this project, the three horizons are each positioned at **2023, 2026**, and **2030**.

Alignment with the Future Vision

On the way to the final future vision, 3 horizons are defined in the process. To guarantee the coherency between design strategies and the future vision, all the elements should be considerably synthesized. As time goes by, different horizons will demonstrate different development priorities, and corresponding design strategies will also be matched in the appropriate context.

Horizon 1: Technology Empowers Existing Teleconsultation (2023)

This horizon focuses on using available technology to improve the current teleconsultation service model. The feasibility and efficiency of the service will be enhanced by providing comprehensive information and guidance. It will result in a smooth consultation journey with fewer pain points related to existing technical problems.
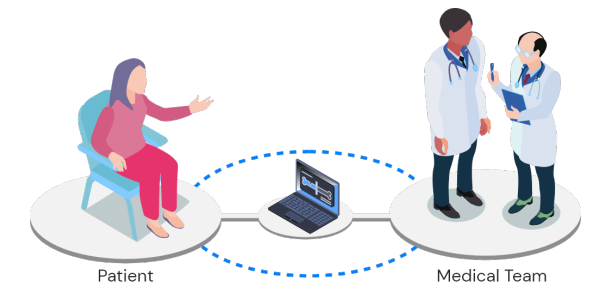
Figure 5.5 Horizon 1

Horizon 2: Innovative Collaboration Goes Beyond Medical Team (2026)

The second horizon concerns involving new "actors" in the context of remote care, relieving the medical team's burden and enhancing social support for patients. Patient groups and community workers will be included after the accomplishment of community-based hubs. Perceptual-trait patients will benefit more from it, which forms miniature personalized healthcare.
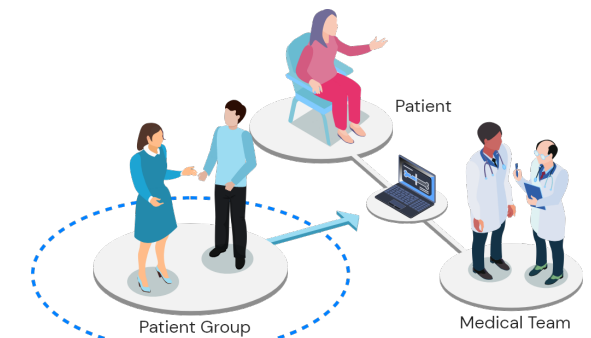
Figure 5.6 Horizon 2

Horizon 3: Seamless Integration Creates New Experiences (2030)

In the third horizon, cutting-edge technologies will be used to create new interaction models. Technological and collaborative innovations will coexist and benefit one another. Stakeholders will be more organically united around the value of the patient, and the intelligent assistant will emerge as a communication facilitator to foster mutual understanding and empathy.
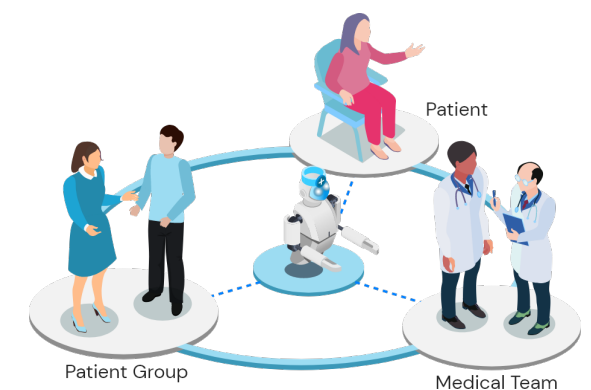
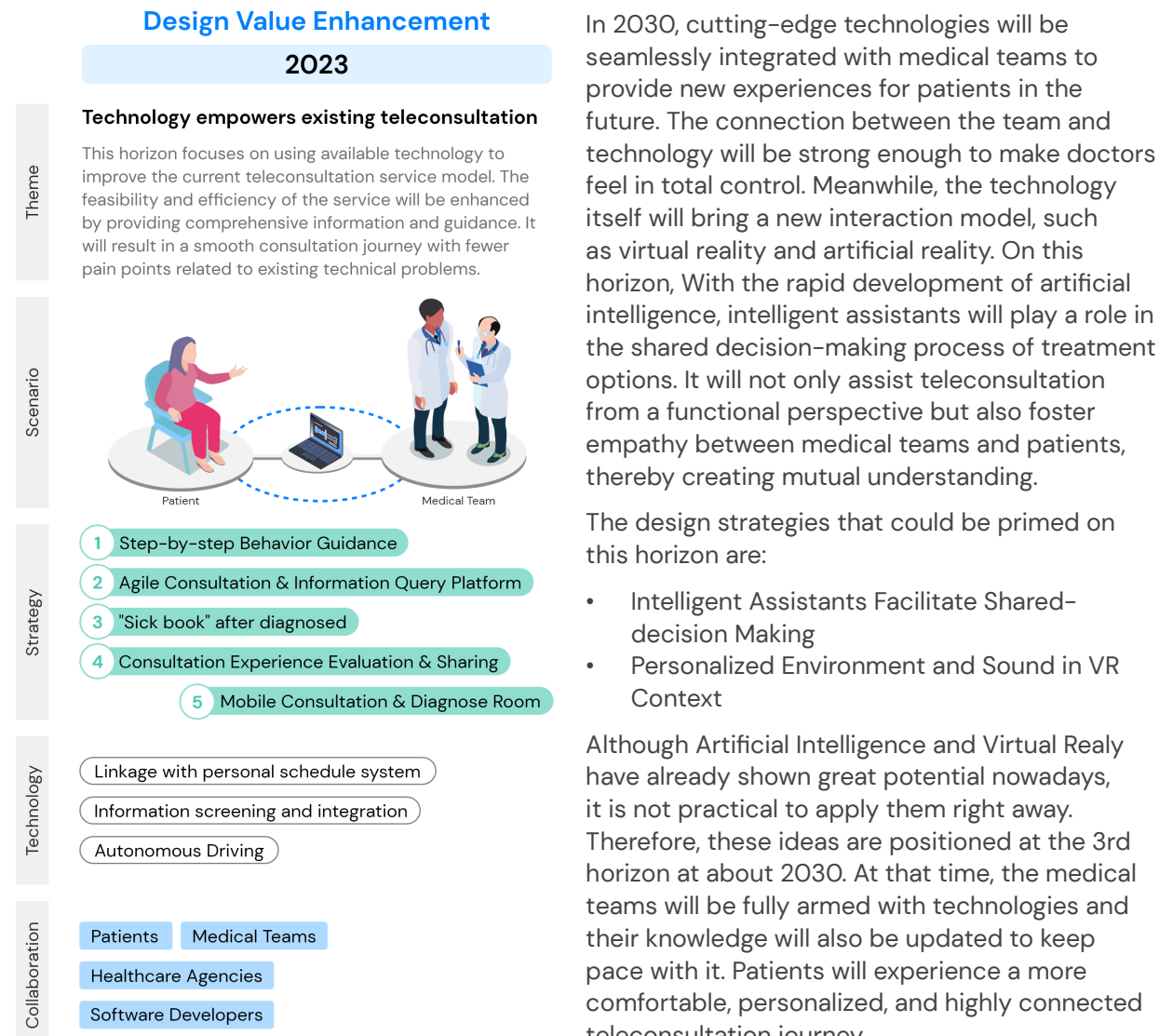Figure 5.7 Horizon 3

Future Scenario 1: Design Value Enhancement

Future Scenario 2: User-centered Value Creation

Design Value Enhancement

2023

Technology empowers existing teleconsultation

Theme

This horizon focuses on using available technology to improve the current teleconsultation service model. The feasibility and efficiency of the service will be enhanced by providing comprehensive information and guidance. It will result in a smooth consultation journey with fewer pain points related to existing technical problems.

Scenario

Patient — Medical Team

Strategy

1 Step-by-step Behavior Guidance
2 Agile Consultation & Information Query Platform
3 "Sick book" after diagnosed
4 Consultation Experience Evaluation & Sharing
5 Mobile Consultation & Diagnose Room

Technology

Linkage with personal schedule system
Information screening and integration
Autonomous Driving

Collaboration

Patients   Medical Teams
Healthcare Agencies
Software Developers

Figure 5.8 Future scenario 1

In 2023, existing technologies will be applied to solve the existing experiences' pain points. The current teleconsultation model will be optimized, where inefficiencies and irrationalities in the current teleconsultation journey will be minimized.

The design strategies that could be positioned on this horizon are:

- Consultation Guidance throughout journey
- Agile consultation & information query platform
- "Sick Book" after diagnosis
- Consultation Experience Evaluation & Sharing
- Mobile Consultation & Diagnose Room

Among them, the first four strategies can be completely covered by the existing technology. For the strategy "Mobile Consultation & Diagnose Room", since the driverless technology still needs further testing, the relevant regulations are not yet perfect, it is envisioned to be ready at the end of Horizon 1 in about 2025. It also serves as an alternative plan before the accomplishment of the community-based healthcare hubs.

On this horizon, actors that will play a role in the collaboration are patients, medical teams, health care agencies for operating the teleconsultation service, and software developers for building up and maintaining the information platform.

Design Value Enhancement

2023

Technology empowers existing teleconsultation

Theme

This horizon focuses on using available technology to improve the current teleconsultation service model. The feasibility and efficiency of the service will be enhanced by providing comprehensive information and guidance. It will result in a smooth consultation journey with fewer pain points related to existing technical problems.

Scenario

Patient — Medical Team

Strategy

1 Step-by-step Behavior Guidance
2 Agile Consultation & Information Query Platform
3 "Sick book" after diagnosed
4 Consultation Experience Evaluation & Sharing
5 Mobile Consultation & Diagnose Room

Technology

Linkage with personal schedule system
Information screening and integration
Autonomous Driving

Collaboration

Patients   Medical Teams
Healthcare Agencies
Software Developers

Figure 5.9 Future scenario 2

In 2026, the innovative collaboration will be comprehensively introduced the teleconsultation service model. In the middle of this horizon, the community-based healthcare hubs will be accomplished. Patient groups and community workers will play a critical role in providing social support for patients outside the medical team.

The design strategy that could be primed on this horizon is "Involve patient groups as facilitators". The time and cost of recruiting and training patient groups are substantial. Since the current patient groups are mainly active in some major cancer hospitals, such as breast tumors, involving the patient groups is considered to be ready on the second horizon of 2026. Other strategies that have already been activated will continue to function.

The strategy "Mobile consultation and diagnose room" will co-exist with the Community-based healthcare hubs in a hybrid model on this horizon, to supplement the limitation at the initial stage of the new model.

On the second horizon, patient groups and community workers will be incorporated into the collaboration, with the responsibility of providing social support to patients and thus building a more humane healthcare solution.

Future Scenario 3: Value proposition Creation

Design Value Enhancement

2023

Technology empowers existing teleconsultation

This horizon focuses on using available technology to improve the current teleconsultation service model. The feasibility and efficiency of the service will be enhanced by providing comprehensive information and guidance. It will result in a smooth consultation journey with fewer pain points related to existing technical problems.

Patient — Medical Team

1. Step-by-step Behavior Guidance
2. Agile Consultation & Information Query Platform
3. "Sick book" after diagnosed
4. Consultation Experience Evaluation & Sharing
5. Mobile Consultation & Diagnose Room

- Linkage with personal schedule system
- Information screening and integration
- Autonomous Driving

Patients · Medical Teams
Healthcare Agencies
Software Developers

(Side labels: Theme · Scenario · Strategy · Technology · Collaboration)

Figure 5.10 Future scenario 3

In 2030, cutting-edge technologies will be seamlessly integrated with medical teams to provide new experiences for patients in the future. The connection between the team and technology will be strong enough to make doctors feel in total control. Meanwhile, the technology itself will bring a new interaction model, such as virtual reality and artificial reality. On this horizon, With the rapid development of artificial intelligence, intelligent assistants will play a role in the shared decision-making process of treatment options. It will not only assist teleconsultation from a functional perspective but also foster empathy between medical teams and patients, thereby creating mutual understanding.

The design strategies that could be primed on this horizon are:

- Intelligent Assistants Facilitate Shared-decision Making
- Personalized Environment and Sound in VR Context

Although Artificial Intelligence and Virtual Realy have already shown great potential nowadays, it is not practical to apply them right away. Therefore, these ideas are positioned at the 3rd horizon at about 2030. At that time, the medical teams will be fully armed with technologies and their knowledge will also be updated to keep pace with it. Patients will experience a more comfortable, personalized, and highly connected teleconsultation journey.

On the third horizon, technology companies will be involved in the collaboration to co-create a technology-led teleconsultation experience for patients.
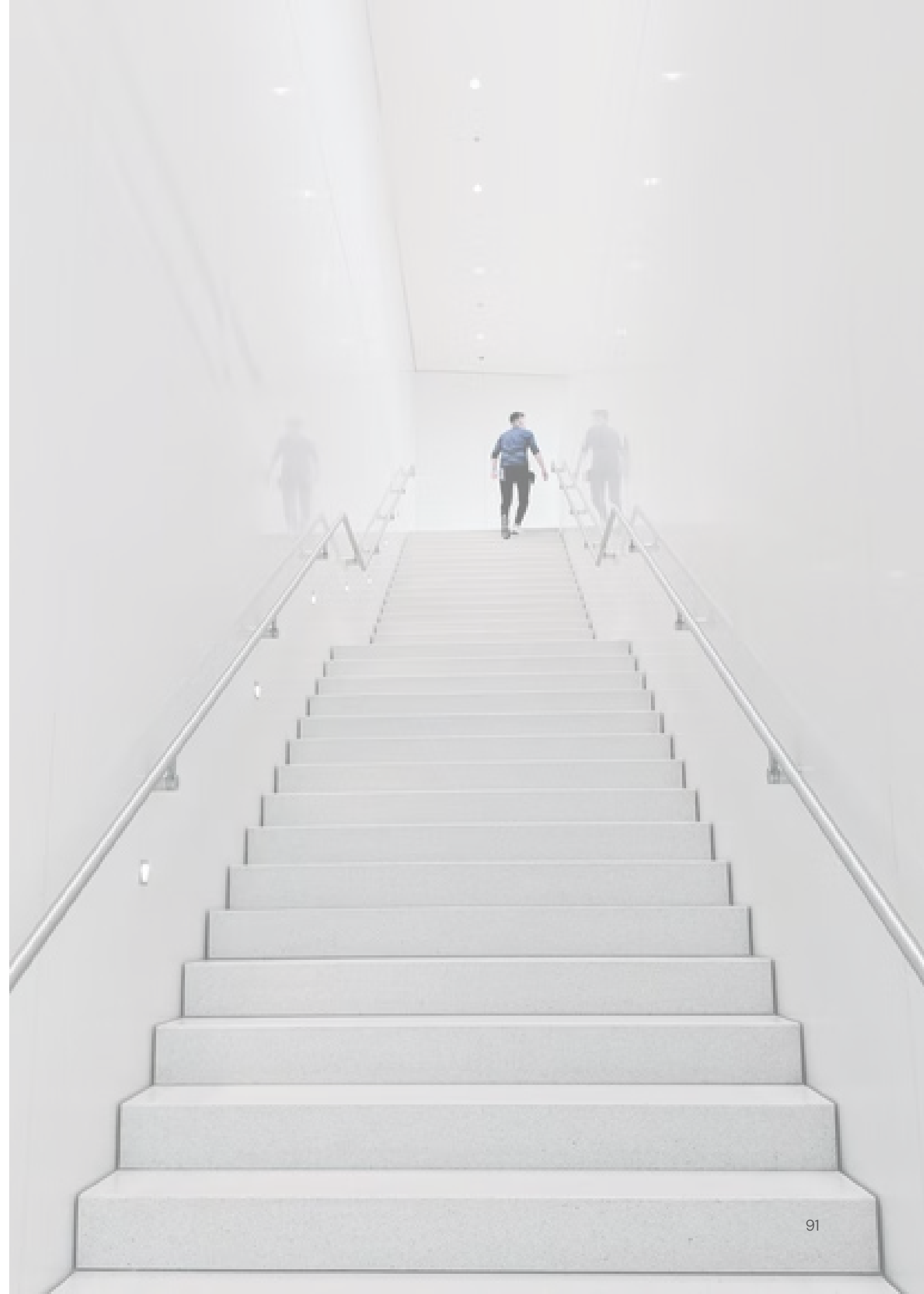
06   Validation & Assessment

This chapter focuses on validating and evaluating the eight strategy proposals in order to further align the final roadmap. A thorough understanding will be gained by inviting past project participants to evaluate the eight strategy proposals. These insights are then analyzed and used to iterate the proposals and reposition them on the roadmap. A final roadmap will be presented at the end of this chapter, along with a design guidance toolkit, which will be demonstrated in the following chapter.

Evaluation Booklet

To further verify the value and usability of the solutions, an evaluation booklet is designed to collect data. Participants who have joined the interview sessions before are invited again to evaluate the strategies put forward in the previous chapter.

Since the questions mentioned in the booklet involve the evaluation of the design quality, and the target audience of the final output of the project are designers who are interested in designing for the future teleconsultation experience, thereby, the evaluation process focuses more on participants with design backgrounds. As a result, six feedback questionnaires were returned.

In the evaluation booklet, 8 strategy cards are presented separately together with an evaluation form (Figure 6.1) after the introduction page. The evaluation dimensions include the following aspects:

- Value for addressing Anxiety (Q1)
- Future feasibility (Q2)
- Acceptance level (Q3)
- Human-centered level (Q4)
- Design quality (Q5.1–5.6)

After all the participants have completed the questionnaire, the feedback will be counted and analyzed uniformly. Feedback from each solution will be analyzed individually to identify opportunities for improvement and iteration. At the same time, the results will also be assessed from a global perspective to obtain more macro-level user insights, such as users' general satisfaction level with the series of strategies, so as to assist further reflection on the project.

Evaluation Dimension	Score						
1. To what degree do you think the solution is valuable for relieving patients' anxiety?	○ *not valuable*	○	○	○	○	○	○ *very valuable*
2. To what extant is your willingness to experience this service/ function?	○ *not willing to*	○	○	○	○	○	○ *very willing to*
3. To what extent do you think the solution is applicable in 2030?	○ *not applicable*	○	○	○	○	○	○ *very applicable*
4. To what extent to you think the solution is humanized/ personalized ?	○ *very indefferent*	○	○	○	○	○	○ *very humanizing*
5. To what extant do you think the solution is:	Unreliable / Reliable	○ *very unreliable*	○	○	○	○	○	○ *very reliable*
	Unfriendly / Friendly	○ *very unfriendly*	○	○	○	○	○	○ *very friendly*
	Uninvolving / Engaging	○ *very uninvoling*	○	○	○	○	○	○ *very engaging*
	Worrying / Reassuring	○ *very worrying*	○	○	○	○	○	○ *very reassuring*
	Overwhelming / Simple	○ *overwhelming*	○	○	○	○	○	○ *very simple*
	Uninformative / Explanatory	○ *uninformative*	○	○	○	○	○	○ *explanatory*

Figure 6.1 Strategy Evaluation Form

Figure 6.2 Evaluation Booklet

Analysis

Figure 6.3 Statistical Table of Evaluation Results

The evaluation booklets were sent to 8 participants, and 7 of them sent feedback. Table 6.1 provides an overview of the basic information of the participants in this stage.

Number	Age	Occupation	Location	Gender
1	24	Design Graduate	Netherland	Female
2	24	Design Graduate	Netherland	Female
3	25	Design Graduate	Netherland	Male
4	27	Design Graduate	Netherland	Male
5	27	Design Graduate	Germany	Female
6	26	Junior Designer	China	Male
7	24	Design Graduate	Netherland	Female

Table 6.1 Participants Overview

All collected data is organized in an Excel table, as shown in Figure 6.3. The evaluation dimensions are listed on the x-axis, and participant data are on the y-axis. The ratings given by participants are averaged from five perspectives, which are "Value for addressing Anxiety", "Future feasibility", "Acceptance level", "Human-centered level", and "Design quality", aligned with the design of the evaluation booklet.

Result & Insights

Evaluation Overview

The first question in the evaluation booklet is about "to what extent do you think the solution is valuable for relieving patients' anxiety?" and is designed to elicit users' intuitive insights into the value of the aforementioned strategies. In this regard, the majority of participants gave a relatively high rating. Figure 6.4 represents the overall scores assigned to each strategy by participants. Six of them had an overall average score of more than 5, and two had a score between 4 and 5. This can indicate that the participants emphasized the value of the set of strategy cards in relieving the patient's anxiety.

Figure 6.5 demonstrates how participants rate the strategies in the five dimensions: value for addressing anxiety (green), future feasibility (red), acceptance level (yellow), human-centered level (purple), and design quality (yellow-green). The lines represent the range of scores, and the dots denote the average score of each strategy.

As can be seen from Figure 6.5, strategy 1 (Step-by-step behavior guidance), 2 (Involve patient group as facilitators), and 8 (Facilitate consultation experience sharing) get a relatively stable score, while Strategy 5 (Personalized environment in VR) and 7 (Mobile consultation and diagnosed room) have large differences in scores across multiple evaluation dimensions.

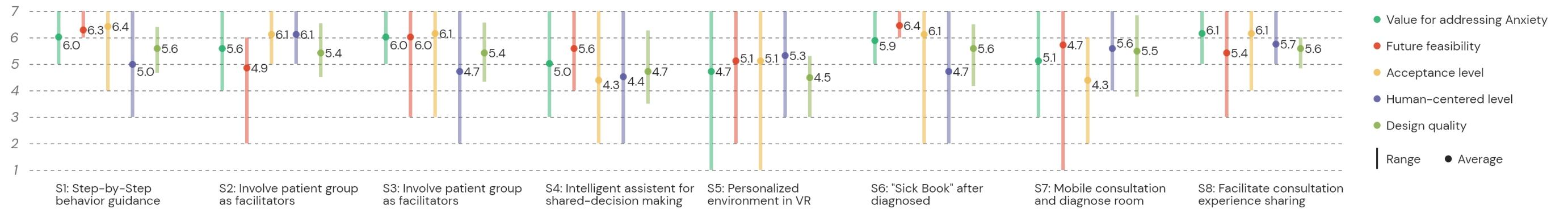Figure 6.4 Perceived value of each strategy

Figure 6.5 Evaluation results from five dimensions

Figure 6.6 combines strategy type, functional stage, planned adoption time, and participants' evaluation result, in which the average score of each strategy and each evaluation dimension are presented. Strategy 1, 2, 3, and 8 possess overall high scores, ranging from 5.5-6.0, and all of them are positioned at the first horizon in the initial roadmap. Strategy 4 and Strategy5 rate relatively low among all the solutions, which range from 4.5 to 5.0, and both of them belong to the third horizon, which is planned to be achieved in about 2030. Therefore, it can be deduced overall that participants are more accepting of strategies that can be implemented in the first horizon and, over time, more skeptical of strategies that are planned to be implemented in the third horizon.

Strategy	Support Type	Journey Stage	Planned Adoption Time	Evaluation Dimension	Min	Max	Average	
S1 Step-by-step consultation guidance	Create Assurance	Before & During & After journey	Horizon 1 [2022-2023]	1. Value for anxiety	5	7	6	5.9
				2. Acceptance level	6	7	6.3	
				3. Future feasibility	4	7	6.4	
				4. Human- centered level	3	7	5	
				5. Design Quaity	4.8	6.2	5.6	
S2 Patient group	Emotion Verify & Emotion Regulation	Before & After journey	Horizon 2 [2024-2026]	1. Value for anxiety	4	7	5.6	5.6
				2. Acceptance level	2	6	4.9	
				3. Future feasibility	5	7	6.1	
				4. Human- centered level	5	7	6.1	
				5. Design Quaity	4.5	6.3	5.4	
S3 Agile consultation and information query platform	Create Assurance	Before journey	Horizon 1 [2022-2023]	1. Value for anxiety	5	7	6	5.6
				2. Acceptance level	3	7	6	
				3. Future feasibility	3	7	6.1	
				4. Human- centered level	2	7	4.7	
				5. Design Quaity	4.3	6.3	5.4	
S4 Intelligent assistant	Create Assurance	During journey	Horizon 3 [2027-2030]	1. Value for anxiety	3	7	5	4.8
				2. Acceptance level	4	7	5.6	
				3. Future feasibility	2	7	4.3	
				4. Human- centered level	2	7	4.4	
				5. Design Quaity	3.5	6.2	4.7	
S5 Personalized environment in VR	Emotion Verify & Emotion Regulation	During journey	Horizon 3 [2027-2030]	1. Value for anxiety	1	7	4.7	4.7
				2. Acceptance level	2	7	5.1	
				3. Future feasibility	1	7	4.1	
				4. Human- centered level	3	7	5.3	
				5. Design Quaity	3	5.3	4.5	
S6 Sick book after diagnose	Create Assurance	After journey	Horizon 1 [2022-2023]	1. Value for anxiety	5	7	5.9	5.7
				2. Acceptance level	6	7	6.4	
				3. Future feasibility	2	7	6.1	
				4. Human- centered level	2	7	4.7	
				5. Design Quaity	4.2	6.5	5.6	
S7 Mobile consultation and diagnose room	Create Assurance	During journey	Horizon 2 [2024-2026]	1. Value for anxiety	3	7	5.1	5.1
				2. Acceptance level	1	7	4.7	
				3. Future feasibility	2	6	4.4	
				4. Human- centered level	4	7	5.6	
				5. Design Quaity	3.8	6.8	5.5	
S8 Consultation experience sharing	Effort Verify	After journey	Horizon 1 [2022-2023]	1. Value for anxiety	5	7	6.1	5.8
				2. Acceptance level	3	7	5.4	
				3. Future feasibility	4	7	6.1	
				4. Human- centered level	5	7	5.7	
				5. Design Quaity	4.8	6	5.6	

Figure 6.6 Strategy type, function stage, adoption plan, and evaluation results

Detailed analysis of each strategy

This part aims to analyze the strategies with apparent differences in scores. Through the form of Q&A, participants' questions and doubts reflected in the evaluation booklet will be described and discussed, through which part of the final insights will be applied for iterating the final roadmap and design manual.

Strategy 1: Step-by-step behavior guidance
- *Concerns: Few participants perceive this solution as not humanized enough, the range of human-centered levels varies.*
- Insights: As the proponent of the strategy, I admit that such doubts are justified. From a macro perspective, this strategy aims to improve the existing user journey and solve the pain points of the current patient journey, and is planned to function in horizon 1 (2022-2023), the individual differences of patients are not fully reflected. However, with the advancement of technology and the further advancement of the program, I envision the "guidance" will also be iterated and take the vulnerability and differentiation of patients into consideration.

Strategy 2: Involve patient group as facilitators
- *Concerns: Some participants are very willing to try this strategy, while the others hold a quite resisting attitude.*
- Insights: By now, patient groups are mainly adopted in some tumor hospitals, which have received positive responses. I think it's normal that people with different characteristics will hold different attitudes. Some patients become more sensitive and need more communication when getting sick, while some may get more socially phobic. However, it doesn't mean that the second type of person has no emotional needs. On the contrary, this also provides a new idea for this project, that is, the organizational form of the patient group is not necessarily offline, but can also be online and anonymous, providing patients with more security and privacy.

Strategy 3: Agile consultation and information query platform
- *Concerns: Participants feel worried about the reliability of the information. Patients may not have good health literacy and it's hard to deliver wrong information and increase panic.*
- Insights: The focus of this strategy is to provide some basic behavior guidance to the patient, such as testing physical functions through some simple movements, rather than providing professional medical advice or prescriptions. The focus is to relieve the anxiety of the patients who have feelings of the symptoms but do not know what to do.

Strategy 4: Intelligent Assistant facilitates communication
- *Concerns: Participants feel worried about data privacy after involving AI in the shared-decision procedure.*
- Insights: Issues related to data privacy are always unavoidable when discussing artificial intelligence. Personally, I believe that in order to realize the highly connected society proposed in the future vision statement, high-speed dissemination and sharing of information is necessary. However, designers should consider how to protect the legitimate dissemination of information and establish secure information-sharing mechanisms by design interventions, and how to build trust in the minds of patients. These can be seen as derivative research questions of this project.

Strategy 5: Personalized environment in VR context
- *Concerns: Some participants hold a skeptical attitude towards the idea, worried that the physical devices may cause an extra burden to patients.*

- Insights: This strategy aims to provide a kind of new and beyond-average experience for patients who have an open mind for innovative ideas. As summarized at the end of Chapter 4, patients are broadly divided into four traits: open & neurotic, open & calm, disbelieving & neurotic, and disbelieving & calm. This solution matches more with the trait of open & neurotic. During the user interviews, some participants mentioned that they are quite sensitive to their surroundings during the consultation, and their emotions could be influenced by multiple factors, such as the room size, wallpaper, light color, etc.

Strategy 7: Mobile consultation and diagnosis room
- *Concerns: Some participants have doubts about the feasibility of this solution before 2030.*
- Insights: based on the previous research, mobile consultation rooms are not as unachievable as participants think. Building a mobile consultation room does not require high technical conditions. During the pandemic, the German government used "Medibus" to provide vaccination services for remote towns. Therefore, I think it is necessary to improve patients' understanding and trust in the new consultation model before implementing this strategy.

Evaluation of Strategy Time-pacing

To further evaluate the time-pacing strategy and the alignment of the outcomes and future vision, 2 interviewees were invited for a deeper discussion, one is from the SPD program in Delft with experience in strategic roadmapping, and another graduated from Interaction Design and is now a Junior Designer. They've provided many valuable suggestions and insights on the time pacing strategy in this project.

A miro board consists of the 8 strategies and a timeline was created to facilitate the discussion session. During the session, the interviewees were asked to map the strategies on the timeline according to their insights following a short introduction. After they finished, the initial roadmap made by me was presented for comparison and discussion.

Insights
- Both interviewees perceived that most strategies should emerge after the second horizon, with the first horizon focusing on infrastructure building.
- Interviewee 1 believes that some of the strategies (e.g. Strategy 1: Step-by-step behavior guidance, Strategy 6: Sick Book after diagnosis, etc) aimed at solving the needs that have become more and more obvious at this stage and are more likely to be implemented in the second horizon, while strategies such as Strategy 5: Personalized environment in VR are aiming at meeting higher-dimensional needs, not just the current medical needs. Gradually enter the market at a later stage.
- Interviewee 2 focuses more on the technology and policy feasibility. She believes that the application of Sick Book (Strategy 6) can be achieved through existing technologies and EPDs that medical systems are already using, while the other strategies will be gradually achieved in the following horizons. Meanwhile, she thinks that the Mobile consultation room (Strategy 7) will be applied at a later stage (near 2030) since it involves the establishment and adjustment of relevant regulations.
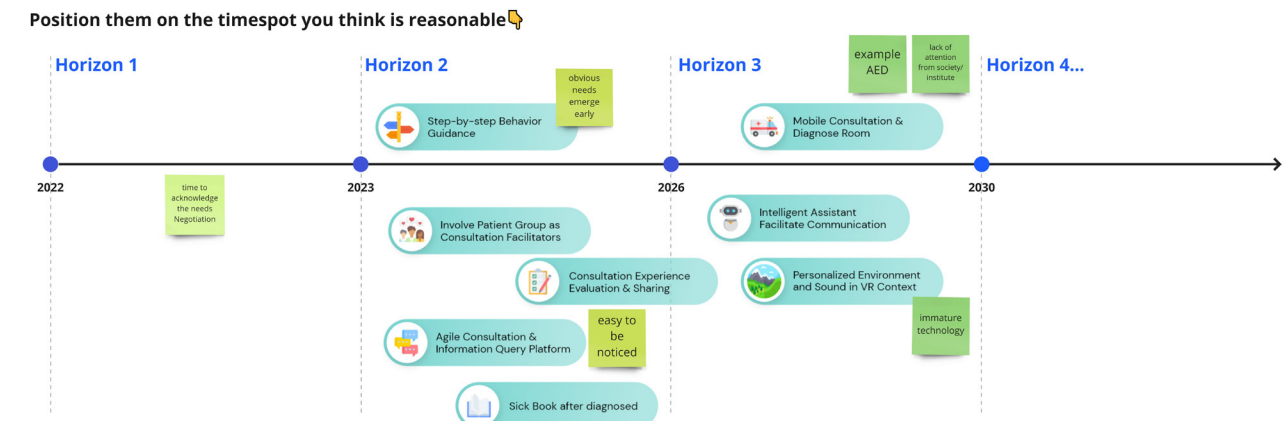

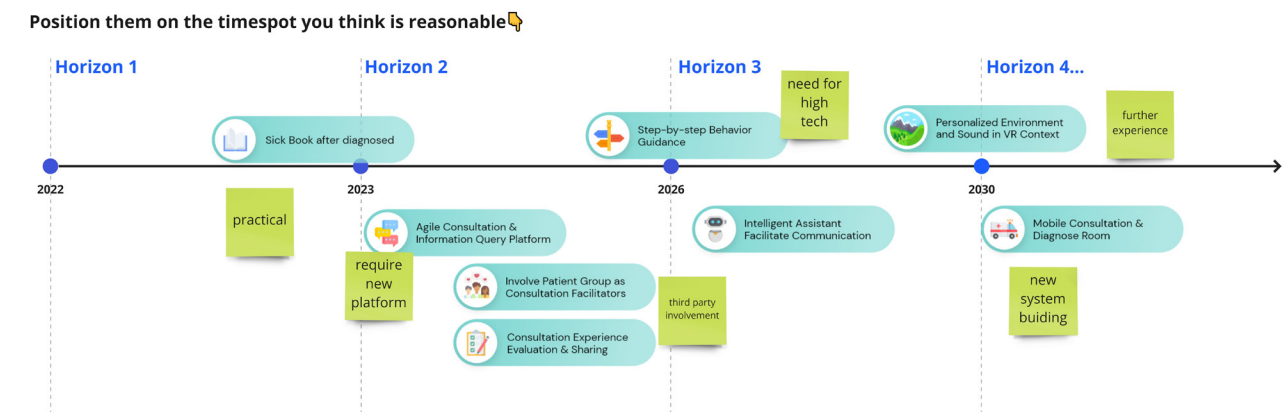Figure 6.7 Interviewee 1 feedback screenshot

Figure 6.8 Interviewee 2 feedback screenshot

Strategic Roadmap towards Future Teleconsultation

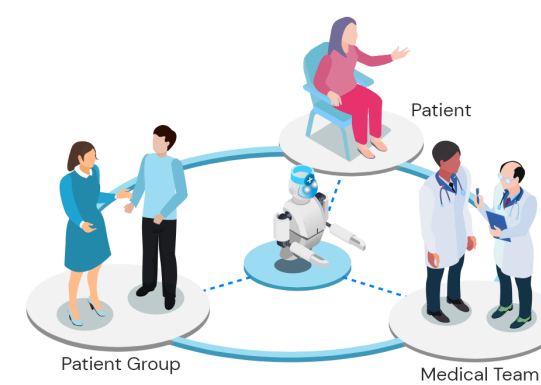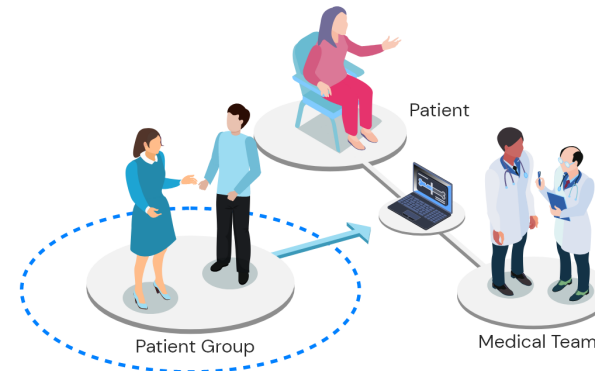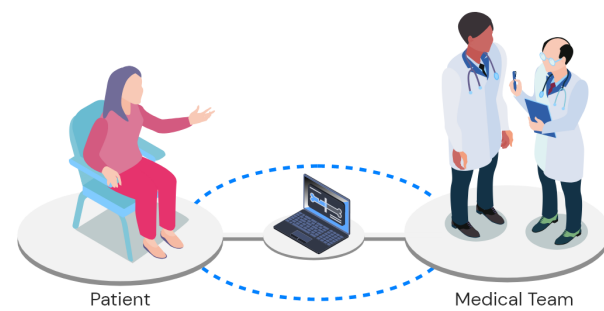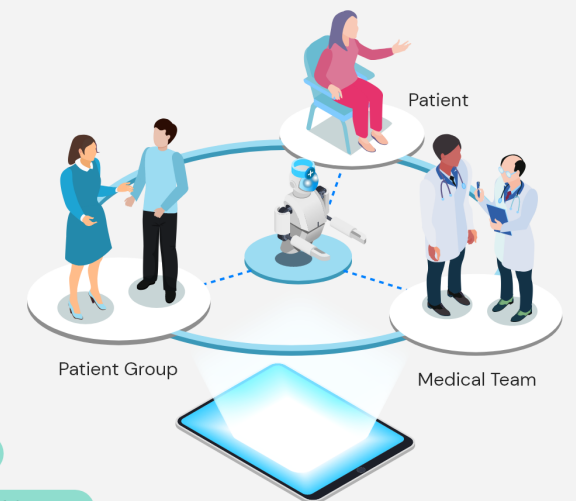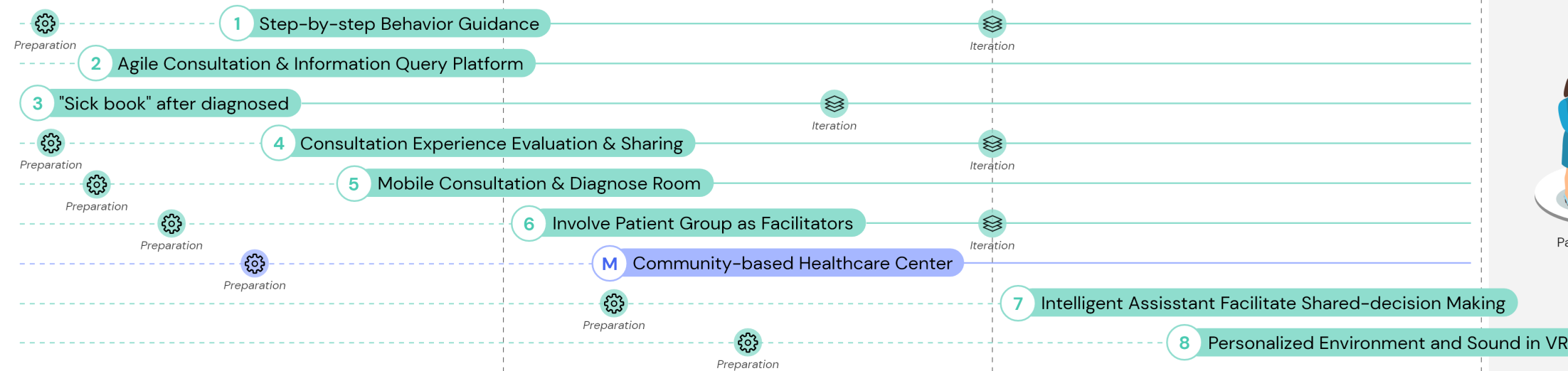| Time Horizon	**Design Value Enhancement** 2024	**User-centered Value Creation** 2027	**Value Proposition Creation** 2030	**Future Vision**
Themes	**Technology empowers existing teleconsultation** This horizon focuses on using available technology to improve the current teleconsultation service model. The feasibility and efficiency of the service will be enhanced by providing comprehensive information and guidance. It will result in a smooth consultation journey with fewer pain points related to existing technical problems.	**Innovative collaboration beyond medical team** The second horizon is about involving new "actors" in the context of remote care, therefore, relieving the medical team's burden and enhancing social support for patients. Patient group and community workers will be included after the accomplishment of community-based hubs. Perceptual-trait patients will benefit more from it, which forms miniature personalized healthcare.	**Seamless integration create new experience** In the third horizon, cutting-edge technologies will be used to create new interaction models. Technological and collaborative innovations will coexist and benefit each other. Stakeholders will be more organically united around the value of the patient, and the intelligent assistant will emerge as a communication facilitator to foster mutual understanding and empathy.	**Highly-connected yet personalized community-based teleconsultation model** High Connected · Personalized · Flexible · Technology-oriented *"In the future, people can obtain a highly connected yet personalized consultation experience through community-based remote care solutions that incorporate social support as an important tool, thereby alleviating the anxiety state during the consultation journey."*

Scenario
- 2024: Patient — Medical Team
- 2027: Patient / Patient Group — Medical Team
- 2030: Patient / Patient Group — Medical Team

Strategy
1. Step-by-step Behavior Guidance — *Preparation ... Iteration*
2. Agile Consultation & Information Query Platform
3. "Sick book" after diagnosed — *Iteration*
4. Consultation Experience Evaluation & Sharing — *Preparation ... Iteration*
5. Mobile Consultation & Diagnose Room — *Preparation*
6. Involve Patient Group as Facilitators — *Preparation ... Iteration*
M. Community-based Healthcare Center
7. Intelligent Assisstant Facilitate Shared-decision Making — *Preparation*
8. Personalized Environment and Sound in VR — *Preparation*

Technology Capability

2024	2027	2030
Linkage with personal schedule system	Infrastructure buiding in the hubs	Natural language processsing
Information screening and integration	Collaborative filtering	Communication facilitation through AI
Autonomous Driving		Emotion recognition
		Customizable Virtual Reality

**Collaboration (Future Vision):** Patients · Medical Teams · Healthcare Agencies · Cyber Engineers · Patient Groups · Community Workers · Technology Companies · Academic Researchers · Designers · ... ...

Collaboration

2024	2027	2030
Patients	Patients	Patients
Medical Teams	Medical Teams	Medical Teams
Healthcare Agencies	Healthcare Agencies	Healthcare Agencies
Software Developers	Software Developers	Cyber Engineers
	Patient Groups	Patient Groups
	Community Workers	Community Workers
		Technology Companies

Figure 6.9 Final Roadmap

Conclusion

In this chapter, the proposed strategies are assessed through an evaluation booklet and small-scale interviews. First, the scores given by the participants were analyzed quantitatively to gain a comprehensive perspective and compare the feedback differences between different strategies. Then, the doubts and concerns of each strategy are analyzed one by one by means of qualitative research. Finally, through interviews, the matching between strategies and time horizons is reconsidered. The limitation of this research lies in the limited scope of the assessment and the fact that the participants are mainly junior designers and design graduate students due to time limitations and accessibility, maybe some more refreshing and innovative insights will be gained if more senior designers were involved. As a result, this chapter evaluates and reflects the strategies through multiple viewpoints to achieve a more complete and reasonable design roadmap.
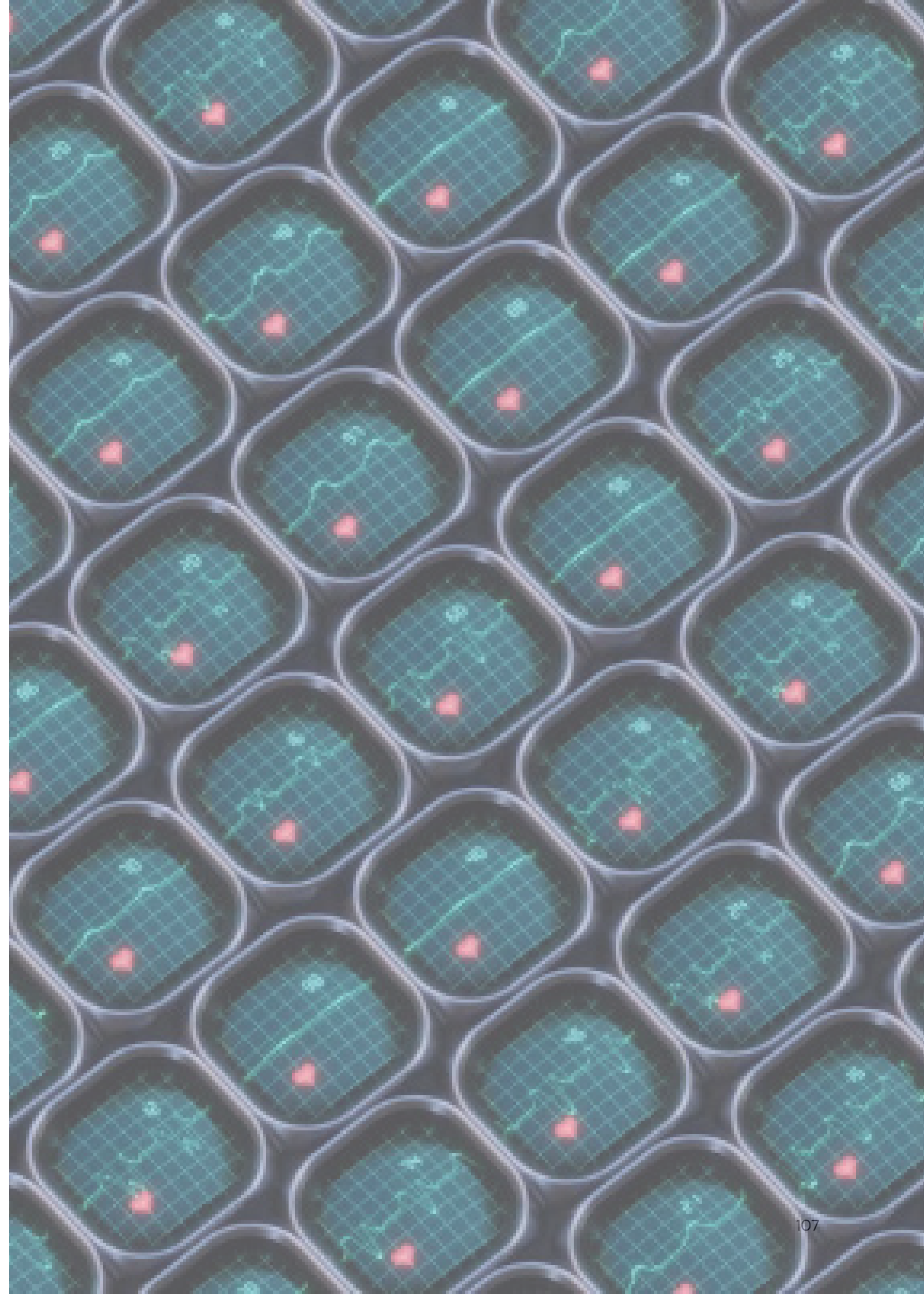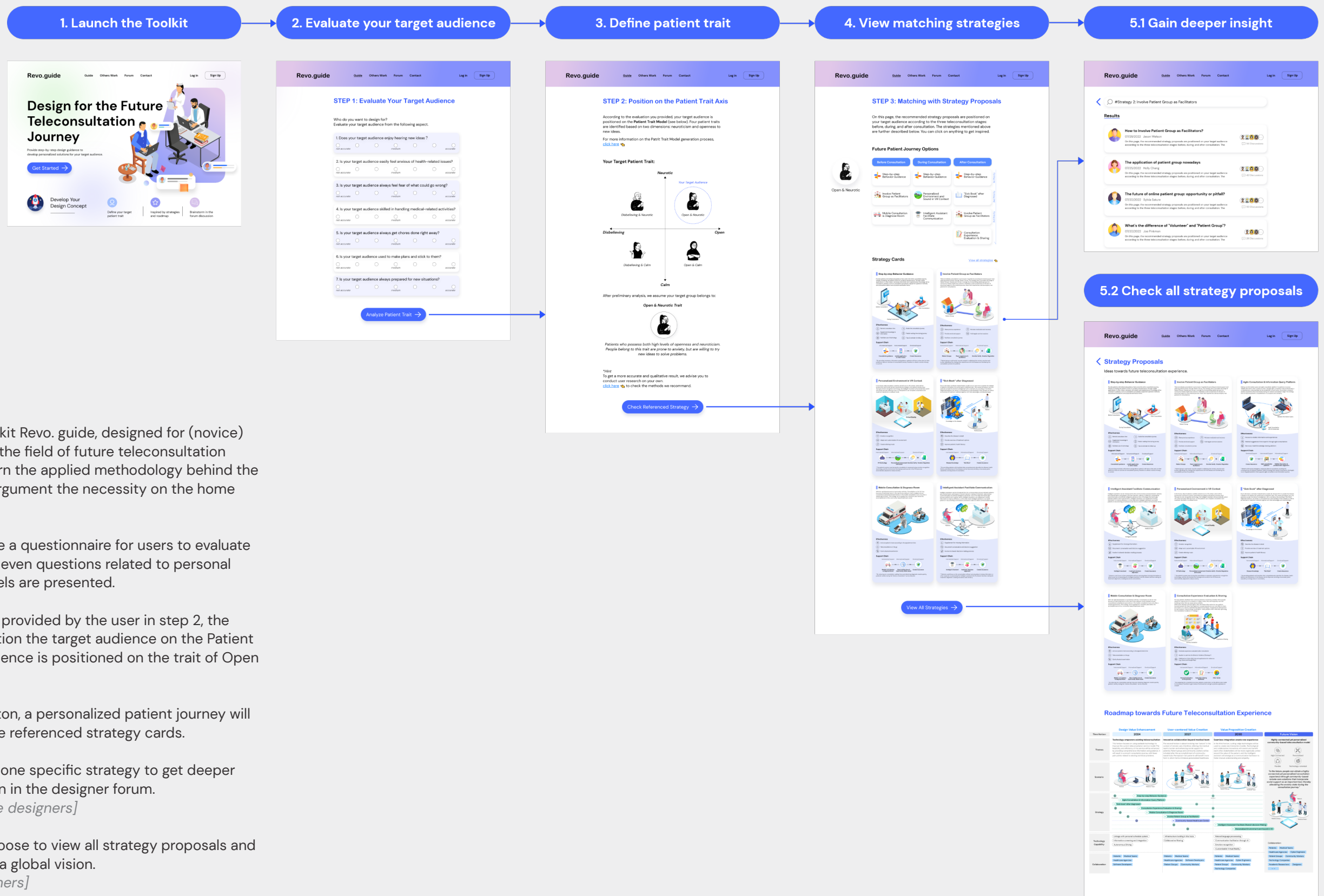
07   Revo.guide

an online toolkit for guiding the future teleconsultation experience design

This chapter develops an online guidance toolkit called "Revo. guide" to help designers who are interested in future teleconsultation experiences explore design opportunities and get inspired. This toolkit incorporates key project outputs and walks the target audience through the proper application of these methods step by step. The operation flow will be thoroughly explained.

Toolkit Operation Process

| 1. Launch the Toolkit | 2. Evaluate your target audience | 3. Define patient trait | 4. View matching strategies | 5.1 Gain deeper insight |

5.2 Check all strategy proposals

Step 1 – Launch the online toolkit Revo. guide, designed for (novice) designers to get inspiration in the field of future teleconsultation experience. Users can also learn the applied methodology behind the toolkit and the data sources argument the necessity on the home page. (not go into detail here)

Step 2 – The toolkit will provide a questionnaire for users to evaluate their target audience's traits. Seven questions related to personal neuroticism and openness levels are presented.

Step 3 – By analyzing the data provided by the user in step 2, the system will automatically position the target audience on the Patient Trait Axis. Here, the target audience is positioned on the trait of Open & Neurotic.

Step 4 – After clicking the button, a personalized patient journey will be presented together with the referenced strategy cards.

Step 5.1 – Users could click on one specific strategy to get deeper insights and join the discussion in the designer forum.
[Reference for user experience designers]

Step 5.2 – Users could also choose to view all strategy proposals and the strategic roadmap to gain a global vision.
[Reference for strategic designers]

Figure 7.1 Toolkit Operation Process

08   Conclusion

The purpose of this chapter is to review and summarize the entire project. The research subject's limitations and future suggestions are discussed in order to provide some recommendations for both other designers and myself. Following that, personal reflections on literature research capability, Method application, project outcome, project management, and communication skills are indicated. In the end, this chapter concludes with an acknowledgment.

Conclusion

In this chapter, the research question and the sub-questions put forward in the project brief will be addressed or discussed. These answers are supported by the knowledge obtained from the research or derived from the execution procedure. A wholistic answer to the research question (RQ) will be provided following the discussion of the sub-questions.

SQ – O1 What are the key influencing factors of patients' anxiety?

Patient anxiety is the focus point of this project. To find effective solutions for alleviating it, first and foremost it needs to address the influencing factors. In this project, this question is studied from anxiety in a broad sense: the definition of anxiety is clarified, and the concepts of anxiety, stress, and fear are also distinguished. Based on that, The specific scenarios in which the patient population is located are further investigated. That is the patient's psychological state can be affected by his or her own disease and the related medical environment.

Through literature research and experts, this question is answered in detail at the end of Chapter 2. In general, in this project, there are seven categories of influencing factors of patient anxiety, which could be first divided into two dimensions: the internal factors and the external factors. Figure 2.7 provides an overview of the factors:
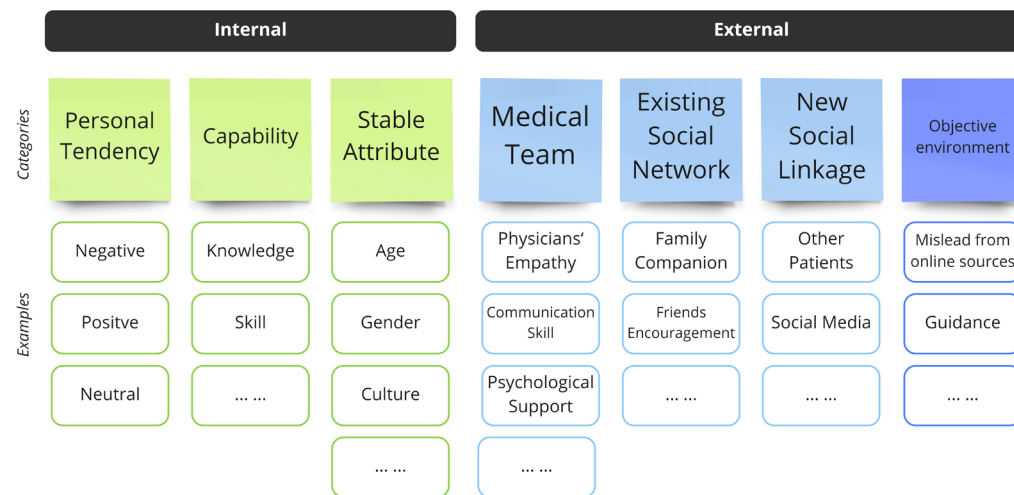

Figure 2.7 Influencing Factors of Patient Anxiety

SQ – O2 How can technology be used to alleviate anxiety? / Where do the design opportunities lie?

This is a relatively broader question compared to the first SQ. The future possibilities are explored and defined in Chapter 3. Through creative trend research, the potential of technology and future healthcare are explored. There are several themes clustered from the technological aspect that are very noticeable. For instance, the extended reality provided through VR&AR equipment. It could not only leverage the medical team's working conditions but also be useful for patient treatment. Second, the cloud services could empower the remote care evolution, and guarantee the infrastructure of future teleconsultation. Third, the advancement of wearable technology is one of the most significant technological innovations in the recent healthcare field. Although this trend is not fully reflected in the design proposals, it could serve as an extra plugin to improve the overall patient experience and increase the accuracy of personal health monitoring. Fourth,

Artificial Intelligence for shared-decision making gradually enters the public eye and plays a role in the medical field. Last but not least, the development of autonomous vehicles also provides an opportunity area for Consultation on the Go. Considering the time efficiency brought by the driverless car trend, patients who previously found little dedicated time for therapy sessions could convert their daily commutes into time with therapists.

In summary, technology has shown significant potential in multiple perspectives for alleviating patient anxiety. However, technology alone cannot solve a problem in isolation, it must be properly applied to maximize its value.

Therefore, together with the other trend themes clustered from the other 3 aspects (Healthcare, Demographic, and Social) eight opportunity areas are mapped out (Figure X). This project focuses more on the ones more related to young patients (18-45) living in cities, but the others also have proved huge potential.

Figure 3.4 Eight Opportunity Areas

SQ – O3 How to align ideas/concepts with the desired future vision?

This question is discussed in Chapter 5 - Strategy Synthesis. The method introduced in the book Design Roadmapping is applied to address this question. Three stages leading to the final future vision are defined according to the time pacing strategy (Simonse, 2018), which are:

Time Horizon	2024	2027	2030
Strategic Life Cycle	Design Value Enhancement	User-centered Value Creation	Value Proposition Creation
Theme	Technology empowers existing teleconsultation	Innovative collaboration beyond medical team	Seamless integration create new experience

Table 7.1 Time Pacing Strategy

RQ – How to utilize technologies to alleviate patients' anxiety during the consultation journey in the telemedicine context in 2030?

In view of the integration of the research results and the knowledge obtained in this project, it could be concluded that emerging technologies are applied in the eight strategy proposals and assigned to their belonging time horizons to lead our society to the final future vision step by step. The final roadmap is a detailed answer to the RQ, from it the strategy launch planning, the preparation phase, and the iteration time of each strategy are demonstrated.

Designers with an interest in future teleconsultation can be supported during the design procedure by the online guidance toolkit Revo.guide, which has combined valuable outcomes from this project. Starting from defining your target audience on the four patient traits map, the matching strategy proposals are then presented to the user (designers), in which related technology applications are introduced.

Limitation & Suggestion

Limitations

This project is dedicated to proposing some innovative design ideas to aid in the evolution of the medical industry. Multiple stakeholders from the fields of design, medicine, and technology were involved. Therefore, many new ideas were absorbed in the research stage. However, it would be more convincing and insightful if the strategy evaluation stage was also conducted in greater depth and on a larger scale. More experts, not just design professionals, but also people from medicine, could be included, along with the insights of design students, to contribute to a more fruitful and diverse discussion.

More co-creations for the design of the guidance manual could be held in terms of method application. If the final audience is involved throughout the design process, I believe the outcome's feasibility and desirability will be increased.

Last but not least, more knowledge based on technological aspects may make the strategies more convincing. Many participants, for example, questioned the viability of using AI for shared decision-making. Despite the fact that numerous frontier cases have already demonstrated AI's potential in these types of contexts, novice designers who are new to the industry know very little about the usability of these technologies. As a result, some techniques/tools could be created to effectively leverage designers' technological literacy.

Suggestions

This project starts from the perspective of solving patient anxiety, but the final solution is not only applicable to patients with anxiety problems but also generally applicable to other patients, so as to build a more humane future remote consultation experience.

During the project process, some related research subjects were also elicited. For instance, as discussed in the former chapter, how to reconcile the contradiction between high connection and patient privacy will always be a tricky problem for designers. Should we give patients more power to police their private data, or should we bring in trusted third parties to oversee data sharing? At the same time, how can we build patient trust in an increasingly linked healthcare system? These are all things that designers need to consider.

At the same time, this project uses a combination of social support and cutting-edge technology to provide patients with a highly connected yet personalized consultation experience, so as to achieve the ultimate goal: alleviating patient anxiety. This is not the only perspective to solve the problem. As mapped out in the Opportunity Area Map from the 3rd chapter, the outcomes are all based on the areas in the red circle (Figure 3.5), aiming to provide healthcare service in the community context and for people with sufficient behavior capability and needs for better care. But for elderly people that mostly live in an atomic model and for people who still need to go to hospitals (centralized model), other innovative solutions are also urgently needed to be proposed.
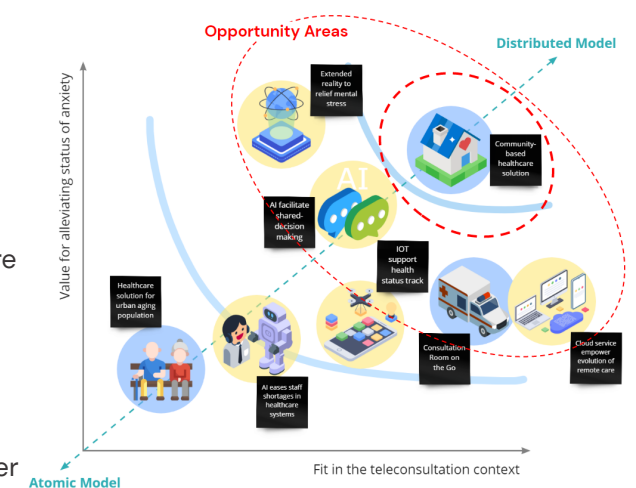

Figure 3.5 Comparison of Opportunity Areas

Personal Reflection

Literature Research Capability

In the stage of preparing the project, one of my personal expectations for the project is to improve my ability of literature research, therefore to be able to extract knowledge and gain insights from literature effectively and systematically. During the project, academic papers, books, news, websites, trend reports, and graduation thesis from previous students were used as knowledge resources to fully understand the research context.

I think this ability has been greatly improved over the project. In the initial stage, I intentionally forced myself to formulate a systematic reading plan and organize the acquired knowledge into notes in a timely manner to avoid the omission of information. Such an approach may seem a little inefficient at the beginning, but its advantages gradually become apparent as the project progresses. In the later stage, I can still follow the index to find relevant articles and reread them quickly.

Design Research Methods Application

During the project, various research methods were adopted, such as literature review, interviews, creative trend research, future visioning, thematic analysis, evaluation questionnaires, design roadmapping, and so on. Personally, I think the combination of systematic analysis and user interviews supported a fruitful outcome. The pity is that the evaluation part was executed fully online, as it could be more engaging if there's enough time to hold some offline sessions.

Design Outcome

Feasibility

First, from the perspective of technical feasibility, the technologies involved in the eight strategic proposals have already begun to emerge in the trend analysis stage (Chapter 3), and have been demonstrated by many trend reports as having broad application prospects in the next decade. Secondly, from the perspective of wide application, many technologies have been applied in other fields, and the feasibility has been verified by the market, but there are few applications in the medical field at this stage.

Desirability

In the literature review stage, the need for taking care of patients' anxiety has been stressed and argued. Also, at the evaluation stage, the end part of this project, it can be seen that most participants hold relatively high acceptance and expectation levels. However, it will be more persuasive if the sample size is larger.

Viability

The proposed strategies is matching the 3 time horizons, and all of them are aligned with the final future vision. The guidance manual and the roadmap could guide designers to get inspiration and go step by step towards the desirable vision. However, it still requires massive integration and allocation of resources and continuous iteration of the roadmap. A consistent study will be necessary to evaluate the viability.

Project Management

This is my first time handling such a large project on my own. A detailed schedule was designed in the project brief to guide the entire procedure, which is expected to last 20 weeks. However, there were some stages of the project that did not go as smoothly as I had hoped, such as the user research phase, where many changes were made, which took more time. However, the project is proceeding as planned. I also learned more about making feasible plans, such as setting checkpoints on my own, keeping a buffer before a big event, and so on.

Communication

The graduation project has leveraged my communication skills, although there is still quite a lot of growing space. Before the official kick-off, I interviewed many experts in TUD for advice and insights, such as P.h.D.s from the areas of telemedicine, professors from Medesign, and people from the VR lab. After the official launch of the project, most of the communications with stakeholders were online. To some degree, it's a little pity for this project, but it also broadens the accessibility of expert resources. So it's a double-edged sword in conclusion. Generally, I still need to make more efforts to improve my communication capability, especially from the aspect of academic level.

Acknowledgement

Time flies, as if yesterday I was still preparing for the first workshop in my master's program, and today I am sitting in front of my computer writing down the acknowledgment for my graduation project.

Studying in TU Delft is both rewarding and full of twists and turns. My first academic year started in September 2019, before the pandemic. And about half a year later, Covid-19 ravaged the whole world. Then I went back to China and took one year gap. During that time, I was confused about the future and sometimes questioned whether I should continue the Strategic Product Design Program.

Covid-19 has made people's life difficult, but it's also the pandemic that got me interested in the healthcare industry. I started to wonder: Why is a seemingly advanced healthcare system so vulnerable when facing pandemics? How to rationally arrange medical resources so as not to cause waste as well as be capable of dealing with risks? How can residents be vaccinated most efficiently in the face of a broad population distribution? I started thinking more and more about these questions that I barely thought about during my first year. Therefore, I participated in many medical-related courses this year.

I greatly appreciate my chair Richard and my mentor Elif for providing me the opportunity to work in this area for my graduation and for helping me in the project execution. During each meeting, they have provided substantial suggestions and guidance that can always make my direction clear. This process made me no longer limited to the surface, some misunderstandings were corrected so that I had a deeper understanding of the design method. At the same time, they can always quickly and accurately find the problems and loopholes in the project process that I didn't realize. This professionalism makes me very admire and inspires me to work hard in the field of design.

At the same time, I am very grateful to my project advisor Tingting, who's not only an excellent project advisor but also a sincere friend. She has provided significant input for this project, and helped me to better understand the context. Thanks to the graduation experience that allowed us to get to know each other.

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