ON THE ROAD TO DIGITAL PARADISE

The Naked Approach

The Naked Approach Project

VTT

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UNIVERSITY OF LAPLAND

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DEMOS HELSINKI

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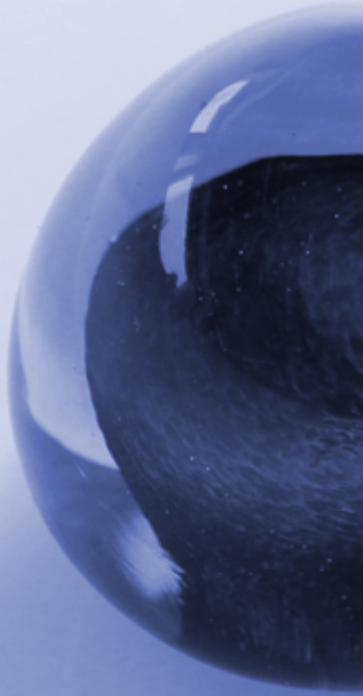


The Naked Approach Project

The Naked Approach research program is built on the strong Finnish assets of excellence in user centric design, and globally respected excellence in ICT, including the emerging technologies in electronics manufacturing and integration. The project team covers the major Finnish research institutes, VTT Technical Research Centre of Finland, Tampere University of Technology, Aalto University, the University of Lapland, and the University of Oulu, complemented with Demos Helsinki - an agile partner focussing on emerging businesses opportunities and future needs research.

Defining the Naked Approach

The Naked Approach is a research and development project aiming towards the creation of a paradigm shift in the relationship between humans and the digital world. The current gadget-centric direction, where advances invariably require the purchase of a new gadget or device, is clearly not sustainable or desirable in the long term. Rather, we aim towards solutions focused on the user and their needs. In this vision the user is gadget-free and hence 'Naked'.

In addition to scientific research and dissemination of new knowledge, a strategic objective of the project is to create a national research and business development environment, the Gadget-free labs. This will provide expertise, facilities and business visions for the future hyper connected world. The core of the research will focus on user experience and user centric design aspects, technologies for the distributed physical interaction layer, and ICT enablers and solutions in the digital environment. The commercial exploitation of the project's results will be advanced with work packages exploring emerging business ecosystems and pilots fociused on specific use cases. The societal, commercial and technical aspects will be covered by the formulation and public dissemination of a future vision of the Nordic hyper-connected society.

There are many layers of potential benefits related to the Naked Approach, briging benefits to individual users, society and businesses.

USER

Digital services available through the surroundings, without the need to carry any personal gadgets

Ambient connectivity and information embedded in the textures of the surroundings

Smart digital services based on the collection of data from the smart environment

Local harvesting of energy as an integral part of the system

SOCIETY

Sustainable growth towards hyperconnected society via a paradigm change in the embodiment of digital services

Energy optimization on several levels, e.g. energy harvesting in devices, reducing the role of wireless cellular networks and decreasing the need for data transmission via surroundings-as-a-service concepts

New services through hyperconnected citizens, objects and spaces. Built on better understanding of the daily connections, rhythms and routines within society.

BUSINESS

Enables for sustainable, cost efficient, calm digital surroundings. Enabling data growth and hyper-scalable services

Changed user relationships with the digital world and environment, catalyzing a significant global impact on society, business and personal life

Exploiting "wicked opportunities", arising from the wicked problems of humankind, such as climate change, resource scarcity, digital privacy, youth unemployment and rapid urbanization

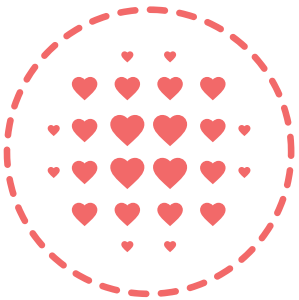
Goals and Motivation for User Centric Future Research

The user centric approach to design (UCD) operates by involving the target users in different phases of the design process. With this approach, the needs and wishes of the users, as well as their domain knowledge becomes integrated into the project, steering it towards the development of better usability and more pleasurable user experiences. In the beginning of the UCD process, researchers and designers seek to gain background domain knowledge of the users, use contexts, current practices and users' needs. End user research is conducted through observations, interviews, and different user study methods, such as user diaries and experience sampling. In the concepting phase, user centric design can involve users through participatory design sessions, and later on, prototypes and designs are evaluated through user tests.

In conventional design cases, involving users in the process is quite straightforward. However, how can the user's viewpoints and preferences be integrated when we are designing visionary future products, where the supporting technologies are yet to be developed? Design as a field offers tools for addressing this challenging question. By creating illustrative presentations of use scenarios, acting out use cases with imaginary technology, and by constructing design prototypes and demos, we can create examples, which provide peepholes to the potential future. In this book, we present examples of the processes and showcases, where we have utilized a variety of design methods that bringing the user centric design approach to the visions of futuristic technology. The motivation for integrating user centric design to cutting-edge technical research is clear - we want to create a future where the people, not the technology, are in the center.

Guiding Themes for the Naked Approach

1) Human connections – Co-work and caring through ambient connectivity

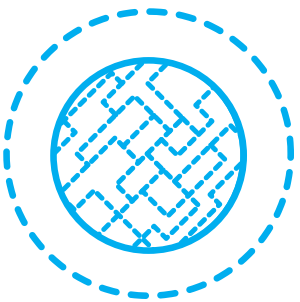


The digital surroundings can be used as a media for ambient connections that form bonds between people and places. Whereas a continuous video connection would be intrusive, our aim is to create the feeling of being connected, but respecting privacy. We want to make the connection alive, but in the periphery of awareness, without requiring the user's continuous full attention. Ambient connections through digital surroundings can play a role in connecting remote family members, maintaining the spirit between team members, and helping provide unintrusive, constant care for those who need it.

2) Lifestyle – Boosting my daily activities

Lot of things happen in our daily life. We sleep, we eat, we go to work, we arrange meetings, we go shopping, we wash dishes, we read and then we sleep again. Our routines usually happen in constant places with the same equipment, following similar daily rhythms. Could we make digital surroundings that learn our habits, predicts our moves, suggests actions, prepares things for us, and especially creates an ambience of tranquillity when needed?

3) User on the move – Migrating services and morphic spaces.



Occasionally we do things in a different way, in a different place, at a different time than in a normal day. Some of us have jobs or routines that keep changing daily and weekly. We need to find new places, we need to access our files or services in totally new environments, we need to present things to our customers on their premises, and we need to re-arrange our usual surroundings for specific occasions. How much can the digital surroundings help us there? What services can they provide for users on the move? Can we change the spaces to make us feel more at home via digital morphic features?

The Vision of Digital Paradise

The Vision of Digital Paradise

The user lives “naked” without gadgets.

Services materialize when the user needs them ...

... and disappear when not needed.

The Naked Approach initiates a new path towards a significant paradigm shift in the relationship between us, as citizens and users, and the digital world. We are leaving behind the gadget-centric era and targeting a true user centric approach with “naked”, gadget free interaction. In our vision, the digital surroundings will form an omni-potential environment around users, providing all the information, tools, and services that users need in their everyday life in the hyper-connected society of the 2020’s and 2030’s.

The Naked approach lays foundations for the vision of a citizen-centric gadget-free world that takes us towards the ‘Internet of No Things’. Our aim is towards for a hyper-connected society with a Nordic flavor of values, serving citizens with personalized services and giving companies tools for building hyper-scalable new businesses and ecosystems. The digital paradise vision is based on gadget-free, human centric and natural interaction. The following four principles highlight the values of the vision:

Four principles of digital paradise

The surroundings provide all the needed information, tools and services

People have complete ownership and control of their own data

People can live without carrying an array of gadgets, i.e. “naked”

Individual’s values, digital privacy and domestic peace are respected

Then Naked Approach is an antitheis the current trend of technology development, where an increasing number of functionalities and services are provided to us via gadgets that we carry with us all the time. Gadgets, such as smart phones, require our full attention when we are using them. Our major sense - vision is focused on the device’s high resolution display, our hearing is probably blocked by earbuds connected to the device, and our mind is concentrated solely on the digital content and the micro-motoric movements needed to interact with the device. The same is partly true with TV and desktop PCs, but their use is limited to a certain location, whereas a smart phone can be used anytime anywhere. We are nowadays more than able to create private spheres or escapist bubbles around us everywhere we go.

The fundamental benefits of the Naked Approach for the user are:

Enabling the use of digital services through the surroundings without needing to carry any personal gadgets.

Providing ambient connectivity and information in the surroundings without demanding full attention is directed carriable gadgets. The surroundings are functionalized and enhanced, instead of pulling our focus away from them.

Our guideline for a new direction in user experience and design is the Naked Approach: In this digital paradise a user can live ‘naked’ without carrying gadgets. The needed services and interfaces will appear from the texture of the environment when needed and disappear when not needed.

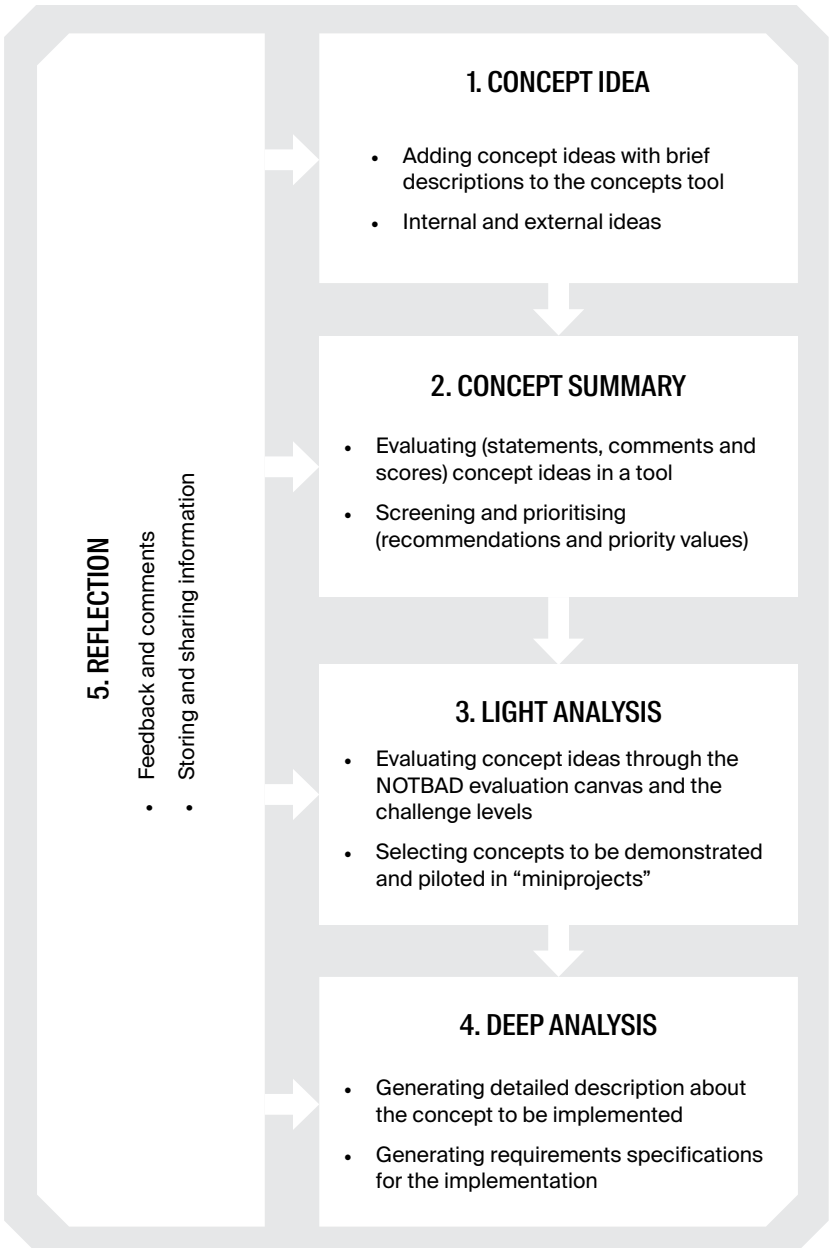
If I choose, I will be constantly but discretely connected to my communities – family, friends, work – and have instant access to all my digital information sources and services. My surroundings, and the services behind them, will support my lifestyle, boosting my daily routines. The environment seems to know me better than I do. But I feel safe, because the use of the information is fully transparent to me. I own and have complete control of my data. My data can be accessed only with my permission, by trusted actors via trusted channels. Legislation on digital privacy and domestic peace ensures I have the ability and right to disconnect - be unavailable and untraceable when I need privacy.


HEALTH ISSUES
- TOUCHING, PUBLIC INTERFACES
Unwanted Social Interaction
MULTI LEVEL PRIVACY/ IDENTITY
YOU ARE 100% CONNECTED, OR 0%
→ SOCIAL BARRIERS?
Business
stronger (bad) players win this race
Who will see my data?
-PRIVACY
ACCEPTABIL

The NOTBAD Toolbox


CHANGING COLOURS IN WALL-PAPER
nanotech. food
Where's the dog!
- Breakfast rating for whom(what) ever is cooking it
who will pick up the kids from school?
Yes, please, dear.
"My morning calories"
dog radar to detect dogs in neighborhood
facial expression shows tension → needs a day off
Self cleaning dishware
virtual dog is barking when bus is coming
SMART CLOTHING
mom doesn't have to cook
"Table tablet screen"
"temperature sticker" hot-ok-cold
Day's schedule on the wall
Vacuum cleaner faster than a dog
NOISE REDUCTION
"dirty hands" detector
Alarm clocks everywhere on surfaces
Chairs are used for exercising
taste and content can changed
DONT USE IT'S OLD
Shirt is the color you want to see it
"Freshness indicator"

The NOTBAD Toolbox



Target and Process

The NOTBAD toolbox is a holistic, user & business centric analysis methodology that has been created for use in the Naked Approach project. The methodology targets the early phases of the engineering process and aims to provide tools to identify requirements and key enablers to create a starting point for multi-disciplinary, collaborative development. The 5 phases in the methodology are showin in Figure X and the 6 evaluation criteria from which the toolbox gets its name are shown in the inset.

The methodology supports the development of concepts and uses cases from each perspective and provides a framework for holistic concept and use case evaluation. In practice, the methodology provides a starting point for requirements development, which consists of activities related to discovering, analysing, documenting and validating requirements. The evaluation process is iterative in nature.

The methodology includes six evaluation criteria:

N **Need** - The Need for the concept

O **Overall** - The Overall relevancy and suitability of the concept for the Naked Approach project

T **Technology** - The technical feasibility and potential of the concept (includes the generation of technical requirements)

B **Business** - The business potential of the concept and its use cases (includes the generation of business requirements)

A **Acceptance** - Societal and personal aspects regarding the acceptability of the concept

D **Design** – The concepts design potential, covering both aesthetic and functional design aspects with a special focus on UX and usability (including the generation of user requirements)

	Need	Overall NA Relevancy	Tech	Business	Accept	Design
Idea	• Idea / concept / owner • Main feature, visual					
Summarizing	• Status of evaluation • Summary of evaluation					
Light analysis	• Basics • All or some aspects					
Deep analysis	• Deeper analysis • All or some aspects					
Reflection	• Feedback • Learnings					

The Toolbox

An overview of the stages involved in using the toolbox is given below. Templates and detailed instuctions for the NOTBAD process are provided in Appendix 1. In the Naked Approach project this process was made using a web tool, accessible by all the project participants which was updated at each phase of the process.

Idea

The first phase of the multi-perspective concept/use case evaluation process is the description of concept ideas, which aims to collect all the ideas that have emerged for further analysis. At this stage a concept idea is visualised and briefly described so that project members from different areas can comment on the idea and approach it from their own expertise area. Teams with a different background (e.g. technical or design teams) can generate ideas for concepts. For example, a technology oriented initial idea can describe the technical building blocks of the system, whilst a business oriented idea can be an initial description about novel business opportunities for gadget-free solutions.

Summarizing

In this phase the concepts are ranked based on the predefined criteria by teams from different experteese areas. A goal of this phase is to provide a light and fast way to summarize the proposed concepts from different viewpoints. The concept idea is scored against each evaluation aspect (5-point Likert scale) and qualitative comments are given. Finally a recommendation for the further development of the concept is created, enabling prioritization of the set of created concepts.

Light analysis

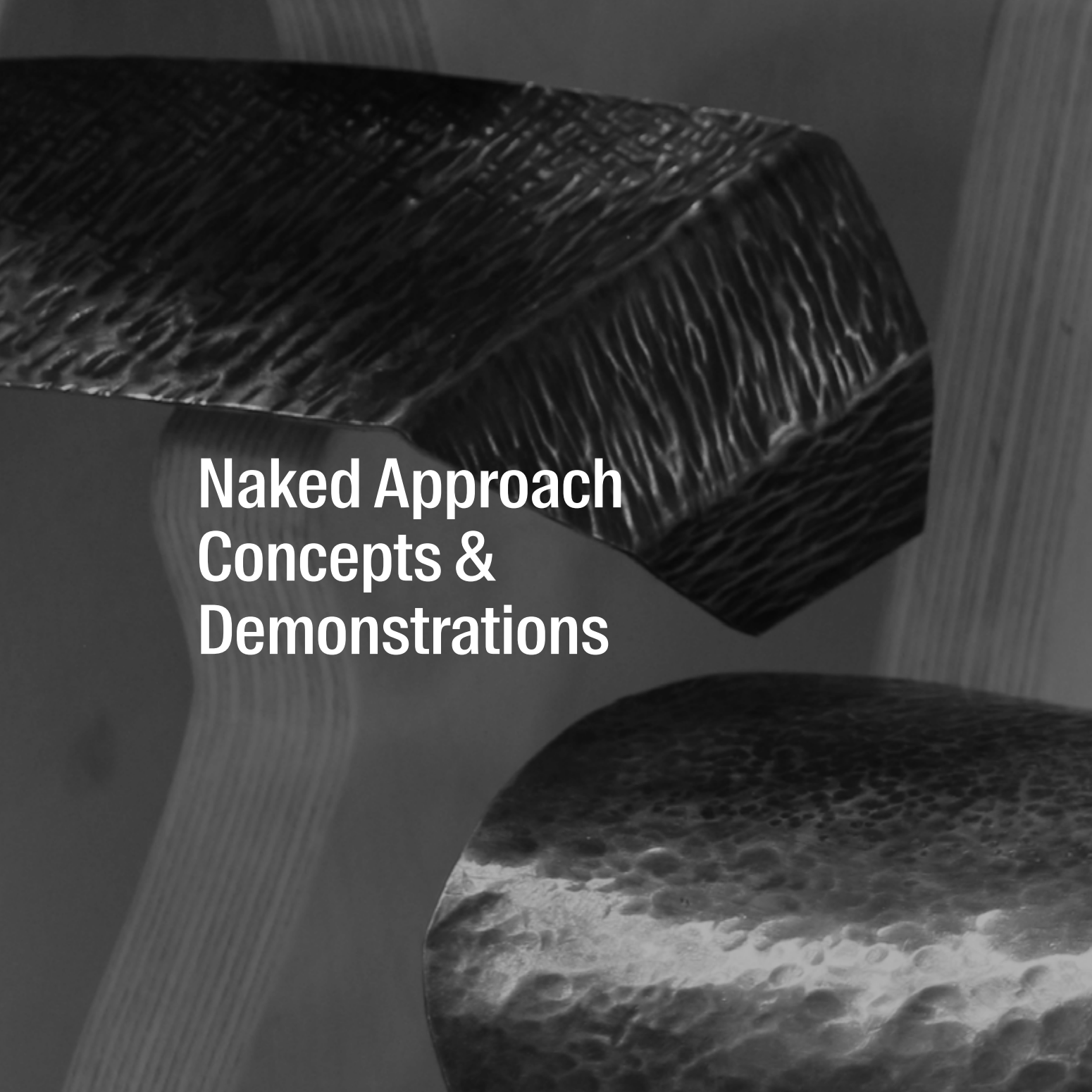
After summarizing and ranking the proposed concepts the most interesting concepts are chosen for a further analysis. In this phase the Challenge Level Table and NOTBAD Canvas tools are used in the evaluation process (see Appendix 1). Based on this, the summary of the concept is updated. A smaller group from the project team then screens the summarized concepts, and priority ranking and brief recommendation for each concept is created.

Deep analysis

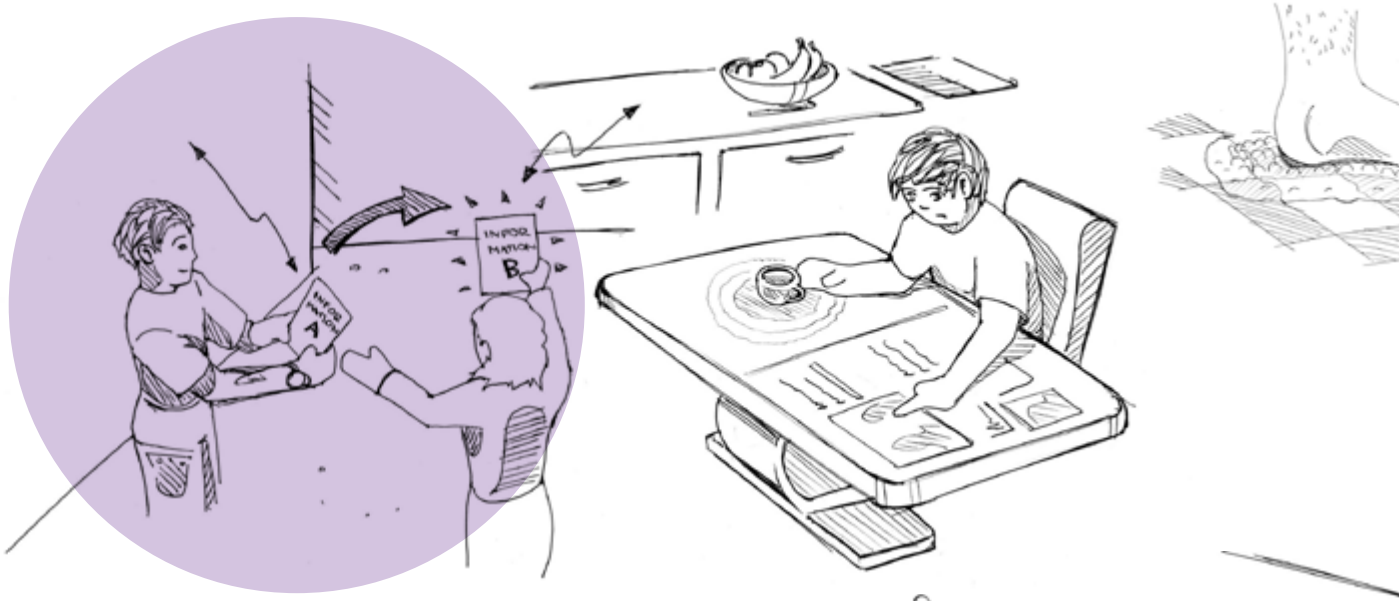
In this phase teams from different domains use their own methods and tools tools to generate requirements specifications for the further development phases. The deep analysis phase produces, technical requirements (functional and non-functional requirements), detailed user requirements and business requirements through business and IPR analysis

Reflection

The analysis process is iterative in nature. It utilises, for example, collaborative workshops and iterative rapid prototyping. Hence the reflection phase is an active phase through the whole process. In practice data is collected and analysed to elicit requirements through the entire project, e.g., from lab prototypes and real usage environments. Demo videos are also used to concretise the proposed concepts and improve the accessability for different Naked Approach teams (and external actors) to evaluate and provide feedback.

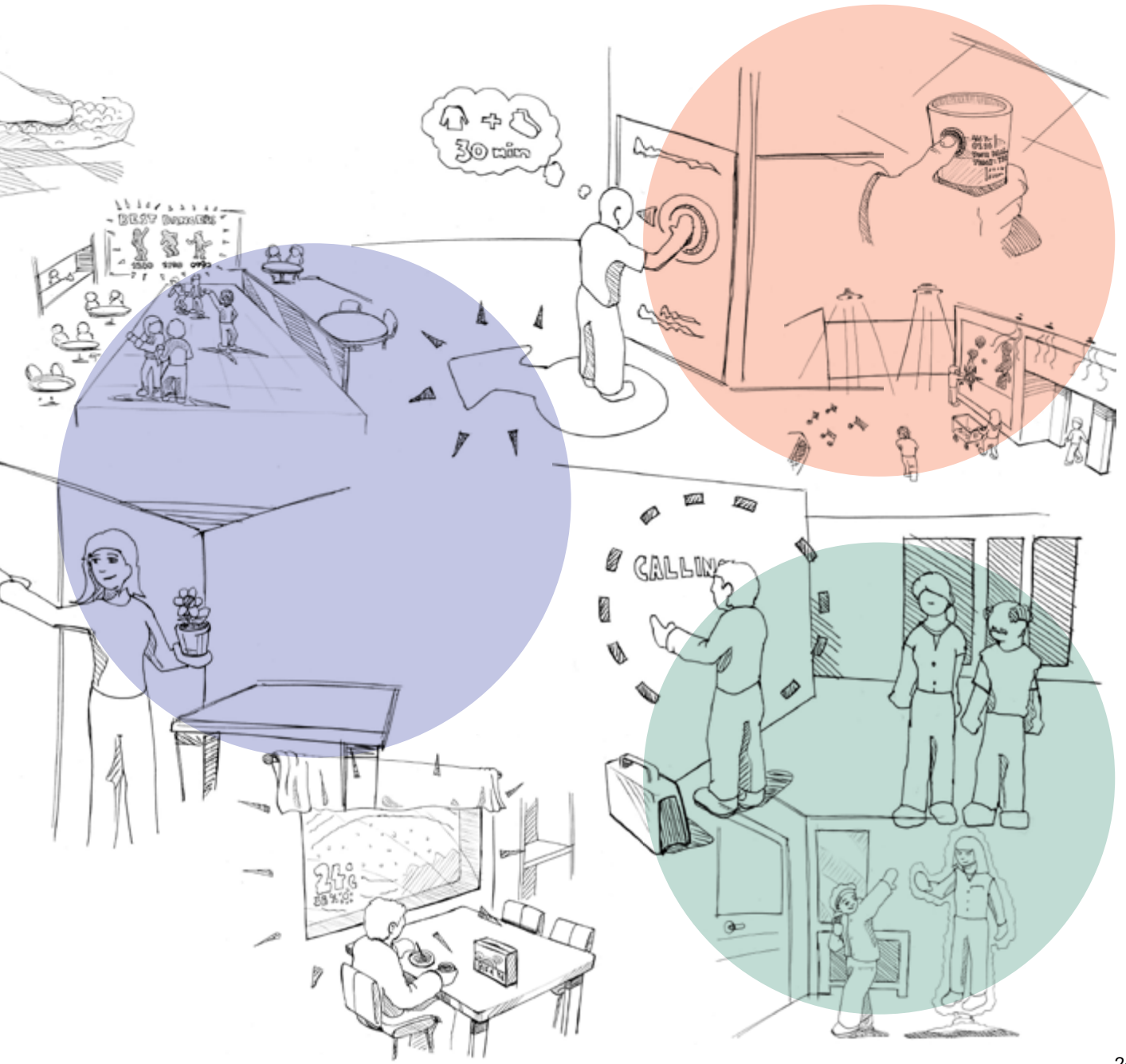


Naked Approach Concepts & Demonstrations



NOTBAD Analysis of the Concepts

During the Naked Approach research project various concepts and demonstrations were built to concretize and visualise the project's goals. On the following pages some of these concepts and demonstrators are described in more detail and their evaluation using the NOTBAD toolbox on a scale of 1-5 is given.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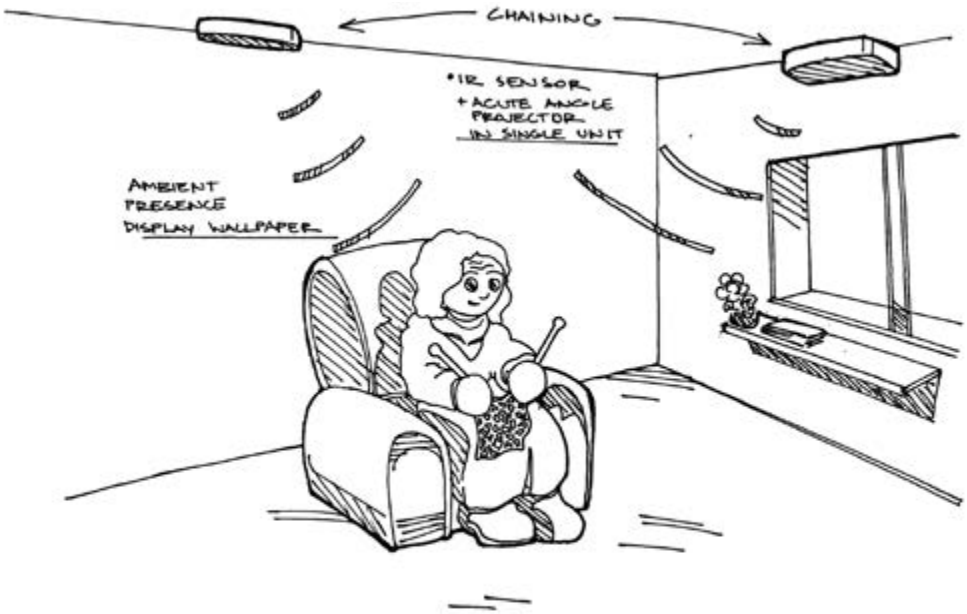
Shadow on the Wall

Theme: Ambient Communications

The idea of the Shadow-on-the-Wall concept is to provide a continuous communication channel between two locations, e.g. remote family connections, elderly care, or distributed work teams, which respects the privacy of individuals. Instead of a traditional video communication link, people see each other as shadows appearing on the wall. The shadow silhouette visualization preserves privacy but contains the essential nuances of human movement such that e.g. emotional states can be interpreted.

N 4 O 4 T 4 B 4 A 2 D 3



The Shadow-on-the-Wall concept was demonstrated in a mini-project camp, organized as a hackathlon style internal event. The demonstration connected two rooms via shadow on the wall techniques. Different visualisations were explored, including skeletal models, natural shadows, pixelating and blurring. In the future, the concept is envisioned to be realized using room lighting and smart wallpaper, which carry the image presentation.

Magic Objects

Theme: Magic Objects

Digitized connected objects can dramatically change our ways of controlling and automating our environment and also brings in a new dimension for communicating with each other. Traditional beliefs and ideas of magic is a good metaphor for this. With IoT-connectivity we can build a magic digital “Harry Potter” world where items have hidden meanings and hidden connectivities based on their past history (e.g. objects have been in contact - cf. “contagious magic”), their similarities (e.g.setting meanings for colours or helping remotely to find a proper tool for a certain job - cf “sympathetic magic”), or simply based on the programming (or “spells”). As an example of this topic (in collaboration with Coreplast company and connected with VTT’s other projects) we realised a smart reflector for pedestrians with bluetooth connectivity, ability for expression via colour changing LED lights, and sensing with accelerometer. The reflector can be paired with other reflectors to open up a communication link between them (e.g. for child-to-parent gesture signalling). The reflector can start blinking in the presence of approaching cars or on the safeway to provide warnings. On the other hand the reflector can be programmed to control any smart items in the surroundings. We demonstrated a control of the smart wallpaper demonstrator from the Info-bubbles workshop. Maybe later you can open your front door by the gesture of the reflector - or your magic wand!


LightSense

Solar Shirt

Theme: User on the Move

The Solar Shirt was exhibited at Ventura Lambrate, Milan Design week 2016. Clothing design by Paula Roinesalo, University of Lapland. Display by Ynvisible, printed electronic solar cells by VTT.

N2 O3 T4 B4 A4 D5

The Solar Shirt is a wearable computing concept in the area of sustainable and ecological design. The shirt showcases a concept, which detects the level of noise pollution in the wearer's environment and presents it via a garment-integrated display. In addition, the design concept utilizes printed electronic solar cells as part of the garment design, illustrating a design vision towards zero power wearable computing. The Solar Shirt uses reindeer leather as its main material, giving a soft and luxurious feeling to the garment. The material selections and the style of the garment derive their inspiration from Arctic Design, reflecting pure nature and the simplicity and silence of the snowy landscape.

Wearable computing is currently emerging from being a technology dominated field towards user experience design. Industrial design, textile design and clothing design play an increasingly important role, when smart technology is integrated to clothing in an unobtrusive and aesthetic way. This provides interesting potential for developing concepts around sustainability, design materials and fashion. The Solar Shirt represents a concept that utilizes these underexplored areas in designing wearable computing.

SOLAR SHIRT - P R 9 3 2016

Communication Candle

Theme: Ambient Communication

Häkkilä, J., Lappalainen, T., Koskinen, S. (2016). In the Candle Light - Pervasive Display Concept for Emotional Communication. In Proc. of International Symposium on Pervasive Displays (PerDis) 2016. ACM.

N	O	T	B	A	D
2	3	4	2	2	4

The Communication Candle is a novel ambient communication concept that uses a live candle flame to create a public display. The actuated candle stand casts shadow patterns representing different emoticons extracted from text messages received by the user's mobile phone. The concept creates an emotional communication link, and explores the hidden embedding of technology into everyday objects. The associations that people have with candlelight match well to the emotional communication concept. In particular, the authenticity of the flame is an important part of the design.

Arctic Drum

Theme: Ambient Communication

Exhibited at Ventura Lambrate, Milan Design Week 2016.

N1 O3 T4 B1 A3 D4

The Arctic Drum design concept and demo is inspired by the arctic cultural heritage of shamanism, which can be tracked to ancient times. The drum symbolizes the connections that are created between different worlds, visible and invisible, when the drum is touched. With this design piece, the user can experience the landscape of the sounds of the arctic nature. The silence is broken when the user brings their hand towards the drum's surface, and the intensity of the sounds varies depending on how close to the surface the had is placed. The interactive prototype uses Finnish and arctic cultural heritage as design inspiration for its visualization and materials – wood and reindeer leather. It is an example of design where old and new elements are entwined to form an interactive experience.

Moving on the Edge

Theme: User on the Move

Exhibited at Ventura Lambrate, Milan Design Week 2016.

N4 O3 T2 B4 A3 D3

How will we move from one place in another in the future? The Moving on the Edge design concept and 3D modelled prototype presents a concept for future vehicle, which has evolved from the cars of today. The future vehicle concept illustrates a design vision where simplicity, speed and practicality meet, with an added flavor of arctic design. The design piece was created by combining modern prototyping with traditional craftsman modelling techniques. The demo consists of a physical model constructed of copper and wood, on an illuminated table. The vision of the future vehicle is presented as animations, illustrating scenarios of how globally connected cars can learn from each other, utilize solar energy, and utilize recyclable organic materials in their structures.

Tangible User Interface with Water and Glass – The Feeling of Light

Theme: Ambient Communication

Exhibited at Ventura Lambrate, Milan Design Week 2016.

The Feeling of Light concept integrates pure design materials, glass, water and light into an interactive installation. Smooth glass objects are based in a bowl of water. By lifting the objects from the water, the user can control the colour of the light shining in the water. This design piece utilizes Arctic Design thinking with its purity of and simplicity, and illustrates how novel, calm user interfaces can be used to control our everyday environments, such as room lightning.

N2 O4 T3 B3 A3 D4

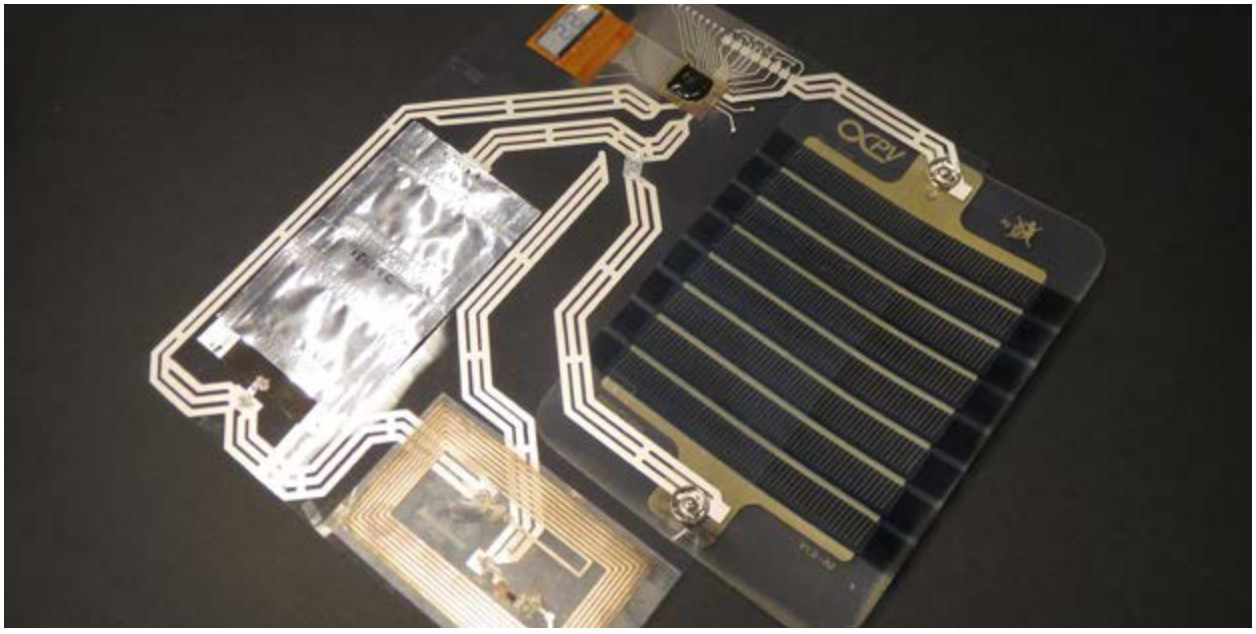
Smart Chocolate Box

Theme: Stick-it-on Device (SioD

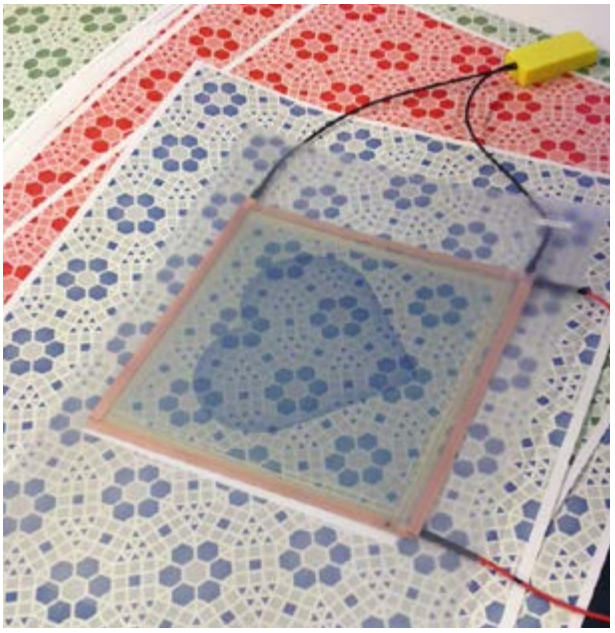
Smart Chocolate Box was funded by: "The Naked Approach: Nordic perspective to gadget-free hyperconnected environments" (Tekes funding decision 40337/14) and "Printed, energy Autonomous UniversaL platform for multifunctional wireless sensors and devices (PAUL)" (Tekes funding decision 40146/14).

With primarily printed components, we have developed the "Smart Chocolate Box" a flexible energy autonomous digital temperature sensor. This demo illustrates the potential of hybrid electronic systems that are comprised of printed and traditional electronic components that is a specialty of TUT's research themes. In this particular prototype, we have incorporated the dedicated ultra-low power SioD microchip designed at Aalto University which manages the system autonomously.

The flexible hybrid system was incorporated in a chocolate box to illustrate its application for smart packaging, although with the highly compatible



form factor this is by no means its limit. The SioD components involved in the demo include a screen printed backplane, two printed energy harvester options (a. organic solar cell and b. RF antenna), an energy storage unit (printed environmentally friendly SuperCapacitor), an integrated circuit with temperature sensor (designed by Aalto), and a printable display (e-ink display). This demo was done in cooperation with TUT, Aalto University, Stora Enso and Walki and received a top three standing at the internationally judged 2016 LOPEC demo competition (Large Organic Printed Electronics Conference and Exhibition, www.lopec.com).



Info Bubble

Theme: Ambient Communications

N4 O5 T3 B4 A3 D2

How can we deliver information to people in a more ambient way, through the user's surroundings? New ways for digitizing, embedding, connecting and hiding the current plurality of information presentation elements are needed, creating 'info bubbles'. The smart wallpaper demo integrates gesture control with printed electronics, providing visual feedback. Other demos present a flat form factor display with energy harvesting and storage that can be roll-to-roll printed, for cost efficient manufacturing.

Alternatively, stick-it-on devices, where the connectivity and application is attached an object with an add-on sticker. The concept of app-stickers combines printed electronics and the vision of modular, transferrable functions, which can be connected to the Internet of Things.

THE NAKED APPROACH CONCEPT IDEAS

Naturally segmented displays
Screenshots of my day
Fashion and circumstance sensitive mirror

Magic Chocolate Box

Active hygiene reminders
Adaptive information curtains
Travel light
1st class travel

Arctic Drum

Upgraded bus ride
Multisensory alarm clock and assistive environment
Demeanor sensitive shower
Bus stop beacon
Everything I need
Optimal route
Guided brief
Interactive bus sign
Upgraded view
Data currency
Brief cloud
Info window
Hot seat

Tangible User Interface

Interactive menu
Sustainable shower
Sell your personal data the way you wish
Neighborhood sensor networks:
Walk-by funding and voting for new services
Building block: Low power video camera
Building block: 128-by-128 pixel single color LCD display
Building block: Gesture sensor / capacitive / differential
Information as a currency
Decision platform
Retrofitting database
Copy-design
Level editor for hardware
Flow talks – braclet that shares participant's location
Thief's cape
Moisture sensors in concrete
Live waiting time
Flow social network
Queue sensor
Flow pulse
Blockchain

Shadow on the wall

Energy capture in front of a bar desk
Networking tool for a festival (bracelet)
Users on the move – understanding contexts
Invisibility cloak
Kilroy is here
Universal finder for traveler
Run away - fast

Moving on the Edge

Is your towel with you?
Good sleep spinner
Personal space guard
Random business lunch networking
Time expander
Adventure road-trip to work
Private chef
Daily routinette
Gentle awakening
Adaptive active acoustics

Info bubbles

Sticky floor tactile interface
Natural moving patterns on surfaces
Ambient light source
Let's play
Virtual secretary

Magic Objects

Screenless screen
Get informed and be aware
Keep me posted!
Slippery roads

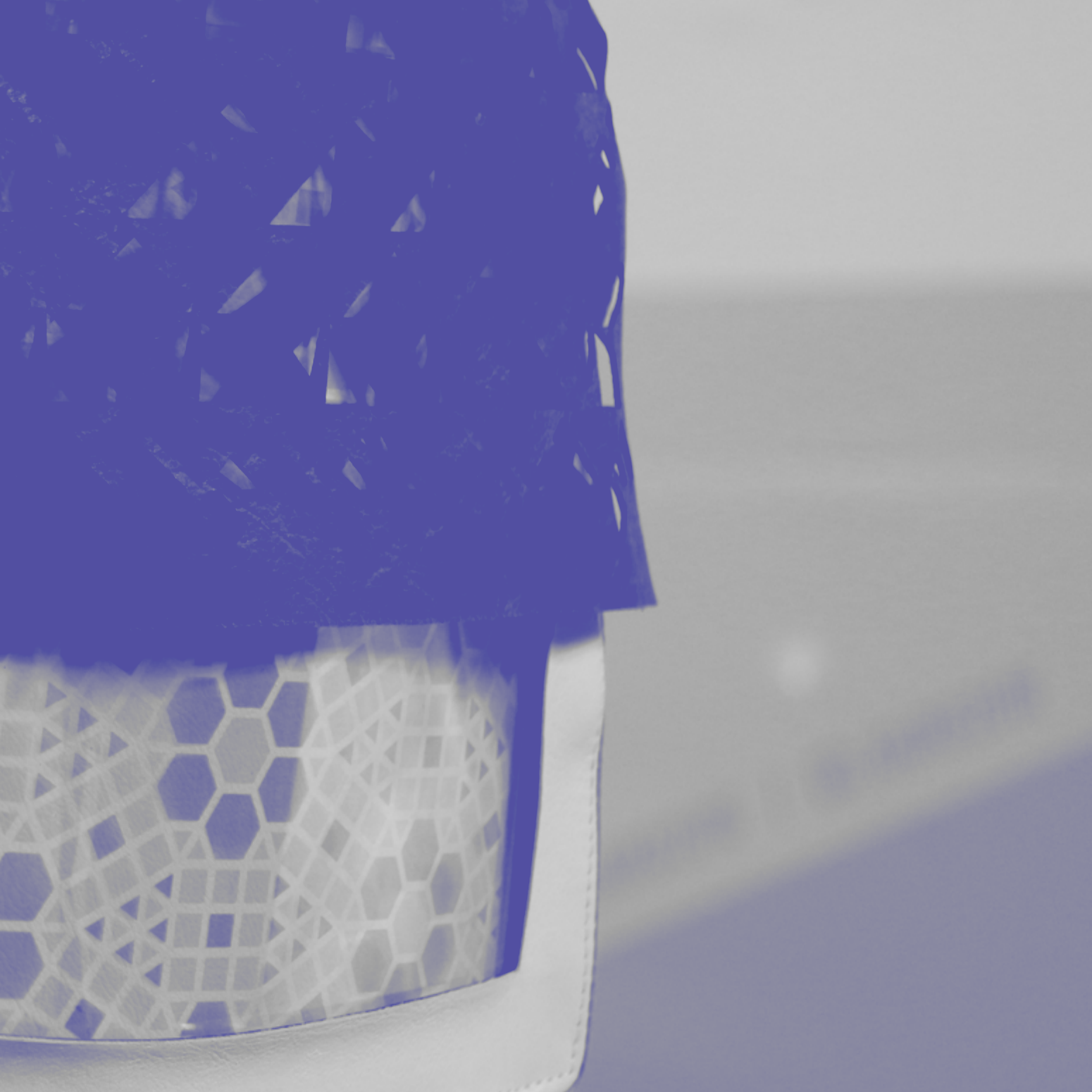
Communication Candle

Temperature adjustable clothing
Self-fixing road that warns you about possible danger
Light my way
My ambient archive
Hologram 3D news
What's going on
Don't forget me
Challenge level evaluation matrix
Boarding pass that identifies the user and allows real-time communication

Solar Shirt

My kind of shopping
Informative drinking glass
Make me dance – collecting dance points
Voice reduction bubble
Keep in touch
Influencing the shopping center atmosphere (by music and lights)
Virtual home help
Modify the walls to your needs and liking
Shapeshifting furniture
Feeling under my feet
Virtual fashion
Ambient countdown
Temperature recognition table top
Intelligent window glass

My Life in Digital Paradise



My Life in Digital Paradise

The central mission of Naked Approach is to create an intuitive, human-centric interface to the digital world by supercharging existing objects and spaces with new meanings and functionalities. To achieve this mission we need to design and develop a Naked Approach ubicom (ubiquitous-computing) platform that provides reusable functionalities and takes us towards the vision of the gadget-free digital paradise. The platform will provide an operating system, applications and HW building blocks. Through an in-depth examination of the Naked Approach concepts and use cases, the functionalities and service roles required in the Naked Apprach operating system have been defined.

Key functionalities required by the Naked Approach

Atmosphere

A

Changing conditions in different environments through different modalities by adjusting e.g. visual, auditory and tactile features.

Information in various forms

I

Different ways of delivering and presenting information e.g., Ambient information ranging from peripheral to focal attention, and from continuous feed to momentary signalling.

User interaction and sensors

U

Collecting data from the environment and actions. Enabling services and interaction between people, places and objects.

Energy harvesting and sharing

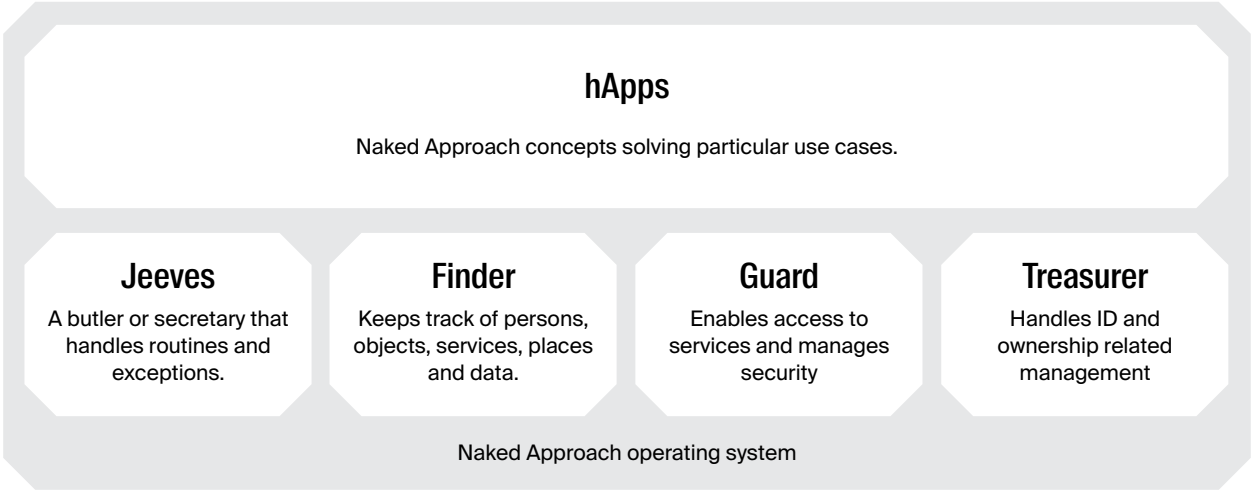
E

Generating and capturing energy from the ambient environment and activity. Sharing energy between devices and functionalities.

Magical Objects and Artifacts

O

Magical objects enabling interaction with the underlying digital world and ambient environment. Supercharging existing objects with magical meanings and functionalities.



Four service roles constitute 'operating system' for Naked Approach services. Naked Approach applications (hApps) can be built efficiently on top of the operating system.

Appendices

Appendice 1: NOTBAD Canvas

BUSINESS

1. Does the solution have a target in global markets?
2. What is the possibility to benefit from the solution by Finnish companies?
3. How the solution complements with other businesses?
4. What are the funding and investment requirements for a company to start work developing these solutions?
5. Is the solution primarily targeted to B2B or B2C business?
6. What are the main customer segments?
7. What is the problem that the solution will solve?
8. What is the value proposition for the solution?
9. What actors (or resources) are needed for a profit-making business with the solution?
10. What is the cost structure of the solution/service?

DESIGN

1. How easy is the solution to use?
2. How engaging is the solution?
3. How aesthetic is the solution?
4. How functional is the solution?
5. How fun and exciting the solution is to use?
6. How entertaining is the solution?
7. How well the solution fits with its environment?
8. How customisable is the solution (personalisation)?

NEED

1. What is a general need for the solution?
2. What problem is going to be solved by the solution?
3. How necessary the solution is from the end-user perspective?
4. What is the expected value received by the end-user during and after the use of a solution?
5. What is the user's motivation to use the solution?

TECHNOLOGY ASPECT

1. to implement the technical solution for the concept?
2. Are there competitive/alternative technologies/ solutions available for the concept? (Alternative/competitive products/solutions)
3. What is the capability of people and availability of tools to work with the technology (people and tools)?
4. How interoperable are technologies utilised in the concept (e.g. technical interfaces)?
5. What are the main technological building blocks that are needed?
6. What are the possible bottlenecks from a technology viewpoint?

OVERALL RELEVANCY FOR THE NAKED APPROACH

How well does the solution address:

1. Digital Ergonomy and Presence?
2. Sustainable digital world?
3. Nordic values: the values of beauty in efficiency, trust, the human rights, and silent respective co-living?

ACCEPTANCE

1. How tight is the relationship with existing technology and users?
2. How much different are the new ways to use the solution compared to earlier ones?
3. How positive is the initial experience with the new technology?
4. How much effort is required from a user to adapt to new technology?
5. Are there social factors (community aspect) that might affect willingness to use the solution?
6. What are the costs regarding the use of the solution for the end user?
7. How societal aspects, such as equality, ecological sustainability and societal well-being are taken into account in the concept?

Appendice 2: Blank NOTBAD Canvas

BUSINESS

DESIGN

NEED

TECHNOLOGY ASPECT

OVERALL RELEVANCY FOR THE NAKED APPROACH

ACCEPTANCE

Appendice 3: Service challenge dimensions and their levels/classes

Contributions: University of Oulu: Timo Koskela, VTT: Antti Anttonen, Juha-Pekka Soininen, Vesa Pentikäinen

Challenge levels & classes	I
D#1: Level of Nakedness	Personal interaction devices: The user carries mobile and/or wearable devices that include a user interface.
D#2: Environment	Private indoors/outdoors: Private spaces are very restricted in terms of the size of the area and the number of users, and therefore, set lesser requirements for other dimensions including, for instance, user/data privacy (D#2), user/data security (D#3), user identification (D#4), and user positioning (D#5).
D#3: User/Data Privacy	Everything is public: Every piece of data related either to the use of the services or their users is public excluding sensitive user data (e.g. a credit card number or a health history when not particularly needed in case of an emergency).
D#4: Data Security	Zero security: Neither user and service data nor the wireless transmission channel is encrypted. Secure authentication and authorization are not implemented.
D#5: User Identification	No identification: As there is no user identification, all services provided must be generic in nature.
D#6: User Positioning	No positioning: As there is no user positioning, users themselves must initiate the use of services.

II	III
Personal digital identity: The user carries personal embedded devices such as personal ID tags or active in-body devices that enable user identification, but do not include a user interface.	Everything embedded in the infrastructure: All computing technology and user interfaces are embedded in the surroundings.
Public indoors: Public indoor spaces are also typically rather restricted in terms of the size of the area, but the number of simultaneous users can already be significant.	Public outdoors: Public outdoor environments are the most demanding as the size of the area is typically large, and in addition, the boundaries of the space are more difficult to indicate. The number of simultaneous users is typically significant.
Everything is anonymous: Every piece of data related either to the use of the services or their users is anonymous, but the data can be used by the services in a statistical manner, for instance, to indicate the number of people at a cafeteria.	Everything is user-controllable: The user has full control over his/her data. The user can decide the parts of his/her profiling data that is accessible by every individual service and other user.
Lightweight security: Light-weight security methods are implemented. These methods do not provide high-level of security, but are lightweight to execute in terms of processing power, memory consumption and energy consumption.	High-level security: Strong security methods are implemented. These methods are hard to break, but are also demanding in terms of processing power, memory consumption and energy consumption.
Virtual Identity: Users are identified using virtual entities. Although users' real identity is hidden from the services, virtual identity enables personalized services through usage history. Use of virtual entities also contributes to dimensions such as user/data privacy.	Real identity: Users are identified using real identities. This sets strong requirements for dimensions such as user/ data privacy (D#2) and data security (D#3).
Proximity: Approximate location of users is known. For instance, it can be resolved whether a user is in space A or space B.	Accurate positioning: Accurate position of users is known.

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Contributions: University of Oulu: Timo Koskela, VTT: Antti Anttonen, Juha-Pekka Soininen, Vesa Pentikäinen

Challenge levels & classes	I
D#7: User-to-user interaction	No interaction between users: The services provided do not include direct interaction between users. However, other users' data can be anonymously utilized in the service provisioning.
D#8: User-to-infrastructure interaction	User initiates: The use of services is always initiated by the user. This is done using a user interface implemented in the infrastructure or provided for user's personal interaction devices.
D#9: Service intelligence	Generic: All service provided are generic, and thus, do not require user identification.
D#10: Contextual intelligence	No context awareness: The services do not recognize users' activities and goals.
D#11: Interaction modalities	Traditional interaction modalities: Traditional interaction modalities (e.g. based on the use of keyboard and touch screen) are utilised for managing interaction with the service.
D#12: Interactive objects	Conventional computing interaction devices: Conventional computing interaction devices, such as mobile phones, are used for interaction between the end-user and the service.

II	III
One-to-one interaction: The services provided include one-to-one user interaction. This sets requirements for other dimensions such as user/data privacy (D#2) as users' may want to control when they are available and who can contact them.	Many-to-many interaction: The services provided include many-to-many user interaction. This sets more complex requirements particularly for user/data privacy (D#2).
Infrastructure initiates: In addition to the user, the use of services can also be initiated by the infrastructure. This typically requires at least user identification (D#4) or user positioning (D#5).	"Things just happen": The services are automatically and seamlessly provided to the user based on his/her identification, position, preferences or/and context (D#9).
Personalized: Services provided can also be personalized, which typically requires	Learning and adaptive: Services learn and adapt to different situations and users' preferences over time.
Situational awareness: The services provided have capability to recognize user's actions and to understand his/her goals to a certain extent.	Contextual history collected: Long-term contextual history of user's activity is collected and used as the grounds for decision making.
Complex interaction modalities: More complex modalities (e.g. gesture based interaction) are used for managing interaction in the service context.	Fully natural, "things just happen seamlessly": Interaction is fully "automated" and does not require any specific effort from the end-user.
Selected unconventional objects: Selected unconventional objects, which can be, for example, everyday utility	Arbitrary objects: Arbitrary objects are available for the use when needed by the user for making interaction possible with the service.

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