

# A New Decision-Making System in Real-Time Strategy Games

Baptiste Suzon<sup>a</sup>, Thomas Dallard<sup>a</sup>, Jonathan Six<sup>a</sup>, Maël Addoum<sup>a</sup>, and Florian Wolf<sup>a</sup>

<sup>a</sup>ISART Digital, Paris, France

## ABSTRACT

One of the important challenges in Real-Time Strategy (RTS) games is to implement GameAI due to the inherent complexity relative to their large state and action spaces, limited decision times, uncertain environment and adversarial human involved. Moreover, AI players have to show human-like decisions during the game for providing an appealing game session. To address these challenges, we propose a decision-making system for controlling an AI army in strategic combat taking into account the emotional factor of the NPC (Non Player Character).

The suggested architecture is composed of three main modules: the intentional, strategic and tactical module. First, the intent module aims to define the character of the army's personality (patience, aggressiveness, empathy, and cupidity) using an utility system. A Fog of war feature is used to limit the perception and lead to a more human-like behavior. Once the personality is set, the strategic part consists then in determining the points of interests (PoI) such as :

1. Attack the enemy buildings,
2. Defend a position if the AI predicts that the enemy will attack,
3. Create buildings or units if a minimum has not been reached.

Each PoI has a priority score that depends on the context, game state and player's actions. The priority assessment is therefore evaluated and updated regularly during the game session. Finally, the tactical module allows the execution of these PoIs according to their priority score. For that purpose, the nearest units can be assigned to the PoI, if they are not already on a more important PoI. New units can also be generated from buildings if there are not enough units alive, or if the AI deems it more efficient in terms of time. This module allows the AI to :

1. Create units specialized for a specific task or against specific enemies,
2. Save resources to use them only when needed,
3. Kill already existing units to replace them by more adapted ones, if the population limit has been reached.

Note that the performance depends on the number of PoIs. In this work, we distributed the priority evaluation over different frames in order to provide an appealing game experience.

The few playtests showed that the gameplay is enjoyable and challenging. The priority system allowed of varied, interesting and unpredictable actions from the AI enemies. Our AI system is a proposed implementation of a decision-making architecture in a RTS game taking into account the human character of the AI army. It can be easily generalized and adapted to other RTS games by modifying, adding and removing some actions, tasks or behaviors.

**Keywords:** Planning Architecture, GOAP, RTS Game