An Agent-Based Model of Live Escape Rooms

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Overview

• An agent-based model is “one of a class of computational models for simulating the actions and interactions of autonomous agents (both individual or collective entities such as organizations or groups) with a view to assessing their effects on the system as a whole” (Scholarmap, FSU).

• Objective: Determine the optimal group composition for a quick solve time

Model Parameters

• Agent [6] attributes: gender, age (empirically 12 to 70), and creativity, expertise, and fatigue levels (randomly assigned)

\[ P(\text{solve})_{it} = \frac{\text{age}_i}{100} + m_i(c_i + e_i) - f_{it} \]

Where \( m \) is the slight male disadvantage to solving (empirical result); and \( c, e \) & \( f \) are the creativity, expertise & fatigue levels, respectively, for a given agent \( i \).

• Puzzle attributes: difficulty (from 1 to 5), type of puzzle (expertise, creativity, or combo), and location

Preliminary Results

• Analytical solution: finding the optimal puzzle difficulties, types, and \( P(\text{solve})_{s} \)s to minimize \( t \), the number of rounds, in order to satisfy:

\[ 0 = \sum_{i=1}^{n_d} d_i - t \sum_{i=1}^{n_d} P(\text{solve})_{it} \]

• After 100 runs with 6 agents & 20 puzzles:

Avg. \( t \) to escape the room: 2,420 (if 1 round = 1.5 secs, avg. solve time = 01:00:30)

Standard dev. = 720 (18 mins)

Impact

• Insight for escape room players and designers

• Inexpensive alternative to live experiments because parameters can be changed easily

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