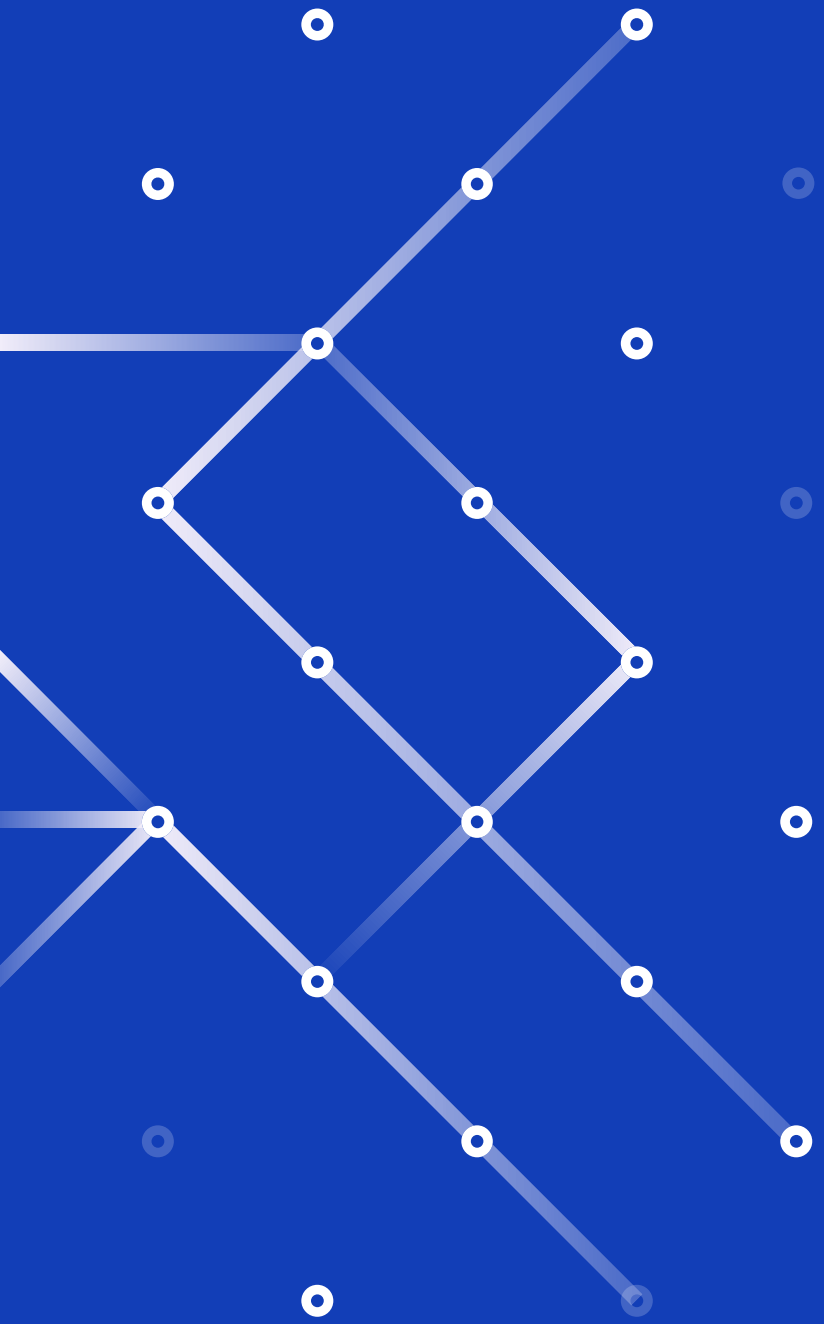


TNO innovation for life

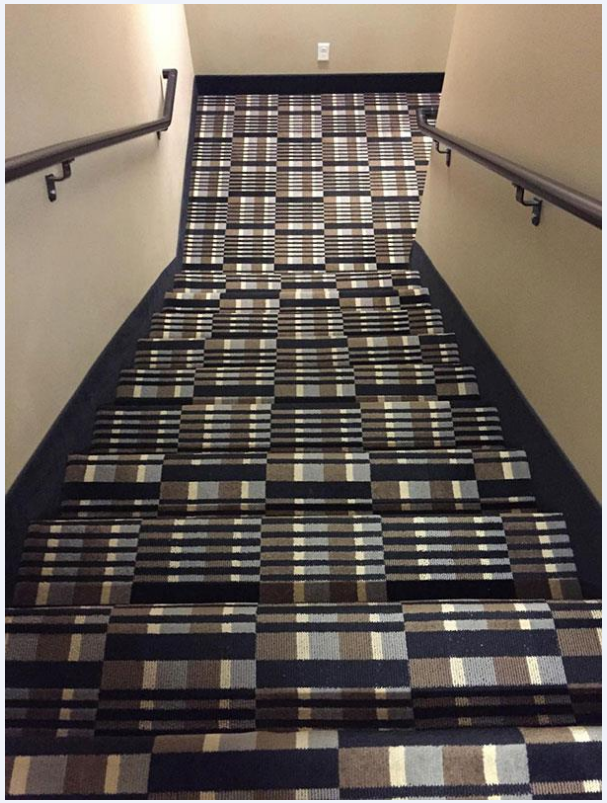
Human-centered design

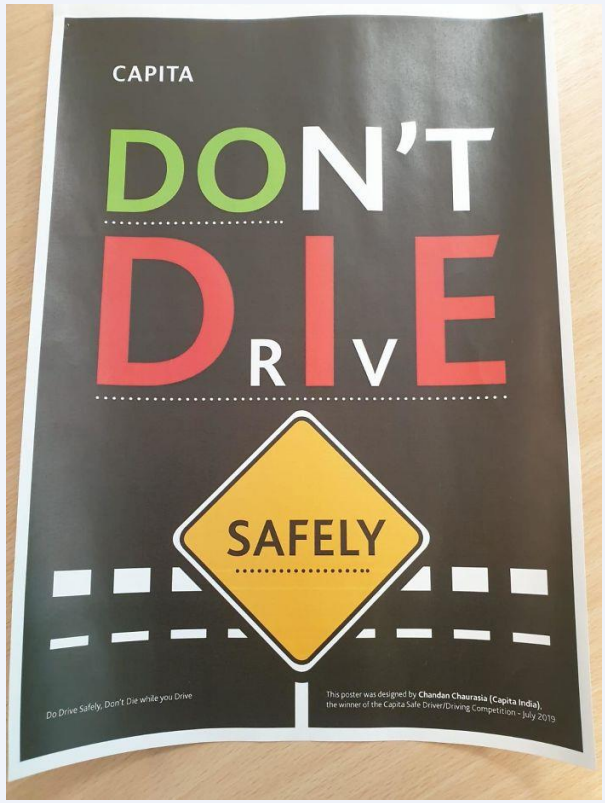
For trustworthy decision-support systems

Tjeerd Schoonderwoerd

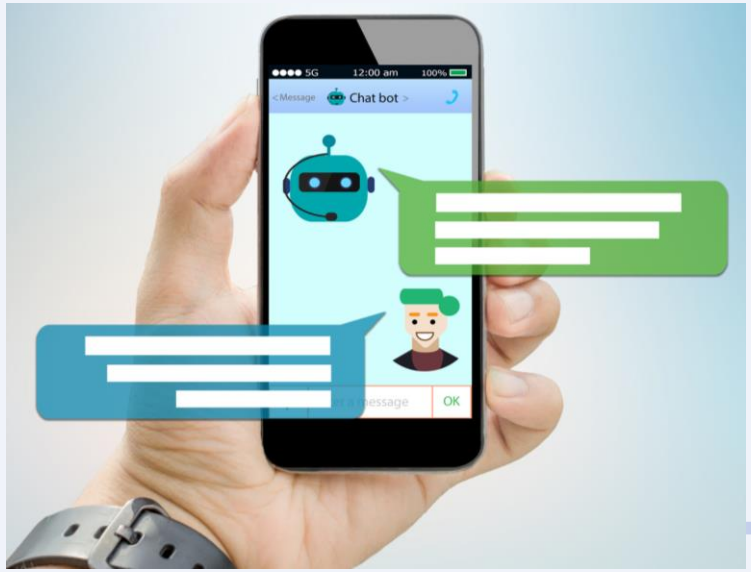
tjeerd.schoonderwoerd@tno.nl

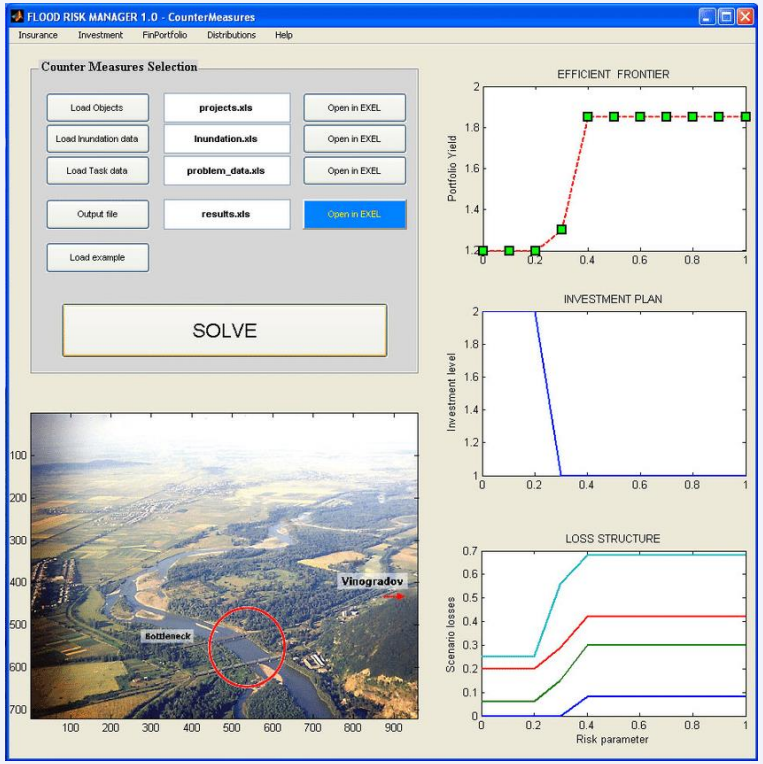
Design examples





More design examples





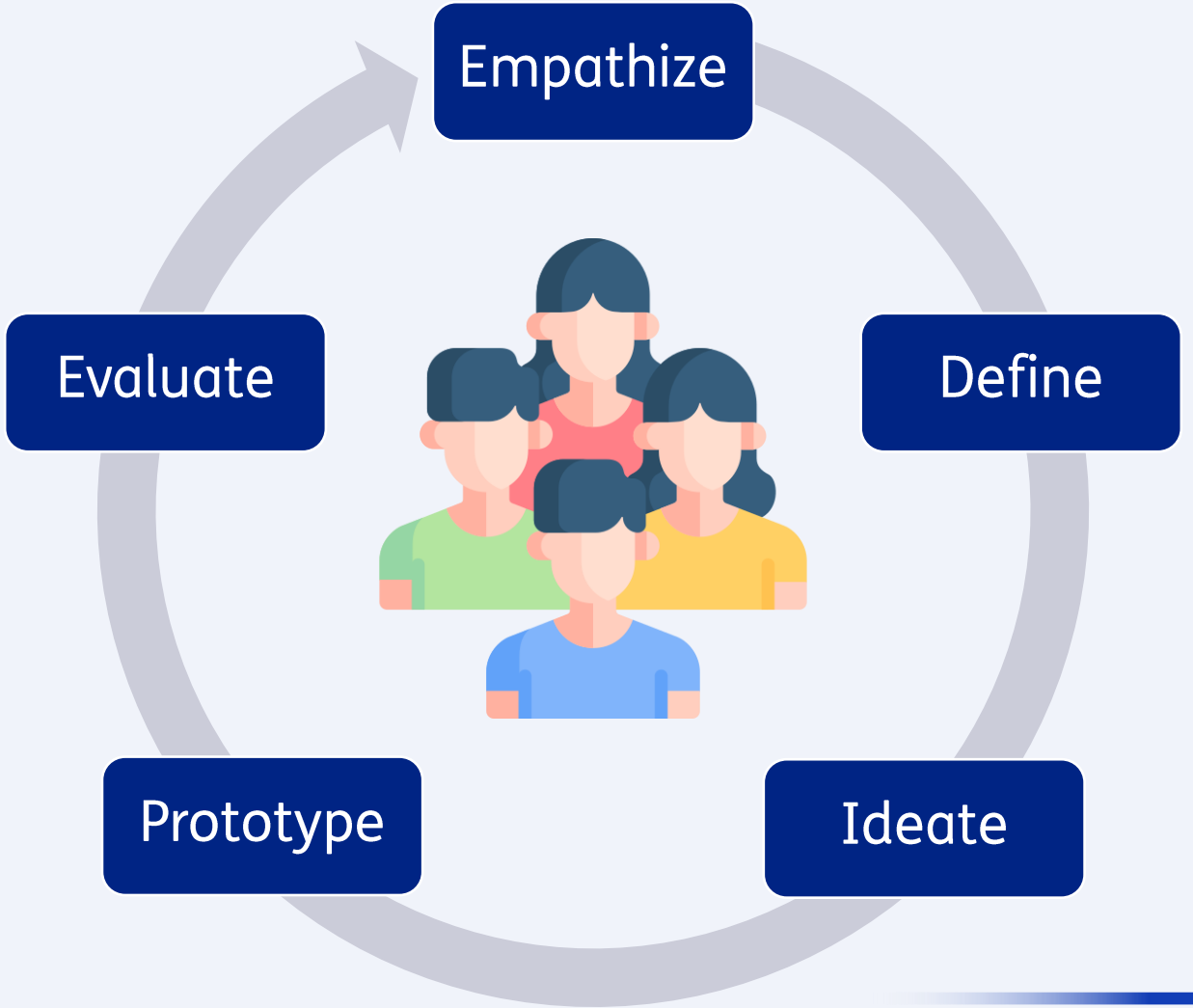
Take-home message

“In the end, designing is all about people.

Therefore, it should be about people

from the very beginning.”

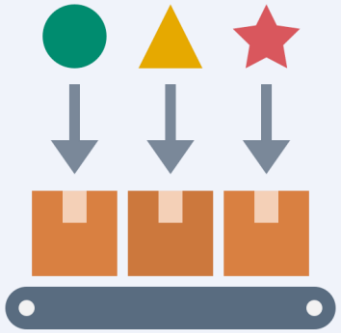
Human-centered design



Human-centered requirements analysis

Research

Collaboration



Cognitive

Behavioural

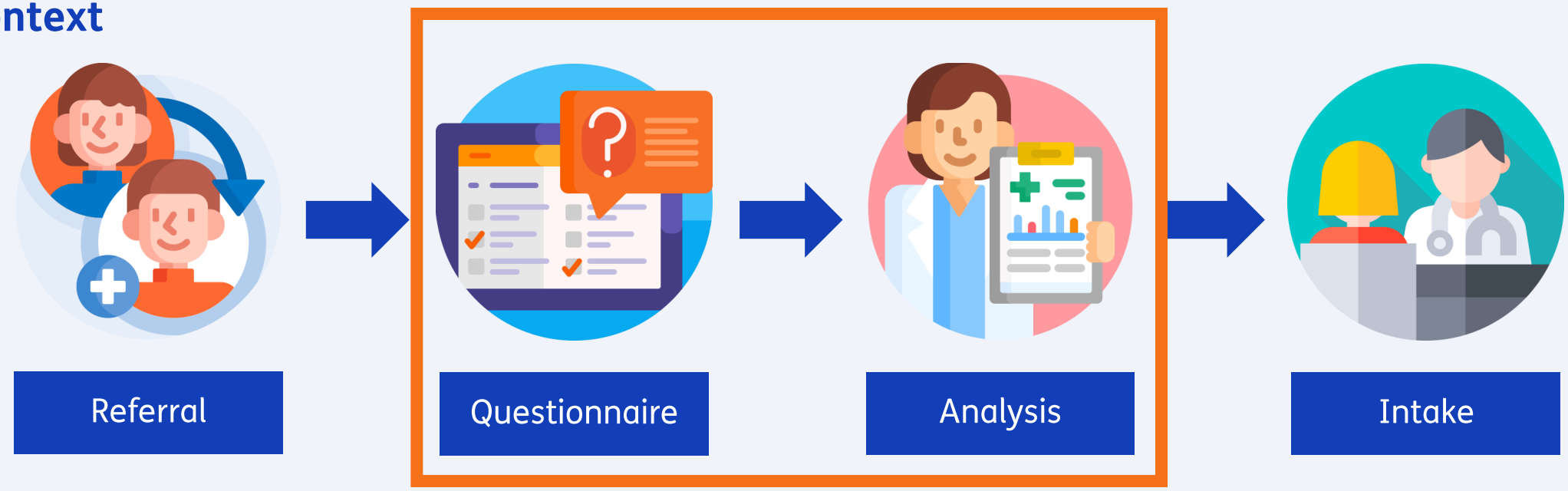
Creativity

Clinical decision-support

Goal

- Explore the added value of a decision-support system for clinicians working in youth psychiatry.

Context



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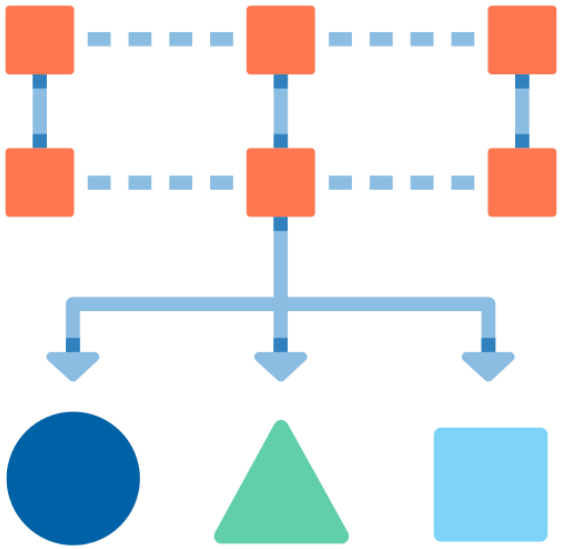
Clinical decision-support



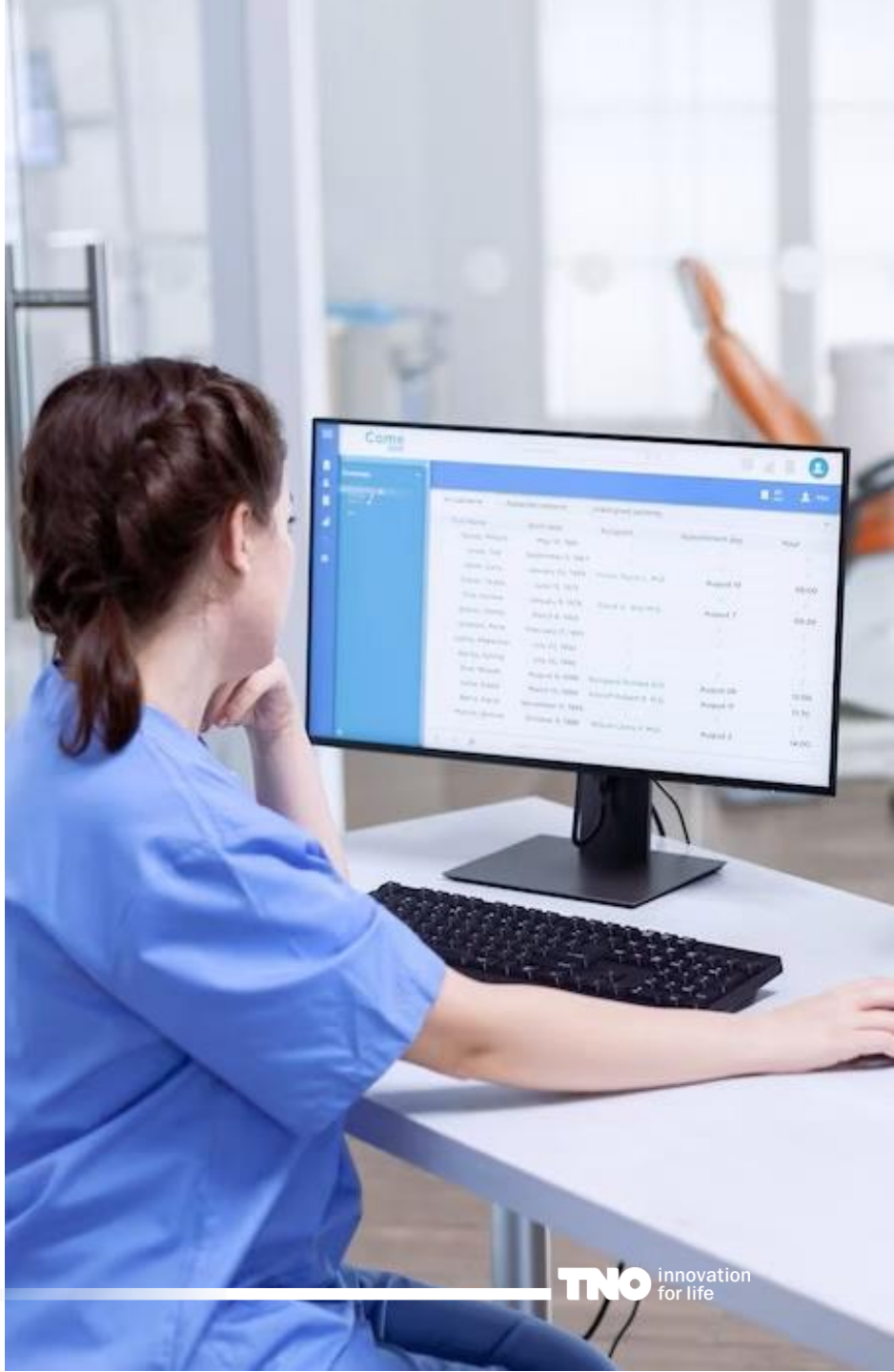
Patient data

↓

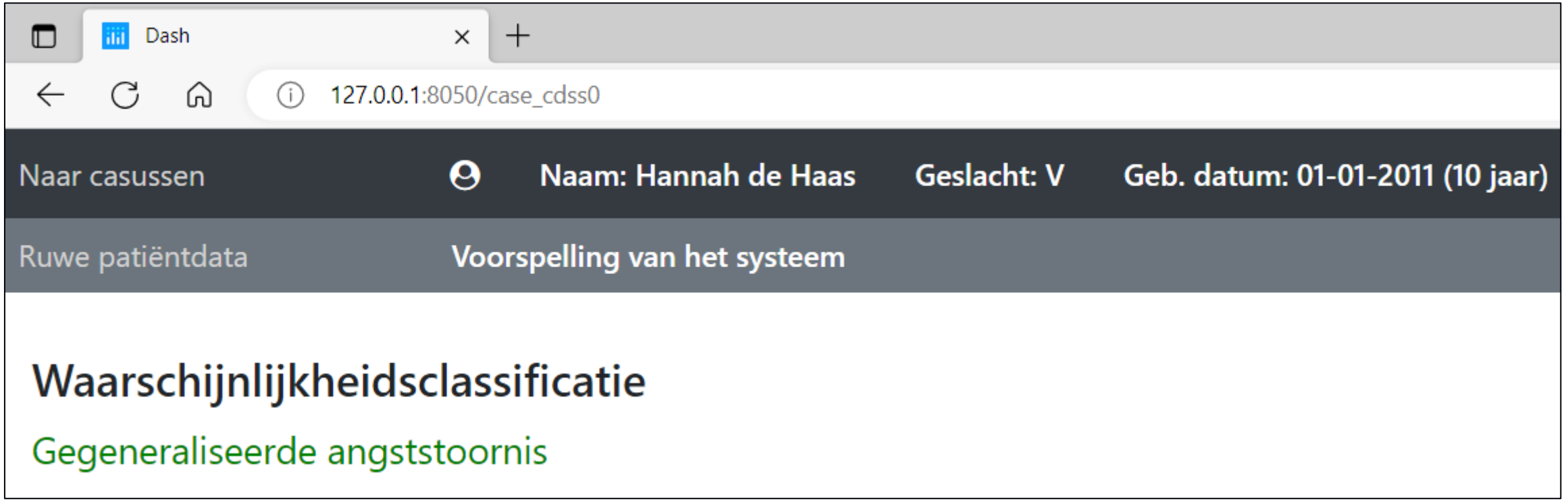
Model

↓

Classification



Clinical decision-support



* Shown patient data (incl. names) are fictitious

Empathize & Define

It's not about classification

- Identify potential problem areas
- Collect evidence
- Differential diagnoses
- Case-based comparison
- System-related: certainty, performance

How to support these tasks by
combining the strengths of AI and humans?

Ideation:
From tasks to system functions

User task	System function
Identify potential problem areas	Classification algorithm
Collect and evaluate evidence	Feature importance (XAI)
Differential diagnoses	Classification hierarchy
Case-based comparison	Example-based explanations
Understand certainty of system outcome	Interpretable Confidence Measure (ICM)
Estimate trustworthiness of the outcome	Context-specific performance metrics

Schoonderwoerd, T. A., Jorritsma, W., Neerincx, M. A., & Van Den Bosch, K. (2021). Human-centered XAI: Developing design patterns for explanations of clinical decision support systems. *International Journal of Human-Computer Studies*, *154*, 102684.

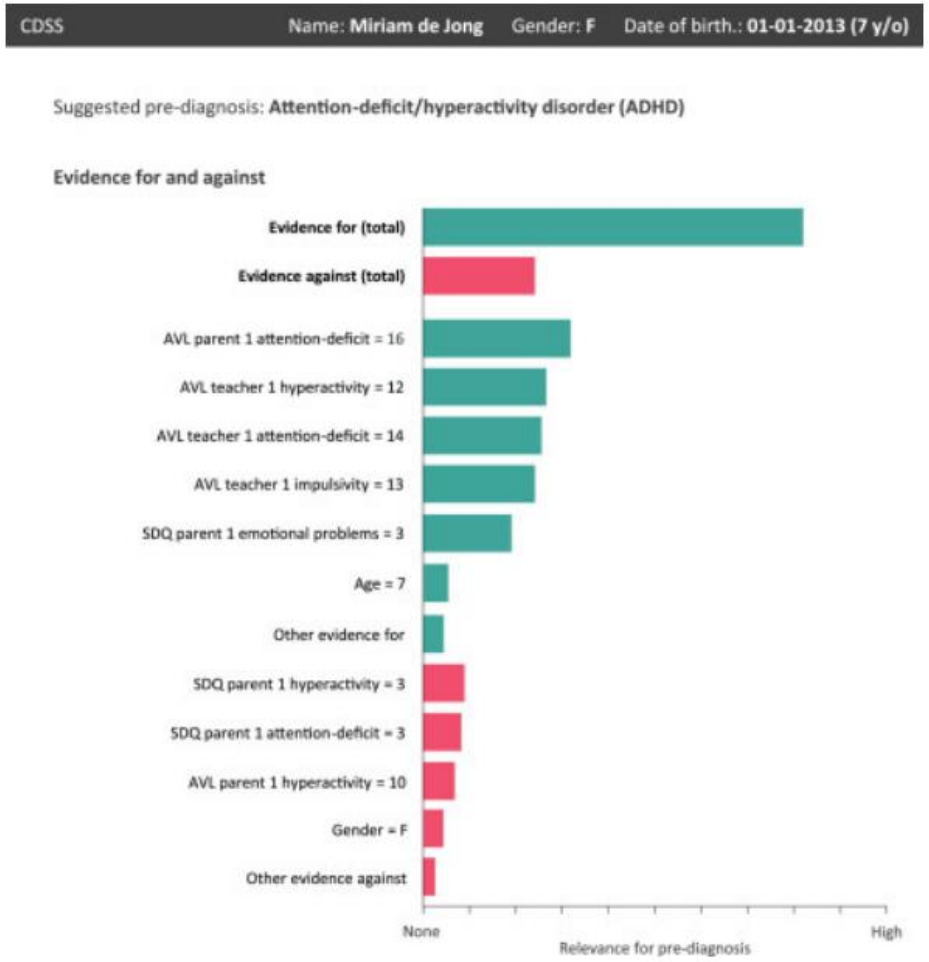
van der Waa, J., Schoonderwoerd, T., van Diggelen, J., & Neerincx, M. (2020). Interpretable confidence measures for decision support systems. *International Journal of Human-Computer Studies*, *144*, 102493.

Design patterns

- General and reusable solutions to commonly occurring problems within a given context.
- Patterns for conveying and interacting with information that supports a decision-making process.

Example problem

- A decision maker wants to understand the reasoning of the AI system to arrive at a particular outcome.



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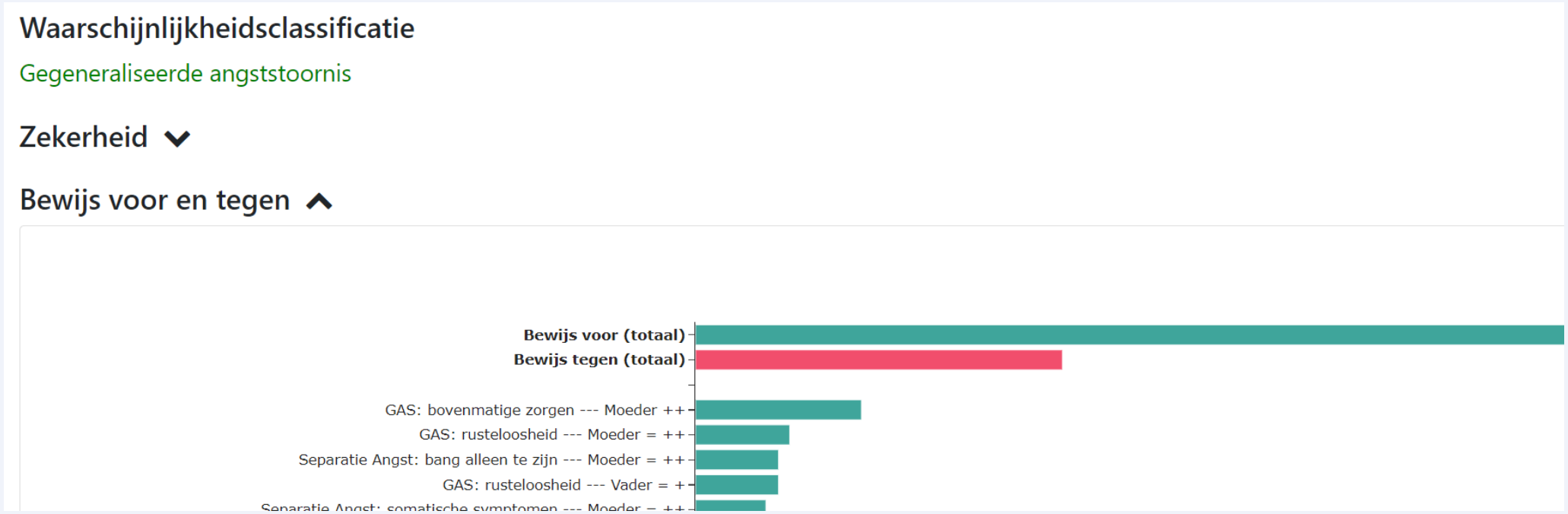
Design pattern prototype

Feature importance



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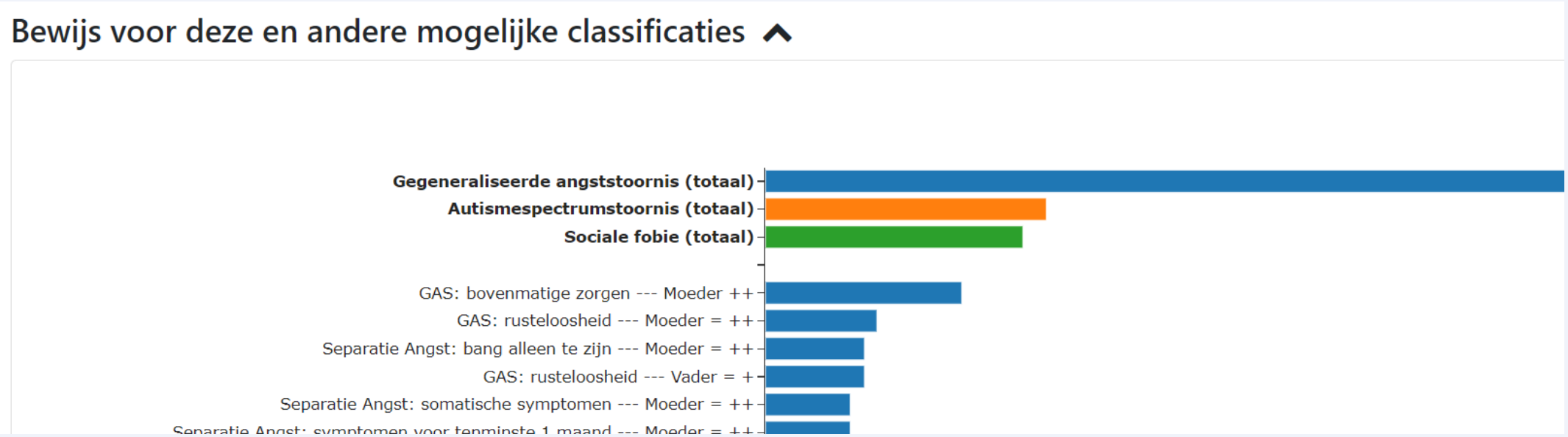
Design pattern prototype

Classification hierarchy



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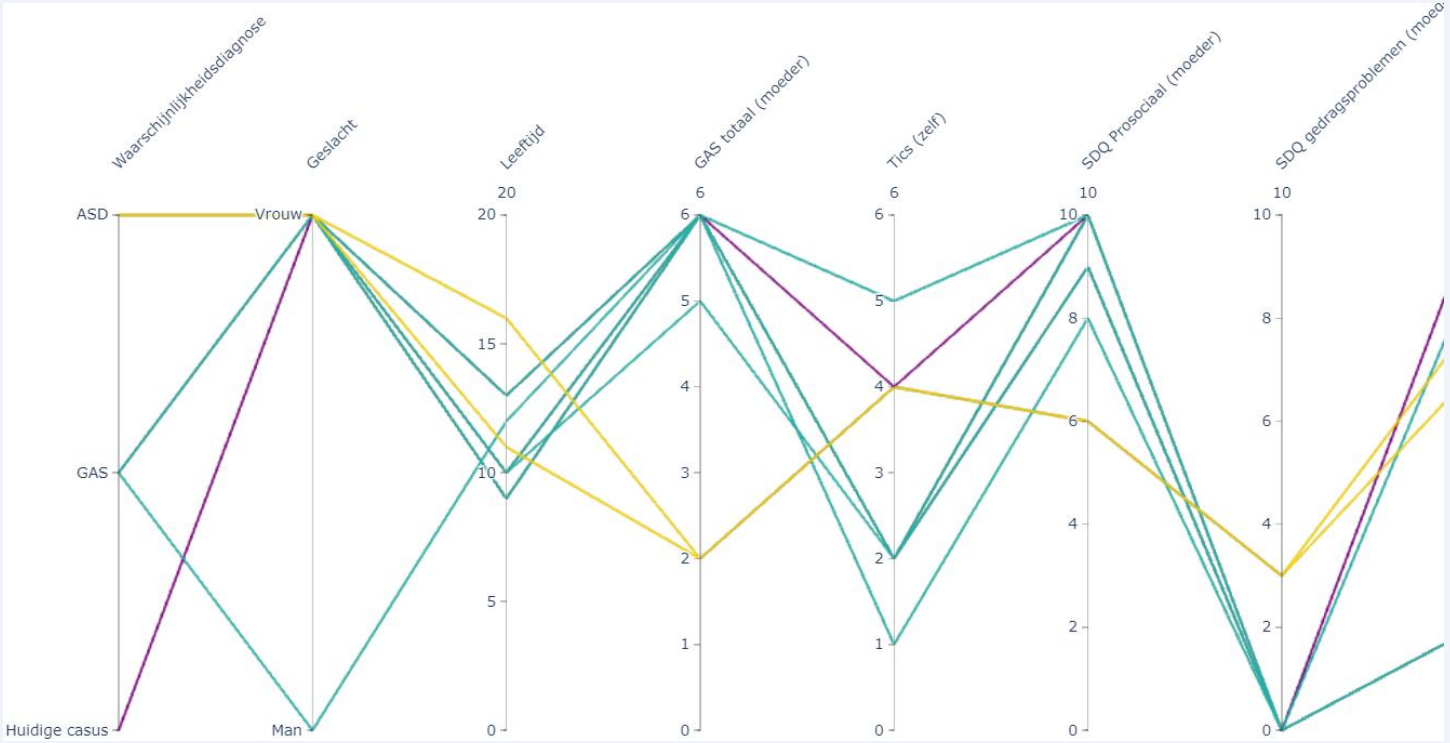
Design pattern prototype

Example-based explanations



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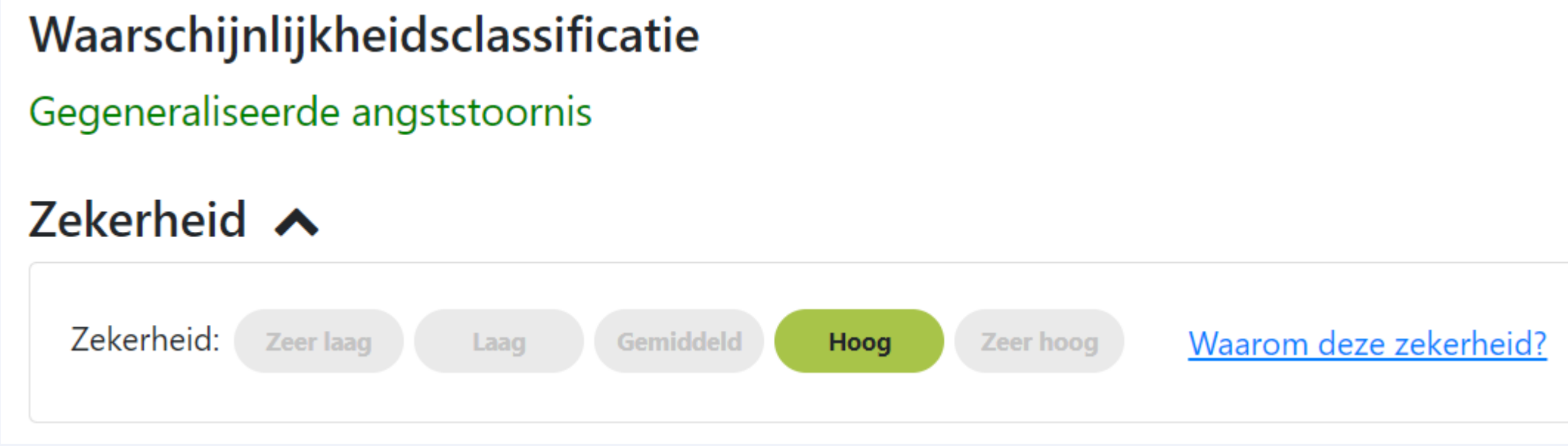
Design pattern prototype

Interpretable Confidence Measure



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Design pattern prototype

Context-specific performance metrics

CDSS prestatie

De prestatie van het systeem voor deze waarschijnlijkheidsclassificatie op de validatie dataset (10.000 casussen)

Sensitiviteit: **94%** Specificiteit: **86%**

		Gouden standaard	
		Gegeneraliseerde angststoornis	Anders
CDSS suggestie	Gegeneraliseerde angststoornis	True positive: 900 (9%)	False positive: 1310 (13%)
	Anders	False negative: 55 (1%)	True negative: 7735 (77%)

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Prototype evaluation

- Most information was highly valued
- Better informed decision-making
- Broadened perspective on case
- Understandable system outcomes
- Helps to align trust in the system
- Increased congruency between clinicians

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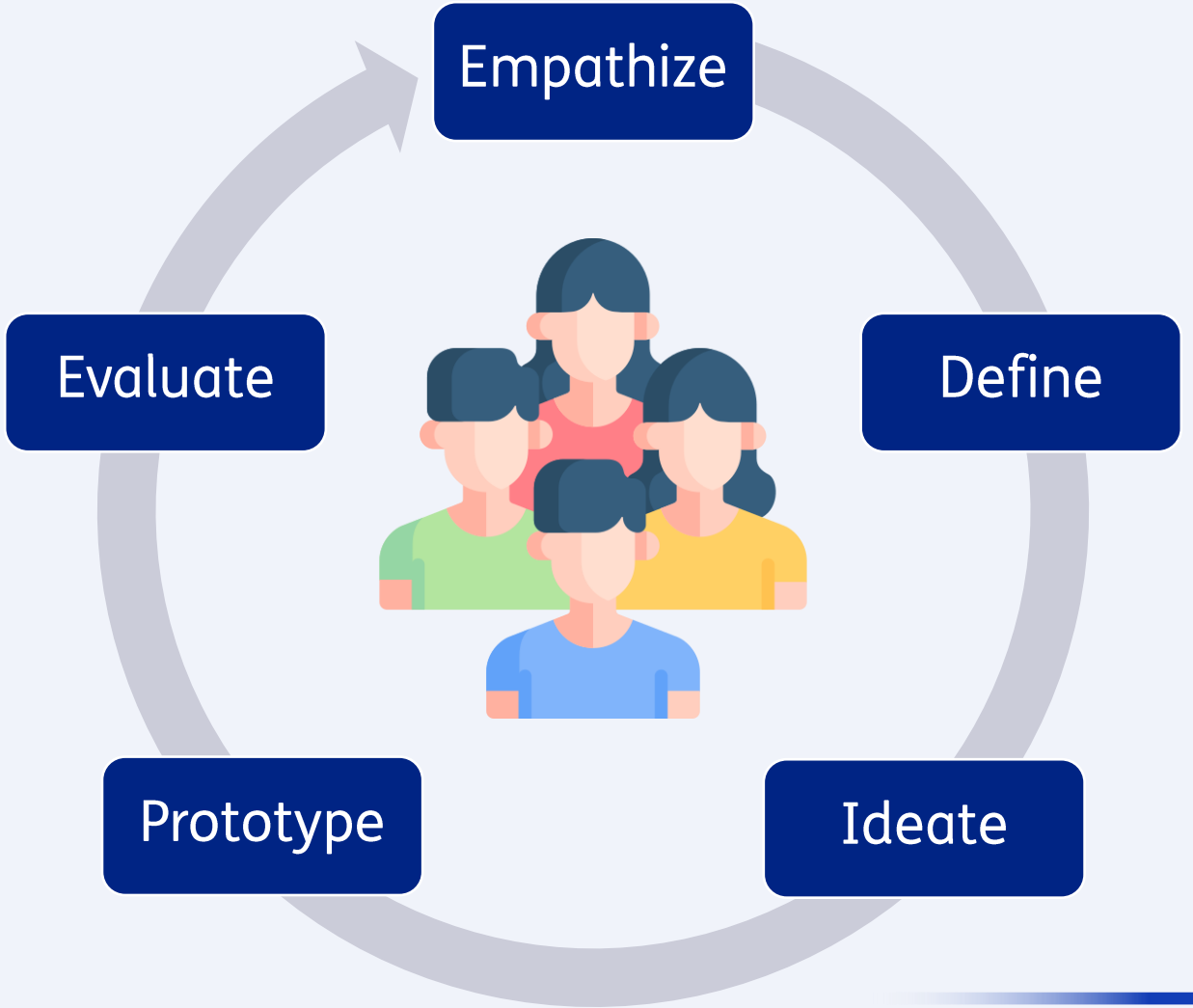
Human-centered design



Take-home message

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Thank you for your attention!

Tjeerd Schoonderwoerd | TNO