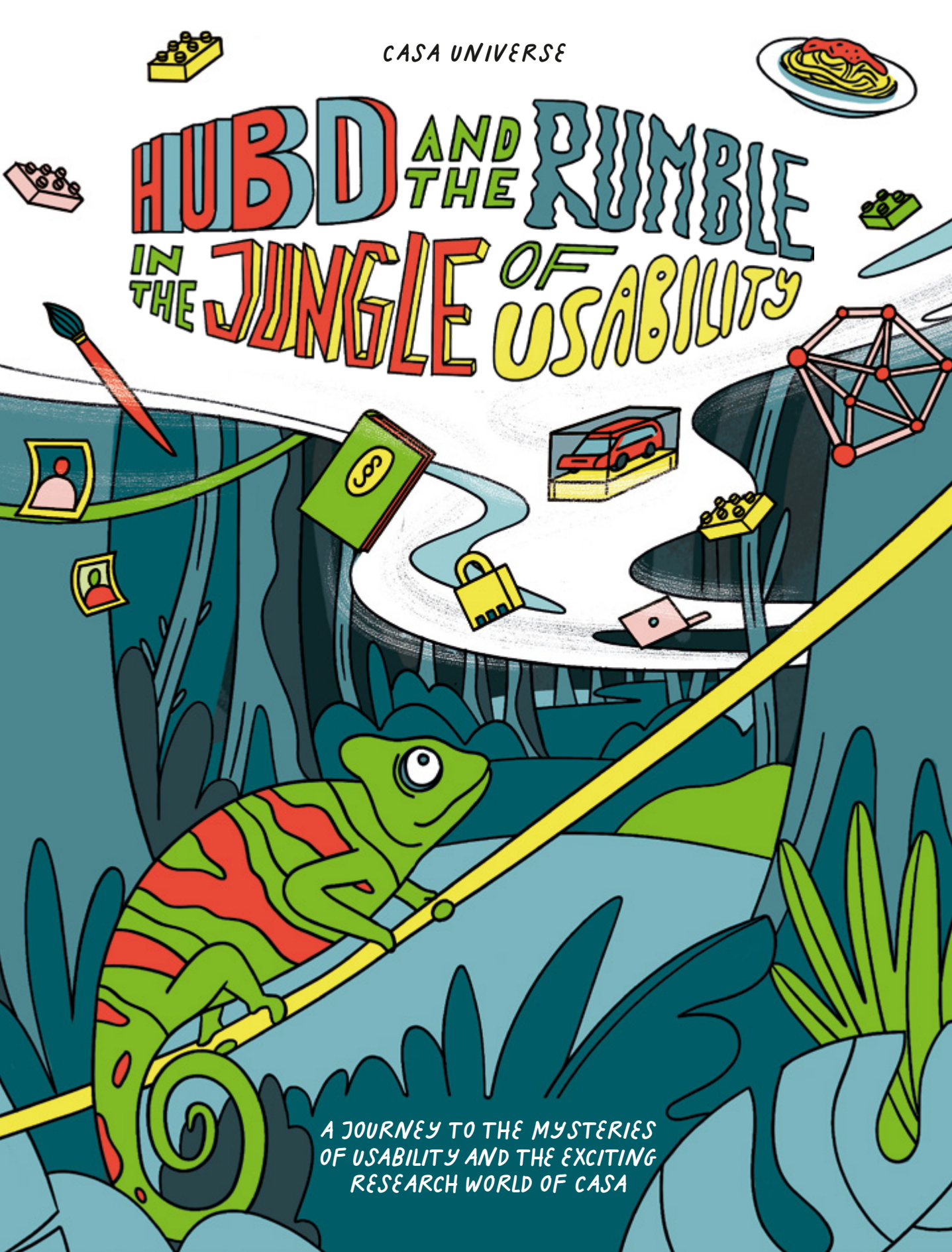


CASA UNIVERSE

HUBD AND THE RUMBLE IN THE JUNGLE OF USABILITY



A JOURNEY TO THE MYSTERIES
OF USABILITY AND THE EXCITING
RESEARCH WORLD OF CASA



HUBD AND THE RUMBLE IN THE JUNGLE OF USABILITY

*A JOURNEY TO THE MYSTERIES
OF USABILITY AND THE EXCITING
RESEARCH WORLD OF CASA*

CASA

Cyber Security in the Age of Large-Scale Adversaries

Outstanding scientists within the Cluster of Excellence “CASA - Cyber Security in the Age of Large-Scale Adversaries” research and develop strong and sustainable countermeasures against powerful cyber attackers, with a particular focus on nation-state attackers. Research in CASA is characterized by a highly interdisciplinary approach that examines not only technical issues, but also the interplay between human behavior and IT security. This unique, holistic approach forms the basis for excellent IT security research.

CASA unites four main research areas:

HUB A “Future Cryptography”: Researching future cryptography and developing quantum-resistant approaches with provable security.

HUB B “Embedded Security”: Tackling the task of strengthening the security of embedded systems at the hardware level by investigating the interaction of security systems with their physical environment.

HUB C “Secure Systems”: Developing secure and efficient systems at the software level. Machine Learning is one of the many methods used to explore and expand this field.

HUB D “Usability”: Focusing on usable security and privacy and researching the interface between humans and technology.

Each HUB addresses specific major research challenges that have been carefully selected to address security issues critical to the protection against large-scale attackers. The challenges of HUB D are:

Research Challenge 10: Engineers and Usability

Research Challenge 11: End Users and Usability



I'M HOT.

It's an ordinary day in the misty and humid jungle of the CASA Universe.



AND I'M UNDECIDED.

STILL STRUGGLING WITH YOUR JOB CHOICE?

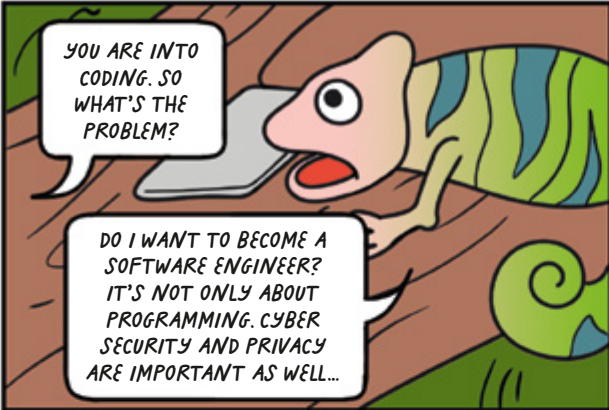
Pablo is passionately painting, while his sister Maggie spends time on her laptop, as usual.



YOU ARE JUST AS PASSIONATE AS ME. SO GO OUT AND LOOK FOR A SUITABLE CAREER PATH!

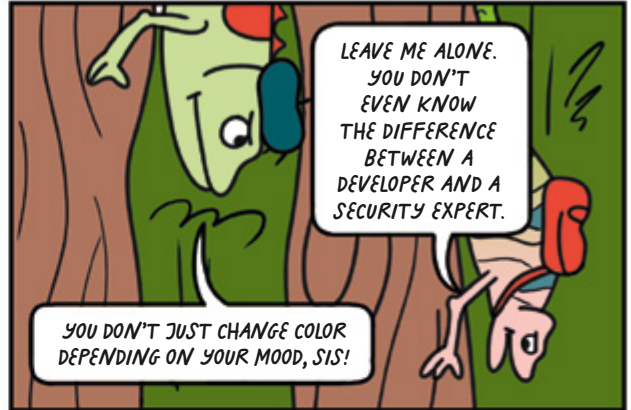
STOP PUSHING ME. IT'S NOT AS EASY AS IT LOOKS.

Since graduating from school, Maggie struggles to decide her next steps: While she enjoys working with people, she's also drawn to numbers and coding. A combination of both would be ideal.



YOU ARE INTO CODING. SO WHAT'S THE PROBLEM?

DO I WANT TO BECOME A SOFTWARE ENGINEER? IT'S NOT ONLY ABOUT PROGRAMMING. CYBER SECURITY AND PRIVACY ARE IMPORTANT AS WELL...



LEAVE ME ALONE. YOU DON'T EVEN KNOW THE DIFFERENCE BETWEEN A DEVELOPER AND A SECURITY EXPERT.

YOU DON'T JUST CHANGE COLOR DEPENDING ON YOUR MOOD, SIS!



BUT DO I? I WANT TO LEARN MORE ABOUT THAT!

Is her brother right? She feels a little torn between writing lean code, fulfilling security requirements, and maintaining privacy. Navigating her way through the jungle of information, she hopes to find an answer.

WELCOME TO RESEARCH HUB D





Content

CHALLENGE 10

Engineers and Usability

How do security mechanisms and tools need to be designed in order to be usable and supportive for IT professionals like software developers or system administrators?

CHALLENGE 11

End Users and Usability

Which methods should we develop to improve security mechanisms and privacy methods for end users? How can we enhance the usability of computer systems and environments with high security and privacy requirements?

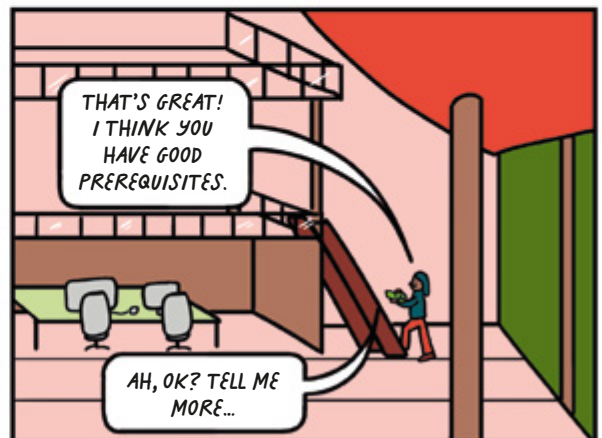
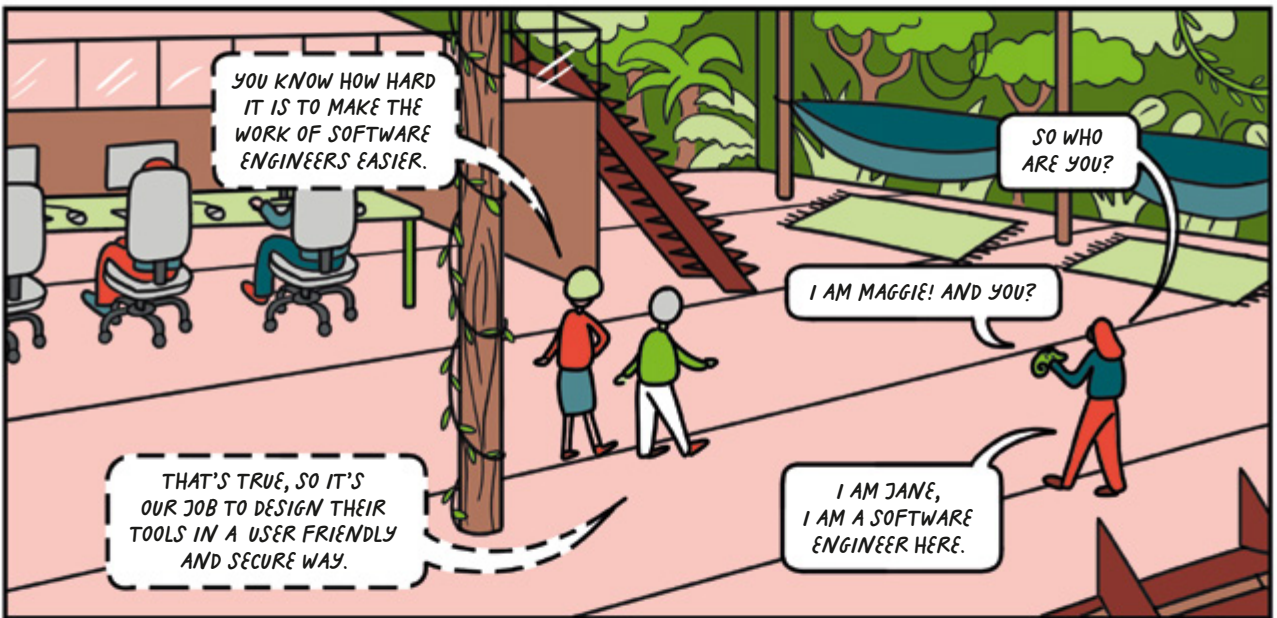
CASA BACKGROUND

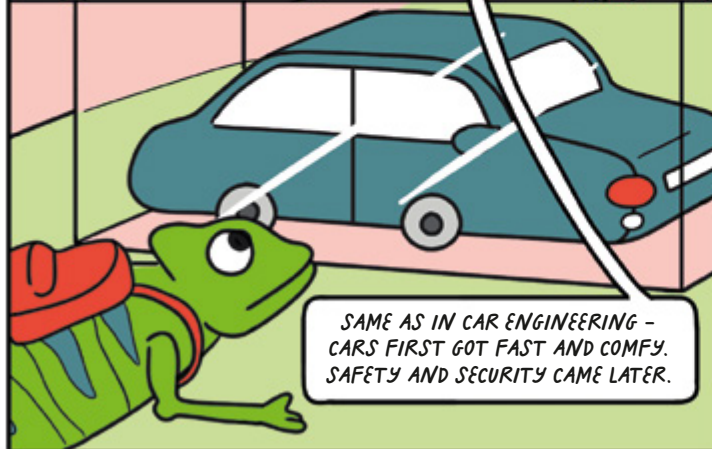
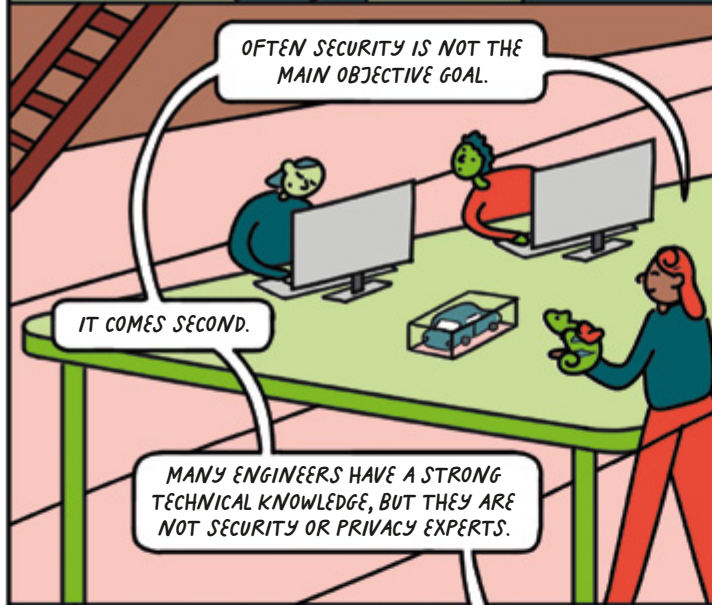
CASA stands for 'Cyber Security in the Age of Large-Scale Adversaries' and is funded as a Cluster of Excellence (EXC) within the Excellence Strategy of the DFG in Germany. Its goal is to enable sustainable security against sophisticated large-scale attacks. Therefore, an interdisciplinary team explores not only technical, but also social factors and implications. The Cluster of Excellence is located at Ruhr University Bochum.



casa.rub.de

ENGINEERS AND USABILITY CHALLENGE 10





CASA WIKI



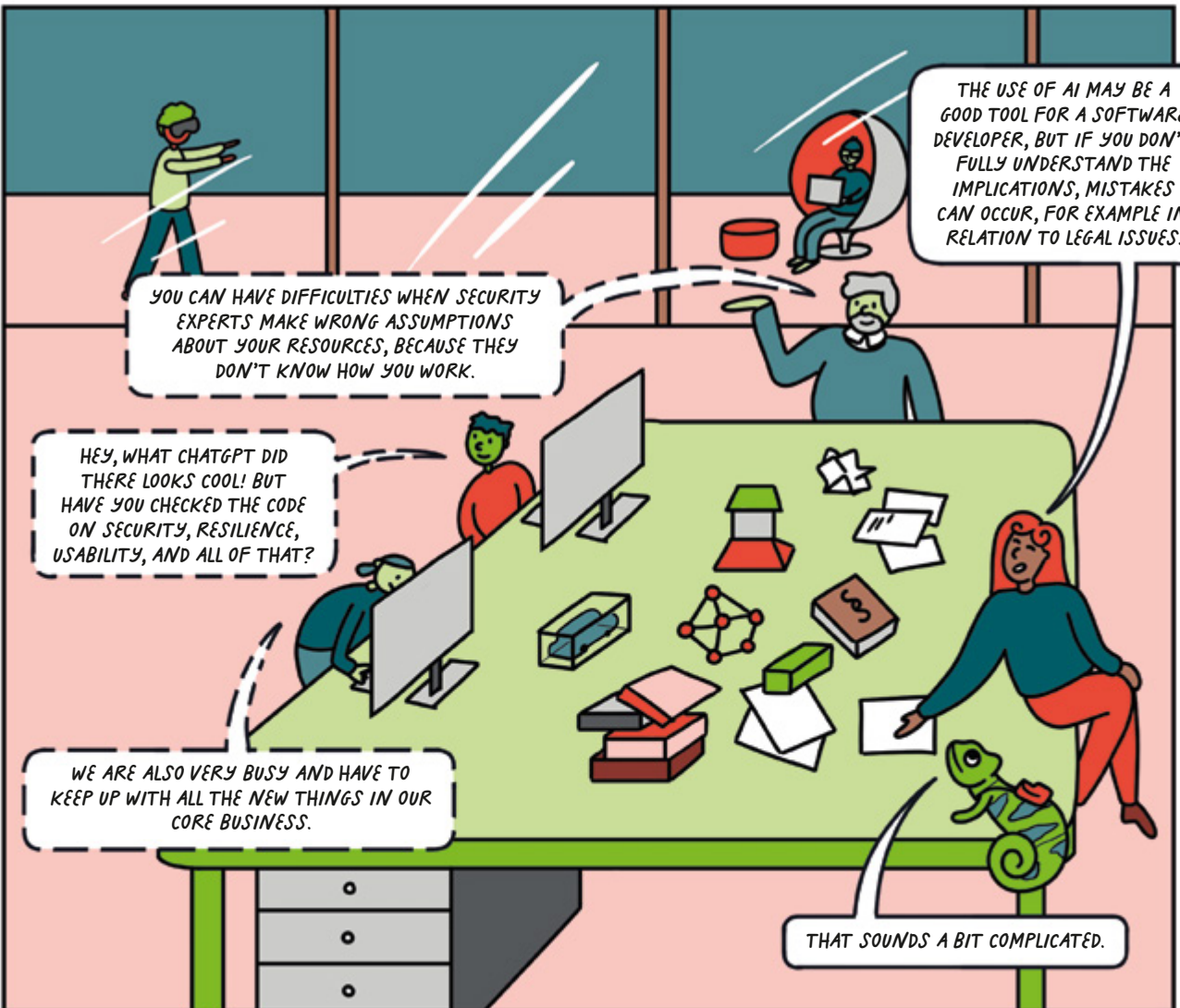
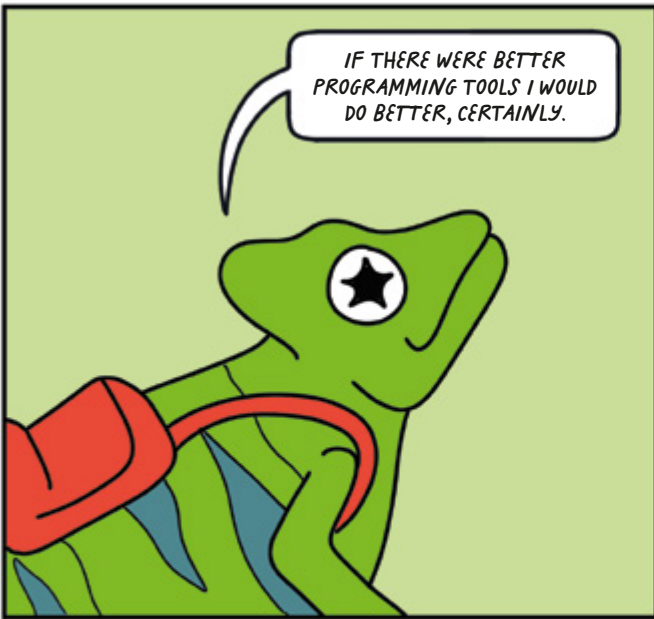
Using an **Application Programming Interface (API)**, one can create a collection of functions for others to use in their programs. For example, you can access information, like the current weather, from an API to integrate it in your program.

The **General Data Protection Regulation (GDPR)** is the data privacy law of the European Union. It was designed to protect the data of European citizens. Companies creating software for the European market must be compliant with these laws or risk significant fines.

AI Tools are programs like ChatGPT that use artificial intelligence and may assist software developers during programming, for example, by generating code or answering questions from the developers. However, it is not yet clear how these tools influence the security of the written software.

S&P is the abbreviation for 'security and privacy'.

Security Champions are employees who have deeper knowledge in information security and a direct connection with the security team.



REAL LIFE STORY

A study revealed that computer science students and professional freelance developers struggled with secure password storage. Among other things, it was confirmed that security is only a secondary task for the developers examined. It was also shown that many frameworks offer secure storage, but only if this is explicitly selected. They do not help the users with security by design and provoke weak security settings.



KNOWING ALL THAT, WE DECIDED TO WORK ON THESE MAIN GOALS:

1 UNDERSTAND the impact of using AI tools.



2 INVESTIGATE the usability of Java APIs.



3 STREAMLINE the recruitment of professional software developers for security and privacy studies.



4 SUPPORT companies and developers to comply with privacy regulations.

5 SUPPORT companies and developers in security by design implementation.



I THINK YOU SHOULD CLEAN UP YOUR TABLE ONCE IN A WHILE...

Solutions

A LITTLE BIT OF CREATIVE CHAOS DOESN'T HURT NOBODY.

I AM SURE IT TAKES SOME CREATIVITY TO FIND THE RIGHT SOLUTIONS FOR THESE PROBLEMS.

TO BE HONEST, I ALWAYS THOUGHT SOFTWARE ENGINEERS WOULD ALSO BE SECURITY EXPERTS.

S&P ARE NEITHER THEIR PRIMARY GOALS NOR THEIR FIELDS OF EXPERTISE. THEY MAINLY FOCUS ON THINGS LIKE EFFICIENCY OR PERFORMANCE.

FIRST OF ALL, IT IS IMPORTANT TO REDUCE THE MENTAL LOAD WITH REGARD TO SECURITY AND PRIVACY.

REQUIREMENTS FOR DEVELOPERS

REALISTIC REQUIREMENTS

SO WHAT CAN YOU DO TO SUPPORT THEM?

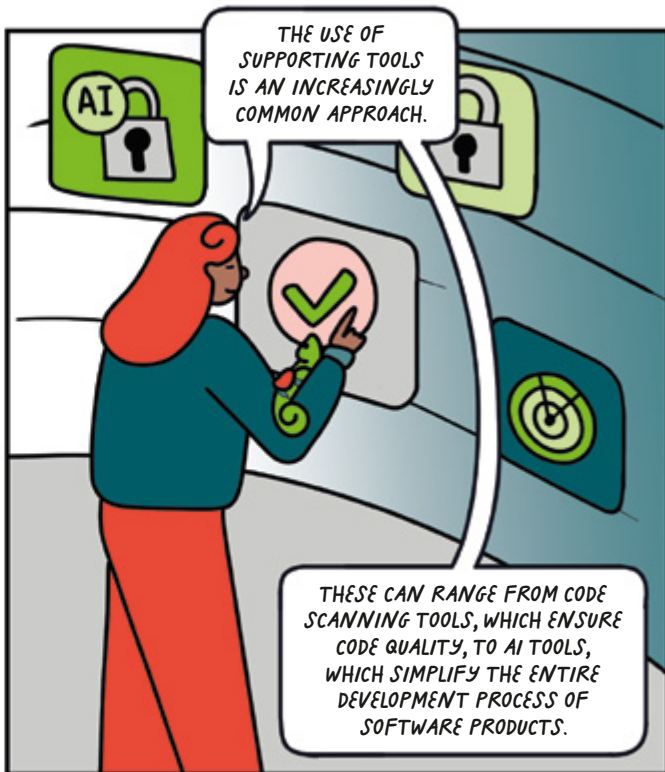
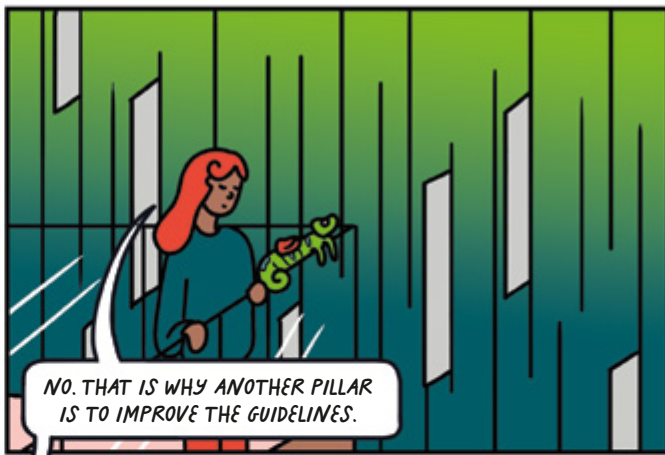
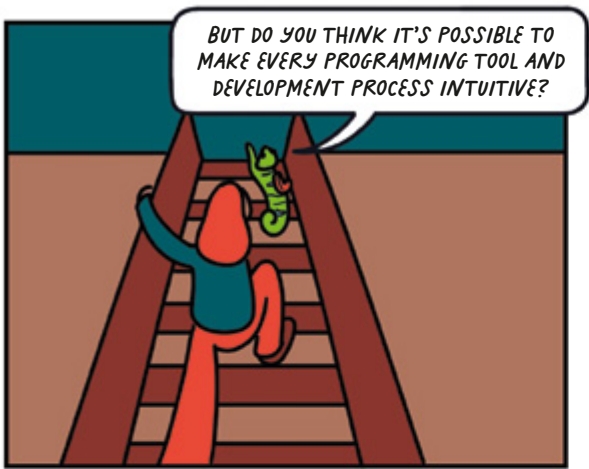
SECURITY TASKS SHOULD BE AS EASY AS BASIC PROGRAMMING COMMANDS TO PROVIDE SECURE DEFAULT VALUES AND PROGRAMS SO THAT IT PROFESSIONALS DO NOT HAVE TO DEAL WITH THEM.

FUN FACT

Even on websites that target developers, security and privacy are sometimes only of secondary importance. For example, on the Android for Developers website, an article on encryption uses outdated standards as a sample code. Although secure solutions are also presented in the rest of the text, some programmers will adopt the sample code out of convenience.

DEVELOPER'S WORLD

AH, LET'S COPY AND PASTE THE EXAMPLE AND CALL IT A DAY.





NEVERTHELESS, IT IS IMPORTANT THAT THE OUTPUT IS STILL UNDERSTOOD AND EVALUATED BY DEVELOPERS USING THESE TOOLS.



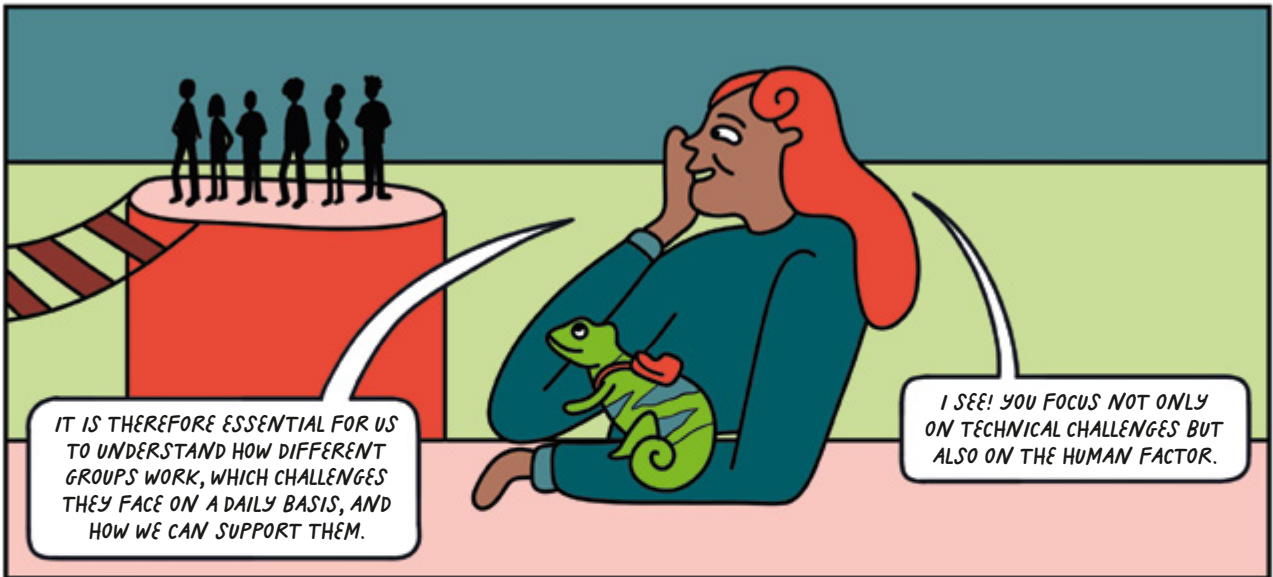
IN ORDER TO INCORPORATE SECURITY MEASURES INTO THE PROCESS, IT MAKES SENSE TO BRING SECURITY EXPERTISE CLOSE TO THE USERS AND EMPOWER EMPLOYEES TO BECOME SO-CALLED SECURITY CHAMPIONS.

INTERESTED EMPLOYEES COULD BE TRAINED AND BECOME CONTACT PERSONS FOR EVERYDAY SECURITY AND PRIVACY ISSUES.

EXACTLY! THIS COULD LOWER THE INHIBITION THRESHOLD FOR ASKING FOR HELP AND INTEGRATE SECURITY INTO THE EVERYDAY LIFE OF DEV TEAMS.

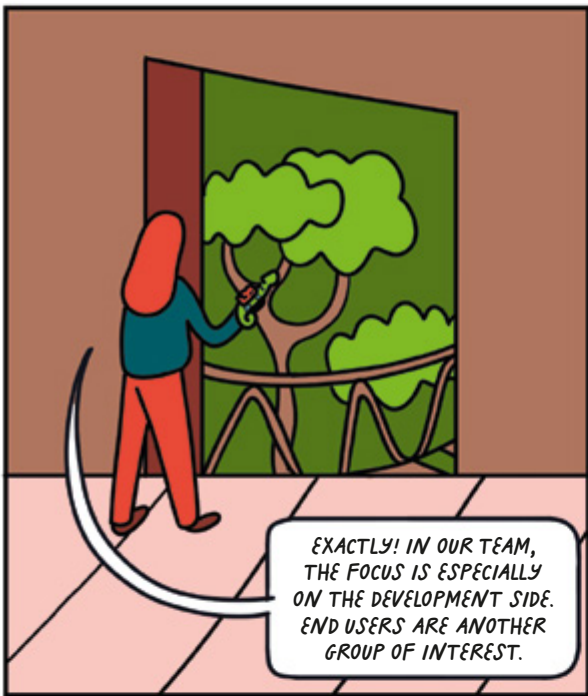


AS RESEARCHERS WE HAVE SET OURSELVES THE GOAL OF HELPING IT PROFESSIONALS WITH REGARD TO CYBERSECURITY CHALLENGES.

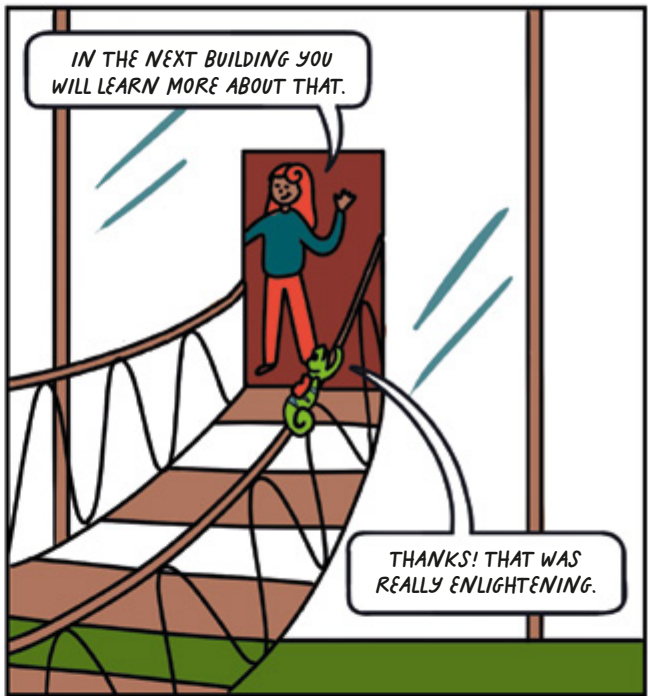


IT IS THEREFORE ESSENTIAL FOR US TO UNDERSTAND HOW DIFFERENT GROUPS WORK, WHICH CHALLENGES THEY FACE ON A DAILY BASIS, AND HOW WE CAN SUPPORT THEM.

I SEE! YOU FOCUS NOT ONLY ON TECHNICAL CHALLENGES BUT ALSO ON THE HUMAN FACTOR.

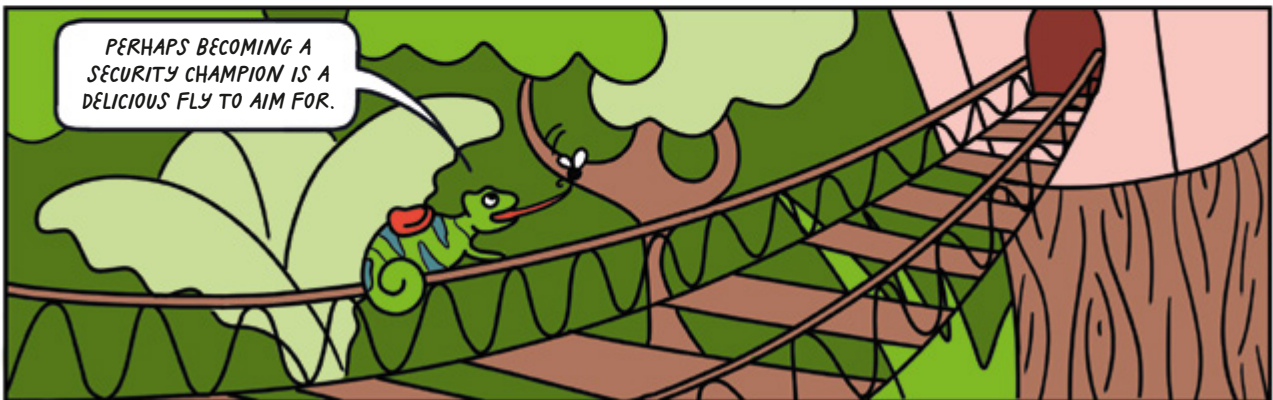


EXACTLY! IN OUR TEAM, THE FOCUS IS ESPECIALLY ON THE DEVELOPMENT SIDE. END USERS ARE ANOTHER GROUP OF INTEREST.



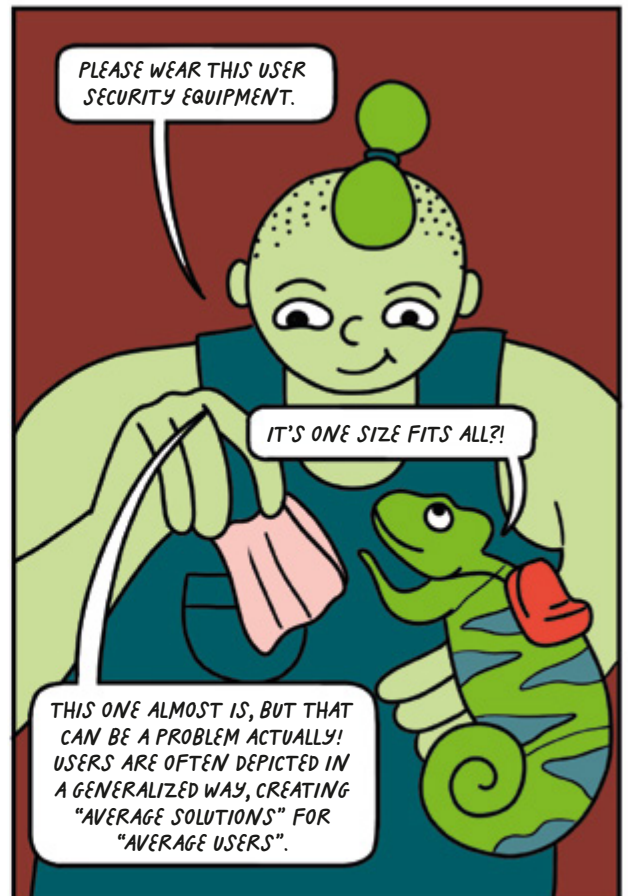
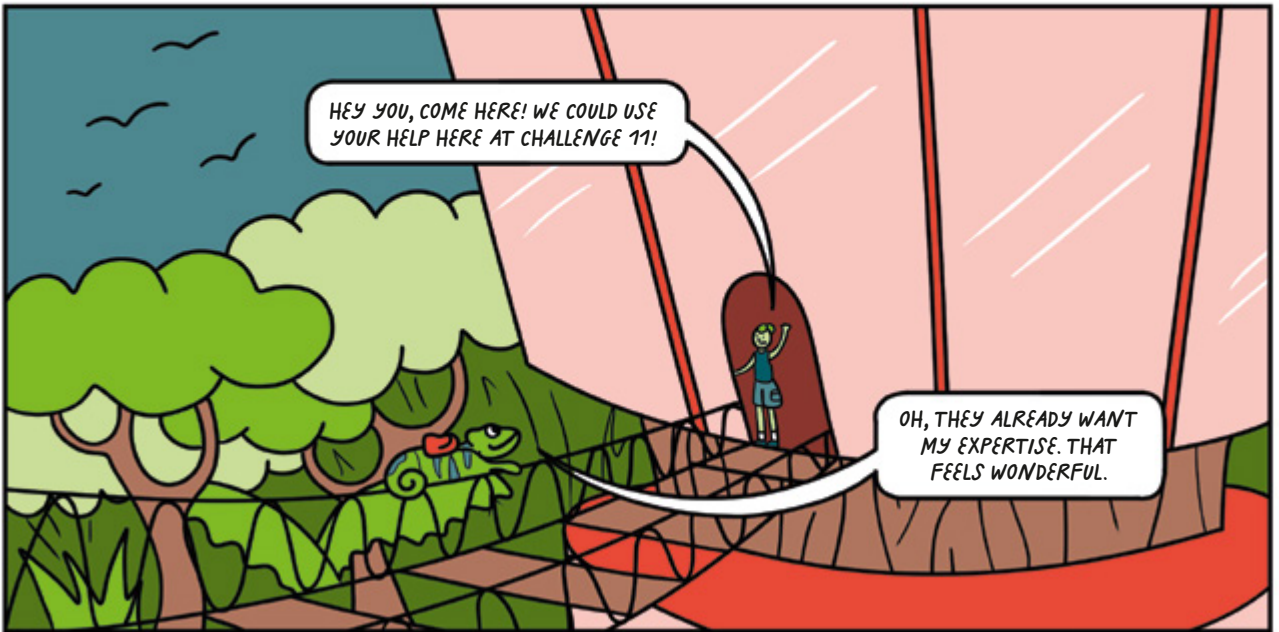
IN THE NEXT BUILDING YOU WILL LEARN MORE ABOUT THAT.

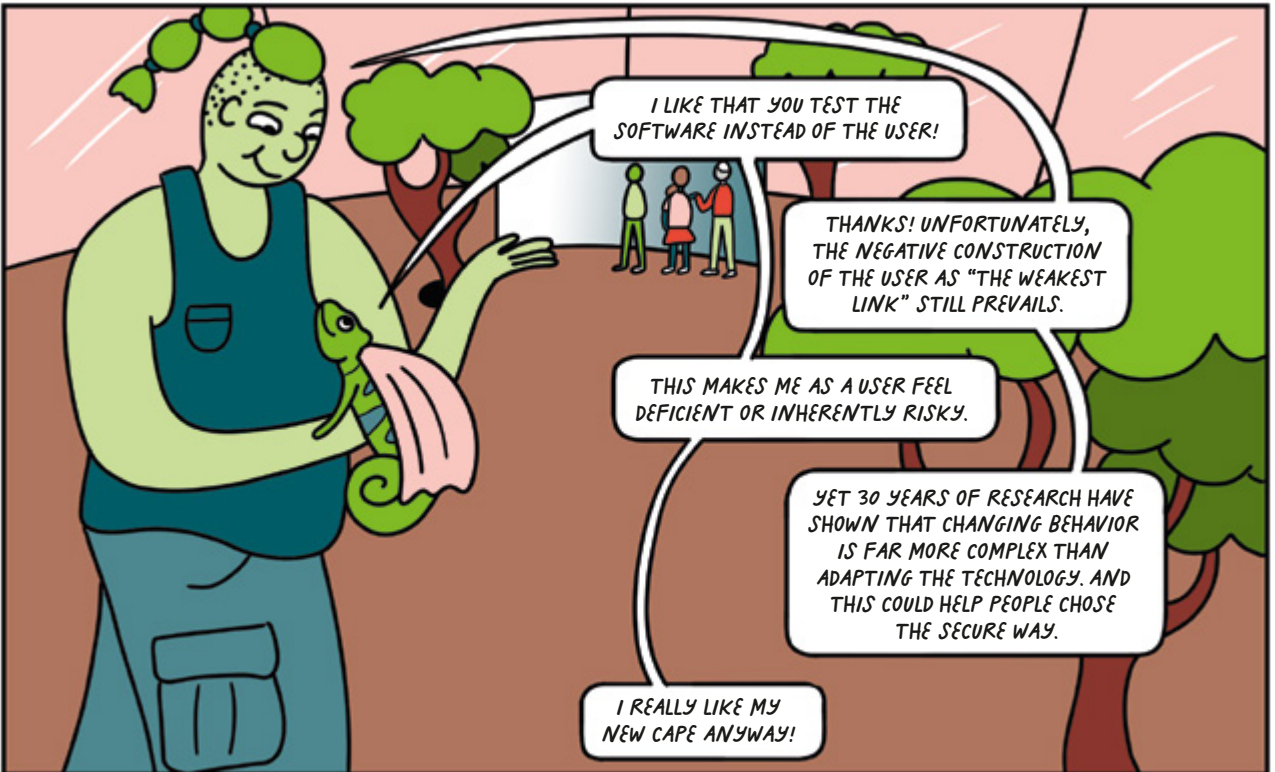
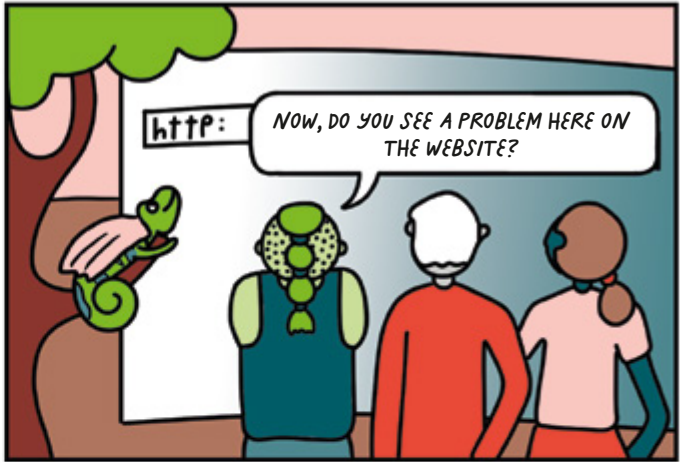
THANKS! THAT WAS REALLY ENLIGHTENING.

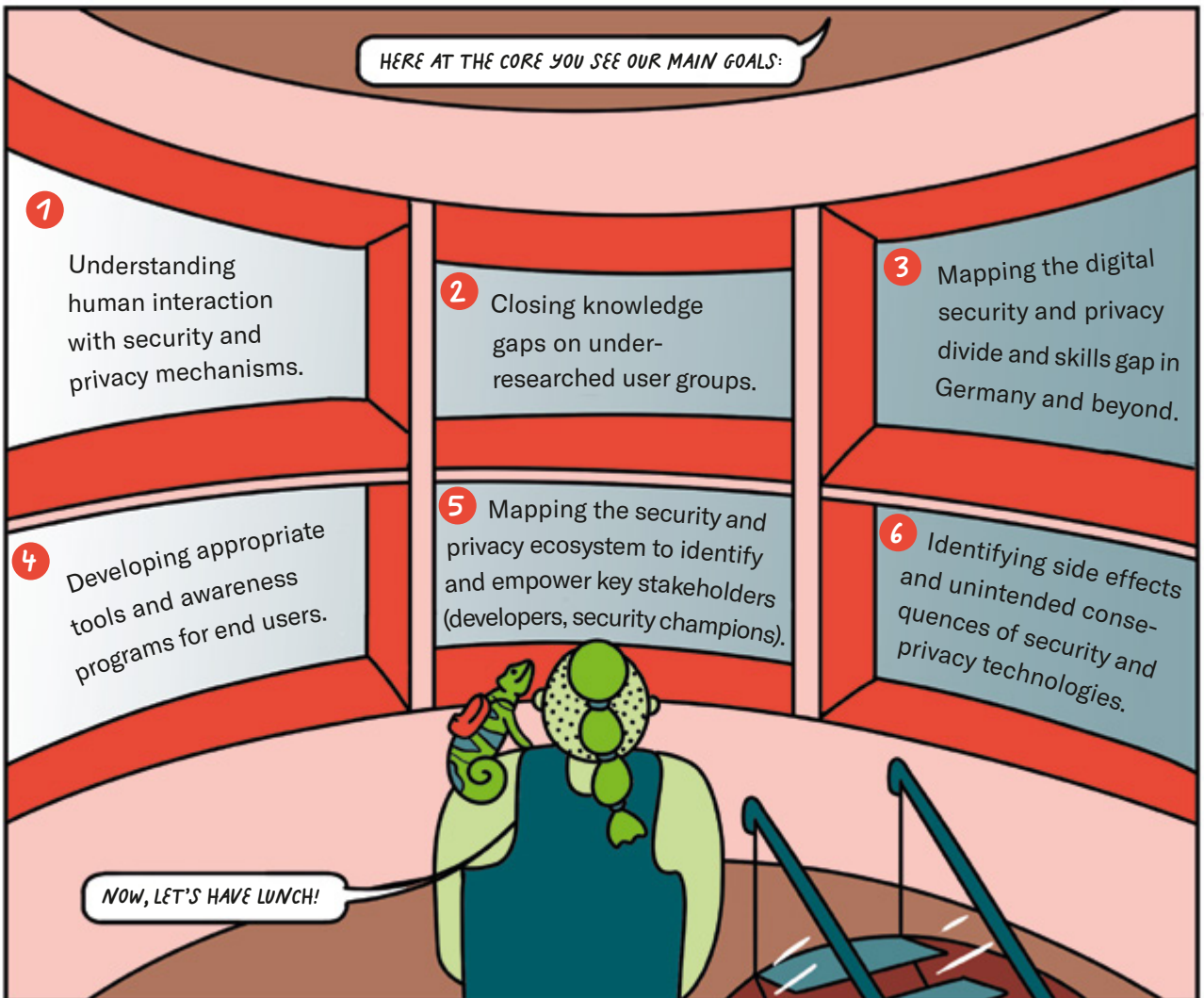
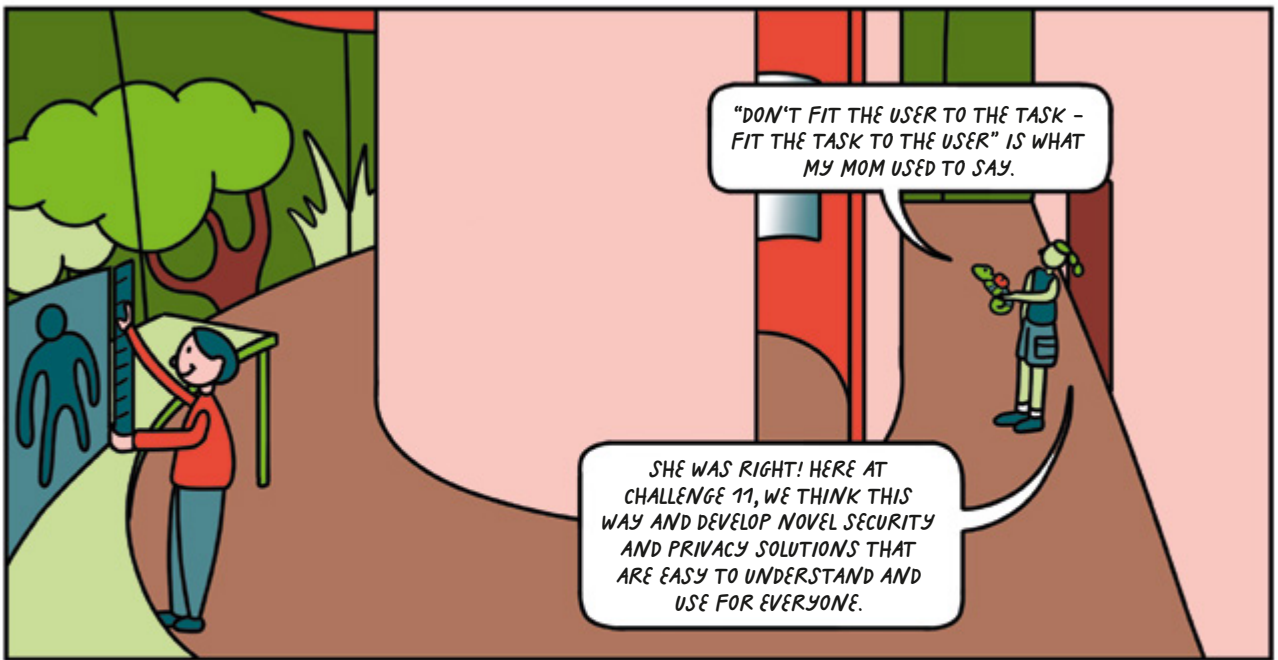


PERHAPS BECOMING A SECURITY CHAMPION IS A DELICIOUS FLY TO AIM FOR.

CHALLENGE 11 END USERS & USABILITY







CASA WIKI

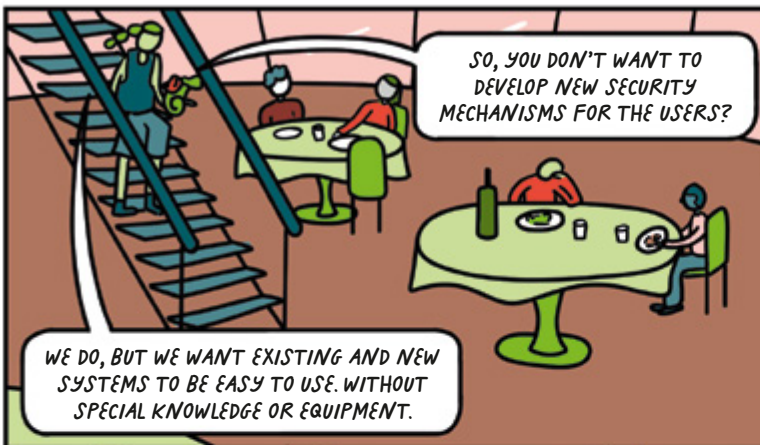


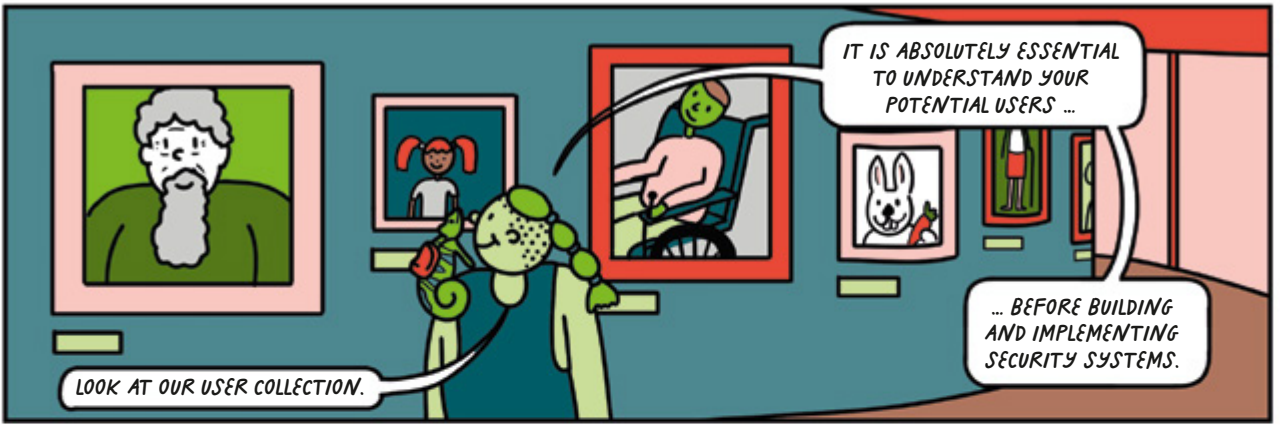
Co-Design is a participatory, co-creation and open design process that involves users as experts and facilitators. It aims to generate ideas that improve user needs, to validate solutions, and to create better relationships.

Creative Engagements are methods of involving users and stakeholders in the research, design, and evaluation of security and privacy mechanisms using creative methods and tools (e.g. lego, drawing, performance, collaging). It helps to understand user needs, generate innovative ideas, and involve people in the process.

HCI (Human-Computer Interaction) is the research in the design and use of computer technology. It is interested in how humans interact with computers and develops new technologies (e.g. computer mouse, touchscreens).

A **User Journey** depicts the experiences a person has when interacting with something, typically software. This method is generally used by those interested in how users interact with software experiences.





LOOK AT OUR USER COLLECTION.

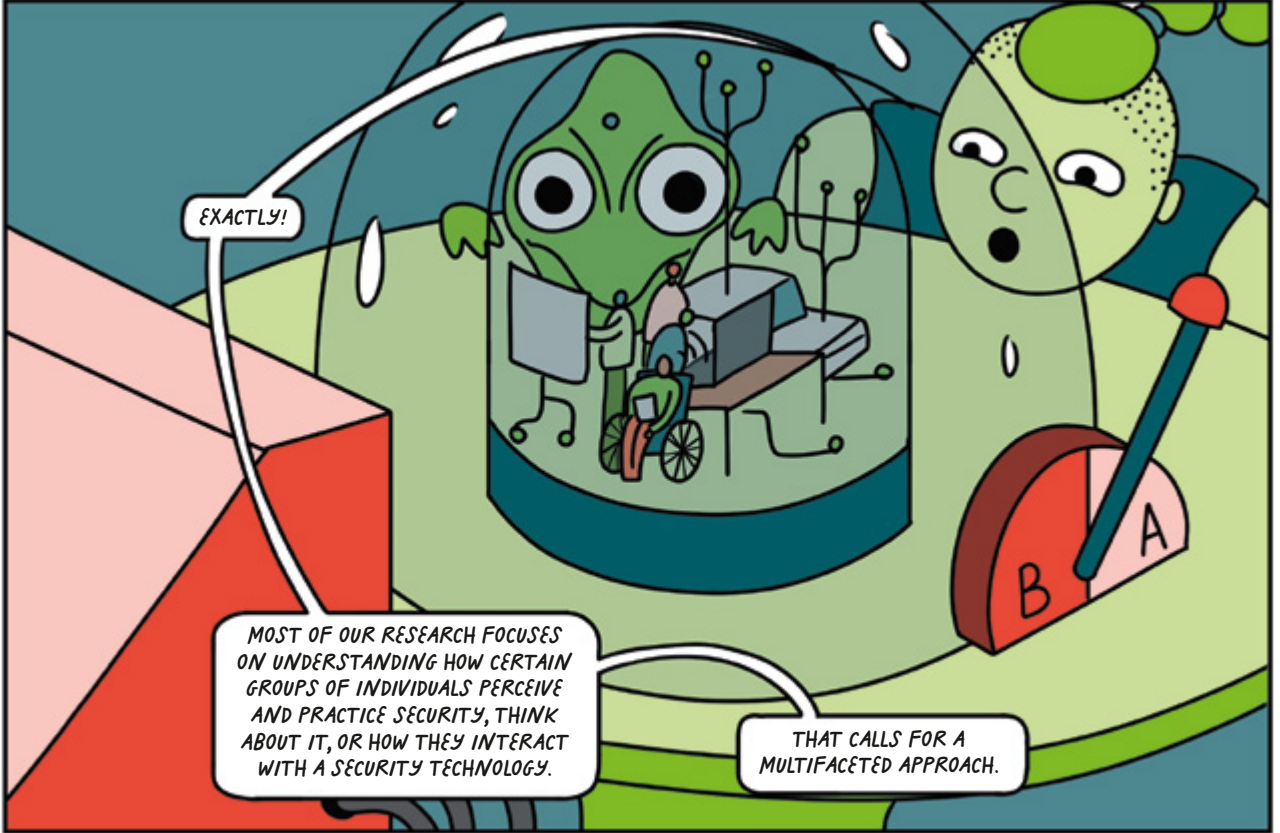
IT IS ABSOLUTELY ESSENTIAL TO UNDERSTAND YOUR POTENTIAL USERS ...

... BEFORE BUILDING AND IMPLEMENTING SECURITY SYSTEMS.



A YOUNG IT PROFESSIONAL MIGHT FACE VERY DIFFERENT RISKS COMPARED TO A GRANDPA USING HIS TABLET TO CHAT WITH ITS GRANDCHILD.

THAT MAKES VERY CLEAR THAT THERE IS NO "AVERAGE USER".



EXACTLY!

MOST OF OUR RESEARCH FOCUSES ON UNDERSTANDING HOW CERTAIN GROUPS OF INDIVIDUALS PERCEIVE AND PRACTICE SECURITY, THINK ABOUT IT, OR HOW THEY INTERACT WITH A SECURITY TECHNOLOGY.

THAT CALLS FOR A MULTIFACETED APPROACH.

REAL LIFE STORY

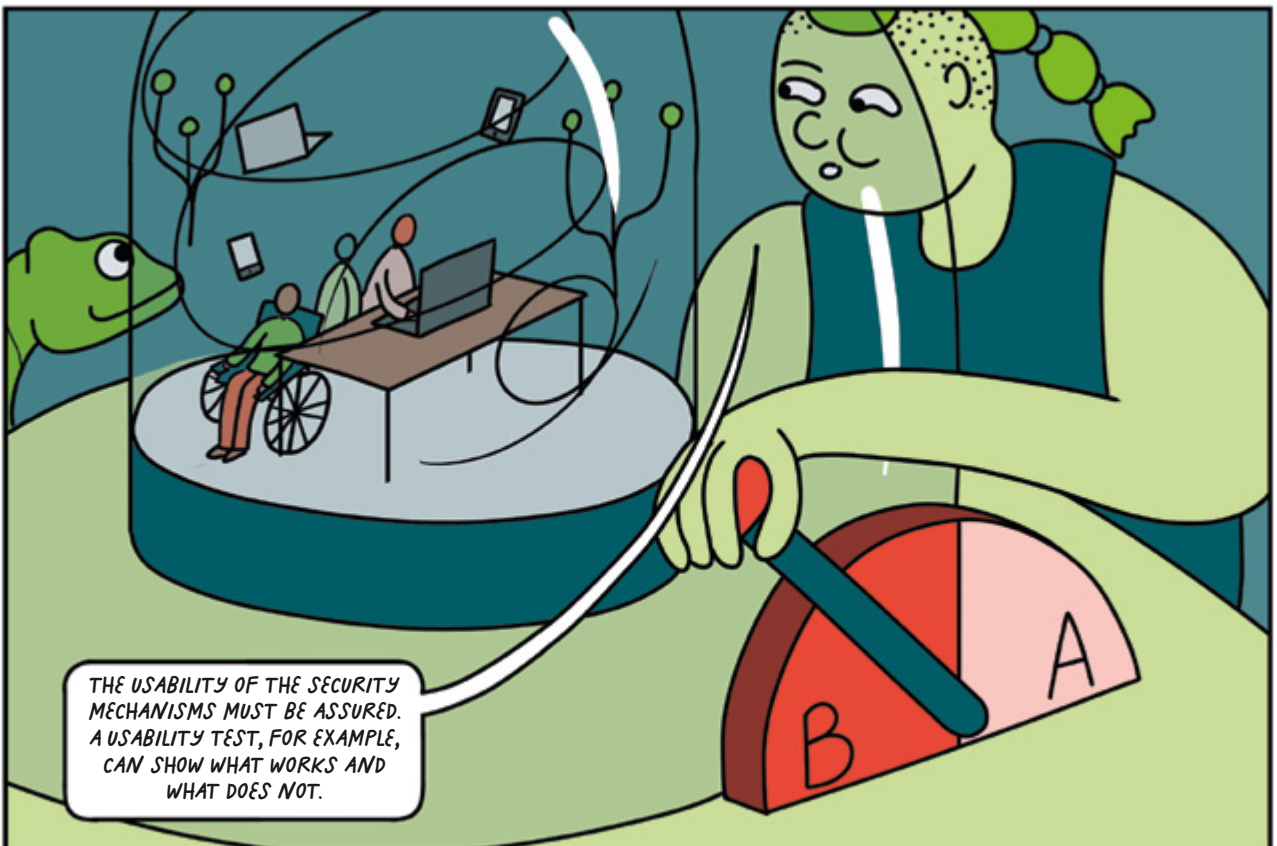
Macros – small executable code embedded in Microsoft Office files – can be used to infect computers with viruses. They are disabled by default, but when opening a document with macros, users receive a warning message and the option to enable the macro with one click.

A study – disguised as a performance test – found that almost $\frac{2}{3}$ of participants activated a potentially dangerous macro because it was just a one-click decision. When asked, participants often had no idea how macros work, and that they can pose a security threat.

DESIGN IS ALSO IMPORTANT. POORLY IMPLEMENTED SECURITY WARNINGS CAN CONFRONT USERS WITH SECURITY DECISIONS THAT THEY ARE UNABLE TO MAKE.



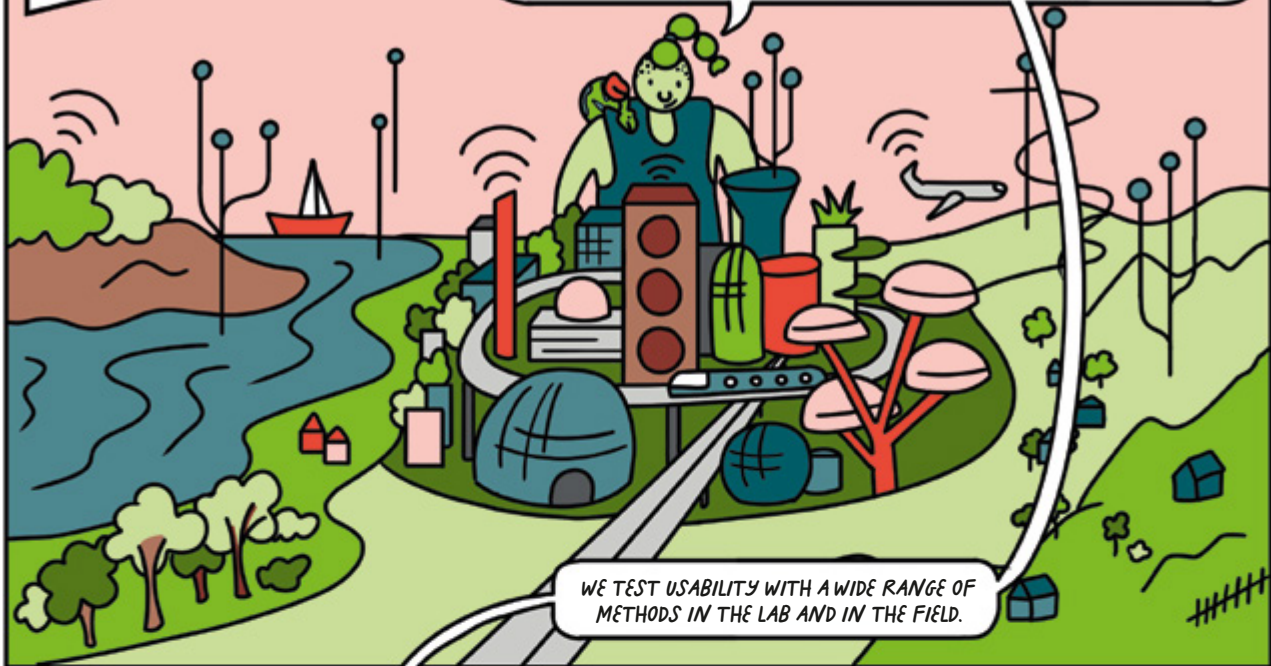
IN ADDITION, BAD DESIGN CAN CONDITION NON-SECURE HABITS, FOR INSTANCE, CLICKING "OK" WITHOUT THINKING ABOUT IT FURTHER.



THE USABILITY OF THE SECURITY MECHANISMS MUST BE ASSURED. A USABILITY TEST, FOR EXAMPLE, CAN SHOW WHAT WORKS AND WHAT DOES NOT.

Defenses

IN ORDER TO BE ABLE TO CARRY OUT THE EXPERIMENT JUST EXPLAINED, WE COMBINE EXPERTISE FROM PSYCHOLOGY, HCI, COMPUTER SCIENCE, IT SECURITY, AND THE SOCIAL SCIENCES IN OUR TEAM. LOOK AT OUR MODEL BUILT WITH LEGO, WE USE TO IDENTIFY DIFFERENT LEVELS OF INVESTIGATION.

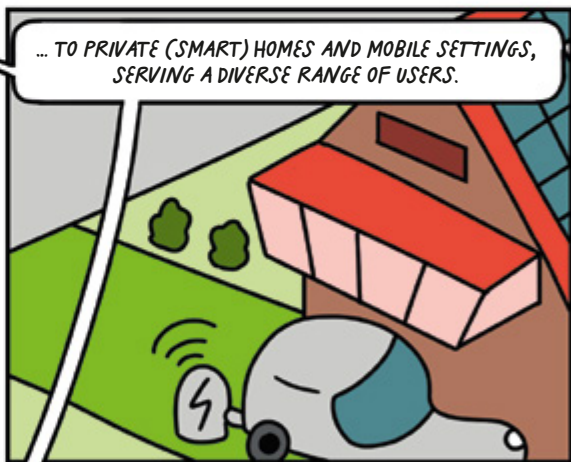


WE TEST USABILITY WITH A WIDE RANGE OF METHODS IN THE LAB AND IN THE FIELD.

FROM THE WORKPLACE AND ORGANIZATIONS ...



... TO PRIVATE (SMART) HOMES AND MOBILE SETTINGS, SERVING A DIVERSE RANGE OF USERS.

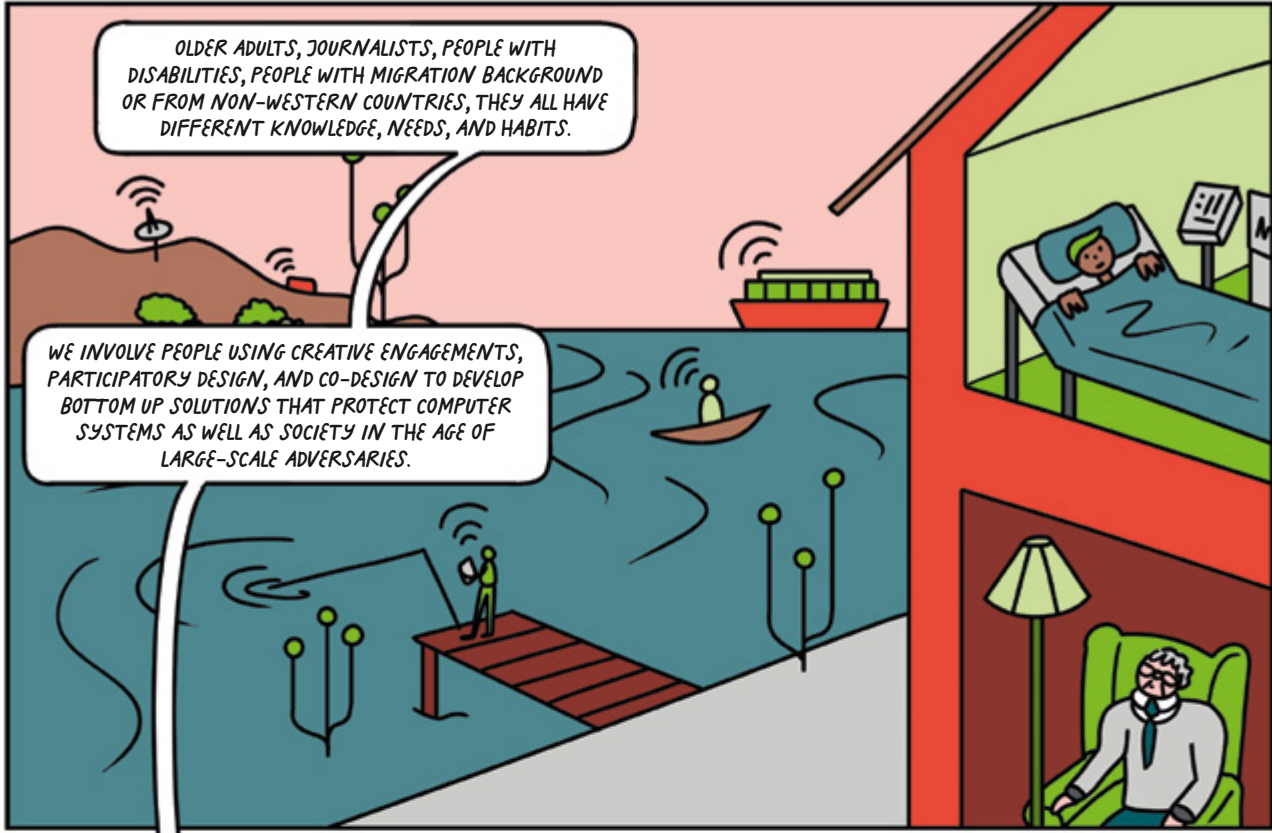


THIS POSES SPECIFIC CHALLENGES TO RESEARCH: SOME GROUPS ARE HARDER TO REACH, AND NOT EVERY RESEARCH METHOD IS APPROPRIATE FOR EVERY GROUP.



OLDER ADULTS, JOURNALISTS, PEOPLE WITH DISABILITIES, PEOPLE WITH MIGRATION BACKGROUND OR FROM NON-WESTERN COUNTRIES, THEY ALL HAVE DIFFERENT KNOWLEDGE, NEEDS, AND HABITS.

WE INVOLVE PEOPLE USING CREATIVE ENGAGEMENTS, PARTICIPATORY DESIGN, AND CO-DESIGN TO DEVELOP BOTTOM UP SOLUTIONS THAT PROTECT COMPUTER SYSTEMS AS WELL AS SOCIETY IN THE AGE OF LARGE-SCALE ADVERSARIES.



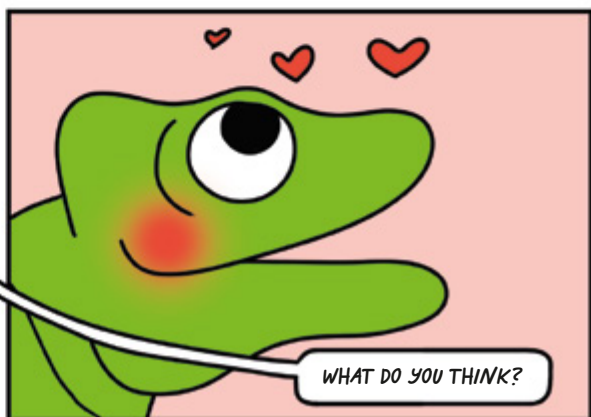
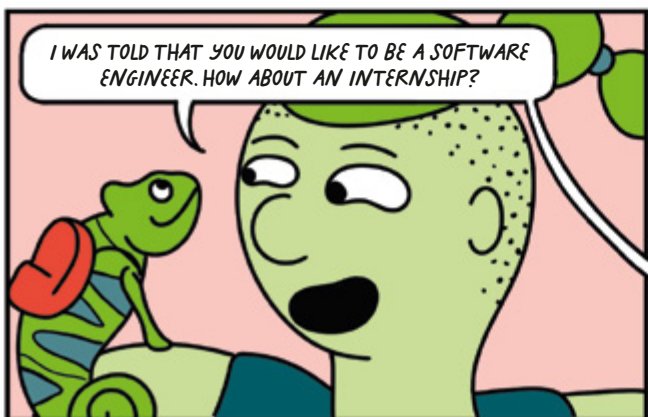
WE ALSO GO BEYOND USABILITY, IN CREATING NOVEL APPROACHES - LIKE COMICS - TO INCREASE SECURITY AND PRIVACY AWARENESS AND CULTIVATING SECURITY CULTURES IN A HOLISTIC MANNER.

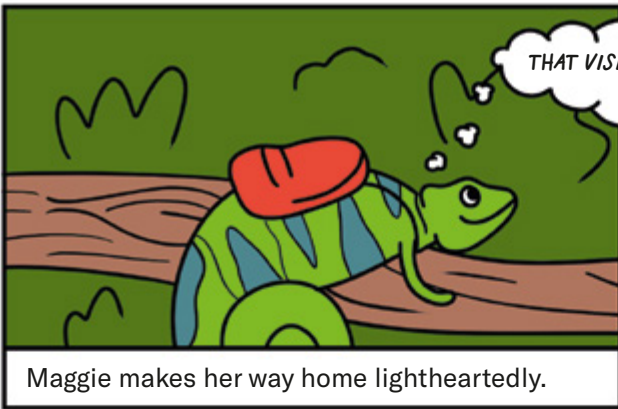
WOW, CREATIVE SCIENCE COMMUNICATION!?! THAT COULD ACTUALLY BE SOMETHING FOR PABLO. HE ALWAYS PRETENDS TO BE SO PASSIONATE, BUT I HONESTLY THINK HE'S A BIT LOST AS WELL.



I WAS TOLD THAT YOU WOULD LIKE TO BE A SOFTWARE ENGINEER. HOW ABOUT AN INTERNSHIP?

WHAT DO YOU THINK?





THAT VISIT HELPED ME A LOT TO MAKE UP MY MIND.

Maggie makes her way home lightheartedly.

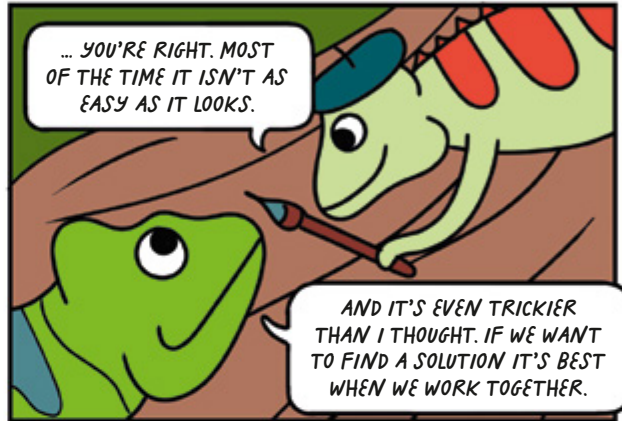


HI MAGGIE! I'M HAPPY YOU'RE ALIVE AND WELL.



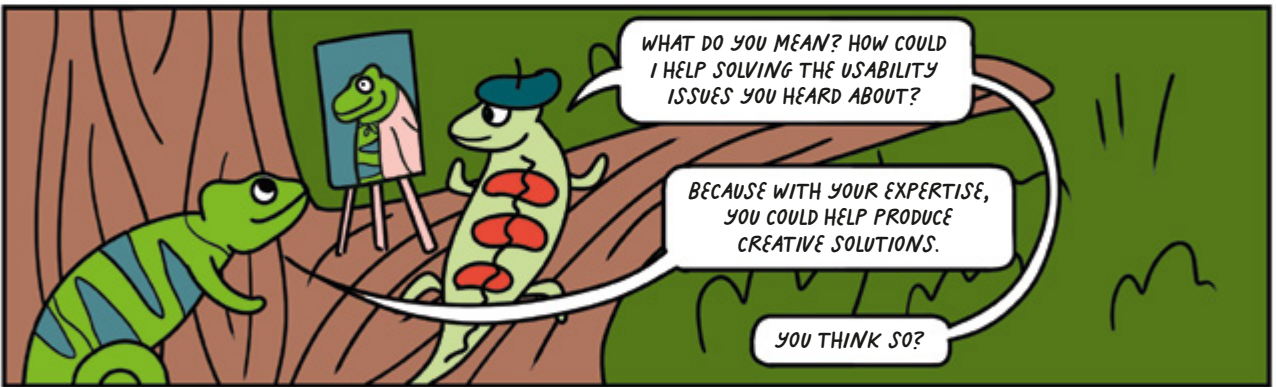
OH, HEY PABLO! I'M GLAD TO BE BACK, TOO.

I WAS THINKING ABOUT OUR CONVERSATION AND ...



... YOU'RE RIGHT. MOST OF THE TIME IT ISN'T AS EASY AS IT LOOKS.

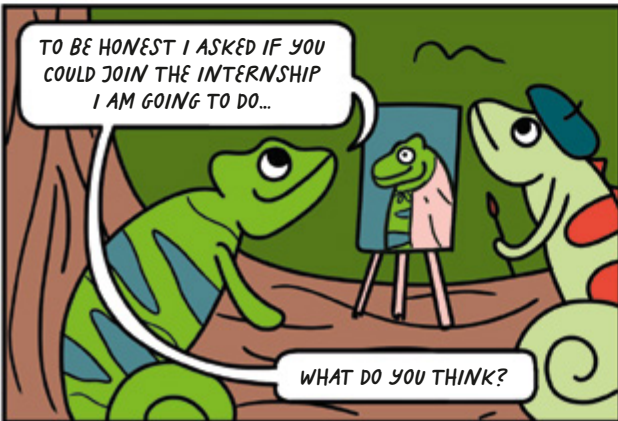
AND IT'S EVEN TRICKIER THAN I THOUGHT. IF WE WANT TO FIND A SOLUTION IT'S BEST WHEN WE WORK TOGETHER.



WHAT DO YOU MEAN? HOW COULD I HELP SOLVING THE USABILITY ISSUES YOU HEARD ABOUT?

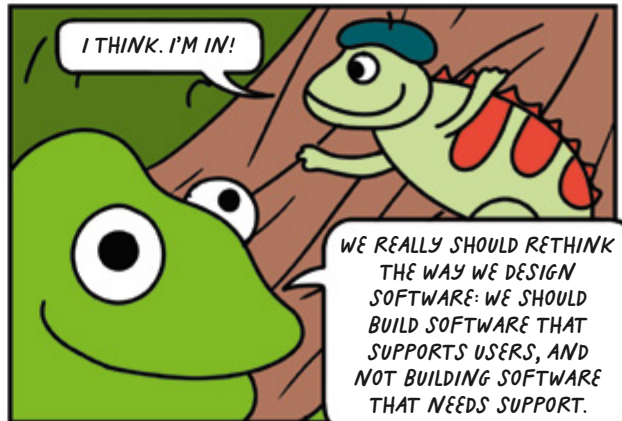
BECAUSE WITH YOUR EXPERTISE, YOU COULD HELP PRODUCE CREATIVE SOLUTIONS.

YOU THINK SO?



TO BE HONEST I ASKED IF YOU COULD JOIN THE INTERNSHIP I AM GOING TO DO...

WHAT DO YOU THINK?



I THINK. I'M IN!

WE REALLY SHOULD RETHINK THE WAY WE DESIGN SOFTWARE: WE SHOULD BUILD SOFTWARE THAT SUPPORTS USERS, AND NOT BUILDING SOFTWARE THAT NEEDS SUPPORT.

ABOUT CASA

CASA: Cyber Security in the Age of Large-Scale Adversaries was established in 2019. It is the only Cluster of Excellence in the field of computer security in Germany. CASA is funded by a grant from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) worth about 30 million Euros, which ensures excellent research conditions.

CASA brings together a core group of principal investigators, chosen with a strong focus on security and privacy, with selected top-level researchers from highly relevant neighboring disciplines. The team covers the full scope needed to tackle the challenging research problems in modern computer security; namely computer science, mathematics, electrical engineering, and psychology.

CASA is hosted by the Horst Görtz Institute for IT Security (hgi.rub.de/en), a pioneering research center in Germany.

Furthermore, CASA collaborates strongly with the Max Planck Institute for Security and Privacy in Bochum (mpi-sp.org) and several other institutes and universities.

What is a “Cluster of Excellence”?

With the funding line “Clusters of Excellence”, internationally competitive research centers at universities or university alliances in Germany are provided with project-based funding for a period of 7 years. Within the clusters, scientists from different disciplines and institutions work together on a research project. The funding gives them the opportunity to concentrate intensively on their research goal, to train young scientists and to recruit international top researchers.

casa.rub.de

TECHNICAL BACKGROUND

The concepts and methods presented in this comic were developed by researchers involved in the Cluster of Excellence CASA. If you are interested in more details, you can find the original publications online. These scientific papers explain the results in more detail. For many publications we also publish the source code and other research artifacts. Please reach out to us, if you have questions: info@casa.rub.de

PUBLICATIONS

Lisa Geierhaas, Anna-Marie Ortloff, Matthew Smith, Alena Naiakshina: **Let’s Hash: Helping Developers with Password Security**, Symposium on Usable Privacy and Security (SOUPS), 2022.

Stefan Albert Horstmann, Samuel Domiks, Marco Gutfleisch, Mindy Tran, Yasemin Acar, Veelasha Moonsamy, Alena Naiakshina: **Those things are written by lawyers, and programmers are reading that. Mapping the Communication Gap Between Software Developers and Privacy Experts**, Privacy Enhancing Technologies Symposium (PETS), 2024.

Jan H. Klemmer, Marco Gutfleisch, Christian Stransky, Yasemin Acar, M. Angela Sasse, Sascha Fahl: **“Make Them Change it Every Week”: A Qualitative Exploration of Online Developer Advice on Usable and Secure Authentication**, ACM CCS, 2023.

Marco Gutfleisch, Jan H. Klemmer, Niklas Busch, Yasemin Acar, M. Angela Sasse, Sascha Fahl: **How Does Usable Security (Not) End Up in Software Products? Results From a Qualitative Interview Study**, IEEE Symposium on Security and Privacy (S&P), 2022.

Franziska Herbert, Steffen Becker, Leonie Schaewitz, Jonas Hielscher, Marvin Kowalewski, M. Angela Sasse, Yasemin Acar, Markus Dürmuth: **A World Full of Privacy and Security (Mis)conceptions? Findings of a Representative Survey in 12 Countries**, CHI Conference on Human Factors in Computing Systems, 2023.

Ahmet Erinola, Annalina Buckmann, Jennifer Friedauer, Asli Yardim, M. Angela Sasse: **“As Usual, I Needed Assistance of a Seeing Person”: Experiences and Challenges of People with Disabilities and Authentication Methods**, IEEE European Symposium on Security and Privacy Workshops (EuroS&PW), 2023.

Franziska Herbert, Steffen Becker, Annalina Buckmann, Marvin Kowalewski, Jonas Hielscher, Yasemin Acar, Markus Dürmuth, Yixin Zou, M. Angela Sasse: **Digital Security - A Question of Perspective. A Large-Scale Telephone Survey with Four At-Risk User Groups**, IEEE Symposium on Security and Privacy (SP), 2024.

Mark Turner, Martin Schmitz, Morgan Masichi Bierey, Mohamed Khamis, Karola Marky: **Tangible 2FA – An In-the-Wild Investigation of User-Defined Tangibles for Two-Factor Authentication**, Symposium on Usable Privacy and Security (SOUPS), 2023.

CASA HUB D

Copyright 2024

All contents, especially texts and graphics are protected by copyright. All rights, including reproduction, publication, editing and translation, are reserved, Cluster of Excellence CASA.

Editorial team

Annika Gödde (CASA/Ruhr University Bochum)
Niels Jansen (Ellery Studio)
Alena Naiakshina (CASA/Ruhr University Bochum)
Stefan Horstmann (CASA/Ruhr University Bochum)
Felix Reichmann (CASA/Ruhr University Bochum)
Aslı Yardım (CASA/Ruhr University Bochum)
M. Angela Sasse (CASA/Ruhr University Bochum)
Annalina Buckmann (CASA/Ruhr University Bochum)
Konstantin Fischer (CASA/Ruhr University Bochum)
Marco Gutfleisch (CASA/Ruhr University Bochum)
Franziska Herbert (CASA/Ruhr University Bochum)
Marvin Kowalewski (CASA/Ruhr University Bochum)
Karola Marky (CASA/Ruhr University Bochum)
Priyasha Chatterjee (CASA/Ruhr University Bochum)
Yizin Zou (CASA/Max Planck Institute for Security and Privacy)

Ellery Studio

Illustrations: Lucía Cordero, Hannah Schrage

Design: Yasemin Çakır

Project Management: Pawel Leyk

Cover image

Hannah Schrage

Printed at

Schmidt, Ley + Wiegandt GmbH + Co. KG,
Lünen, www.slw-medien.de

Published by

CASA: Cyber Security in the Age
of Large-Scale Adversaries
Universitätsstraße 150
44780 Bochum

hgi-presse@rub.de

casa.rub.de

Scan to access the digital version of our comic:



Also published in this series:

- The Secrets of HUB A and the Traces of the Cookies
- A Deep Dive Into HUB B and the Swirl of Embedded Security
- What's the Fuzz About HUB C and the Missing Carrots?





HUB A



HUB B



HUB C



HUB D

HOW CAN IT SPECIALISTS AND SECURITY EXPERTS COMBINE THEIR SKILLS IN THE BEST WAY? WHICH TOOLS MAY HELP TO GET CLOSER TO THE GOAL OF SECURITY AND PRIVACY BY DESIGN? AND WHAT ABOUT THE USER EXPERIENCE FOR THE DIVERSE CROWD OF END USERS?

ACCOMPANY CHAMELEON MAGGIE ON HER SEARCH FOR A PURPOSEFUL PROFESSION. WILL SHE FIND THE CLEARING OF ENLIGHTENMENT IN THE INFORMATION JUNGLE?

FIND OUT MORE!