


A Logic-based Model for the Detection of Fixation Bias

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September 26, 2025

Context

- Decision-making[a]
- Human error in sensitive fields
- Cognitive biases[b]

[a] Croskerry, 2009
[b] Saposnik et al., 2016

Medical errors are today one of the **leading** causes of mortality[a], of which 75% are estimated to be related to **cognitive errors**[b].

[a] Makary and Daniel, 2016
[b] Graber et al., 2024

Frame

Diagnostiquer les biais cognitifs, 2020.
Valentin Fouillard, Safouan Taha, Nicolas Sabouret, Frédéric Boulanger

- A post-hoc diagnostic model
- The challenge of monitoring: detecting an inconsistent action as early as possible

- IDEFIX ANR Project
- Fixation bias

Methodology

Objective of the model

Represent and monitor an agent in its environment, with a focus on:

- The agent's actions
- The state of the world
- A set of reasoning rules

Methodology: Conceptualization

Data Processing: Symbolic values

Model Expressiveness:

- Time, durations
- Action conditions[1]
- Desires
- Types of action

Bias Detection:
Incoherent action according to reasoning rules and world state

[1] Barot, Lenne and Lourdeaux, 2014

Methodology: Conceptualization

Data Processing: Symbolic values

Model Expressiveness:

- Time, durations
  - Action durations
  - Observation durations
  - Order of events
- Action conditions[1]
- Desires
- Types of action

Bias Detection:
Incoherent action according to reasoning rules and world state

[1] Barot, Lenne and Lourdeaux, 2014

Methodology: Conceptualization

Data Processing: Symbolic values

Model Expressiveness:

- Time, durations
- Action conditions[1]
  - Nomological
  - Regulatory
  - Contextual
  - Favorable
- Desires
- Types of action

Bias Detection:
Incoherent action according to reasoning rules and world state

[1] Barot, Lenne and Lourdeaux, 2014

Methodology: Conceptualization

Data Processing: Symbolic values

Model Expressiveness:

- Time, durations
- Action conditions[1]
- Desires
  - Example:
    [Patient survival $>$ Patient recovery $>$ Patient relief]
- Types of action

Bias Detection:
Incoherent action according to reasoning rules and world state

[1] Barot, Lenne and Lourdeaux, 2014

Methodology: Conceptualization

Data Processing: Symbolic values

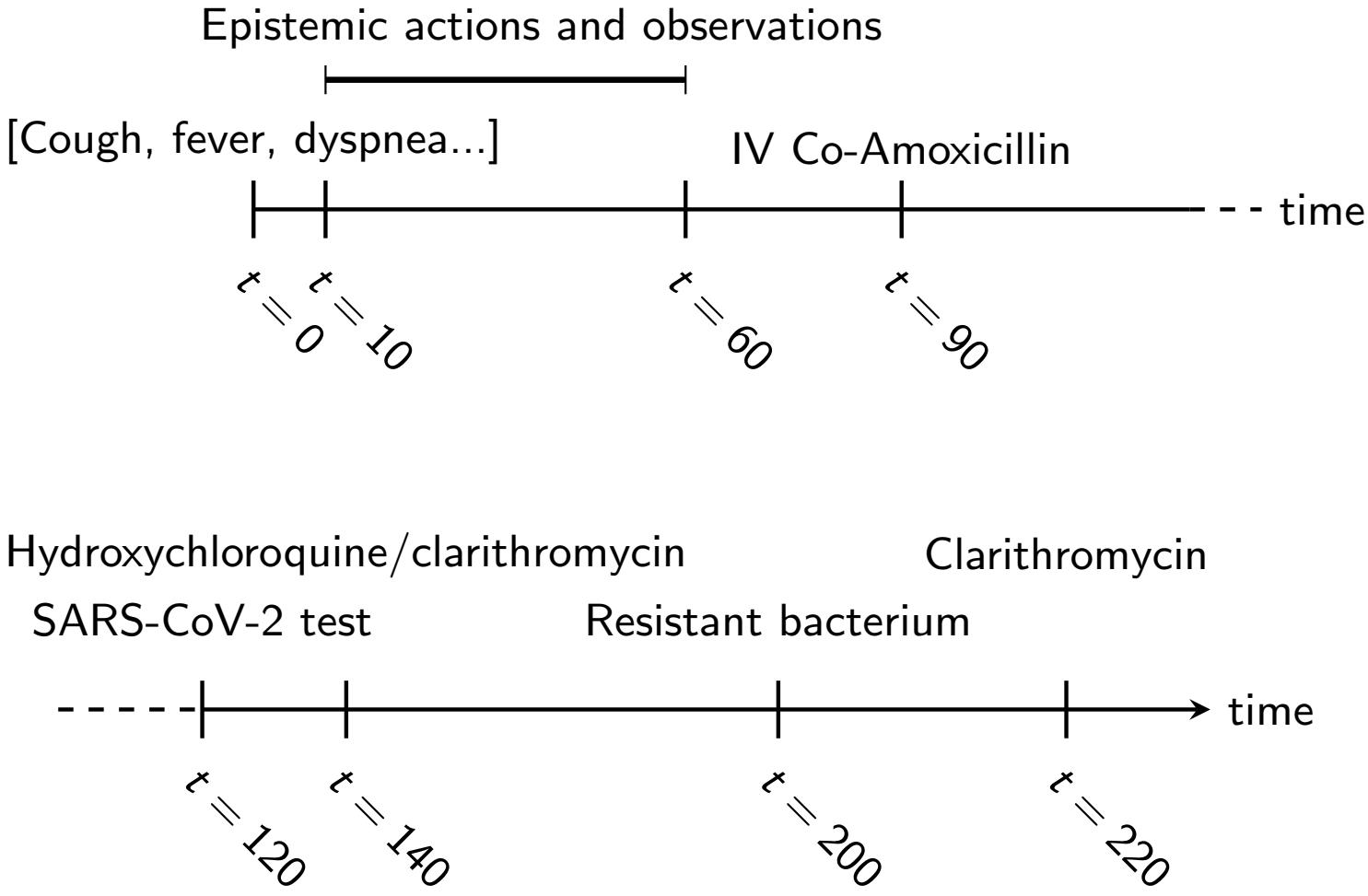
Model Expressiveness:

- Time, durations
- Action conditions[1]
- Desires
- Types of action
  - Epistemic actions
  - Pragmatic actions

Bias Detection:
Incoherent action according to reasoning rules and world state

[1] Barot, Lenne and Lourdeaux, 2014

Methodology: Test Scenario [2]



[2] Bertaux, Alameda, Tataw and Kenfak, 2020

Solution

Structure with two vectors evolving in parallel:

- A vector ϕ of physical possibilities
- A vector ψ of psychological belief distributions

Observations modify the weights associated with the diagnostics ϕ, actions modify the weights associated with the diagnostics ψ.

Association dictionaries

- Between action/observation, diagnosis, and weight

Fixation bias detection

- Deviation δ_D between the vectors over a duration δ_T

Results

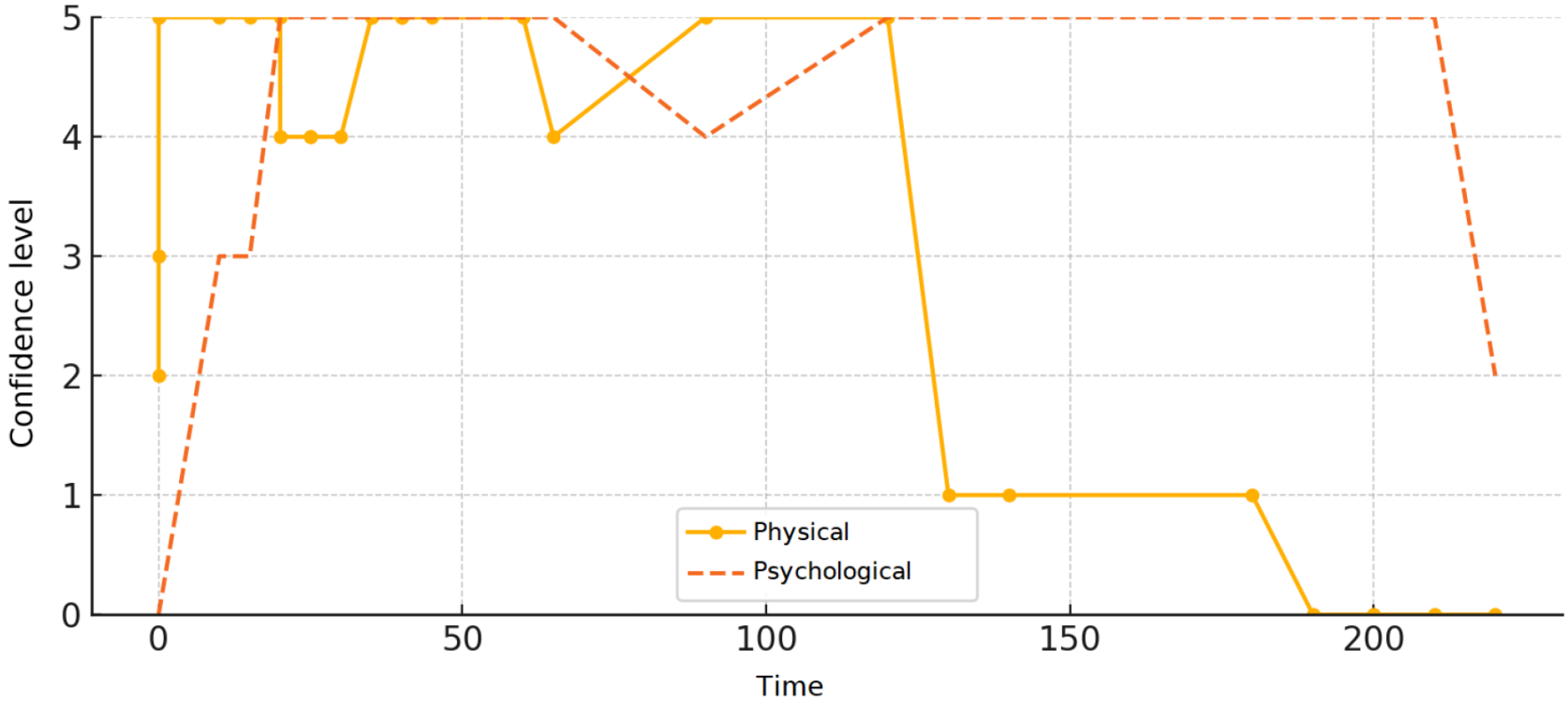


Figure: Evolution of the weights associated with the “covid” diagnosis in the physical and psychological vectors

Results

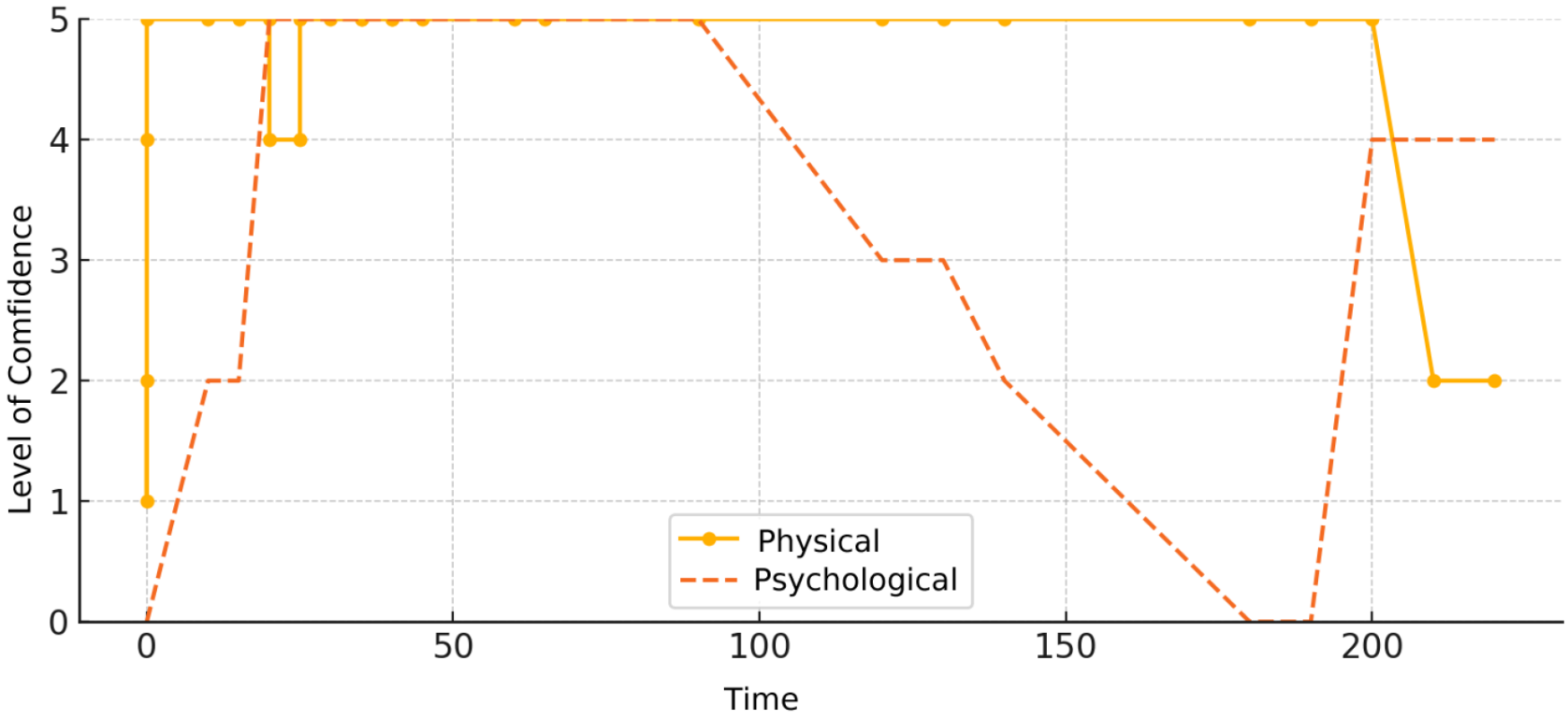


Figure: Evolution of the weights associated with the "Pneumonia 1" diagnosis in the physical and psychological vectors

Results

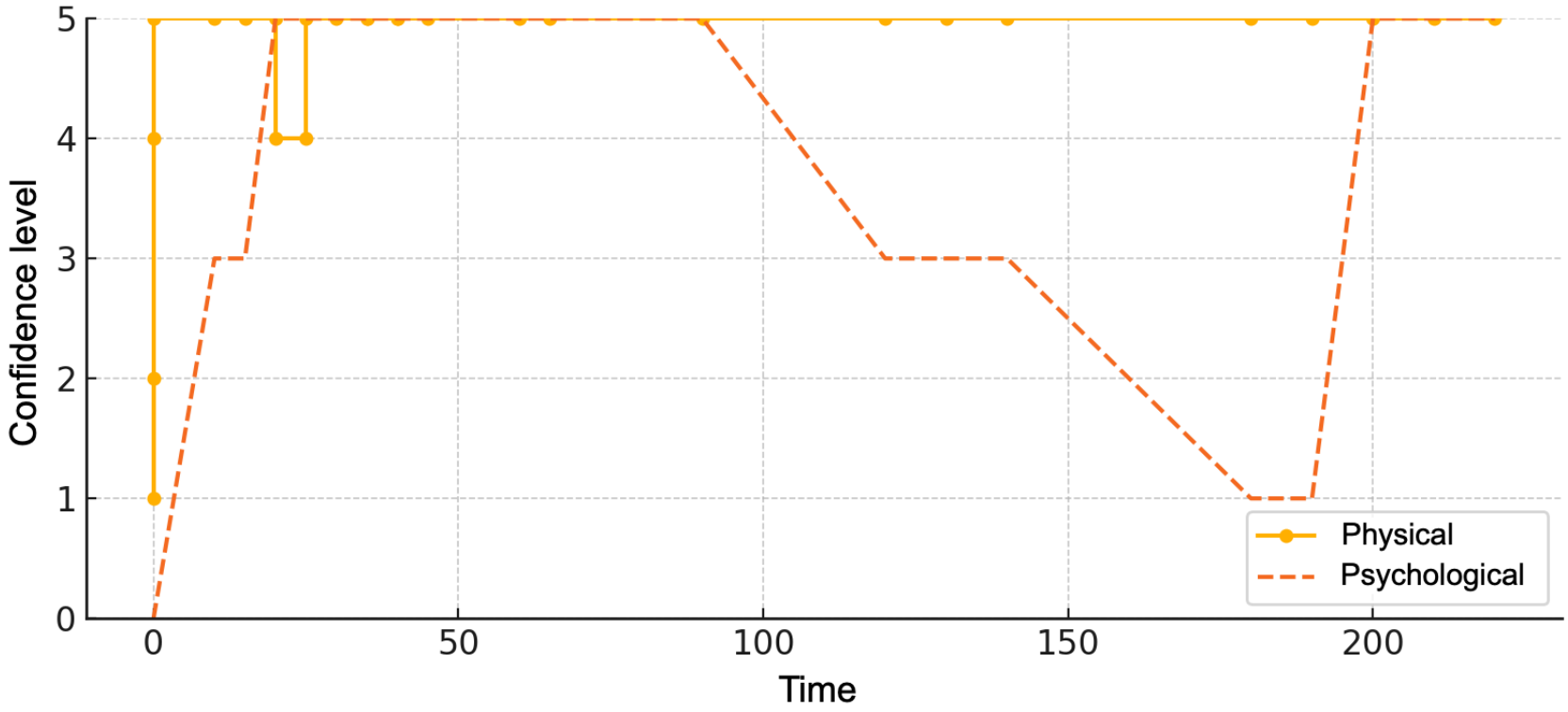


Figure: Evolution of the weights associated with the "Pneumonia 2" diagnosis in the physical and psychological vectors

Critical Analysis

- When to raise an alert?
- Parameters: time window and weight difference
- Risk of error and desensitization
- Next steps:
  - Implementation of action types and durations, conditions...

Thank you for your attention.
Any questions ?

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Projet ANR IDEFIX, (2024).