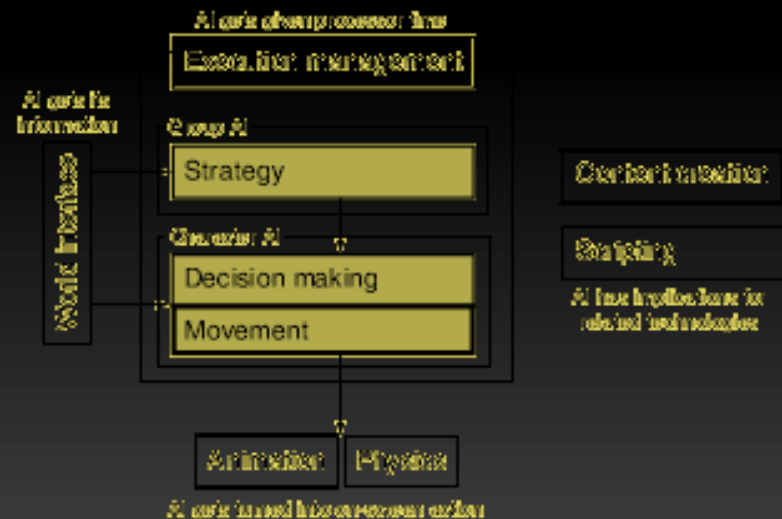


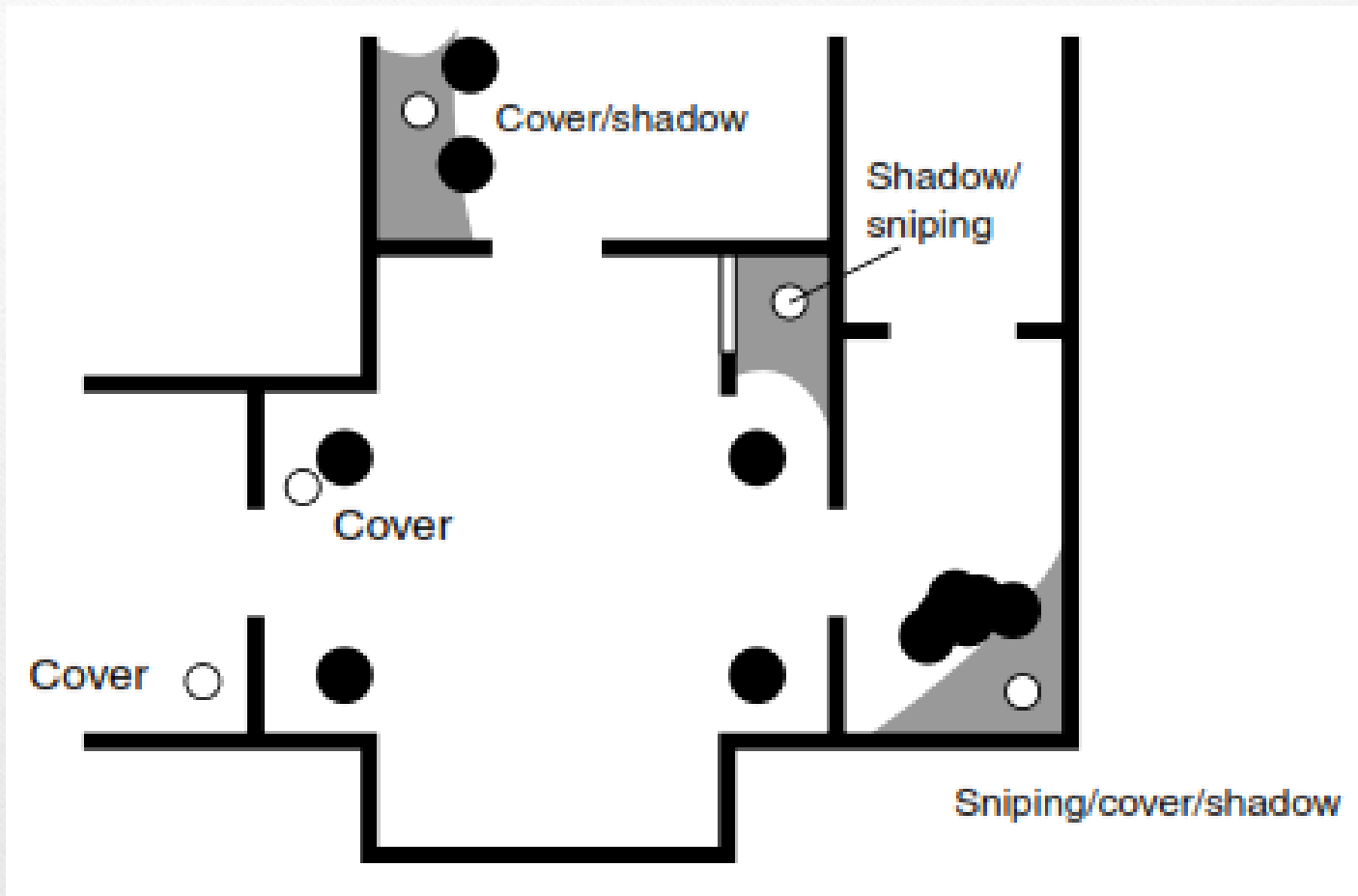


Intro Movement Path Finding Path Planning

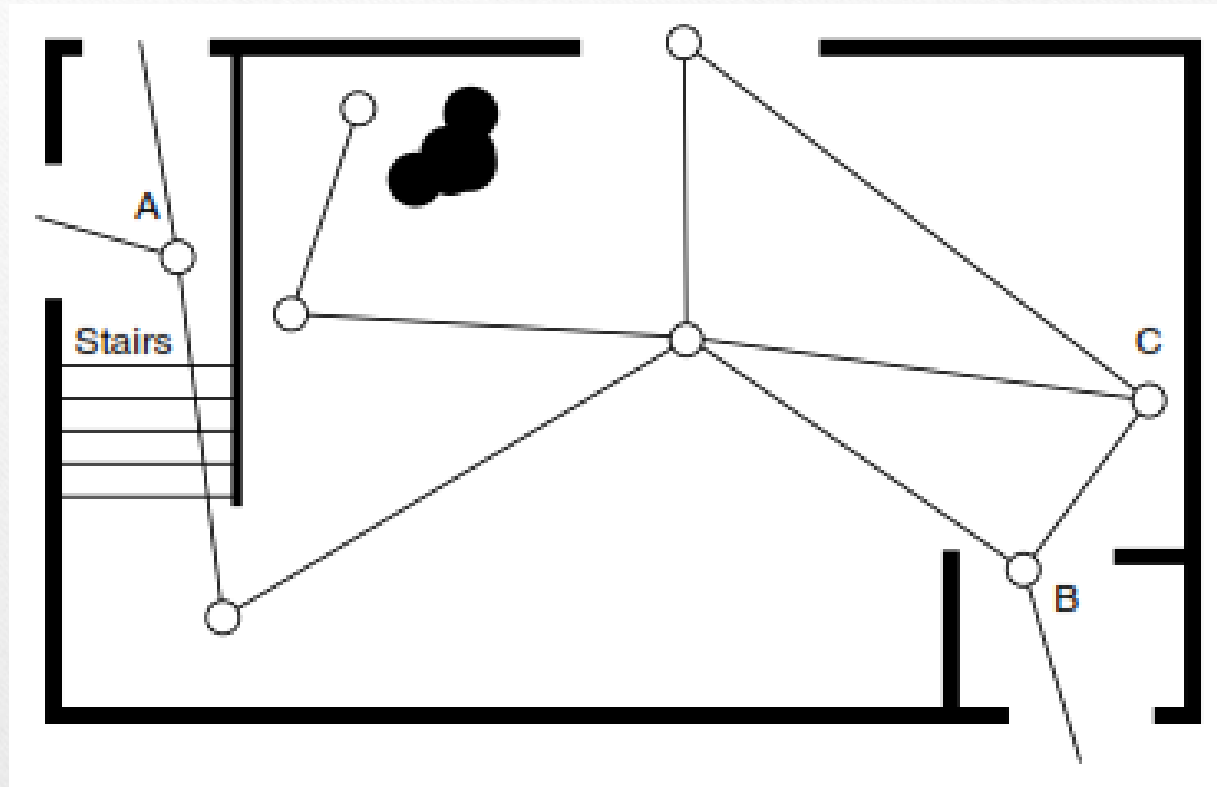
- Waypoints Tactics
- Influence Maps
- Terrain Analysis
- Tactical Path Finding
- Coordinated Actions



Examples of Tactical Positions



Topological Analysis



Complex Rules

Fuzzy Rules

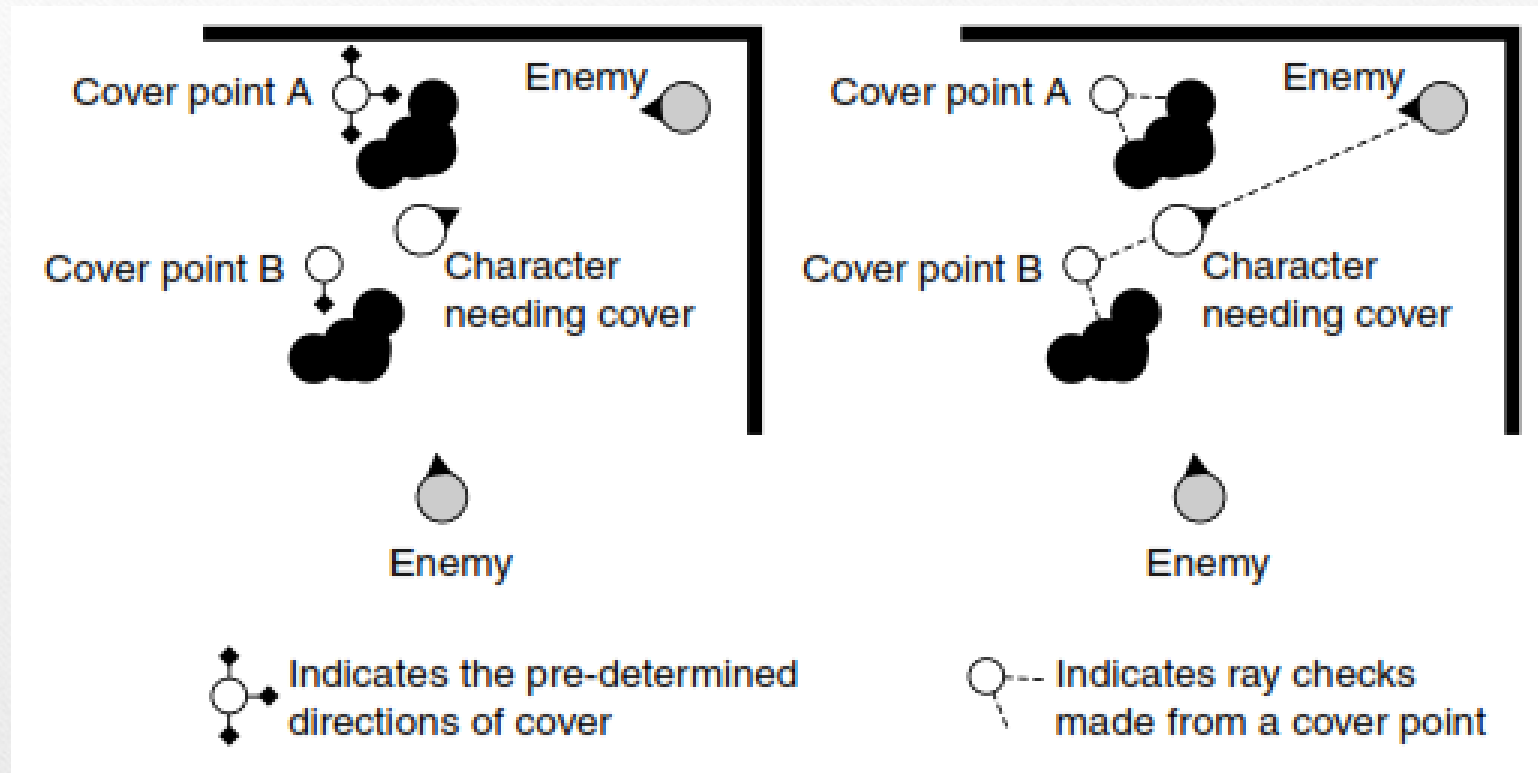
Sniper = Cover & Visibility

$$w_{sniper} = \min(w_{cover}; w_{visibility})$$

First-Order Rules

Visible (WP1) = (! Cover) | (Cover & !Crouch) &
 \exists WP2 Visible(WP1; WP2) & Enemy(WP2)

Visibility



Tactical Path Finding Based on Penalties and Rewards

Trajectory Parameters

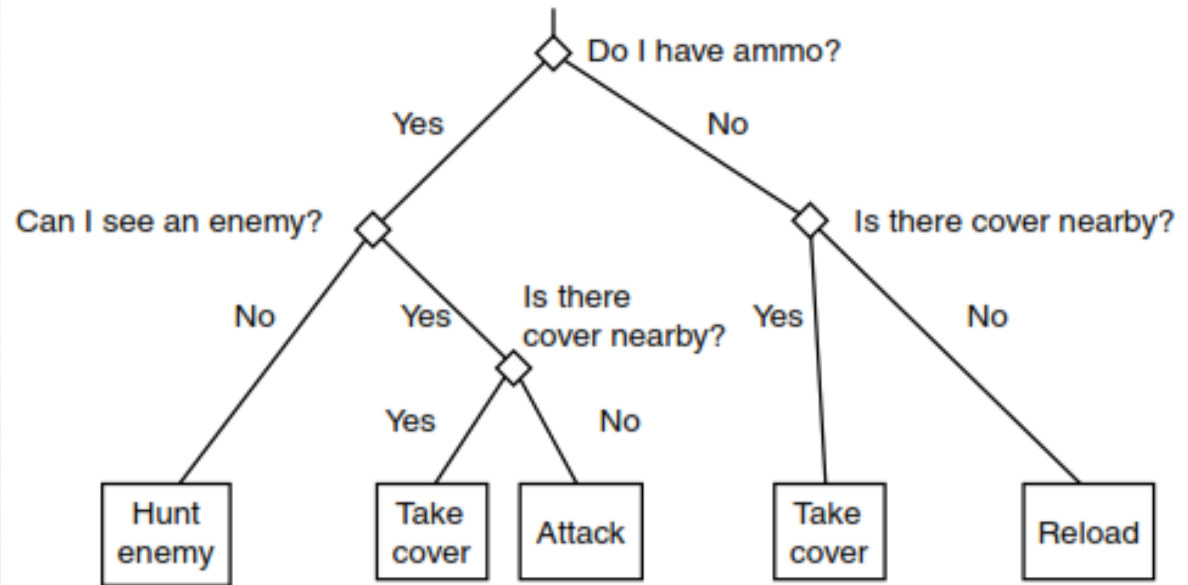
1. PenaltyForRotation – Bounded Curvature
2. PenaltyMultiplierForCrouch – Silent Movement vs. Walking
3. PenaltyMultiplierForBadVisibility – Cover Walking vs. Shortest Path
PathLength * (1 – Visibility) * PenaltyMultiplierForBadVisibility
4. PckRandomPointInCell – Simple Randomizing inside Voronoi Cell

Topological Map Properties

1. BasicCost – Cost of one Step
2. BasicEnterCost – Cost for Entering Cell (used to distinguish friendly and enemy map sectors)
3. NoWay – Map Geometry
4. Visibility – Offline (graphical effects, small covers, etc.) and Online (BOTs)

Tactical Path Finding in Terms of Decision Making

1. Decision Tree



2. Rule-Based Schema

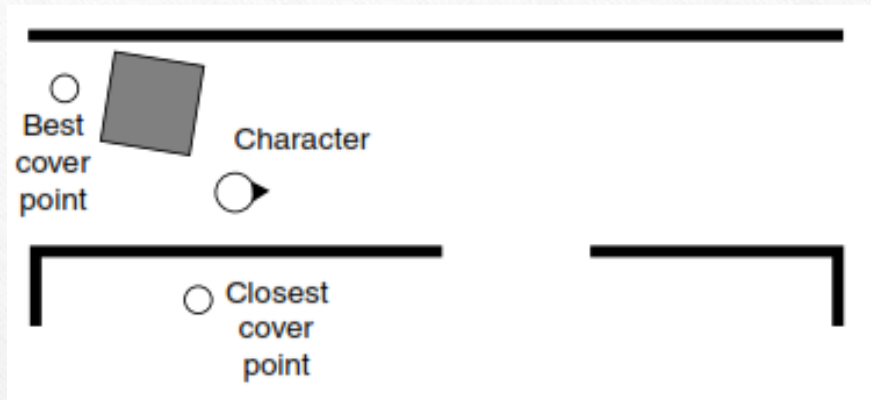
IF cover-point THEN lay-suppression-fire

IF shadow-point THEN lay-ambush

IF cover-point AND friend-moving THEN lay-suppression-fire

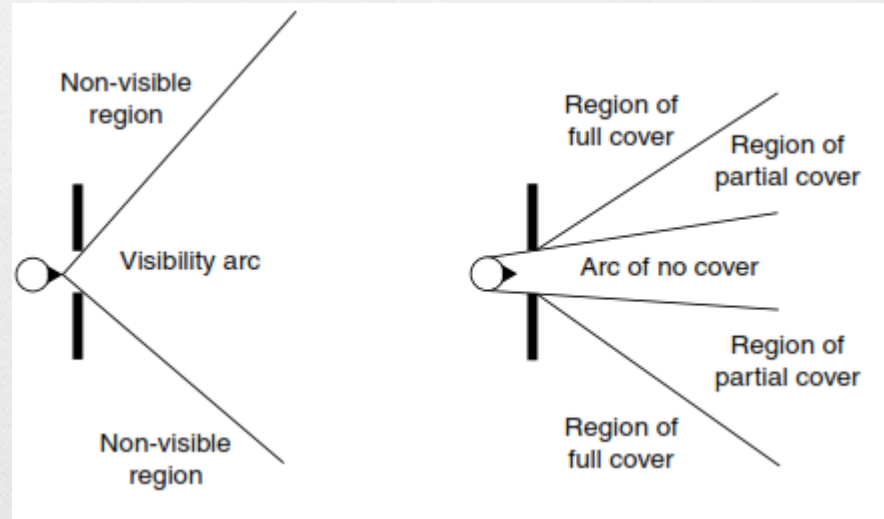
IF shadow-point AND no-visible-enemies THEN lay-ambush

Choosing Cover – Quality vs. Dist. vs. Wave Dist.



Going to the closest Cover is not an option. Proper Level Design and Weighted Fuzzy Rules as one of Solutions

Simple Estimation of Visibility (Pic. 1)/ Cover (Pic. 2) Relation



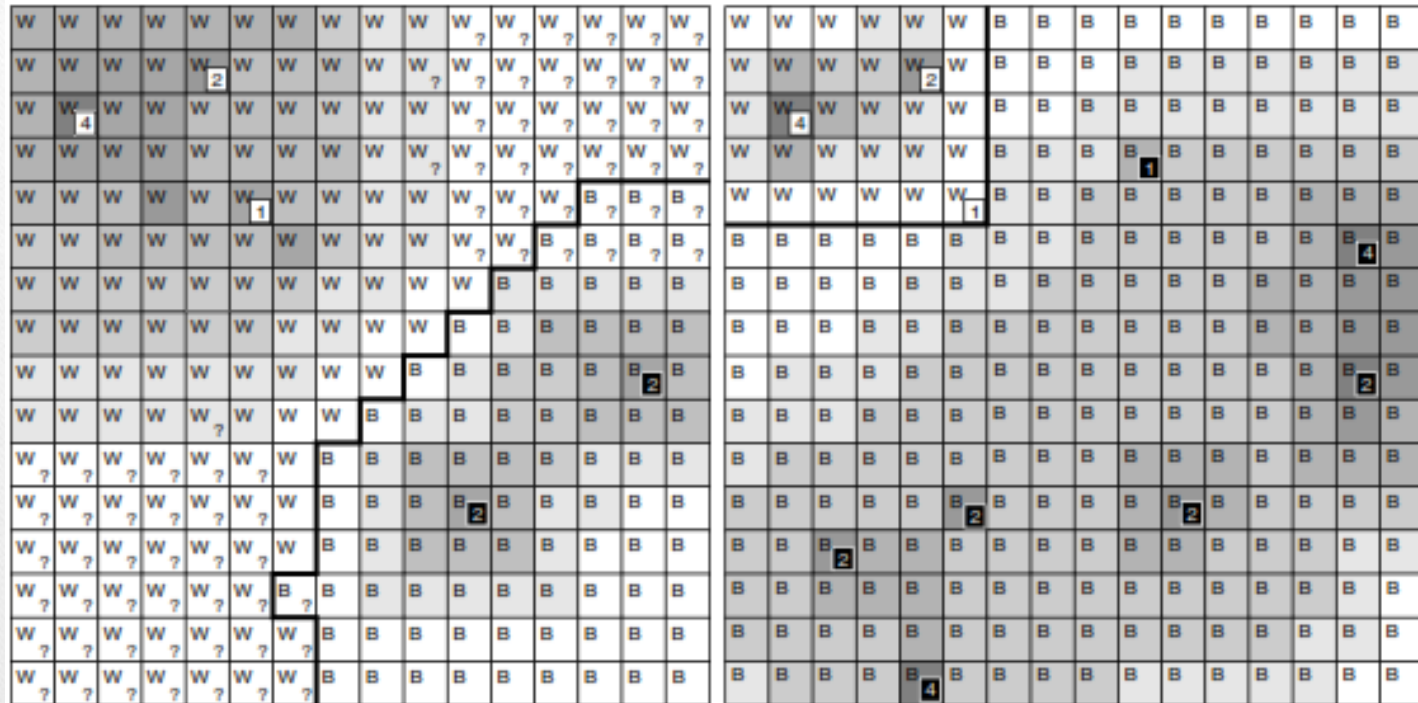
Generating Waypoints

1. Human Tracing via Demo Records
2. BOTs' Simulations
3. Semi-Random Walking

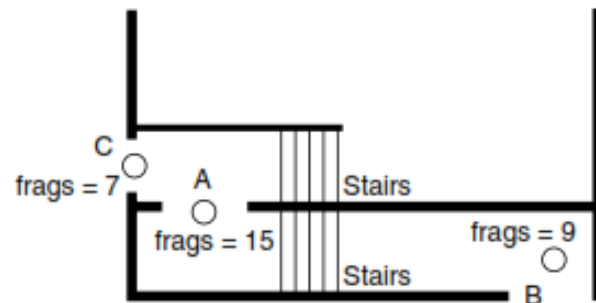
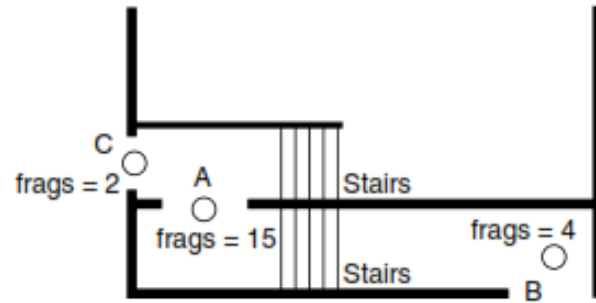
Map Processing

1. Offline Geometry Decomposition
2. Offline Tactical Position Highlighting
3. Online Tactical Properties
4. Semi-Random Walking
5. Condensing Paths

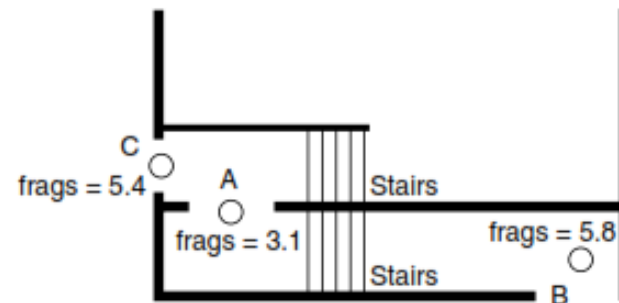
Influence Map with Convolution Filter



Frag Maps



No unlearning



With unlearning

Tactical Analysis

Category 1

Multi-layer properties
combine any categories

Static properties
terrain, topology, (lighting)

Suitable for
offline processing

Category 2

Evolving properties
influence, resources

Suitable for
interruptible processing

Category 3

Dynamic properties
danger, dynamic shadows

Requires
ad hoc querying

Combined Tactical Analysis

$$\text{Quality} = \frac{\text{Security} \times \text{Visibility}}{\text{Tower Influence}}$$


$$\text{Quality} = \text{Security} \times \text{Visibility} \times \text{Distance}$$

Security

W	W	W	W	W	W	W	W
W	W	W	W	W	2	W	W
W	2	W	W	W	W	W	W
W	W	W	W	W	W	W	W
W	2	W	W	W	2	W	W
W	W	W	W	W	W	W	W
W	W	W	W	B	2	B	W
W	W	W	W	B	B	2	B

Visibility

Proximity

 Existing tower

Combined analyses

Filtering the Result is necessary

$$\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

Combined Actions

Classes