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# Speculative design in the present & future

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## **Keywords**

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## **Abstract**

How will the future healthcare look like within several years? A framework created by Reon Brand of Philips design introduces potential future paradigms that question the way society shall develop. By conducting speculative design, each paradigm was explored and resolved into a probe. These had the aim to provoke people and make them think about each future world related to healthcare. The gained insights were then used to create a fifth probe that challenges the way of thinking of the current society about preventive healthcare. The gut bacteria plays a crucial role in the health, personality and behaviour of a human. Allowing parents to develop an ideal gut flora for their baby to live a healthier life later on, inspired by the gut flora of idols, evokes the debate. Exhibiting the fifth probe led to many interesting discussions and insights.

## **Introduction**

How would our world look like 20, 30, 40 or 50 years from now? Will we monitor each individual on the planet to live a low-risk life? Will we replace organs, eyes, or other parts of our body with artificial alternatives? Will we upload our brains and live on a server? Or do we seek ways to embrace a life more related to mother earth? In this Design Fiction project, several potential healthcare futures are explored. The project is a collaboration between Philips Design, Eindhoven University of Technology, Design Academy Eindhoven, and Frank Kolkman.

When designing and developing for an audience, as was done in this project, a wide range of different opinions have to be dealt with. A well-known example are robots and Artificial intelligence (AI). Some people only see the positive side and potentials: what if robots could take over all our work so we have full-time vacation? Others only see the downsides and risks: what if robots become smarter than people and start attacking us? Either way, the truth will be somewhere in the middle, but it is very important to capture such opinions and discover what society thinks of current developments. The goal of this project was to do exactly that by developing design probes for four potential healthcare futures – based on a framework by Philips Design – and exhibiting them during the Dutch Design Week (DDW) and within Philips to provoke a debate.

During the first part of the project, four teams each developed a design probe for one of the potential futures, which were exhibited at the Dutch Design Week. The project was continued within another team and a fifth probe was designed based on the insights gathered at the DDW. This time, the focus was laid on preventive healthcare in the present time, which led to the design of a fictive device that helps parents to monitor their baby's health and aids them in growing a healthy child.

This report describes the underlying framework on which this project is based, the design processes, final designs, and findings for each probe. How can provocative design probes be developed? What did the audience think of the probes? What are they afraid of, and what do they hope for?

We hope to address those questions to inspire further developers within the domain of healthcare.

## **Design Background**

### *Thoughtful Futures Framework*

The 'Thoughtful Futures' framework developed by Reon Brand (Philips Design) describes potential future values and socio-cultural paradigms and serves as the basis for this project. It outlines four different future paradigms, based on philosophies and mindsets such as Hinduism, Buddhism, Christianity, or Western Reductionism. The framework describes how the development of socio-economic paradigms in the past, like the Industrial and Experience paradigms, have led to the current Knowledge paradigm, and how this could in turn develop into different paradigms in the future: A Transformative paradigm, with a preventive mindset, or a Trans-mutative paradigm with an augmentative mindset. According to these two paradigms, four 'Thoughtful Futures' are described as the result of these developments. The Transformative paradigm might result in an eco-centric future, or a steady-state future. The Transmutative paradigm might result in a transhuman future or even a post-human future [4].

### *Eco-centric: Gaia*

The eco-centric movement aims to live in harmony with nature and values biological, cultural and technical diversity. Rather than modifying the planet to fit their needs they believe in regenerating nature and adjusting their lifestyles to exist within dynamic ecosystems. Products used by the eco-centric movement are bespoke, partly grown and partly hacked together from what is locally available.

*Steady-state: Habitania*

Resource-centrism aims to adapt human civilization for sustainable production and consumption. Whereby a basic quality of life should be balanced with measures to protect the earth. Everything is optimized, tracked and monitored by technology to enable a more equal distribution of resources and to ensure more responsible behavior. Ownership is discouraged and sharing is the new norm.

*Trans-human: Immortalia*

Trans-humanists value human progress and growth above all else. They aspire to human longevity and immortality through rational scientific and technological augmentation. In general trans-humanists place the freedom of individual choice above the needs of society or the planet. Nature is there to be used up as necessary and their society knows large inequalities.

*Post-human: Etherea*

The post-human mindset is rooted in a liberation from the cycles of life and death. Post-humans believe that uploading the human mind and consciousness to machines can empower us to transcend our intellectual limitations and expand the human experience. Biology is seen as a limiting factor and to get rid of our clumsy bodies would be a logical next step for evolution.

*(Paradigm descriptions by Frank Kolkman based on work by Reon Brand and Frank Kolkman, see appendix A)*

The four potential futures as described in the framework are stereotypical futures and can co-exist next to each other. Often, one or more characteristics of a potential future might merge into our definitive future; however, the framework tries to address and describe several parts of paths that society might take.

*Design Fiction*

When designing a product or service, a small part of the nearby future is designed. The result is usually something that might be used within a few weeks, months or years.

But how does a product or service look like in a more distant future? Design Fiction is a design discipline that aims to explore potential worlds and see how they might look like. It helps to speculate about our future world. Design Fiction, sometimes also referred to as speculative design or critical design, is a way for designers to create design probes that provoke debate with an audience. It is not meant "to show how things will be but to open up a space for discussion" [16]. According to Frank Kolkman (personal communication, 2018), Design Fiction is "the practice of designing artefacts for imaginary worlds. [...] By letting go of the constraints of practical reality, design fictions can communicate different sets of beliefs and represent alternative values – that reflect back to our current world.

## Probing Emerging Futures

### Gaia

Team members: Kimia Amir-Moazami, Daan Colussi, Xander Cummins, Sam Kragtwijk

The eco-centric world is focused on living in harmony with nature and being part of the ecosystem, instead of the human standing above nature and the ecosystem. They believe in regenerating nature and adjusting their lifestyle to the dynamic ecosystems of the planet. Humankind is scattered over the world into small communities, that have a local governance and use the abilities of humans and nature that fit best in their environment. Within the communities people work together and at the same time the communities help each other, when some communities risk failure due to circumstances. The health care is quite good and focused on basic health, as it is not focused on increasing the lifespan of humans. The technology is developing rapidly, because there is continuously experimentation going on, which means the specializations are different in each community. A more elaborate explanation of the eco-centric world is written in the BIOME GAMES booklet written by Reon Brand and Frank Kolkman [5] found in Appendix A.

#### *First exploration*

The first step in order to understand the eco-centric world was to establish the different communities, values, beliefs and habits. The BIOME GAMES booklet gave an impression of the world, but as the project continued the story became more elaborate. New communities and skills related to the Gaia-atmosphere were invented by the project members in order to gain different perspectives on health care in this world. In this world the practices related to science of nature, such as insectology, animal behavior analysis, (micro-)biology and agriculture have more value in daily life. In the exploration two topics were derived; healthcare for the whole ecosystem and communication issues in the ecosystem. Based on these topic four design concepts were made in order to gain

new inspirations through the feedback sessions.

#### *Healthcare for the whole system*

As mentioned above humans live in harmony with the ecosystem and value the ecosystem as equal, which means that healthcare should also be provided for the whole ecosystem. The question that arises is: what is healthcare for the different parts in the ecosystem and should humans intrude in the ecosystem in order to create a healthier ecosystem? While exploring this topic a new topic arose according to the communication within the ecosystem.

#### *Communication issue in the ecosystem*

In the different communities people specialize in the resources provided and this means each community develops a scale of measurement and understanding in their own way. Within the communities people are strongly connected and are working together to maintain a healthy life for everything. However, there is often a miscommunication in global decision-making. Sharing ideas and technologies is difficult as every community has different resources and ideas about the world. This communication issue does not only occur on global level in humankind, but also between species. As humans tend to live in harmony with nature it is important that humans understand nature. In the eco-centric world people probably have developed a way of communication with nature, but looking at the current world people seem disconnected from nature due to a lack of communication. In that sense you can say we don't know how to communicate with nature without advanced technology. The communication in the eco-centric world can happen on many levels and the balance of the communication should be taken into account. There are examples of how to communicate with nature. David Abram describes in his book "The spell of the sensuous" the sensual foundation of language in relation to nature [54]. One of the stories in his book describes his experience with guiding ants to eat from the rice offerings outside the house instead of killing the ants, when they

are inside the house. In this way the people and ants are living in harmony.

A different issue that arises is how do nature and humans communicate as equals? As humans are perceived as the more intelligent species, we tend to bend nature towards our hand instead of living in harmony. One of the in-between prototypes describes the use of synthesized pheromones in order to notify ants about certain natural diseases or problems, where the ants can aid. But is this providing of pheromones in the air equal communication? We, as humans, force a certain task on ants, while nature probably solves the problem.

#### *Mapping of communities and nature*

Clearly, there is a communication issue, so therefore there was a deeper exploration on the different communities and how they communicate with nature. Each project member then got the task to represent two of the communities in a conversation with termites. Termites were chosen due to the abilities they possess, which play a crucial role in multiple ecosystems [25]. One tool of communication that came out strongly of each community was the language of smell. Termites use pheromones and odors to communicate signals, such as: alarm, sex, contact and trail [30]. Besides this, each termite colony possesses a particular smell, which means outsiders are easily detected [15]. Many other organisms use the language of smell to communicate to each other. The human nose is able to smell thousands of different odors, but many people are not trained to detect and link certain smells.

In the eco-centric world are schools with insectology, agriculture and biology courses, but what if there is also a course in smell. A new idea arises: The school of smells. What would happen with our relation to nature if we learn the language of smell from the moment we are born and what are the possibilities in technology to actually learn and use this language? In order to gain more perspective in the use of smell an interview with Tobias Esselborn, an

expert in smell, was held. Based on the first hand-on knowledge from Tobias, the possible technology and the relation to healthcare for the ecosystem was explored.

#### *Technology*

The research of smell has been evolving for many years. Scents are constructed from molecules and when vaporized they leave a certain smell. According to Tobias, these molecules can be individually detected and linked to a certain memory, object or even disease. For example, there are dogs that can smell variants of skin cancer and a woman named Joy Milne, who can smell Parkinson disease and cancer [22][35]. Besides this Tobias mentioned the opportunities of re-creating smell, which is also a way of learning. Comparing and analyzing made Tobias the smelling expert as he is today.

#### *The language of smell in health care*

The combination of language of smell and healthcare for the ecosystem will drastically change the idea of healthcare as we know it. Doctors will probably be taking care of multiple organisms, which causes the doctors to become field doctors in order to reach 'patients'. Slowly, the idea for the final probe evolved.

#### *The practice of Myroscopy*

Myroscopy consist of tools for field doctors to understand how the health of the ecosystem is. It consists of a Myroscope, which helps doctors to focus on particular smells of organisms by placing the tube close to the patient and inhale deeply through the nose. The Myroscope blocks the sense of sight and sound in order to heighten the sense of touch and smell. Next to the Myroscope the doctor possesses a Scentograph, a database of many organisms, diseases and the smells linked to these organisms and diseases. The doctor is trained to detect certain smells and irregularities in the ecosystem and the Scentograph supports by giving the doctor the possibility to print certain smells of diseases and compare that with the smell he diagnosed at the patient.



## **Habitania**

Team members: Jordy Alblas, Jade Badra, Jip Geven, Arisha Isaeva

My team explored a potential future 30 years from now, which was, according to the framework, characterized by a no-growth, steady-state society where risk is avoided, where sharing is the new norm, and whereby everything is optimized, tracked and monitored by AI.

We started the project with a super quick prototyping session, focused on health and food, to get ourselves immersed in this future world. Because our future paradigm is based on continuation of current societal developments, we did a lot of research about emerging technologies. We discussed a lot which often resulted in ethical dilemmas. We explored our world during several brainstorm sessions and we came up with many topics.

We explored a few of them with further research, drawings and scenarios. We had difficulties in finding a topic we all liked. At a certain point we focused on accidents in our future world, but during our discussions, we came up with the idea of showing extreme ways of a society that avoids accidents at all. We thought about sports as being a good way to keep society healthy, while at the same time requiring people to stay healthy to make use of health insurance provided by the government. According to reports by the National Center for Catastrophic Sport Injury Research [34], swimming is one of the safest sports. We came up with the concept of a swimming pool where a healthy life is encouraged through monitoring, minimal risk and community goals.

We sketched and prototyped several things, such as screens in the pool. We did research about developments in the areas of sports, risk-avoidance, and communities. With only very limited time until the Dutch Design Week, we created a model of a 'one person communal swimming pool' which shows many aspects of the future world we all imagined. The pool is a place to gather, as well as a safe,

low-risk place to keep yourself in good health and do a personalized workout with optimal resource utilization. We explained our probes through a detailed story during the exhibition. The other groups exhibited their probes as well and we had many interesting discussions.

Monitoring in our current society, monitoring your own health becomes more and more important. With Fitbits and other applications, people can monitor their behavior, such as steps and heart rate. On the other hand, we imagined that in a future world data becomes more and more transparent and decisions are made according to your data. This already happens often, in ways we might already find 'normal' such as personalized advertisements according to your browsing behavior to more extreme ways, such as facial recognition to catch criminals [19] or facial recognition in Chinese schools to monitor and analyze students' attendance, personal development, and behavior [10]. We imagined that in a future world, you are required to take care of your own health to benefit from health insurance. Your data is available everywhere, which is reflected in our prototype with a public screen showing your health data and your personalized swimming workout plan.

### *Minimal risk*

In our society, we try to become healthy and stay healthy. We try to cure diseases and develop new medicines. We invent safer ways of transport and better ways to cope with risk. This all means we are developing towards a low-risk society. We tried to maximize this in our probe by showing a low-risk pool, characterized by a few details: there are no corners anymore: all corners are rounded, you don't have to swim from one side to the other: the pool has artificial flows, the pool has a shallow end, and the swimming suit doesn't sink and makes it almost impossible to drown.

### *Community goals*

A common risk in design fiction is to only show the negative sides of our future world. We had many of those discussions: your data is available everywhere, it can be misused, you lose control over your own life, and so on. However, obviously, in reality also great things can happen. Besides, when we try to provoke a debate with our audience, we also want to show the positive sides. This is why we came up with 'community goals', showing that individuals are not alone but part of a community. We see this in our world with Facebook groups, fans of a particular band, online game communities, et cetera. In our probe, each individual is part of a bigger community that tries to motivate you to reach your workout goal. For instance, in our final design of the swimming suit, the orange ribbon shows which community you are part of.

### *Optimal resource utilization*

Our world constantly tries to optimize the use of resources. Since world population is currently growing fast, resources have to be spread over many more people. We tried to reflect that in our probes by creating reusable swimming suits (everyone uses the same suit and the stitches show that it was repaired multiple times) and an individual pool instead of one large pool for multiple individuals.





one person communal swimming pool

## **Immortalia**

Team members: Erik Melander, Pollyana Moss, Viki Oh, Clarissa Schmitt

In the transhuman world, humans have taken evolution into their own hands. Through bio-engineering, gene editing and similar technologies, they keep augmenting themselves and their environment to fulfill their needs and desires. Human progress, longevity and comfort are the priority, with continuous research and technological developments to enable this [4][50]. The wealth disparity in this world is growing. The newest augmentations and technologies are only available to the wealthiest members of society, who keep expanding their many advantages. In regards to health, these people have completely eradicated any causes of disease in their environments and their own bodies. They and their descendants do not have to worry about being affected by any kind of disease in their lives, and will not even have ever witnessed anybody else being sick.

For these very privileged transhumans, the thought of being ill is almost exotic, and awakens large curiosity. This might be caused by a wish to understand the reason for the eradication of disease, a wish to feel connected to their "purely human" ancestors, or simply out of a desire for a unique and radically different experience in their decadent lives in which nearly everything is possible. For them, a unique retreat awaits at the flu spa. Different packages are available for returning customers, but the first experience resembles a light flu. After checking in, customers administer themselves with a precisely engineered Influenza virus by eating a gelatinous blob, presented similarly to a dessert. What follows is a precisely mapped one-week journey of experiencing the various symptoms of a flu, such as sneezing, coughing or a fever, for the first time. The symptoms will naturally alleviate without need for medication. The patient can return to their everyday life with a completely fresh perspectives on life and their own augmented body.

This story and the representing probe were developed to show the biggest possible contrast between our current world and a possible healthcare system in a transhuman future: From our treatment and sometimes prevention-based healthcare to a system aimed at making people sick, even depicting illness as desirable. But however far away this scenario might seem, it is an idea based on several aspects often discussed when it comes to transhumanist believes, many of which are pointed towards in current trends and developments.

For one, the strive for a healthy and long, eventually eternal life through augmentation of the human and its environment [50]. Our current healthcare system is focused on treatment, but developments in technologies like gene coding and editing or regenerative medicine increasingly enable the prevention of a variety of diseases [6]. Taking this trend further to an extreme inevitably leads to the fulfillment of transhumanists' vision [50] of humans in whose life disease does not play a role at all anymore. But what kind of healthcare do people who don't get ill need?

Another topic often mentioned when discussing transhumanism is boredom. The above described extension of lifespan and increase in quality of life often raise the question of how transhumans will spend their optimized lives in an (from the perspective of human comfort) optimized world [50]. When nearly anything is possible, what is still exciting, what do people really want to do?

Thinking about both of these aspects, especially in combination with another, brought us the topics of "healthcare for leisure" and "pain for leisure". Healthcare as we know it won't be needed anymore due to the many health-focused augmentations. Hospitals might transform into leisure spaces, offering safe and curated experiences. In fact, many (private) hospitals nowadays already merge with spas to combine necessary healthcare with luxury [28] [3] the global market for luxury health and wellness is growing [20]. The rise of plastic surgery also points towards a trend of (often medically) unnecessary health services [6]. In a strive for unique experiences and

possible adventures, we already do seemingly dangerous and illogical things like bungee jumping nowadays [52] [47], so becoming ill for the experience can just be seen as the next step to that.

All of these pointers inspired the creation of the above described flu spa. In developing a specific scenario for it and the probe to embody it, we chose to focus on the wealthiest part of the population. This follows another topic often connected to the transhuman world: A growing wealth and social disparity [6]. This is happening today already, with extreme examples in healthcare in the United States where treatment costs can be too high for people to afford, often resorting to crowdfunding to access life-saving procedures [1] [24]. This split is often assumed to rapidly widen with the beginning of the transhuman era, where early-stage augmentations at very high costs might bring immense advantages to those who can afford them [50]. We believe that wealth disparity in health care is an interesting topic to discuss, and hope that integrating it into the probe can shed a new light onto the current situation and a possible future.

The described absence of disease in these people's lives which might still be exclusive to them as pioneers of the transhuman revolution emphasizes the wealth disparity in the flu spa scenario and makes it an important part of the story. Focusing on the wealthiest part of the population also allowed us to go to further extremes while building a believable story. Known to often be eccentric [51], this part of the population might be the most believable to actually make use of services like the flu spa which for us nowadays seem totally absurd. The creation of the whole flu spa as a luxury resort resembling a vacation retreat is lead not only by these people's willingness, but also ability to make use of it. The contrast between something so desirable and luxurious as a retreat and the nowadays undesirable, possibly even feared situation of becoming ill is an important part in highlighting the intentional absurdity of the concept, wrapped in a logical story.

By following current trends and developments in technology and society to an extreme, the flu spa represents a kind of opposite of today's healthcare. While this contrast and new perspective might evoke new insights about the current healthcare, the fact that all aspects of the flu spa are based on current developments should also inspire a broad audience to critically think about said current developments.





## **Etherea**

Team members: Nesrin Güneş, Kai Landolt, Lisa Li, Lara Villa

The ethereal paradigm is defined by a belief of a post-biological future. Where the consciousness is valued over all. This is done by scanning, replicating or uploading the mental state (including long-term memory and "self") of a particular brain substrate. The ethereal paradigm characterizes itself from the Greek philosophers, several believes (Christianity, Islam, Hinduism and Jain), western reductionism and the quantum theory [4].

Throughout history almost all human cultures seem to have developed religious or moral sanctions and norms on how the souls and spirits of people are allowed to move, transfer, and operate in the world. Social concerns in earthly life were also apparent in ancient Greek religions, where the purity of the soul influenced who would go through in the afterlife, meaning that the faith of the soul was based on how well the human did in the trials. Not everyone mortal being was allowed to cross over only those with a strong soul [29]. Cognitive science and developmental psychology researched and more or less established that humans instinctively separate mind from matter in their everyday lives [2]. With this said, the interest of transferring our minds is pervasive and is visible in the modern time. This isn't only done by science fiction movies but, tech-companies such as in Silicon Valley whom promises to transfer the mind to silicon-based mediums [29]. The current modern research believes that with enough resources it is possible to examine everything, post-humans see biology as a limiting factor and find getting rid of their bodies a logical step for the next evolution.

Yet currently the word "Health" is mostly related to our bodies, having healthy organs and a strong body. But in a Post-Human society, where your existence surpasses the permanence of your physical self and all that remains is your mind, what would health mean?

## *The ethereal paradigm: probe*

In the post-biological future healthcare is bounded to the society that grows healthy minds in early developmental stages. They strive children to become healthy adults for the construction of a healthy collective post-human future. According to Sigmund Freud's (founder of Psychoanalysis theory) "psychoanalysis", a person's personality is formed in early childhood. A child's life builds a foundation for future health and life successes during its first eight years of life. Meaning that the lifelong impact of early experiences on a child's development can be profound [39].

The probe Healthy Algorithms, focuses on the early development stage of children between 0-2 years see. As research of the Harvard University states "Exposure to neglect, stress and trauma before 3 yrs old can have long-term negative consequences for the child's brain" [8] Healthy Algorithms allows parents to track their children's mental health by brain screening, in order to record and modify brain activity for the post human future. By looking at the three levels of mind by Sigmund Freud, you can estimate that an healthy mind is influenced by context, genetics and experiences [11]. Healthy Algorithms won't be influencing the context, which stands for the environment. Yet it will play a role in the genetics/biological factor and the experiences or so said behavior see.

There have been several studies about Artificial Intelligence (AI), training Algorithms and shape recognition software. One example includes a study done by researchers from Radboud University Nijmegen in the Netherlands [40], where they were able to determine which letters a person was looking at by using brain scan data and a set of computer algorithms. They made us of an artificial intelligence and the deep learning method to teach the system beforehand what letters looked like. The date got extracted from the occipital lobe which is at the back of the brain that reacts to visual stimuli. A similar technique is utilized for Healthy Algorithms. It consists out of a baby monitor and baby hat.

In the chips of the baby hat an AI tracks down the brain activity that gets displayed by the magnetic resonance scanner, which maps out the brain on the baby monitor. If stressor occurs the shape recognition software identifies the stressor (the trained algorithm knows how a healthy mind looks like and bases the stressors on that image), which gives the parents the option to influence the development of the brain of the child or as said it offers parental advice.

Would you trust an AI to make parental recommendations in the best interest of your child?





## Emerging Future Insights

During the Dutch Design Week (DDW) 2018, the four probes were presented at the Embassy of Health for a whole week. Visitors from all over the world, from experts to parents with their children, visited the exhibition. It was estimated that around 10.000 visitors passed through the exhibition. Some visitors that were spoken to gave valuable insights which were noted down. The retrieved insights are shown in Appendix B.1.

To categorize the sentences a coding scheme was established to understand what the visitors found the most intriguing and questionable about each paradigm. A general impression of visitors was that they found all the probes and the worlds they were in interesting to think about. A visitor stated "It's a great look into the future".

Each paradigm showed different insights gained by the visitors of the DDW, in the Gaia paradigm visitors were mesmerized by the eco-centric healthcare where the healthcare involves people and the whole ecosystem. Yet as the world is evolving itself now, visitors questioned why doesn't a machine analyze the smell alone? A visitor stated "If the machine analyzes it for us, why does a human need to wear the mask? It's an unnecessary step in-between". For the Habitania world, where resources were shrinking and the population kept growing, visitors felt like they were enforced into the system. They said if this would be the future healthcare then they would want to have several options to choose from. In the transhuman society, where only the top 1% of the population has access to the new healthcare system, visitors wonder why only them, why aren't there equal rights so everyone can make use of the system. In the post-human paradigm, where people strive to reach immortality by uploading their mind, visitors stated that they found it scary in the sense of what happens if the AI takes over? And how fair is this for the child? He or she doesn't have the right to speak whether they would like to conduct the system or not?

With the insights and coding scheme, different themes arose as possible directions for the new probe, which can be found in Appendix B.2. Most retrieved insights were related to the themes: society, control, ethics and individuality. Which led to six possible future directions to work in, see appendix C. Discussing the future directions with Reon Brand and Caroline Hummels on 23th of November led to following approach; Retrieving the perspective of all four future paradigms to create a design probe for the now.

## Second iteration

Preventive healthcare is defined as the healthcare that you can receive to prevent illnesses or diseases. It includes services like counseling, wellness visits, screenings etc. [21]. The right preventive care can help anyone at every stage of their lives to stay healthy and avoid or delay the onset of diseases. Despite knowing this often people go without needed preventive care [9]. When looking at the developing society, it is noticeable that environmental problems have gone up at an alarming rate. As the decisions the society globally makes isn't in favor of protecting the planet [38]. Which is quite interesting if you look at what visitors during the DDW stated. Most visitors were positive about the Gaia paradigm where society and nature worked together, and would want to see this back in the current society. When linking this to preventive healthcare there is an interesting patterns within the society now. On one hand the current society doesn't try to stay healthy by itself (or so said tries to prevent themselves of getting ill) and neither does it help to keep the environment they live in well. Although a lot of campaigns have been held regarding this matter, the society hasn't been moved to the point of transformative social change. A reason for this might be a negative stigma around focusing on health and a relationship to nature in ways that deviate from the societal norm, such as following a certain diet. So how do you switch the mindset of a society? Or create changes in



thoughts and actions of people?

Currently the healthcare system focuses on analyzing and diagnosing a certain disease, and not on preventing an illness. This is mainly due to the fact that preventive healthcare isn't seen as lucrative for companies. Marketers must convince consumers to change their lifestyle, the challenge is to design creative interventions that persuade consumers to embrace healthy lifestyles [7]. Thus the challenge in the probe lays in how to design something which would be provocative enough to challenge the way how the (western) society thinks about preventive healthcare in combination with the four future paradigms perspectives retrieved from the DDW insights.

## **Related work**

### **Influence of the gut**

The gut is home to part of the human microbiome, and hosts ca.  $10^{14}$  microorganisms, such as bacteria, fungi, viruses and protozoa [44]. While the microbiome within each body is very diverse, it also differs greatly between different people, accounting for many differences between individuals [17]. The differences in the microbiome are in part based on a person's genotype [44] and factors like exercise [33] or medication [17], however someone's diet seems to play the most significant role, and is able to lead to shifts in the microbiota within 24 hours [44].

This intestinal microbiota fulfills many beneficial functions in the human body. As part of the gut, it influences the metabolism [14][17] and plays a crucial role in digestion by synthesizing vitamins and essential amino acids, as well as digesting components to human body isn't able to digest, which produces beneficial byproducts [44]. It can also influence physical factors such as body odor [17], inflammation levels [12] and athletic performance and recovery [12][46]. Even the type of sport which an athlete plays could be linked to certain microbes [46], illustrating the mutual influence of gut flora and certain types of exercise might have on each other. The intestinal microbiota is part of the human immune

system [49] and develops and educates other parts of the immune system [17][27]. A balanced gut flora is critical to the health of the whole immune system [44]. It plays a crucial role in determining the risks for chronic diseases like inflammatory bowel disease, obesity, type 2 diabetes, cardiovascular disease and cancer [44][27]. Many of these diseases are connected to a low diversity, disruption or imbalance in the microbial community [44][17]. In fact, the microbiome might be more influential on health factors than the genomes [27]. It also determines whether certain medication works or is even toxic for an individual [27].

The gut flora also plays a role in the development of for example autism and mood disorders like depression and anxiety [44]. This can be lead to its (bidirectional) connection with the central nervous system and brain – the so-called gut-brain-axis. Hormones, neurotransmitters and immunologic factors produced in and released from the gut communicate with the brain directly or through autonomic neurons [27]. This way, the gut microbiota can also affect one's stress resistance [12], pain tolerance, cognitive performance, mental clarity and even moods, attitudes [46] and behavior [17][46].

### **Early development of the gut**

The human microbiome consists of a combination of bacteria, archaea, viruses and eukaryotic microbes that live in and on our body. As mentioned above, the human microbiome influences the body on many levels and has been considered as the second brain of the body. The establishment of the microbiome has been associated with later health and diseases. This establishment takes place until the age of 3. Whereas the exact window of establishment is still debatable, there are three important moments in early life that have great impact on the creation of a human's gut microbiome and the healthy development of children [31]. The first stage is at birth, where the gut microbiome is affected by the mode of delivery and the microbiome of the mother. The second stage is influenced by breastfeeding, the use of antibiotics and the living environment. And lastly, the third stage is

focused on the change of breastfeeding towards solid foods [53]. Having said this, it should be taken into account that the infant gut microbiota has a high degree of instability. It certainly matters whether an infant is delivered vaginal or caesarean, breast or formula-fed, which feeding patterns are used, as well as how and when solid food is introduced [48].

This project focuses on the above mentioned third stage. Dietary changes are known to influence the adult gut microbiota. However, there is only little research done on how diet influences the gut development of infants, while this is such an important period in relation to future health. The few studies addressing the diet of infants in combination with the establishment of the gut microbiota show the great importance of further research in this field. Several studies show that this topic must be addressed more as foods greatly impact the development of the gut [31].

#### **Characteristics and the gut**

The construction of the human microbiome has tremendous potential to impact on our physiology. The microbes contribute to the metabolic functions, protect against pathogens, educate the immune system and other physiological functions [43]. Besides this, the microbiota has a great influence on epigenetic processes due to a group of bacteria that produce Low Molecular Weight (LMW) bioactive substances, which participate in epigenetic processes. These LMW substances bring about epigenetic modifications such as changes in DNA methylation or indirectly act in activation or inhibition of certain enzymes that influence the expression of human genes [36].

It was also found that modifying microbiota through probiotics could be an important therapeutic tool in improving athletes' overall general health, performance and energy availability [32]. This again is due to the influence of bacteria on several physiological processes in the body, for example: the energy metabolism. An

example of modifying the microbiota is shown in a recent observational study, where the fecal bacterial profile of male elite rugby players was compared with non-athlete healthy subjects. The study showed that athletes had lower and higher levels of certain bacteria, which was concluded to be a healthier gut microbiota [13].

Another research that draws attentions is how the gut bacteria called Christensenellaceae minuta is associated with being slim. In this research the fecal samples of 416 twin-pairs were analyzed and it showed that this bacteria and related ones were enriched in the individuals with a low body mass index [18].

There are many more researches that address the influence of the gut microbiota on the functions and characteristic of the human being. One of the main influence is dietary. In 2015 a systematic review was conducted in order to map the effects of several common dietary components on the microbiota [45]. An example of this effect is the positive influence of fermented food on cognitive functions in the brain [26]. An overview of types of food and their influence is found in Appendix D.

## **Oh crap: I gut my future**

'Oh crap: I gut my future' attempts to make people aware of why preventive healthcare is important and how we can learn to work together with nature and our body itself. This is done by focusing on developing an ideal gut flora for a baby which lays the foundation for a successful life, by looking at the gut flora of idols. It was mainly inspired by an article [41] which shows a new study where scientists at the church lab at Harvard medical school identified gut bacteria that could help others improve their internal microorganisms and cultivate internal physiological traits that enhance athletic performance. The gut bacteria plays a crucial role for the health, personality and behavior of a person. Their foundation is built before the age of two [31] and affects the person throughout their whole life. By connecting certain (health) benefits based on the gut microbiome to popular idols, possible stigmatization can be overcome, making a health-focussed lifestyle desirable instead. The probe consist of several parts that profoundly show the effect of the gut flora on the human body. It starts where the child's feces gets analyzed through AI in the smart diaper. Currently there are several researches regarding AI to detect diseases such as Alzheimer, or designs such as the pet care monitor by Sharp (a company that uses innovative technology to improve the welfare of people throughout the world) [3] which analyzes a cat's urine for health issues [23] or the crowdfunding product of Pixie scientific (a company that aims design products which improve the lives of people) [37], a smart diaper that shows signs of possible diseases based of the urination of the child. As the AI analyzes the feces, the monitor displays the gut flora and list of bacteria of the child that are present in his/her body. This gives parents the option to pick a desired health improvement based on a certain idol. As the bacteria is selected, the interface displays the nutrition needed to grow the bacteria over time. Parents retrieve the necessary nutrition and put them in the attached blender to prepare the baby food. As the baby is fed, over time by

analyzing the child's feces it will be noticeable that the bacterial flora changes.

The challenge was to make people aware of preventive care, by implementing the four future paradigms perspectives gained from the DDW insights. The probe (Oh crap: I gut my future) shows the cooperation of the human with its nature, the accessibility for everyone and the choices parents can make within the probe. During the Demo-day (which is a day where all Industrial design students present their probes/products they worked on during the semester) that was held at the Industrial design faculty of Eindhoven University of Technology, the probe was an eye catcher for the public. A lot of visitors were not aware of the functions of the gut flora or of its principle, and that preventive care starts with ourselves. Visitors saw the value of preventive healthcare in a way they hadn't seen before and gained more interest in the gut flora. Most of them initiated to research more about the gut.

So what are you waiting for, you gut your future!



MEL. INTORSA BIR

EMALT. INDIK. PRODU

- Bele antidy
- Bele nytra
- Bele otit ak end. Dumb.
- Ura bdy
- Bele summatulak

- Belasat kumul. chokk
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Luputur

### **Project insights and discussion**

In this project, four future paradigms were explored by using Design Fiction in order to provoke debate on healthcare in the future, which resulted in four design probes. Thereafter, a new design probe placed in the current world was created, based on the insights of the debate about the four probes and future paradigms.

This process created a new way of designing by taking on a different perspective. In the first phase of probing, the four project members were divided onto the four futuristic paradigms, subsequently they worked together on the final probe. This resulted in different mindsets and views on the second phase of the project. In this case not only the insights of the debate were included in the final probe, but due to the deeper understanding of the future paradigms, the members sort of became part of the paradigms. In our opinion this approach of looking onto and drawing from a future paradigm can have great influence on designing meaningful products which prepare current society for the future.

Secondly, throughout the project we had our expectations on how people would react on the different probes, whereas in some cases this surprisingly was the opposite. This was not only confronting, but also ignited many debates at the Dutch Design Week 2018. An example of this was in the paradigm Etherea, where the expectation was that the technology would scare people or be seen as taking it too far. Still, there were people very convinced of this concept, as they reasoned that the human race should evolve, just as the world is continuously evolving. This was a clash with the beliefs and views of some members of the group, but also brought more understanding of society and the complex dynamics of it.

For the final probe, we constructed several goals. One of the goals was to provide people with a new perception on preventive health care. One of the best ways is to care for your gut microbiome, as it has a strong positive influence on your health. In current society, there is a certain stigma on diet. Our group members have all experienced

negative comments on the fact of being conscious of food, being vegetarian, eating halal or even supporting alternative healthy diets. In the final probe we tried to create a certain acceptance around this, by using topics that people find interesting, funny or can relate too. At the Demo Day, we saw that many people were very positive about the idea of preventive health and there was definitely a noticeable shift in perception. However, in order to confidently conclude something from this, it should be exposed to a larger and more mixed variety of crowds.

At the Demo Day, several companies visited the stand and expressed potential interest in the concept. A member of 040Verloskundige was intrigued about the concept as a lot of mothers have questions regarding this subject, whereas midwives feel pressure on transferring knowledge towards the mothers. A product like this could take pressure of the subject as it gives direct knowledge of what happens with the baby, when certain food is given. This is of course a sensitive topic. Should we give babies probiotics and is the current knowledge on food for babies sufficient?

Lastly, we would like to address the discussions which emerged at the Demo Day. A couple of people questioned the feasibility of actually connecting back to nature and the opportunities to create a healthy body in the current society. Many food products are processed or altered with chemicals that could negatively impact the human microbiome, so people questioned how they could bypass this problem. Several questions arose: Should people grow their own vegetables? What about the influence of air pollution? How to create a healthy environment for a baby?

## Conclusion

After exhibiting the first four probes at the Dutch Design Week and the fifth one at the Industrial Design Demo day, many interesting discussions were held with members of the public and useful insights were obtained. By showing the probes to the audience, we tried to emerge people in a currently non-existing but possible future world. One interesting conversation during the Demoday was with a group of people within an organization that prepares pregnant women during their pregnancy. These employees were very interested in how babies could be fed in a healthy way. One other visitor mentioned how happy he was that Philips actually did research about possible futures and the opinion of 'the crowd'. This showed the importance of design fiction for big companies that give visitors a small peek into the future and capture people's opinions.

During the design process for the final probe, the gut scanner, we got into new, emerging worlds of health, the microbiome, children's upbringings, and more. The major developments and breakthroughs in the medical world, related to microbiome and, especially, the gut, were new to us and showed the opportunities that lie in this field. According to scientists, understanding the microbiome may be key to understanding and treating many common health problems. The interesting conversations with visitors confirm that this field might be very interesting for further research.

Future healthcare designers might use the design process and insights described in this report as input for their own research towards future healthcare products.

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