Third Eye Crime: Building a Stealth Game Around Occupancy Maps

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Abstract

Rarely does an AI algorithm form the core mechanic of a commercial game. But this is what happened in the case of Third Eye Crime, an upcoming stealth puzzler by Moonshot Games, soon to be released on iOS, whose gameplay relies heavily on the use of Occupancy Maps.

Occupancy Maps

Occupancy Maps are a simple representation for probabilistic object tracking, in which object positions are represented not as a vector but as a discrete probability distribution over space. Every time-step in which the target is not observed, the target's probability distribution is diffused. Locations that are visible to the observing NPCs have their probability content zeroed out. The result is a system that allows AI to search a space in an emergent, methodical, organic and unscripted way. (Isla 2005).

Occupancy Maps have origins in the robotics literature, such as (Moravec 1988), and have been used in video games before, but Third Eye Crime marks their first use as a core component of gameplay. In Third Eye Crime, the player takes on the role of Rothko, a telepathic art thief, who must steal as much priceless loot as he can and make it to the exit, while avoiding groups of hostile NPCs. Because he is telepathic, Rothko can actually see what is happening in the minds of the NPCs. What this means to the player is that the Occupancy Map which the NPCs use to track them is actually rendered at all times. The Occupancy Map therefore becomes a sort of "heat map" indicating the threat level of various areas of the map. A bright red glow to the player indicates a dangerous area. Under the hood, that red glow actually represents high probability values in the Occupancy Map, meaning the NPCs are likely to search there for the player.

Reinventing Stealth

Occupancy Maps provide an interesting new capability for the player, resulting in NPCs that are at once more lifelike (because they search the environment in a believable way) and predictable (because the way in which they search makes sense). But most exciting of all are the design opportunities Occupancy Maps open up in the stealth genre.

Many stealth games feature sophisticated sensory models for vision (including the effect of lightness and darkness, movement speed etc.), and audition, such as in (Leonard 2003), but few feature sophisticated knowledge models for position tracking. Hence once a player has slipped away, there are only two options for a searching NPC: search the environment randomly (perhaps using heuristic information such last known movement vector) or return to its patrols. Occupancy Maps overcome these limited options by allowing the NPCs to search indefinitely based on the structure of the space and in a way that makes sense. The fun of the game for the player, therefore becomes not avoiding detection but evading the searching NPCs. Indeed one of the distinguishing features of the gameplay of Third Eye Crime is that the fun happens after, not before, the player is detected. The result is a unique brand of NPC-evasion gameplay that is only possible through the use of Occupancy Maps.

References

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