VOICE ASSISTANTS — PEOPLE, EXPERIENCES, PRACTICES, ROUTINES

Contents

What is a Workbook?

Design workbooks can be considered as a design method. Workbooks are a tool for methodological approach which recognises that ideas may develop slowly over time. Important issues and perspectives may emerge from multiple studies, ideas or speculations within the workbook.

On a more practical not they can also:

» Document a project, or part of a project
» Be a finished document that help show a process or be used to gain input into certain elements of a project
» Give a good overview of the work from a top level down to very granular details
» Act as an engaging Interim report
» Be a helpful way to show all project stakeholders how everyone works on a project
» Contain any or all of the following: literature review, contextual Review, research, studies, experiments, insight generation, ideation, idea development, testing/reactions

The VA-PEPR Team

Aurelio Todisco - Project Contact Person

Aurelio Todisco recently completed his Master in Design at the Lucerne University of Applied Sciences and Arts (HSLU-Hochschule Luzern). He is interested in human-centered and participatory design processes. In the VA-PEPR research project, he is the contact person for study participants.

Aysun Aytac - Product Design

Aysun Aytac, PhD, design researcher at the Competence Centre Design and Management at Lucerne University of Applied Sciences and Arts (HSLU-Hochschule Luzern). She combines theories and approaches from material culture, visual culture, visual ethnography, everyday life, culture, everyday life creativity and design thinking to explore interactions between people and artefacts.

Beat Tödtli, - Data Science and Data Analysis

PhD, data scientist, researcher and lecturer at the Eastern Switzerland University of Applied Sciences (OST- Ostschweizer Fachhochschule). He develops and teaches machine learning courses and has a background in industrial algorithm development for fraud detection.

Bettina Minder - Innovation Processes

Bettina Minder holds a PhD in organisational design and innovation processes from Aalborg University. She is the deputy head of the Competence Centre Design and Management at Lucerne University of Applied Sciences and Arts. She focuses on participatory and collaborative research approaches that translates research insights into proposals and design briefs for actionable design.

Edith Maier - Social Anthropology and Applied Linguistics

Edith Maier, PhD, professor at the Eastern Switzerland University of Applied Sciences (OST- Ostschweizer Fachhochschule) and has a background in applied linguistics, social anthropology and information science. More recently, her research focuses on cultural aspects of human-computer interaction and behavioural change support.

Inesa Halilovic - Information Systems

Inesa Halilovic is a research assistant and Master student in Information systems at the Eastern Switzerland University of Applied Sciences (OST – Ostschweizer Fachhochschule). She works on various projects in application development.

Jens O. Meissner - Management and Organizational Studies

Jens O. Meissner, PhD, professor of organizational design and head of the interdisciplinary future laboratory CreaLab at Lucerne University of Applied Sciences and Arts (HSLU-Hochschule Luzern). His research focuses on questions around organizational resilience in the digital age.

Jon Rogers - PHuman Computer Interaction

Professor of design at Northumbria University with years of experience working at the interface between design and emerging technologies. Following a recent three year fellowship based in Mozilla Berlin, he is co-directing OpenDoTT, an EU funded doctoral training programme with Mozilla in trusted IoT. With the Lucerne University of Applied Sciences and Arts he is exploring new narratives for the design of voice assistants in our homes.

Matthias Baldauf - Information Systems

Matthias Baldauf, PhD, professor of information systems at the Eastern Switzerland University of Applied Sciences (OST- Ostschweizer Fachhochschule). His research centers on pervasive computing and human-computer interaction with a recent focus on voice-based user interfaces.

Michael Doerk - Psychology

Michael Doerk, PhD, professor at the Lucerne University of Applied Sciences and Arts, a psychologist, expert in health promotion, social computing, risk and quality management and innovation management. He developed the award-winning HSLU business application 'relax-concentrate-create' that captures VA-activities related to resource management that are central to the analytical part of this study.

Michelle Murri - Law

Michelle Murri, research assistant in the School of Business at Lucerne University of Applied Sciences and Arts (HSLU-Hochschule Luzern). She received her Master's degree in law and is particularly interested in data protection law. She supports the project management in VA-PEPR research project

Michelle Thorne - Open Data

Michelle Thorne is interested in climate justice and a fossil-free internet. As a Senior Program Officer at the Mozilla Foundation, Michelle leads a PhD program on Open Design of Trust Things (OpenDoTT) with Northumbria University and several art and research initiatives as an Environmental Champion in Mozilla's Sustainability Program.

Mike Shorter - Creative Technologist

Dr. Mike Shorter is a Research Fellow at Northumbria University. In his time, he's worked as a Researcher, Creative Technologist, Product Designer, Craftsperson and Innovation Strategist. Across all these roles Mike consistently explores new technology with reflective and playful processes in order to make meaningful objects and experiences.

Patricia Wolf - Innovation Management

Since 2005, she is a professor of innovation management and future research at Lucerne University of Applied Sciences and Arts. She also teaches at ETH Zurich since 2012 and she is a professor of integrative innovation management at the University of Southern Denmark since 2018. Her research focuses on the link between innovation, emergent technologies and social change.

Sabine Junginger - Design Research

Sabine Junginger, PhD, professor in the Lucerne School of Art and Design and head of the Competence Centre Design and Management at Lucerne University of Applied Sciences and Arts. She contributes her expertise on human-centred design and studies its contribution to social change and economic innovation in the context of digital transformation. For VA PEPR, she also looks at voice assistants with an eye to policy design and the design of future public services.

Tom Ulmer - Data Analysis and IT Architecture

Tom Ulmer lecturer at the Eastern Switzerland University of Applied Sciences (OST-Ostschweizer Fachhochschule) and has a background in media design, computer sciences and human computer interaction. His main research interests include digital health, active assisted living as well as smart living.

Ulrich Reimer - Computer Science

Ulrich Reimer, PhD, professor at the Eastern Switzerland University of Applied Sciences (OST- Ostschweizer Fachhochschule) and computer scientist with a background in AI, semantic technologies and knowledge management. His current research focuses on behavioural change support systems for digital health, with an emphasis on sensor data mining and self-learning to adapt to individual users.

Ute Klotz - Imformatics

Ute Klotz, PhD, co-leader of the focus group 'Technologies for Tomorrow's Digital Working World' in the interdisciplinary thematic cluster 'Digital Transformation of the Working World' at Lucerne University of Applied Sciences and Arts. She deals with future studies and the interfaces between humans, work and technology. She is interested in methods that make the future more tangible and predictable.

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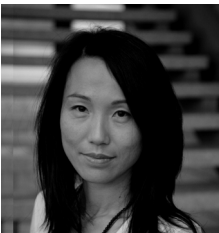
Vivien Luong - Research Coordination

Vivien Luong is a research coordinator in the School of Art and Design at Lucerne University of Applied Sciences and Arts (HSLU-Hochschule Luzern). In VA-PEPR research project, she is responsible for coordinating the reporting to SNF and is responsible for the financial controlling and the financial reporting.

INTRODUCTION

Introduction

No other technology is spreading as rapidly in the home as voice assistants (VAs). Siri, Alexa, Google Assistant and Cortana have conquered living rooms, bedrooms and kitchens by becoming accessible via smart speakers such as Amazon Echo, Apple HomePod and Google Home. The few existing surveys about the use of VAs in Switzerland have been conducted by consultants, tech companies or providers and have primarily a business perspective. Insights into the use of VAs in home settings are badly missing.

This four-year study brings together experts in human-centred design, human-computer interaction, text-mining, home automation, ambient assisted living, computer science, behavioural economics, socio-informatics, organization design and innovation management, Open IoT, and health who will make use of a range of methods to explore, capture and depict current VA use in Swiss homes to find out about how everyday practices and routines as well as notions of privacy change as a result of the increasing penetration of VA into people's homes.
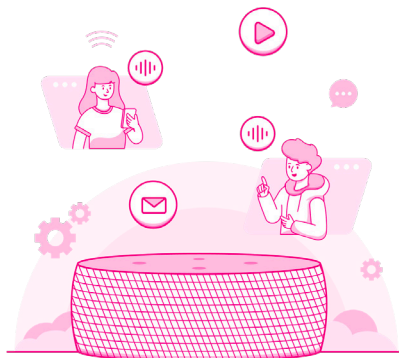
(Previous page)
VA-PEPR planning session.
Credit: XXX

VA-PEPR Research Goals

1) Find out why people buy and install VAs in their homes and investigate the purposes for which they use them

This will establish the expectations and hopes VA users put in these technologies but also allow for a first 'check' of how these expectations are met by current VA skills. Findings will generate insights into usability, meaning, and usefulness of current VA and can point to desirable and required future skills.

2) Investigate in detail the role of VA in the home in relation to everyday practices and routines in the domestic set-up

This will result in an evidence-based assessment of current VA's reach into home life activities, for example their role in planning, scheduling or monitoring to make the home itself and household chores more efficient; their role in opening the home to the IoT; their role in communicating, interacting and socializing with people in (and outside) the home, and with that their influence and impact on everyday practices and routines.

3) Conduct an in-depth study on informed consent and everyday navigation of privacy and security that arise with the use of VA and its IoT connectivity

This will reveal the level of awareness VA users have in regard to the IoT and VA capabilities of their homes. It will also generate insights into how VA users currently engage with issues of privacy and security: What risks are they aware of? What risks are they willing to take? What risks would they like to avoid? Do risk perceptions vary between different family members or house-mates? How do they learn about and/or assess these risks? What strategies, tools and other means do they employ to make such an assessment and how and when do they act on it? The findings will create
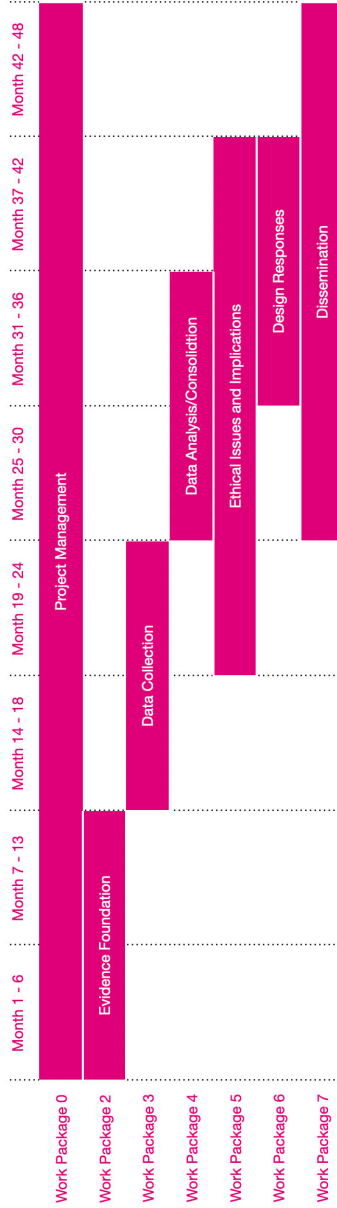
the foundation for Goal 4.

4) Identify design criteria and design approaches to design for transparency, safety and data security as well as positive user experience with desirable VA and IoT

The project will enable us to derive implications for design, implementation of VAs, IoT/connected devices, which can be translated into future design briefs that enable context-specific boundary regulation; personalisation of VAs by using context (defined as tasks, ongoing interests and routines) to provide suggestions; design guidelines to ensure transparency, awareness and control; macros for controlling IoT; etc. Artefacts to be developed include speculative design films as well as conceptual prototypes that can be installed in homes.

5) Contribute to greater awareness of the social and societal implications associated with voice-controlled devices (in collaboration with the Mozilla Foundation)

The project will indicate (and ideally specify) concrete recommendations relevant for a wide range of stakeholders in government, business, civil society and academia. Results will inform neighbourhood and community evaluation/awareness events as well as advocacy campaigns that enable individuals and communities to take action on the futures they want.

This workbook was published at around the 24 month mark. We wanted to bookend the first research and exploration stage of the project. There will be a second workbook to document what follows.

Work Package	Month 1 - 6	Month 7 - 13	Month 14 - 18	Month 19 - 24	Month 25 - 30	Month 31 - 36	Month 37 - 42	Month 42 - 48
Work Package 0	Project Management							
Work Package 2	Evidence Foundation							
Work Package 3			Data Collection					
Work Package 4					Data Analysis/Consolidtion			
Work Package 5				Ethical Issues and Implications				
Work Package 6						Design Responses		
Work Package 7					Dissemination			

We are about here at time of producing this Workbook.

1) **What are people's motives/ expectations with regard to installing/using a VA in their homes?**

2) **How do people use the VA in their homes? For which practices/ purposes? (E.g., controlling home devices, playing music, making queries, etc.) And why?**

3) **How do people's practices and routines change as a result of using a VA? (E.g., they may change the language when talking to their VA, cook without consulting a cookbook, etc.). And why?**

4) **How do people perceive VA in their homes? Do they regard them as tools or conversational buddies?**

5) What differences exist – if any – in terms of uses, expectations and attitudes between different family members or house-mates?

6) To what degree do people know about the IoT capabilities and activities of these devices within their homes?

7) What kinds of changes in attitude towards privacy occur?

8) What does privacy mean to VA users in their homes? Does it differ across the German, French, and Italian cantons?

9) What negative side effects of VAs emerge in the home? And what is needed to mitigate them in terms of services, tools or regulations?

10) What desirable uses of VA in the home emerge? And what would be needed and how could they be realised?

What do we mean by a Voice Assistant?

There are many different interpretations of what VAs are, this has become even more complex over time as technologies advance. Does the V in the acronym stand for voice or virtual? Is a VA the same as a VUI, and where do chat-bots fit into everything? Does the Voice in VA represent our voice or the voice of a digital device? Are VAs defined by natural language processing or natural language generation?
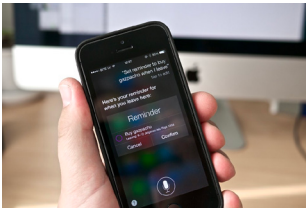
Voice Assistant (VA)	**Virtual Assistant (VA)**
Smart Voice Assistant Speaker (SVAS)	**Conversational Agent (CA)**
Intelligent Personal Assistant (IPA)	**Voice Activated Virtual Assistant (VAVA)**
Smart Home Personal Assistant (SPA)	**Voice-activated Personal Assistant (VAPA)**
Voice Activated Interface (VAI)	**Chat-bot**
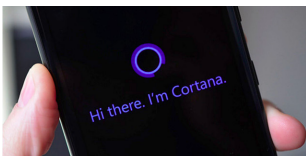
Due to this general ambiguity on what a VA is we best thought that we should communicate what we are classing a VA to be:

A voice assistant (VA) is a digital assistant which gives access to a dynamically extensible range of services and to which a user can talk in natural language.

Ein Sprachassistent ist ein digitaler Assistent, der mittels Spracheingabe Zugriff auf eine dynamisch erweiterbare Menge an Services erlaubt.

The assistant can cover a wide range of services such as answering questions, planning a route between two locations, triggering actions in the home automation environment, making use of web-based services for ordering food, calling a taxi, checking in a flight etc.

The kinds and breadth of services offered by the digital assistant are not part of its definition. It can be a broad range or be rather narrow, i.e. a navigation system to which I can talk would also count as a digital assistant. The range of services must be extensible, thus a gadget with a speech interface to control it (e.g. a DVD player) does not count as a VA. The distinction is between hard-wired speech control vs. flexible access to services via a speech interface. The latter obviously needs some degree of natural language processing and understanding.

In many cases, VAs are able to answer in natural language, however, other feedback modalities (e.g. written text or images on a built-in display) are possible. The assistant does not need to be able to answer in natural language.

The definition focuses on the abilities of the system and decouples it from its physical "incarnation", i.e. via which kind of hardware it is accessible to the user. A VA may have a dedicated physical representation (e.g. a smart speaker) or may be an add-on function of a multi-purpose device (e.g. smart-phone, smart TV, navigation system). The definition does not require the assistant to be intelligent. First, we would then have to define what we understand by "intelligent", secondly, what is considered intelligent today might not be seen as intelligent tomorrow.

In our project we look at digital assistants in the context of a household only, e.g. the usage of Siri on a smart-phone only within the home but not when travelling.
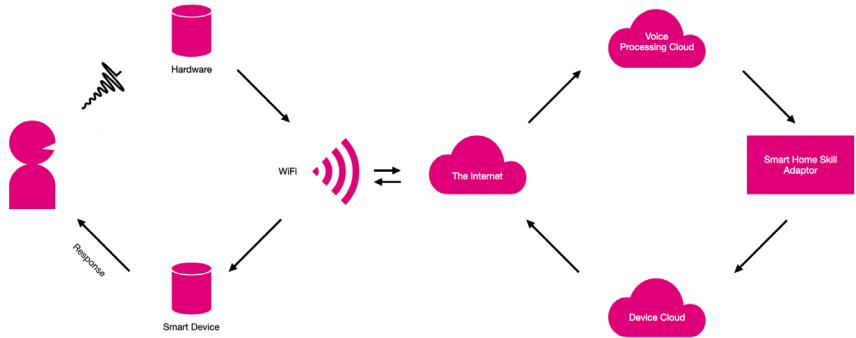
Voice Assistant Service Model - What bit(s) make a Voice Assistant? For the VA-PEPR project it is the full model.

OUR
APPROACH

The VA-PEPR team dissecting voice assistants. We want to explore both the physical and non-physical components of the device.

1.1 Methodological Approach

The VA-PEPR project aims to fill the research gaps in the everyday use of voice assistants. Our methodological approach aims to:

Focus on VA use in domestic settings from a user perspective rather than on technological issues or the impact of VA on marketing.

Generate insights into changing social interactions, practices and routines in the home involving VAs.

Include different cultural and linguistic regions in Switzerland.

Provide actionable guidance on how to mitigate privacy concerns of the general public by developing specific design responses.

The VA-PEPR team are using an interdisciplinary research approach based on activity theory supplemented by concepts from domestication theory and design thinking methodology. Whilst Activity Theory (AT) provides the theoretical framework of our study, when it comes to practical implementation, our approach is guided by Design Thinking. This is well suited for interdisciplinary teamwork because its focus on user experience and its roots in human-centred design provides a common ground, dispenses with hierarchies, allows for and validates different forms of knowledge and expertise (including experiential), promotes an iterative, non-linear research process and stresses both interdisciplinary analysis and interdisciplinary synthesis.

The data collection and analysis serve the discovery and initial research, while speculative design workshops serve the ideation and prototyping of initial design responses. This approach supports a mixed method design collection and analysis as shown in the figure over leaf.
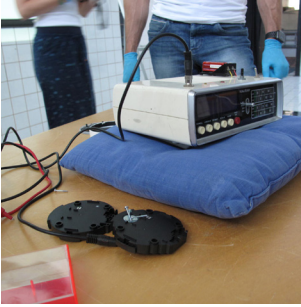
Most of our research is of qualitative nature, which goes well together with AT because activities including the new human experience associated with VA can only be understood in context. Activity theory scholars have argued that the ideal data for an application of AT consist of longitudinal ethnographic observation, interviews and discussion in real-life settings, supplemented by experiments.

In our study, the empirical data is gathered mainly by means of ethnographic methods such as interviews, participant observation with the tool "Indeemo" and focus group discussions because they help us gain an in-depth understanding of the context in which an activity occurs. Participant Observation is used to gather data on current use of individuals of VA technology in their homes (Flick, 2009). The research period of four weeks was intertwined with semi-structured reflection interviews once a week focusing on interactions between VA technology, space, individuals, new experiences and reciprocal effects between these elements. After six and twelve months, each participant was interviewed about the mid- and long-term VA-related changes in the home. Focus group discussions will aim at extending insights from the above research methods and help fill in gaps, discuss possible contradictions (e.g. trade-off between privacy concerns and convenience) that have emerged and ascertain if changes in everyday routine practices attributed to the use of VA have happened just at an individual or single household or at societal level, possibly influenced by age, gender or other factors.

VA-PEPR convergent mixed method design collection and analysis
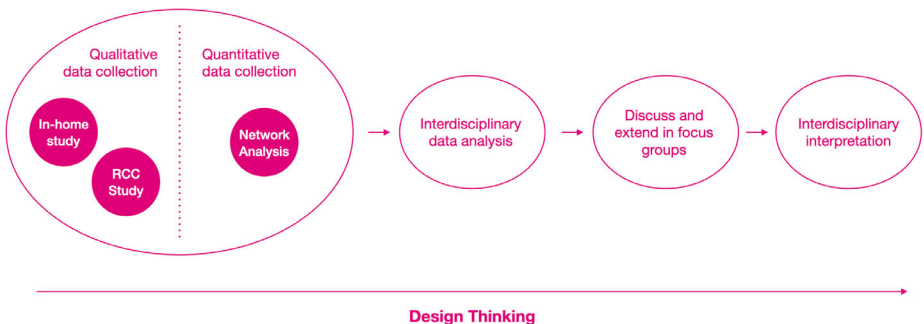
The ethnographic methods for data collection is supplemented by the use of the rcc-Tool for conducting a survey of activities and a tool for monitoring network devices. The survey generates data from self-reported activity journals to get an overview of a wider range of VA use situations. Data entered included the duration of an activity, its emotional effects and meaning. Free text for self-reflections and personal remarks or resolutions, for example about how to change one's behaviour can be entered. Up to July 2021, 70+ participants filled in their journal data. Each journal consists of an average of 40 pages of self-reflections collected by Swiss students on types of activities (relax, concentrate, create), time of day and weekly assessments. Findings are analysed now and then used to anticipate requirements for the subsequent study of VA use through this rcc-tool.

We also monitored device communication in selected households through network scanning and monitoring (with the help of the data traffic monitoring tool Wireshark). Basic information such as IP and MAC address, host name or vendor, DHCP type, time online and similar statistical information about the connected devices was collected. The data is analysed may increase the users' awareness regarding the VA-related data traffic in their home.

When it comes to communicating and disseminating our findings, we may use a combination of film-making and product design, apart from the scientific dissemination channels such as journals and conferences. For this purpose, we will organise speculative design workshops. Speculative design creates fictional artefacts – objects, images, films, texts, and more – that bridge the speculative and the everyday 'inviting the public to explore the implications of new developments across science, technology and politics, and unsettling tacit assumptions and social norms'(Voss et al., 2015 referring to Bassett, et al, 2013).

The Future Laboratory CreaLab at LUASA together with the Mozilla Foundation will develop and implement a formative intervention method in a variety of settings where a working collective consisting of students and users, goes through eight to ten sessions in which they analyse the contradictions of their activity, for example to construct a new model to resolve them. Findings will also feed into the development of design artefacts, prototypes, or prototypes using open source hardware and the exploration of a sensuous design approach in close contact with the maker and hacker communities.

REVIEW

Literature Review

To ensure that the VA-PEPR project is built on solid foundations we conducted an in-depth Literature Review to understand the state of the art of Voice Assistants. This review covers published research from 1988 - 2021. The objectives of this review were to give the project team a common baseline of knowledge, identify both common and rare research approaches and methods, uncover interesting research gaps and provide inspiration for subsequent project phases.

The literature review consisted of three parts.
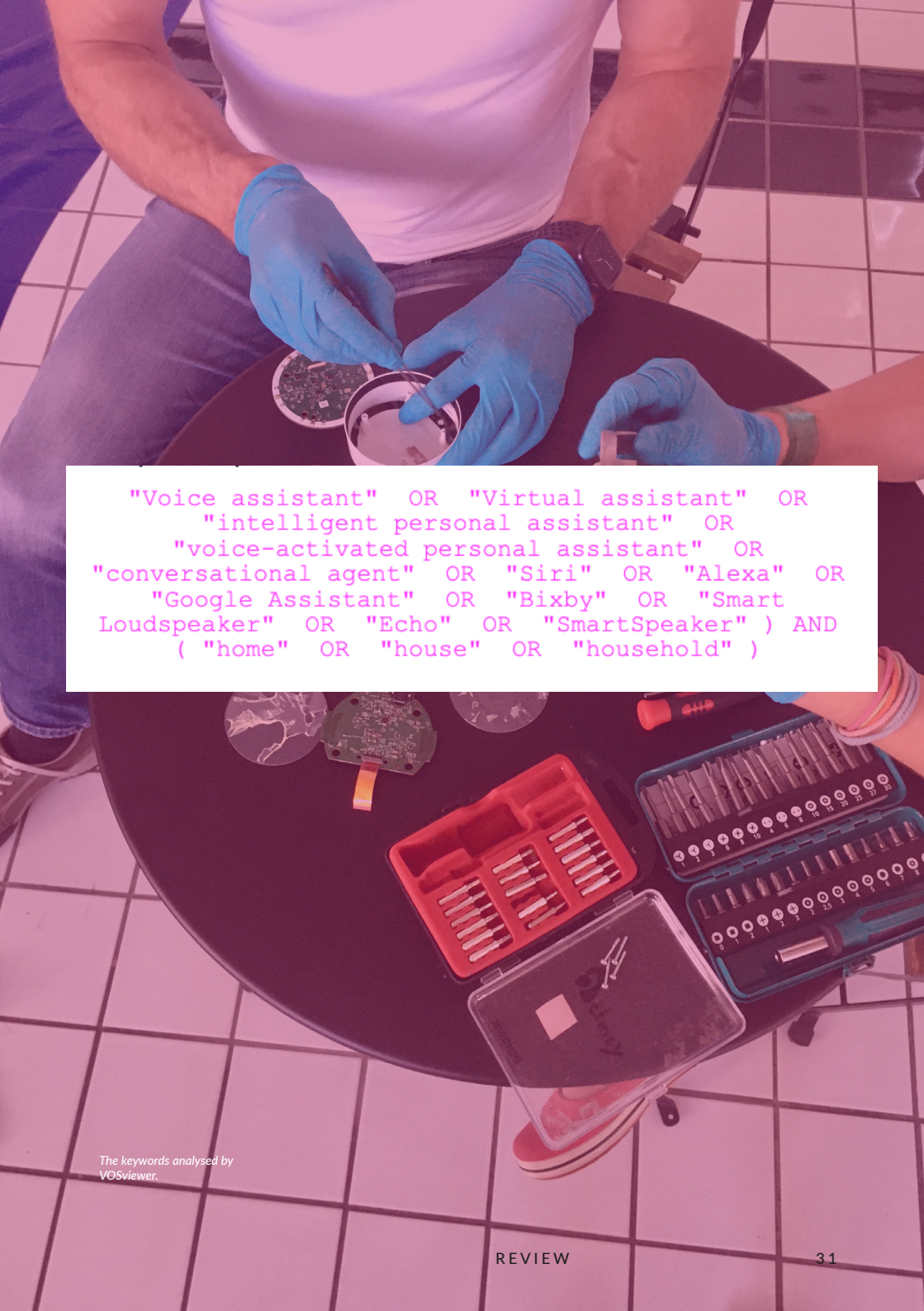
A systematic review of scientific literature
A collection of recent online newspaper and blog articles
An Automated bibliographic analysis using VOSviewer

Automated Bibliographic Analysis

The automated bibliographic analysis was conducted using VOSviewer - a tool that constructs bibliometric networks. These networks explore and connect anything from citations, bibliographic coupling, co-citation, co-authorship and key works. These networks highlighted important commonalities between 428 computer science papers, 356 social science papers, 40 business and management papers.

The keywords analysed are on the opposite page. This automated analysis produced the networks on the following page. These networks uncovered nine clusters in the research material.

"Voice assistant" OR "Virtual assistant" OR
"intelligent personal assistant" OR
"voice-activated personal assistant" OR
"conversational agent" OR "Siri" OR "Alexa" OR
"Google Assistant" OR "Bixby" OR "Smart
Loudspeaker" OR "Echo" OR "SmartSpeaker") AND
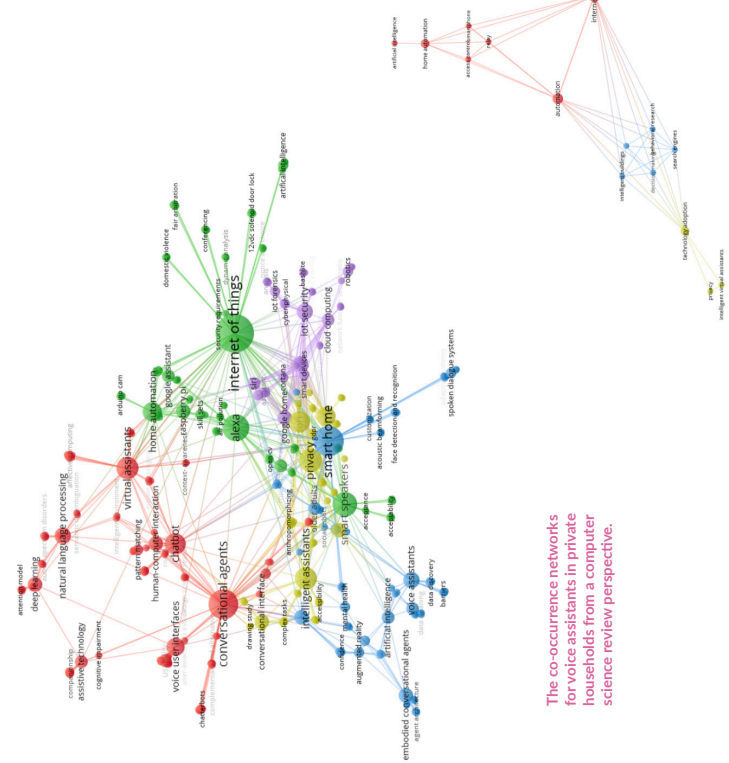("home" OR "house" OR "household")

The keywords analysed by VOSviewer.

The co-occurrence networks for voice assistants in private households.
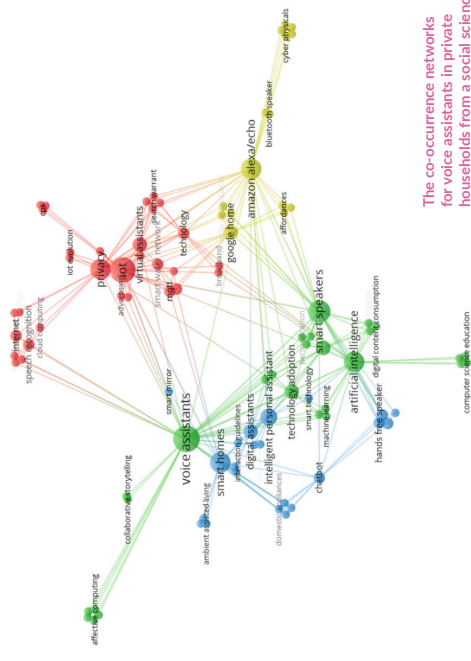
The co-occurrence networks for voice assistants in private households from a social science review perspective.

The co-occurrence networks for voice assistants in private households from a business management science review perspective.

The co-occurrence networks for voice assistants in private households from a computer science review perspective.

| Clusters	Computer Science	Social Science	Business & Management
Cluster 1: Equipping households with smart devices, learning about different solutions and requirements for set up and use affordance	Smart devices, cortana, siri, assistant google home IOT, security requirements, alexa, air pollution, skill sets, raspberry pi, google assistant home automation Smart home, customisation, acoustic beamforming, face detection and recognition,	Affordance, google home, amazon, alexa/echo	Access control, smart phone, relay, home automation
Cluster 2: Voice as part of human-computer interaction from the point of view of user satisfaction and possible applications	voice user interface, conversational agents, natural language processing, deep learning, disorder, semantic disambiguation/understanding Spoken language systems	Voice assistants, Conferencing, fair arbitration, domestic violence, 12 vdc solenoid door lock	
Cluster 3: Privacy as part of what hinders technology adoption and discussed in relation to ongoing and continuous technological evolution	Gdpr, accountability, amazon echo, anthropomorphising,	IoT, virtual assistants, search warrant, technology, mqtt, iot evolution, Controller/Internet protocols, speech recognition cloud computing	Intelligent virtual assistants, technology adoption
Cluster 4: Marketing strategies for VA informing product development and societies and institutions and generating effective advertising			Advertising, virtual/voice assistant, product development, societies and institutions
Cluster 5: Technical challenges as part of developing VA-applications and respective solutions according to usability, HCI standards	intrusion detection Malware/bashlite, cyber-physical, iot forensics, robotics Chatbot, HCI, pattern matching/identification, virtual assistance, affective computing (glass human being), voice user interface, usability, user awareness evaluation Accessibility, complex tasks, conversational interface (drawing study?) anthropomorphizing,	Machine learning, smart speakers, personification, technology adoption, smart personal assistant, affective computing	
Cluster 6: Expansion enabled by VA and AR and potential future developments and applications for (mental) health application	Embodied conversational agents, AI, augmented reality, VA, (mental health? confidence), open source vision (open cv)		
Cluster 7: Efficiency as a result of exploiting the possibilities of VA in home settings and for in the context of big data	Intelligent buildings, decision making, behavioural research, search engines		IOT, access controls, smart home, AI
Cluster 8: VA used in legal context to provide digital evidence to the court of law	Iot forensics/presenting digital evidence to the court of law		
Cluster 9: VA allowing new forms of assisted living, coaching resulting from hand free appearance of VA	Assistive technology, cognitive impairment, conversational agents, autism spectrum, voice user interfaces, usability	Smart homes, smart personal assistant, ambient assisted living, domestic appliances, hand free speakers, chatbots	

This table summarises the 9 research clusters identified. The coloured text corresponds to the colours in the previous networks.

Manual Systematic Review of Scientific Literature

To dig deeper into the research we manually reviewed around 200 scientific papers and 50 blogs/newspaper articles. This allows us to uncover any singular hidden nuggets that may be relevant to the project that an automated process may miss.
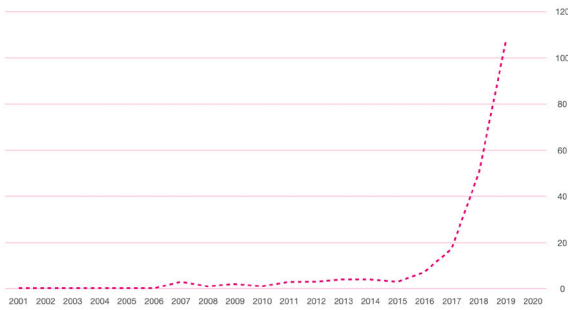
This graph shows the number of relevant publications per year. It is clear to see discussions around VAs have only really been happening for the last five years. The curve predicts these conversations are only going to continue at an exponential rate.
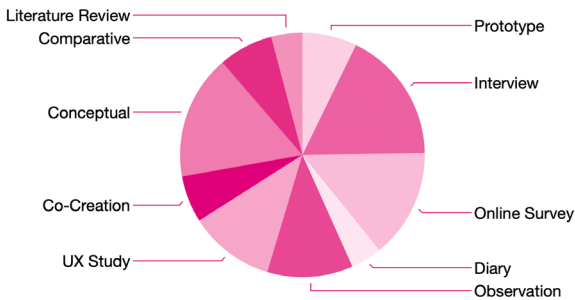
This pie chart summarises the methods deployed for all articles in our literature review. It is clear that not many diary studies were used, and only a small percentage of co-creation undertaken.

Through the manual systematic review 18 themes arose. The team felt that many of these themes were not so relevant to the VA-PEPR project, as we are particularly interested in the use of VAs in the domestic setting, and the changes in social interactions, practices and routines that VAs can create. This left us particularly interested in the research around Family and Kids, Privacy and Ethics, Routines and Behaviours and Smart Homes.

Error Handling

Learnability/ Intelligibility

UX & Usability

End-User Development

Language

Smart Home

Consumer/ Marketing

Elderly

Security/ Network

Automotive

Impairment

Routines & Behaviour

Applications

Gender

Privacy & Ethics

Adoption/ Perception

Family & Kids

(Assistant) Personality

[Our thematic clusters uncovered. The solid circles highlight the clusters most relevant to our research regarding Voice Assistants within the domestic setting.

Literature Review Insights

Privacy & Ethics

Large body of research on privacy concerns

Insufficient user knowledge, awareness and understanding on how VAs/smart homes work

3rd party extensions are often confused with native VA functions (security issues)

Novel privacy mechanisms

Visualization tools for laymen

inter-cultural differences in privacy attitudes

Behaviour and Boutines

Known behaviour patterns are from enthusiasts, users who quit using voice assistants are not covered

Studies suggest that the expectations users have inform practices and routines

Evidence for changes in practices and routines with visitors (e.g. device asked to tell jokes)

Personality of device is relevant: e.g. kind of persona people assign to their VA (Friend, Admirer, Aunt, Butler)

Children learn how to operate and control things

Differences between practices in single household and multi-member household (e.g. more likely to personify VA)

Dissatisfaction/abandonment comes from various unmet expectations, e.g. regarding humanness

Usage frequency drops after the first days

Current home automation devices don't meet "plug-and-play"-expectations

Language/Voice

Limited works on language, dialect, etc.

Poor recognition for small languages like Danish, English language plays a vital role

Particular focus on error handling: apologising vs humorous expressions of VA /guessing approach to problems / failure causes abandonment; family members collaborate to fix break downs

Learning to adapt to VA: e.g., becoming better at asking questions

UN study finds female voice assistants reinforce harmful stereotypes

Blind user language recommendations: brief responses, increased voice speed, definition of custom voice (also "natural" human-human conversation model)Conversational affordance as relevant assessment criteria for quality of VA

Appearances and Functionality of Assistants

Novel appearances of (voice) assistants, e.g. with screens (and cameras)

proactive voice assistants

Current application focus on health education and fitness – may influence daily routines/practices

Customisation

Research on end-user development of voice-based services is scarce

Limitation of mimicry approach (voice)

Future Research Topics

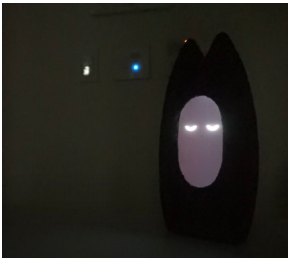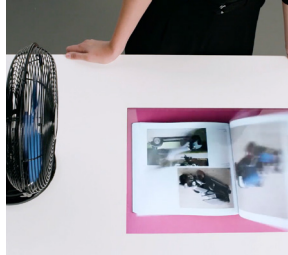Practices of children with VA, concerns of parents

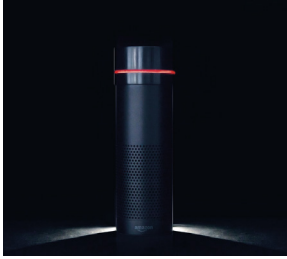Influence of algorithmic biases and profit motivation of providers

Identities (e.g. gender, race) and cultures needs further research (e.g. on the interaction with VA)

Beyond usefulness: enchantment, playfulness and motivation dimensions have not been covered sufficiently
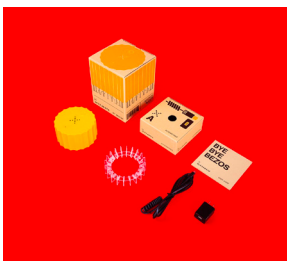
Contextual Review

As well as a literature review the team explored the current landscape of products and software currently available, as well as experiments and explorations into the VA and other closely related sectors.

Contextual Review Clusters

Data Control

There are a number of products and services that explore how to limit what the VA can hear. Some of which are simple add on products and some involve hacking the VA hardware. VAs are now in over half of the connected households around the world. Consumers are becoming more and more aware of the powers of these smart objects. Users want control over the physical hardware as well as the ways in which VAs can collect personal data.

There is also an example (Scout) of a companion object that works alongside your IoT objects to uncover data being sent from your home to the owners of your connected objects and services. This device is acting more as a way of making your data visible rather than controlling it. It allows you to see how much data is being collected and what is a 'normal' amount of data to be collected.
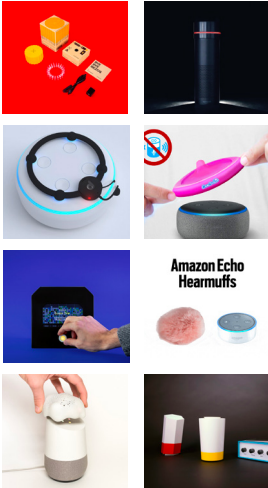
Customisation/Personalisation

Thee are few examples of VAs that can be personalised and customised. These personalised products and services explore how we can use actions completed on behalf of the user to create a more bespoke product and service. On the other hand the examples of customisable products and services explore how the user can initiate the process of creating a product or service that is fit for them.
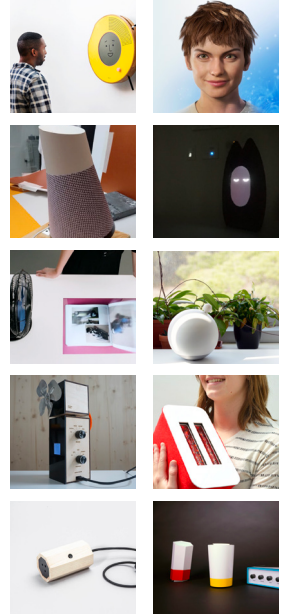
Either way users are wanting VAs to be more in tune with their lives whether through hardware capabilities or software.
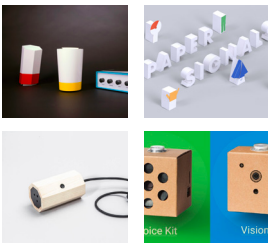
Adding Complex Human Behaviours

There were many examples of where the messiness of humans was trying to be brought into VAs. From what do our VAs dream of to giving our VAs feelings and emotions. This human messiness adds personality to these objects and can greatly affect the relationship that we have with seemingly inanimate objects.

There are also examples of where we want our VAs to question what we ask of them. Similar to how a child will learn by asking why to every command. This allows the VAs to build a rationale for why it makes particular decisions and helps it to be a smarter object in the future.
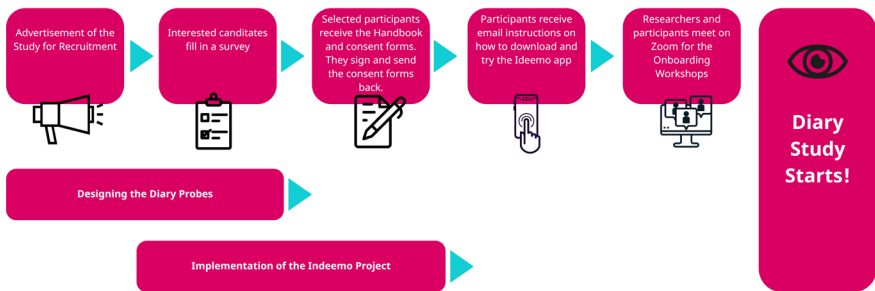
IN-HOME
STUDY

In-Home Study Overview

Considering the aims of the project and its qualitative exploratory approach, an in-home study seemed to be one of the best ways to understand how people experience VAs in their homes and private lives and if/how they develop new practices and routines around their use of VAs. An ethnographic approach was planned as we wanted to focus on everyday life in the home environment and the user experience.
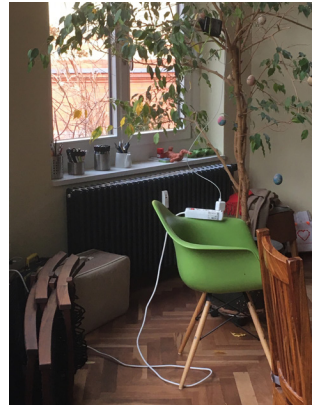

An overview of the process to set-up the in-home study.

Our original research plan counted on us being able to visit participants in their homes to observe and to conduct face-to-face semi-structured interviews to allow us to partially immerse ourselves into their everyday lives. However, as was true for many researchers around the world, the pandemic situation forced us to change our research strategy. We adjusted our mixed method approach to ethnographic data collection via a mobile diary app (Indeemo), supplemented by weekly 15-minute semi-structured interviews conducted by two researchers with each participant on Zoom. This ethnographic part of our project ran from March 5th through May 28th in 2021. During that time, we conducted 4 mobile diary studies with 31 households.
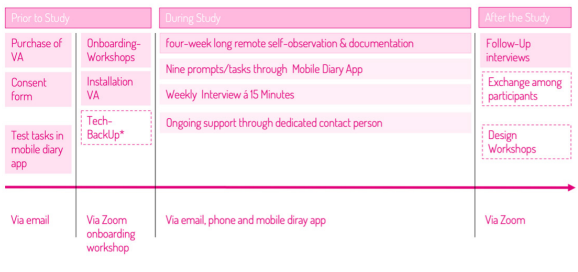
The purpose of the in-home studies was to collect data that would help us to understand how people experience VAs in their homes and private lives, in the context of Switzerland. We were particularly interested in finding out what a VA in the home meant for people in terms of privacy but also any implications for social interactions and relations. For example, would they form new practices and routines based on the skills of their VA? More generally, with this phase we aimed to generate insights into answering our research questions.

In combination with weekly interviews and follow-up interviews, mobile diary studies were the main data collection phase of the study. The diary entries of participants were used to frame the weekly interviews; in which researchers encouraged participants to reflect on the entries and experiences of their past week. The interview data is being coded which will shape the speculative design workshops at a later stage in the VA-PEPR project.

A sample image from the in-home study.

Elements of Remote Ethnographic in-Home Study

Prior to Study		During Study		After the Study
Purchase of VA	Onboarding-Workshops	four-week long remote self-observation & documentation		Follow-Up interviews
Consent form	Installation VA	Nine prompts/tasks through Mobile Diary App		Exchange among participants
	Tech-BackUp*	Weekly Interview á 15 Minutes		
Test tasks in mobile diary app		Ongoing support through dedicated contact person		Design Workshops
Via email	Via Zoom onboarding workshop	Via email, phone and mobile diray app		Via Zoom

An overview of tasks in preparation for, during and after the in-home study

50 people received the Handbook, consent form to sign & info to order a VA

32 participants sent back the signed consent form (1 dropout)

indeemo Participants received instructions to download Indeemo and register
15 days to get familiar with Indeemo and order a VA

Participants joined the Onboarding Workshop on Zoom

Participants started to receive the assignments and self-reported for 4 weeks.

Target Group	🖼	🎞	📄	TOTAL
TG 1 9 Participants	43	28	109	180
TG 2 7 Participants	15	13	43	71
TG 3 9 Participants	22	76	50	148
TG 4 6 Participants	14	34	33	81

Moving from Traditional Ethnography to Online Ethnography

The COVID-19 pandemic meant that we had to make one big change to the planned research activity for the in-home study. Suddenly we had to take a traditional ethnographic study and figure out how to manage it entirely remotely.

Once the suggestion of using mobile diary apps was made, we approached six companies to learn more about this method and the service they provide: Indeemo – Experience Fellow – dScout – Over the Shoulder (OTS) – Happisodes – EthOS.
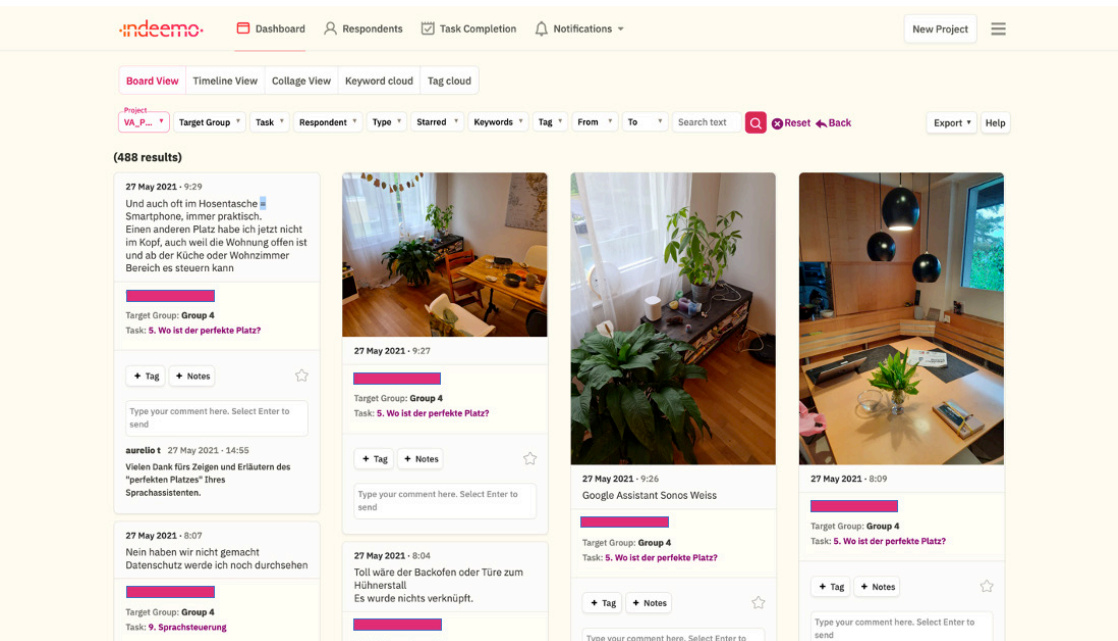
We decided to go with Indeemo based on the test runs and following criteria: Interface design and performance, features of the app, language and automated transcription, data security, tech support, academic experience, professionalism, and cost efficiency.

Before the decision, we also considered free online platforms where we could establish similar environments, employ diary technique, and gather ethnographic data in a similar way such as WhatsApp, Facebook, Slack, HumHub, etc. However, these free platforms were lacking either one or more of the above criteria, such as lacking tech support service, data security, researchers' back-room, mobile app and bulk data export.

Although we had to change our path from the traditional ethnography methods to mobile diary study, the qualitative approach still enabled us to be involved in the lives of our participants, to contextualise, understand and interpret the settings that VAs were being used/not used and to search for patterns of interactions.

indeemo · Dashboard · Respondents · Task Completion · Notifications · New Project

Board View · Timeline View · Collage View · Keyword cloud · Tag cloud

Project: VA_P... · Target Group ▾ · Task ▾ · Respondent ▾ · Type ▾ · Starred ▾ · Keywords ▾ · Tag ▾ · From ▾ · To ▾ · Search text · Reset · Back · Export ▾ · Help

(488 results)

27 May 2021 · 9:29
Und auch oft im Hosentasche = Smartphone, immer praktisch. Einen anderen Platz habe ich jetzt nicht im Kopf, auch weil die Wohnung offen ist und ab der Küche oder Wohnzimmer Bereich es steuern kann

Target Group: **Group 4**
Task: **5. Wo ist der perfekte Platz?**

+ Tag   + Notes
Type your comment here. Select Enter to send

aurelio t   27 May 2021 · 14:55
Vielen Dank fürs Zeigen und Erläutern des "perfekten Platzes" Ihres Sprachassistenten.

27 May 2021 · 8:07
Nein haben wir nicht gemacht Datenschutz werde ich noch durchsehen

Target Group: **Group 4**
Task: **9. Sprachsteuerung**

27 May 2021 · 9:27
Target Group: **Group 4**
Task: **5. Wo ist der perfekte Platz?**

+ Tag   + Notes
Type your comment here. Select Enter to send

27 May 2021 · 8:04
Toll wäre der Backofen oder Türe zum Hühnerstall Es wurde nichts verknüpft.

Target Group: **Group 4**

27 May 2021 · 9:26
Google Assistant Sonos Weiss

Target Group: **Group 4**
Task: **5. Wo ist der perfekte Platz?**

+ Tag   + Notes
Type your comment here. Select Enter to

27 May 2021 · 8:09
Target Group: **Group 4**
Task: **5. Wo ist der perfekte Platz?**

+ Tag   + Notes
Type your comment here. Select Enter to send

(Above)
The Indeemo dashboard

During the Study

   I was expecting more in-depth data on Indeemo, but researchers agreed that the method or the tool was not successful providing that. Weekly interviews became our kind of main data collection tool. Also, they agreed that we were not successful in encouraging the participants to upload their surprising incidents, diary like entries or random thoughts. I mean, we did not receive much for the 'My Diary' task (FYI, we designed 9 tasks to be released on Indeemo. Each task was released at a specified time over four weeks (including on weekends); new tasks were released regardless of completion of the previous one. When participants completed these tasks, they shared the results uploading photos, videos or notes on Indeemo. And, apart from these 9 tasks, to enhance the diary feeling, we included the task 'My Diary-Spontaneous Thoughts.' This task was always visible and available to the participants since the beginning of the study, which was explained during the on-boarding workshops. With that, we hoped to encourage participants to make spontaneous entries throughout the four weeks to capture any incident, surprising moments or thoughts they wanted to share with the researchers. Unfortunately the 'My Diary' task did not work quite well. Perhaps the participants needed more structure to their content generation.

(Previous page top)
Keyword cloud created by Indeemo based on the notes uploaded by participants

(Previous page bottom)
How the entries look from researchers' end on Indeemo

Coding the results

The full team helped to code the vast amounts of interview transcripts. The following tables gives an idea of initial themes, along with an approximate number of relevant quotes to that theme. The transcripts were coded using MAXQDA.

Code	Quotes (approx.)	Responsible	Validation Partner
Contextual factors	735	Bettina	Aurelio
Practices	608	Ute	Michelle
Surprises	95	Sabine	Edith
Desiderata	233	Bettina	Ute
Privacy	391	Edith	Uwe
Problems (Translation organised by Michelle)	588	Aysun	Mike
Smart Home	215	Jens	Ausun
Perception (incl. Memos Mental Models)	1097	Patricia	Jens
Indeemo	81	Aurelio	Michelle
Changes	270	Sabine	Uwe
Expectations	344	Jens	Patricia
Exploration/coping strategies	403	Uwe	Edith
Technolgocial affinity/competence	189	Ute	Bettina
Time/development dynamics	142	Edith	Sabine
Total	**5391**		

A summary of how the coding exercise was split up among the VA-PEPR team.

Findings So Far...

The team met for an analysis workshop to synthesise our coding. We made a huge mess creating a big picture with all codes and sub-codes. We then co-created the dominant relations between those sub-codes. And the 14 resulting "General Themes" that you find below is the (preliminary) result. The next coupe of spreads illustrate how all these general themes are connected.

1. Ecosystem ambivalence: Balancing benefits and costs and dissatisfaction with regard to ecosystem dependencies, mostly based on experiences and assumptions related to compatibility issues.

2. Mutual dependency & learning: Mutual dependencies of VA and household members using a trial-and-error approach or external help - whereby humans and VA learn to achieve better performance.

3. Privacy of location: Varying feelings of privacy depending on the location of VA use – e.g., in different rooms of the home, car or in public. Varies from unsafe or embarrassing to challenging and acceptable.

4. (Unclear) value of my data: Existing awareness of value of data among some of the participants – e.g., approval of the trade off as the perceived benefit exceeds the (data) cost.

5. Concern about digital future (of living): Mainly dystopian description of fully digitalized future (e.g. de-skilling) stated mostly by RCC participants. Smart home users are the opposite.

6. People expect more (unfulfilled expectations): Disappointment with VA in relation to its capabilities. In the rare discovery of 'smart' functions, it is perceived as positive surprise.

7. Humans adopt to technology: Adopting behaviours to overcome VA limitations (e.g. learning commands, switching language, moving with or to the VA, using smart home functions).

8. Impact on family members: Changing behavioural patterns and atmosphere in a household like language at the dinner table and loss of privacy or spontaneity. Children have to be protected.

9. New social management: Creation of new managerial behaviour and roles in the household aiming at control, maintenance and development of VA and at the instruction of using it.

10. (Mis)trust: Mistrust from VAs' incomprehensible privacy regulations is perceived as obstructing transparency and feeling of secure use. But you can 'trust' in the ecosystem useful functions.

11. Lack of control: Misinterpretation and faulty interaction feedback leading to a feeling of loss of control. Includes the wish for more efficient and convenient smart home to control.

12. Inefficient use case: VA as unnecessary box with limited added value, incompetent of doing most complex things. Useful functions are perceived as positive surprise and quickly trivialized.

13. Seeing VA as a toy (as a playful device): Seeing VA as a technology toy. A central coping strategy is spending time on the 'VA-playground', mostly regarding smart home use.

14. Finding the right place: Moving VA to different locations for convenient entertainment or work support. – E.g. additional speakers, better sound, different privacy issues.

General Themes

1) Ecosystem ambivalence (--> 10)
2) Mutual dependency & learning (--> 7)
3) privacy of location
4) value of my data
5) concern about digital future (of living)
6) people expect more / less (unfulfilled expectations)
7) humans adopt to tech (--> 2)
8) impact on family/members
9) new social management
10) mistrust
11) lack of control
12) inefficient usecase
13) seeing va as a toy (as a playfull device) (--> 1)
14) finding the right place (--> 3)

12. TECHNOLOGICAL AFFINITY

a. Family interaction / social interaction (9) (8)
b. Trial & error user / playground approach (13)
c. Plug & play user
d. No user: fear of failure (9) (7)

11. DESIDERATA

a. Thought assistant (perceiving mood/feelings) (13)
b. X
  i. Design
  ii. Visual representation (6)
  iii. Technical improvement (6)
  iv. Support activities (6)
  v. Additional equipment (SMART HOME)
  vi. protection & privacy (6) (PRIVACY)
 vii. Compatibility & synchronization (1) (6)

10. SURPRISES (--> EXPECATIONS)

a. Functionality
  i. Surprises in the context of functionality of VA and network
b. Capability
  i. Surprises in the context of capabilities - and lack thereof (6) (?)
c. Social interactions
  i. Surprises in the context of social interactions & inferences (6) (9)

9. CONTEXTUAL FACTORS

a. Time to play around/playground (13)
b. Spatial requirements for VA (3) (14)
c. Context Switzerland (Language & Amazon) (1) (7) (4)
  i. Legal aspects (e.g. hands-free-driving /contradicting ??)
d. Common household and family (category)
e. Standards, norms and related expectations
f. Technological ecosystem (1)
g. Health (6)
h. Helplessness with regard to ideas for the future (5)

8. EXPLORATION/COPING STRATEGIES
(--> EXPECTATION) (--> TIME ISSUES) (13) (7)

a. Exploration
  i. Poor usability as a problem (?) (12)
  ii. Strategies of VA exploration (?) (13)
b. Coping
  i. Coping with linguistic limitations of the VA (6) (7)
c. Seeing VA as Toy (tbc)
d. Others
  i. Lacking possibilities for correction
  ii. Time required as a problem
  iii. A visual component as desiderata
  iv. Smart home application and their problems
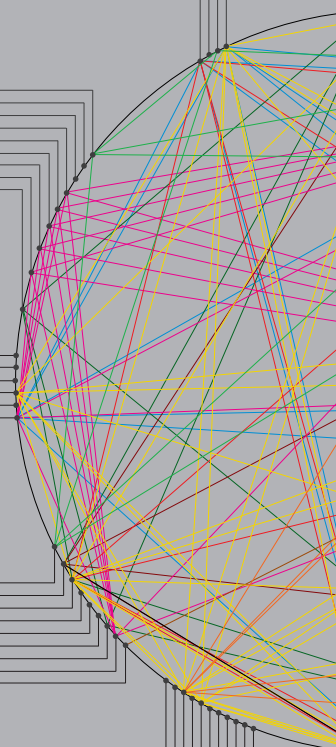
1. PRIVACY

a. Ambivalence to VA companies
  i. Proactive VAs
  ii. People have privacy concerns, but still adopt & use VA (1)
  iii. Reasoning for not trusting & refusing the use of VAs / Reasons for trusting the VA (10)
  iv. Reasons for trusting the VA (10)
b. Value of my data/privacy (4)
  i. Different types/uses of personal data
c. Protection of children (tdc) (8)
d. Privacy of location (tbc) (3)
e. Consequences of privacy attitudes
  i. Desiderata (<--> DESIDERATA)
  ii. Loss of spontaneity
  iii. Deceit /Loss of control (11)

2. EXPECTATIONS

a. Devices should be smart / everyday helper / VA must be practically useable (6)
b. Intensivy the relation with one ecosystem/company (1) (12)
  i. Ecosystem playground (13)
  ii. War of ecosystems
  iii. Insecurity due to increased dependence on technology and ecosystem
c. Unlearning competences (9) (-->PROBLEMS)
d. Increase in mutual dependence (2)
e. Humans adopt to technology (7) (6)

3. PERCEPTION

a. Seeing VA as a friend / human being
b. Seeing VA as a toy (13)
c. Seeing VA as an unnecessary box (12)
d. Limited added value as a voice assistant (12)
e. Successful support for the Smart home (SMART HOME)
f. Ambivalent communication behaviour with VA (3)
g. Getting used to VA – the VA does not really learn with it (2) (PROBLEMS)
h. VA use with multiple negative consequences:
  dependency/laziness/reliability/loss of control/too complicated/not sophisticated (11)

4. PROBLEMS

a. Dependency / digital vs. analogue living (5) (8)
b. Obscurity – unknown smartness / privacy issues (4)
c. Inconvenience
  i. Incompetency in speech recognition (12)
  ii. Incompetency in Compatibility in Switzerland (--> CONTEXTUAL FACTORS)
  iii. Incompetency in "Smartness" / Unfulfilled expectations / Not worth it (6)
  iv. Incompetency in Ecosystem (9)
d. Participants learn towards convenience / developing tactics (7)

5. CHANGES

a. Change of perception / attitude over the time of VA use (9)
  i. New forms of interaction
b. Change in behavior
  i. Speaking foreign languages at home
  ii. Using VA to avoid distractions
  iii. Less physical movement and activity versus more relaxation and convenience
  iv. Learning to ask questions the right way
  v. Impact on family/household members and social interactions (8)
  vi. Making regular / daily use of VA and its functions
    1. Changes in how users relate to their VA and how VA replaces other devices in the home (?)
c. Change in location of VA (3) (PRACTISES)
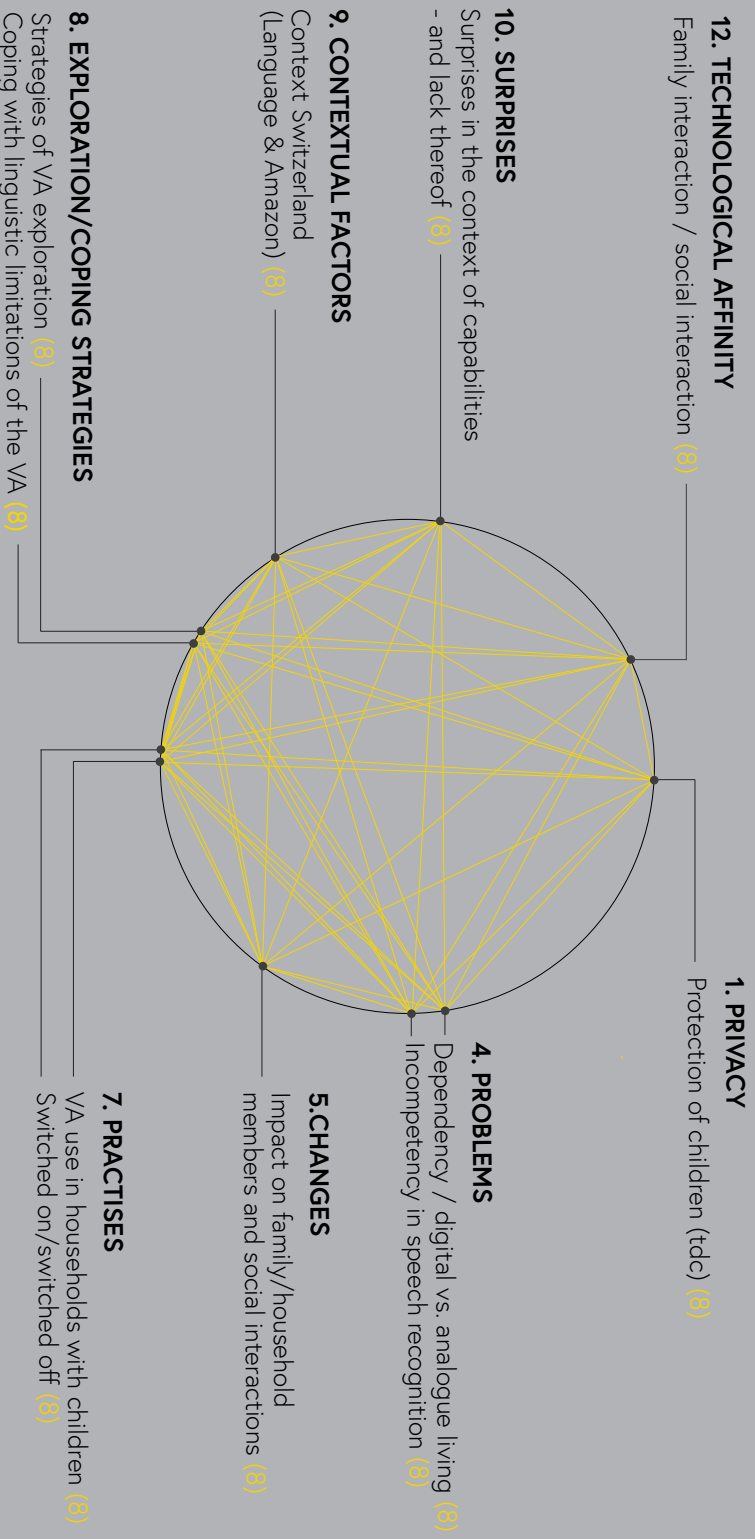d. No change through use of VA (PROBLEMS) (PRACTISES) (12)

6. SMART HOME

a. Mistrust in technology (--> PROBLEMS) (10)
b. X
  i. More control & monitoring (11)
  ii. Ease in everyday life
  iii. Desires for more convenience (--> PROBLEMS) (--> EXPECATIONS)
c. Not worth it (12)
d. Growing into use cases
e. Dissatisfaction regarding compability of devices /
  desire for standardization and doubt regarding the longevity of devices & solutions (1) (PROBLEMS)

7. PRACTISES (--> COPING)

a. Useful functions
b. Simple & short commands / Talking to VA (7)
c. Use in the presence of others or alone (9)
d. VA use in households with children (8)
e. Location of VA (14) (3) (7) (CHANGE)
f. Switched on/switched off (11)

12. TECHNOLOGICAL AFFINITY
Family interaction / social interaction (8)

10. SURPRISES
Surprises in the context of capabilities
- and lack thereof (6)

9. CONTEXTUAL FACTORS
Context Switzerland
(Language & Amazon) (8)

8. EXPLORATION/COPING STRATEGIES
Strategies of VA exploration (8)
Coping with linguistic limitations of the VA (8)

1. PRIVACY
Protection of children (tdc) (8)

4. PROBLEMS
Dependency / digital vs. analogue living (8)
Incompetency in speech recognition (8)

5.CHANGES
Impact on family/household
members and social interactions (8)

7. PRACTISES
VA use in households with children (8)
Switched on/switched off (8)

9) new social management

2. EXPECTATIONS
Unlearning competences (9)
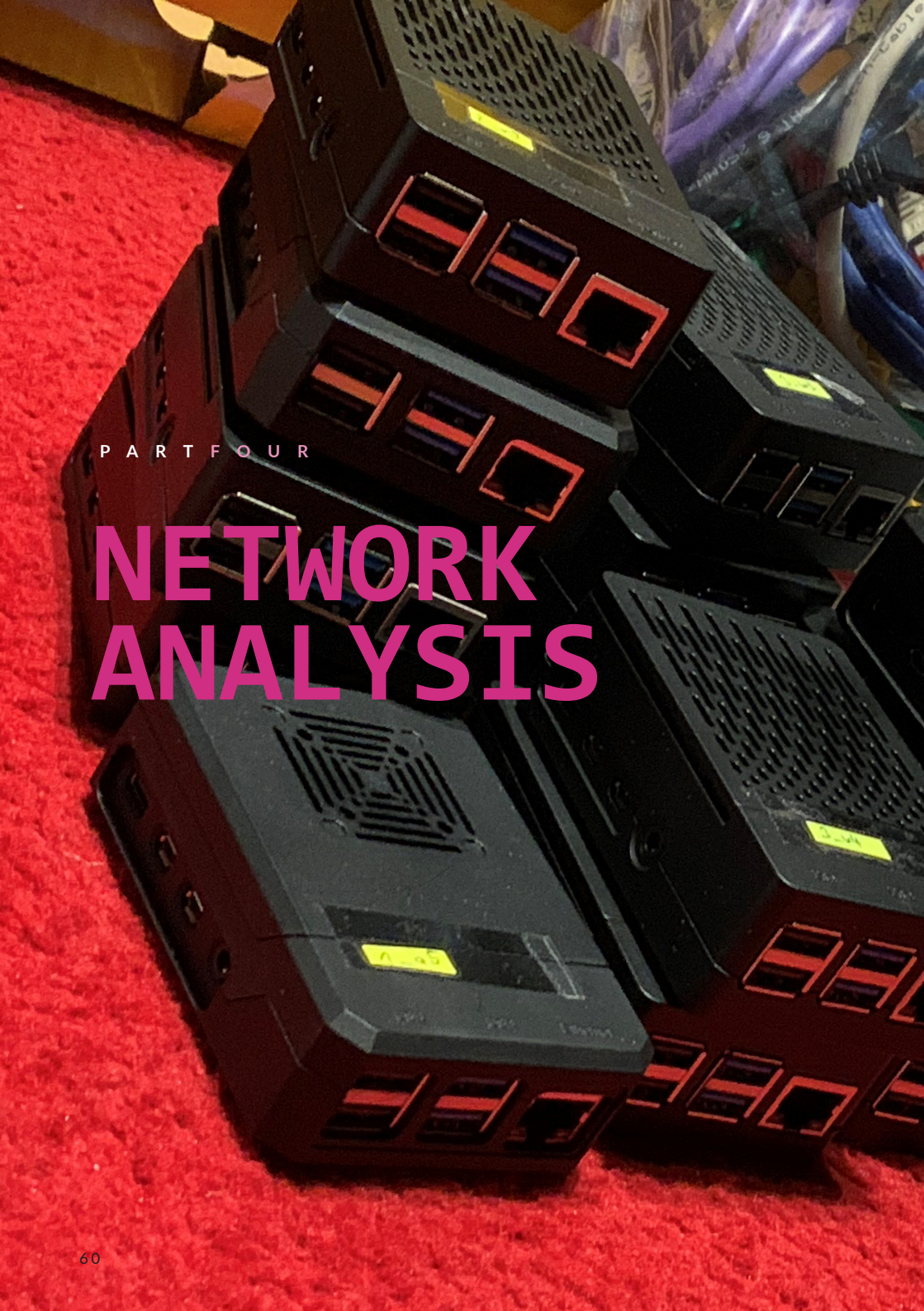(-->PROBLEMS)

4. PROBLEM
Incompetency in Ecosystem (9)

5. CHANGES
Change of perception /
attitude over the time of VA use (9)

7. PRACTISES (--> COPING)
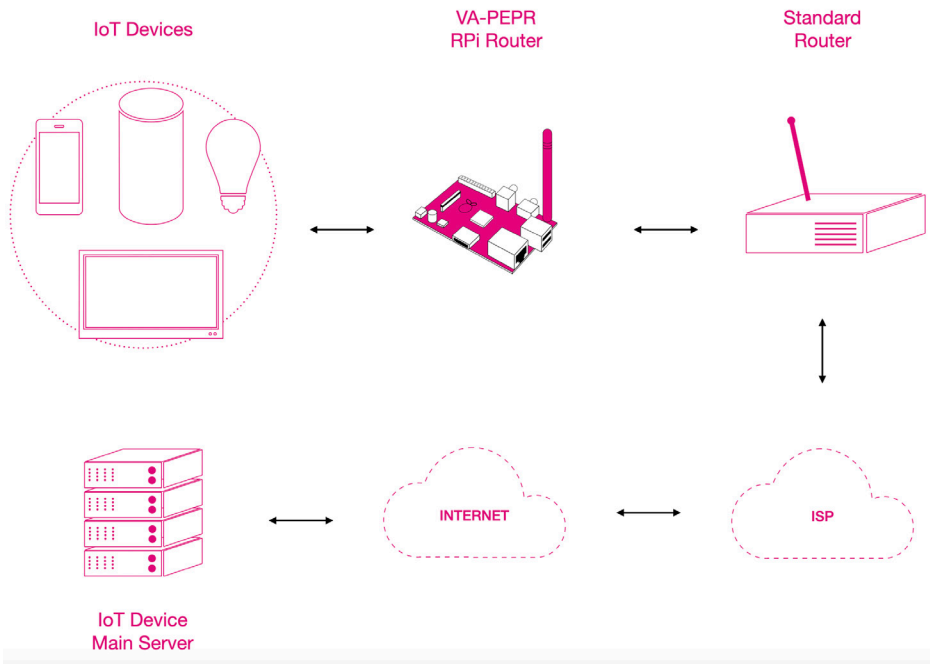Use in the presence of others or alone (9)

12. TECHNOLOGICAL AFFINITY
Family interaction / social interaction (9)
No user: fear of failure (9)
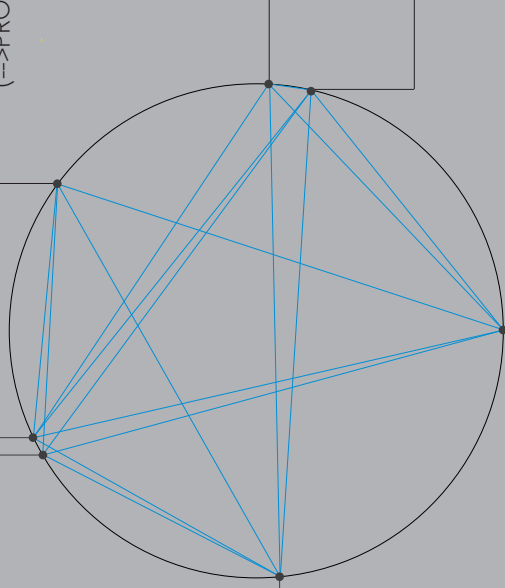
10. SURPRISES (--> EXPECATIONS)
Surprises in the context of social
interactions & inferences (9)

NETWORK ANALYSIS

IoT Devices

VA-PEPR
RPi Router

Standard
Router

INTERNET

ISP

IoT Device
Main Server

This diagram shows the flow of data from our IoT devices, through the VA-PEPR built data packet sniffer, through the home router, into the cloud and finally to the main server of our IoT devices. Data packets will flow both ways across this system.

Understanding our Network

It is known that sometimes a VA listens even without the user being aware of it. Sometimes these audio samples are analysed by humans, and they report that sometimes they listen to very private conversations.
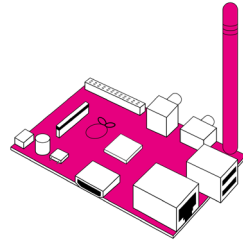
The VA-PEPR team wanted to find out what type of information is sent out, and (to generalize) between devices in the network. One assumption was that we might see packages being sent at a time when we knew no user was interacting with the device.

Of course it turned out that this information is encrypted, and that we do not know what kind of information is sent out to Amazon, Google and other hardware servers around the world, but the motivation was to see if we could bring some kind of transparency into what kind of network traffic is generated by a VA.

The VA-PEPR data sniffling router was built using the Raspberry Pi open computing platform. The Raspberry Pi acted as a gateway between the IoT devices and the main router.

For the VA-PEPR Team as a whole, questions around privacy and data were most relevant from the start. The expectation there was that we could find out about the notion users have of their own network, how much control they would like to have. The research on this first was on finding out what can be extracted from the network by inserting a monitoring device. Then we would find out how to go from there.

How did we do this?

The VA-PEPR team built a custom piece of hardware using a Raspberry Pi. This hardware acted as the router where all your devices connect to. Every time they "talk" to another computer somewhere else in the world, sending or requesting data from it, our device intercepts the data and logs it for us to analyse.

Boxing up the Raspberry Pis before going out for deployment in participants homes.

What data could we collect?

What device is sending a data packet?

When is the device sending data packets?

Where is the IP address it is sending the data packet to?

Is the data packet encrypted or not?

How big is the data packet?

No.	ip.src	ip.dst	src_device_name	dst_device_name	src_mac_a
985848	192.168.1.1	192.168.1.227	Sagemcom Broadband Sas (192.168.1.1)	f2:34:e0:f0:bd:fa (192.168.1.227)	38:35:fb:2
2202975	192.168.1.235	192.168.1.235	Xerox Corp (192.168.1.235)	Xerox Corp (192.168.1.235)	00:00:00:0

Source IP Address of the IoT device

IP address of destination of the data packet

The information extracted did not link immediately to privacy concerns of users (e.g. the packages sent were encrypted, and we would only get statistical information on them), and in particular because the data collected did not tell us to which external server the data went, we opted to use the analyses we did as "prompts" to talk to the participants about their concept of their network and their view on privacy.

The data analysis is mostly complete, and we are finishing the interview design. The interviews will soon be conducted, then analysed.

The datasets collected were quite big, and the analysis takes a significant amount of compute. We do not really have adequate hardware, so we are struggling with all kinds of "out of memory" errors etc. Analysis takes about 10-20 hours per participant, which is a lot for a single laptop to handle. The configuration of the data extraction process also posed challenges- as some information was simply dropped and we had to redo the analysis.

address		protocols	frame_len	datetime_time	time
e:62:93		sll:ethertype:arp:vssmonitoring	62	2021-05-01 20:22:43	May 1, 2021 20:22:43.753279000 Mitteleuropäis...
0:00:00		sll:ethertype:ip:tcp	60	2021-05-03 19:05:28	May 3, 2021 19:05:28.895884000 Mitteleuropäis...

Port address

Number of Bytes included in the data packet

Timestamps of when the data packet was sent.

When analysing the data, we realized that we would not have any information on outside IP-Addresses (where the data goes to, and where it comes from if it's outside the private network). That drastically reduced what was possible to do. We also found out that it is not possible to clearly identify the devices inside the network. This limits our ability to attribute network traffic to specific devices, which is a shame. We clearly hoped to squeeze more insights out of the data, but we couldn't.

There was a WOW-effect when we presented the chord graphs. It clearly shows the complexity of the home network, and is nice to look at.

When analysing the network traffic, we found an "interesting" peak of activity every three hours. It turns out that was our own sniffing device's analysis work.

So far it's been an interesting journey on the technical side, but rather disappointing with regards to the insights we can hope for. The shift from a technical focus to the participant's view on privacy and the way their private network operates is interesting and has a direct link to some of our key research questions.

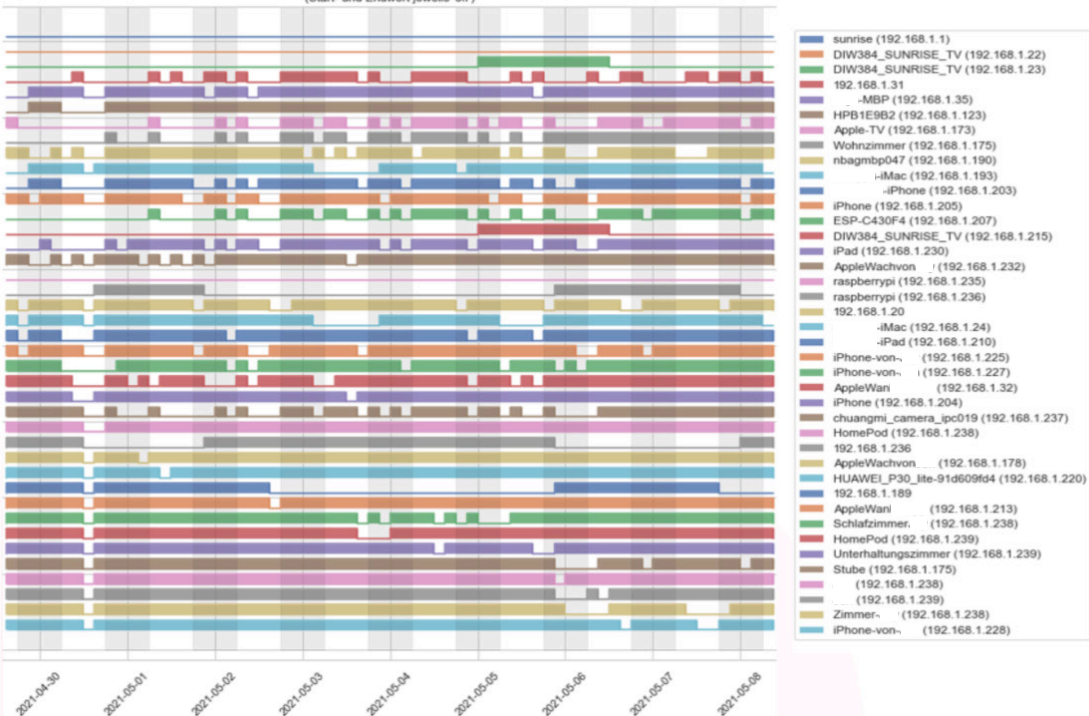| ip-Adresse	Gerätename
192.168.1.190	nbagmbp047 (192.168.1.190)
192.168.1.35	-MBP (192.168.1.35)
192.168.1.32	AppleWan (192.168.1.32)
192.168.1.215	DIW384_SUNRISE_TV (192.168.1.215)
192.168.1.175	Wohnzimmer (192.168.1.175)
192.168.1.236	raspberrypi (192.168.1.236)
192.168.1.1	sunrise (192.168.1.1)
192.168.1.173	Apple-TV (192.168.1.173)
192.168.1.239	(192.168.1.239)
192.168.1.22	DIW384_SUNRISE_TV (192.168.1.22)
192.168.1.31	192.168.1.31
192.168.1.189	192.168.1.189
192.168.1.193	-iMac (192.168.1.193)
192.168.1.220	HUAWEI_P30_lite-91d609fd4 (192.168.1.220)
192.168.1.227	iPhone-von- (192.168.1.227)
192.168.1.235	raspberrypi (192.168.1.235)
192.168.1.238	(192.168.1.238)
192.168.1.237	chuangmi_camera_ipc019 (192.168.1.237)
192.168.1.205	iPhone (192.168.1.205)
192.168.1.24	-iMac (192.168.1.24)
192.168.1.230	iPad (192.168.1.230)
192.168.1.225	iPhone-von- (192.168.1.225)
192.168.1.207	ESP-C430F4 (192.168.1.207)
192.168.1.203	-iPhone (192.168.1.203)
192.168.1.228	iPhone-von- (192.168.1.228)
192.168.1.210	-iPad (192.168.1.210)
192.168.1.178	AppleWachvon (192.168.1.178)
192.168.1.213	AppleWan (192.168.1.213)
192.168.1.232	AppleWachvon (192.168.1.232)
192.168.1.204	iPhone (192.168.1.204)
192.168.1.123	HPB1E9B2 (192.168.1.123)
192.168.1.23	DIW384_SUNRISE_TV (192.168.1.23)
192.168.1.20	192.168.1.20

On/Off der Devices von TN 4_y6
(Start- und Endwert jeweils 'off')

Legend:
- sunrise (192.168.1.1)
- DIW384_SUNRISE_TV (192.168.1.22)
- DIW384_SUNRISE_TV (192.168.1.23)
- 192.168.1.31
- -MBP (192.168.1.35)
- HPB1E9B2 (192.168.1.123)
- Apple-TV (192.168.1.173)
- Wohnzimmer (192.168.1.175)
- nbagmbp047 (192.168.1.190)
- -iMac (192.168.1.193)
- -iPhone (192.168.1.203)
- iPhone (192.168.1.205)
- ESP-C430F4 (192.168.1.207)
- DIW384_SUNRISE_TV (192.168.1.215)
- iPad (192.168.1.230)
- AppleWachvon (192.168.1.232)
- raspberrypi (192.168.1.235)
- raspberrypi (192.168.1.236)
- 192.168.1.20
- -iMac (192.168.1.24)
- -iPad (192.168.1.210)
- iPhone-von- (192.168.1.225)
- iPhone-von- (192.168.1.227)
- AppleWan (192.168.1.32)
- iPhone (192.168.1.204)
- chuangmi_camera_ipc019 (192.168.1.237)
- HomePod (192.168.1.238)
- 192.168.1.236
- AppleWachvon (192.168.1.178)
- HUAWEI_P30_lite-91d609fd4 (192.168.1.220)
- 192.168.1.189
- AppleWani (192.168.1.213)
- Schlafzimmer. (192.168.1.238)
- HomePod (192.168.1.239)
- Unterhaltungszimmer (192.168.1.239)
- Stube (192.168.1.175)
- (192.168.1.238)
- (192.168.1.239)
- Zimmer- (192.168.1.238)
- iPhone-von- (192.168.1.228)

2021-04-30 2021-05-01 2021-05-02 2021-05-03 2021-05-04 2021-05-05 2021-05-06 2021-05-07 2021-05-08

Chord Graph detailing the data sent between passive network devices

Chord Graph detailing the data received between passive network devices

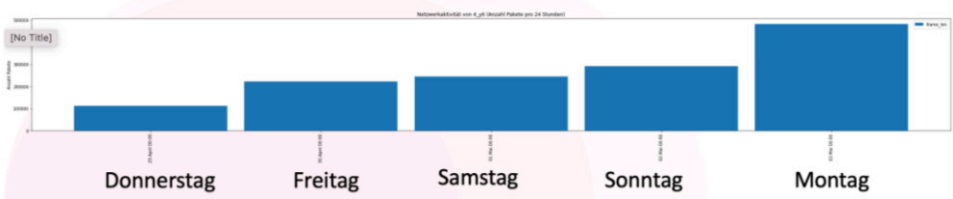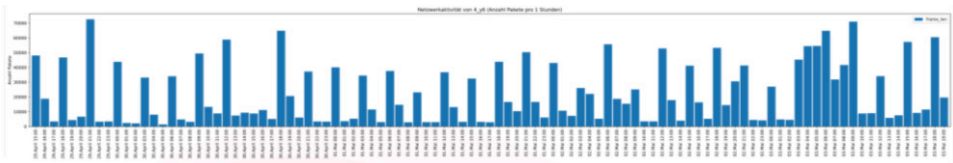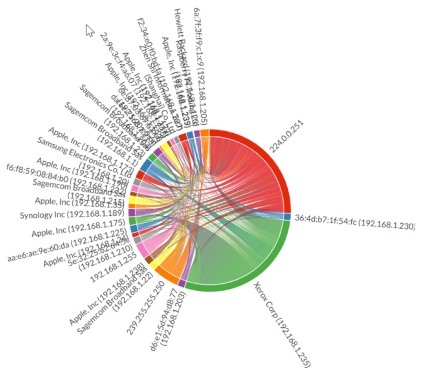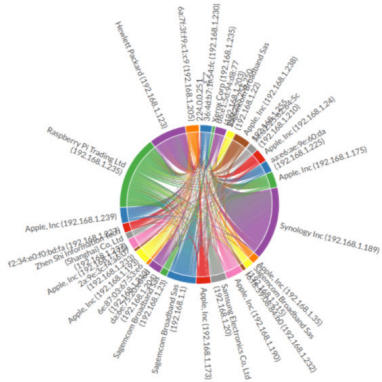**Traffic intensity over time. This graph illustrates the amount of data packets that have been sent from all devices on the network hourly over the course of 4 days.**
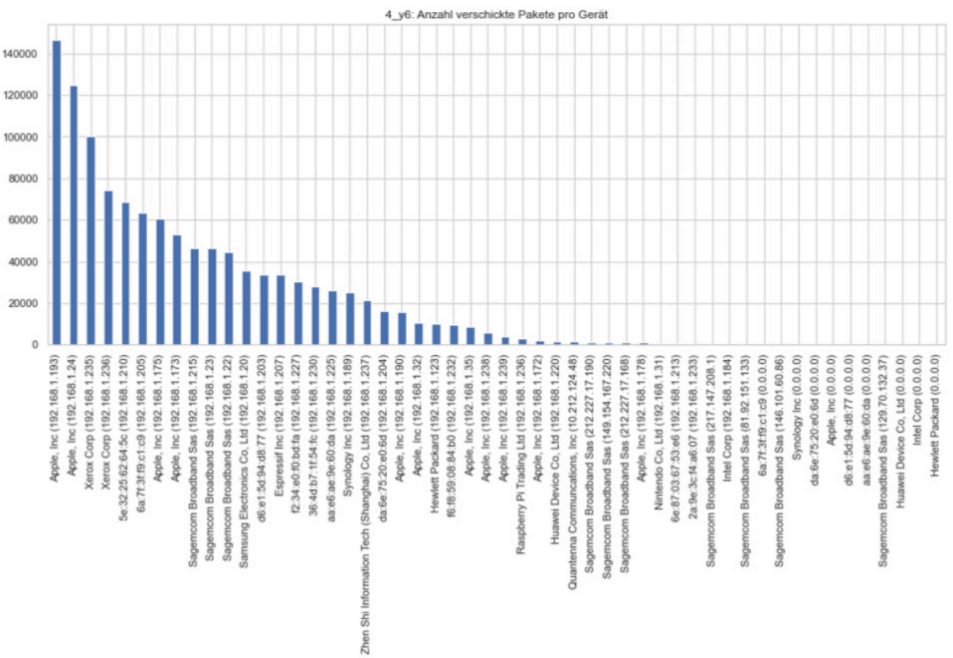
Traffic intensity over time. This graph illustrates the amount of data packets that have been sent from all devices on the network across 5 days.

This graph explores the amount of packets transmitted over the networks of 11 participants. Each bar is broken down into different protocols for delivering and receiving packets - TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).

Number of packages sent per device. It is interesting to see here that the X-axis is logarithmic.

Datenmenge pro TeilnehmendeR, nach Datenübertragungsprotokoll

Netzwerkaktivität von 4_y6 (Anzahl Pakete pro 1 Stunden)

Netzwerkaktivität von 4_y6 (Anzahl Pakete pro 24 Stunden)

| Donnerstag | Freitag | Samstag | Sonntag | Montag |

4_y6: Anzahl verschickte Pakete pro Gerät

Network Analysis Study Reflections

With the NTA study, we successfully experimented with an off-the-shelf data monitoring device build with actual users in mind. We were able to reveal practices and routines in the home and make them visible to everyday people. As one of the key findings, we learned that people lack a concept for what are normal data security and data privacy risks. This part of the research points to the need of services and visualizations understandable and accessible to lay users first in terms of actual data capture and analysis and second in terms of interpreting these results in regard to actual risks. It also points to the need for less invasive and intruding tools to conduct such NTAs. Interdisciplinary approaches including data visualization and information design need to come together with computer analyists, network analyists and others.

RCC STUDY

About The rcc Tool

The rcc (Relax- Concentrate - Create) process is an award winning business application developed by HSLU. The resource is available to all students and employees of the Lucerne University of the Applied Sciences as well as 470,000 Switchaai users in Switzerland. This includes all students and employees of Swiss universities and other institutions such as university hospitals, CERN or the Swiss National Science Foundation.

The software suite contains five web-based training platforms, which basically introduce the model and the extensive topics of regeneration, concentration and creativity. The rcc process consists of a web-based application with which the learning and development process of individual resource management can be managed. A multi-layered journalistic and questionnaire tool provides users and researchers with results according to their needs. A data framework enables the statistical evaluation of the recorded data.

The users of the software and, above all, the students of the interdisciplinary 3-ECTS modules, which are carried out three times a year, develop their personal resource management over a period of 13 weeks. Based on the relax-concentrate-create model and the didactic concept of the module, the students pursue three goals they have set themselves and take appropriate measures in the areas of regeneration, concentration and creativity.

Why use rcc with VA-PEPR?

Voice Assistants are touted and sold by the industry as a technology and tool that make people's lives easier and richer. For this reason, it was obvious that the rcc students for VA-PEPR would be a suitable group to integrate Voice Assistants into their everyday lives. This would allow the team to analyse whether voice assistants are really able to make life easier, and to enrich the management of one's own resources.

Multi-stage surveys were developed for the VA-PEPR participants, which collected data from students on their various experiences with voice assistants in connection with their personal resource management. This was conducted in two pilot studies and since 2021 in the main study itself.

The purpose of the study

We hoped that the rcc study would provide even more detail about the routines and practices of the students, how they used voice assistants in their everyday life (studies, work, leisure), and whether the voice assistant enriched their resource management. We also assumed that we will experience even more creative ideas about the form and functionality of voice assistants.

Below are some initial findings from the study so far. The initial study is due to be completed by the end of 2021. If it makes sense in the context of the project, data collection will be continued in 2022.

Voice Assistance animieren:
Ich nutze in meinem Alltag bereits Voice Assistance.
Ich möchte jemandem zeigen bzw. jemanden animieren, wie Voice Assistance zur Unterstützung des Ressourcenmanagements im Hinblick auf *relax-concentrate-create* eingesetzt werden kann.
Beispiel: Ich selbst profitiere bereits durch VA in meinem Ressourcenmanagement und denke, dass andere auch davon profitieren können.

Voice Assistance kennenlernen:
Ich nutze noch keine Voice Assistance.
Ich möchte mich durch jemand anderen von den Vorzügen von Voice Assistance animieren lassen, wie Voice Assistance zur Unterstützung des Ressourcen-managements im Hinblick auf *relax-concentrate-create* eingesetzt werden kann.
Beispiel: Mein Freund setzt VA bereits erfolgreich ein und profitiert durch VA in diversen Lebensbereichen. Das möchte ich für mein rcc-Management von ihm lernen.

Voice Assistance hinterfragen:
Ich will keine Voice Assistance nutzen.
Obwohl ich mich eingehend mit den Möglichkeiten von VA vertraut gemacht habe, möchte ich Voice Assistance aber trotzdem nicht für mein Ressourcenmanagement nutzen, sondern gemeinsam mit anderen eine Gegenposition etablieren und begründen.
Beispiel: Ich möchte die Datenschutzproblematik im Einsatz von VA aufzeigen und gemeinsam mit Kolleginnen und Kollegen Beispiele finden, in denen der Einsatz von Voice Assistance sinnlos und sogar schädlich wird.

The status of the study

Below are some initial findings from the study so far. The initial study is due to be completed by the end of 2021. If it makes sense in the context of the project, data collection will be continued in 2022.

Results so Far (as of Spring 2020)

7 out of 56 students (4 female, 3 male) have recorded VA-related activities

As of 15.06.20 a total of 87 journal entries were recorded

Systems used (and declared)are: Duolingo (language learning app), Siri, Alexa, Google (Translator)

Activities in association with voice assistants: Learning/self-study, Arrival and Departure, Prepare Day/Night, Sports, Pause/relax, Sleep, Friends, Hobbies, Chores, preparing meals/cooking, eating/dining, eating/dining mixed, TV/ Internet/Socialnet

Some records indicate the mixed use of VAs and DAs

Data gathering intensity seemed strongly dependant on the motivation and daily mood of the student

VA-activities (except for listening to music/audio books) seemed rather experimental and less like a daily routine

VAs understand spoken natural language very well but context awareness (understanding) is severely lacking

Usability is severely hampered by a lacking robustness of VAs to natural

variations in human communication, such as using different formulations for the same command/wish expression to a VA

Humans optimize their language for communicating with a voice assistant

In the rcc-Tool, the question of whether a VA command "worked" is crucially connected to its usage frequency: Failed Commands are not repeated, although the user might have wanted to adopt a routine in that respect

Journal writing routines are different from actual routines

Advanced usage such as defining custom commands might have a strong influence on the adoption probability of routines the user would wish to adopt

A consideration for this study (forced participation)

We see that many students decided to get to know their voice assistants, but since the students are informed about the project, there may be a bias.

Was their participation forced too much?

The first pilot data taking campaign has provided clear information on who is willing to share their VA-usage data. However, we have no information about the intrinsic motivation to use VAs and capture their usage in a journal.

Maybe more students use VAs, but don't want to assess or reflect on their VA-usage?

Impact of COVID19?: Maybe at home there is only one notebook present, no printer etc.

Umfrage Voice Assistance

Burnout-Indikator
Lern- und Arbeitsstil-Indikator
Boundary-Indikator
Dashboard
Details
Test
Vollständigkeit
Managementanalyse
Ressourcen und Risiken
Umfrage Voice Assistance

Dies ist eine Demo, wie eine Umfrage für Voice Assistance im Kontext von Digital Everyday Life aussehen könnte.

Die Umfrage ist nur sichtbar für rccsupervisor und man kann nichts speichern, um nicht unnötige Datensätze zu erzeugen. Die Fragen und Optionen sind frei erfunden, ausser Nr. 5 ist gemäss Screenshot rcc Voice Assistance Entwurf.

Wording: "Voice Assistance" oder "Sprachassistenz"??

Didaktischer Tipp: Fragen? Klicke auf allen Ebenen der Web App auf das gelb hinterlegte Fragezeichen oben rechts. Es zeigt kontextsensitive Hilfe.

Fragen:

1. Findest du den Gebrauch der Sprachassistenz sinnvoll?
   - Ja, sehr
   - Ja, manchmal
   - Eher nicht so
   - Nein

2. Wie oft führt Sprachassistenz zu einem Erfolgserlebnis?
   - Immer
   - Mehrheitlich habe ich Erfolg
   - Zwischendurch habe ich Erfolg
   - Nie

3. In welchem Bereich profitierst du am meisten von Sprachassistenten?
   - Persönliche Organisation, z.B. Reiseplanung und Recherche
   - Persönliche Ressourcierung, z.B. Einkäufe und Beratung
   - Unterhaltung
   - Sonstige:

4. Findest du den Gebrauch der Sprachassistenz für die Gesellschaft gefährlich?
   - Ja, Sprachassistenten müssten politisch eingeschränkt werden.
   - Ja, aber es lasst sich kaum ändern.
   - Ja, aber der Nutzen überwiegt.
   - Nein, mit genügen Aufklärung.
   - Nein.

5. Warum wurde bei Aktivitäten Sprachassistenz nicht verwendet, obwohl es möglich gewesen wäre?
   - Aufgrund früherer Misserfolgserfahrung.
   - Weil das Thema zu persönlich ist.
   - Weil ich in Eile war und nicht probeln wollte.
   - Weil ich etablierte andere Wege kenne, um an die Information zu gelangen.
   - Sonstiges:

1494 Accounts → **560** Accounts have made relevant Journal entries → **420** Jou...

(*Previous page*)
Sample questions put to the rcc students to gain feedback on their experiences with voice assistants.

(*This page*)
A screen shot of the rcc logging process.

(*Below*)
Summary of data collection during the rcc study

Aktivität ?

Von	12:00 ⊙
Bis	12:15 ⊙
Tatigkeit	An- und Abreise ⌄
Thema	z.B. Zug verpasst

Journaleintrag

z.B. Bin wieder einmal zu spät von daheim losgegangen. Heute hat es sich gerächt und ich habe den Zug verpasst.

Beschreibung der Erfahrung

Sinn	●—————	(leer)
Bewusstheit	●—————	(leer)
Befinden	●—————	(leer)
rcc	relax ○ conc. ○ create ○	
	Nicht definierbar ○	(leer)

Voice Assistance

Wurde für diese Aktivität Voice Assistance benutzt?

VA nicht erfassen Nein ● Ja ○

OK   Abbrechen

...urnals as PDF ...ncl. overall ...conclusion → **84** Journals TV/Social-Media/Internet-related activities → **15** Journals based on quantitative indicators, and analysed them qualitatively
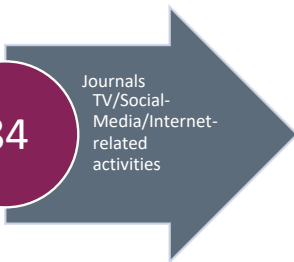
Total VA-Aktivitäten:87
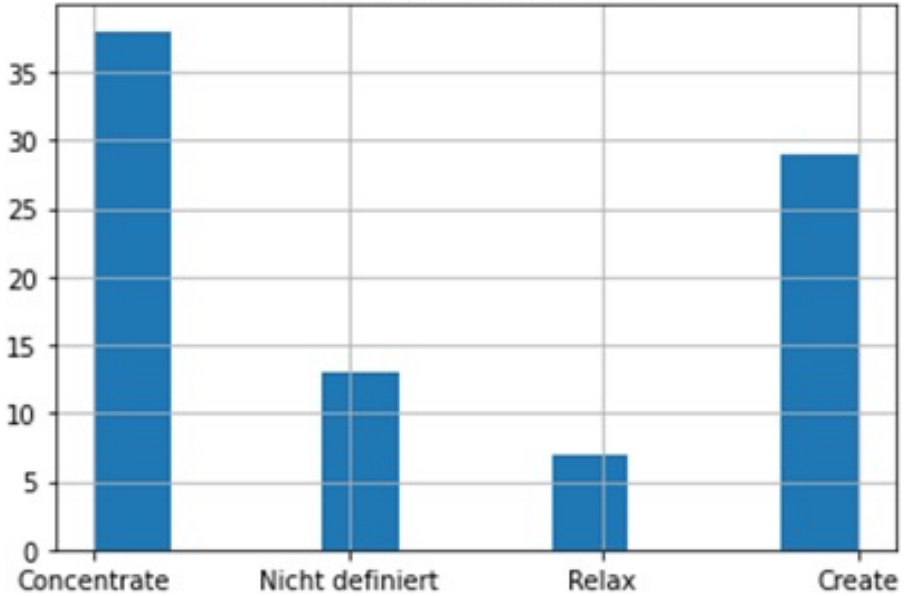
(*Bottom*)
Overview of how participants used the VA. Most participants used the VA to concentrate, while very few used it to relax.

(*Next page top*)
Time line of participants usage of the Voice Assistant.

(*Next page bottom*)
Activities mentioned broken down into the categories of relax, concentrate and create.
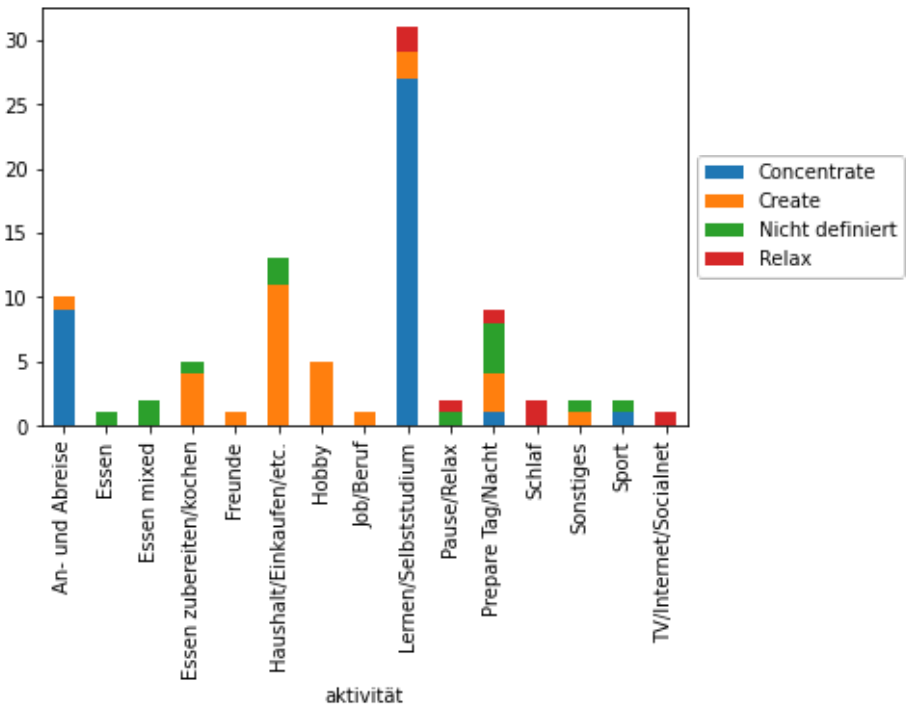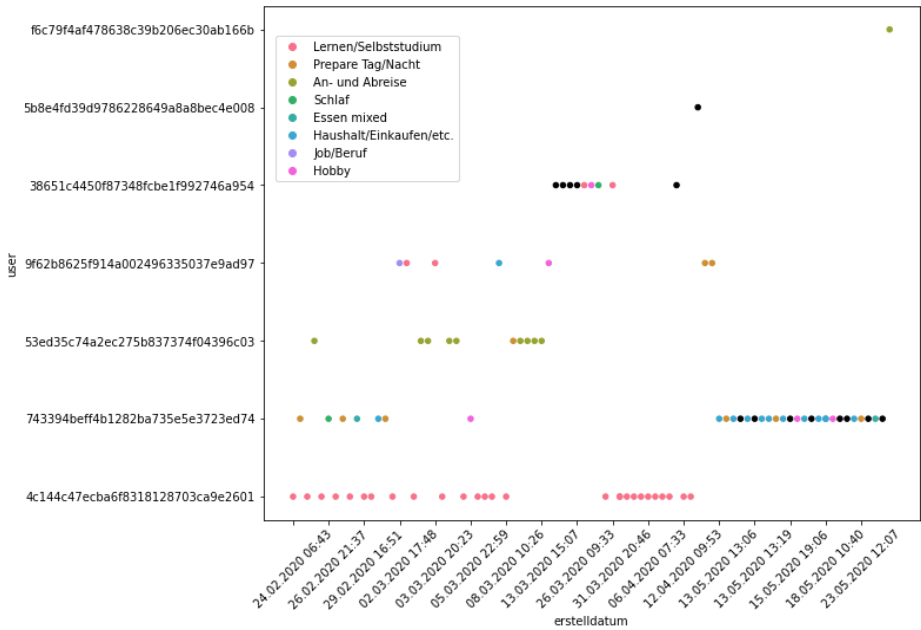
Häufigste Themen
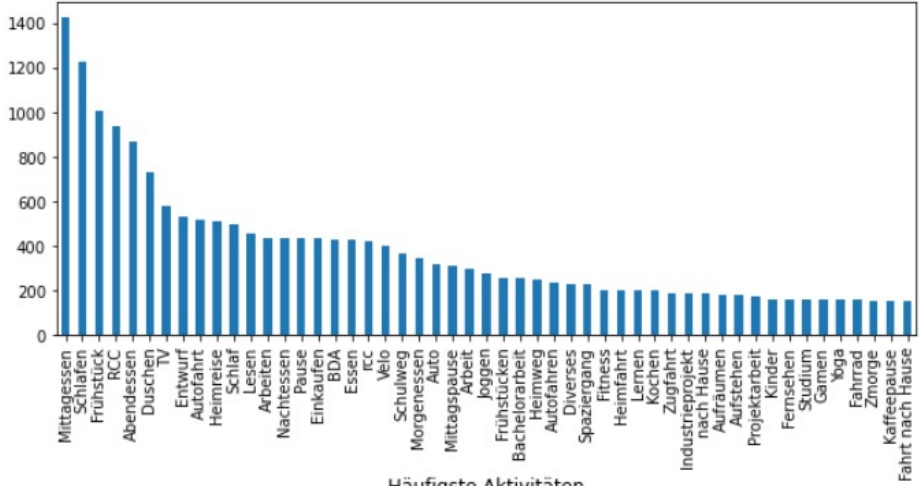
Häufigste Aktivitäten
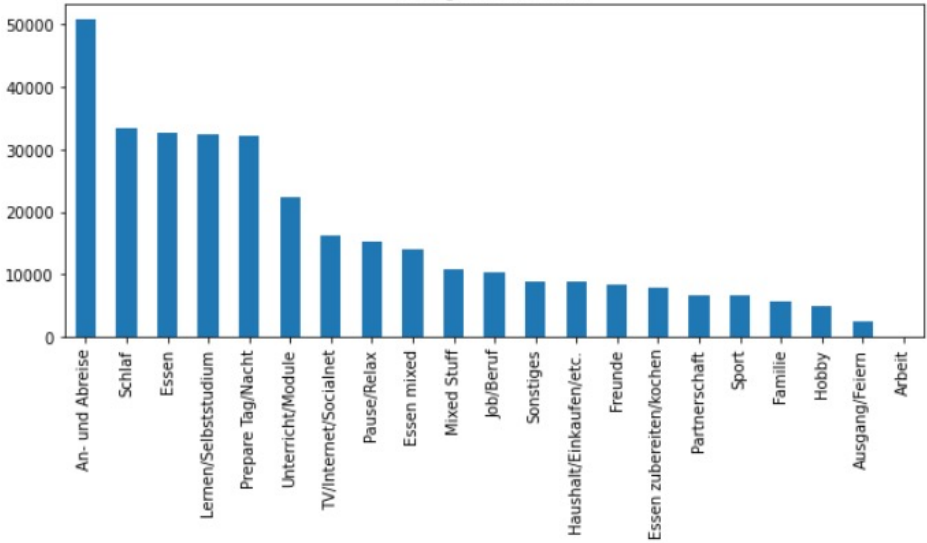
(*Top*)
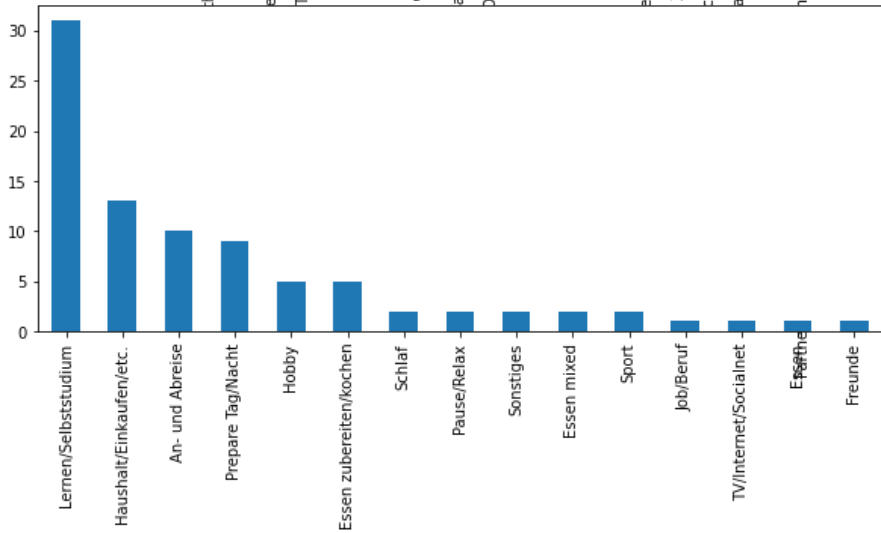**Most common themes mentioned during the rcc study across all participants**

(*Bottom*)
Most common activities mentioned during the rcc study across all participants

Häufigste Themen
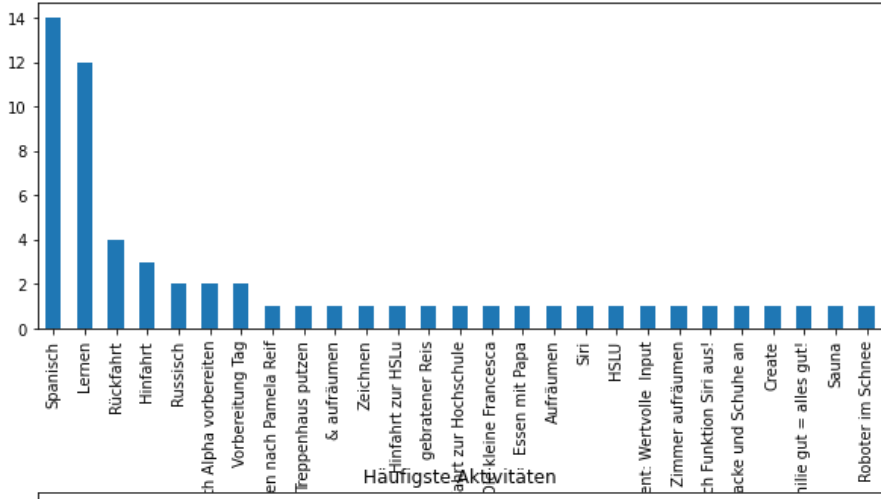
Häufigste Aktivitäten

(*Top*)
Most common themes mentioned during the rcc study for one participant

(*Bottom*)
Most common activities mentioned during the rcc study for one participant

rcc Study Reflections

The rcc study allowed us to learn about VA attitudes, behaviors, practices and routines from a younger age group that can generally be described as digital natives. We could learn how their expectations about and experiences with VA differed from that of the participants from the in-home study. RCC participants had to engage with the VA technology in one way or another while the participants from the in-Home study had volunteered to do so and was generally much more open to use VAs. This also means that changes in practices and routines among those participants tend to follow from the tasks these participants had to solve. Overall, we could get a better sense about the general knowledge and awareness of VAs in Switzerland.

PROVOCATIVE PROTOTYPES

Provocative Prototypes, or Provotypes.

Provotypes are a tool that can help designers explore possible futures.

Before we talk about provotypes first we should probably define what we mean by a prototype. We usually class a prototype as something (anything from a cardboard model to a bit of code) that can represent an idea, or perhaps a particular feature of an idea. It allows designers to test ideas and gain feedback from users. Prototypes are typically brought in during the development stage of the design process.

A Provotype is a provocative prototype

Now what is a provotype? A provotype comes into the design process a little earlier. They tend to run in parallel with the discovery and research stage of a project. They are inspired and informed by the Literature Review, Contextual review, and the three studies we have undertaken. They serve the same function as all these other activities - to expand our thinking around a subject matter.

Provotypes are used to spark ideas, discussions and debates

Where a prototype is made to refine our thinking - to help us rule out options and slowly arrive at a final solution, a provotype is designed to expand our thinking and ideas. They help us to explore many possible futures. And in exploring these many futures we can start to have conversations about how we get to these futures.

If a prototype is a response to a design problem then a provotype is something that helps to define the problem or problems. They will challenge assumptions, they will shift our focus from the present to the future and they will ask some big 'what if' questions.

"A provotype is an untested hypothesis about the future that can be accepted, rejected, or re-imagined by those that engage with it"

The initial nine provotypes that have been created for the VA-PEPR project have been inspired by the initial thoughts generated from the study transcripts and are rooted in the original research questions. These were created to demonstrate this method to the wider team.

Our provotypes were quick 3D printed sketches. In building these provotypes we learned how to use some interesting technologies and platforms that may become useful when it comes to the prototyping stage of the project.

Particle Photons (Arduino based IoT platform)

Raspberry Pis

ESP8266 WiFi modules

Thermal Printers

AIY Voice Kit

AIY Vision Kits

IFTT

Google Cloud Platform

Alexa Skills

PyCroft

The VA-PEPR provotypes

Below are the in initial provotypes created for the project. This was round one of building provotypes as we were slowly unpicking interesting insights from the other research. These provotypes very quickly sparked some really interesting and productive debates within the team already.


1. What if your VA could have added inputs and outputs?
2. What if you could dial something up and down?
3. What if your VA was not associated with a big tech provider?
4. What if your VA looked like a Speaker?
5. What if you could instantly block your VA
6. What if your VA had eyes?
7. What if the VA looked like a microphone rather than a speaker?
8. What if a VA had only one function?
9. What if a VA could print off everything it heard that day?

(Opposite page)
Development pictures of some of the provotypes.

```
1   """A demo of the Google CloudSpeech recognizer."""
2   import argparse
3   import locale
4   import logging
5
6   from aiy.board import Board, Led
7   from aiy.cloudspeech import CloudSpeechClient
8   import aiy.voice.tts
9
10
11  def get_hints(language_code):
12      if language_code.startswith('en_'):
13          return ('turn on the light',
14                  'turn off the light',
15                  'blink the light',
16                  'goodbye',
17                  'repeat after me')
18      return None
19
20  def locale_language():
21      language, _ = locale.getdefaultlocale()
22      return language
23
24  def main():
25      logging.basicConfig(level=logging.DEBUG)
26
27      parser = argparse.ArgumentParser(description='Assistant service example.')
28      parser.add_argument('--language', default=locale_language())
29      args = parser.parse_args()
30
31      logging.info('Initializing for language %s...', args.language)
32      hints = get_hints(args.language)
33      client = CloudSpeechClient()
34      with Board() as board:
35          while True:
36              if hints:
37                  logging.info('Say something, e.g. %s.' % ', '.join(hints))
38              else:
39                  logging.info('Say something.')
40              text = client.recognize(language_code=args.language,
41                                      hint_phrases=hints)
42              if text is None:
43                  logging.info('You said nothing.')
44                  continue
45
46              logging.info('You said: "%s"' % text)
47              text = text.lower()
48              if 'turn on the light' in text:
49                  board.led.state = Led.ON
50              elif 'turn off the light' in text:
51                  board.led.state = Led.OFF
52              elif 'blink the light' in text:
53                  board.led.state = Led.BLINK
54              # Our new command:
55              if 'repeat after me' in text:
56                  # Remove 'repeat after me' from the text to be repeated
57                  to_repeat = text.replace('repeat after me', '', 1)
58                  aiy.voice.tts.say(to_repeat)
```
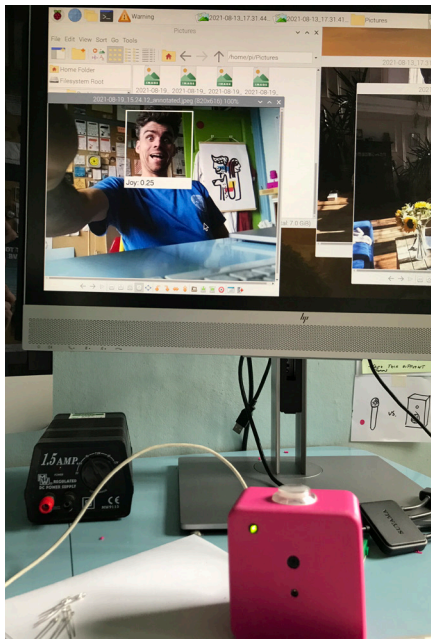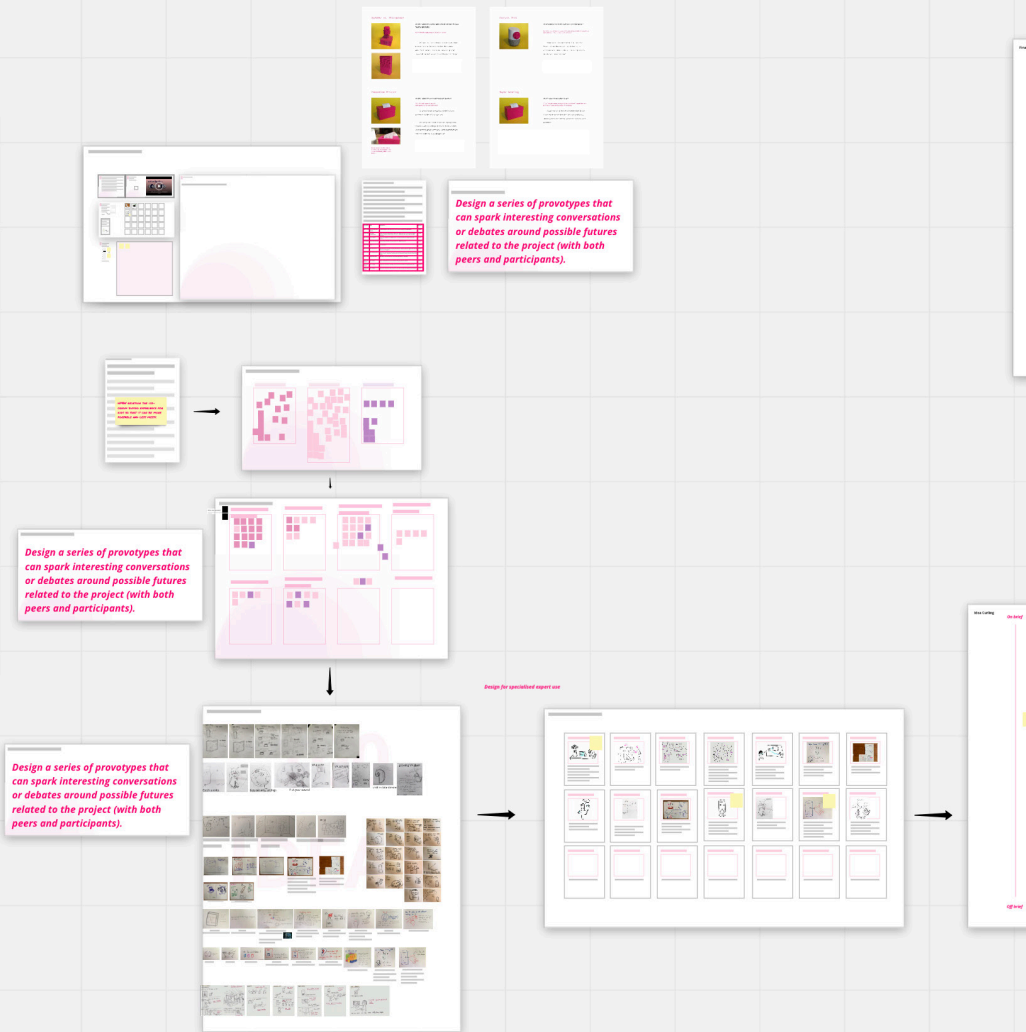
A screen shot of the Miro workshop undertaken to develop the second round of provotypes. We began by giving an overview of all current research and writing down notes from as opportunities using the HMW technique.

We then synthesised these notes into 6 themes to explore:
How might we improve Digital Literacy
How might we enhance user agency?
How might we bestow character & enable VAs to become a different versions of themselves (Humanising)
How might we design VA-communication more like a natural interaction?
How might we make VA a trustworthy buddy?
How might we design for play(fullness) in and through our interactions with VAs?
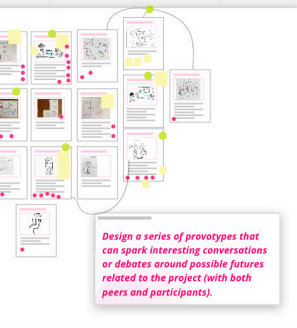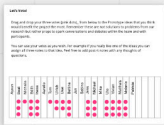
Design a series of provotypes that can spark interesting conversations or debates around possible futures related to the project (with both peers and participants).
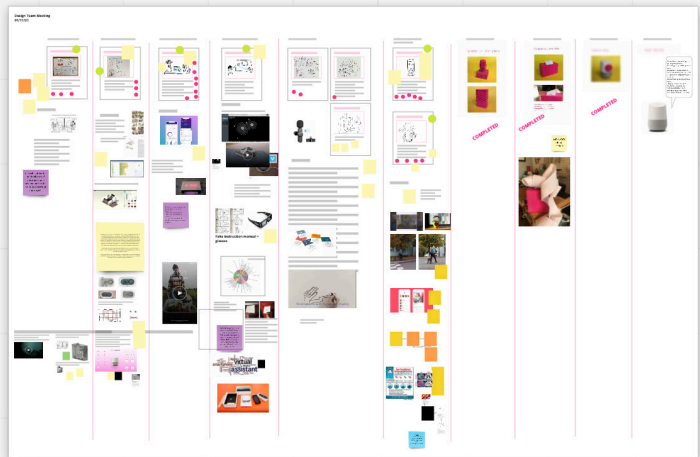
The team then spent time ideating around these themes, generating as many ideas as possible. These ideas were then filtered voted on by the entire team. (See next spread).

These ideas were then developed further (skip forward a couple of pages to see this development in more detail, and further again to see the final 12 provotypes. Some of these were developed as physical products and some as short films to best convey the concepts).

Build your own VA

Data Value — Bidding on data.

Transformer

Wearable VA

VA Psychiatrist — Using Alexa against Alexa / Bringing the spiritual into a data driven world

Controlling Our Data

I agree! - Me too! — Expectations vs Reality

Data Viewers — Bringing in the non physical

Talking furniture

Catch a voice

Reflective Behaviour VA — Treats for VAs

Don't trust me

VA using a plant approach

Animal VA

(Previous page)
The initial provotype idea sketches.
These ideas were responding to the
six themes identified to explore.

(This page)
Developing and voting on a shortlist
of ideas with the aim of taking six
concepts further.

Speaker vs. Microphone

COMPLETED

Companion Printer

COMPLETED

E-ink work cloud version

Control Dial

COMPLETED

Super Hearing

Treats for VAs

Notes and queries

Developing the six provotype ideas further, bringing in some outside references and starting to build stories and narritives around the ideas.

Tne final 12 VA-PEPR Provotypes
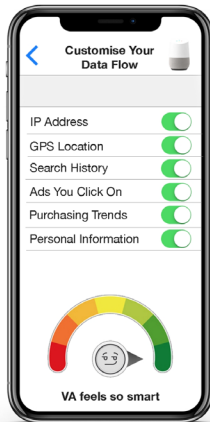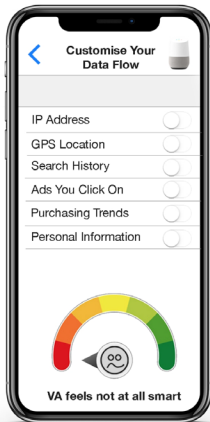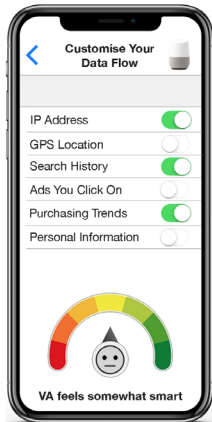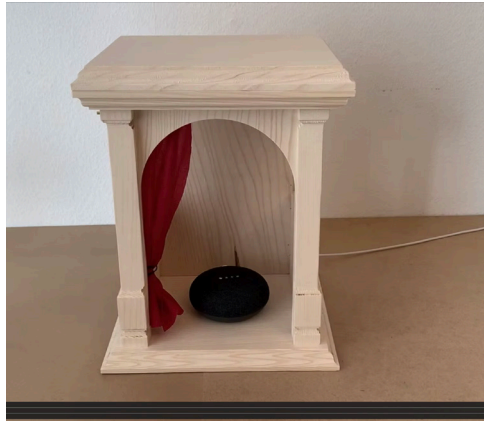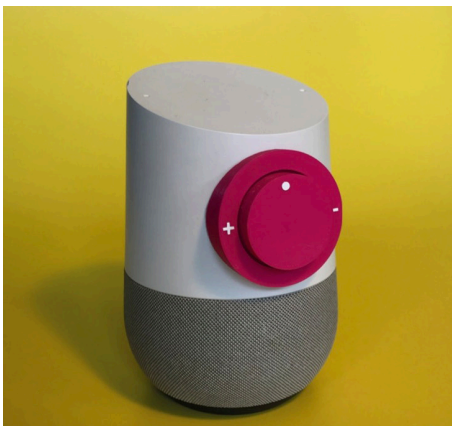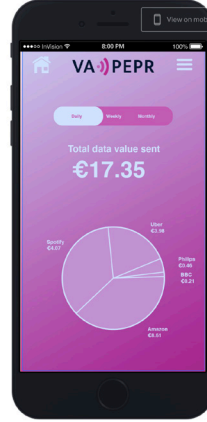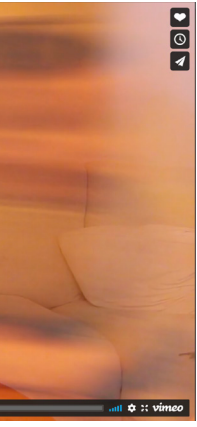
VA-PEPR provotypes round two

The next three pages detail the 12 provotypes the VA-PEPR design team created to explore during the speculative design workshops. These provotypes manifested in various forms. From physical digital products to voice skills and from concept films and imagery to props pointing at particular futures.

We deliberately do not go into too much detail for each provotype as the ambiguity of these 'things' can unlock unexpected conversations and tangents.

Super Hearing

What if our VAs could tell us about stuff that humans can't hear?

Provotype talking points:
Discuss how the AI back-end of these devices can make sense of the ambient data within our homes. Discuss how these machines have better hearing and senses than us.

Take Me To Church

What if our VA can work with our automated home to act as therapy/well-being?

Provotype talking points:
Challenge the "cold" rationale of home automation with its focus on monitoring, controlling, calculating. Could this combination of VA and home automation take people into a different place, spiritual, therapy, well being.

VA Everywhere

What if our VA was everywhere we went?

Provotype talking points:
How is this different from our phones? What balance between convenience and privacy do we desire?

VA Pest Control

What if we lost control of our VAs?

Provotype talking points:
Fast forward to the future: call on experts to rid your house of unwanted data leaks, data intruders etc. Also connects to diagnostic concepts to identify issues that experts than can tend to. What would such an expert do? When would s/he be called? What tools would need to be available?

Speaker vs. Microphone

What if our VA looked like a microphone rather than a speaker?

Provotype talking points:
Are VA manufacturers trying to make us forget we are constantly being listen to? What is the importance, if any, of the physicality of a VA?

VA Confession Box

What if our VA could admit when it had done wrong?

Provotype talking points:
Can VA sin (data leaks, privacy intrusions, sharing information with businesses/externals, other devices) and confess its sins to its owner? What if VA owners are "priests"? How would this contribute to trust in and understanding of IoT in everyday life? How would this speak to our values, norms?
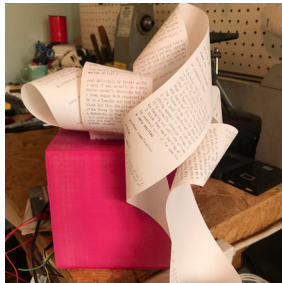
Constant Transcriber

What if we could see everything our VA heard, or thought it heard?

Provotype talking points:
Could we use this to train ourselves to use VAs better? Could we see where a specific command went wrong? Could we use this to explore the ethics of these super hearing machines? Is our VA eavesdropping into our neighbours and people outside our windows?
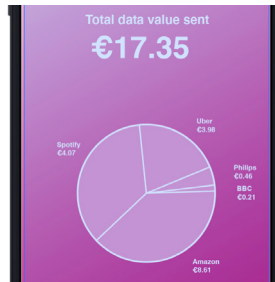
Data Value Monitor

What if we could see the monetary value of our data, and start to take control of it?

Provotype talking points:
What is our data worth? Does this make us more or less precious of data privacy? Who is actually collecting our data? What is your data worth to you?

Data Flow Customisation

What if we could change the individual fields of data flow about ourselves?

Provotype talking points:
Would you like to be able to customise the user data flow in VA? Would you like to control how much information about you becomes available to the data miners? Would this give you a sense of control of your data/privacy? How do you think this would impact the smartness of the assistant?

VA Everything

What if we can choose what can be a VA in our home simply by sticking a sticker on it?

Provotype talking points:
What would we choose to make a VA? How would you interact with these differently? Would they interact with each other?
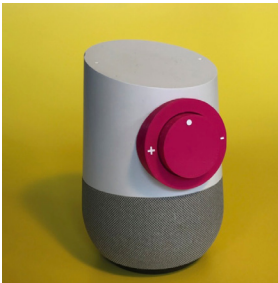
VA Control Knob

What if we could add a new controller to a VA, what would you dial up and down?

Provotype talking points:
Question hardware capabilities and sensitivity. Question smartness. Discuss the tensions and balances between data control and smartness.

Data Packet Viewer

What if we could see data packets flying around our home in real time?

Provotype talking points:
What would we want to do with it? Would this be useful? What would we want to know about our data packets?
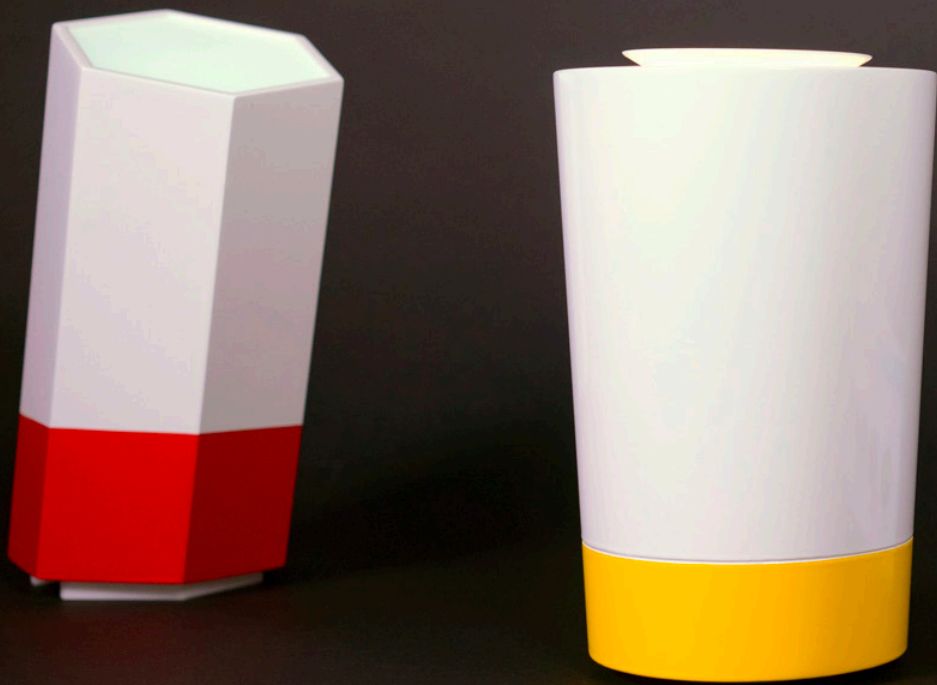
Our Friends Electric. A previous Speculative design project from Jon Rogers, Mozilla and SUperflux

SPECULATIVE DESIGN WORKSHOPS

Speculative Design Workshops

Before we go into the detail of what we'll be doing in our workshops, I wanted to talk about why we are looking to speculate, and not just design, through and in these events.

Essentially we want to build on our knowledge of the current practices and relationships that people have with voice assistants to create designs that help us to further unpack this complex emerging relationship. We want to do this through design. We use the term 'through' to echo Christopher Frayling's Research Through Design -> where design takes an active role in exploring the world. A break, he argues, from design as product. Research through design is as much posing questions as it is finding answers. Design is the process and not necessarily the outcome.

The objects that you will come across in a research through design approach are unlikely to be like any form of design previously encountered. While they might mimic and borrow from consumer products and appliances, their function is not to consume but to pose questions. To provoke responses. A scientist uses science to conduct their research. In research through design a designer uses design to conduct their research.

The objects that you will come across in a research through design approach are unlikely to be like any form of design previously encountered. While they might mimic and borrow from consumer products and appliances, their function is not to consume but to pose questions. To provoke responses. A scientist uses science to conduct their research. In research through design a designer uses design to conduct their research.

One approach commonly used in research through design is speculative design.   The roots of this come from a very particular time in the 1990s through the work of Fiona Raby and Tony Dunne, Bruce Sterling and Bill Gaver. There are of course many others, but these were my influences.

I use speculative design to test possible futures. To allow people to 'kick the tyres' on what might be coming with emerging technology and to reflect on what this means. It also helps to act as an pin in the map of the future to work backwards from in order to find a route to that future. This approach, essentially, back-casting, is useful in helping to create pathways to the future that, hopefully, go beyond single points and build actionable narratives.   Something I tell my students is this.

The Self Reflector by Rogers, Shorter et al. Imagining the future of retail.

"If I were to ask you to travel from your house to a specific tree in a wood just outside the village I live in, you would struggle to get to the exact point. You may find the wood, but not the tree. However, if I took you to the tree and asked you to travel back to your home, the pathway would be easy."

We so often imagine the future as a line, but it's not. It's the past that is a line, the future is a sphere. That the line we have travelled is one route through this sphere to get to the here and now.

Scout by Uniform. Imagining the future of home data control.

We want to speculate on future point in time through design. The most effective way to do this is to create stories. After all, every product has a plot. Every future has a story. Creating these stories is something we can do on our own or in a more participatory way. On this project we will explore how we co-create stories with our participants. To create futures inspired by, or possibility, directed by, them.

Solo by Uniform. Imaging the future of AI in the home.

Responses that are linked to data from our participants that create props to frame stories.   The outcome of this stage we call provocative prototypes.

Stories need inspiration.   That's where design comes in. Our aim is to bootstrap the creation of stories by creating objects as props to provoke responses. Responses that we can use as a catalyst for narratives around future interactions with voice assistants.   This process is iterative and multi-staged. Taking as many iterations as are needed to arrive at compelling, meaningful futures.   Futures we can then frame and work-back from in terms of key imagined moments that led to this future becoming real. It might be the policies that are needed to foster innovation of this future; it might be technological developments; it might be social or environmental trigger points. Everything that exists is a sum of its histories. Sometimes their histories are known, some are unknown. Amazon began life as an online physical bookstore. The online bookstore became both an online digital book (Kindle) while at the same time becoming an online general store. The next progression was to shift from being the online store, to being the online store assistant. An online assistant with a voice. A voice assistant. Within each of these development moments, there were of course specific technological achievements. The online bookstore first needed to have the internet. The online book required e-ink screens. The online store assistant required speech-to-speech artificial intelligence. The story of Amazon of course continues. The store requires a delivery person (massive AI in warehouses and route-finding tech), the delivery person requires a doorbell to press (Amazon Ring). The story will no doubt continue as driver-less cars, with conversational AI and with mobile robotics. Charlie Brooker takes this to a dystopian conclusion in (FIND THE BLACK MIRROR EPISODE WHERE THE FACTORY HAS SYNTHETIC HUMANS DELIVERING TO SYNTHETIC HUMANS..REBELLION ETC). Now it's our turn to write out own adventures. Design can provide prompts and provocations to continue stories in multiple directions that don't assume the inevitable conclusion where Jeff Bezos announces that he is the digital Father Christmas – 365 days a year.

The plan for the workshops. Two distinct phases/audiences:

1)   VA-PEPR team – to co-create the stories, props and prompts as a team. To arrive in a shared place and test-out ideas.

2)   Participants – to return to existing, or find new, participants to co-create the future narratives that stem from their relationships and lived experiences of voice assistants.

The VA-PEPR Team Workshops

We split the team into two groups of about eight participants. Each team would explore six provotypes. We gave ourselves a few days between the workshops to allow us to make any changes to how we ran the workshop to make them as useful as possible.

The workshops revolved around discussions inspired from a series of six physical and non-physical provotypes that are anchored in the previous VA-PEPR research. These provotypes were a series of props designed to interrogate certain aspects of our research - resulting in discussions and debates. The aim of these discussions was not to narrow the scope of our thinking, but to rather have in-depth conversations around our research and the directions we could take it.
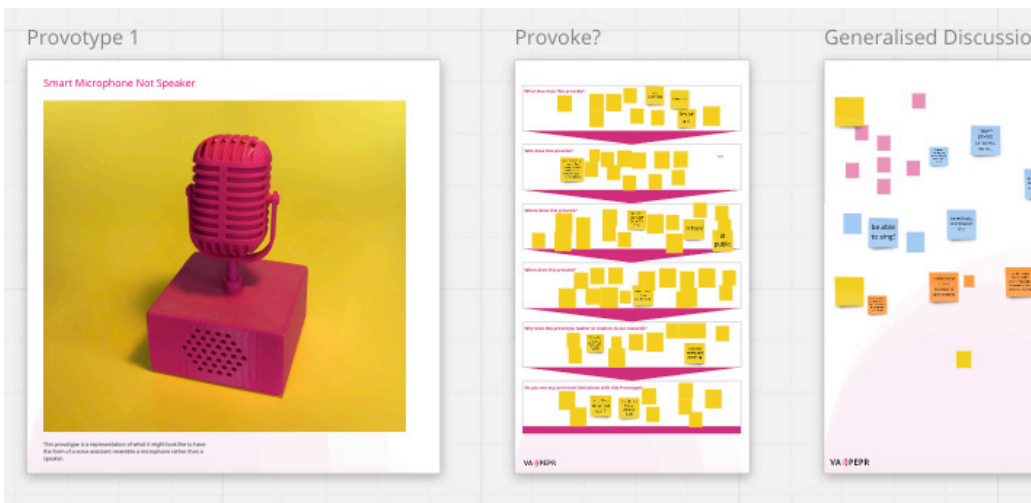
The outcomes from these workshops would be a synthesise the discussions and debates captured during the sessions. Allowing us to uncover new tangents, explore the role of VAs in speculative futures and bolster our existing findings. The workshop may also expose gaps or contradictions in our literature review.

This workshop was a pilot workshop before we run a similar session with participants, industry and policy makers.

The first workshop followed the below format. We worked together adding in comments unpacking all the different ways this provotype provoked. This was followed by a generalised discussion, and finally finished by tying our thoughts into our research questions and other bigger picture activity.
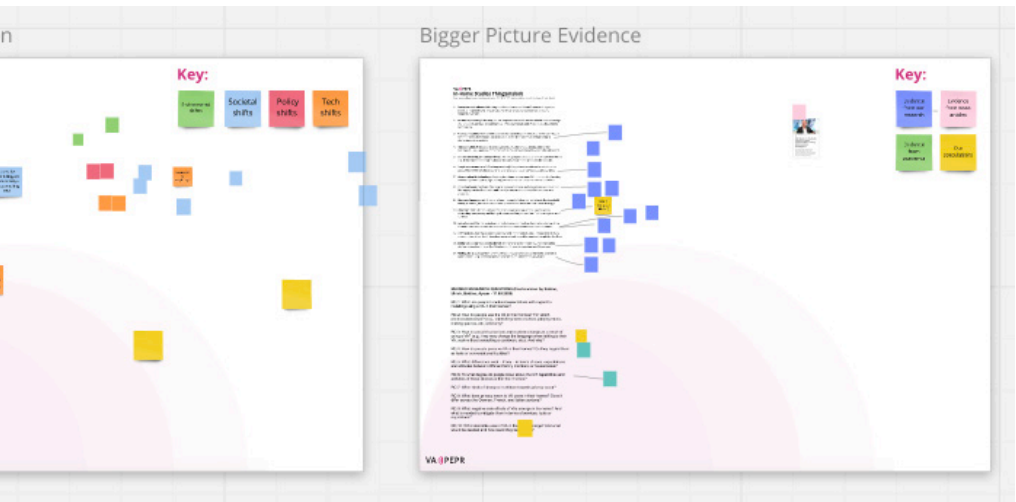
What idea does this provoke?

- the spy in the room
- it provokes me to sing!
- wanna grab it!
- feelings of truth could we have politics that enforce form to follow 'true' function
- Radio Broadcasting
- Performance
- recording me!
- could we have the size of the mic represent how far it can have ... the bigger it is the further away it can listen
- could this be a cover for an existing VA - e.g. Amazon Echo? As an advocacy campaign?
- I'm on air!
- recording session!

Who does this provoke?

- wanna be singers
- great for a Mozilla advocacy campaign
- extraverts!
- Everyone who wants to be seen and heard (performance)
- me as a user
- All of us
- manufacturers, all users in the home, but also visitors to the home, it is much more in your face
- people who like to engage in things
- karaoke lovers
- governments to think about what the true nature of a VA is
- teachers - e.g. product design lecturers
- Radio presenters

Where does this provoke?

- in homes as a cover (tea-cosy) for smart speakers
- a massive billboard when you entre a city from the airpot
- wherever I find it
- Private, at home
- anywhere! private and public!
- open mic night/day! (open VA day)
- In our homes
- At the dinner table
- as a prop in an educational setting
- by the coffee machine / water cooler in a workspace
- in the home specifically in different rooms: bedroom, bathroom, kidsroom
- meeting room, 360 degree mic
- complaint station :)
- a hairdresser's or barber's shop - to provide a discussion with costumers
- school
- in public
- recording studio

When does this provoke?

- Nowadays, retro design lovers
- now and could have been worked in the past as well
- whenever we want to open up to someone
- 1960ies - when radio sort of had the monopol on mirc?
- In solitude
- when it is switched on
- In a group - who gets to talk?
- now!
- when I want to provoke
- ...in universities and schools for internal communications (loudspeaker)
- when I buy a VA -> it may also provoke different interactions, for example kids may start to sing to the VA rather than the VA to the Kid
- when I want to be spontaneous
- when I don't see it
- no
- ...

Why does this provotype matter in relation to our research?

- ?
- It shows that we open our private space to a wider audience
- what is my motivation in talking/singing to this device?
- ... because it's more a one-way communication, an unfinished product...
- it questions the perception of the voice assistant
- It is a reference to a very common object that may close people's mind
- It may raise the awareness among users
- pushed the user relationship further on trying from (?) to opening that opppurm to back to social object that the mic is so it manipulates to the world outside
- its a cheap hack in making it appearer/more/reach/reach between a human... more simplistic it on a big ... parody emotic more important from the world outside
- What is the underlying mechanism
- shakes the notion of privacy and assistance to the user when actually user is shouting and sending off data into an unknown cyberworld
- It's about privacy and screening

Do you see any percieved limitations with this Provotype?

- It looks quite isolated but it is not
- who likes oldschool stuff?
- too big too heavy. attracts dust
- is this prototype a hint for the dying radio broadcasters?
- the colour? why red? why is and when a technology red coloured?
- Knowing the idea behind this provotype, I would say that this is limiting. Maybe its retro shape ... for me it reminds singing and not more. But maybe something like an ear (listening) on a recorder ...
- It is a reference to a very common object that may close people's mind
- may reduce the thinking around artificial intelligence etc as it is a higher focus on the mechanical characteristics
- it could be seen as oversimplistic and a bit of a gimic
- how does it move on the research? Is it more a reaction to evolving?

Reflections on the initial Workshop

We learned a lot from running the first workshop with the team. Below are the immediate reflections we had regarding the workshop process. We would look to address all of the below points before running the second session a couple of days later.

Too much focus on provotype image

Not enough discourse

Too linear a process

Too much focus on physical appearance

No way of making links between different provotypes

No closing remarks to highlight key thoughts

No need to bring in RQs - that's our job

For the second session we re designed the Miro board. The provotype image was made smaller in the hope to make the discussions around what this provoked rather than what it looked like. We worked in breakout groups to help foster conversations and debates. A facilitator wrote down notes allowing conversations to flow. The Miro boards were also designed in a non-linear way allowing for free flowing tangents. We regrouped after each provotype discussion in break out spaces to discuss the key points with the wider group.

(Left)
A close up of the linear
process from the first
provotype workshop.

In-Home Studies Thingamabob

Research Questions

Aurelio
1

Mike
1

Mike
2

aysun
1

aysun
2
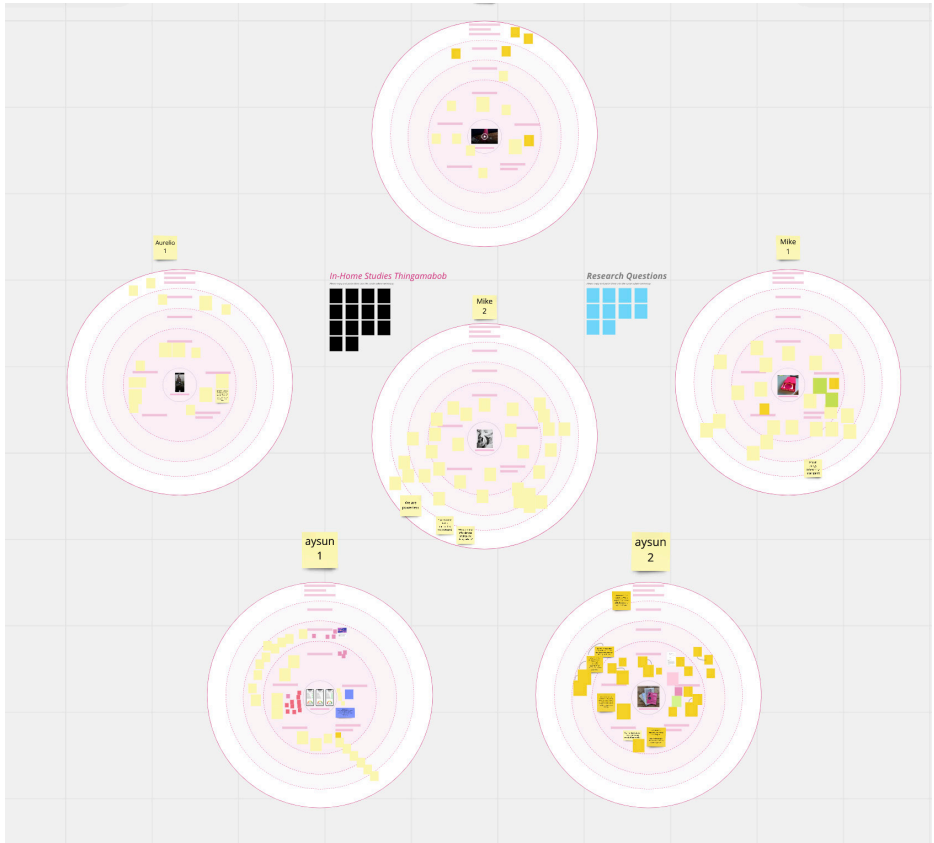
(Above)
The re-designed second session.
Taking the focus away from
the physical appearance of the
provotypes and allowing for a
more free-flowing facilitated
conversation to take place.

(Right)
A close up of the free-flowing
process from the second
provotype workshop

Workshop results

The team spent some time going over the Miro boards from both sessions unpacking some of the key discussions that took place. We also wanted to understand how these insights tied in with not only with our existing research questions but also with the final results from the in-home study coding. We also wanted to highlight if any of these provotypes and associated conversations had sparked any immediate next steps. Full details of this analysis can be found on the next couple of pages.

Provotype

Workshop Responses

Super Hearing
This provotype explores what it could mean if our voice assistants could hear and make sense of more than just the spoken word

Moving VA away from a black box and towards a more transparent device in terms of intelligence of 'ears'. Exposes the nature of multiple uses/users in one house. Who is this information for? New social Role of VA. What if the Voice Assistant could recognise different family members (and the VA knows everything about the different members) and interact in a networked way, it would become an active "family member". This would lead to a whole new type of interaction between device and family. More control and security. The VA becomes a translator between you and your house. Could this be used by and for tradespeople (plumbers, electricians etc) or even for home insurance. Do voice assistants come across as 'smarter' if they have this non-human power? Can we start to have too much information. Similar to when cars became smart they reported on all faults big and small and made us worry.

Take Me To Church
This provotype explores what it might be like to treat a VA as an emotional support device

The capability of VAs is dependent on an ecosystem of complementary technologies - for example, Artificial Intelligence, Cloud-Services, service specific technologies (e.g. music streaming), microphone development, VR equipment, etc. >> Connecting the VA to other technologies to create immersive experiences. VA as an emotional support service (fulfilling a friend or companion role, useful for self-management issues, mindfulness, etc). Which poses the question of what types of intelligence is the VA connecting to? Can this generate new use values? Can simply talking to a VA (non-human) be used as a form of therapy? They are great listeners after all... >> the relation between users and the VA can go beyond talking (movie HER). Would users do this just because they can?

VA Everywhere
This provotype explores what it might be like to have a VA in your pocket at all times

People have different mental models for smart phone and VA. How can we make people aware that we carry a VA (phone) in our pocket?

What's the desired form/appearance of a VA? What features make a VA really useful? Or which devices should a VA be built into? ("would not take a device with me that is just a VA alone...")

Data Control Services
This provotype explores a future where we need a specialist service to fix home data problems such as data leaks, data infections, AI bias and data fraud

"What would really scare me if I had to have a Voice Assistant." This might happen gradually and be too late to prevent once this happens. Opportunity to use this type of provotype to work with policy makers to address above situation. What other services might we require to support VAs in the future? How does this look like in the world of DIY? How can we understand how many visible and invisible VAs are in a home/space? **Implicit assumption about VA potential emerges**: It challenges VA potential - e.g. suggest VA being not beneficial at all ; VA must be evil; the presence of this service is a failure of development; this feels quite dystopian. **Cleaning is understood differently**. e.g. "The cleaning should not be about data cleaning - abut about how it is analysed (e.g. feelings and moods)". It poses a new question: Can I trust this service? **Implicit assumption of VA potential:** Economical perspective: Would this undermine the VA market? We assume, we see VA: "What if you did not know it was there?" Instead - we don't.

Microphone not Speaker
This prototype explores what it would be like if the form of a VA resembled a microphone than than a speaker

Opens a discussion on privacy to a wider audience (e.g. policy makers). Can the form of the Mic communicate its capability? Could the VA start the interaction rather than the human? Underlines that user is an active contributor to the program. One speaker suggests one VA one person when in reality there are many in one household.

VA Confessional
This provotype is a playful provocation that asks people to imagine what it might be like to be able to interrogate an AI, like a confessional session with a priest

Potential of "more-than-human" VAs. A way to explore trust in AIs in a playful setting. Becoming more aware of data privacy > what VA does in the background. Your VA confesses - now what? The bad thing has happened. What can we now do about this to prevent it from happening again? How would different religions or cultures alter what is confessed? How would our relationship with a VA change if it had this very human characteristic? How do we even know it's being honest. At what point would we need to put the Confession box in another confession box.... If there a never ending path of trying to make our technology honest here? Does the application/skill running on a VA change the degree to which we anthropomorphise them? Designing for transparency - new forms of transparency and openness that borrow from existing cultures, rituals and practices.

Constant Transcriber
This provotype prints out everything it can hear - or rather what it thinks it can hear

Shines a spotlight on ethics. Particularly when it is capturing conversations outside of the home - e.g. through an open window. Also points the new family interactions (ethics and privacy in the household) > Who is in control of the device?

A teaching device of how to speak to a VA in the most effective way.

Provotype

Data Value Monitor
This provotype explores what it might be like if we could see the value of data our VA was collection on us

Data Flow Customisation
This provotype explores what it might be like to be able to customise a VAs 'smartness', and what it means for the functionality of the device

VA Everything
This provotype explores what it would mean if we could turn everyday objects into a VA simply by placing a sticker on it

Extra Control Dial
This provotype explores what it mean if there was an extra control dial that you could stick onto a VA allowing users to turn 'something' up or down

Data Packet Viewer
This provotype explores what it might be like if we could see and touch data packets moving from one device to another within our homes.

Workshop Responses

Analogy Waste Recycling: Difference-- data are infinitely durable What are the limits of data value? Do these change over time? Who receives the data is important in setting the value of data.

Can we become Data super users - we get paid to be a data point. What makes users not care about their data. Is the proximity of the 'listener' on the other side of the world. Or is it down to the amount of people that are being listened to - their data is just a drop in the ocean. Compare this to your neighbour listening in. Can we decide to donate our data to good causes? Who are we will to give this to free for and what justification do we need?

While the fields on the App in the image were not seen as being "Smart" there are possible really smart functions we may want to control. This includes: moral judgements, critical friend, biometrics, smart-ass-scale etc.

We have no language of the level of 'intelligence' in artificially intelligent voice assistants. There is no IQ test for machines. A lack of a language around "smartness" leaves a door open to misinformation and paranoia. The future metrics could include more than understanding what you're saying, but also understand and use emotional intelligence to go beyond current human readability of other humans. Should this be allowed?

Conversations happening between VAs/objects and can they acquire features and intelligence from one another? What are the benefits of having smart objects around the house? (What does it mean when an object around the house becomes smart? A sofa providing facts about the softness level of the cushion, a fridge letting you know that you are out of eggs, is there more to it?)

"Attack of the devices" > How would several objects and VAs act if they were able to speak to each other?

How do we speak to/get spoken to by a mug vs a calendar? What affects users decisions on which object to make 'smart'? Could this be used to create games with VAs?

Search for agency and control - both in terms of user-device interaction and cloud intelligence. What settings would you want for different users and rooms? Would users know what the control options would be? Relevance/opportunities of multimodal interaction with assistants (voice, haptic physical buttons, gestures?, visual?, ...)

What are the affordances of data and data packets? Data is there to be transmitted not protected Is it possible to transform the complex data flow into a meaningful format for the users? Regulation, security. How can we show a data packet is to be trusted - similar to the 'secure communication channel' padlock in our browsers. Can we become ethical data stewards by dictating what our data can be used for - advertising, pharma etc. The notion of a Data broker. How does the the sensitivity of data differ between cultures? One man's trash is another man's treasure. This works from the perspective of the user and the data collector.

Workshop next steps

We now plan to run very similar workshops with both existing participant, as well as new participants. During these workshops we will focus on co-creating future narratives that stem from their relationships and lived experiences of voice assistants. It will be interesting to see how well these provotypes resonate with the existing participants as they have all stemmed from insights generated from the studies they have been involved in.

The VA-PEPR Provotypes

MOVING FORWARD

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& THO

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CTIONS

UGHTS

Papers, Workshops, Presentations and Exhibitions

Papers

Voice assistants in private households: Aconceptual framework for future research in an interdisciplinary field - CInformation Systems Frontiers Journal 2021 - ???

Exploring the Potential of Off-The-Shelf Tools as Digital Probes: Appropriation of a Mobile Diary App - CHI 2022 - Rejected

Exploring the Potential of Off-The-Shelf Tools as Digital Probes: Appropriation of a Mobile Diary App - CHI 2022 - Rejected

Voice Assistant Use: Challenges for the Home Office Work Context - EURAM 2022 - Accepted

Of Ports, Packages and Privacy: Making Network Traffic Tangible for Users - SOUPS 2022 - Rejected

Materialising the Immaterial - Provotyping to Explore Voice Assistant Complexities - DIS 2022 - PENDING ACCEPTANCE

Presentations

Do you Dig Voice Assistants? - AyeMyth - 2022 - India

Open Sauce - Northumbria School of Design - 2021 - Newcastle

Exhibitions

Materialising the Immaterial - Provotyping to Explore Voice Assistant Complexities - Design+ - 2022 - Northumbria School of Design

Workshops

Materialising the Immaterial - Provotyping to Explore Voice Assistant Complexities - Design+ - 2022 - Newcastle

Speak up! Exploring decentralised voice assistant futures through speculative design - Re:publica 2022 - Berlin - PENDING ACCEPTANCE

Speak up! Exploring decentralised voice assistant futures through speculative design - Mozzilla House 2022 - Manchester

Glossary

VA - Voice Assistant

IOT - Internet of Things

RCC - Relax, Concentrate and Create

VA-PEPR - Voice Assistants - People, Experiences, Practices and Routines

MAXQDA - a Qualitative Data Analysis Software

Demonstrators - Research objects designed to collect qualitative data

Activity Theory - a collective work activity, with the basic purpose shared by others (community), is undertaken by people (subjects) who are motivated by a purpose or towards the solution of a problem (object), which is mediated by tools and/or signs (artefacts or instruments) used in order to achieve the goal (outcome)

Domestication Theory - an approach in Science and Technology Studies and media studies that describe the processes by which technology is 'tamed' or appropriated by its users

Indeemo - A diary phone app used for remote ethnography

Speculative Design -

ISP - Internet Service Provider

Data Packet - A data packet is a unit of data made into a single package that travels along a given network path. Data packets are used in Internet Protocol (IP) transmissions for data that navigates the Web, and in other kinds of networks.

IP Address - An IP address is a unique address that identifies a device on the internet or a local network. IP stands for "Internet Protocol," which is the set of rules governing the format of data sent via the internet or local network.

Provotype -

How do we live in the omnipresence of voice assistants?

VA-PEPR stands for Voice Assistants – People, Experiences, Practices, Routines. We conduct research into how people experience voice assistants in their homes and private lives and how they develop new practices and routines around their use of VAs. By focusing on the home environment, user experience and ethical issues, the project aims to contribute to a deeper understanding of this new technology.

This interdisciplinary research project is conducted by Hochschule Luzern (HSLU), OST – Ostschweizer Fachhochschule and Northumbria University under the lead of HSLU School of Art & Design. It is funded by the Swiss National Science Foundation.