

De nieuwe factor

Exploring persuasive technology in the context of health and wellbeing at work

We are not able to imagine life without technology. Also in the work setting, technology is everywhere around us. Developments in ICT have brought about many changes in work, and these changes will continue as technology evolves. Technological developments like persuasive technologies offer new possibilities as interventions to enhance health and wellbeing at work. Persuasive technology shows real potential to drive improvements in working life, to reduce occupational risks or better manage risk factors. However, can we trust persuasive technology? On which theories, models or standards do they base their feedback and recommendations? Are they effective to change behavior? Who is actually profiting from persuasive technology? The challenge is to explore when, where and for whom persuasive technology can be meaningfully implemented.

Since the beginning of my professional career, I have been interested in the interaction between people and technology. In particular, how technology influences our life, work and health.

The very first research project I performed was a graduation project at Ergocare about computer work, the risks for developing Repetitive Strain Injuries (RSI), and ways to prevent this. The first years at TNO, I continued to do research in this area.

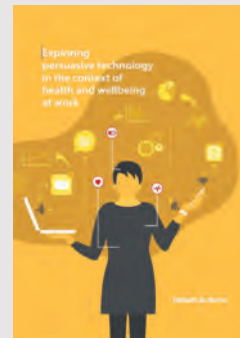
As technology continued to develop, my focus shifted to research on the new ways of working. Developments in ICT had a major impact on the way we work. It changed how we work, where we work and when we work. These changes in work continue as new technologies evolve. Up until now, technology has mostly made our work easier, faster and more efficient. During the COVID pandemic, we have seen how technology enabled many knowledge workers to work from home. At the same time, technological developments are related to new occupational risks, such as physical inactivity, RSI, and work related stress.

However, technology might also offer new opportunities. I became increasingly interested in the



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question how technology might be used as an intervention to enhance health and wellbeing at work. This became the subject of my thesis. The aim of my thesis was to explore the potential of persuasive technology for health and wellbeing at work.

What is actually persuasive technology? Persuasive technology is defined as 'interactive systems developed to change attitudes or behaviours of users, through persuasion and social influence, without coercion'. In addition to monitoring or (self)-tracking, persuasive technology provides active feedback to the user. For example smart watches, or fitbits, or an app like 'Ommetje', which continuously collect data. These collected data form the basis for persuasive technology. It can monitor users behaviour, emotions, physical and mental activity and bodily functions. Smart software can analyse these data and discover patterns that are invisible to the user. By giving feedback to the user, these technologies give insights and recommendations and thus help the user to make everyday choices in a variety of areas such as sports, health and lifestyle.

Persuasive technology is also interesting for the work setting because when it's portable or wearable, it can track our behaviour, physical activity and bodily functions also at work. Automated context tracking makes it possible to bring the intervention into the daily work situation, contexts where people make decisions and where they encounter barriers to healthy or safe behavior. The connectivity makes it possible to share data with health professionals or peers. And these technologies are typically personalised and tailored to the individual user.

There's no doubt that persuasive technologies might be handy – but can we trust them, and on what do they base their recommendations? Are they effective, and who is actually profiting from these technologies and the data they collect? These are the research questions of my thesis.



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Elsbeths promotie digitaal te volgen.

To answer these questions, we assessed the consistency of persuasive technology with evidence-based practices. As said above, persuasive technologies collect data using sensors, analyse and interpret these data accordingly, to give adequate feedback. To do this, it draws on a variety of assumptions, theories and standards. However, it is often unclear whether theories or models are being used and if so, which ones. We performed a study to look into that question in more detail. Research shows that interventions are more effective if they incorporate 'behaviour change techniques'. We performed a review of 45 apps for mental and physical health of employees. Which behaviour change techniques could be identified and which combinations of behaviour change techniques were present? Results showed that some techniques were used more often than others. Apps contained seven behavior change techniques on average.



We know from other literature that it is not only about the number of techniques that are used, but also about combinations of certain techniques. Some apps used unfavorable combinations of techniques. These results indicated that the potential of apps for mental and physical health of employees might be substantially improved by incorporating knowledge of behaviour change theory.

Is persuasive technology effective as a medium for delivering interventions at work? The purpose of persuasive technologies is to help users achieve their goals. The question is whether these technologies are in fact able to do that. Do they always have the desired

effects? To answer these questions, we performed several studies with a persuasive computer mouse. During computer work we see long durations of mouse use, unfavourable postures of lower arm and wrist and sustained muscle tension. This might eventually lead to RSI complaints. The persuasive computer mouse contains a sensor, recognizing these postures. And when it does, it gives a tactile feedback signal to the user, as a reminder to change your posture. We tested the persuasive computer mouse in the laboratory and in the field. Evidence was found for the persuasive computer mouse to positively impact employees' behaviours. It decreased static muscle loading of the lower arm muscles, thereby decreasing the risk to develop RSI. However, there was no clear consensus about liking or disliking the persuasive computer mouse. The results prompted us to go even deeper. Would it make any difference using different types of feedback?

We performed another study to compare four different feedback signals. Just noticeable to change behaviour, but not too present to disturb task performance or to irritate the employees. We used two tactile signals, comparable to the vibration of your mobile phone, one continuous and an one interrupted signal. And two visual signals. One consisted of four small orange squares in the corners of the screen. The other signal can best be described as a water ripple over your screen. Results showed that all feedback types were equally effective to influence behaviour. However, differences were found in user experiences. Tactile feedback appeared to be less irritating compared to visual feedback. With these studies, we showed the potential of persuasive technology as an effective intervention to prevent risks for RSI. However, these studies also showed the importance of involving end-users; user experiences and the context of use should be taken into account as early as possible in the design stages of persuasive technology.

How far can we permit technology to go in influencing our behaviour, our working life and our private life? The continuous gathering of information also raises



questions about safeguarding privacy and responsible use of personal data. All the more so because persuasive technology often crosses the boundaries between work and private life. Imagine an app for nightworkers that measures sleep data and gives feedback on how to cope with negative effects of irregular working hours. Would you feel like big brother is watching you?

In addition, can the employer and the employee trust the data? This can be illustrated with a well-known question for persuasive technology: to determine the cut-off point for an employee to fall into a certain health or safety risk category. This is decided by the algorithm. Minor variations in sensing might suddenly have large implications for the given feedback. Careless interpretation might worry users unnecessarily (false positives), or ease their minds while they should worry (false negatives). At the moment, Dutch legislation on privacy, data protection and working conditions provide a framework for responsible use of persuasive technology. However, for employers as well as employees it still remains unclear whether their rights to privacy and autonomy are respected by persuasive technologies. This could be remedied through

appropriate guidance such as setting standards and providing assessment guidelines. The good news is: such standards are on their way.

Persuasive technology is already impacting the workplace and it will become even more relevant in the future. Given the current status of persuasive technology, it may be concluded that application at work is at its early stages and huge challenges remain. That means that now is the time to think about how we can guide the introduction of persuasive technology at work, in a responsible manner. To preserve, or preferably enhance, health and wellbeing of workers. This is what I plan to research further in the years to come.

This is an adapted version of the layman's talk, which preceded the ceremony, containing a selection of topics covered in the dissertation. A copy of my dissertation can be requested by sending an email to elsbeth.dekorte@tno.nl.