Landcare Research
Manaaki Whenua

Computer games as a novel medium for knowledge transfer

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Pen Holland, Julian Looser

HITLabNZ
Human Interface Technology Laboratory New Zealand
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driedfrog
software & game development

Computer Games

The Power of Computer Games

Aim: To turn complex scientific problems into accessible, engaging computer game environments.

Objective: To engage a wider audience with the complex problem of pest management in New Zealand

Engaging people with science

BMC Ecology

BioMed Central

Commentary

Open Access

Troublesome toxins: time to re-think plant-herbivore interactions in vertebrate ecology

Robert K Swihart*[1], Donald L DeAngelis[2], Zhilan Feng[3] and John P Bryant[4]

Austral Ecology (2001) **26**, 571–581

Heterogeneity in vertebrate and invertebrate herbivory and its consequences for New Zealand mistletoes

LAURA A. SESSIONS* AND DAVE KELLY

Plant and Microbial Sciences, University of Canterbury, Private Bag 4800, Christchurch, New Zealand (Email: l.sessions@botn.canterbury.ac.

Ecology, 89(3), 2008, pp. 621–634
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RESOURCE PULSES?

JUSTIN L. BASTOW,[1] KENNETH O. SPENCE,[2] AND AMBER N. WRIGHT[1]

of Evolution and Ecology, University of California, One Shields Avenue, Davis, California 95616 USA
Department of Entomology, University of California, One Shields Avenue, Davis, California 95616 USA

Wildlife Research, 2000, **27**, 69–74

The role of non-toxic prefeed and postfeed in the development and maintenance of 1080 bait shyness in captive brushtail possums

J. G. Ross[A], *G. J. Hickling*[A], *D.* [B], *and C. T.*

[A]Ecology and Ento[illegible] Box [illegible], Lincoln University, Canterbury, New Zealand
[B]Landcare Research, PO Box 31[illegible], Lincoln, Canterbury, New Zealand

Abstract. Shyness to sodium monofluoroacetate (1080) in cereal bait can persist in sub-lethally poisoned brushtail possums (*Trichosurus vulpecula*) populations for at least 2 years. We investigated the use of non-toxic cereal 'pre-feed' and 'postfeed' as ways of inhibiting and overcoming such shyness. The postfeed result was also compared w

CSIRO PUBLISHING

www.publish.csiro.au/journals/wr

Wildlife Research, 2007, **34**, 67–76

Optimising bait-station delivery of fertility control agents to brushtail possum populations

l M. Tompkins[A,C] *and David Ramsey*[B]

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Available on-line at: http://www.newzealandecology.org/nzje/

SHORT COMMUNICATION

Large-tree growth and mortality rates in forests of the central North Island, New Zealand

Sarah J. Richardson[1*], Mark C. Smale[2], Jennifer M. Hurst[1], Neil B. Fitzgerald[2], Duane A. Peltzer[1], Robert B. Allen[1], Peter J. Bellingham[1] and Peter J. McKelvey[3]

The evaluation of indices of animal abundance using spatial simulation of animal trapping

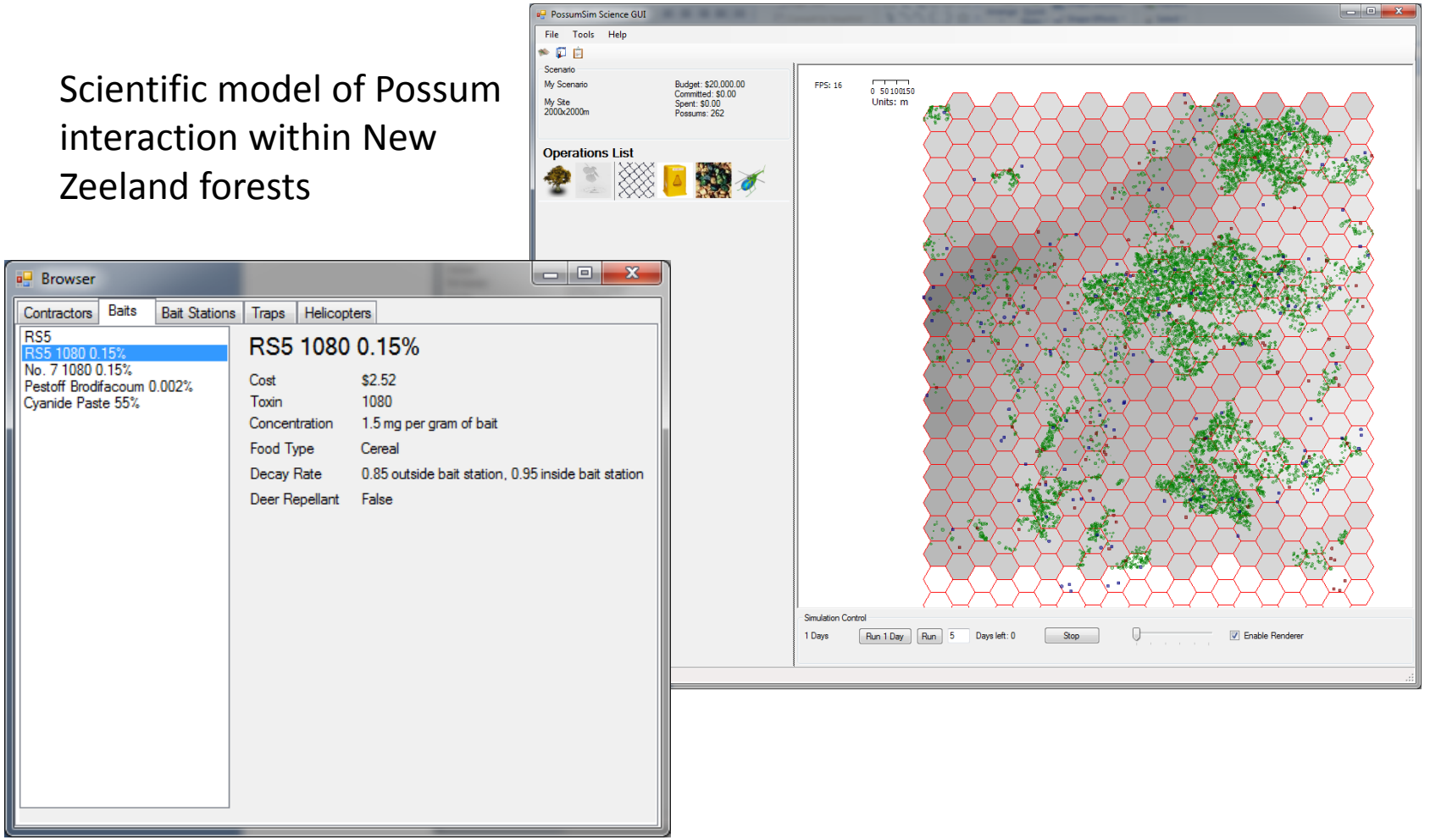
Dave Ramsey[A,D], *Murray Efford*[C], *Steve Ball*[B] *and Graham Nugent*[B]

[A]Landcare Research, Private Bag 11052, Palmerston North, New Zealand.
[B]Landcare Research, PO Box 69, Lincoln, New Zealand.
[C]Landcare Research, Private Bag 1930, Dunedin, New Zealand.

Public Friendly?

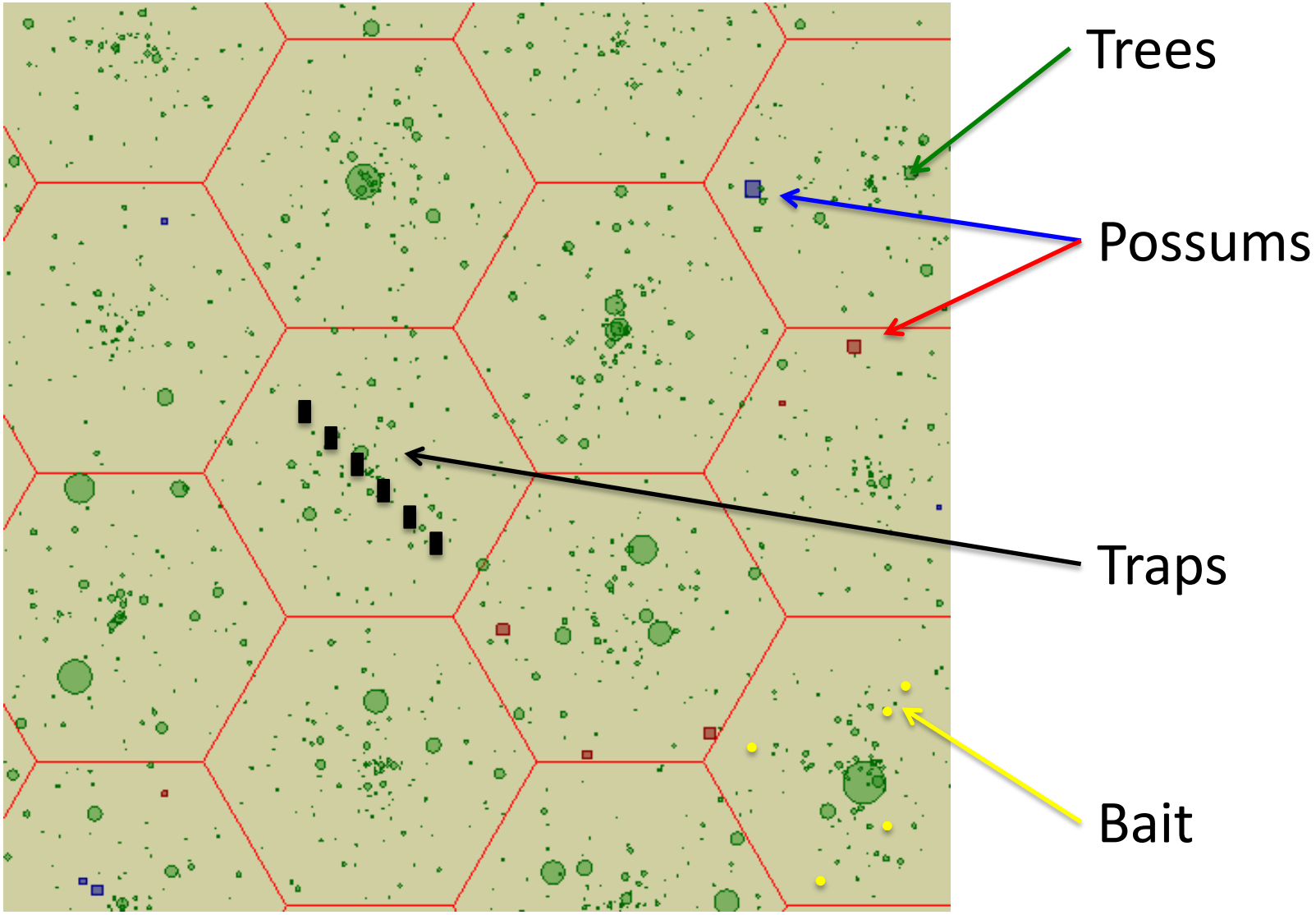
Science Simulation

Scientific model of Possum interaction within New Zeeland forests

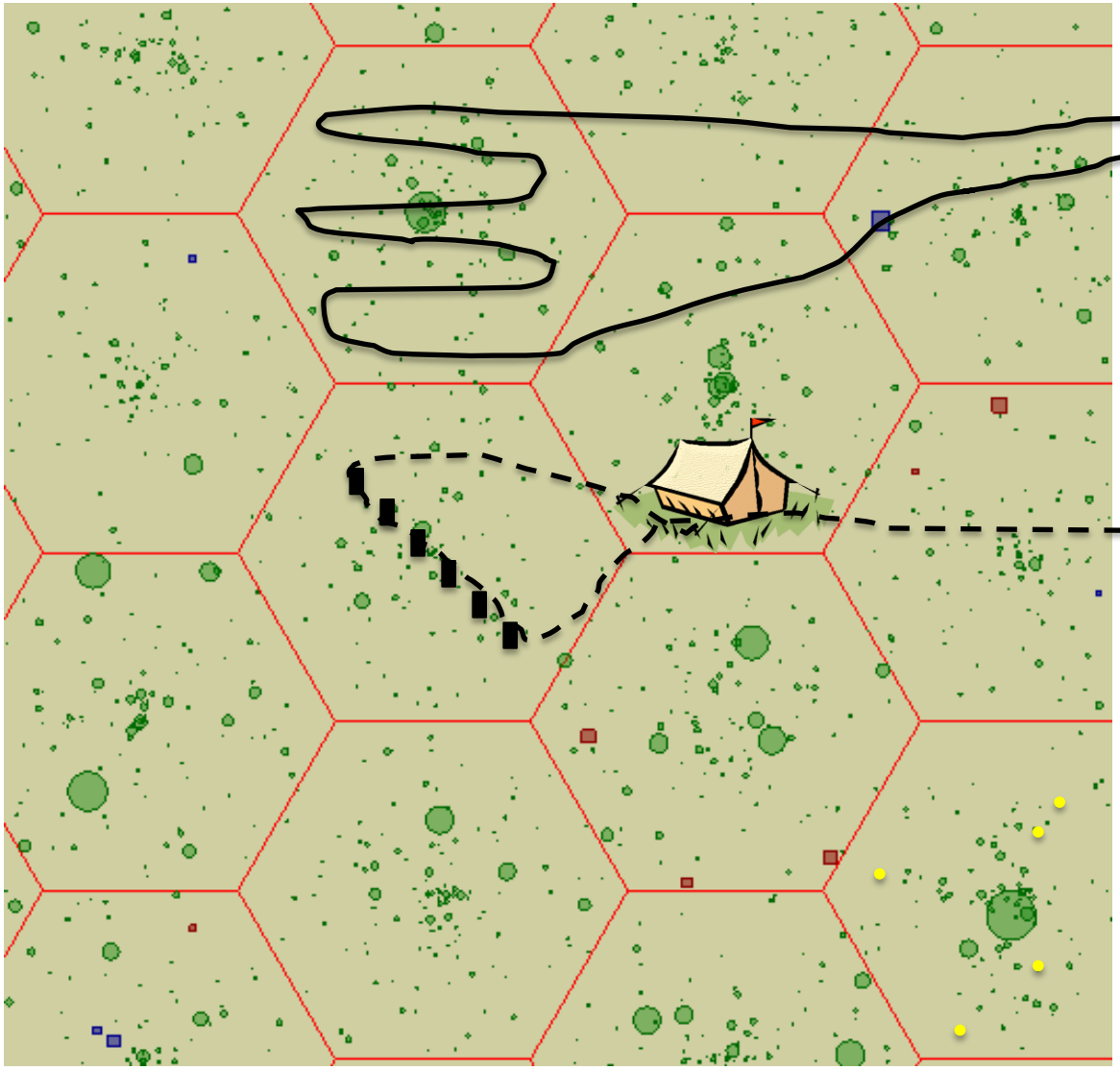


Developed by Dr Pen Holland of Landcare Research

A spatial model



A spatial model



Flight time

Contractor costs

Best routes

Equipment costs

Pest Management Research Tool

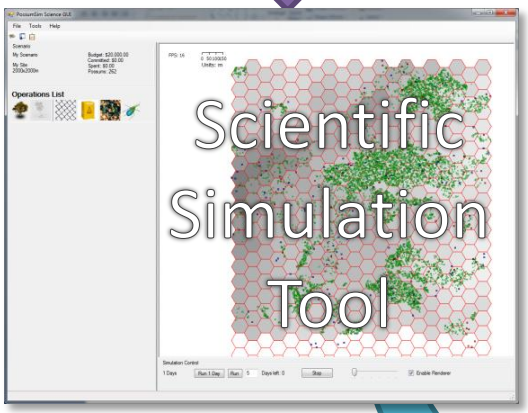
Research goals

Emergent Behaviour:
Providing pest focused solutions

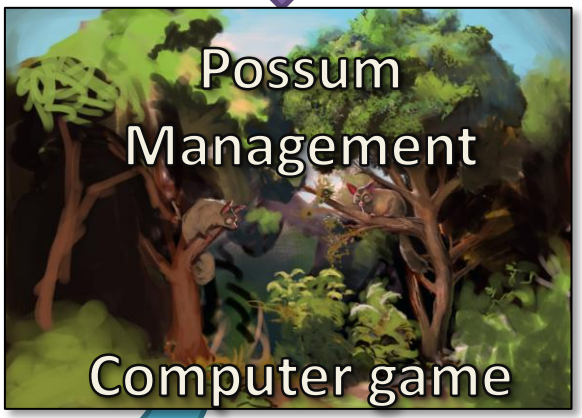
Scientific Exploration

Research Tools

Public Engagement

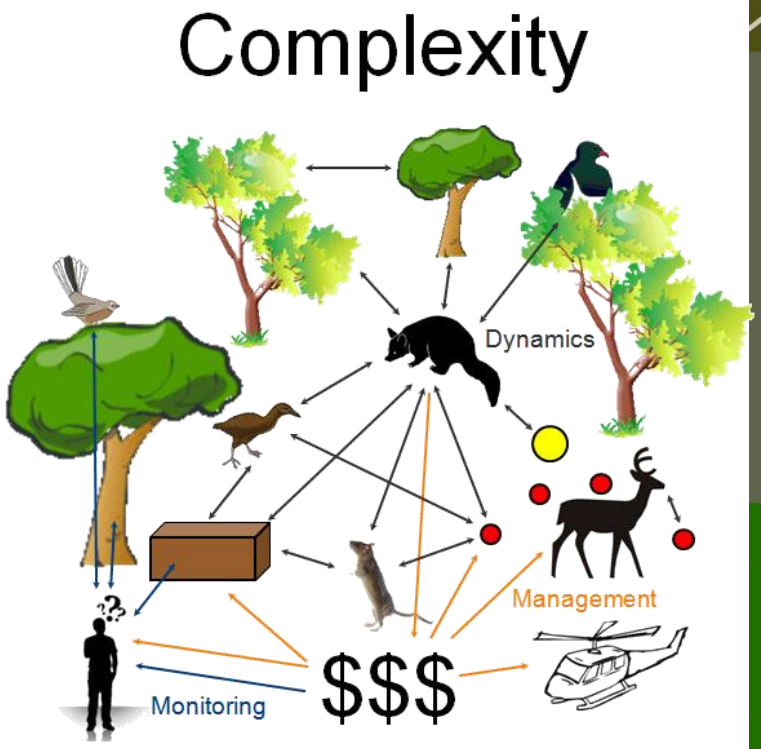


Metrics Data

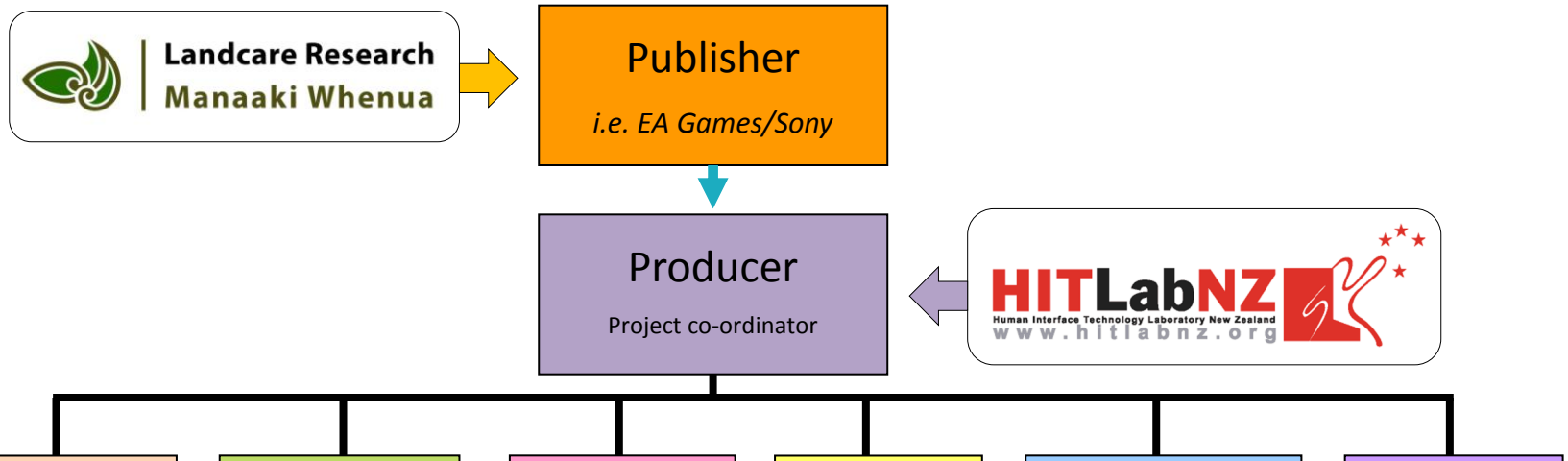


Computer Game Rationale

- An aid to public dialogue and engagement with a complex problem
- Scientific knowledge transfer
- The use of novel media to present environmental information
- Innovative and engaging ways to implement and present research findings



Serious – Game Production Team



Research	Design	Art	Sound	Programming	QA
• Motivations • Learning Outcomes • Skill stages • Metrics planning • Assessment	• Gameplay • Levels • Missions • Story • Interface	• Animators • Modellers (environment, characters) • Concept (drawing) • Texture • Interface	• Music • Sound FX • Foley •Voice acting	• Tools • Engine • AI • Graphics	• Test Game • Report bugs • Communication effectively with Programmers

My Research Purpose

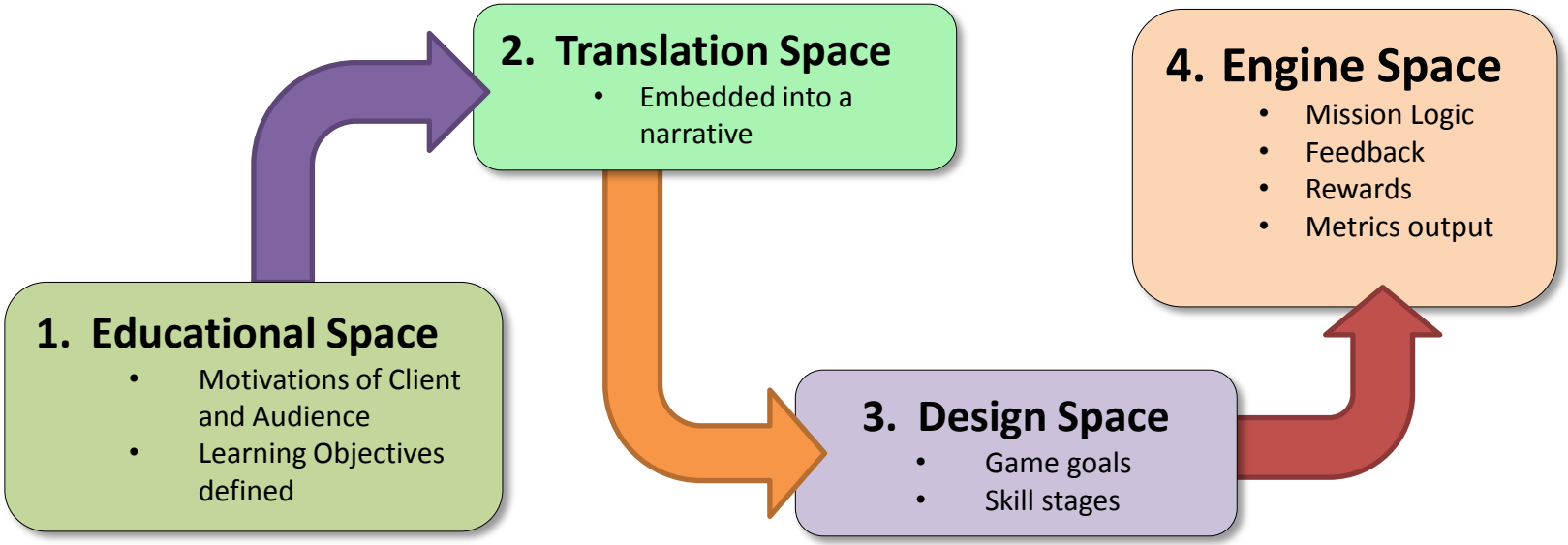
Engaging Games for Learning & Knowledge Transfer

- Computer games provide **context based learning**
- Applies **systematic approach** for development of educational gameplay
- **Cost effective** design with maximum **educational impact**
- **Generalisable** across educational domains
- Appropriate for any game genre or gameplay environment – **2D or 3D**

My Research Approach

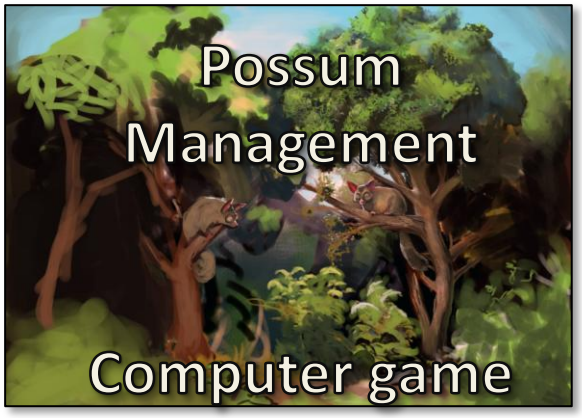
Effective Design Processes for Educational Computer Games

What is an effective design process for computer games that deliver structured learning activities?



Educational Space

- *Learning Outcome:* To gain a realistic appreciation that management of an ecosystem is a complex problem
- *Learning Objective:* Maintaining and restoring the ecosystem of NZ forests based on biodiversity conservation
  - *Objective Tasks:*
    - Monitor environment
    - Manage environment



Translation Space

The Story

- The public is the hero saving the fragile, beautiful but resilient ecosystem from the jaws of the invasive Brushtail possum.

Gameplay goals

1. Save the native flora and fauna,
2. By repelling an army of mammalian pests led by marauding possums,
3. To restore the forest ecosystem to its former glory.

Design Space

Multi Level expandable gameplay

- **Level 1** – Ground operations
- **Level 2** – Aerial operations
- **Level 3** – Managing stakeholders
- **Levels 4+** Combination of levels 1-3 across multiple land sections

An adaptive design system

- In-game ‘patching’ of new scientific research
- Expansion of science simulation for other invasive species control
- Direct delivery channel for public engagement with science concepts

Level 1

Level goal: To create an area of forest suitable for a kiwi sanctuary.

Outcome: Show positive tree health and a healthy bird population.

Action: Reduce the Possum numbers in the area

Level Epic Win State – All possums dead inside the fenced area, trees at 80% health or more and release of nurtured Kiwi bird.

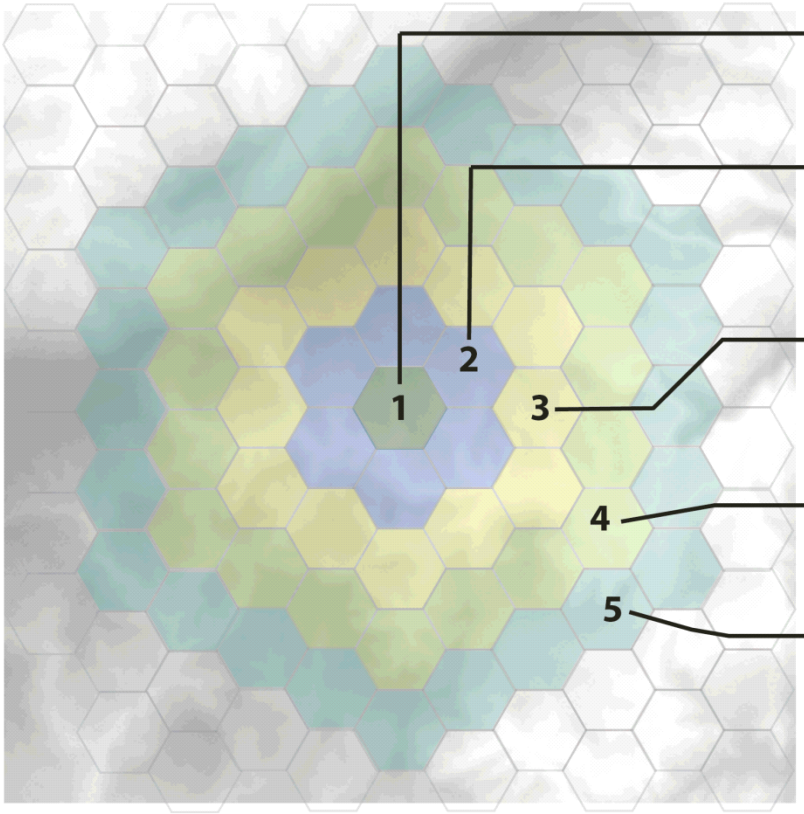
OR

Level Epic Fail State - 100% possum health, 20% tree health and/or unhatched egg or released Kiwi.

Level 1 – Kiwi Sanctuary

Possum Management Game - Level 1 outlined in 5 skill stages

Overview of the active gameplay space of Level 1 - Boundary Stream



1km^2 fenced area where the player is taught the basics required to monitoring and managing the eco sytem

Skill Stage 1: monitor flora to establish health of environment

Keyskill: basic environment monitoring

Skill Stage 2: continued flora monitoring with nonlethal intervention for fauna density
i.e. Trapping for population density (non-toxic)

Key skill: trapping methods

Skill Stage 3: continued monitoring and the use of lethal intervention to impact possum population
i.e. baited trapping (toxic)

Key skill: baits and toxins

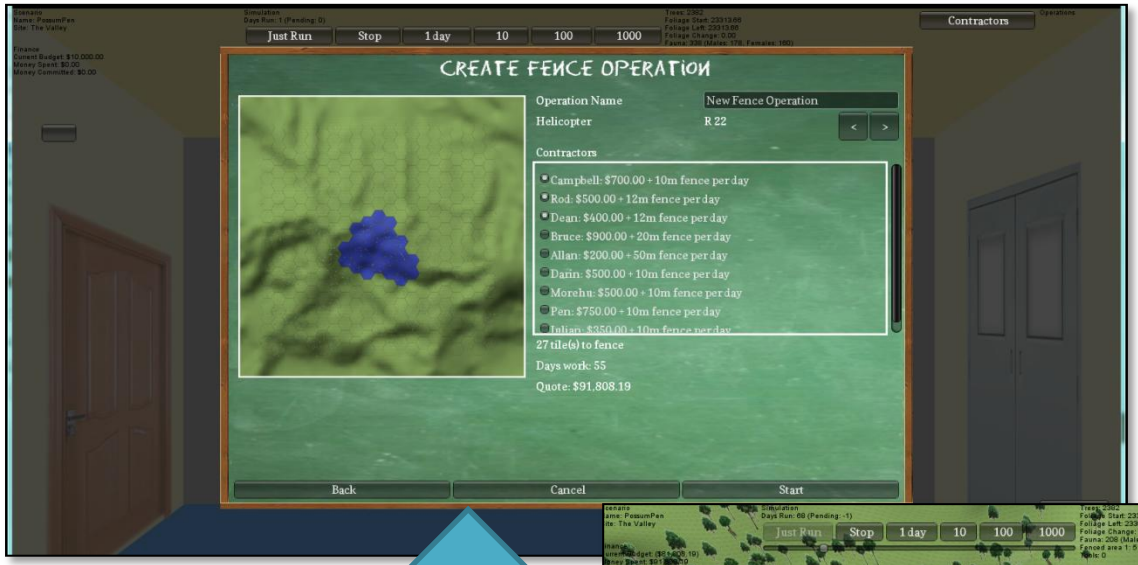
Skill Stage 4: continued monitoring with active managment goal of lethal intervention to reduce possum numbers

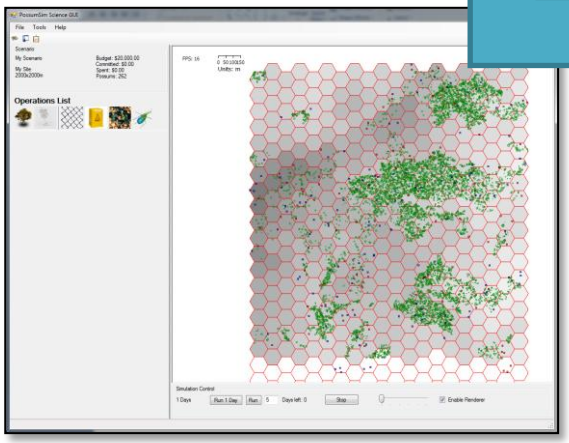
Key skill: strategies for traps, baits and toxins

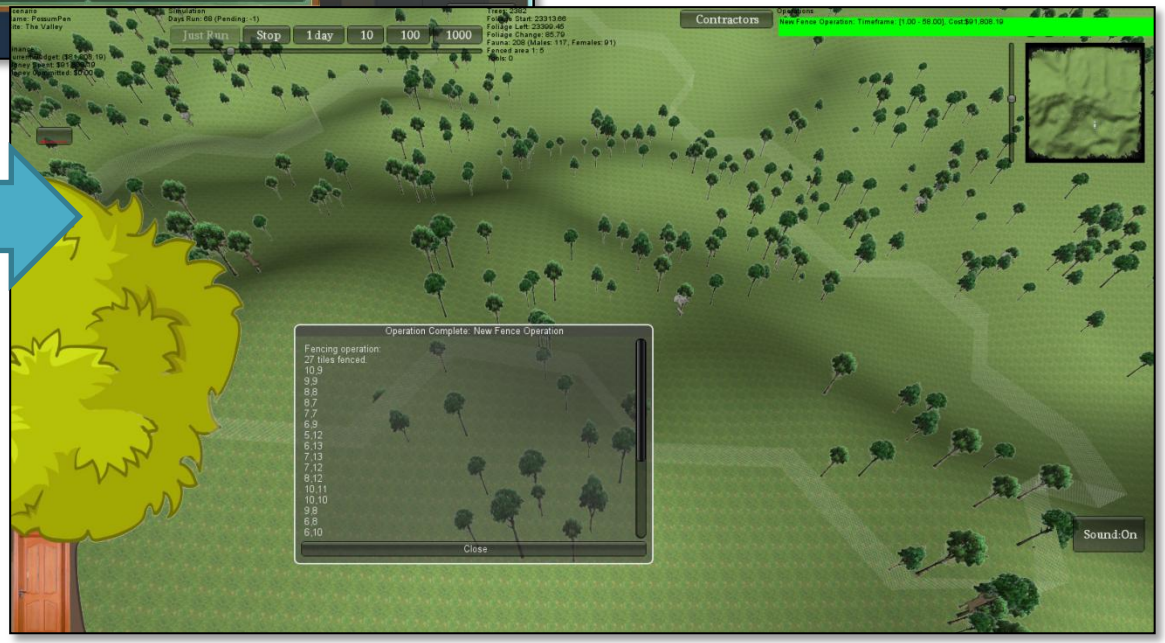
Skill Stage 5: Total intervention, combined use of all learnt skills to clear the fenced gameplay area of possums.
Monitoring of the environment to establish rate of recovery.

Key skill: applied managment strategies and tool use

Engine Visualizations

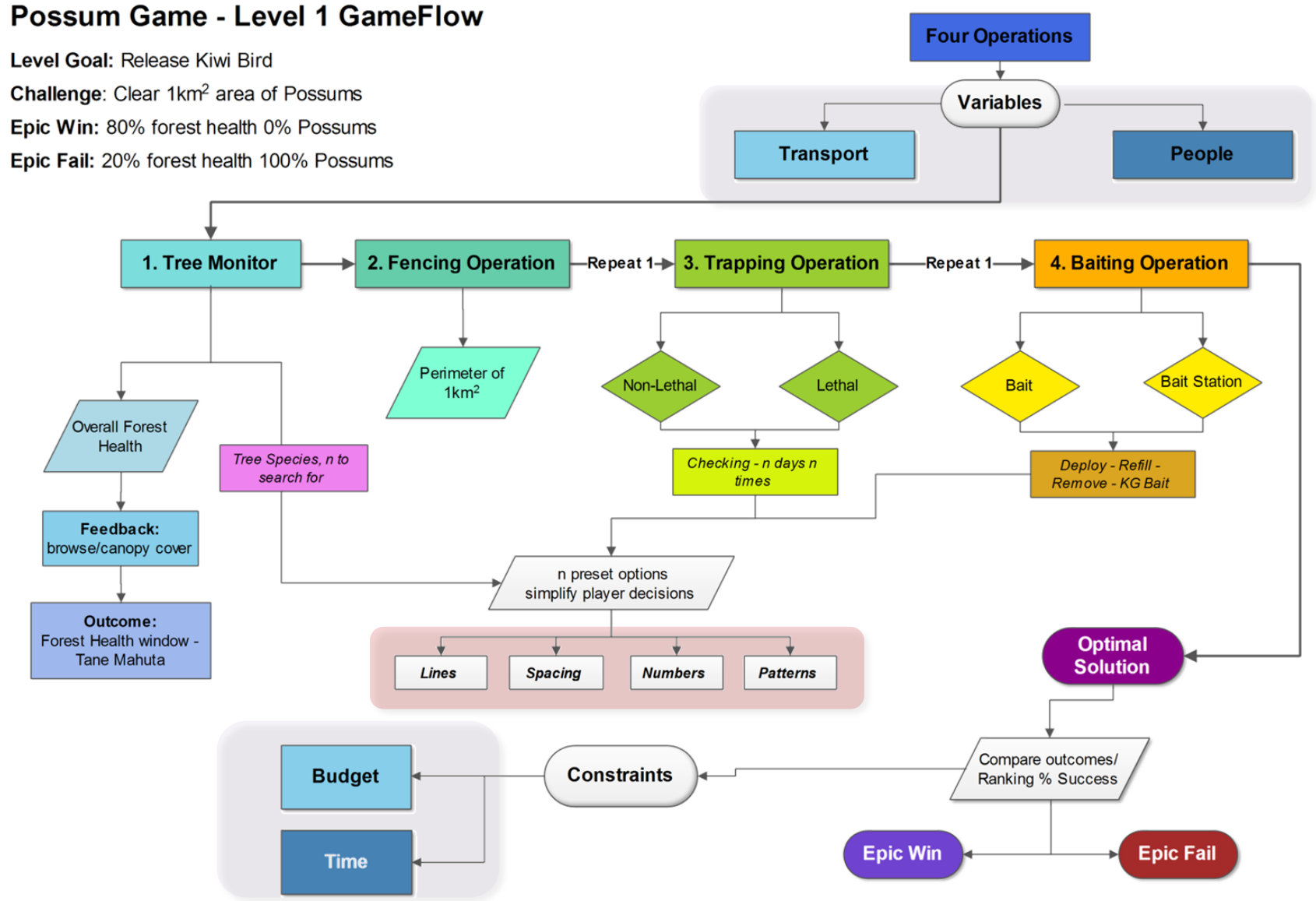




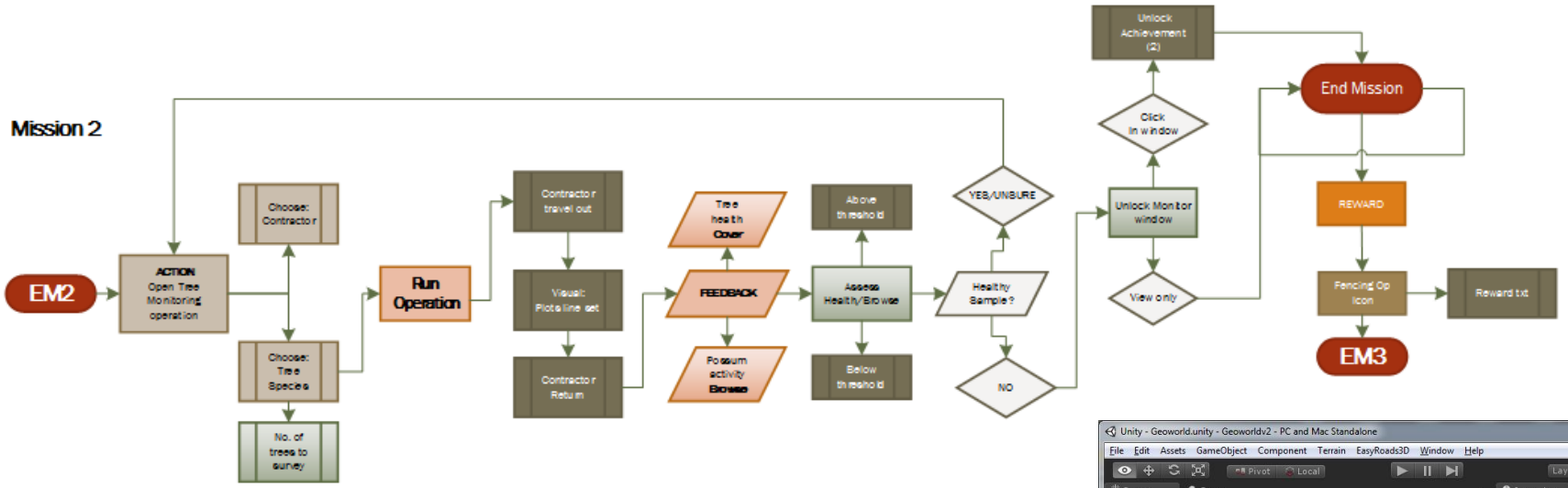


Proof of concept visualisation of the simulation inside the Unity 3D Game Engine

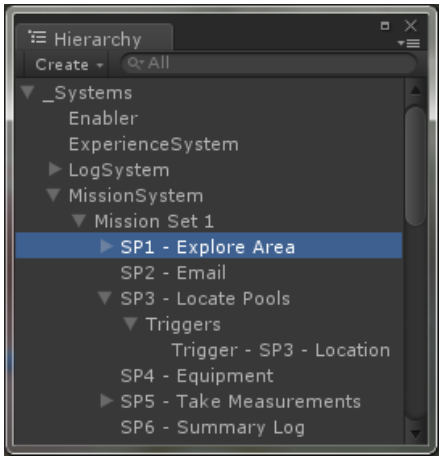
Engine Space

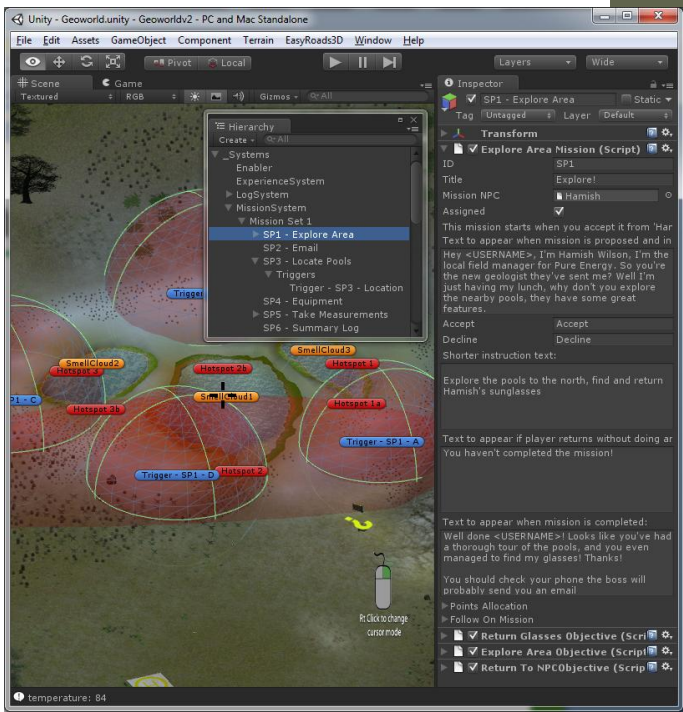


Engine Space



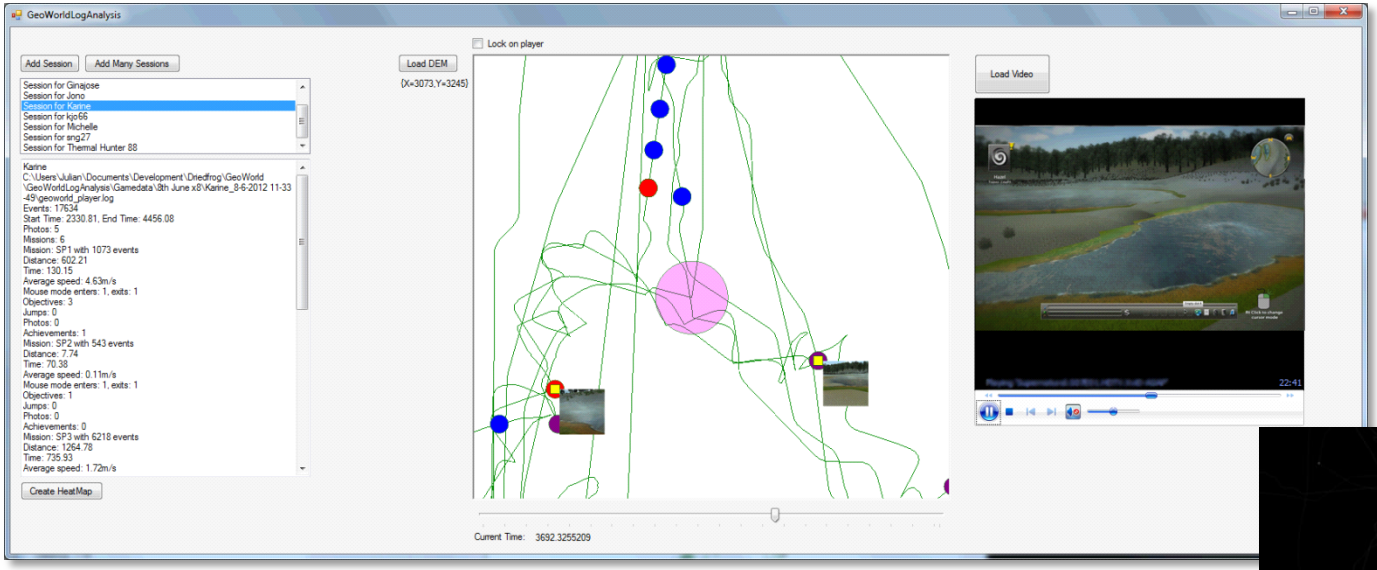
A Flow diagram of showing how the mission logic for a tree monitoring operation is mapped for implementation in the game engine





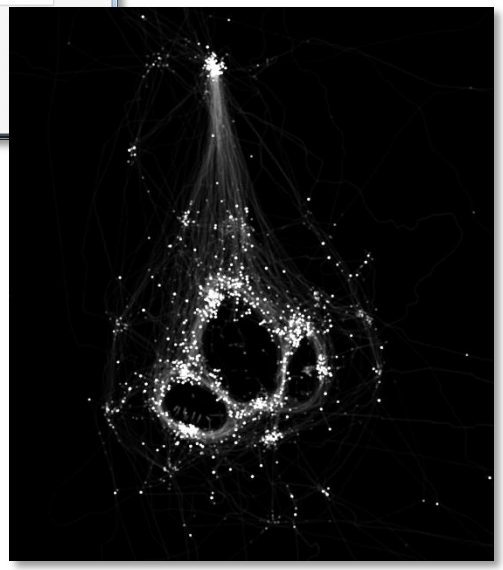
Engine Space

Metrics – Raw data analysis via Heat Mapping



Analyse data:

- Position
- Time
- Actions
- Tool use



Feed in raw data:

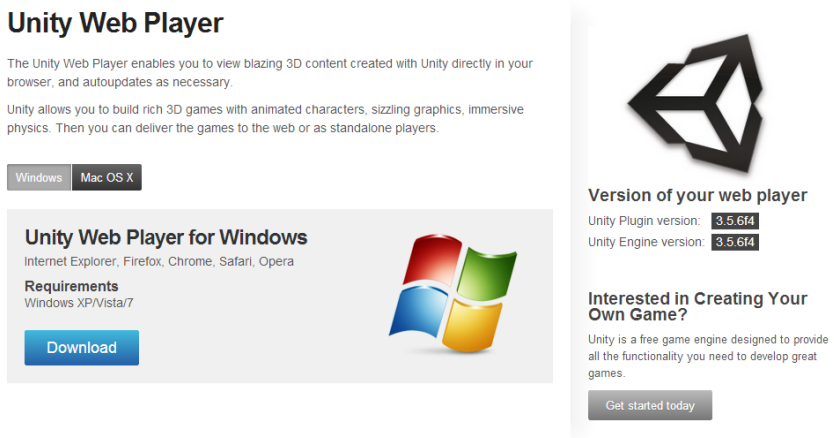
- Position
- Time
- Actions
- Tool use

Visualize data:

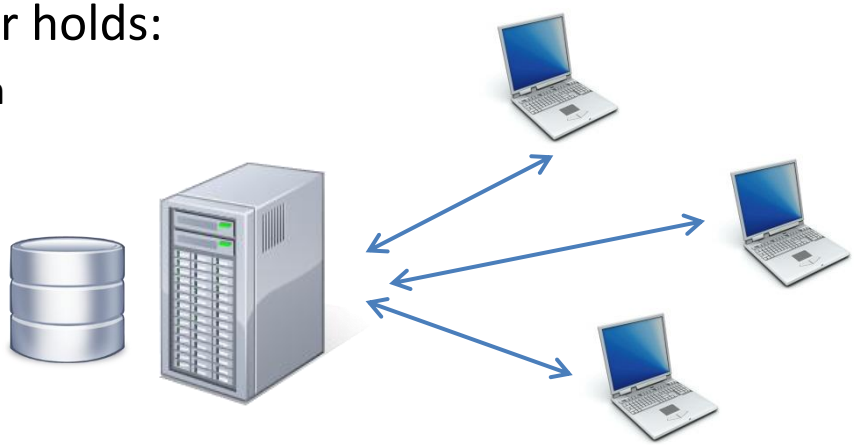
- Position
- Time
- Actions
- Tool use

Distribution

- Game is played in the web browser
  - Windows and Mac OS supported
  - Game updates seamlessly



- Web server provides:
  - Web page presenting the game
  - Player registration and logins
  - Database on server holds:
    - Player information
    - Saved games
    - Gameplay logs



Mini Game

Purpose:

- mini-game ***teaser*** to promote the main possum management game
- Un-lockable level for main possum management game

Playing style:

Nest defense – Angry kiwi stomps on zombie possums coming to steal it's eggs

Platforms:

PC

Mac

Mobile

Tablet

Possum Stomp!