

# White Paper

## Design and development of Onnikka: Why it works?

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Despite generally promising results of digital health interventions, there is insufficient understanding of why some interventions succeed and some do not work. This short paper seeks to describe the success recipe in behind of Onnikka's development and its core features.

### Background and history

Onnikka's information content is based on cognitive-behavioral theories seeking to educate users to identify and cope with dysfunctional thoughts interfering with their behavioral goals and self-efficacy beliefs. Healthcare professionals with extensive experience in guiding people in lifestyle changes provided the content for it and it has been thoroughly tested in multiple stages.

The software design and development process didn't happen only once. Originally Onnikka was implemented as a web information system for digital health research purposes at the University of Oulu, starting in 2012. User experience studies and health outcome studies were carried out in long-term randomized controlled trials. The way how content was being served and the health outcome results were found to be excellent. Research results from these have been published. Design lessons learned lead us to the core software features and how they should be implemented as well as the critical requirement of unobtrusiveness.

The currently available Onnikka was developed based on these findings as a platform-independent mobile information system by using modern software technologies and architectures with security and privacy features as well as requirements for medical devices close in mind. At this stage it was still a research vehicle. User experience studies and a randomized controlled trial were once again conducted. After obtaining great results from these the university encouraged to spin it off as a commercial product. Onnikka was brought to the market in spring 2022.

### Influencing the way people think and do

There are myriads of digital health interventions trying to influence health behaviors, and most of them have been developed on an ad-hoc basis without software strategy. Some of these interventions have been designed and modelled as persuasive systems. Persuasive systems are software information systems designed to form, alter or reinforce attitudes or behaviors or both without using coercion or deception. They seek to do it by marrying psychology and information technology to both compel reasoning and trigger emotions. Persuasive design does not substitute other software development methods, techniques and lifecycle, but it guides them and specifically enables introduction of the persuasive elements to be built into the software system. Rather than just by glueing wishful features into a system, it is the design of digital health interventions as persuasive systems from the very beginning of the development process which gives the advantage.

## Onnikka's persuasive design process

Onnikka has been developed as a persuasive system from Day One. The Persuasive Systems Design (PSD) model and the Behaviour Change Support Systems (BCSS) framework provided systematic and effective methods to develop a system that appeals to both reason and emotion in an open, transparent and ethical manner. The PSD model and BCSS framework utilize theories from social and cognitive psychology such as self-efficacy theory, goal-setting theory, theory of cognitive consistency and elaboration likelihood model, and it builds on top of lessons learned in the software engineering and information systems fields such as technology acceptance model. As such the PSD model and BCSS framework are not health-specific but can also be applied in domains such as security, sustainability, and responsible behaviors during a pandemic.

In Onnikka's design and development process, an in-depth analysis of the persuasion contexts were carried out, including the Intent (what is the specific outcome and change intended, whether there is any designer or domain expert bias in behind of the design decisions), the Event (contextual issues related to the application domain and to differences between individual users and software technologies utilized) and the Strategy (what are the overall message and its subordinate messages to be delivered to end-users, and by which cognitive routes that is to happen). Only after these steps the persuasive software features were carefully selected and implemented into the system. These related to four families of features: Primary Task support, Computer-Human Dialogue support, Credibility support, and Social support. The solution's unobtrusiveness was emphasized in all stages of the intervention.

## The difference maker

Most generally available forms of diet are not that different from each other. Thus, with regard to the information content, Onnikka doesn't promote one particular form of a diet or health behavior over another but it rather focuses on helping users to reflect and better understand one's own behavior regarding why one acts in different settings as one does. Becoming better aware of the thinking and doing traits enables a durable behavior change. To make it happen time and time again, a nimble behavior change support system is needed.

The software qualities built into Onnikka result from the systematic analysis and design process diligently carried out with the Persuasive Systems Design model. The system's credibility naturally is one of the keys for success. Basic software functionalities include self-monitoring of weight and some other key parameters. These have been made only periodic and as lean as possible. Metaphorically, the Onnikka system makes regular stops, where short and concise information content and virtual rehearsals help keep moving forward and thus sustain the change process. At the same time the user keeps reflecting one's own thinking with the help and support from this faithful digital companion and motivator. Beyond self-monitoring, information bites and virtual rehearsal, key features of the system include positive praise and feedback given for the user, persuasive reminders related to self-set goals, and various different types of suggestions and tips that are to be put in action in the daily routines.

University of Oulu is a leading center for research around persuasive systems design and behavior change support systems, which means that cutting-edge knowledge over these topics is accumulating into it. New emerging research themes include investigation of the persuasive designs' neuro-physiological responses and through functional magnetic resonance imaging effect in the brain.

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