**Plinko IROS Framework**

**Goal:** Low-cost & sustainable deployment of large numbers of biodegradable monitoring robots/drugs

**Problem:** Environments are complex & unpredictable; without active control of deployment, it is difficult to achieve target distributions.

**Hypothesis:** Simple changes in casing morphology can facilitate passive programmability when deployed in chaotic environments.

**Proof:** GAs & 3DP used to evolve desired exit distributions in a Galton Board – a provably chaotic physical system.

**Conclusion:** Biodegradable passive casings can be evolved for desired behaviours in otherwise chaotic environments, enabling large-scale deployment in agricultural/marine monitoring/drug delivery applications.

**Title:**

**Figures**

1. Applications, workflow, and process abstractions
2. Experimental setup
3. Effect of morphological changes on a single impact/bounce:

Diagram

Description automatically generated

1. How these impact effects extend to macroscopic patterns over the entire board:

Diagram

Description automatically generated

1. GA implementation: parameter space, population printing, fitness function definition.
2. Results of optimisation for specific distributions:

Diagram

Description automatically generated

1. (FIG 10) Evolution of behavioural distribution

Logo, company name

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**Directions for larger paper**

1. (Rotating system if not yet introduced: adapting to ‘infinite environment’)
2. Transferring results to a different shape/weight/size of payload
3. More counters:
   1. Minimise a population’s ‘death rate’ in the rotating system (generational adaptation)
   2. How must behaviours shift as size of population increases? (i.e. increase number of counters whilst aiming for the same average distribution)