Applied Data Science Project

L 18 – The Users personas

FONDAZIONE links

PASSION FOR INNOVATION

Politecnico di Torino

A.A.2023/2024

Service design

Technology and data enable services.
Technological change resulted in the Industrial Revolution, which changed the way companies worked and offered many new possibilities.

Humans have individual needs
Clients are complicated. They have individual needs and expectations that can't be standardised.
Depending on the context and situation, every person has different needs, even for the same service**.**
The mechanics of human behaviour play a much bigger role in information chains.
Especially in services where clients are directly involved in the process.
No technology or system can cope with the individual needs of clients sufficiently.

Services happen over time and across several **Touchpoints**. Clients perceive services on many different levels. The overall interface and experience connect is a combination of the experiences of all Touchpoints.

Stefan Moritz. Service Design. Practical access to an evolving field.

Service design core principles

- Understanding and embracing he **users' perspective** to provide optimal user experience.
- Designing for the **experience as a process** lasting over time, from the beginning to the end of the service.
- **Collaborate** with users, collecting data from the real world to foster the development
- **Test and iterate to collect** user feedback.

Which is the role of the data scientist in this process?

- Provide data and analysis to understand user needs
- Collect and analyse data to test and improve services.
- Monitor services over time to improve it

Understanding the perspectives

Imagine a music streaming service wants to improve the experience of its users.

In particular, the business developers wants to:

- Reduce the abandonment of customers (e.g. 15%)
- Increase the service usage time (e.g. 20%)
- Improve the satisfaction of customers (e.g. 10%)

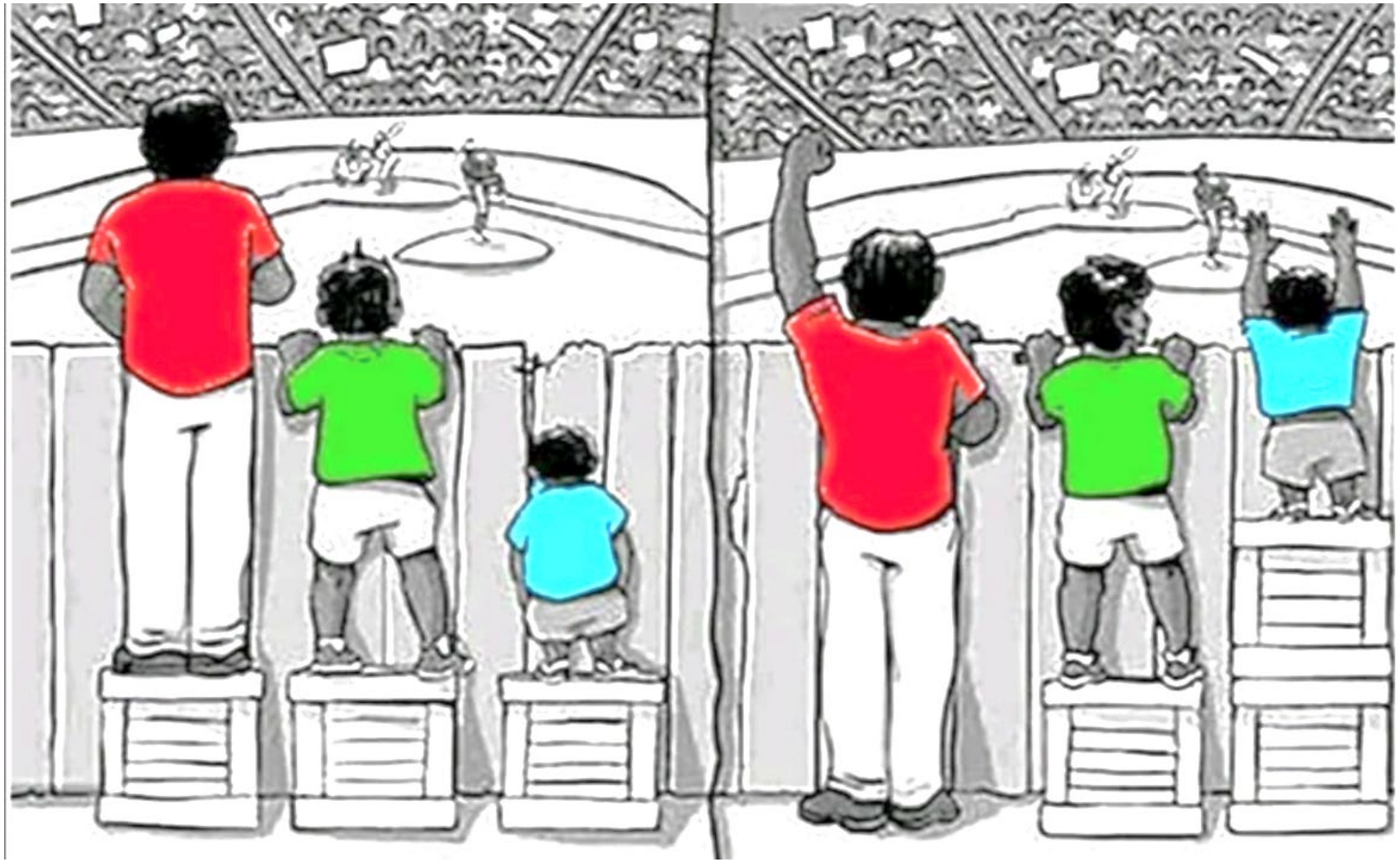
What are the needs and wants of the end users?
Can we translate the strategic goals into users' needs?

- Why they abandon the service?
- When did they abandon the service?
- What functions do they prefer?
- What does make the service the unique way to list music?

We are not the user
The user is not the boss...
And not even a colleague, a friend, the desk mate...

- We need to access to the users' knowledge (both explicit and implicit)
- In many situations, observers, listeners, and researchers are not allowed, so we need for indirect knowledge.
- Gathering information to know and map the mental models of users allows us to get out of **our perspectives** and biases and design solutions widely usable and accepted.

THE AVERAGE USER DOES NOT EXIST.

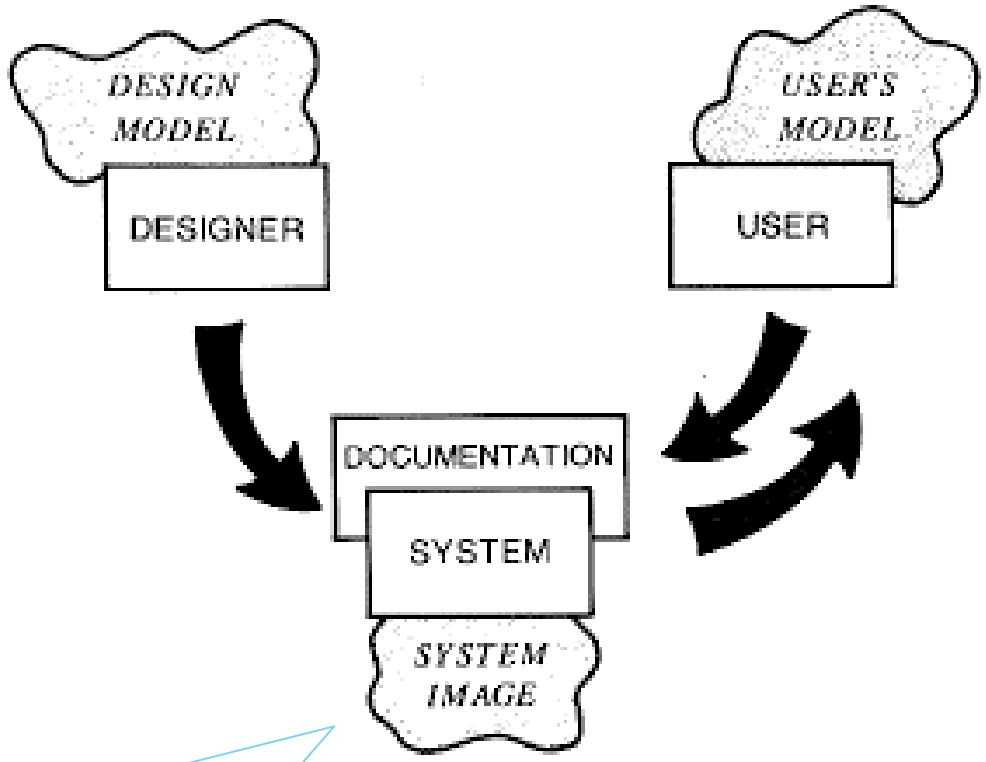


1 project, several mental models

We all create mental models that explain and organise our actions and interactions with the world.

The mental models we create derive from **what we can perceive of a system, its structure and visible behaviours.**

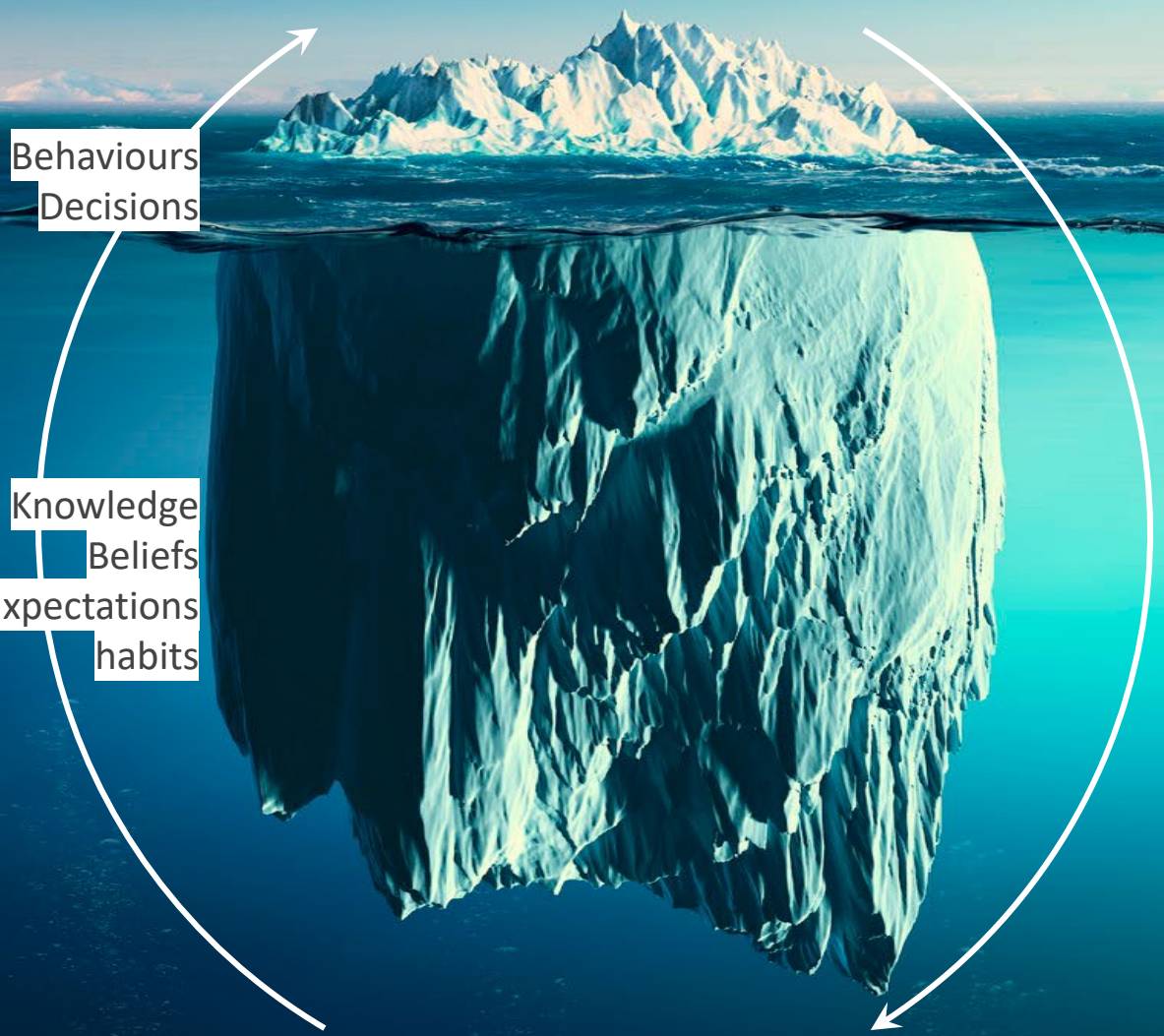
If the system image is incomplete, inadequate, or inconsistent, a weak usage experience will occur.



The system image is the mental model materialised by design activities, and that will be developed.
It is like a text open to interpretation

Norman, D.A. The Design of Everyday Things, Basic Books, 1988; 2019

A matter of mental models.



A mental model is an **internal mental representation** of the **perceived real world** and the **relationships between its various parts.**

A mental model contains knowledge, beliefs, expectations and habits deriving from our perceptions, direct and indirect experiences.

We develop mental models on any aspect of the experience, including the digital systems we use, through intuitive **perceptions of their actions and consequences**

Mental models drive our decision and behaviours (including the interaction with systems)

A. Collins and D. Gentner, How people construct mental models. In Cultural Models in Language and Thought, Cambridge, U.K.:Cambridge Univ. Press, pp. 243-265, 1987.

Mental models

How to book a flight
We have our **habits** when searching for a flight and the information we will need along the way.

How to drive a car
We expect what are the **main commands** to interact with, what the car can do and **how to drive it appropriately** in **our country**.

How to use IM apps
We expect **messages** to come back in real-time and to send attachments like photos and GIFs.
We expect **to be notified** as soon as someone has responded.

How to interact with a bot
We usually ask for information and provide commands. We expect replies in a very short time and we expect event negative feedback.

UX Collective. Understanding mental and conceptual models in product design.2019.

Mental model and operational images

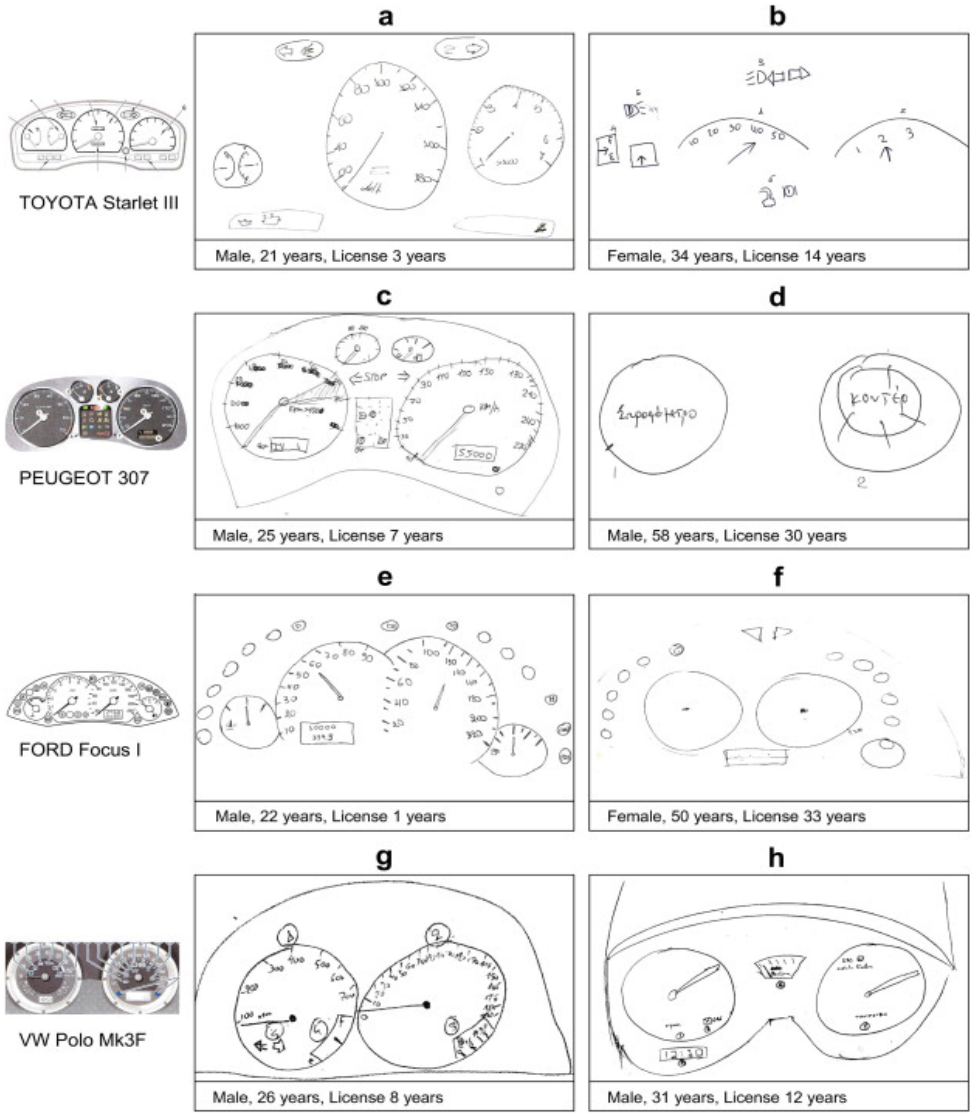
Mental models result in the interaction with the systems.
What we remember and how we represent them show that we use a task- oriented memory, excluding details not useful (interesting, emotional).

We store a big picture that is:

- **Incomplete** (or **essential**)
  as it better focuses on some aspects
  to the detriment of others

- **Unstable** (or **flexible**)
  as it changes over time, with experience and time,
  highlighting some details and forgetting others.

- **Thrifty** (or **efficient**)
  since it aims to reduce the mental workload



Proportions correspond to interest/priority

Teresa Colombi [Disegnami un sito: le immagini operative a servizio della UX](#).

Why model humans?

The simplicity and convenience of advanced systems, such as human-AI interfaces, with the increase in machine decisions, requires a **deeper understanding of the human experience with algorithms**

Model the humans to shape better systems that can:

- show **human-like behaviour**, e.g. in communications systems such as chatbots
- provide certain **autonomy**, e.g. humanoid robots in health support
- exhibit **contextual understanding**, as in advanced natural language translation systems based on NLP
- solve classification problem-solving, e.g. in the medical domain
- enable intelligent interaction, such as voice input or facial recognition
- …

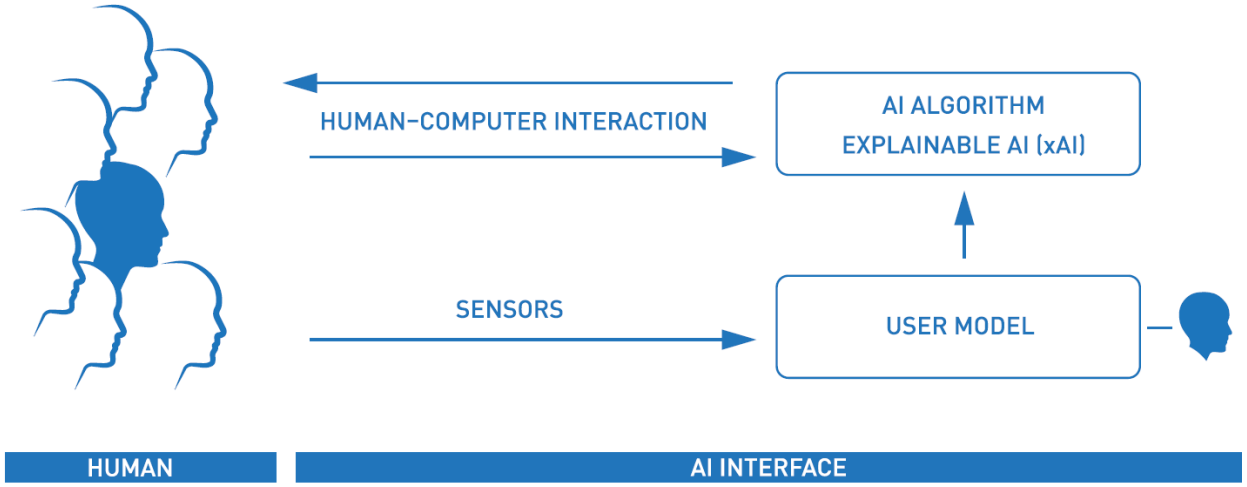
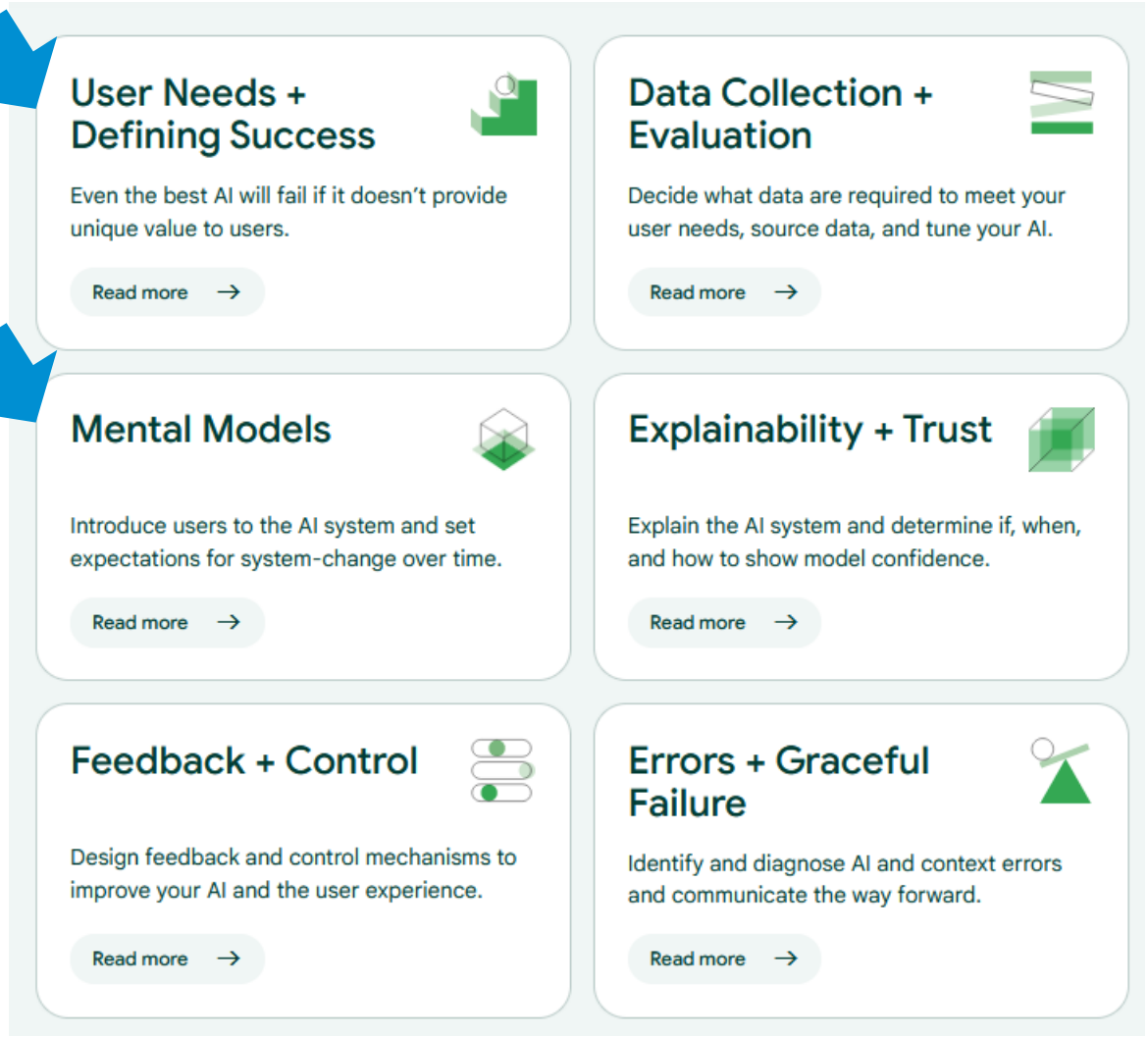


FIGURE 1. Human–AI interfaces differ in many ways from classical human–computer interfaces: they learn unobtrusively from our interaction behavior, store every interaction and can react adaptively and even make predictions about our next behaviour. They acquire some degree of human-like cognitive, self-executing, and self-adaptive capabilities and autonomy, and produce unexpected outputs that require non-deterministic interactions.

Google PAIR paradigm



- Who are your different **user groups**?
- What **primary goal** will each user group have?

- What is the **step-by-step process** that **novice users** from each group currently use to accomplish the task that the AI system will accomplish? **How uniform or variable is this process**?

- What is the step-by-step process that **expert users** from each group currently use to accomplish the task that the AI system will accomplish? How uniform or variable is this process?

- What **mental models** might already be in place based on the step-by-step process and any **non-AI-driven tools** used by each group?

    - Which data they need and use?
    - Where and how they search them?
    - Which information shaper their decisions?
    - Which are the biases related to belief, habits, or context?

[Google People + AI Guidebook]

Bias*

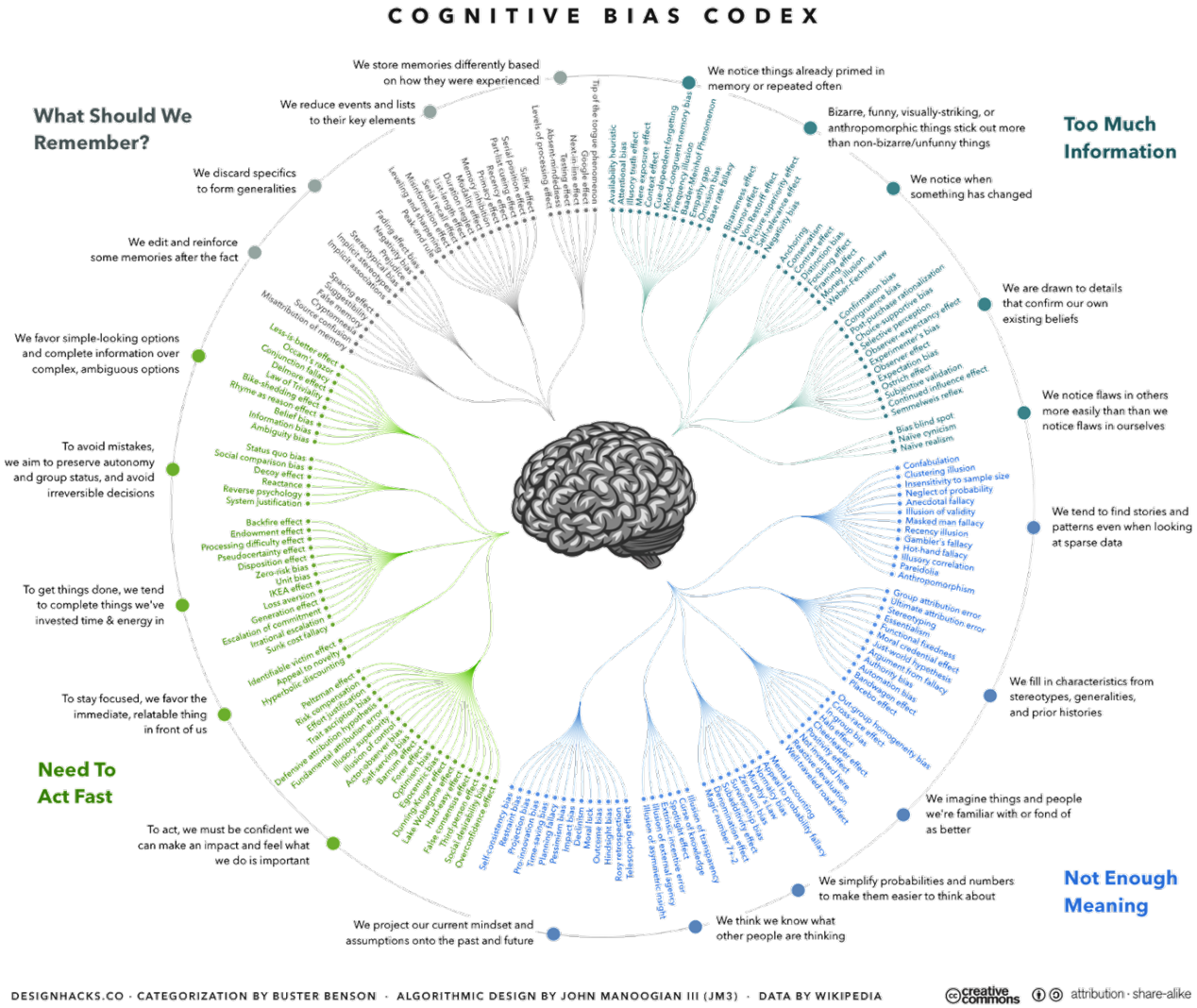
*From French “biais”, that is an oblique shot (in the game of pétanque)

Systematic errors that shape our judgments in ways that do not correspond to reality (prejudices).

They results in heuristics (decisions) that may be be incorrect and not adequate to the situation

COGNITIVE BIASES
assessments based on prejudices or emotional states, and **reinforced by the characteristics of the information**:

- excess of information
- lack of information (COMPENSATION)



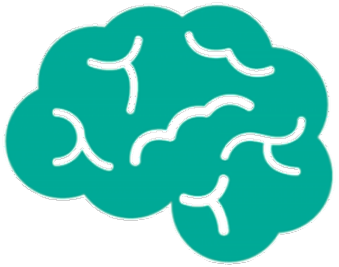
FONDAZIONE links PASSION FOR INNOVATION
Politecnico di Torino 1859

The origins of biases and heuristics

System 1

Instinctive, rapid, unconscious and economic. Supports Heuristic Thinking (95% of our daily functioning)

Unconscious
Fast
Associative
Automatic pilot



System 2

Takes effort
Slow
Logical
Lazy
Indecisive

Slow, deliberative, precise and expensive. Supports algorithmic thinking based on computation, rational problem analysis and verifications.
(5% of our daily functioning)

The conflict between the two systems causes our systematic errors (BIAS)

Kahneman, Daniel. Pensieri lenti e veloci. Mondadori, 2019

Algorithmic bias

In the data cycle, the main vulnerability is the **algorithmic bias:**
When the algorithm favours some results over others,
it often reinforces privileges held by dominant social groups.

DATA are not neutral,
The description of the phenomenon sets the field for the real context application.

"Bias in algorithms can emanate from **unrepresentative or incomplete** training data or the reliance on flawed information that reflects **historical inequalities**. If left unchecked, biased algorithms can lead to decisions which can have a **collective, disparate impact on certain groups** of people even **without the programmer's intention** to discriminate."

Lee, Resnick and Barton

There is a power and **informational asymmetry** between developers and users, which end up deploying algorithms that function in a "black box" style and whose criteria and methods are unknown to users.

UX Collective, User vulnerabilities in the data cycle and how UX designers can help to mitigate them, 2022

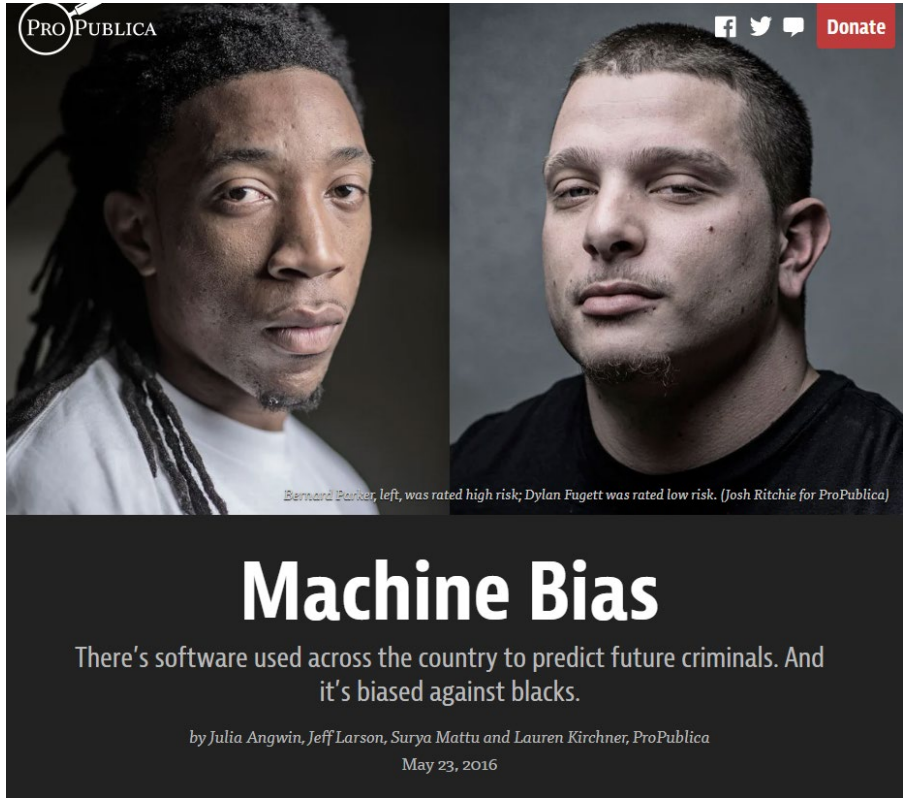
Algorithmic bias

Pregiudizi algoritmici:

- Racial prejudice in the USA in the system of predicting the risk of recidivism to decide on a prison sentence or probation. ProPublica (investigative journalism agency) demonstrated the error of the algorithm (assigned twice the rate of recidivism to black people)

- Gender bias in financial services. When Apple e Goldman Sachs Appl launched a new type of credit card, several customers noticed that the software granted men 10 to 20 times the amount of credit.

In both cases, the companies denied the allegations but refused to disclose the procedures and data used.



Most common biases > information overload

Confirmation bias
the most common unconscious mechanism
to find evidence (select, accept data) in favour of our opinion and repulsion towards the unknown.

Exposure effect
confidence in data that are available or that we've been recently exposed

Outcome bias
we make decisions only on past experiences
«we have always done so»

Polarization pattern
tendency to see significant data relationships, even when values are random (we are wired to see models even where do not exist)

Most common biases > lack of information

Automation bias
our tendency to favour outputs generated by automated systems and to ignore contradictory information made by non-automated systems, even when correct.

Defect of knowledge
we attribute the same degree of our knowledge on the topics in question

Stereotypes
rigid and generalised opinions, not based on direct experience and regardless of the assessment of individual cases)

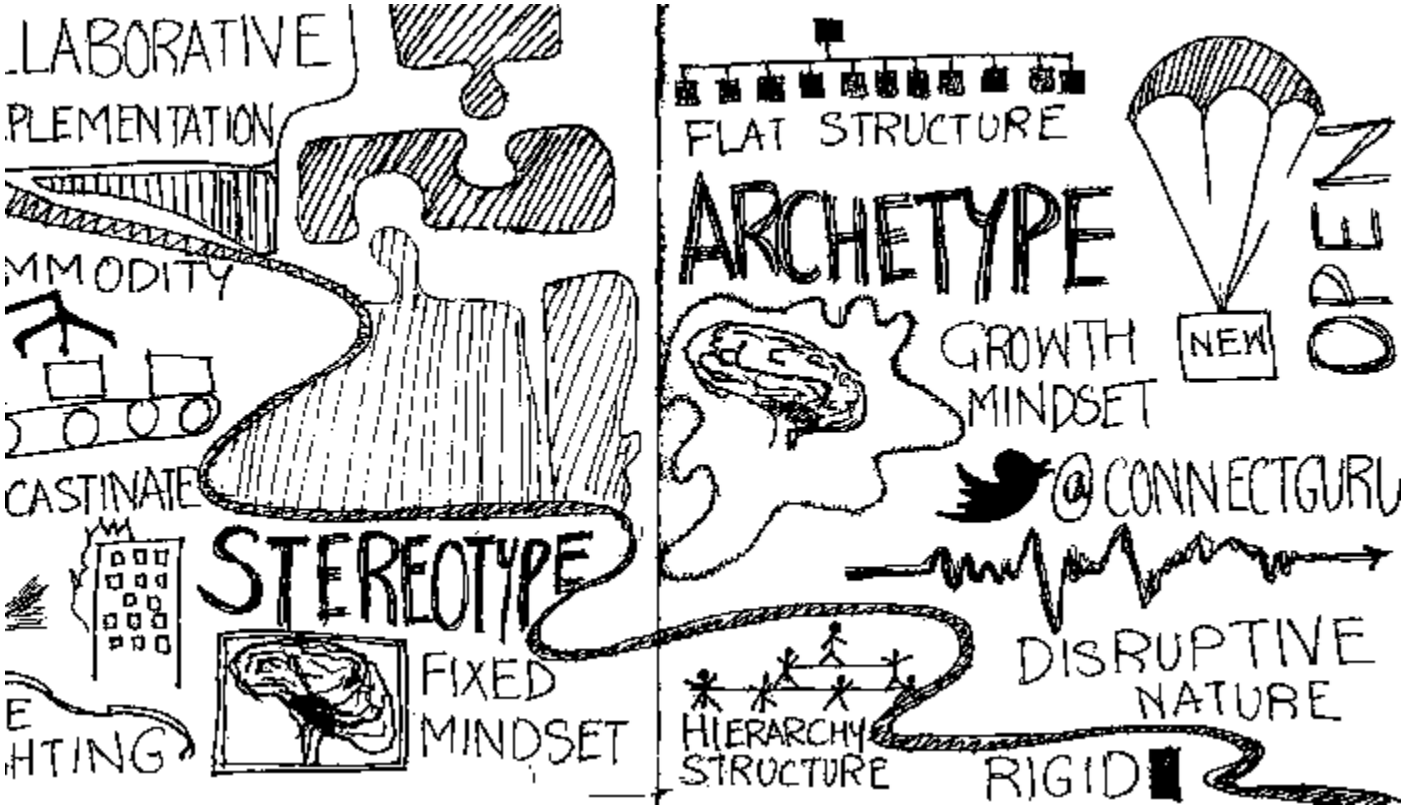
Stereotype vs archetype

Stereotypes are simplified, generalised ideas about a group of people. They can be positive or negative, but they are often **based on inaccurate or incomplete information**.

- stereotypes can lead us to make not accurate assumptions (e.g. all gamers are young, male and antisocial)

Archetypes are universal symbols or **patterns** that are found in stories and data. They represent fundamental human experiences and motivations.

- archetypes can help us to understand the underlying needs and desires of users.



Which stereotype can affect your project?

ADSP Projects	Stereotypes	Data sources	Archetypes
1) Predictive model for Humanitarian Aid	"immigrants primarily hold low-wage jobs and hurt the economy"	Germany calls for more immigrants to fix its shrinking economy, Financial time, Reuters (2023)	Employers Employee Candidates
2) , 3) Object Recognition and Object Collision Detection	…		
4) Cross-modal Retrieval Project	…		
6) Urban Air Quality Assessment and High-Resolution Temperature Mapping	Non-experts rely on basic sensory cues to perceive air quality, such as visibility, smell, or feel; neighbourhood halo effect;	Air pollution perception bias: Mismatch between air pollution exposure and perception of air quality in real-time contexts (2019)	Citizens CEO of industries Physicians Public officers
7) Heat Forecast	People don't see heatwaves as a pressing issue.	5 things we've learnt about people's experiences of heatwaves (2018)	Frail citizens (elderly, pregnant, children, chronic patients) Red cross and responders Physicians Public officers
8) Pre-training language model on Electronic Health Records **9) Incorporating Patient Preference Studies into clinical research and decision models**	Black patients are more likely than White patients to be described in negative terms	Electronic Health Record Notes May Be Perpetuating Biases (2022)	Patients (various) Physicians Medical institutions Insurance companies

HCD | THE USERS PERSONAS

User Personas

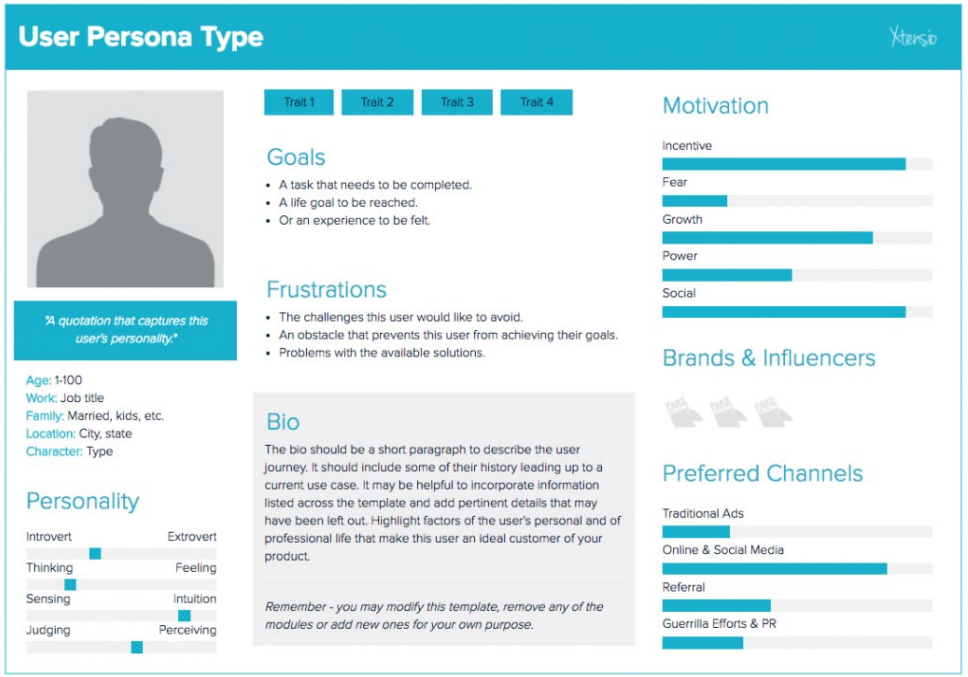
Design technique was introduced In 1999 by Alan Cooper, aiming at ***capture, communicate and use the research findings***

Personas are **data-driven portraits** of **archetypical stakeholders**
that help designers and developers focus on the needs and goals of target users throughout the product development process.

- based on user research, they are not meant to be literal descriptions of any individual user.
- help team project members to overcome their biases by forcing them to think about their users as individuals with their own unique needs and goals.

Grounded in real user research, Personas layout includes:

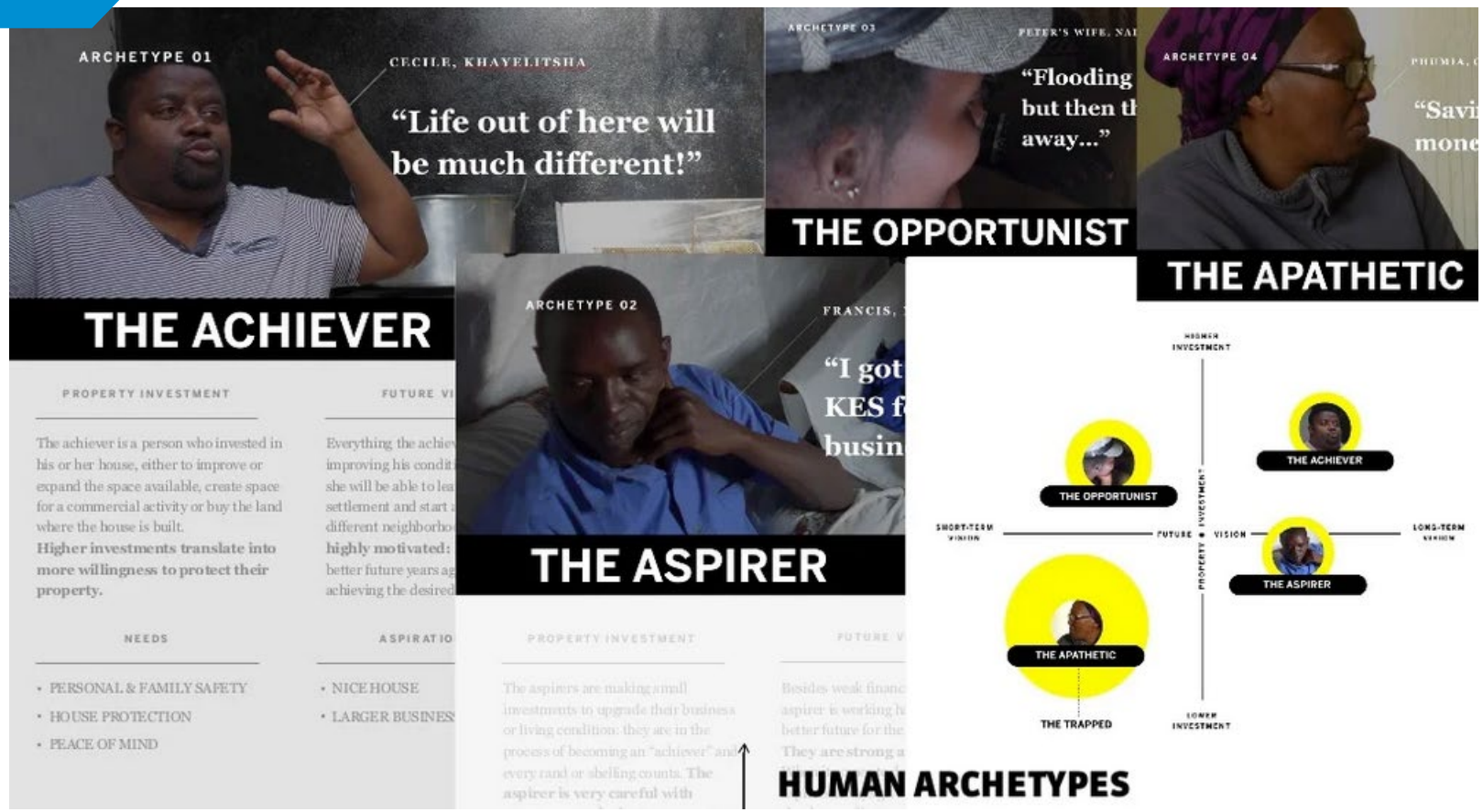
- Research findings encapsulated in many individual user portraits
- **Users' goals and needs supporting the ddep understanding of them by the sceintists and dev people**.
- **Data and features prioritised** based on a clear understanding of which user groups will benefit.



A. Cooper and P. Saffo, The Inmates Are Running the Asylum, London, U.K.:Macmillan, 1999.

UX24/7. eGUIDE INTERNATIONAL USER RESEARCH. https://ux247.com/publications/

Examples



Tassi, R. Visual tools to design. 2016

The User Personas

PRO:

PERSONAS

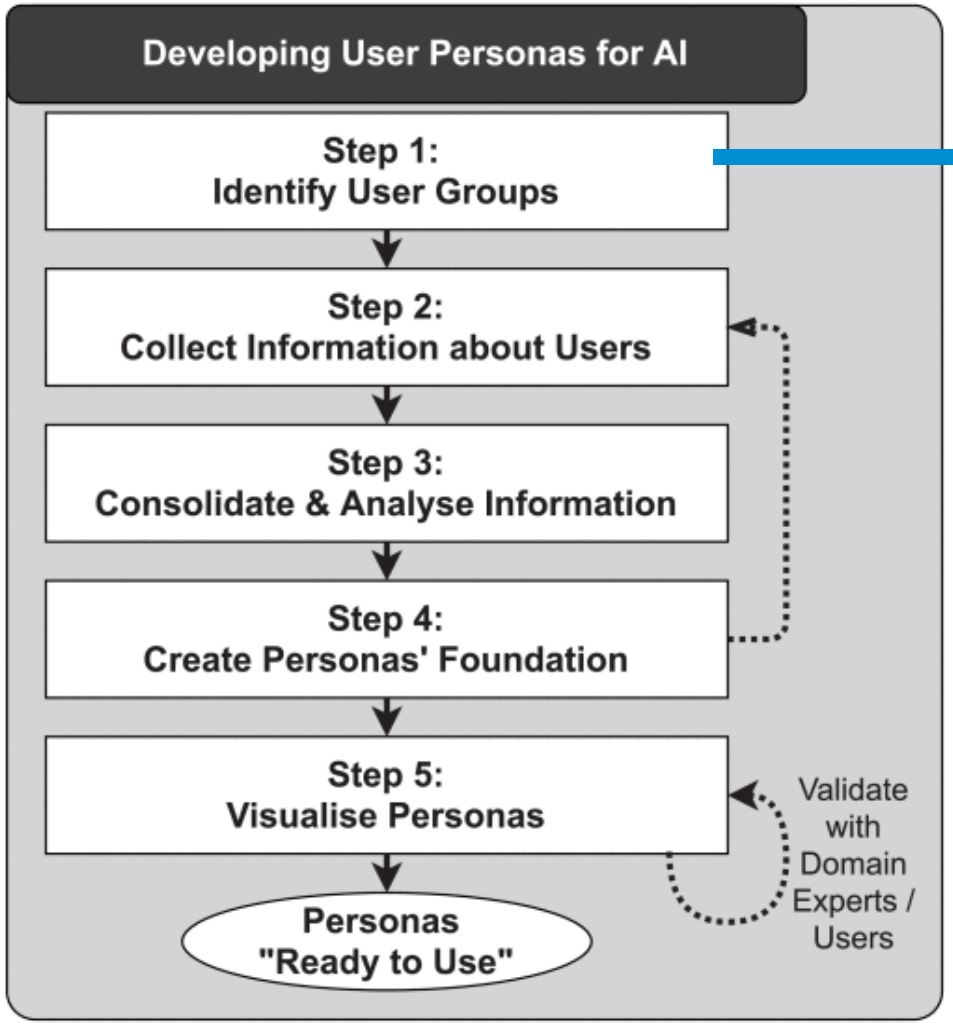
- enable designers and developers to **empathise** with these imaginary users and **understand better** their goals and needs, taking on the perspective of underrepresented or easily overlooked users.
  For example, Personas explicitly designed to represent **human diversity**, known from gender difference research, have been successfully used to detect gender-inclusiveness issues in software.
- **aid the communication within the team** (i.e., the term 'user' can mean different things to different people within the group)**,** making implicit assumptions of users explicit.
- support the communication with the stakeholders, adopting **a common language about users**
- closely **approximate the mental model of various end users,** which results in a focus on the user priorities and a meaningful feature set.
- Help to **avoid self-referential projects** based on the user's (and not developers') goals, motivations, and skills.

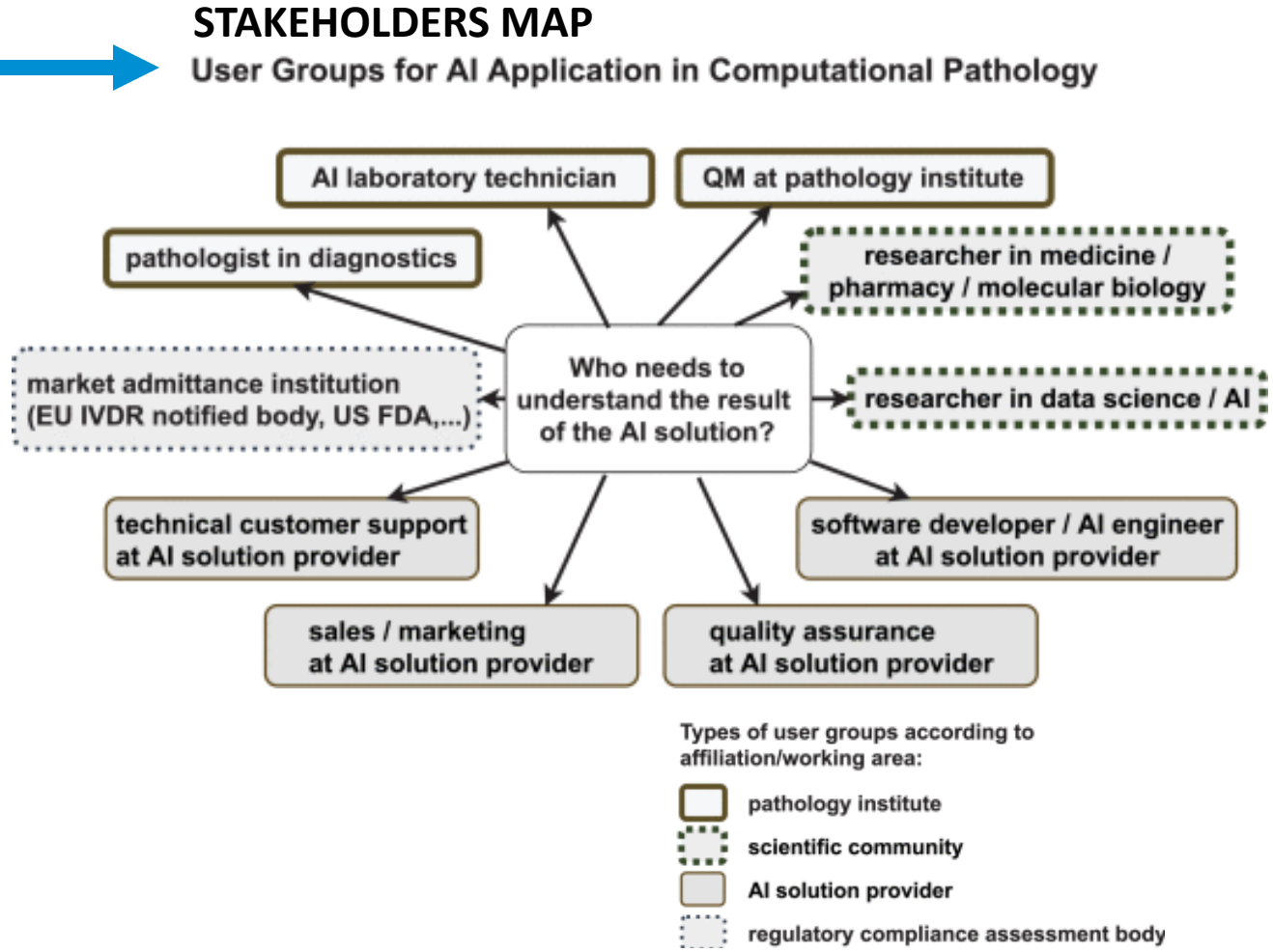
CONS:

PERSONAS

- are prone to activate and reinforce stereotypes. For this reason, it is necessary to ensure that the diversity of people is accounted for

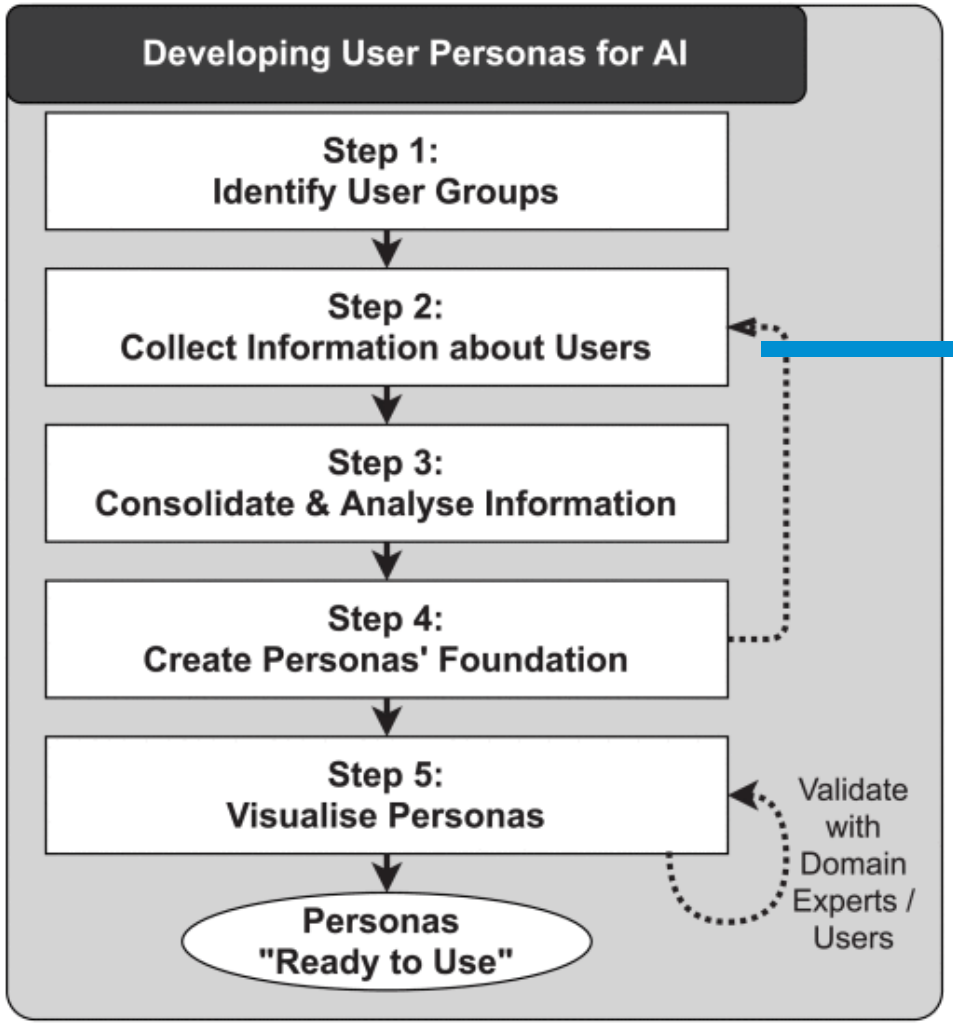
Design Personas for AI



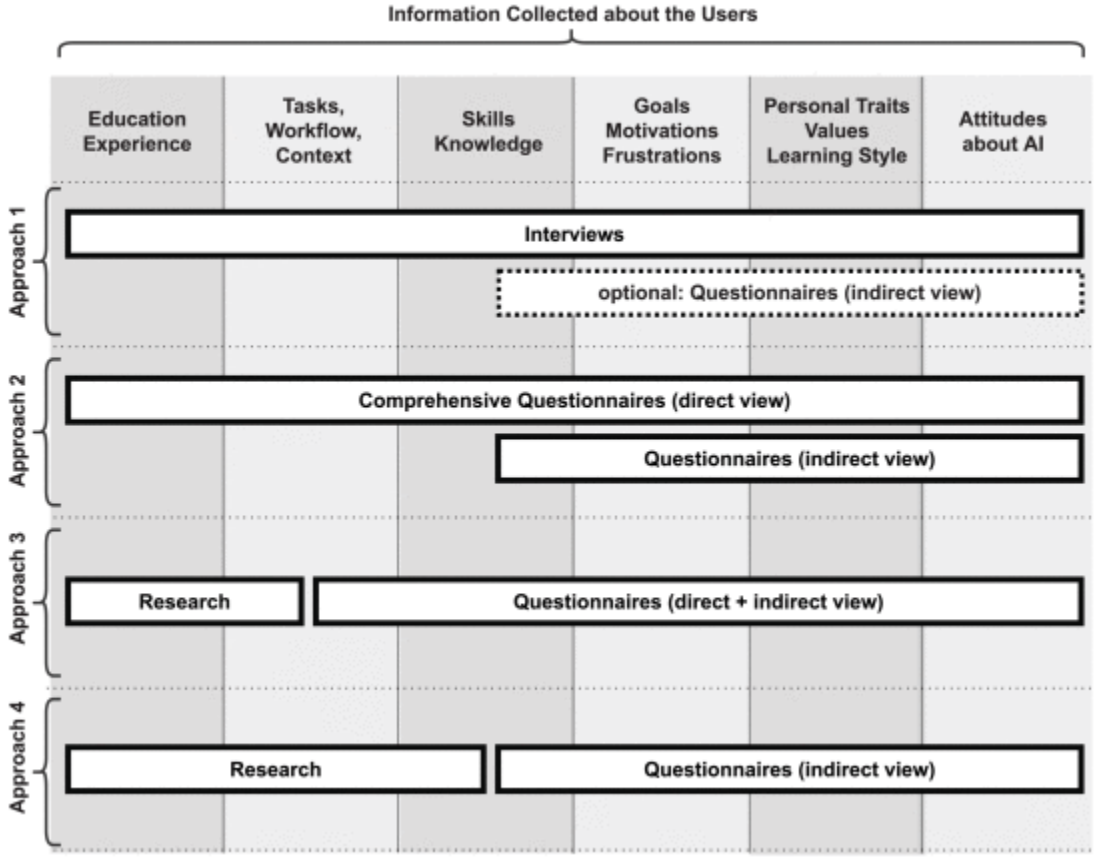


A. Holzinger, M. Kargl, B. Kipperer, P. Regitnig, M. Plass and H. Müller, "Personas for Artificial Intelligence (AI) an Open Source Toolbox," in *IEEE Access*, vol. 10, pp. 23732-23747, 2022

Design Personas for AI



USER RESEARCH



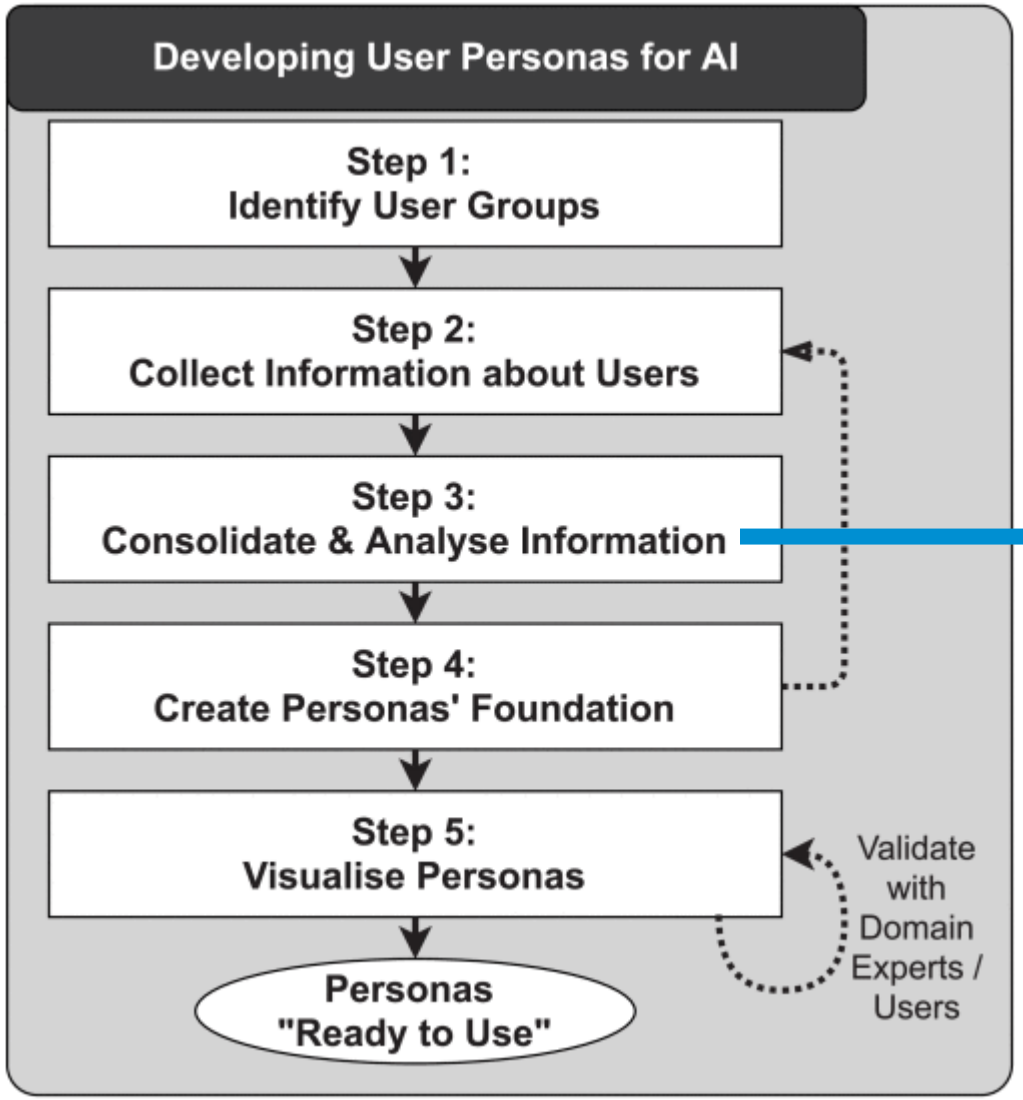
GOAL: to get to know (potential) users'

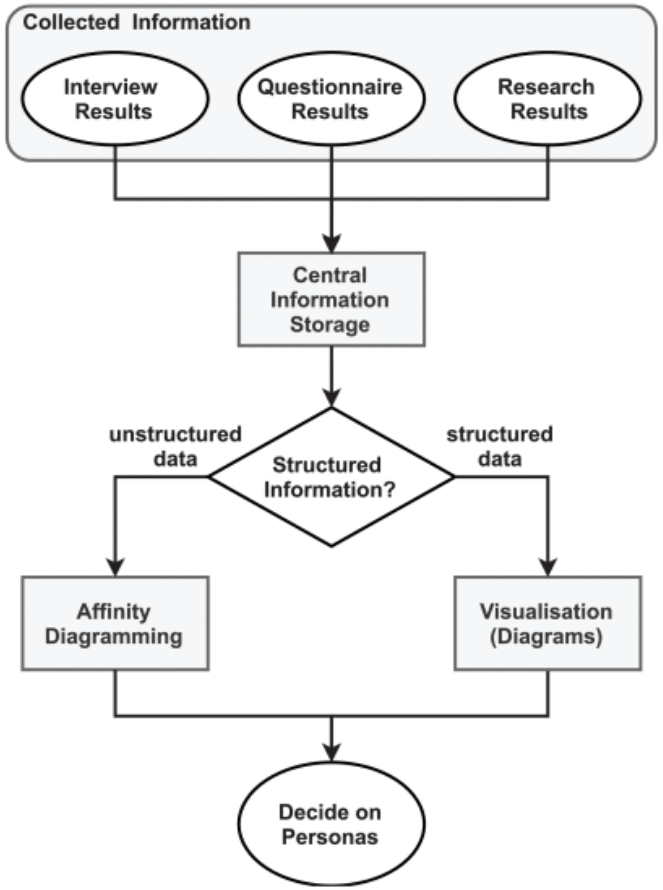
- **goals** and motivations, frustrations and hopes/aspirations, **skills**, education and knowledge, personal traits and aspirations
- **tasks** and **context** they would probably use the AI solution
- attitudes towards new technologies and innovations and machine decisions

A. Holzinger, M. Kargl, B. Kipperer, P. Regitnig, M. Plass and H. Müller, "Personas for Artificial Intelligence (AI) an Open Source Toolbox," in *IEEE Access*, vol. 10, pp. 23732-23747, 2022

https://www.youtube.com/watch?v=fGTNZ7YMdCk

Design Personas for AI

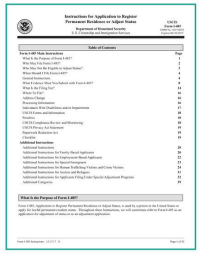




DISPLAY DATA

Example

They are a sample of real users, not generic users but «archetypal», different for specific socio-demographic variables, roles, OBJECTIVES ... moving into specific **scenarios**.



Instructions

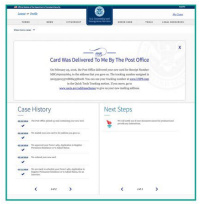
- Length of instructions for both forms = **54 pages**
- These hold instructions for every type of green card applicant, intermixed so an applicant has to seek what's relevant to them

Forms

- In total the two necessary forms = **364 questions**
- Many of which are situation-specific or occur twice between forms
- Minimal clarification & guidance

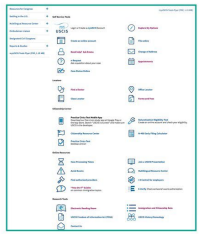
Document Checklist

- Minimally informative with many conditional statements ('if applicable'), making many of it potentially erroneous
- Too broad - missing certain important details



Case Status

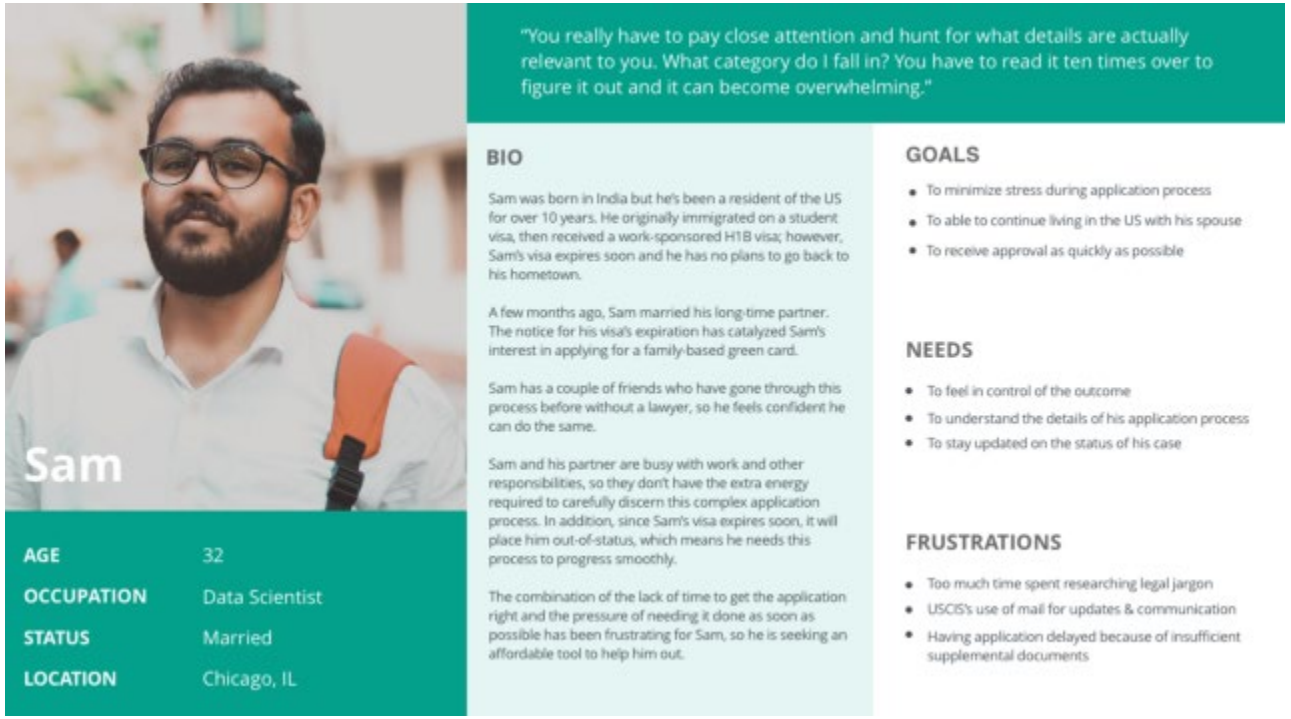
- Case status tracker shows no information about the timing of the future steps



Tools & Resources

- Available only if a user signs in/up, yet the resources are not specific to the applicant's situation, requiring sifting

Analysis of documents
+
Interviews



UX Collective. How to simplify the immigration application process — a UX case study, 2019.

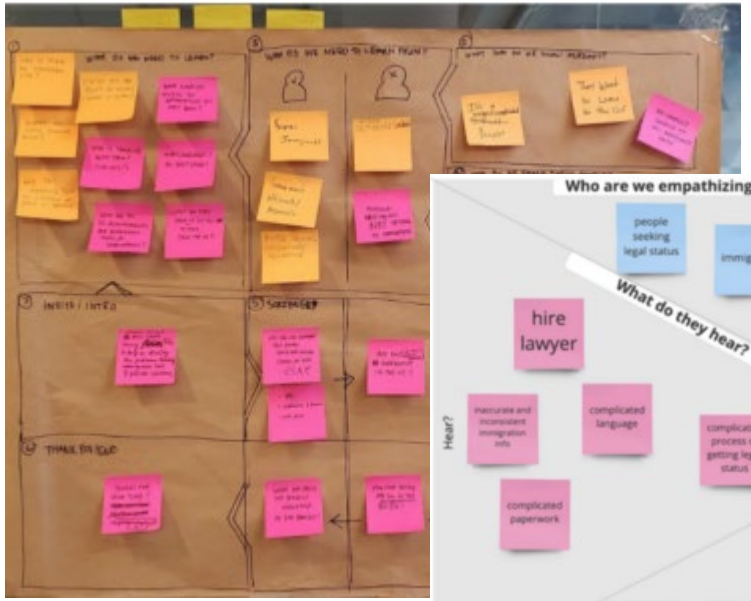
Example

They are

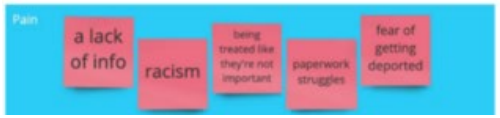
- **data-driven synthetic representation of complex knowledge**, useful for internal communication

- **dynamic** documents to be updated

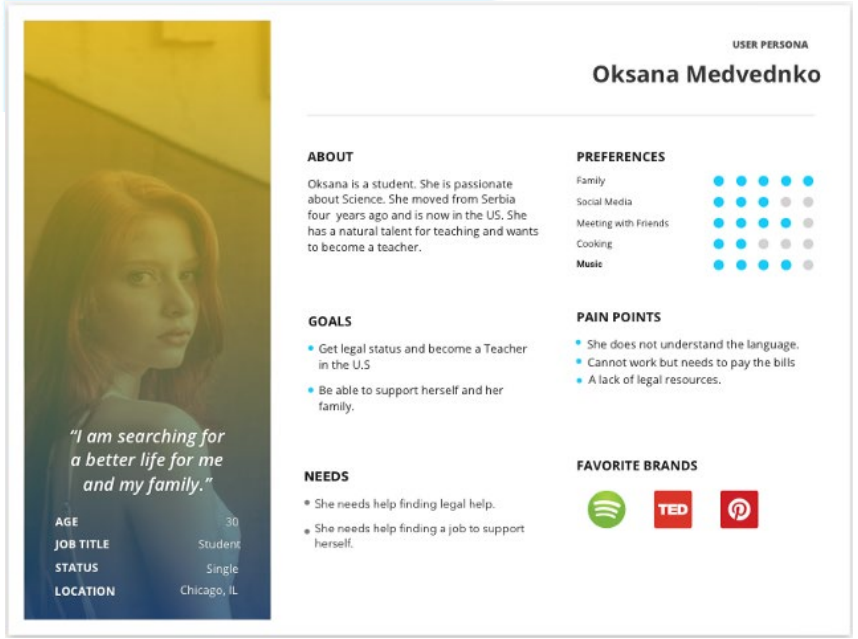
- a **reality check tool**



Affinity diagrams



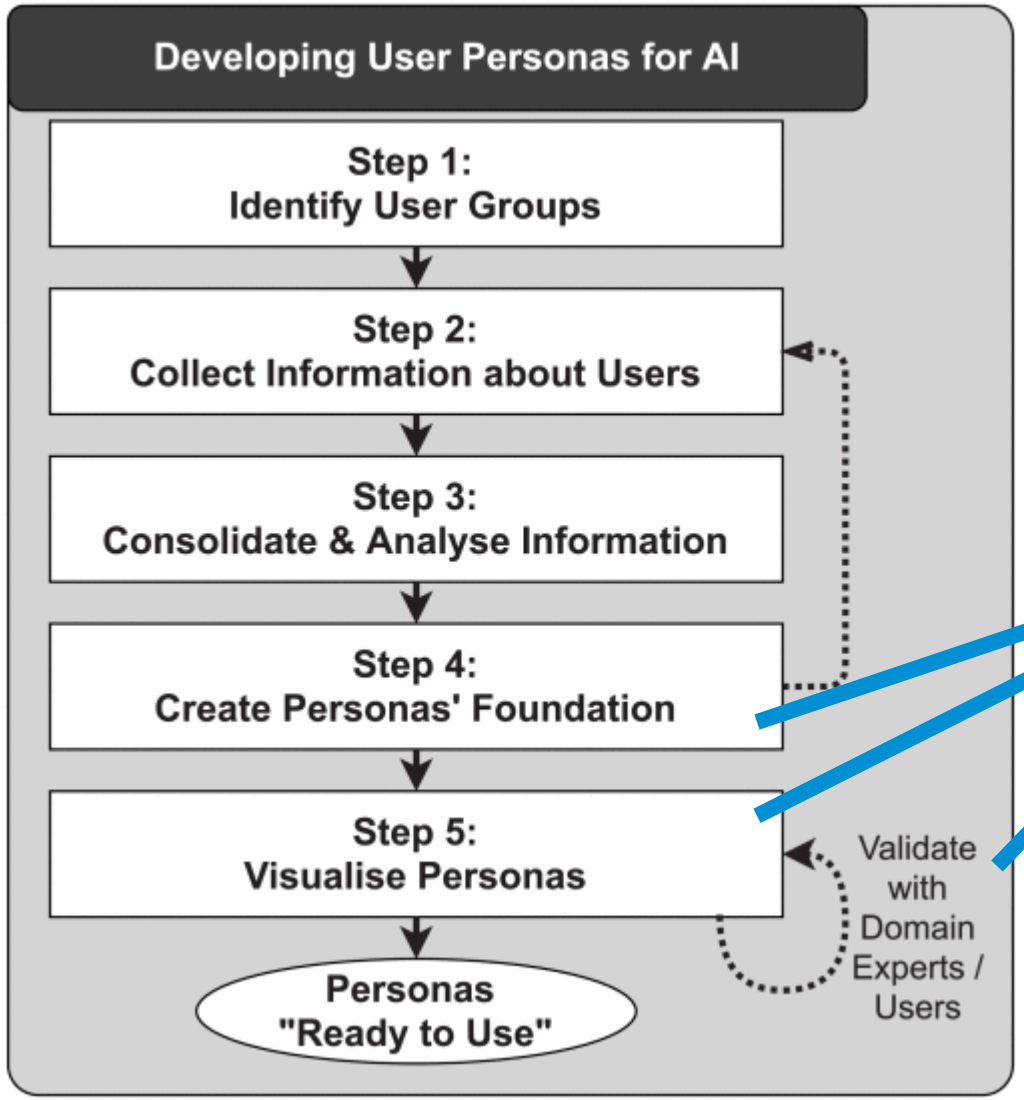
Empathy map



Persona

[Immigration Support- A UX Case study]

Design Personas for AI



PERSONAS

Per every personas include:

- A **photo**/portrait
- **Short bio** /demographic details
- **Mindset**: a brief description of the point of view (specific and characteristic of the person in relation to one or more aspects of the project theme
  - Role, Tasks, values
  - Work (tasks, workflows, context)
  - Education/knowledge/skills
- **Goals**, values
- Relevant **pain points and gains, motivations and barriers**
- Attitudes towards **technology/AI**

A. Holzinger, M. Kargl, B. Kipperer, P. Regitnig, M. Plass and H. Müller, "Personas for Artificial Intelligence (AI) an Open Source Toolbox," in *IEEE Access*, vol. 10, pp. 23732-23747, 2022

Data portraits

When to Use Which User-Experience Research Methods

Personas types

Usually, when creating a persona, **not the whole person is described**, but the focus is put only on **relevant aspects** (goals, needs, attitudes, skills…) and specific context associated with these aspects. Personas usually encompass aspects such as **context and environment**, **tasks and workflows**, **skills and knowledge, personal traits, goals, values, motivations but also frustrations**.

- **Goal-oriented personas,** distinguished from one another based on their different goals (Cooper, 1999).
- **Role-based personas**, defined by their roles, (Pruitt et al, 2000)
- **Scenario-oriented engaging personas**, based on their individual characteristics, and their goals are based on these needs and appear only in the context of a specific scenario (Nielsen).
- **Pastiche personas**, fictional portraits established on user data but entirely grounded on fictional characters from literature or film (Blythe).

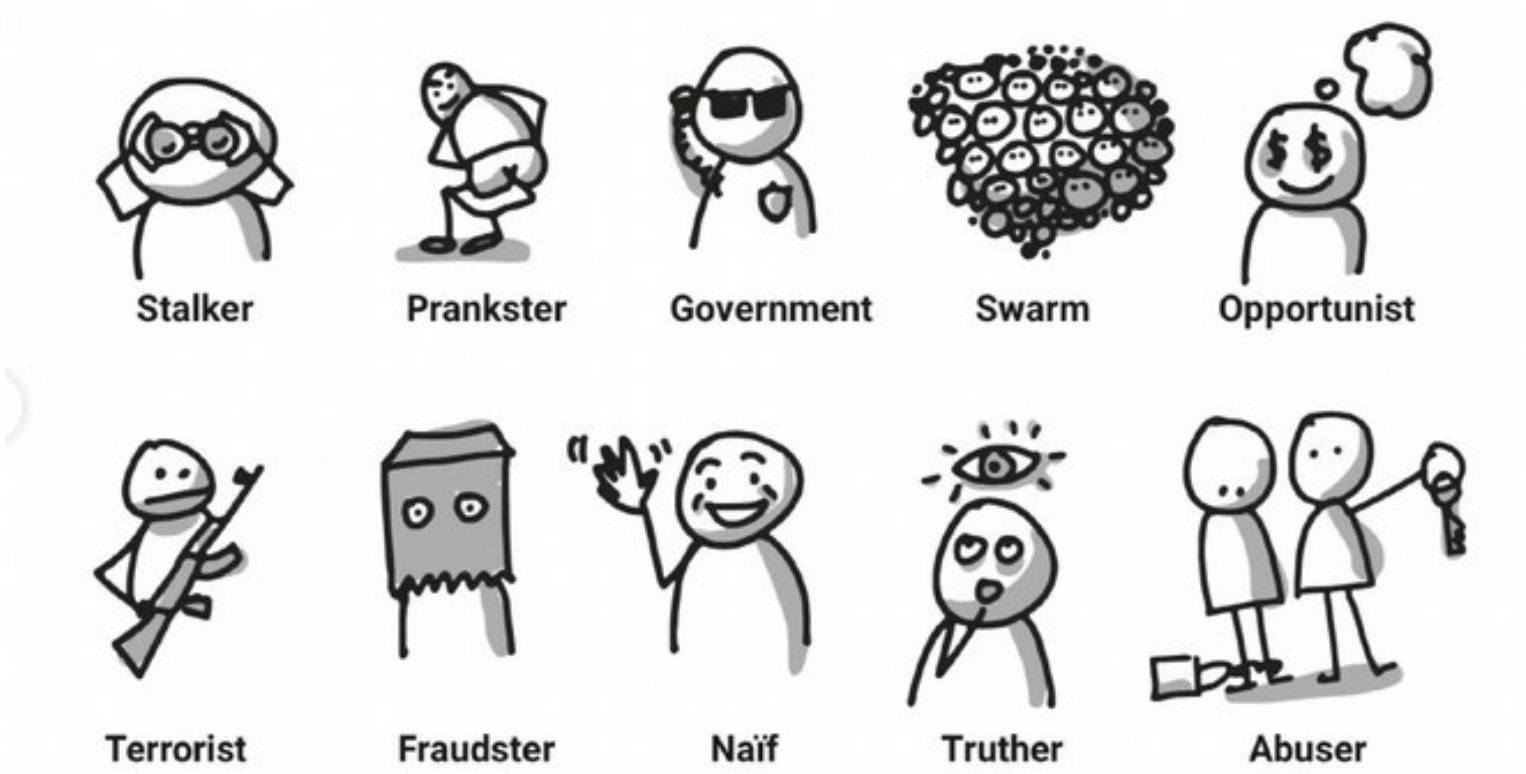
To adapt the personas method to the context of HAII, additional aspects describing the user's attitude regarding AI solutions as specifically relevant for personas for AI:

- **Trust** (How much trust does the user have in the decisions/output of the AI system?)
- **Acceptance** (Does the user accept (and follow) the decision of the AI system?)
- **Assent** (Is the user willing to accept/use the support by the AI system?)

A. Cooper and P. Saffo, The Inmates Are Running the Asylum, London, U.K.:Macmillan, 1999.

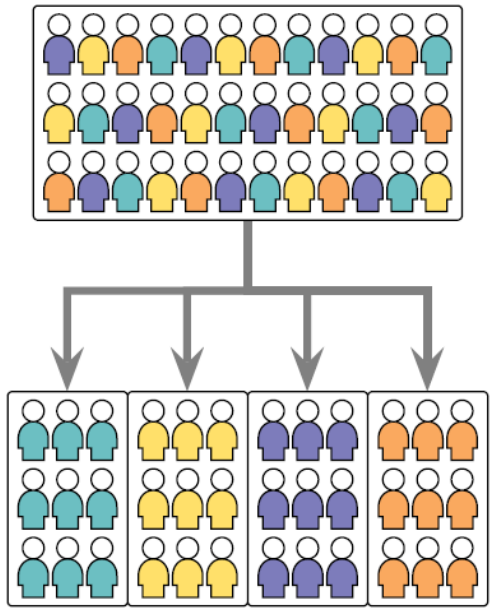
Dark personas

When designing you are completely focused on the actions and behaviors we want to foster and support.
But there will always be someone ready to use our service in **unexpected and unwanted ways**.



Tweet di @mollyclare

Data-portraits



Among the stakeholders, define different users groups and create portraits depicting their different perspectives.

1. BASED ON WHAT PEOPLE DO

Behaviour/ 'mode'

Use & Behaviour, e.g.
- Frequency
- Place
- Time
- Occasion
- Extent of use e.g. heavy, light
- Persistency e.g. loyal
- Channels used for contact

Lifestyle, e.g.
- Holidays taken abroad
- Multiple/holiday homes
- Lodgers/rental income
- What money is spent on

Media Consumption e.g.
- Internet and digital usage
- TV channels, radio, press
- Where most info comes from
- How information is absorbed
- What media engage them
- Access to media

2. BASED ON WHO PEOPLE ARE

Socio-demographic

Demographics, e.g.
- Gender
- Ethnicity
- Family
- Age and life stage
- Household type/ composition
- Education
- Income and social class
- Benefits claimants/non-claimants
- Working status
- Physical status
- Urban vs. rural
- Postcode & region
- Mobility
- Moving frequency
- House ownership

3. BASED ON HOW PEOPLE THINK AND FEEL

Attitudes

Needs, Benefits, Motivations, e.g.
- Need convenience, need reliability, need support etc.
- Beliefs, desires, wants
- Deep-seated drivers e.g. love, belonging, praise, security
- Loves & hates

Attitudes & Beliefs, e.g.
- In general
- Specific e.g. to our brands, services
- Balance between time, cost, convenience
- To value and money

Influencers e.g.
- Authority figures, e.g. accountants, solicitors, tax inspectors
- Parents, friends, peers
- Role models
- Community influences

4. A COMBINATION OF MANY FACTORS

Multi-factorial

Data portraits

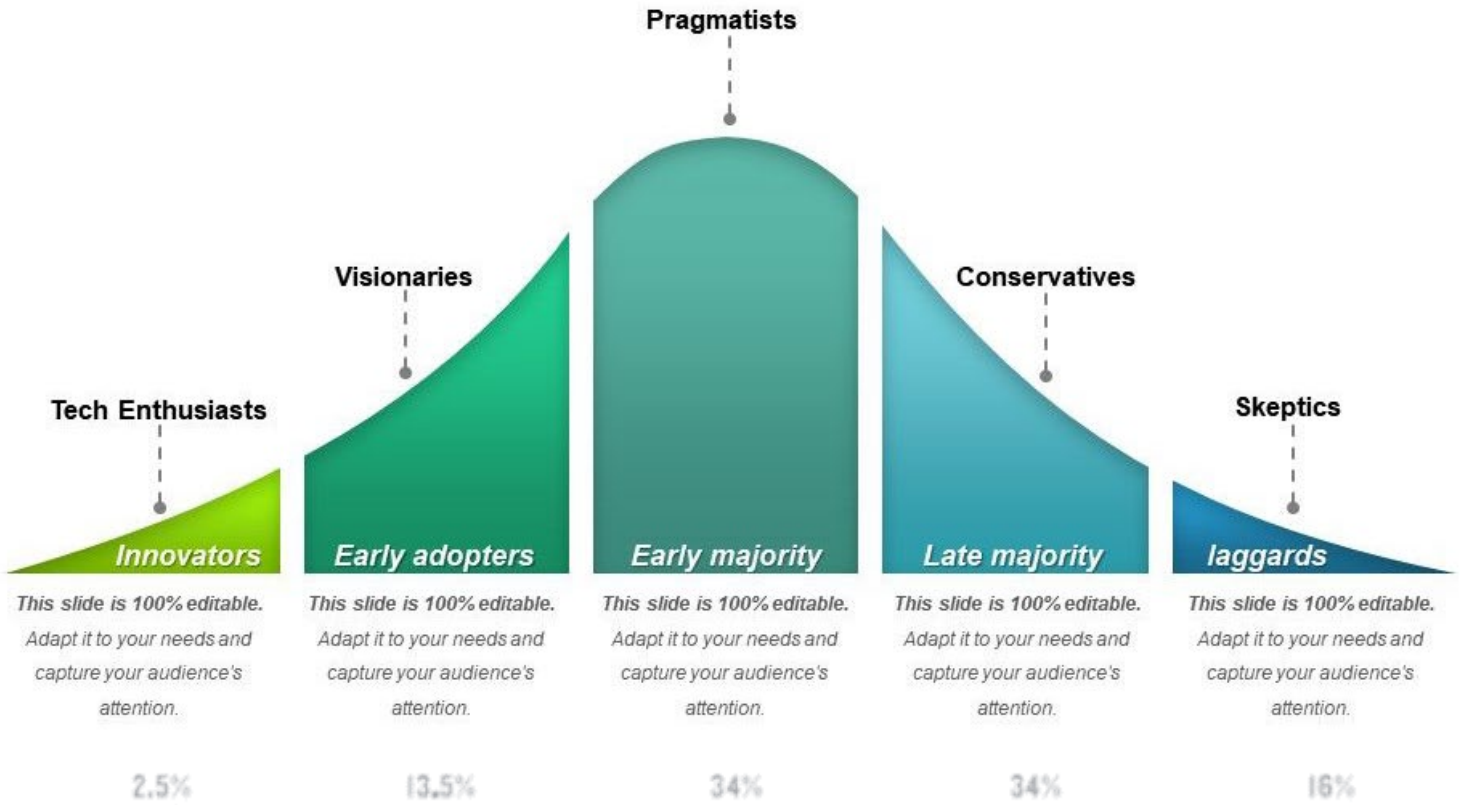
Aggregate multiple criteria:

Demographic criteria:
gender, age, education, marital status and family composition, income

Psychographic profiles:
attitudes, opinions, perceptions

Technological profiles:
level of confidence with technologies, technological consumption

Organisational/social Roles
According to the context

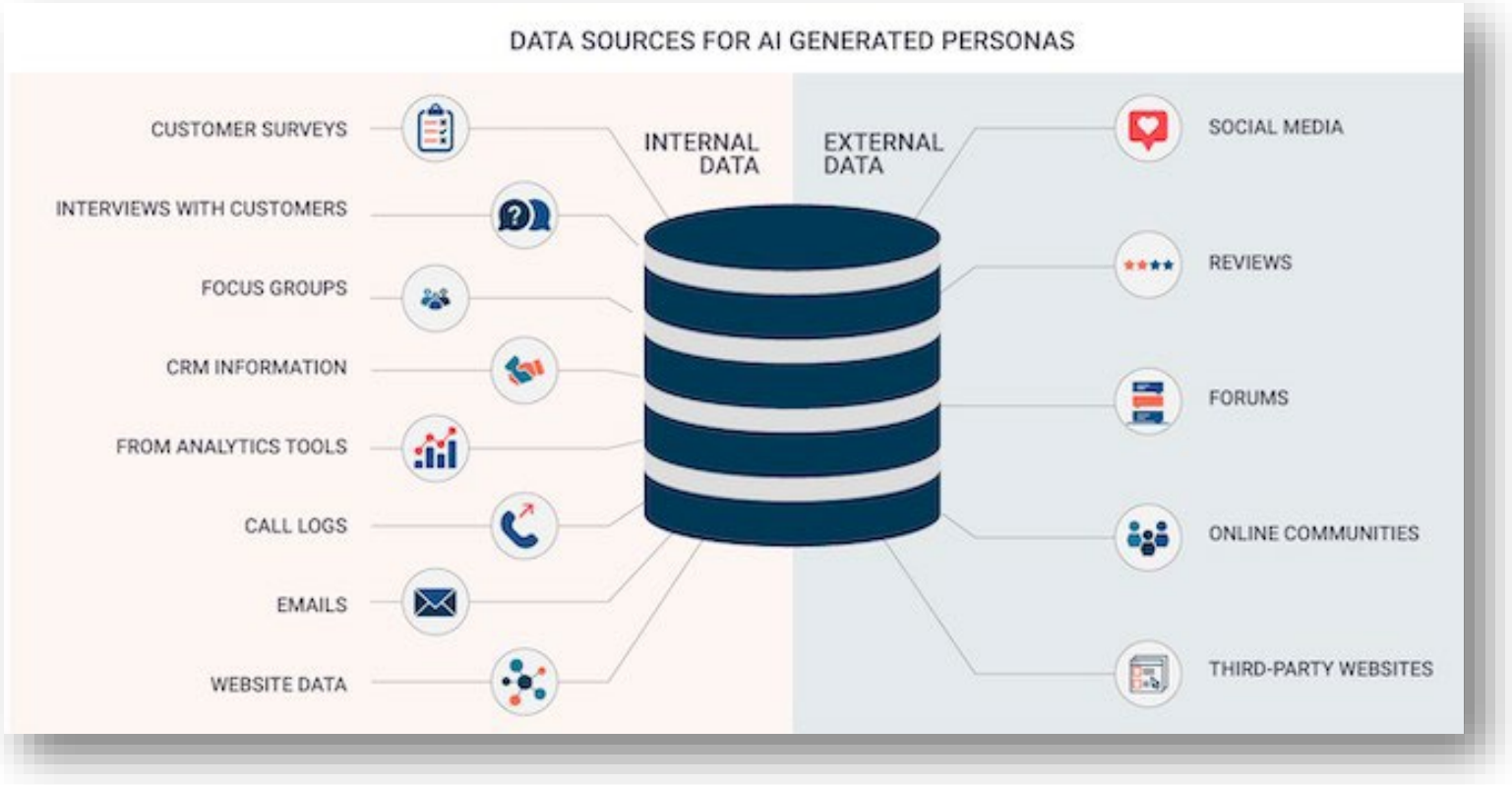


Maeli, J.P. The Rogers Adoption Curve & How You Spread New Ideas Throughout Culture, Medium, 2016

AI generated personas

There is no single way of creating and using personas, neither in literature nor in practice.
Usually, with the exception of pastiche personas, **personas are based on data and information collected about real people** by using **qualitative methods** such as ethnographic interviews, open-ended survey questions, or contextual inquiries and field studies.

In the last 15 years, a collection of **large amounts of quantitative data** (for example, from web analytics, social media, online customer data, and online surveys) together with machine learning techniques led to so-called **digital data-driven personas** (mainly used in marketing and customer research).
So-called **hybrid personas** are created by utilising quantitative data from online analytics and qualitative insights.

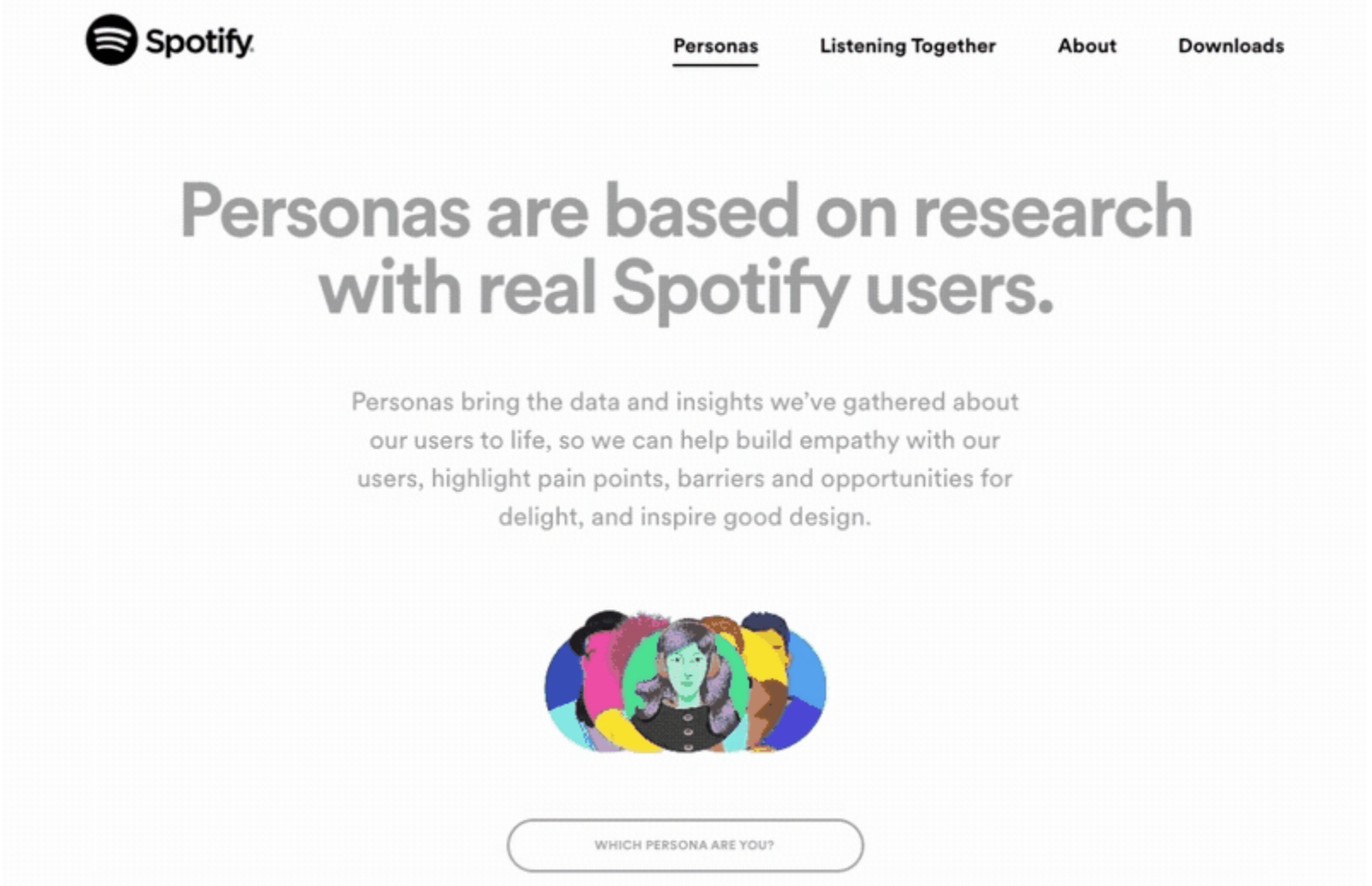


A. Holzinger, M. Kargl, B. Kipperer, P. Regitnig, M. Plass and H. Müller, "Personas for Artificial Intelligence (AI) an Open Source Toolbox," in *IEEE Access*, vol. 10, pp. 23732-23747, 2022

Case study

Phase 1 (2017)

Phase 2 (2018)

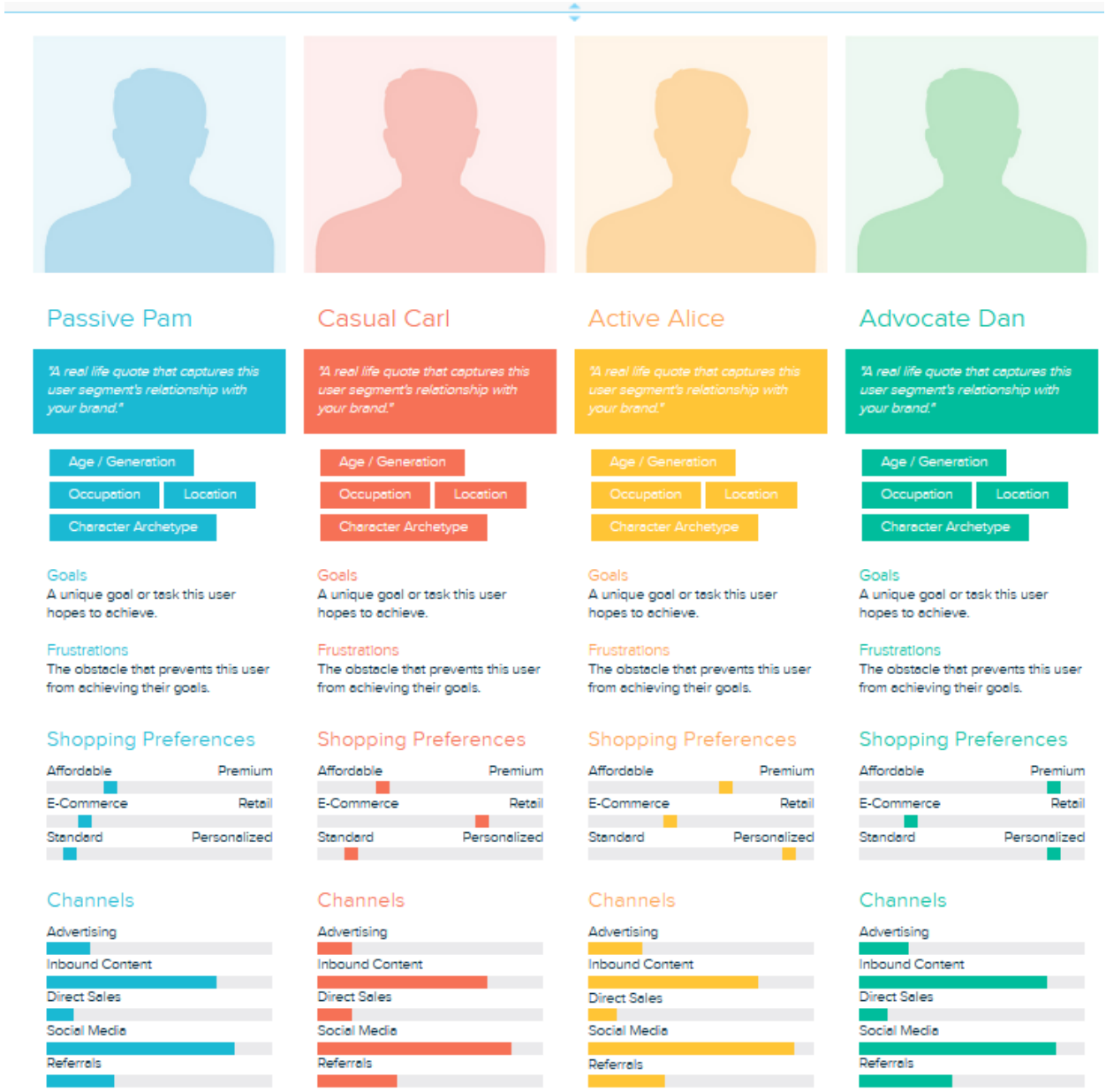


[The Story of Spotify Personas]

User personas comparison . Collection

1. Use Personas with your team members or clients to **deepen your user segments**.

2. Visually compare the user profiles created.

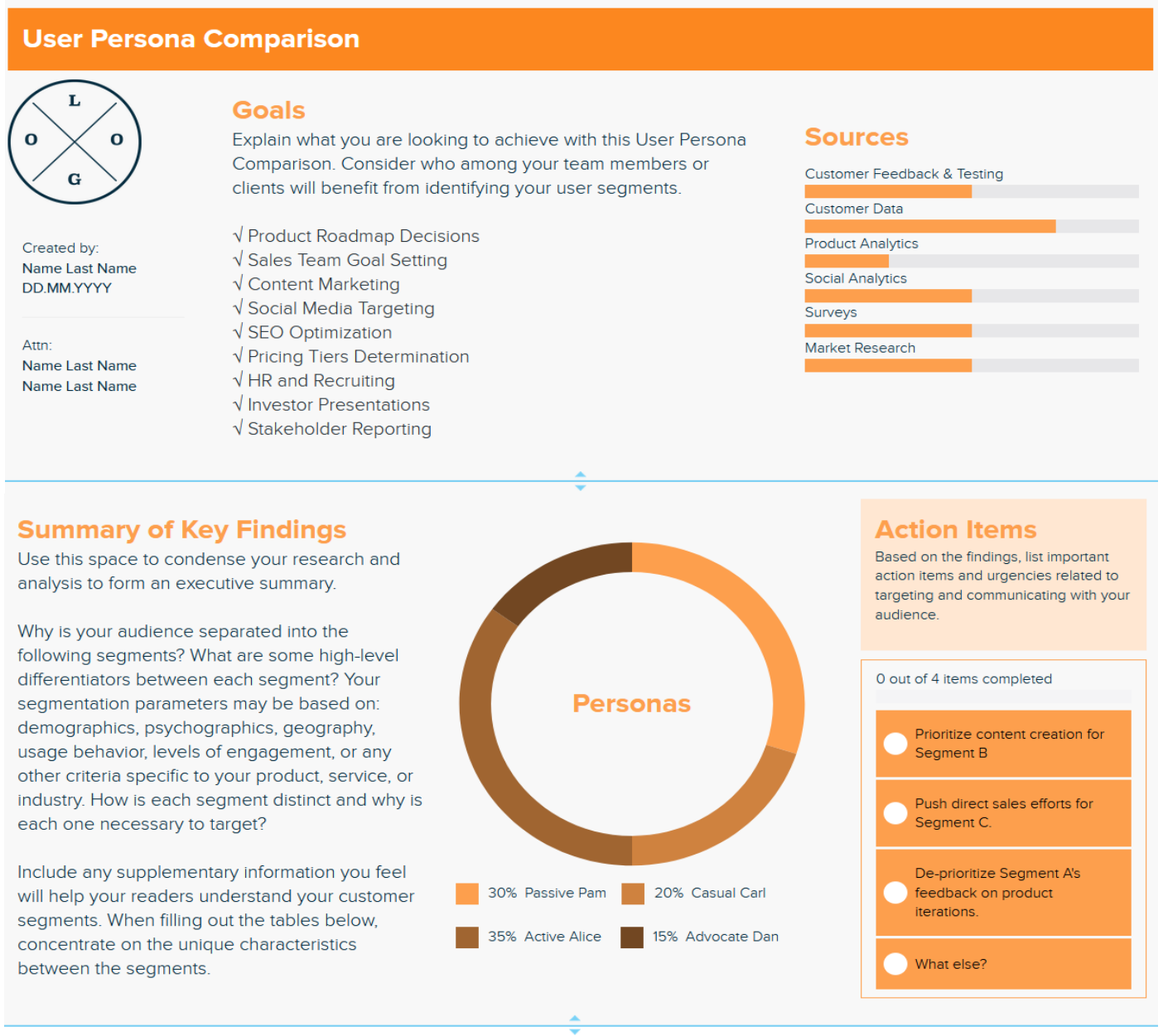


[User Persona Comparison template](#)

User personas comparison . Table

1. Use Personas with your team members or clients to **deepen your user segments**.

2. Condense your research and analysis to form an **executive summary,** highlighting the unique characteristics between the segments.



User Persona Comparison template

Create your personas

1. Synthese the data you've collected from different sources
2. Identify the emerging archetypes
3. Fill in the Personas portraits (one per archetype)
4. Refine it with additional data you may collect during the process-

Focus on data →

Contacts

Antonella Frisiello
. Researcher in Digital Ergonomics [LINKS Foundation]
. Adjunct Professor [Politecnico di Torino]

antonella.frisiello@polito.it