Detecting deviants within flocks

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Abstract

Flocking refers to a family of grouping behaviours commonly seen in nature (fish, birds, moths etc.) Whilst flocking is a complex pattern of behaviour, Reynolds (1987) and others have demonstrated that it is underpinned by the application of three simple rules –separation, alignment and cohesion– that expressed as vectors can be summed together to give the eventual heading of any one agent and thus produce an emergent flock from multiple independent agents. However, despite the ubiquity of flocking to the natural world and its recent use as a basis for the simulation of human crowds, relatively few studies have examined the perception of flocking. In the present study we examined the ability of observers to pick out 'deviants' (that is, agents that only obey a subset of the rules described by Reynolds) within flocks under cued and un-cued conditions. The results show that cuing causes differences in deviancy detection suggesting that whilst some violations are easier to detect by directing attention to individual agents, others are more reliably detected by considering the flock as a whole. This finding has resonance with accounts of real-world crowd monitoring and suggests that both the global observation of a crowd as a whole and the monitoring of individuals is required to detect a full range of potentially noteworthy deviant behaviours. It is speculated that this requirement arises as a result of the underlying processes that cause crowd behaviour to emerge from the interactions of individuals.

Introduction

Flocking refers to a family of group aggregating behaviours commonly seen in nature, perhaps most visibly in the case of birds and fish but found across a wide range of taxa (see Parrish & Hamner, 1997). Despite being an apparently complex activity at the group level, particularly in terms of how flocks can split and reform to navigate around obstructions, it was demonstrated by Reynolds (1987) through his "Boids" (bird androids) model that flocking could be an emergent group behaviour that might arise from the interaction of agents individually adhering to a small set of simple steering rules. Since this initial demonstration of emergent flocking, similar approaches have been taken to modelling crowds of humans (Reynolds, 1999) and flocking rules have also been used in data visualisation and within architected systems (e.g., Unmanned Aerial Vehicles and reconnaissance satellites). However, despite this wide-spread interest in the technique and apparent ubiquity of flocking in

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