Pride & Prejudice

Pride & Prejudice is an initiative of the 4TU.Foundation

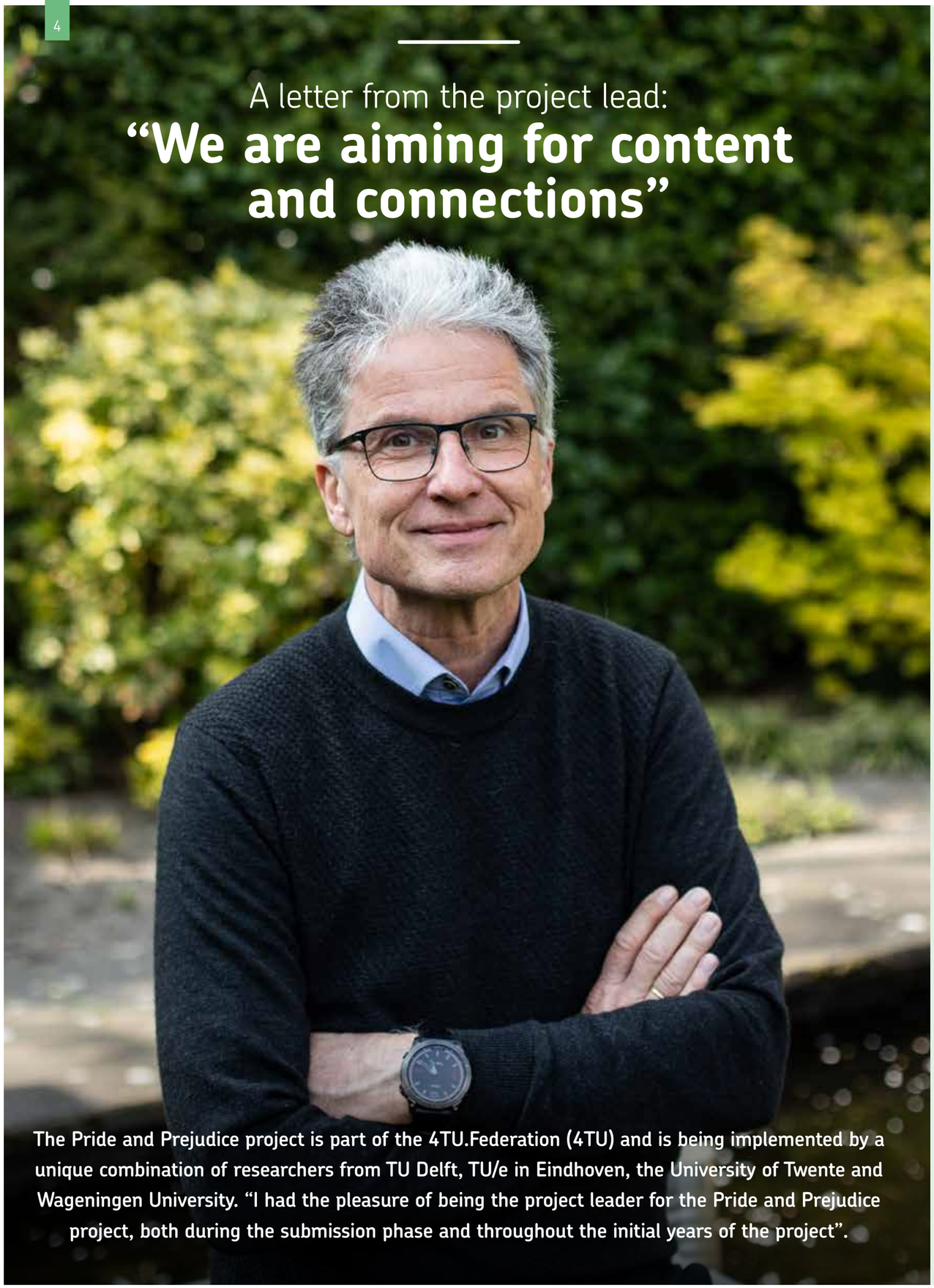
TU Delft · TU/e Eindhoven University of Technology · University of Twente. · Wageningen University & Research

the recipe

and many more

A letter from the project lead:

“We are aiming for content and connections”



The Pride and Prejudice project is part of the 4TU.Federation (4TU) and is being implemented by a unique combination of researchers from TU Delft, TU/e in Eindhoven, the University of Twente and Wageningen University. “I had the pleasure of being the project leader for the Pride and Prejudice project, both during the submission phase and throughout the initial years of the project”.

When you delve into this magazine, you will see that the Pride and Prejudice project consists of two components: content and connections. Great research has been done and valuable results obtained. The process was often a journey of discovery, which was complex too – because of the COVID pandemic, which really did put a spanner in the works for a while. However, the virus also highlighted the importance of our ambitions.

Let me take you back to February 2020. We were in one of the first Pride and Prejudice project meetings when I was suddenly called away. Something about a COVID virus. And about a lockdown in the worst case scenario. But we were also reassured that this was a grim scenario that wouldn’t materialise. Well, we now know better and the rest is history.

The ambition we had of frequent visits with each other went straight out the window. Everyone was stuck at home and struggling with the restrictive measures. When these were relaxed, we found that a certain modality had crept into the field. And in the way we worked with each other. Meeting up with each other was no longer the norm. We continued to seek each other out via Teams. Is that a shame? Perhaps, but we also realise that online meetings have opened a lot of doors as well.

The challenges we have faced in recent years have made it all the more amazing that the Pride and Prejudice project has managed to build bridges. The connections between universities are better than ever and substantive connections have been established that will be valuable for the future. To create a healthier society.

When we consider this ambition, it is - again - impossible to ignore COVID. You could actually say there was a double pandemic. On the one hand, the flu-like symptoms that make people ill and can even be deadly. We, as a society, have little control over symptoms like these. On the other hand, there is a group of people who have been hit undeniably hard by health problems and lifestyle diseases like diabetes. These are problems and diseases that we as a society are able to influence.

At the Ministry of Health, Welfare and Sport - where I am a member of the TopTeam Sport and Exercise committee - we can see a lack of physical activity and healthy living among young people. Their unhealthy lifestyles are making them more susceptible to diabetes, cardiac problems, cancer and other diseases later in life. This is one of the biggest problems that the Netherlands is facing now and will continue to face in the future.

Within the Pride and Prejudice project, we have made a good start at getting people to do more physical activity and eat more healthily. Wonderful networks have been created and valuable insights and projects initiated. But we’re not there yet. We have proved that much is possible where technology is concerned. Now we have to make sure that this becomes embedded in society.

It will be particularly challenging to reach people in deprived areas, which is where the most health gains stand to be made. This is why it is important not just to bring together food science, technology and design but also create a connection with social science. To do this, collaboration with universities that specialise in this sociological field will need to be broadened. The basis for this has been established via the Watertoren sport and physical activity cooperation platform (*Watertoren Sport en Bewegen*), in which we work with 12 universities, universities of higher professional education (HBO) and senior secondary vocational education institutions (MBO). Thanks to the Pride and Prejudice project, the seeds have now been sown for cross-domain collaboration. The bridges have been built and the support is there. And most importantly of all: The urgency is clear throughout our society. There’s work to be done!”

The urgency for cross-domain collaborations to create a healthy society is clear, there is work to be done!

About the name: Pride & Prejudice

During the first brainstorming session, the name of the project was brought up for discussion. Someone suggested using the title of a novel by Jane Austin: Sense and Sensibility. But it looked suspiciously like Philips' old slogan. A little later in the brainstorming session, someone mentioned the title of another Jane Austin novel: Pride and Prejudice. Initially, the idea was not taken seriously and was met with some laughter. However, it gradually became clear that the title was a very strong contender: it matched the content of the project and was a good alternative to the often abstract abbreviations chosen for projects like this.

We concluded that Pride and Prejudice was a suitable name for this project, which aims to improve people's lifestyles. The two main words in the title refer to important emotions that are often experienced when changing an eating and/or activity pattern in order to gain a healthy lifestyle.

Prejudice:

Someone with an unhealthy lifestyle, or with a lifestyle disease like diabetes, cardiovascular disease or obesity, will be on the receiving end of prejudice. Often, people who are overweight are stigmatised as lazy or incapable of any self-control. Prejudice comes from people at work, on the street and in shops. Even from people who ought to be supporting the individuals in question, like family, friends, doctors and nurses. And even the researchers who are trying to understand them. Prejudice is also relevant when considering the barriers people have to overcome if they want to make changes to their lives. For example, fixed ideas about what foods are (not) appropriate for us to eat ("I don't eat salads; I'm not a rabbit", etc.). And also patterns that have become ingrained in our lives. For example: "As a housewife, it's my job to make sure everyone gets enough to eat". These prejudices can stop us adopting new, healthy behaviour.

Pride:

People who decide to adopt a healthier lifestyle feel pride. By giving these individuals the right tools, they will feel more powerful and vital. Their sense of self-esteem and pride will increase when they take the first step towards change and the achievement of their health goals. They can proudly show their family and friends the progress they have made. Their support then acts as a catalyst for individuals to persevere. And as motivation for others to do the same. We also hope that the researchers are proud of the new tools they develop during the project. These devices and interventions are a more than welcome support in the transition to a healthier lifestyle. Finally, participants should be proud of their contributions to this important research, which will benefit society as a whole.

Taking a firm stand together in 4TU

Rick Schifferstein: "The 4TU.Foundation (4TU) enables the universities in Delft, Eindhoven, Wageningen and Enschede to work together, get to know each other and also take a stronger stand as an alliance consisting of four institutions. Naturally, we hoped that we would work together intensively as a unit in the Pride and Prejudice consortium for many years to come. Unfortunately, reality does not always play ball. You can't force a large-scale alliance like this. Firstly, because some researchers have not had hours freed up for them to participate in the consortium. Everyone has commitments and their own agendas outside the consortium and other interests, that lay claim to their time. Because of this, the collaborations that develop are mainly small and often personal. There are many small clusters, often consisting of just two or three people, in which individuals work together on specific projects."

So, has the consortium been one big, collaborative entity? No. Partly because the coronavirus pandemic threw a spanner in the works and put a stop to many meetings. But have the boundaries between the four universities blurred? Definitely. Many great collaborations have developed between Delft, Eindhoven, Wageningen and Enschede. We got to know each other better and are clear about the potential of what we can accomplish together. In short: the network has expanded and we now know how to access each other much more easily, following the completion of the collaborative projects initiated as part of the consortium. So, the Pride and Prejudice project lives on.

‘It has always been notoriously difficult to measure eating behaviour’.

The 4TU Pride and Prejudice project is changing this.

Although obesity is a serious threat to health in prosperous countries, it is proving difficult to do anything about this situation. Physical activity and diet, the two most important factors for a healthy lifestyle, are both difficult to improve and measure in the long term. With this in mind, the Pride and Prejudice research project is focusing on the development of various interventions and on monitoring, measuring and evaluating the long-term effectiveness of these interventions in daily life.

“We observe what people do and are also making technology more intelligent, so that it can help people change their behaviour in a positive way,” says one of the founders, prof. Dirk Heylen, professor of Socially Intelligent Computing at the University of Twente.

The object of the project is to generate new scientific knowledge and innovative technology and, by doing this, improve people’s lifestyles: by monitoring people with sensors, by developing design interventions and by evaluating the effectiveness of these interventions in the long term. Examples include a chatbot coach that can make it easier for diabetics to interact with others in socially awkward situations, a table with built-in weighing scales and sensors that can be used to study people’s eating behaviour in a social environment and smart digital interventions that present consumers who are shopping online with a healthier or more sustainable alternative at the appropriate time.

Pride and prejudice

The project owes its name to the Jane Austen novel Pride and Prejudice. The name of the project refers to the prejudices that many people face. People who might be suffering from lifestyle diseases like diabetes, cardiovascular diseases and obesity and who are struggling to maintain a healthy lifestyle. The word ‘pride’ refers to the emotions these individuals experience when they decide to make the changes that will help them live healthier lives.

“Giving people the tools they need to improve their lifestyles will empower them and make them feel more energised, which will then also improve their self-esteem and pride,” says co-initiator prof. Kees de Graaf, now a retired emeritus professor of Sensory Science and Eating Behaviour at the University of Wageningen.”

Major social themes

“Diet, physical activity and health are major social themes,” De Graaf explains. “It is an emotional and loaded subject, about which many prejudices exist, and there are 17 million nutritionists who all know better. “The fact that we jump to conclusions is a problem too,” Heylen adds. “People are quick to say what you can and can’t do or eat. Food is rejected or approved on the basis of arbitrary criteria. People are publicly judged on their eating behaviour and pronounced too fat, too thin or too skinny. Eating is no longer something we all do to survive; it has become a social theme. Is it morally responsible, has it been sustainably produced, does it contain too much fat and is it too sweet or too salty? All of a sudden, everything we put in our mouths starts a discussion. Even a tomato grown in a greenhouse in the Netherlands is a hot topic these days.”

New ways to monitor eating behaviour
"The problem of establishing what and how people eat is hugely underestimated", De Graaf continues. "There are all kinds of questionnaires and 24-hour recalls that you can use to ask people to keep a record of everything they eat on a particular day, but it's never really accurate. It is notoriously difficult to pinpoint what, how and how much people eat. People forget things, are afraid to say everything and give socially desirable answers."

So, when we learned about this 4TU consortium, it became clear that we could use technology and innovative techniques to approach and solve this problem without having to bother people at all. We would be able to obtain measurements that were more accurate too. Suddenly, there was the potential for new ways to identify and monitor eating behaviour."

A lot of potential
"The idea came about in 2017 and we launched the project two years after that," De Graaf says. "The possibility to collaborate with other universities had huge potential. Wageningen knows a lot about nutrition and technology, but there was an almost complete absence of any connections between them and research into behavioural change." Heylen: "Nutrition, Technology, Well-Being and Behavioural Change: these were the topics we wanted to work on together and we suddenly found ourselves with a huge open playing field at our disposal, plus four technical universities with all kinds of faculties and departments with different perspectives."

"Kees and I focused mainly on the eating aspect," Heylen says. "dr. Aarnhout Brombacher from TU/e Eindhoven focused on physical activity and behavioural change. So, everyone had their own areas of expertise. The challenge was to see how we could work together to make the world a better place in this respect. We then had to appoint tenure trackers (young researchers) from the four universities who are aspiring to futures in this field."

A lot of collaboration
"It's very special to see that people are still developing their thoughts and ideas and continuing to work with each other, even though the project is now over", Heylen continues. "A number of projects are still underway and new ones have been launched as well. For example, research on the swallowing behaviour of babies is now the subject of follow-up research. "This project was a great way for us to get to know each other", De Graaf says. "For the researchers and the universities. We were in uncharted territory, having collaborated very little previously and having few shared agendas. The benefit of universities working together requires no explanation. So, the opportunity being created by 4TU was very welcome. We have had an open line of communication with the other universities ever since.

Heylen: "With the future in mind, we could see what else comes of the project and what else we can promote together. Initially, the tenure trackers will need to secure their careers. It would be a shame not to support them anymore and leave them to go their own way alone."

Inspiring and intellectually satisfying
De Graaf: "The innovation, confrontation and new ideas you would otherwise never have come up with because you would have been limited to your own field and perspective: all this was inspiring and intellectually satisfying. This approach is necessary too because it is the only way for society to move forward. The connections created are extremely important."

"The great thing about an alliance like 4TU is that it confronts you with a different way of working and thinking and shows you that you can exchange ideas about it with each other," Heylen says. "To me, this is exactly what science should be: not writing a paper alone in a room but going out for dinner together, sharing ideas and developing new alliances by doing this."

Expanding your horizons and discovering new approaches
De Graaf: "It really has been very successful. A collaborative project like this can be likened to a seed that grows and then blooms. You are less likely to be successful if you work solely with your own research group and stick to your usual approach. Because you will be casting your nets far into the distance but not widely around you. A collaborative approach enables you to expand your horizons and discover new approaches, which are badly needed in this field."

"The problem of establishing what and how people eat is hugely underestimated"

The Pride and Prejudice project:

Tackling chronic disease prevention through real-life monitoring and context-aware intervention design

As a society, we are working hard to look after our health and maintain our vitality. Are we succeeding in our efforts? Not really. This is evidenced by the growing number of people with lifestyle diseases. It would appear that the large scale embracing of a healthy lifestyle is a complex and challenging process. This situation prompted four universities – Eindhoven, Enschede, Delft and Wageningen – to join forces in the 4TU.Federation (4TU) to take up the gauntlet and address this issue.

Focusing on diet and physical activity

Physical activity and diet are two key lifestyle factors for sustainable health and both are closely linked. Increasing energy expenditure through physical activity and reducing energy intake by reviewing one's diet promotes weight loss. However, inactivity and poor nutritional behaviour are both influenced by an interplay of personal, social, cultural and societal circumstances. In our affluent society in particular, people find it a huge challenge to stick to a healthy diet and combine this with regular physical activity. Food is abundant and available 24/7 and people are constantly tempted by marketing campaigns. For these reasons and others, many people find it impossible to change their habits. The most successful attempts to change people's behaviour involve combined interventions in multiple settings (at home, school and the sports club) and focus on target groups rather than individuals.

New scientific knowledge and innovative technology

Physical activity and diet are difficult to measure. Most studies rely on self-reporting, from which it is difficult to obtain reliable and valid measurements. Memory bias and socially desirable responses are common when reporting various aspects of food intake and physical activity. As such, objective measurements are urgently needed to facilitate a better insight into actual behaviour. We also need longitudinal measurements because health effects typically occur in the long term.

The Pride and Prejudice project aims to generate new scientific knowledge and innovative technology in the fields of diet and physical activity and then create new frameworks for:

- systems to remotely monitor health parameters and behaviour
- interventions that convince people to adopt a healthier lifestyle

Why Pride & Prejudice?

Pride and Prejudice project was the brainchild of a number of different disciplines. For dr. ir. Rick Schifferstein, it started with the ambition to design interventions that help individuals learn healthier eating habits. Rick: "Efforts to get people to make lifestyle improvements are not new. And let's be honest: we haven't been having much success. Despite all efforts to stop it, people are getting fatter. Lifestyle diseases like diabetes and cardiovascular diseases continue to be a major challenge. Turning the tide on this situation has turned out to be complicated. This complexity was the trigger we needed to get started on the project."

"Efforts to get people to make lifestyle improvements are not new. And let's be honest: we haven't been having much success."

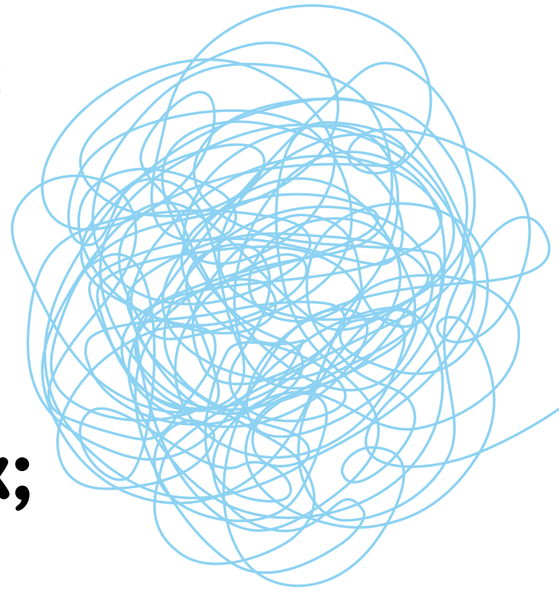
"During a 4TU matchmaking meeting, it became clear that researchers from the various Dutch universities of technology shared the same ambition. Meetings like this can be compared with a dating platform on which people are matched on content. They are designed to enable researchers to become part of valuable collaborations that tackle an issue from different perspectives, to enable people from different technical universities to get to know each other better and also to learn from each other's expertise and see how others complement them."

"After this meeting, we created a consortium made up of all kinds of people from relevant disciplines, ranging from researchers and designers to technicians and marketers. We thought it would be a good idea to unite all the relevant worlds, exactly in line with 4TU's philosophy of looking beyond your own borders. The trend in the academic world for consortia to try to find external funding for their research should not be forgotten either."

"After the matchmaking meeting, everyone involved gave some thought to what they wanted to tackle together. Everyone shared their ideas about what they wanted to research. The main goal was already quite clear: lifestyle interventions to get people to eat more healthily and do more physical activity. This goal has been translated into the following work areas:

- real-life **monitoring** via sensors (food intake, physical activity and health parameters)
- **The development of design interventions** at different levels of the system (person, group and society)
- **The evaluation** of the effectiveness of these combined interventions in the longer term

The problems the world is facing are becoming more and more complex;



the answer to them often lies in collaboration

dr. Indre Kalinauskaite was involved in the 4TU.Foundation (4TU) Pride and Prejudice project as a consortium coordinator, the chair of the Tenure Core Team and a member of the Flow research team. The project showed her that collaboration is the way forward for future science, especially future science with a social impact. The project also taught her that collaboration is not something that comes naturally, but that you can create the right conditions for successful collaboration.

Today's social issues are too complex to solve alone, but collaboration is not self-evident. This makes collaboration beautiful but sometimes difficult too.

Collaboration means something different for everyone involved

The Pride and Prejudice project was launched in the first year of the coronavirus pandemic. Clearly, this was not the easiest time for people to come together. Before the pandemic, we thought that everything had to be done physically; we gradually learned that it was possible to work online as well. However, virtual meetings do sometimes stand in the way of real group dynamics. It is difficult to develop close collaborative relationships remotely. Relationships need warmth and attention to grow. This is especially true in our project, which involves a wide range of different people, who need each other's knowledge and skills. Many doors opened during the Pride and Prejudice project; doors that we didn't even know existed before. Many bridges have been built between professionals who stand to benefit greatly from the knowledge they have to offer each other. Being someone with a psychological back-ground, it was interesting for me to see how different people define 'collaboration'. It varies significantly from one person to another. Some researchers feel that collaboration is achieved simply by a number of individuals putting their names under a proposal.

For me personally, collaboration involves much more than this. It means working through the entire process together and learning from each other. Sharing knowledge and making compromises. It can sometimes even involve giving up something that is very dear to you.

We have a duty to contribute to society

Transparency and knowledge sharing are crucial in the event of societal challenges, which are being more and more complex and fragmented. Don't get me wrong: it really is important to conduct research on fundamental issues in mono-disciplines. However, as researchers, we also have a duty to contribute to society and create value for the world by answering complex questions together. About health, for example. You need different fields of knowledge to be able to do this. Knowledge about the healthcare system, human psychology, engineering and the medical field ... Everything comes together in a project like Pride and Prejudice. The art is to both combine and share knowledge and also to adapt to the standards of another scientist. You have to be flexible. To be fair: this is something that many researchers are still finding difficult.

Open to other worlds

When I switched to the field of psychology, as someone with a mathematical background, I was confronted with just how different both fields are. I saw how difficult it is to quantify human feelings, behaviours, and wishes. Especially outside a laboratory setting, in the real world, or in so-called living labs. Living labs confront us with the true complexity of the real world. They show that the measurable effects of our interventions are very small; ecologically valid but very small. This can mean that you suddenly find that your findings are less strong, which is something you have to be able to deal with as a researcher - especially if you always use the same approach. It is vital to be open to experimenting with new theories and methods, learning from and with other disciplines, which is usually a sign of good collaboration between researchers. I think this is a situation that many researchers have been confronted with in the Pride and Prejudice project in recent years. That's progress. Both for the universities and for us as researchers as well.

The Sensory Interactive Table provides an insight into social eating behaviour.

Friends have invited you to dinner, but you are watching your calories. That’s a difficult situation. How does someone manage to monitor personal goals when faced with a table full of food they had actually wanted to avoid? You’ll put your good intentions on hold just this once, right? Do you subconsciously start to eat faster when everyone else does, so that you’re not the last one left with a full plate? Do you usually serve yourself more pasta than vegetables and wonder who will grab the last croquette?

The Sensory Interactive Table (SIT) was developed to measure these and other aspects of eating as a social activity without disrupting the positive experience of being together.

Add a tablecloth and it looks just like a normal, round, six-person dining room table. However, the top of the SIT has been fitted with all kinds of technical gadgets, including 199 built-in weighing scales and 8,358 coloured LED lights, all of which can be controlled individually. The object of this special piece of furniture is to study the eating behaviour of people in a social environment. “The table was ready when we presented it; the research wasn’t. There is still so much to learn”, says inventor dr. Juliet Haarman, a researcher at the University of Twente. “This will keep academics busy for years to come.”

Promoting health and vitality

Haarman developed the instrumented, interactive dining table in 2019 with dr. Roelof de Vries, a behavioural change researcher, and technology and former Interaction Technology student at the University of Twente, Emiel Harmsen. In the same year, the table was presented at the Dutch Design Week event (DDW) in Eindhoven. The table is perfect for the Pride and Prejudice project, which aims to promote health and vitality. The involvement of the four technical universities provided the technical component. De Vries: “Naturally, as academics, we wanted to know how we could use technology within this theme.”

“Many nutrition apps focus on the individual”

“Almost all tools that record nutrition intake and promote responsible eating focus on the individual,” Haarman says. “For example, apps and dieticians focus on what someone consumes throughout the course of a day. In my opinion, this is a mismatch. It certainly is when the aim is to influence eating behaviour. - when the starting point is influencing eating behaviour anyway. People often eat their meals with others and interventions do not usually take this into account.”

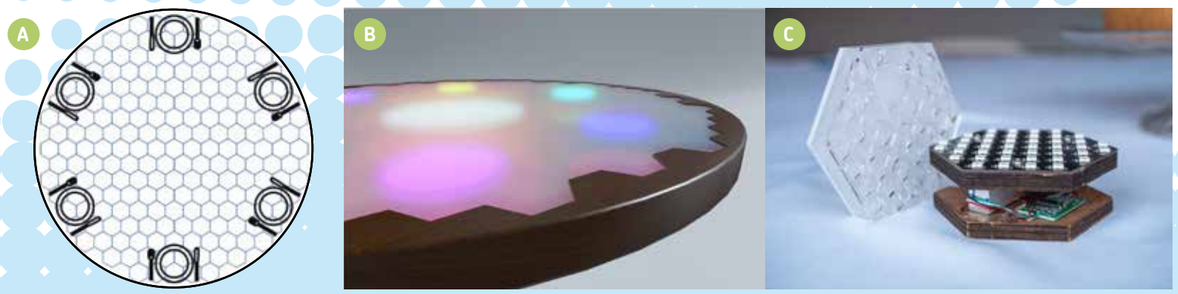
“Knowing how someone eats when they are in the company of others is important information,” Haarman explains. “Food has a social aspect. It becomes even harder to maintain desired behaviour when you are in a group. People often influence each other subconsciously. If you can show this, you can anticipate these situations and give people tools they need to help them change or adapt their behaviour. “Suppose you want to eat with friends or family, but you are on a diet. It’s difficult to say anything to your friends or family because no-one wants to be difficult. (Real or imagined) peer pressure may often make people decide to say nothing. We want the research we are doing to make people, who have their own individual goals, feel they have the support they need to achieve their goals at all times. They then just need to be aware that they are doing it.”

“Amongst other things, the table enables us to support people by reminding them of their goals. We do this by presenting them with something via the LED lights,” De Vries explains. “Suppose you want to eat slower. We could literally project a counter and a mouth that is chewing slowly, or, more metaphorically, a beating heart that people can use to synchronise their eating rhythm with. We can also help people remember not to eat certain foods. For example, by making a red arrow appear around these foods, or by highlighting other foods more.”

Sensor-based interventions

“We use sensors to register (and measure) data,” De Vries says. “The table measures weights via a number of small weighing scales. We process this information and then translate it into feedback to the user via LED lights built into the surface of the table. We are able to gain an insight into a number of things, including eating speed and the amount or type of food. The type of food will need to be entered in advance, but the weighing scales under the relevant pan register the decrease in volume, by exactly how much and onto which plate the weight in question is added. This is then also translated into behaviour in the context in question. For example, by registering the fact that someone starts to eats faster or slower when everyone else does to avoid being rude. When you understand what is happening in a particular situation, you can come up with an intervention to help the person in question and motivate them to eat more healthily or slower, for example. The table itself is not the solution;it just registers information.” it just registers information.”

Haarman: “The insights we gain from our findings can lead to various interventions. Simply making people aware of what they are doing can be a good way to set behavioural change in motion. This could be achieved, for example, by having a red circle appear on someone’s plate that gets redder and redder the more a person exceeds the desired number of calories. This might encourage someone to eat less. However, this would not work in a social setting because everyone would see the red circle. If you always make sure that something fun happens in the room, or around the plate or pan, when a child puts some vegetables on its plate, the child will hopefully eat more vegetables. A lot is possible in theory.”



Composition of the sensors embedded in SIT. (A) spatial distribution of 199 modules over the table surface; (B) wooden outer layer of SIT does not comprise any sensors; (C) single module with loadcell, LED panel, and plexiglass diffusor on the top.

Living lab setting

“This approach to research is a challenge,” Haarman says. “It quickly becomes invasive. Because try acting normally when you’re eating in a lab and know that you’re being monitored. With this in mind, the table has been set up in the UT eHealth House, in a living lab setting; this is an apartment in which measurements can be taken in a setting that is as natural as possible. There is a shower, a toilet and a bedroom. Sensors have been fitted everywhere and there is an observation room with a two-way mirror. This enables us to observe people without them seeing us. However, they do know that they are in a test lab.”

“In 2019, we presented the table at the DDW: Haarman remarks. “People were impressed by all the little coloured lights and what they could detect. It’s an achievement to be able to measure all the movements, but how do you make good use of all the data obtained? So, many improvements and changes have been made over time. For example, the table is now set up in a way that enables people to build on the work of previous researchers. This means that future researchers are not forced to reinvent the wheel; all the data obtained is saved for future use.”

“What you measure depends on the research question at hand”

“We wanted a tool that we could use to measure things with. And that’s what we got,” De Vries says. “Anyone with an interesting question in this field can now use the table. And we’d really like them to.” Haarman adds: “It might be interesting to know exactly who is sat where, for example. Where is the mother, the child, or the elderly person with dementia who needs to be encouraged to eat more? Or perhaps you want to treat everyone in the group as equals. That’s possible too. What you want to measure will depend on the research question at hand.”

Translating knowledge

“We want to gain new ideas and insights from our research and learn from it,” Haarman says. “Ultimately, everyone will want to translate the knowledge gained into something that can actually be used at the kitchen table. For example, a placemat with sensors that give you feedback while you eat, or dieticians who can warn their clients about copying the behaviour of others in a social setting, amongst other things.”

“Anyone with an interesting question can now use the table. And we’d really like them to.”

FLOW: measures of breastfeeding and infant sucking behaviour

Flow participants:

dr. JAM Haarman
(j.a.m.haarman@utwente.nl
Assistant Professor - Human Media Interaction, Electrical Engineering Mathematics and Computer Science, University of Twente.
Expertise: development of smart sensor technologies, (bio)medical engineering, human-computer-interaction and AI.

dr. E.M. Brouwer-Brolsma, Assistant Professor - Division of Human Nutrition and Health - Global Nutrition, Wageningen University and Research.
Expertise: dietary assessment and maternal and child nutrition

dr. M.P. Lasschuijt, Assistant Professor - Division of Human Nutrition and Health - Sensory Science and Eating Behaviour, Wageningen University and Research.
Expertise: innovations in dietary assessment

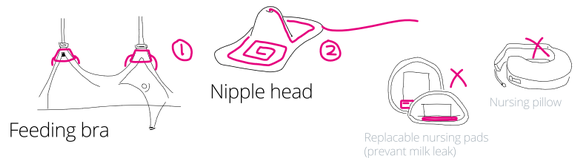
dr. I. Kalinauskaite, Assistant Professor – Public Health team, Julius Center for Life Sciences and Primary Care, UMCU (previously Postdoctoral researcher - Department of industrial Design, Systemic Change group, Eindhoven University of Technology.)
Expertise: transdisciplinary research, human-technology interaction, human and community-centred design and design with multiple stakeholders

Breast milk contains thousands of unique nutrients, bioactive factors and microbes that offer a child various benefits that a formula milk cannot provide. For example, protection against infectious diseases and various diseases later in life, including obesity and asthma. Breastfeeding protects the mother against various adverse health consequences too; breast cancer, for example. So, you might think that we already know quite a bit about breast milk and breastfeeding. "But", Elske Brouwer-Brolsma emphasises, "we don't know much about how the physiological side of many of these health benefits works yet (i.e. which specific factors and nutrients are responsible for what). And that's something we do want to understand. For a number of reasons..."

Elske worked on the Flow project with Juliet Haarman (University of Twente), Indre Kalinauskaite (Eindhoven University of Technology) and Marlou Lasschuit (Wageningen University and Research). In the Pride and Prejudice project, the first steps were taken towards the development of a breastfeeding assessment device: a system that made it possible to measure the direct milk intake and sucking behaviour of infants in a non-invasive manner. The desired result was to obtain meaningful data that would reinforce the importance of breastfeeding and then share this data with society.

More knowledge will pave the way for better advice
Elske: "Thanks to numerous studies conducted in past decades, we know that breastfeeding has a positive effect on children's health. Breast milk is healthier for babies than formula milk is. Comparisons show that breastfeeding leads to fewer allergies and obesity, etc. in the long term. But we don't know the biological reason for these outcomes. Nor do we know which nutrients are responsible for this. Having this knowledge will enable us to advise and support mothers better. It would then also put us in a position to optimise the recipe for formula milk, so that the babies of mothers who do not breastfeed benefit as well."

Creating social value
The project group that has been put together for the Flow project is approaching the issue from a nutritional, sensor-technology and user perspective. For Indre, the project was particularly important as a way to create value for society and also with the public health interest in mind. Indre: "The Netherlands is lagging behind in the length of time mothers keep up with breastfeeding. A general (WHO) rule states that this should be six months, but in the Netherlands mothers breastfeed for a maximum of three months and sometimes even just six weeks."



This short amount of time can be explained to some extent, Indre says. "After three months, women often go back to work, which is when they decide to stop breastfeeding. This decision makes little sense from a health point of view. Mothers are generally guided by their emotions and are often unsure about what the right choice is. Unfortunately, we lack the science to convince women to breastfeed longer. The breastfeeding assessment device is a good start to efforts to enrich mothers with this knowledge and, as such, society too. It provides substantive arguments in favour of breastfeeding."

Elske: "For this issue, we focused on developing a tool that measures the amount of milk a baby drinks at the breast. We reviewed existing sensors and looked at technologies already available on the market that could help measure babies' sucking behaviour at the breast."

"When feeding a baby formula milk, the volume drunk is easy to read from the bottle, but it's a different story when babies breastfeed," Marlou adds. "Babies themselves often let their mothers know when they have had enough. At the moment, there are no studies that show how much milk a breastfed baby drinks. And the situation only becomes even more complex when a mother starts to combine breastfeeding with formula milk. If you ask the mother about both months later, she has already forgotten her baby's eating behaviour The idea is for the breastfeeding assessment device to provide this insight in the future, as well as information about the speed at which a baby breastfeeds. This is valuable data too because many people who are naturally fast eaters develop a predisposition to obesity."

Continued development of prototypes in Flow 2.0
Marlou: "We have developed several prototypes for the device as part of the Flow project. For example, one of the sensors makes an audio recording of the number of sips a baby takes. This tells you how much it drinks in a certain time frame. Another example is the stretch sensor, which measures the weight of a breast when a baby is breastfeeding and helps a mother see if the baby is getting the nutrition it needs. Yet another sensor measures the difference in the abdominal circumference of a baby before and after feeding. This too is an indicator of how much a baby has drunk."

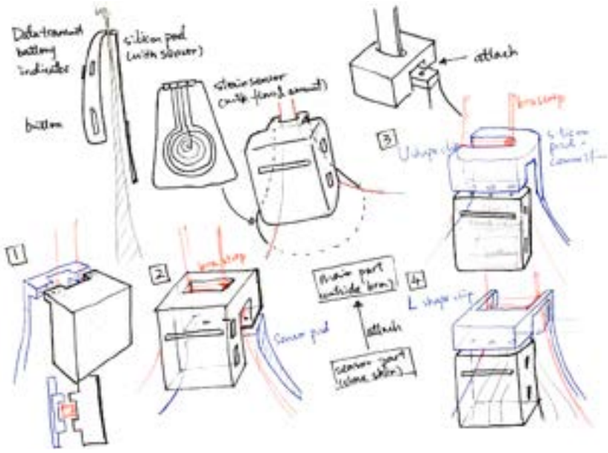
According to Elske, the ultimate solution will involve a combination of the sensors above. "We will use the solution envisaged to focus on quantity-related aspects of drinking behaviour, in terms of eating speed and quantity. The quality of the food will be investigated in the second phase that the Flow project is now entering. In Flow 2.0, which has been made possible by new funding from the EWUU alliance, we will also extend our focus to the composition of breast milk (the nutrient composition). Here too, this will require researchers from a number of disciplines to work together."

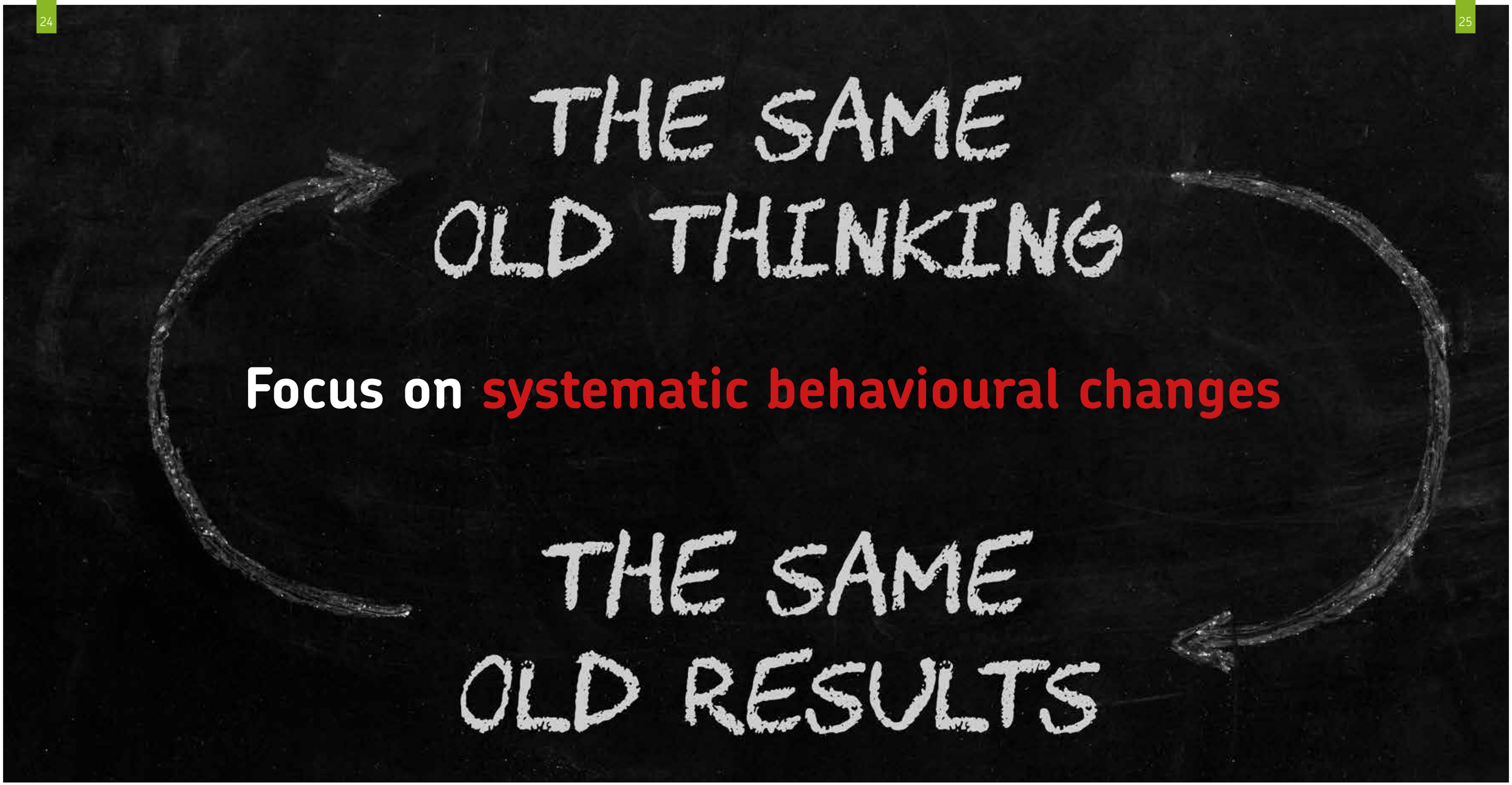
"Working together makes the development process much faster and the quality is better as well," "We can't ignore the fact that we need each other. A fairly simple example: in Wageningen, we are still heavily reliant on the food questionnaires we present to mothers. These questionnaires generate valuable data, but they are often long and not very user-friendly. Thanks to the contribution of colleagues from TU/e, we can now make great strides in optimising these types of measurement with users in mind. The expectation is that optimisations like this will reduce the number of participants who drop out. We will also turn our attention to optimisations that ensure that the methods we use are more user-friendly for people with limited literacy."

The importance of gaining broad support for research
Indre: "The reliability of research depends on people with limited literacy. We need data from society as a whole to be able to draw to arrive at sound conclusions. It's this that makes our collaboration so valuable now and even more important in the future. Although we already have a lot of data, it is often not representative of society as a whole. However, we often lack data from people in vulnerable situations, like those with a low socioeconomic status score (SES score). Because of this, we do not have the important information we need to design effective health strategies and solutions without losing sight of anyone. So, we need to reformulate our research strategies to ensure that the conclusions we reach do not become less and less reliable."

"We also have to be realistic," Elske adds. "We have actually only been serious about nutritional science since the 1980s. Studies like this take a lot of time. I think we have now reached the stage where we can start to differentiate between populations. With all the knowledge we have gained, this is the perfect step for us to take right now."

Flow 2.0
In the second phase, the FLOW project will focus on creating new knowledge in scientific domains like nutrition science (so that we learn more about nursing behaviours and, all being well, breast milk too), as well as the public health domain, which will use the increased scientific understanding of breastfeeding to design optimal healthcare policies to support breastfeeding. This project will also deliver direct societal value through transdisciplinary collaboration, in this case via technology innovation in healthcare, and, hopefully, better support for breastfeeding mothers.





prof. dr. ir. Geke Ludden was there when Pride & Prejudice was still in its infancy. She briefly looks back at the initial phase when the key focus areas of the programme were being established.

Geke: "We quickly agreed on one thing. The focus had to be on behavioural change. Not necessarily on the individual level, but rather on the system level. This kind of systematic approach, including all the environmental factors that affect humans, is complex. On top of that, very little research has been done in that area, while the insights would prove valuable for future interventions. For example, in order to link an individual's behaviour in a designed environment, such as a supermarket, which in its own way is part of a larger system.

Research on these issues involves a lot of different disciplines that converge in 4TU. And it requires every person involved to step out of his or her own specialism. You need to get to know each other in order to take a broad approach to the field. While that is quite ambitious, it is also necessary. We will only succeed in unravelling the system-level issues by working together. To be honest, four years is too short a time to achieve this. Especially for a large consortium where people who don't actually know each other yet need to work together.

Despite the relatively short amount of time, we have built invaluable bridges within Pride&Prejudice to address the major challenges in our society. We have taken steps to raise awareness about how to support behavioural change. For example, by giving people control over what they want to change about their own behaviour and by letting them choose or personalise the process through interventions. We have also made people more aware that choices are not just individual, but part of the bigger picture. Part of your environment, the behaviour of others, and what is offered in our society.

One area where there is still a lot of ground to be gained is in reducing health inequalities. People who are more distant from technology and health awareness warrant extra attention. It is good to see that new 4TU programmes have been launched that include ongoing projects. That is proof that we have been on the right track over the past four years. But it is also important not turn a blind eye to all the work that still lies ahead.

How smart digital interventions can help consumers make healthier and more sustainable choices

We all need to improve our unhealthy and unsustainable eating habits. It is evident that simply telling consumers what a product contains and how and where it was made is often not contributing to significant changes in this respect. When shopping, we are bombarded with so much information that it is impossible for us to take it all in. We are also ordering more and more of our food online. Smart digital interventions – for example smart tools that make consumers aware of their behaviour at the time of purchase – could help consumers make healthier and/or more sustainable choices.

Consumers make decisions about the food they buy every day. This affects the way food is produced, processed, transported and, ultimately, consumed. Understanding consumer's buying behaviour is crucial to the promotion of sustainable and healthy food consumption. Gaining an insight into how physical and online shops influence consumer choice behaviour could pave the way for changes to these shops aimed at encouraging consumers to choose healthier and more sustainable alternatives.

Ellen J. Van Loo, Associate Professor in Marketing and Consumer Behaviour in the Digital Food Landscape at Wageningen University and also the initiator of a P&P project on consumer decision-making for food: "The goal is to motivate individuals to make healthy and sustainable buying choices when they are standing in front of a physical or digital shelf and trying to decide which product to buy. Ideally, we want to facilitate these choices swiftly, because consumers will soon move on."

Creating actionability

"It is important for retailers and producers to be transparent about their products and communicate this clearly," Van Loo explains. "Looking at the product itself often isn't enough to tell you whether it is healthy and has been produced sustainably. To do this, you need the packaging, which includes a lot of nutritional information which may consist of a nutritional label such as nutriscore or number of health label. Although handy, people just want to quickly grab something from the shelf. They don't want to read everything on the packaging and consider different options. Informing them is often not sufficient. Therefore, it is important for us to create actionability in choice environments, so that consumers do ultimately choose the healthier or more sustainable option."

"Researching this properly turned out to be a challenge," she says. "In a physical shop, you can ask the retailer if you can put up some informative banners. This makes it possible to advise people to eat less meat, for example. The combination of image and text on banners like this gives consumers a subtle but clear nudge in a different direction. However, everyone in the shop will see the same message. This approach makes it difficult to focus on a personalised intervention."

Experimental online shopping environment

"Online, it's easier to see whether certain interventions work and also personalise interventions. Of course, you can't do tests like this in a real online store because tens of thousands of consumers visit them every day. So, we created an experimental online store where we could easily test all kinds of smart digital interventions.

"Online, you can personalise your intervention via a personalised message. For example, the system looks at the products you have in your basket, and gives you feedback: 20% of what you currently have in your basket is healthy and 80% less so. This gives people an overview of their buying behaviour. You can go even further as well because another tool can use the products you have chosen to recommend a number of healthier alternatives and give you (the buyer) the option to swap your existing products for these alternatives."

A little nudge in the right direction
“We developed an entire infrastructure for a lifelike shopping environment and a product database with all the characteristics you might expect, including photos, product information and ingredients. We were able to do tests in this experimental online environment, including the food swap mentioned above. For example, we were able to offer an equivalent vegetarian alternative to replace the animal product initially chosen by consumers. Naturally, they were able to stick to their original choice if they wanted to. Visitors to the store were given a nudge in the right direction, without restricting their freedom of choice.”

“We have been able to show that the above helps people make healthier choices and also encourages them to reconsider their choices,” Van Loo says. “People revert to autopilot so quickly when making routine choices. So, if a better product is suggested to them at the moment of shopping and it is healthier and more sustainable, they are likely to think: ‘oh yes’: you’ve interrupted their automatic thought process and they take a moment to reflect.”

One step closer to reality
This was purely a test environment and respondents knew that they were participating in a study. We said: ‘this is the scenario. Imagine that you are sitting on your sofa at home, you need certain products and you are going to order them online in the environment we have created. What will you do? They didn’t really buy the products. We now want to develop follow-up research to see what people do if they are actually buying the products. What will they choose if they have to pay for what they have in their baskets. The situation is no longer fictional and you are one step closer to reality. The disadvantage of a non-incentivised environment is that people sometimes pretend to behave more social desirable than they would do is real life. It will also be a logistical challenge to actually get the products delivered to people’s homes, but that’s another story.”

Consumers are already being made aware of their online buying behaviour. Anyone who has an account with AH can do the nutricheck, which provides them with an overview of the orders they have placed in the last 30 days. An overview of the distributions (percentage) of purchased products in terms of nutriscore) shows customers how healthy or unhealthy their past purchases were. Van Loo: “This doesn’t just happen when someone is making a choice but afterwards. We believe that a ‘just in time’ intervention, which involves influencing people when you need to influence them most, when they are standing in front of a shelf, ‘at the moment of crime’, will have a bigger impact. I really doubt whether a person having an insight into his/her buying behaviour will influence the choices he/she makes afterwards.”

Develop further in the future
In the future, we can personalise the above on the basis of an individual’s shopping behaviour,” Van Loo says. “So, what have you bought in the past and what are your values and preferences? When we know your purchase history, we can use it to develop an even more personalised approach. If you like strawberries, we’ll offer them to you. If it’s important to you that products are sustainable, or low in salt or saturated fats, we can give you suggestions with this in mind as well. If we get people to create a profile by answering a number of questions, we could go even further.”

“It’s all still quite new,” Van Loo explains. “Online buying behaviour is only being studied to a limited extent at this stage. Especially in the field of food purchases. However, we are seeing a need for more research in this field. Younger generations are increasingly doing their shopping online. So, there is still a lot of work to be done.”

Extend to home delivery meals as well
“Recently, a new project of ours was approved, which we are implementing in collaboration with Michigan State University,” she continues. “Our aim is to encourage people to choose healthier meal options when ordering via home delivery platforms too. This could be achieved via the same interventions as the ones used in online supermarkets. For example, food substitutions and basket feedback: you now have this drink, this dish and a dessert in your basket; the total number of categories is far higher than your daily requirement. You can make these substitutions to lower the total calorie content. However, this will require restaurants to share their ingredients and/or nutritional information of the meals. Platforms like thuisbezorgd.nl could make this mandatory, for example.”

“Taking it yet further, we could bring the digital tool back to physical shops. A hand scanner could be used to share information about products at the time of scanning and also advise consumers to choose something healthier or more sustainable from the shop. We aren’t there yet, but there are a lot of options.”

Explorative self-experimentation:

discover your own ideal intervention for behavioural change

Suppose you are a parent and have a child who hardly ever eats vegetables. There are a number of tools you can use in this situation. For example, you could try to tempt your child through play and song. Or you could encourage your child by offering him/her a reward. And, if that doesn't work, you could always force your child to sit at the table until he/she has eaten all the vegetables on his/her plate. These are methods commonly used to achieve behavioural change, but how we do know which methods works for which individual and in which setting.

The Explorative Self Experimentation project is based on a project by graduate student Antonia Fedlmeier. The following Pride and Prejudice researchers were involved in the ESE project:
Marina Bos – De Vos
Merijn Bruijnes
Mailin Lemke
Jos Kraal

We know that behavioural change is difficult to achieve. In the Explorative Self Experimentation project, which is part of the Pride and Prejudice project, a method has been developed that supports behavioural change on the basis of a different approach. It starts with something that really appeals to the individual in question. In other words: tailor-made interventions, in which the person him/herself discovers what works for him/her. dr. Jos Kraal explains.

The complexity of behavioural change requires a tailored approach

"Behavioural change is very complex. The behaviour that a person exhibits depends on many factors, ranging from personal, social and environmental factors to character traits and/or how someone feels. These factors are rarely considered in the world of behavioural change. Often, a set of interventions is used that you are expected to work through. If you want to lose weight, you need to do diet X. If you want to do more physical activity, use app Y. Numerous behavioural change tools have been developed in this way. However, they are designed for the public at large, which means that they are often doomed to fail.

Take the New Year's resolutions we make in January every year. Many of us will resolve to eat more healthy and walk every day. And if that fails, for whatever reason, we give up and say: 'I'll do better next year. I'll give it another go then'. The problem is that people rarely think about why they failed. What actually went wrong? Why didn't it work? Why doesn't the approach I chose to help me live a healthier life work for me?"

"Questions like this are key to Explorative Self Experimentation. It focuses on what suits the individual. What does he/she want? How would he/she prefer to work on the problem? And is the person being honest about what he/she really wants to achieve? In our approach, we let individuals figure out the answers to these questions themselves. They discover which intervention will help them successfully change their eating or exercise behaviour, for example.

Of course, some thought is already being given to the question of personalisation in practice. People who are at high risk of a certain disease are given a different intervention to people who are at lower risk. Goals vary from one person to another as well. Are you aiming to do 8,000, 10,000 or 14,000 steps a day? These are all attempts at personalisation, but they don't go far enough."

The essence of experimentation: learning what works by trying it out

"The ambition we set for ourselves in the Pride and Prejudice project was to take this level of personalisation to the next level. We let people learn what does and doesn't work for them themselves, via experimentation. We conducted our research in three rounds. In the sessions organised, everyone discussed what they wanted to change about their lifestyles and also what they had in mind. Three weeks later, we regrouped to see how well everyone had done."

"If we noticed that a certain intervention wasn't working, we tried doing something else to achieve the same goal. For example, walking in the evening instead of the morning. Or – when someone wanted to eat more healthy – changing the way they shopped: in a different shop, for example. In this way, we monitored activities and analysed what went well and what didn't. We then used those insights to enter a new cycle of interventions."

Listen to your gut, not just data

"As researchers, we took part in the research ourselves too. My behavioural change goal was quite clear: I am always involved in sport – from watching to teaching it – but I felt that I wasn't actually being active enough myself. So, there was a lot of work to be done. I resolved to do some kind of sport three to four times a week. After various experiments, I discovered that my goal wasn't right. I didn't necessarily want to play more sport, I just wanted to use my free time better. What I discovered along the way was my need for a sensible alternative to sitting on the couch."

"I gained this insight through intuitive evaluation, an important step in this project. We learned how important it is to listen to your gut and try to gauge what you like and don't like. What are you happy or proud about and what not? By asking questions like this, you are able to reflect properly about what is important to you. Your gut feeling is an important parameter, but we ignore it in science and society far more often than we ought to. Nowadays, we focus mainly on data and hard outcomes. Promoted in part by trackers, smartwatches and Fitbits, which are always within hand's reach."
"I have a background in numbers and like to keep track of everything I do. For example, how many steps I have taken and how many calories I have burned. However, I never asked myself how I rate my effort from a qualitative point of view. The data we obtain via all kinds of technical platforms and apps doesn't give us any insight into this. We don't have a parameter that tells us whether what we are doing is satisfying, fun or makes us feel happy. The only one who can answer this question is you. This explains why it is far more effective for someone to create their own interventions. And not the designer, who is there to provide the tools that someone can use themselves."

"It will take a lot of effort to effectively change your behaviour yourself. It's a process of trying, failing, learning and trying again. But good intentions are no different: you definitely shouldn't stop if you're not getting the results you want. It's important to learn from a failed attempt. Eventually, you will identify your ideal goal and your ideal approach, by doing what suits you and keeping it up because you like it."

Science and designers working together
Jos Kraal: "In the Explorative Self Experimentation project, we conducted research and designed the method at the same time. While we were designing the method, we were also updating the design in line with the insights gained. This is what makes the Pride and Prejudice project so unique: science and the design field come together in it.

Scientists and designers continually seek each other out in alliances. They complement each other well because the scientific community have difficulty to design tools, while the individual designing the tools often lacks a scientific basis. Both worlds come together in this project. Researchers are trying to unravel the complexity of behavioural change, while designers are trying to design solutions to this complexity.

Both perspectives and qualities are merged in the Pride and Prejudice project and we are aiming to do the same at TU Delft as well. We are not training students to just become a designer, but to become a design researcher as well. We are increasingly recognising that design involves so much more than just designing products. Research by design can help contribute to the reformulation of the questions and goals that science and industry have and present results in an interesting way that benefits the world of science, the public sector, industry and design."

A paper toolbox as the first tangible result
Explorative self experimentation is still in its infancy. The design could currently be described as a paper toolbox. However, the logical next step will be to develop it further technically, by adding an app, for example. The booklet guides you through the different steps of a cycle and provides a number of useful monitoring tools. For example, how many days something goes well, when you were or weren't able to persevere and why.

Why use Explorative Self-experimentation?

AN ARGUMENTATION GUIDE FOR PUBLIC HEALTH

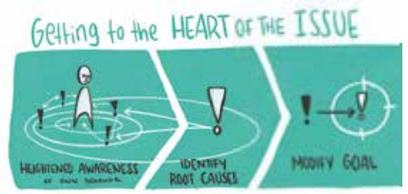
Premise
Due to increasing strains on healthcare systems worldwide, there is a need to move healthcare upstream, to focus on prevention and increasing the overall population health. Although many individuals intend to change their behaviour, there is much evidence for a gap between intention and action. Despite there being many "solutions" for changing health behaviours, finding an intervention that fits with one's goal, personal preferences, as well as physical and socio-economic context is a challenge in its own right. A strategy is needed that helps individuals find health behaviour change intervention that *work for them.*

Definition
Explorative Self-experimenting (ESE) is a meta-strategy for helping individuals change and maintain personal health behaviours. The core idea is that individuals try out interventions themselves to see if they work, exploring their effect on personal behaviour in their own context.

Pros and Cons
+ ESE omits the need to design interventions that are suitable for everyone, as it helps individuals find and adapts interventions that already exist.
+ Engaging in the method once forms a mindset that users can re-applied over and over to changing other behaviours
- ESE requires a high-cognitive work load as a result needs some time and mental space to be effectively applied.
- Building ESE tools is challenging due to the high individuality of the method application

Five Phenomena Explorative Self-experimentation achieves:

TAKING INCREMENTAL STEPS TOWARDS A LONG-TERM GOAL
ESE offers users a concrete starting point which leads them to take incremental steps towards a long-term goal. Users make progress towards their health goals and are aware of it! This leads to behaviour change as:
- ESE creates a sense of urgency by specifying a time-frame and by triggering a commitment and consistency bias
- Seeing progress helps satisfy user's need for competence which leads to a boost in intrinsic motivation



GETTING TO THE HEART OF THE ISSUE
ESE gives users a heightened awareness of their own behaviour. This leads to them identifying root causes and adjusting their goal to address these. This leads to behaviour change as:
- Consciousness raising helps users be aware of potential causes of "relapsing", and thus helps avoid these
- It increases the perception of relevance of addressing the identified health issue leading to a higher intention to act

TRIAL AND ERROR TO SUCCESS
ESE promotes users to try multiple interventions in a short period of time. Users adapt a problem-solving mentality in that they identify barriers in their interventions and try to overcome them. This leads users to find interventions that fit, or at least identify what works or does not work for them. This leads to behaviour change as:
- The high periodicity of interventions increases the likelihood of finding a good fit
- Engaging in problem solving helps address contextual problems that may stand in the way of successful change

DISCOVERING NEW PERSPECTIVES
Engaging in ESE leads users to new perspectives on personal agency in that they realise they can change their behaviour. It also helps users shift the blame for unsuccessful behaviour change attempts from them to the incompatible interventions. Some users attain a new attitude towards their own health in the priority they assign it, and most users make discoveries regarding their own behaviour tendencies. This leads to behaviour change as:
- An increase in self-efficacy, leaves people more confident in their ability to change their own behaviour, and therefore more likely to pursue it
- A positive change in attitude towards the behaviour helps shape the intention to act

FINDING SUPPORT
ESE is often a conversation starter between users and their close social circle. This results in many users finding social support. This leads to behaviour change as:
- Finding social support can aid in adhering to the behaviour

How to Facilitate Explorative Self-experimentation?

A QUICK GUIDE FOR DESIGNERS

Introduction
This guide provides two lenses from which to approach the challenge of facilitating explorative self-experimentation. The first is to design for the underlying needs of people wanting to change their health behaviours. The guide provides seven starting points that cater to the seven core needs of self-experimenters. The second approach is to consider the activities comprising each phase of the Explorative Self-experimentation process and design different ways to guide participants through them. The final part of this guide shows how the two approaches overlap, so designers know which needs to focus on in which part of the process.

Seven starting points for facilitating ESE:

One way to facilitate self-experimentation is designing for the underlying needs of people wanting to change their health behaviour. The seven starting points ensure that the solution addresses these user needs.

PROVIDE GUIDANCE THROUGH THE PROCESS
Self-experimenters value feeling guided and knowing what to do. Some ways to provide guidance include:
- A structured process with a clear starting point
- Actionable tips and examples
- Open questions
- Guidelines for how to formulate a goal

PROVIDE INCENTIVE FOR MOTIVATION
A key component for changing behaviour is staying motivated over time. Some ways to provide incentives to keep going include:
- Playful elements
- Visual triggers / reminders
- Visualizing progress
- Celebrating small achievements

PROVIDE INSPIRATION FOR INTERVENTIONS TO TRY
Self-experimenters value being inspired during their exploration with different interventions. Ways to provide inspiration include:
- Examples of interventions others have found helpful
- Samples of proven behaviour change techniques
- Presenting novelty and variety over time

MAKE ROOM FOR PERSONAL GROWTH
Self-experimenters want to learn about themselves in the process and feel personal growth. Ways to make room for this development include:
- Prompting reflection through questions
- Having check-in meetings

FOSTER A RESILIENT MINDSET
A resilient mindset helps self-experimenters deal with set-backs on the journey to change their behaviour. Creating the right frame of mind can be done by:
- Making things modifiable to allow mistakes
- Set-up malleable goals that can be adjusted along the way
- Diverge on interventions to have options to fall back on.

GIVE IT A PERSONAL FEELING
Self-experimenting is a highly personal journey. Creating a personal attachment to the tools can help foster intrinsic motivation. Ways to give it a personal feel include:
- Make it tangible
- Leave room for personalization
- Deliver high fidelity tools
- Encourage hand-written commitments

PROVIDE FLEXIBILITY THROUGH ADAPTABLE INTERVENTIONS
Day-to-day life can be highly variable, and thus self-experimenters value flexibility from their interventions. Adaptable interventions pave the way for compatible solutions. Way to introduce flexibility include:
- Create room for exceptions
- Make tools compact and portable

Provide Guidance through the process:

Another approach to facilitating ESE is to consider the activities comprising each phase of the process and design different ways to guide participants through them.

PROVIDE AID IN INITIATING:
What do users need to start self-experimenting? Help users get into the right mindset, define an issue and a goal, as well as assess their current situation.

PROVIDE AID IN EXPLORING:
How can users be facilitated in thinking of interventions to try out? Provide guidance for exploring interventions and creating a behaviour change plan.

PROVIDE AID IN TRACKING:
How can users keep track of their progress? Help users measure success and help them check-in regularly with themselves.

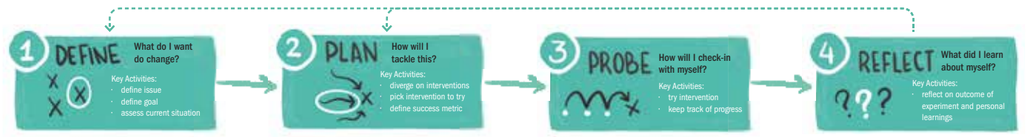
PROVIDE AID IN MAINTAINING:
Help users iterate and maintain their self-experimentation efforts. Alternatively, for users who find a compatible intervention, help them maintain their behaviour change.

PROVIDE AID IN EVALUATING:
How can users evaluate if an intervention is working for them? Help users reflect on outcomes and make decisions based on their evaluation of the experiment.

Seven core underlying needs of self-experimenters can be mapped onto the phases of the process framework. This shows that some needs persist across all phases, while others are localized to a single moment in the process. Knowing how the needs are spread across the various phases can inform which starting point to use for design solutions in each phase.

How to Find what Fits for you?

A QUICK GUIDE TO SELF-EXPERIMENT



What do I want to change?

1. LET'S EXPLORE THE ISSUE
Are there any health-related issues in your daily life that you would like to work on? Write down any that come to mind and choose one to work on for the next weeks.
Ex: bad posture, weight gain, lack of focus, low energy, stress, etc.

2. LET'S DEFINE A GOAL
There is a difference between an outcome goal and a behavioural goal. An outcome goal is focused on the result of a behaviour, while a behavioral goal defines what you do. Losing 2 kilos is an outcome goal. Eating less food is a behavioral goal. What is your behavioral goal?
TIP: Having SMART goals is known as an effective strategy for success in improving behavioral problems. Smart goals are those that are: Specific, Measurable, Actionable, Realistic, and Timely.
Ex: Eat two meat-free dinners per week for one month; Put away all mobile devices and shut off all screens by 9 p.m. on week nights for one month.

3. LET'S SEE WHAT WE'RE WORKING WITH
What do you need to achieve your goal?
Ex: A yoga mat; running shoes, information
What are barriers to reaching your goal? What makes it hard? What motivates you? What enables you to achieve your goal?

How will I tackle this?

4. LET'S EXPLORE POSSIBLE TACTICS
What are possible interventions you can try out? Take some time to brainstorm – the more options the better. If one does not work out, you'll have plenty of others to fall back on.
Ex: putting a reminder in the calendar; creating a visual trigger; downloading an app, asking a friend to be your referee...

5. LET'S MAKE A PLAN
Which intervention(s) do you want to try first? Pick a concrete starting date. How will you know if your intervention is successful?
Ex: You can use quantitative measures such as counting steps, weight, time, etc. Or qualitative measures such us checking how you feel.

How Will I check-in with myself?

6. LET'S TRACK YOUR PROGRESS
Depending on your goal, you may want to check-in daily or weekly on how it is going. Find a way to keep track that suits you and your goal /intervention.
Ex: you can keep track by journalling, using an app (for counting steps for example), or simply make check-marks on a calendar.

7. LET'S START EXPERIMENTING!
Start trying your intervention. Check-in regularly with yourself. If you notice it's simply not working – move to phase 4.

What Did I learn?

8. LET'S EVALUATE THE EXPERIMENT
How did it go? What are your barriers and enablers for maintaining this intervention? What improvements can you make?

9. LET'S REFLECT ON PERSONAL LEARNING
What did you learn about yourself? What are the things that work or don't work for you? Is the issue you are working on still relevant? Or can you identify other root causes that need to be addressed first? Does your goal still motivate your? If not, make it more specific, or more ambitious, or break it down into something smaller.

10. WHAT'S NEXT?
Based on your reflections, decide your next steps. Can you tweak your intervention or your goal so it better fits you and your context? Or is it better to try something entirely new? Perhaps even change your goal or issue?

Research on Personalising Wearables for Health:

Visualisations that users identify with are more interesting and helpful

Tracking how many steps you take and monitoring your heart rate throughout the day are handy tools that can be a positive addition to your health and well-being. That is, at least, when they are used regularly and help support our goals. It is a pity that although they are widely available, few people find them helpful. That often has to do with the appearance of the tools and what data they show. People like to decide this for themselves, according to the study 'Personalizing Wearables', as Rúben Gouveia, assistant professor at the University of Twente explains.

There are apps that register your heart rate or indicate how many calories you burn. Then there are those that remind you to drink or eat enough or that monitor your sleep at night from hour to hour. These tools and many more are now being built into the devices we carry with us, including mobile phones and smartwatches. Everyone uses them to varying degrees. Some occasionally for fun, while others use them intensively to achieve their pre-determined goals.

Much to gain

However, there is still a lot to gain when it comes to the effectiveness and use of these tools. Gouveia and Daniel Epstein, assistant professor at the University of California, researched needs and preferences in relation to personal tracking systems. "We were interested in how people would like data to be presented, if they had a choice," explains Gouveia. "We also wanted to know whether people actually started customising their data. If so, we naturally wanted to know why they did it, when and how often."

"Health visualisations should be helpful, but often do not match the user's interests"

"It would make sense for digital health solutions to allow people to choose what data they want or need to see," he continues. "They often miss the mark here. Many solutions are one-size-fits all, delivering the same solution to a large population. Interfaces end up showing irrelevant information to users. That's demotivating and many people stop using them altogether. These kinds of devices should be helpful, but often end up in the drawer."

Gouveia and Epstein decided to look at some solutions. "Some smartwatches, like Fitbit or the Apple Watch, already let people choose which health data they want to see on their screens as well as which colours and styles they want to match. We asked users of these devices to send us pictures of their screens and looked at how they represented their health data. We asked them what they liked about it, how often they changed it. We then analysed which health data was visible and which colours and styles were used."

A visualisation to match your identity

"We received photos and responses from 368 people and ultimately interviewed 18 of them," Gouveia continues. "What struck us was that many people customised their health data a lot, sometimes several times a day. Some changed what data was shown on their screens, to help answer different questions that came up during their day. How well did I sleep? How active am I at work? That usually depended on their personal goals. Do I want to sleep better, be more active, eat healthier? Changing the data that was being shown on a screen helped answer the different questions that people had about their health."

"Changing the aesthetics was just as important," Gouveia explains. "People consider their smartwatches to be part of their outfits and style. They wanted whatever was shown on screen to match those styles. Some people would change their data colour to match their different outfits or tattoos. For many people, it turned out to be part of their identity. If all that data was also presented in a way that was attractive and that people could identify with, it would be looked at more often and actually used."

"It also motivated people to reach their goals," he continues. "One woman had a picture of her grandchildren on the background of her screen, with some health data on top. The picture made the data more important to her. It reminded her of why she was trying to be more active, stronger and spend more healthy time with her grandchildren."

Easy to customise

"As designers, we often assume what data people are going to find useful and how they want their data to look," says Gouveia. "Our study showed that this is often different from what people actually want. People like when there is a lot to choose from and plenty of options to change. They might not always know what they want to see, especially in the beginning. But through experimenting and trying things out, they start to learn. If we have discovered one thing, it is that these tools still need to make it easier for people to customise their experience. Many choices and options have to be built in. Everyone wants something different, but without all the complicated programming and coding."

The desire to personalise does not apply to everyone," says Gouveia. "In Madeira, where I come from, there is a running race of 120 kilometres every year along the entire length of the island. Most runners wear smartwatches. A few years ago, the winner at the time proudly showed off his retro Casio watch after the competition. He found all that information far too confrontational. It also distracted him from his focus on winning the race. He just wanted to know what time it was, that's all."

A chatbot coach that removes social discomfort has huge potential benefits for many diabetics

How handy would it be: a chatbot that facilitates your interaction with others in situations that are socially uncomfortable for you. A chatbot that you can train on how to represent you, taking away the burden of entering into diabetes-related conversations that could lead to stigmas, judgments, or invasive questions. It may sound impossible, but research into chatbots as reliable coaches is now in full swing.

'Developing a social interaction assistance to enhance social support perception for people with diabetes', is the full, yet comprehensive name of the study. "Participants have responded enthusiastically, but a lot more research is still needed," explains post-doctoral researcher Amal Abdulrahman, who leads the research team for TU Delft within the Pride & Prejudice project. "Having a chatbot provide information is one thing, but to really give this bot an advisory role, you have to entrust it with a lot of personal information. When it comes to privacy, that's a sensitive matter, of course."

Avoiding social events

For people with diabetes, parties, get-togethers, social events, and work-related obligations can be more of a burden than something to look forward to. Snacks and drinks often contain sugar or are made of fast carbohydrates. Both are a no go for someone with this medical condition. Having to explain again and again why you don't eat something can become annoying over time and asking in advance whether something else can be served can be uncomfortable and therefore not always an option. Then maybe just a glass of water... or even cancel the whole event.

"Many people with diabetes experience this kind of social stress to some extent, often resulting in them socially isolating themselves," says Abdulrahman. "People feel embarrassed or troubled and decline invitations in order to avoid questions, unsolicited advice, surprised looks, or judgements. That's a shame and would also prove unnecessary if they had a chatbot that could explain on their behalf about what is going on."

Technology as an assistant

Abdulraman received her PhD from the Department of Computing at Macquarie University in Sydney. She has an interest in how current technology can help people in their daily activities to achieve a better quality of life. Since 2022, she has been researching a virtual coach that can support people with diabetes to help change their behaviour in social contexts.

"Traditionally, behavioural change has mainly focused on the individual," explains Abdulrahman. "However, when it comes to how to adopt a healthy lifestyle and maintain it, it is essential to consider that person's social environment. My current research therefore focuses on developing an artificial means to support people with diabetes in dealing with the diabetes-related social issues they face."

Chatbot as a facilitator

"380 people with diabetes participated in our study," she says. "We asked them what they would like the bot to communicate on their behalf, in what way, and when. How much information is desirable and what is the message you want to convey? We learned that people prefer to talk face to face to family members or friends about things such as why they inject insulin, why they are not allowed to have certain products and that some comments can be hurtful or uncomfortable."

"However, the wider the circle spread, from more distant friends and acquaintances through to complete strangers, the more welcome it became to have a representative explain the situation on their behalf. This was particularly true when it came to providing feedback such as: 'you hurt me when you say that', or 'I feel troubled', a chatbot would come in very handy as a mediator. Children or young students in particular can often be unintentionally hurtful to each other. This often stems from ignorance. A chatbot that informs them or gives feedback on their behaviour can be hugely beneficial and therefore help take the burden off the person who feels embarrassed or hurt."

Sharing sensitive data

"The first part of the study is nearly over," explains Abdulraman. "Now that information has been collected from both sides, the people with diabetes as the receivers of social support and their social circles as providers of support, we are at the part that is a bit more complicated. The way the bot represents the person with diabetes, including what and how to communicate, has a great impact on stimulating better support from the contact in the social circle. In order to ultimately receive the best social support, our bot is now learning from the collected data on how it can get the best support possible according to the state of the person with diabetes. Everyone is different and has different opinions on how the bot should represent them. So, the bot is learning about these differences and how to act accordingly as a representative to gain better support. Once the bot has this understanding, it then moves from the observation stage into the coaching stage. At that point, it can coach the people with diabetes from its previous experience on what information to disclose and how the bot can discuss the situation with the social circle."

"In order to provide targeted coaching, the chatbot needs to know the person with diabetes and their social encounters. What discomforts do they struggle with, how does that make them feel or react to the encounter, and what expectations do they have when it comes to support? This requires numerous, very personal questions. Questions that then have to entrusted to a technological gadget. And therein lies the difficulty, because when it comes to sharing privacy sensitive information, people are clearly a bit more reserved. That makes sense, because can we be sure that all this sensitive data is really safe? But at the same time, the information is necessary to allow chatbots to predict what help is needed at what time."

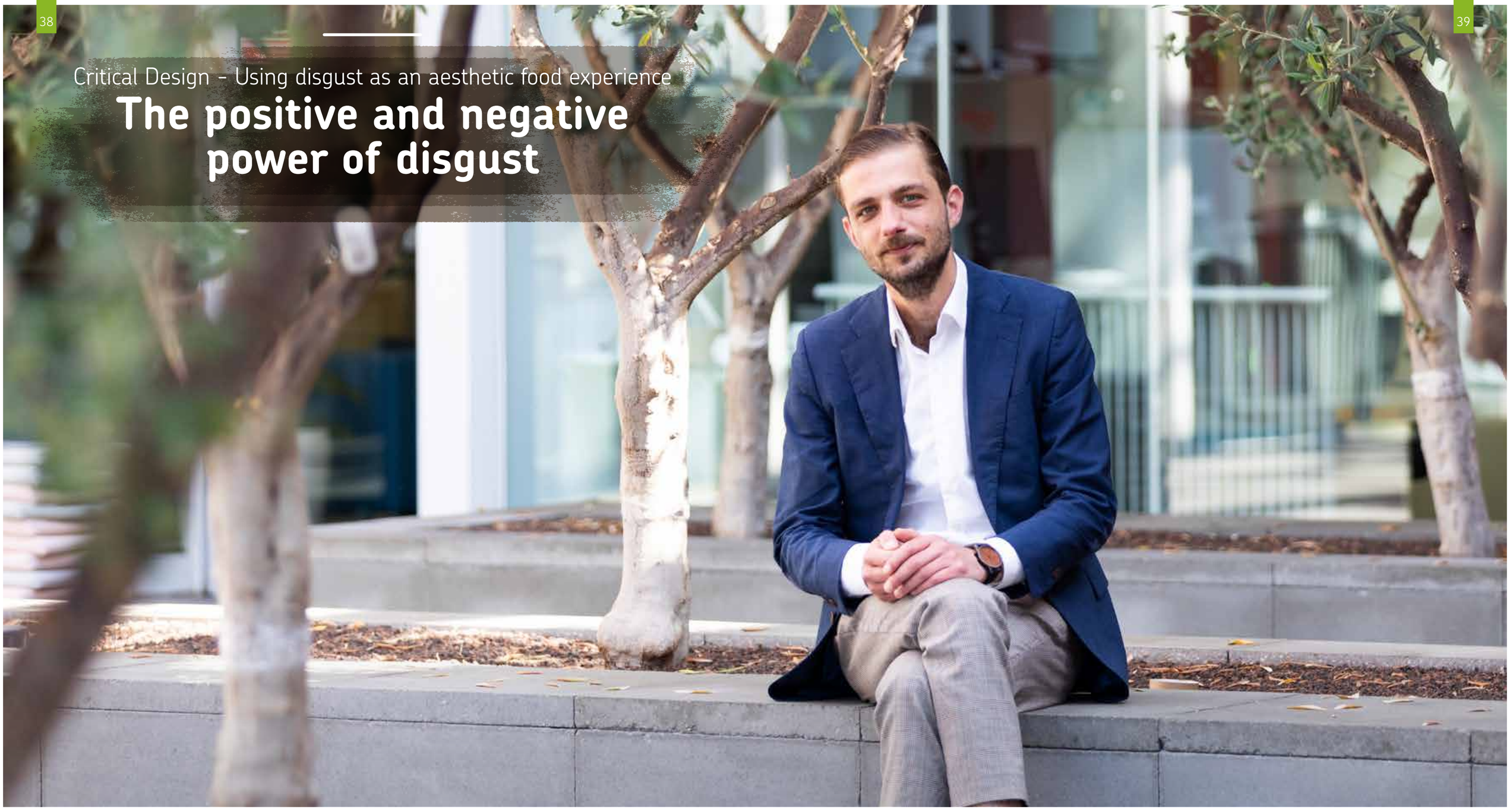
Only ask for relevance

"Because we are asking all these questions now, it will hopefully be possible in the future to determine the desired coaching method with just a handful of questions," says Abdulraman. "Chatbots are constantly learning and evolving. Irrelevant questions will no longer be asked and only the most effective will remain. It will take some time for chatbots like this to hit the market, but we now know that it can and will happen. That is something I could only dream of two or three years ago."

"The intention of our research is that people will eventually start participating in social circles again and that they may not or hardly need the chatbot anymore. The use of a chatbot coach is not only applicable to diabetics. People living with other medical or psychological conditions can also benefit from this. The knowledge we are now gathering can be applied to many target groups. But first things first."

Critical Design - Using disgust as an aesthetic food experience

The positive and negative power of disgust



Years ago, TV commercials urged people to stop smoking. Someone arguing with his neighbour ended with the one-liner: “but I don’t smoke.” The suggestion was that smoking was worse than assaulting someone verbally. Today, we are seeing a similar communication strategy. Graphic photos of smokers’ lungs on packs of cigarettes, for example. Photos that evoke disgust and are designed to contribute to behavioural change. However good these intentions may be, philosopher Bas de Boer and nutrition expert Mailin Lemke see a different side to this approach. Bas: “Disgust has a stigmatising effect, is often ethically shaky and its effect is questionable as well.”

In the ‘Critical Design – Using disgust as an aesthetic food experience’ project, Bas and Mailin examined the use of the phenomenon of disgust to bring about behavioural change. They also studied various scenarios to see whether it is possible to turn disgust into a positive experience. For example, to turn products we dislike into food we all embrace.

Disgust as a stimulus

Bas: “The concept of disgust ties in well with the context for the Pride and Prejudice project, in which behavioural change is key. Disgust is widely being utilised to bring about changes in society. For example, advertising and health campaigns use disgust as a tool to encourage people to change their behaviour. Certain settings are often framed as very black and white. Thin is beautiful; being overweight isn’t. Certain behaviour is presented in the same way. Smoking is bad; not smoking is the preferred behaviour.

“When we analysed campaigns, Mailin and I soon discovered that disgust is not just used as a tool to achieve a certain health goal but also to present groups of people in a negative light. It’s quite unusual to present your most important target group as disgusting because you are stigmatising the very people whose health you want to improve. That seems very contradictory. For example, if you look at people with a higher than average weight, you will see that they often already have a weaker position in society. You have to ask yourself whether it’s right to make their situation even worse by depicting their bodies as disgusting.”

“There’s another questionable aspect to campaigns like this. They suggest that people are in control of their body weight, for example. When many other aspects play a role too, like someone’s socio-economic circumstances. These are aspects over which people have very little control. For example, information about the advantages and disadvantages of products is often inadequate - because the wrong communication strategies have been chosen, for example. Also, many people don’t have the financial resources necessary to put health advice into practice. That’s something we really need to be aware of when we judge people in a certain way.”

“If we can succeed in making insects tasty, we all stand to benefit”

What is health?

“We also need to realise that we don’t even know exactly what health is. Does being overweight automatically mean that you are less healthy too? If you base health on a person’s BMI maybe, but health involves so much more than that. It would help if we were to define health far more broadly than we currently do. In society today, we want to make everything measurable in our quest to understand it. But we are actually making very few aspects of health measurable. Mental health in particular is difficult to measure. For example, we don’t know whether someone feels happy in a bigger body. Suppose they are: that contributes to health as well. So, you can’t rule anything out. That’s what makes the stigmatisation we are seeing in many campaigns ethically and factually incorrect.”

Disgust: a biological reflex with a cultural background

During the project, Bas and Mailin considered the social context of disgust and also the biological frameworks. Bas: “What also makes disgust remarkable is that it seems to be something that’s purely physical. Disgust is a natural reflex that might involve gagging or stomach contractions, etc. However, we learnt that disgust has a cultural component as well. In other words: our cultural backgrounds play a role in determining what disgusts us. So, social and cultural frameworks determine our physical response to certain images. That’s remarkable. And inspiring too …”

“The idea of disgust as something that is culturally determinative helped inspire us to coin the term ‘aesthetic disgust’. It challenged us to see whether we could use disgust as a positive experience. We should not automatically see disgust as something that makes us shun something but also as something that makes us frame things positively. For example, to embrace certain products. One good example of this is insects as a food source …”.

Don’t be disgusted by insects but embrace them as a food source

“From a sustainability perspective, it would be wise for us to start eating insects as a meat substitute. However, people in Western Europe usually view insects with disgust. The general opinion is that they are dirty little creatures. We organised a workshop on this subject to explore how we could change our attitude towards insects as a food source.”

“If you compare insects with shrimps, for example, you will see that they are actually very similar. They are related to each other and have the same nutritional value too. The strange thing is that we enjoy shrimps as a food product but are disgusted by insects. This is strange in itself. We find insects unpleasant because they have legs and you have to eat them whole. But the same applies for shrimps. And herring too, for example, around which a whole culinary food culture has developed. This culture ensures that eating herring is experienced as pleasant. Disgust has been converted into a positive framing.”

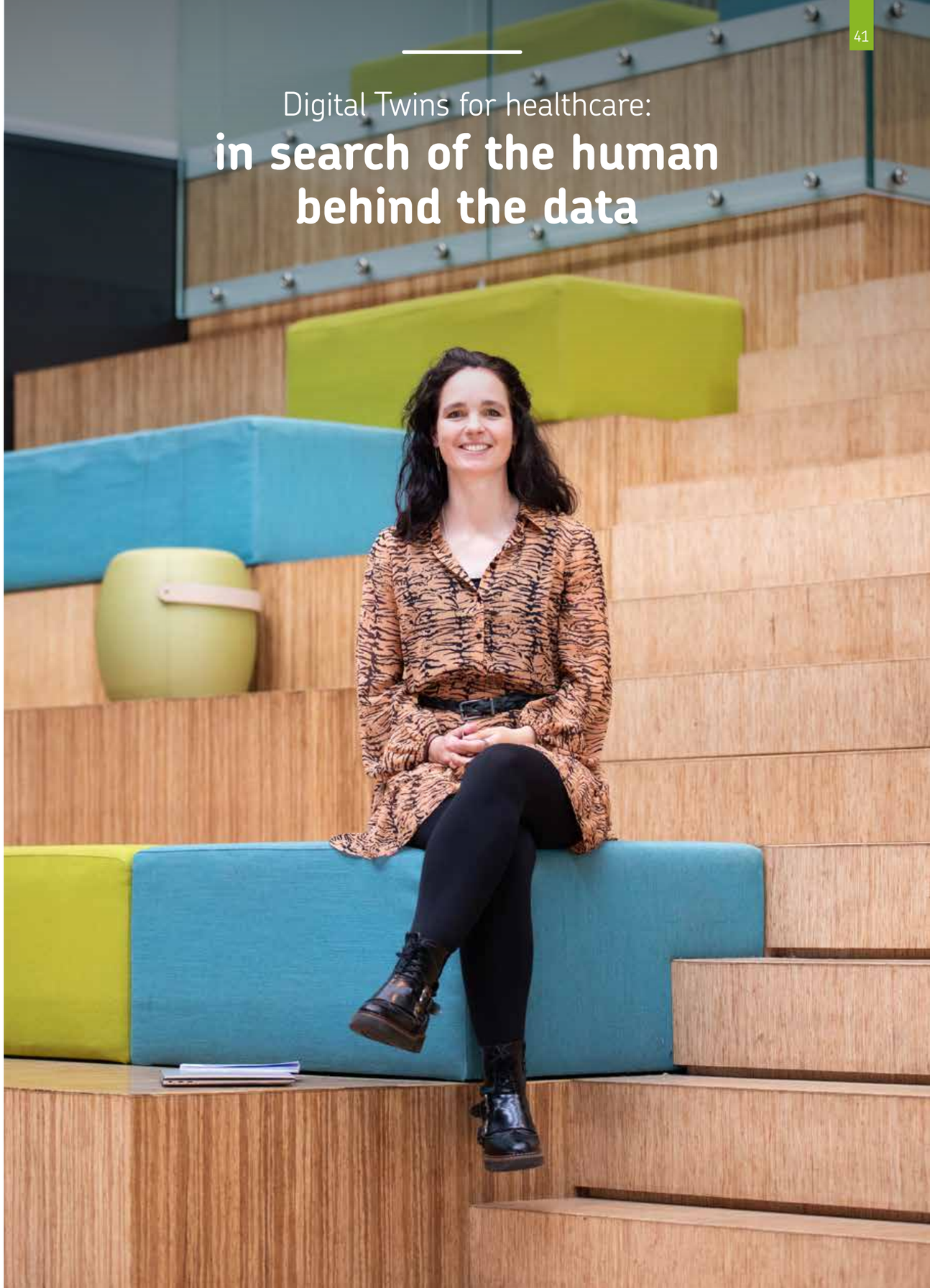
“It is interesting to study the same effect when eating insects. If we can succeed in making insects tasty, we all stand to benefit. More and more people would start to eat insects, which would then contribute to the sustainability aspect as well. At the moment, we’re grinding them into burgers, so that we can’t see them in the food we are eating. However, this has not led to the creation of a successful product yet. Also, the idea of grinding insects is at odds with how we eat shrimps, lobsters and herring, which we eat in their original form. We believe that insects also have the potential to be embedded both culturally and with a culinary use in mind. Harnessing the power of disgust may even enable us to make a small contribution to the achievement of the climate goals.”

About ‘Critical Design – Using disgust as an aesthetic food experience’

In this project, Bas and Mailin’s research focuses on awareness. For example, by making the way in which certain groups of people are presented a point of discussion. They also want a better understanding of disgust to contribute to changing consumption patterns and perhaps even relationships with other people.”

Digital Twins for healthcare:

in search of the human behind the data



About Value-based Digital Twins

A digital twin is a replica that can be used to guide lifestyle and health choices. Under the term 'digital twinning', data, models and processes are brought together to create a digital life cycle alongside a physical life cycle.

The Value-based Digital Twin project was an exploratory study carried out by scientists from a variety of backgrounds. From healthcare and data science to design. This diversity was key in taking a broader approach to the topic. For example, what data and algorithms are needed for a twin, and how can this information be aggregated, stored and evaluated. Marina Bos-de Vos and her colleagues focused mainly on the human values behind the use of digital twins. At what point does a twin become truly meaningful for a user? They included the user perspectives of both the receiver of care as well as the care provider.

Digital twins are rapidly on the rise. In the construction world, in industrial settings … and in healthcare. A digital twin contains data about a real person, allowing us to see, for example, whether someone is at high risk of developing a disease or disorder. It provides valuable insight that can be used to help reduce this risk. For instance, by making people aware of aspects that could lower their risk. Marina Bos-de Vos and the other participants involved in the "My Digital Twin" project have observed that the development of these kinds of twins is mostly technology driven, and the human dimension is often overlooked.

In the Value-based Digital Twin project, the team started working on a provocative prototype of a human-driven version of a digital twin, merging the current state of technology and care with possible future scenarios for the use of a digital twin. Marina: "What you primarily see with twins, regardless of the sector, is that data is the central focus. This is positive, of course, as the more data you have and the more reliable it is, the better insights you are able to gain. But our concern is that the human drivers behind the use of digital twins have hardly been taken into account. How do people experience digital twins? What aspects do they like? What needs do they have? And how can we respond to these needs? These are the kinds of questions that were of interest to us and that were central in our development of the 'provotype' of the twin.

Focus on pregnant women

"For our research, we focused on the target group of pregnant women. This is a crucial target group, because at that stage of your life, you have a great deal of influence on the health of your baby as well as your own. The choices you make during your pregnancy, from physical activity to nutrition, largely determine how healthy a baby will become. Another added benefit is that pregnant women tend to be much more open to making positive lifestyle changes. Precisely because of the responsibility they bear for their baby."

The various roles of a digital twin

During the project, a provotype of a digital twin was developed that can assume three different roles:

- **A calculator**, where a pregnant woman consults the digital twin as a knowledge base.
- **An advisor** that provides the pregnant woman with personalised advice on certain lifestyle or medical choice.
- **A docter** that assumes the role of a healthcare professional and can even administer medication automatically.

Testing through interactive stories

Marina: "These three roles each have a different type of autonomy in the decision-making process with regard to lifestyle and medical care. We utilised these different roles in our approach to the study. We took participants through an interactive story. Each participant represented a pregnant woman with certain risk characteristics within a certain health context. As they progressed through the story, they faced a number of choices. For each of these choices, they had to decide whether they would use the twin, and if so in which role."

"For example, a pregnant woman finds herself in a situation where she has elevated blood pressure during the 20th week of her pregnancy. This situation presents a relatively low risk of adverse effects on the health of the mother and child. It could help to take extra calcium tablets, and the question was which type of twin she would turn to: for example, 'the calculator' that provides her with knowledge, 'the adviser' for targeted advice or 'the doctor' who could automatically administer the calcium. We presented the same choice to participants in a preeclampsia situation, a health situation that is alarming for both the mother and baby."

"Our initial assumption was that people would rely less on a digital twin in a high-risk health situation than in a low-risk situation. However, it was found that the twin was actually afforded a sense of trust in high-risk situations such as this. Many first consulted the digital twin as an advisor before relying on what the professional advised them. On the other hand, in the low-risk situation, they placed a lot of trust in themselves or in the healthcare professional, as the participants expected them to be able to better assess what suited them than the digital twin could. There were also some participants who did not want to use the digital twin at all."

The importance of customisation

"The study shows us the importance of making distinctions between people with different backgrounds and preferences. For example, someone who has had previous complications may prefer to use a digital twin in a different way than someone who has not. Whether someone has an affinity for using technical tools will also certainly play a role. In addition, our research shows that a person may have different needs depending the situation, such as how high the level of risk is. All of these factors influence a person's choices. And this confirms our belief that we need to take a highly personalised approach to developing and deploying digital twins in healthcare. Flexibility and personal customisation are very important."

The twin of the future

Technical developments related to digital twins are progressing rapidly. At the same time, there is a great deal of uncharted territory that we have yet to explore. In particular, Marina is of the view that the human touch should not be overlooked here. "My hope is that technological developments will include values for all these different end users. That the twins will serve the needs of people and what they are comfortable with for a given time and situation. This can only happen if there is also a sufficient focus on the social aspect of the twin."

"Also, we have to keep a watchful eye to ensure that his technology is not misused. For example, that health insurance providers do not collect data to check whether someone is leading a healthy lifestyle. Or that people become captivated by this technology and addicted to the insights generated from their data. This could lead to the digital twin determining how they will live their lives, rather than them making decisions for themselves. An effect that can be compared to that of social media on the lives of many people today. I think that is where the challenge of the future lies. Because virtually anything is possible in terms of data technology, but above all else, we need to avoid losing sight of the people behind it."

Value Based Digital Twins project participants:
PIs: Marina Bos-de Vos (TUD) & Lenie van Rossem (EMC)
Postdocs: Dajung Kim (TUD), Niko Vegt (TUD), Ki-Hun Kim (TUD), Babette Bais (EMC), Skander Mulder (EMC)
Advisors: Valentijn Visch (TUD), Régine Steegers – Theunissen (EMC), Melek Rousian (EMC)

Solving Societal Health Challenges using Data Science:

a course that bridges the gap between data science and health

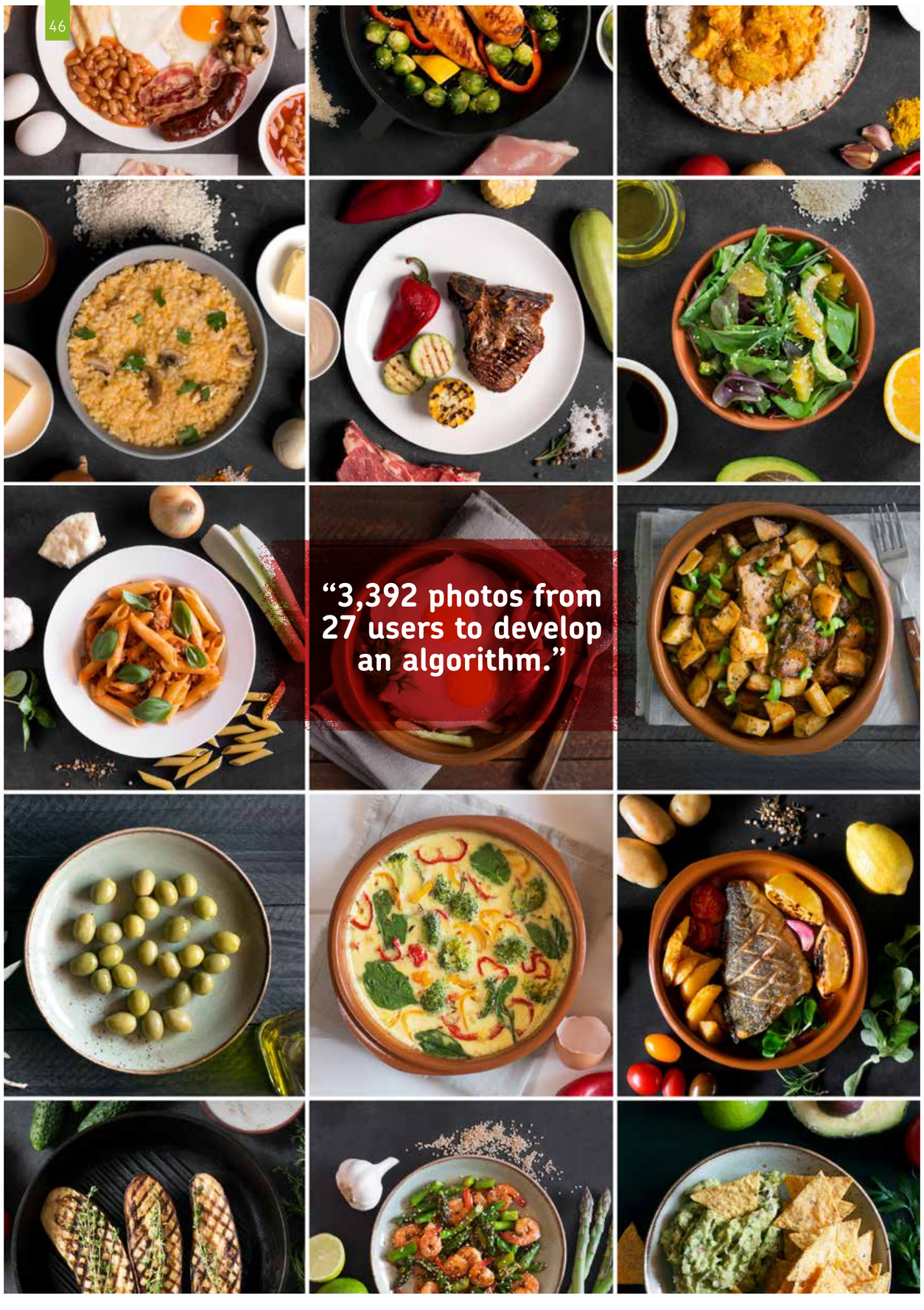
When using intervention tools like an app to encourage people to do more physical activity and eat more healthily, it will be important for the app to know what someone's goals are, what he/she needs and … most importantly … when. Timing is everything because sending someone a reminder to do more physical activity when they are asleep or in a meeting is a missed opportunity. By combining data science and health, the data collected can be specifically used to provide personalised advice.

There is no shortage of information because devices continuously collect data from users – for example, smartphones that use sensors to track how people behave. Does a person do physical activity, how often and when? How does the person in question eat and where is he/she? All the data taken together provide a huge wealth of knowledge, which can be used as an intervention tool to remind people of their health goals at appropriate times.

The targeted use of data

The Consumption and Healthy Lifestyles chair group at Wageningen University has recently launched a new course: Solving Societal Health Challenges Using Data Science. Last year, the course was part of the new Data Science for Health interspecialisation. This year, it was part of the newly-established Data Science for Food and Health Master's programme.

"Data scientists usually lose interest when presented with anything to do with people, behaviour and behavioural change theories," explains dr. Monique Simons, Assistant Professor of Persuasive Technologies for Healthy Lifestyles in the Consumption and Healthy Lifestyles chair group. "It's all about numbers for them. They often aren't interested in the meaning behind the numbers.



Conversely, behavioural scientists don't really know what to do with large amounts of data. This is a shame. It will only be possible to specifically use data as a prevention tool when we are able to achieve a crossover between data science, health and food."

Bridging the gap

"It's important for our students have a good base level for both pillars," Simons continues. "We want them to be able to call themselves data scientists and also have a sound knowledge of diet, health and behavioural change. We also want them to have the unique ability to bridge the gap between these two pillars. This is the so-called Pi-shaped model. During the course, students work in groups on various issues from the business and public sectors. We always ensure that there is a good balance between students with a data science background and students with a health background in each group. This enables them to learn from each other."

Simons is a researcher at the University of Wageningen and has a special interest in the promotion of healthy lifestyles. She is also the co-founder of the new course and the Master's programme. In her research, she aims to identify how people can be encouraged to do more physical activity and eat more healthily and also which role technology and data can play in this process. She brings together different disciplines in her research. For example, in collaboration with data scientists and geographers, she developed a Just-In-Time-Adaptive app intervention: an intervention that uses data to determine the most favourable timing for delivery of the intervention and also when and where people need the intervention and can do something with it.

Location-based message

"In one of our research projects, we look at the location that is collected via GPS data," Simons says. For example, the app sees that someone who has said they want to eat more healthily has been in one place in a snack bar for a very long time. In this situation, a message can be sent with the menu and the advice to choose a salad. The app can also see if there is a supermarket nearby, or a lunchroom, with healthier options. Based on the information available, the app sends messages that are useful to the person in question and also does so when these messages are most useful. However, for the app to be accurate, we need more information from an individual than just a location. This will also make it possible to consider other determinants in the future. For example, how stressed someone feels or previous nutritional intake."

The personalisation-privacy paradox

"It's important to know whether people would be willing to provide the data we need, which is why we are involving end users in the development of the intervention," Simons continues. "People accept a certain amount of interference, but there are concerns about privacy sometimes. This is interesting too. We call it the personalisation-privacy paradox. On the one hand, people really want a personalised intervention. They want the app to know when they don't have time, when they are sick and when they are having a lie in. They want support that suits them, but they will have to allow the app to collect certain privacy-sensitive data to get this support. Research shows that people do appear to be willing to share their location at the very least. As long as they get something in return. An intervention that really helps them, for example."

Too big a time investment

Simons initially focused on physical activity in her research on Just-In-Time Adaptive Interventions. "The built-in sensors in smartphones (an accelerometer, for example) make a lot of data easily available," she explains. "The next step was to translate it into dietary behaviour, as both physical activity and diet are important to the successful achievement of a healthy lifestyle and the prevention of chronic diseases. However, to be able to measure dietary intake properly, you currently still have to ask people to enter what they have eaten and drunk themselves. This is a time investment and people find it difficult to remember everything. They see the benefits of an app like this as long as it doesn't cost them too much time."

Image-based algorithm

"One solution could be to get people to take photos of everything they eat," Simons continues. "Tilburg University asked our students to use a dataset of 3,392 photos from 27 users to develop an algorithm to extract information from these images. Using an image to identify how many calories there are in a dish and what its dietary value is saves a lot of time and people like taking photos of what they are eating."

"We are optimising the just-in-time interventions via a reinforcement learning algorithm, a data science technique," Simons says. "A smart system that uses all the data you enter into it to learn when the best time is to send a message. It optimises itself and learns from previous situations. How does the person react? Will he/she actually increase his/her level of physical activity or eat more healthily? If not, the time wasn't right. Everything is then recalculated and the system tries to motivate the same person again at a different time. Ultimately, this optimises the intervention and it adapts in a way that is most helpful for the person in question."

A wide range of issues

"The students now have five clients with a wide range of issues. The Fitcoin App, for example. This aims to encourage people to engage in physical activity by allowing them to earn digital points if they achieve their goals or challenges. Users can exchange these fitcoins for a gift or voucher. This app is used by more than 200 organisations and has more than 23,000 users. It's a very good data source. This client wants an insight into how it could use this data to optimise its services. For example, it wants to know how to reach people who are not doing enough physical activity yet; they need extra support and would benefit most from a healthier lifestyle."

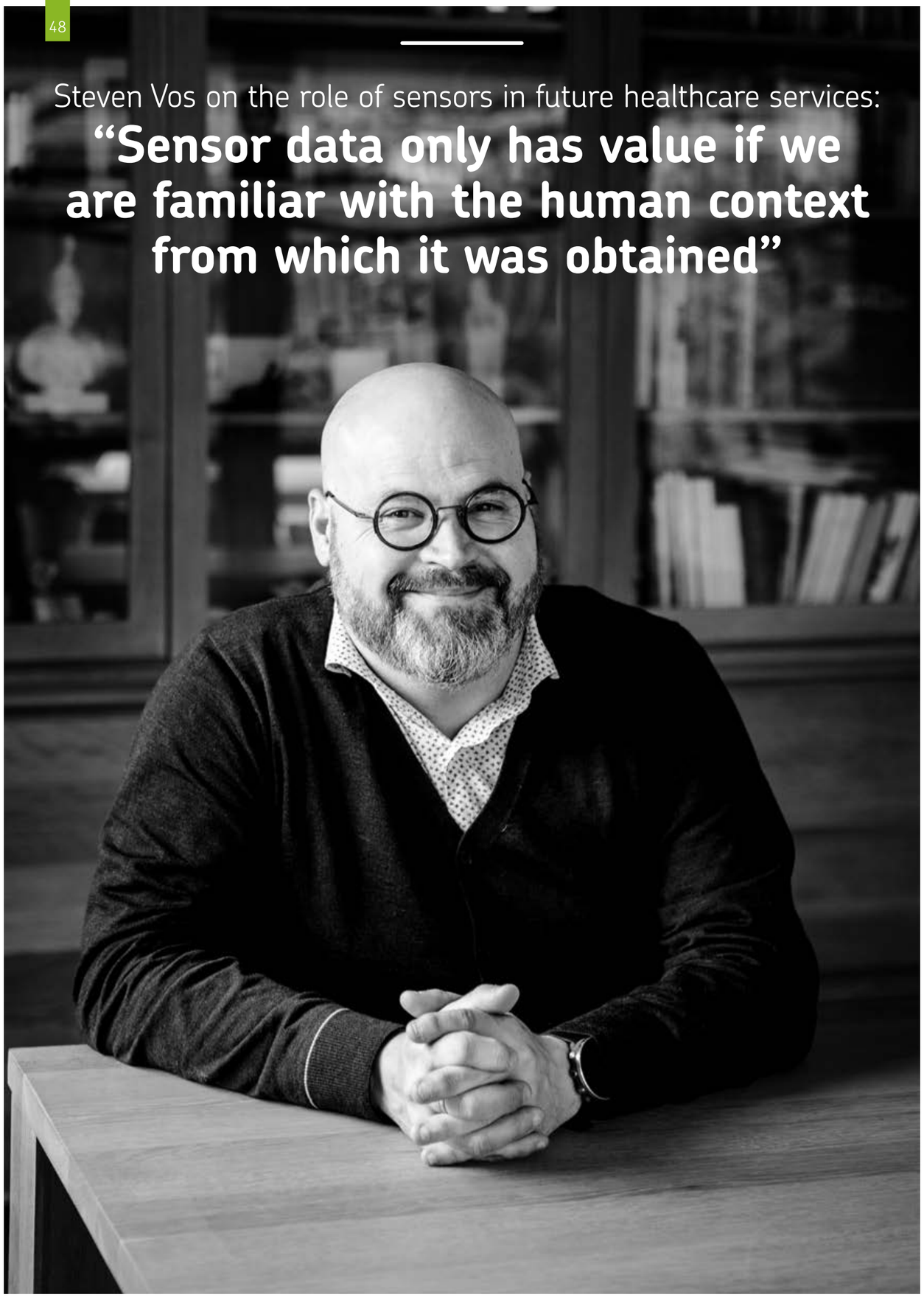
Another client, the municipal health service for North and East Gelderland (GGD Noord- en Oost-Gelderland), would like to know how to connect different (public) data sources. A lot of data is available, from sources including Statistics Netherlands (CBS), the National Institute for Public Health and the Environment (RIVM) and the municipal health services, but how do you link it all together to make it easier to predict where risk groups will be when something like covid rears its head again, for example. Currently, all the sources available are still fragmented at different levels."

Application in real life

"Innovations like these will pave the way to the development of personalised and, as such, more valuable interventions," Simons concludes. "For example, a dietician can offer support to people when they are in his/her practice space, but the temptations and moments of choice lie outside the practice space, in everyday life. People come across temptations in their daily environment, not in a dietician's practice. The choice between something healthy or unhealthy is made outside the dietician's practice, in the real-life setting. And it's at times like this that people could use some help to resist temptation. If the timing is right."

Steven Vos on the role of sensors in future healthcare services:

“Sensor data only has value if we are familiar with the human context from which it was obtained”



The world is full of sensors. We measure everything, so we have a lot of information. But exactly what value do all these sensors have? How do we manage the mountain of data? Which kinds of challenge will we actually be facing if we zoom in on the future of sensors in healthcare? Steven Vos, involved in the Pride and Prejudice project on behalf of TU/e, explains the role of sensors in our society.

Steven was a psychologist originally but moved into the technical domain after obtaining a PhD in kinesiology. He looks at the social value of sensors with his broad background in mind. Steven: “One of the most interesting issues for me is how we can use technical design to eliminate health inequalities in society. In other words: how can we use technology to ensure that far more people have the opportunity to engage in more physical activity and eat more healthily?”

“This issue consists of three interconnected components: people, physical activity & diet and technology. To me, they are an inseparable trinity because technology has the potential to support our health behaviour. However, we do also have to be realistic and recognise that technology has its limits. For example, sensors are ideal when monitoring and collecting data but cannot provide an accurate insight into a person’s personal situation. This is because human behaviour is very unpredictable and difficult to measure.”

Two basic sources: technology and people

“Broadly speaking, there are two basic sources we can use to predict and recognise this type of human behaviour. One of these is a sensor, which actually does nothing other than retrieve numerical data. Hard numbers in which you can try to recognise certain patterns. However, these patterns will not provide an insight into the contexts for human feeling. In other words, the rich and qualitative information about how a person experiences and appreciates something, for example. Or the motives on which a person bases the choices he/she makes. This kind of information can only be obtained by consulting the second source: the person him/herself. Simply by asking questions about what someone thinks and feels. About what stops someone from doing something or actually encourages them to go ahead and do it. This information provides an insight into a person’s situation, which makes it easier to interpret the sensor data.”

“An everyday example is the well-known sports watch. Amongst other things, it allows you to monitor whether or not someone has done any physical activity. Suppose that someone has done nothing on a day when he/she would usually have done some form of physical activity, this information will gain far more value if you combine it with information from another source: people. By asking how someone was feeling on that particular day. And why he/she stayed at home. These combined data sources – the sensor and people – enable us to develop crucial control mechanisms for behavioural change. Because you will only be able to steer someone’s behaviour if you know what their motives are.”

Sensor data versus context

“We occasionally did experiments in which we used sensors to retrieve some level of context. For example, with a tracking app that doesn’t just record the time and date but GPS data too. You then know the time and location and might be able to draw conclusions from both. For example, the weather conditions at a certain time and a specific location. You could use this data to conclude that rainfall was responsible for a drop in someone’s level of physical activity. However, you still don’t know if it was the rain that stopped the person from doing any physical activity. It might have been the route, which was difficult to use because of the rain. Or it might just have been a coincidence that the person decided to stay at home on the day in question. This experiment gave us slightly more information about the context but left us guessing about the real reasons.”

Exactly what does ‘desired behaviour’ mean?

So, we need to realise that, although sensors provide crucial information, the human context is indispensable for a proper understanding of the factual data they generate and the ability to steer people towards the desired behaviour. This term immediately raises new questions too. Because how do we determine exactly what desired behaviour is? And who determines what it is? Is it based on public opinion? Who sets the standards?

Steven: “There are no clear-cut answers to these questions. Framing and human interpretation are always necessary. This is why we can never leave behavioural change to technology alone. Also, individuals are still deciding which technology they let into their lives themselves. And the decision they make depends on many factors. One important one is product design. Is it user-friendly? And is the design attractive enough for someone to want to be seen using it?”

“When we make a prototype these days, we make sure it looks really good. Just a couple of decades ago, a prototype would have been held together with duct tape and cardboard. Now, it looks like a finished product, which makes it far more likely that people will use it. In this example, technology, design and people very clearly come together. This once again emphasises the importance of multidisciplinary collaboration in the Pride and Prejudice project.”

Building together in 4TU

Was the Pride and Prejudice project a success? Steven says that we should not be tempted to look at the concrete results achieved for an answer to this question. Steven: “It’s about the networks we are developing, for now and the future. That’s where the real gains stand to be made. You know in advance that ambitions will always outweigh the outcomes. All the participants feel the urge to solve problems, but that’s virtually impossible to achieve in just a few years. You have to work intensively with various universities. The challenges we are facing today aren’t really technical because a great deal is possible in this respect. The difficulty lies more in the application and understanding of data.”

Today’s challenge: understanding data

“The world is full of sensors. The prevailing idea is that they can be used to identify and address any problem that arises. However, this approach doesn’t usually work because a sensor-based solution to a problem you identify today will often only be available several years down the line. The chances are that reality will catch up with you. Conversely, you could use existing sensor-based solutions and see which problems they could solve. This often doesn’t work either because the sensors will not have been developed for the issue in question. So, support will be absent too. This is why the interplay between both worlds is so important. The solvers of social problems need to be aware of what technology is able to do and vice versa.”

Also, we should not be under the illusion that every sensor will solve a problem straight away. We should see a sensor as a tool that creates new challenges and opportunities to understand and address social problems. We need to understand what is going on in society much more. The only thing we know for sure is that sensors always collect data. The important thing for us is to understand this data together. Its relevance. possibilities and inadequacies. That’s where the issues lie that we are all facing today.”

Sustainable collaboration on social issues within 4TU

Marjolein Dohmen-Janssen is the Secretary General of the 4TU.Federation. In this capacity, she supports the board of 4TU, is involved in strategy development by 4TU, maintains external relations and coordinates research, education and valorisation activities for 4TU.

The 4TU.Federation (4TU) is an alliance between the four universities of technology in the Netherlands. Their joint aim and the reason why they joined forces is to strengthen technological knowledge and make society resilient, healthy and safe. 4TU's ambition can only be achieved if there are enough well-trained engineers, designers and researchers who are able to deliver internationally-leading and socially-relevant research on fields including diet and eating behaviour. These are both themes that the Pride and Prejudice project focused on from 2018 to mid 2023. Marjolein Dohmen-Janssen looks back at the origins of this project.

Marjolein: "To show just how valuable the Pride and Prejudice project is, it's good to go back to 2016 when Wageningen University & Research joined forces with the technical universities in Delft, Eindhoven and Twente to establish 4TU. Wageningen was a valuable addition because of its focus on life sciences and agrifood. Like the other technical universities, it wants to both understand the issue and come up with solutions to it. Its additional expertise enriches the other universities, which highlights the importance of working together: to become smarter together and take a joint stand against major social challenges.

4TU has reserved a special budget for the long-term collaboration involved when the universities join forces with each other. This budget is being used to create permanent positions for scientific talents ('tenure trackers'). In the past, more emphasis was put on postdocs, but they often leave before their temporary contracts have ended.
By creating permanent scientific positions within a consortium, we are creating opportunities for long-term collaboration.

Armed with the subsidy available, 4TU has formed a number of consortia within the overarching theme: "High Tech for a Sustainable Future" (HTSF). At a meeting in Wageningen, scientists were able to register for a call to define programmes. It turned out to be an impactful meeting at Impulse in Wageningen, the ultimate platform for creative and innovative ideas.

The kick-off of the Pride and Prejudice project

The room in Wageningen was literally full to overflowing. It was designed to hold a maximum of 150 people, but 300 had packed themselves in. The atmosphere was chaotic and fun and people were brimming with ideas. Everyone was given the opportunity to explain their proposals and get researchers to commit to their initiatives. Sparks flew in every corner of the room and there was plenty of 'dating' on content. The day ended with 10 proposals, five of which made it through. One of these five proposals was for the Pride and Prejudice project.

The one requirement that 4TU had was that each technical university would created a minimum of one tenure position for each HTSF programme and, as such, for the Pride and Prejudice project as well. Money was available for these positions and several postdocs. 4TU will fund the collaboration for the first few years, with the expectation that people from different universities will continue to seek each other out afterwards, because a fruitful collaboration has been developed and also because the faculties were asked to commit themselves in advance to the retention of the positions in question once collaboration ends. This creates a climate in which the lines of research established will be maintained and developed for years to come. This climate is desperately needed given the social issues our society is facing today.

More attention necessary for preventive health

Long-term sustainable collaboration is crucial to the theme of the Pride and Prejudice project because improved healthcare is always the subject of discussion. I believe that even more attention should be paid to prevention. Our entire system focuses on cure, at the expense of prevention. Even healthcare insurers rarely finance prevention programmes. Which really says it all. However, it is also true that it is difficult to design prevention efforts properly and to change ingrained behaviour. Because who wants to continually be told that 'that's not healthy', 'you'd be better off not eating that' and 'it would be wiser to eat this'. This makes behavioural change complex, because of which an integrated approach like the one adopted in the Pride and Prejudice project - which focuses on health, the technology available and our behaviour - is very much needed."

Lessons learned

Five years of the High Tech for a Sustainable Future (HTSF) programme, with the Pride and Prejudice project as one of a total of five projects, have provided us with valuable insights on a number of subjects and enabled us to fund a number of tenure trackers. We have decided that tenure trackers will receive a starter package for the next round of HTSF programmes. This will make it possible to hire PhD candidates, which benefits academics who are at the start of their careers. It can take up to two to three years to establish your line of research, write a proposal for a research fellow position and then submit it, especially if you are not from the Netherlands and not yet fully familiar with its funding and grant systems. This is why we are now telling tenure trackers that they will be given a budget for a research fellow position to get their research started. This accelerates the process considerably.

Marjolein Dohmen-Janssen

Managing director 4TU.

"Every field has its own language, which is why the way a particular researcher thinks will be fundamentally different to researchers with other specialisms. When I - a food scientist - use the term 'sensory system', I'm referring to the human senses. However, a designer will have a technical sensor in mind. For me, sensory research involves getting people to taste or smell something, while a designer will want to figure out which sensors it would be best to use. In the Pride and Prejudice project, it took a while for everyone to get on the same page. But when they did, new and valuable insights were gained.

For example: technical researchers ask themselves how they can make something. This was a vague question to me initially. We always opt for a far more linear approach: we identify the target group, what we want to know about it and then we set to work. Armed with the lessons I learned from the Pride and Prejudice project, I will be more inclined to take a step back in my research. I would now be more inclined to establish who the individual user is. What are his/her characteristics? What does a specific user need and how does someone behave? These are factors that we never paid much attention to before. But they are actually very important because each person is different and makes different choices based on numerous factors.

Another lesson I have learned is how to organise collaboration on the basis of a smart approach. Although it is good that 4TU 'thinks' like a big consortium, researchers have to stay close to their own niches. The real art is to combine disciplines that complement each other well. With people who share the same interests. It is impossible to combine just any arbitrary specialism.

It is precisely the short lines of communication and personal collaborations that were developed as part of the Pride and Prejudice project that have proved most valuable. If you add up all these small alliances, the conclusion for 4TU is a good one. What makes this even more valuable is a absence of any real research question. This promotes creativity in the process and creates a level of freedom that has allowed us to deliver great results."

Marlou Lasschuijt

PhD. Assistant Professor of Sensory Science and Eating Behaviour.

Valuable cross-pollination

“During Pride&Prejudice, we gained a lot of new expertise that was beyond our own scope. At Wageningen we do a lot of research into what people eat. To a great extent, we examine this topic from a nutritional point of view, while the user experience for the design of our research tools has often not been considered sufficiently. We have routinely received feedback that our questionnaires are too long, and therefore tedious to complete. Thanks to cross-pollination with other universities, we have enhanced our own knowledge in that area. For instance, how to research user-friendly tools. How to develop tools from a user perspective using co-creation, for example. These are valuable insights that will help us design surveys that are smarter and more user-friendly.”

Elske Brouwer-Brolsma

Assistant Professor at the Division of Human Nutrition and Health at Wageningen University

Learning by doing

“Preserving the collaborative relationship between the four technical universities was a major goal of Pride&Prejudice. A number of post-docs started with a plan written by a professor. When we began, I had no real insight into the expertise of the other researchers. My first assumption was that I was going to be working with tech companies that develop sensors. I started by exploring what they do and how that converged with our research at Wageningen. We gradually formed a strategy to streamline this process. We began working together on mentoring master’s students paired with relevant projects. This gave us insight into what everyone was working on and therefore accelerated the preliminary exploratory process.” Using that information made coming up with new research ideas such as FLOW 1.0, for example, a much smoother process in the end.

Collaboration is people work

During Pride & Prejudice, we did not rely on familiar AIO projects and instead focused on more seniority through the use of post-docs and tenure trackers. Theoretically, this is a logical approach, but in practice it works a little differently. We gathered together in a room, staring at each other wondering what we were going to do. This was partly because we had to find out what everyone’s expertise was, but also because we all had very full schedules already and could not easily set up and run a study ourselves (you really need extra hands for that). You could say: we have 4 universities and we’re going to work on some nice things together. But in practice, it’s all people work. Ultimately, you gravitate toward the people you click with. And those you work together with more easily. That involves basic human factors that you can’t pre-calculate in a cooperation agreement.

An eye for content as well as process

“When we started Pride&Prejudice, I had a pretty ad hoc approach to working together. I though to myself: in Wageningen, we know all about nutrition, in Delft it’s engineering and in Eindhoven it’s AI. Add all of this knowledge together and you’ll be able to build a sensor that can record nutrition. But in practice, it turned out not to be that simple. Collaboration is not achieved by simply combining different areas of expertise in the hope that something magical will happen. The trick to successful collaboration is to designate someone to drive the project. Someone who guides others within the various organisations and who physically works on the project. I’ve noticed that successful projects are mainly made possible because of people who not only focused on the content, but also deliberately streamlined the project process.

”Therefore, success is highly dependent on the kind of leadership that is put in place. If no one takes the lead, things are soon in danger of stagnating. However, not everyone has the character to take on that challenge. A lot of scientists are fairly introverted and attached to their own environments. You can’t simply uproot them from their workplace to start somewhere else. Because while collaborating with other institutions is great, it can also be stressful. You have to request a pass to another university building you have never been to. You don’t know where exactly to go, where to sit or where the coffee machine is. Whether you like it or not, you have to deal with these inconveniences as a project organisation. You have to anticipate these things in advance.”

Just build it and dare to make mistakes

“During Pride&Prejudice, we learned how to do things differently at Wageningen. We saw some powerful examples in Twente and Eindhoven. They demonstrate a lot of courage there by putting projects in the hands of students, with the mindset of ‘go build it’. That was a real eye opener for me. At Wageningen, we are more accustomed to taking students by the hand. A more cautious approach, in other words. The lesson I learned is that you gain much more when you throw students in at the deep end. Let them try out more and learn from each other. If you come up with everything yourself, the only seeds of knowledge that bear fruit are your own. New knowledge emerges when you leave it in the hands of student collaborations.

And when you dare to make mistakes. Those lessons are just as valuable. Greater freedom leads to greater creativity. And therefore to cooler and more valuable projects.

One example: at Wageningen, we are at the forefront of the world of dietary assessments. The entire design work for Pride&Prejudice was done by a Wageningen student. But the project mainly succeeded because this student worked physically alongside the people in Eindhoven. If this student had just stayed at Wageningen, the developments would not have been nearly as interesting.”

Guido Camps

Pride & Prejudice researchers

TU Delft · TU/e Eindhoven University of Technology · University of Twente. · Wageningen University & Research

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Merijn Bruines, PhD
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Bouwewijn Boon, PhD

Position during P&P Postdoc - Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

Current Position Postdoc - Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

Expertise Food design & behavior change

Your most important contribution during P&P Doing explorative research about how seasonality can inspire designers to support more healthy and sustainable food practices.

What do think is the most important outcome of P&P For me personally, to have had the opportunity to steer my career more into a direction that is in line with my values and interests.

m.j.b.boon@tudelft.nl

Steven Vos, Prof

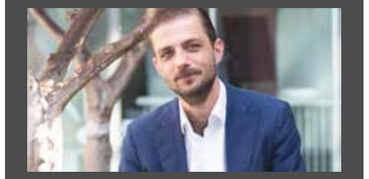
Position during P&P Full Professor -Department of Industrial Design, TU Eindhoven

Expertise Designing for vitality and active lifestyle

Your most important contribution during P&P Coaching and supporting researchers

What do think is the most important outcome of P&P Collboration between 4 universities and building a network of researchers.

s.vos@tue.nl



Bas de Boer, PhD

Position during P&P PostDoc - Philosophy Section - BMS Faculty, University of Twente

Current Position Assistant Professor (Tenure Track) - Philosophy Section - BMS Faculty, University of Twente

Expertise Philosophy of Health; Philosophy of Technology

Your most important contribution during P&P Research on how our understanding of health changes due to the development of technologies for preventive medicine

What do think is the most important outcome of P&P Doing interdisciplinary research at the intersection of design and the philosophy of health.

s.o.m.deboer@utwente.nl

Willem-Paul Brinkman

Position during P&P associate professor, Fac. EEMCS, TU Delft

Expertise Digital behavior change

Your most important contribution during P&P research on conversational agents for behavior change.

What do think is the most important outcome of P&P validated standardised measurement instrument for evaluating human interaction with an artificial social agent

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Rúben Gouveia, Dr. Ir.

Position during P&P Tenure Track - Department of Design, Production and Management, University of Twente

Expertise Human Centered Design and Self-tracking technologies

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Monique Simons, PhD

Position during P&P Postdoc/ senior researcher- Chairgroup Consumption & Healthy Lifestyles, WUR

Current Position Tenure Track, assistant professor

Expertise Persuasive Technologies for Promoting Healthy Lifestyles

Your most important contribution during P&P Knowledge building on Just-in-Time Adaptive Interventions and sharing this knowledge among students and other researchers. Contributing to the development of the new master Data Science for Food and Health at WUR.

What do think is the most important outcome of P&P Expansion of my network of researchers working on topics related to my two main research lines 1) Just-in-Time Adaptive Healthy Lifestyle Interventions and 2) Participatory approaches (e.g. co-creation) to increase impact of healthy lifestyle interventions

monique.simons@wur.nl

Amal Abdulrahman, PhD

Position during P&P PostDoc - Interactive Intelligence Group - Department of Intelligent Systems - EEMCS - TU Delft

Current Position Researcher - Macquarie University - Sydney, Australia

Expertise Human-agent interaction for behaviour change

Your most important contribution during P&P Designing a reinforcement learning based social agent for people with diabetes

What do think is the most important outcome of P&P Establishing a wider professional network of researchers from different disciplines.

What else would you like to share? It was an enriching experience to work on this project with the resources and funds available to build new connections and foster personal and professional growth in academia.

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Ellen Van Loo, PhD

Position during P&P Tenure Track - Marketing and Consumer Behavior Group - Wageningen University & Research

Expertise Consumer Food Choice in Digital Choice Environments

Your most important contribution during P&P Piloting new research infrastructure for testing interventions on online food choice platforms

What do think is the most important outcome of P&P Connecting the 4TU by building a network of young researchers with complementair expertise across different universities and research units.

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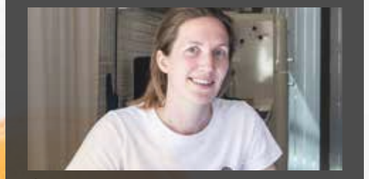


Juliet Haarman

Position during P&P Post-doc - Human Media Interaction - Faculty of Electrical Engineering Mathematics and Computer Science, UT

Current Position Assistant Professor - Human Media Interaction

Expertise Interactive technology to support healthy behavior

Your most important contribution during P&P Design and development of the Sensory Interactive Table: a research and intervention instrument that can capture eating behavior in a social dining setting, and that can support and motivate people in making changes in their behavior

What do think is the most important outcome of P&P Long lasting collaborations

j.a.m.haarman@utwente.nl

Jos Kraal, PhD

Position during P&P Tenure Track - Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

Expertise Designing for Health Behavior Change

Your most important contribution during P&P Organising education on motivation and behavior for industrial design students at TU Delft.

What do think is the most important outcome of P&P Building a network with researchers with a similar interest/ expertise throughout the 4 technical universities

j.j.kraal@tudelft.nl

Prof.dr.ir. A.C. (Aarnout) Brombacher

Position during P&P Full prof Industrial Design, TU Eindhoven

Current Position Full prof JADS institute for Data Science, TU Eindhoven/Tilburg University

Expertise Data acquisition and analysis fo health, vitality and sports

Your most important contribution during P&P Project leader/building a community

What do think is the most important outcome of P&P A community of researchers, active in this field

a.c.brombacher@tue.nl

Niko Vegt, PhD

Position during P&P Postdoctoral Researcher - Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

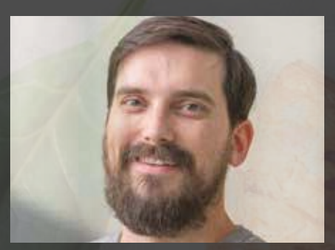
Current Position Postdoctoral Researcher - Department of Psychology, Education, and Child Studies - School of Social and Behavioral Sciences, Erasmus University Rotterdam & Postdoctoral Researcher - Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

Expertise Participatory eHealth Design and Co-creation with Youth

Your most important contribution during P&P A speculative design research project on values of AI in pregnancy care.

What do think is the most important outcome of P&P Developing networking skills and my own research line

n.j.h.vegt@tudelft.nl



Roelof de Vries, PhD

Position during P&P Postdoctoral researcher - Biomedical Signals and Systems - University of Twente

Current Position Senior Researcher and Lecturer - Human Experience and Media Design, Utrecht University of Applied Sciences

Expertise "Human-Centered Design, Behavior Change Technology, HCI theory, concepts and models"

Your most important contribution during P&P developing tools and knowledge to bridge the inference and operationalization gap between theory and practice in the context of behavior change

What do think is the most important outcome of P&P a network of interdisciplinary researchers

roelof.devries@hu.nl

Inare Kalinauskaite, PDEng, PhD

Position during P&P Post Doctoral Researcher - Department of Industrial Design, TU/e

Current Position Assistant Professor - Public Health Practice team, Julius Center for Health Sciences and Primary Care, UMC Utrecht

Expertise Transdisciplinary collaboration, Inclusive Design for Health Prevention, Research in Living Labs

Your most important contribution during P&P Facilitating collaboration within P&P consortium, setting up and chairing P&P Tenure-Core-Team, Organising P&P days at DDW'21

What do think is the most important outcome of P&P Collaboration spin offs between different early career researchers across 4TUs.

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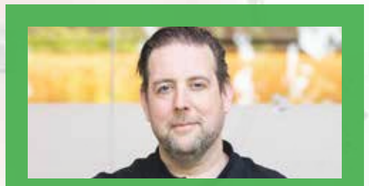

Guido Camps, PhD

guido.camps@wur.nl

Rick Schifferstein, PhD

Position during P&P Associate Professor- Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

Expertise Food Design

Your most important contribution during P&P Looking for ways to employ negative emotions like shame and disgust to improve consumers' eating behavior

What do think is the most important outcome of P&P Involving designers in developing innovations for preventive healthcare

h.n.j.schifferstein@tudelft.nl

Geke Ludden, PhD

Position during P&P Professor of Interaction Design - Department of Design, Production and Management, University of Twente

Expertise Design for Health & Wellbeing, Behaviour Change and Engagement.

Your most important contribution during P&P Making connections between disciplines needed for effective health behaviour change.

What do think is the most important outcome of P&P More focus on originality in making changes in the different domains of health behaviour change.

What else would you like to share? We are far from finished, we have exciting chalenges ahead of us, ao in integration of health domains and making this understandable to people.

g.d.s.ludden@utwente.nl

Marlou Lasschuijt, PhD

Position during P&P Postdoc- Assistant Profesor, Division of Human Nutrition and Health, Sensory Science and Eating Behaviour Group Wageningen University and Research

Current Position Tenure Track- Assistant Profesor, Division of Human Nutrition and Health, Sensory Science and Eating Behaviour Group Wageningen University and Research

Expertise (clinical) Eating behaviour and physiology

Your most important contribution during P&P Organizing eindhoven design week workshop, co-development of breastmilk intake divice together with HNE Global nutrition group at WUR, Tue, and Twente univeristy, mEETr food intake tray co-development.

What do think is the most important outcome of P&P Building a network of researchers that compliment eachother which helps shape larger research projects

marlou.lasschuijt@wur.nl

Dirk Heylen, PhD

Position during P&P Full Professor - Human Media Interaction, Faculty of Electrical Engineering, Mathematics and Computer Science, University of Twente

Expertise Computational Social Intelligence

Your most important contribution during P&P Overlooking the field of nutrition and technology.

What do think is the most important outcome of P&P Starting up collaboration between HCI researchers and nutritionist researchers. Devoloping new approaches to happy and healthy eating.

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Elske Brouwer-Brolsma, PhD

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Mailin Lemke, PhD

Position during P&P Postdoc - Department of Human Centered Design - Faculty of Industrial Design Engineering, TU Delft

Current Position Senior design researcher and project manager at dreiform GmbH

Expertise Senior design researcher and project manager at dreiform GmbH

Your most important contribution during P&P Publishing several journal and conference papers based on P&P's aims and goals

What do think is the most important outcome of P&P Connecting with researchers with a similar interest in supporting a healthy lifestyle

mailin.lemke@googlemail.com

Marina Bos-de Vos, PhD (Dr.ir.)

Position during P&P Assistant Professor (Tenure Track), Department of Design, Organisation and Strategy, Faculty of Industrial Design Engineering, TU Delft

Current Position Assistant Professor (Tenure Track), Department of Design, Organisation and Strategy, Faculty of Industrial Design Engineering, TU Delft

Expertise Strategic design for joint value creation in system transformation projects (including health innovation projects)

Your most important contribution during P&P Collaborating in and coordinating the development of a concept for a meaningful Digital Twin in pregnancy care, including the development of a provocative prototype, and research into how Digital Twin users would prefer to distribute autonomy among AI, patient, and care provider in high-risk and low-risk situations.

What do think is the most important outcome of P&P Developing the foundations for transdisciplinary research into the future of health; both in terms of topics relevant to address and how different disciplines can contribute to these. And of course the network of people that has taken shape to continue with this.

m.bos-devos@tudelft.nl

Arnout Fischer

Position during P&P Associate professor Consumer Behaviour, Marketing and Consumer Behaviour Group, WU

Expertise Consumer response to new food and food technology

Your most important contribution during P&P Collaboration with Ellen van Loo on WU project on personalised nutrition

What do think is the most important outcome of P&P Establishing/deepening the link with the other TU's - in particular the consumer-design relations

What else would you like to share? Lets look for new opportunities to work together

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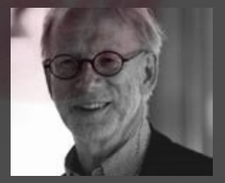

Bart Verkerke, Prof. Dr. Ir.

Position during P&P Full Professor, Biomedical Device and Production Technology, University of Twente

Current Position Retired

Expertise Biomedical Product Development

g.j.verkerke@utwente.nl

Max Birk, PhD

Position during P&P Tenure Track - Department of Industrial Design, Systemic Change Group, Eindhoven University of Technology

Current Position Tenured - Department of Innovation Science and Industrial Engineering, Human Technology Interaction Group, Eindhoven University of Technology

Expertise Human Factors of Video Games

Your most important contribution during P&P Representing Industrial Design and Design for Behaviour Change at TU/e across internal and 4TU meetings

What do think is the most important outcome of P&P Collaboration, ideation, and implementation across the 4TU network

m.v.birk@tue.nl

Hermie Hermens, Prof. Dr. Ir.

Position during P&P Full Professor, Biomedical Signals and Systems, University of Twente

Current Position Retired

Expertise E-Health and Telemedicine

h.j.hermens@utwente.nl

Yuan Lu, PhD

Position during P&P Associate Professor - Department of Industrial Design, TUE

Expertise Design for healthy aging

Your most important contribution during P&P "Participated in four projects with WUR and other partners to empower children with special needs to live with healthy lifestyle behaviors.

1. Towards personalized cardiovascular risk assessment and management in children with chronic disease
2. HAPPYthalamus; the app that makes your hypothalamus happy
3. Towards age-appropriate food groups and supporting icons for children 8-10 years old
4. LIFTS: Healthy Lifestyle for low liTerate teenagerS"

What do think is the most important outcome of P&P Interdisciplinary research collaboration supported by P&P creates great potential for preventive health for children with specific needs

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Kees de Graaf, PhD

Position during P&P Chair (professor) - Sensory Science and Eating Behavior, Division of Human Nutrition & Health, Wageningen University & Research

Current Position Emeritus chair (professor) - Sensory Science and Eating Behavior, Division of Human Nutrition & Health, Wageningen University & research

Expertise Sensory science, Eating Behavior, Nutrition and health

Your most important contribution during P&P Facilitating,initiating collaboration between institutes

What do think is the most important outcome of P&P Collaboration and integration of different perspectives, some joint papers; In Wageningen start of new careers for young researchers

What else would you like to share? Inspiring important project continuing to be fruitful

Kees.degraaf@wur.nl

TU Delft · TU/e Eindhoven University of Technology · University of Twente. · Wageningen University & Research

The Pride and Prejudice project was part of the 4TU.Federation and was being implemented by a unique combination of researchers from TU Delft, TU/e in Eindhoven, the University of Twente and Wageningen University.