

Modelling of Personality in Agents

From Psychology to Logical Formalisation and Implementation

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Motivation and Problem

This work aims to motivate the impact of **personality** on essential elements of the behaviour of agents (e.g. **decision-making processes**, emotions, moods, or coping strategies). We show that available works on agent behaviour and works that investigate the nature of emotions are somewhat disconnected and that bridging this gap is able to further our efforts in conceptualising **human behaviour** in software agents. We argue that such a connection requires a formalisation that specifies the concept of personality and the concept of decision-making processes jointly.

Personality

Human factor psychology describes a human's personality by means of traits or types, which are characteristic features of human beings that can be used to explain a human's behaviour and motives. Although there are different theories about personality, we have shown [1] that the *Five-Factor Model* [2] (FFM) is the theory that psychologists commonly favour as a conceptual framework. FFM describes personality along five dimensions, which are openness, conscientiousness, extraversion, agreeableness and neuroticism.

Personality and Logic

- Available works on personality in agent-based systems concentrate on the engineering perspective
- Formalism is required due to on-going discussion between psychologists, about the existence and definition of personality traits that all too often leading to subjective explanations of fundamental terms
- To satisfy the requirement of having clear definitions and semantics we started to include the concept of personality into an established and formalised agent-behaviour concept, namely *Belief Desire Intention logics*, (or short, *BDI logics*)
- Approach is based on the '*Logic Of Rational Agents*', a multi-modal, branching-time logic of Belief, Desire, and Intention [3, pp. 69]
- Minimally extended the syntax and semantics of *LORA* by introducing a new modal connectivity, representing the personality of an agent
- Personality of each agent is given by the personality modality *Per*, which, for itself, is characterised using the following function:

$$\mathcal{P} : D_{Ag} \rightarrow \wp(W \times T \times W).$$

- Personality-accessibility relation, i.e. that it can be used to determine the set of worlds that is accessible for an agent giving a specific situation

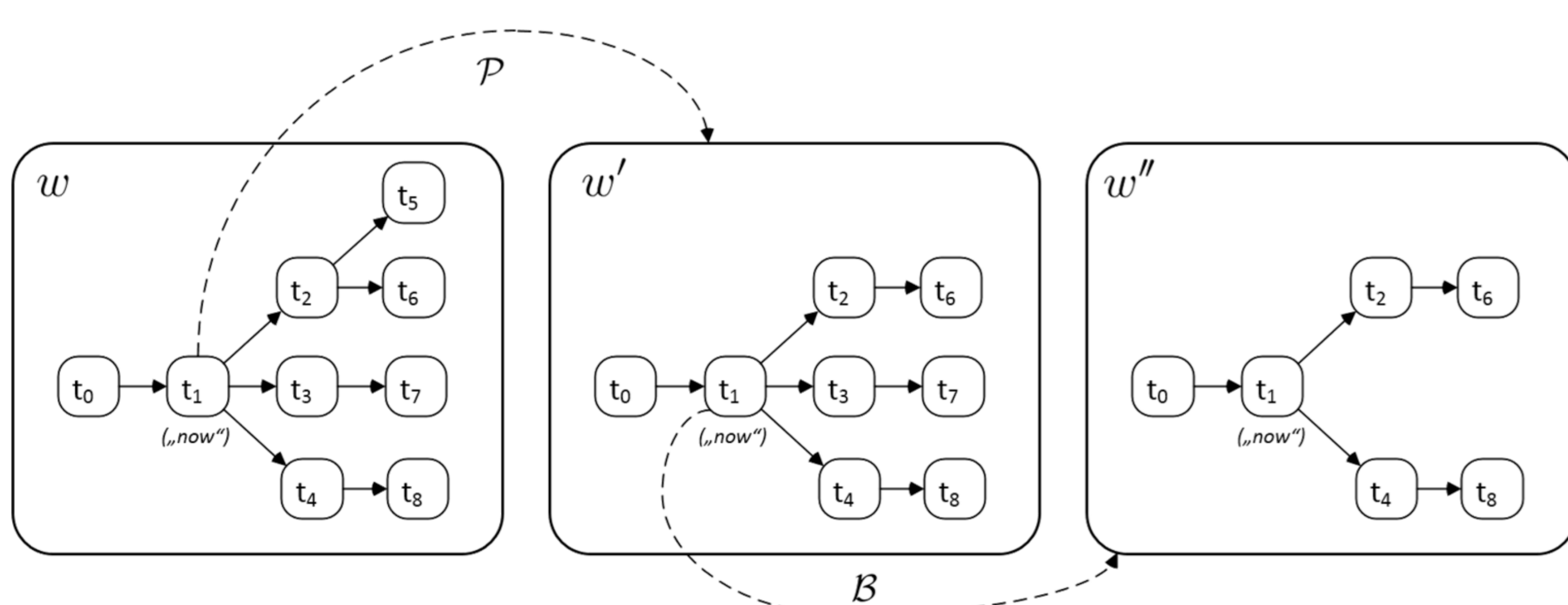
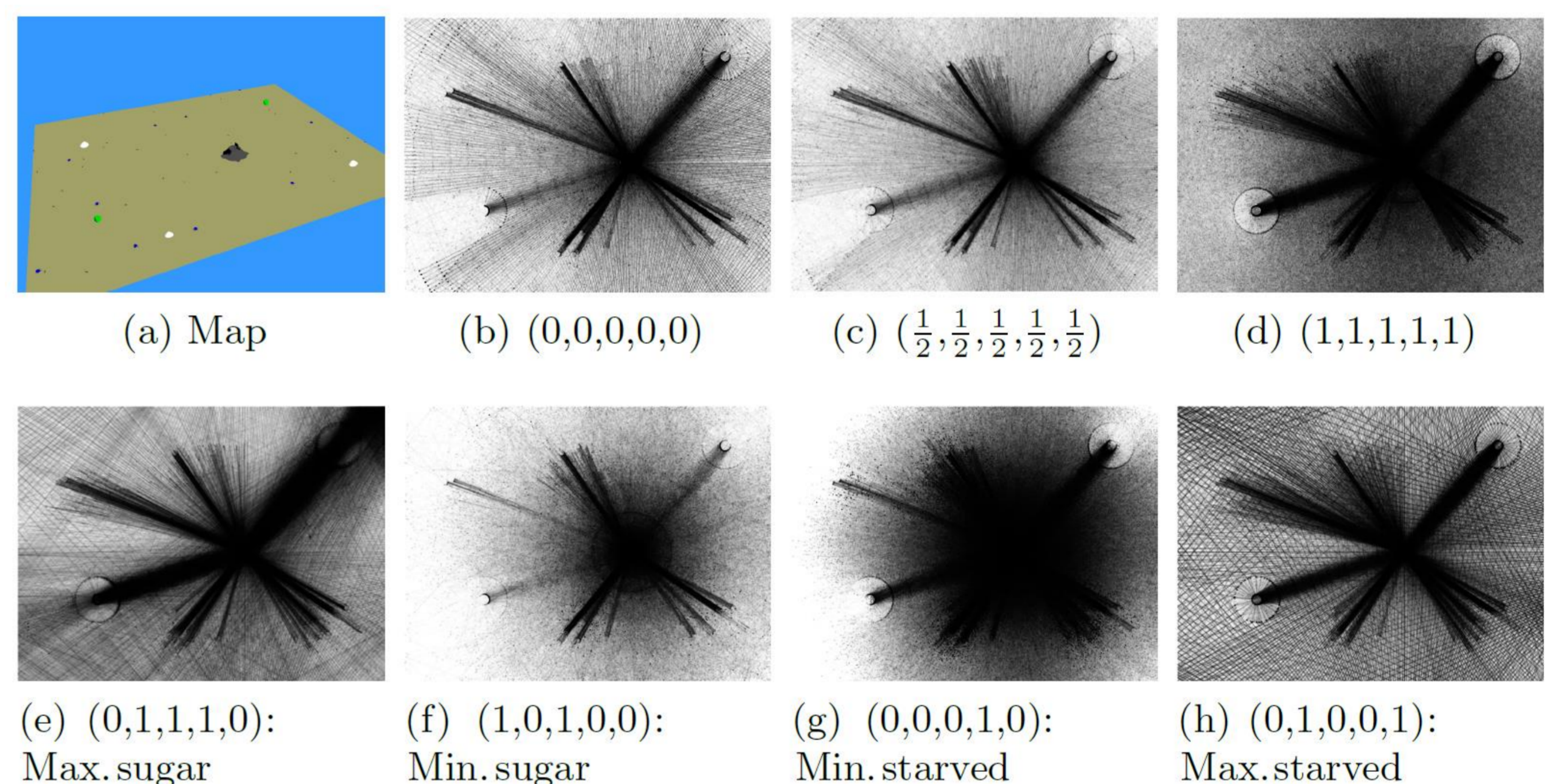


Fig. 1: Personality as a structural superset of beliefs. Respectively, beliefs as a structural subset of personality.

Personality and Algorithms

- Implemented the model by means of AntMe!, an agent-based simulation framework, which provides a completely adaptable test-bed for behavioural studies
- Showed that personality affects all relevant phases of the decision-making processes



- Personality as influential characteristic influences all phases of the BDI life-cycle, e.g., conscientiousness strongly influences the goal-driven behaviour, whereas the trait extraversion influences the agent's preference to interact with others
- Different personalities affect the result of the simulation and certain personalities are better suited for particular tasks than others
- Findings extend available work on this topic to the complete set of personality traits available through the FFM

References

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- [2] R. R. McCrea and O. P. John. An introduction to the Five-factor model and its applications. *J Pers*, 60(2):175-215, 1992.
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