

Challenges to Develop an Interactive 3D Virtual World for Psychological Experiments

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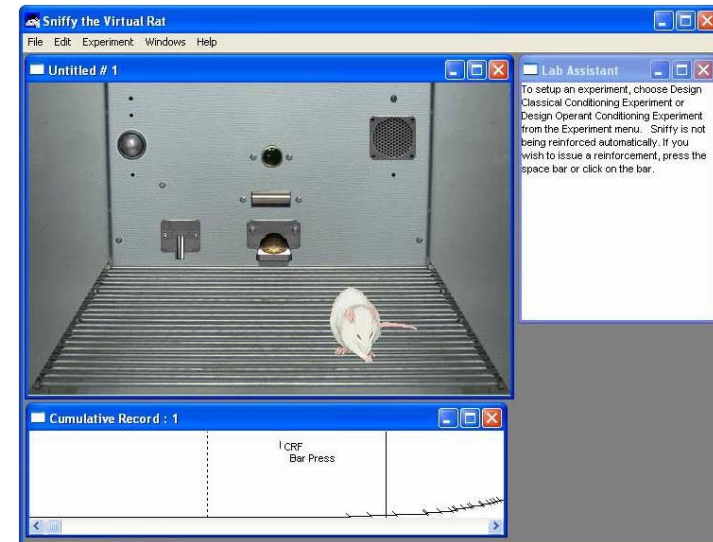
Motivation

- Engage students in experimental design, testing, data collection, and analysis
 - reinforce their understanding of the scientific method
- To validate models and theories of operant conditioning learned in the classroom

Sniffy the Virtual Rat

Alloway, Wilson & Graham, 2012

- Used extensively in psychology since the 1990's
 - Ethical alternative to live animal testing.
- Operant chamber
 - Bar to dispense food and water.
- Classical conditioning or operant conditioning
 - Modify specific behaviours from repertoire of actions.





The Island

Bulmer & Haladyn, 2011

- Survivors of a shipwreck which occurred in 1779
 - Population grew - 39 villages over 8000 people

- Designed for epidemiological studies
 - To see data in context
 - Teach statistical reasoning to first year undergraduates
 - Address limitations and management issues relating to studies involving human subjects.



Problem: Undergraduate Research

- Management Issues
 - Ethics
 - Delays
 - Working with human subjects

- Limitations on scale of research.
 - Recruiting participants
 - Convenience samples
 - Skewed results

- Lose connection between experimental design & validity of results



Model for Operant Conditioning

- Rescorla and Wagner (1972)
- If a stimulus is followed by something unexpected or surprising
 - learning will be improved
- Conditioning is dependent on
 - the strength of the stimulus
 - and the amount of surprise



Operant Conditioning

Rescorla and Wagner (1972)

$$\Delta V_x = \alpha_x \beta (\lambda - \Sigma V)$$

Where:

V is the predictive value

α is the salience of the Conditioned Stimulus (CS)

β is the rate parameter of the Unconditioned Stimulus (US)

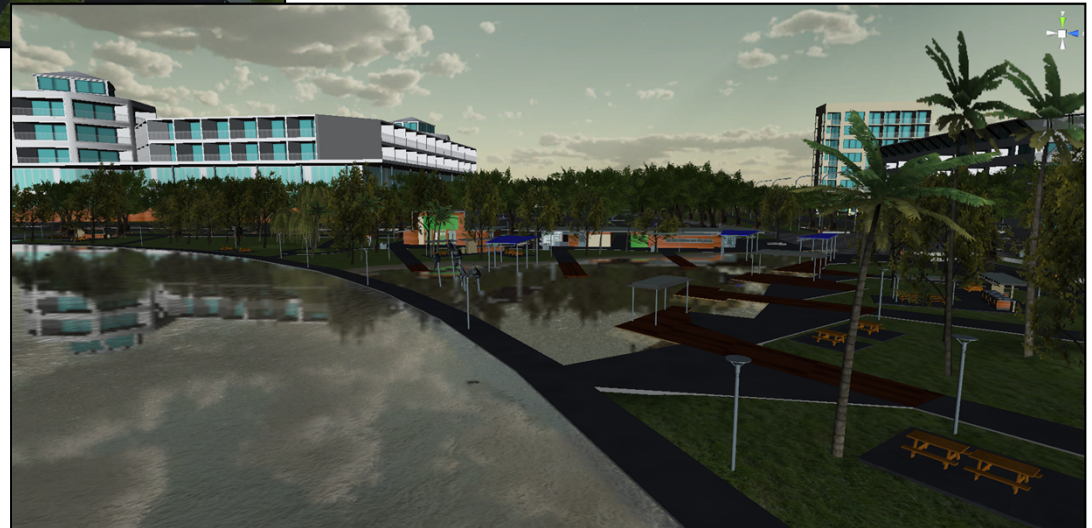
λ is the maximum associative strength of the US

ΣV is the sum of the associative strengths presented in the trial
and ($\lambda - \Sigma V = \text{surprise}$)



Environment

- Cairns Lagoon
- Locals and tourists
- Business, restaurants, outdoor activities





Behavioural Matrix

Behaviour	Zone/s	Probability		
		Avatar 1	Avatar 2	Avatar 3
Exercise	Grass	50	7	0
Sunbath	Grass	10	40	60
Sit down	Grass	5	25	30
Drink	Fountain	30	10	5
Smoke	Any	1	0	70
Dance	Any	10	5	0
Idle	Any	100	100	100

Idle Behaviours

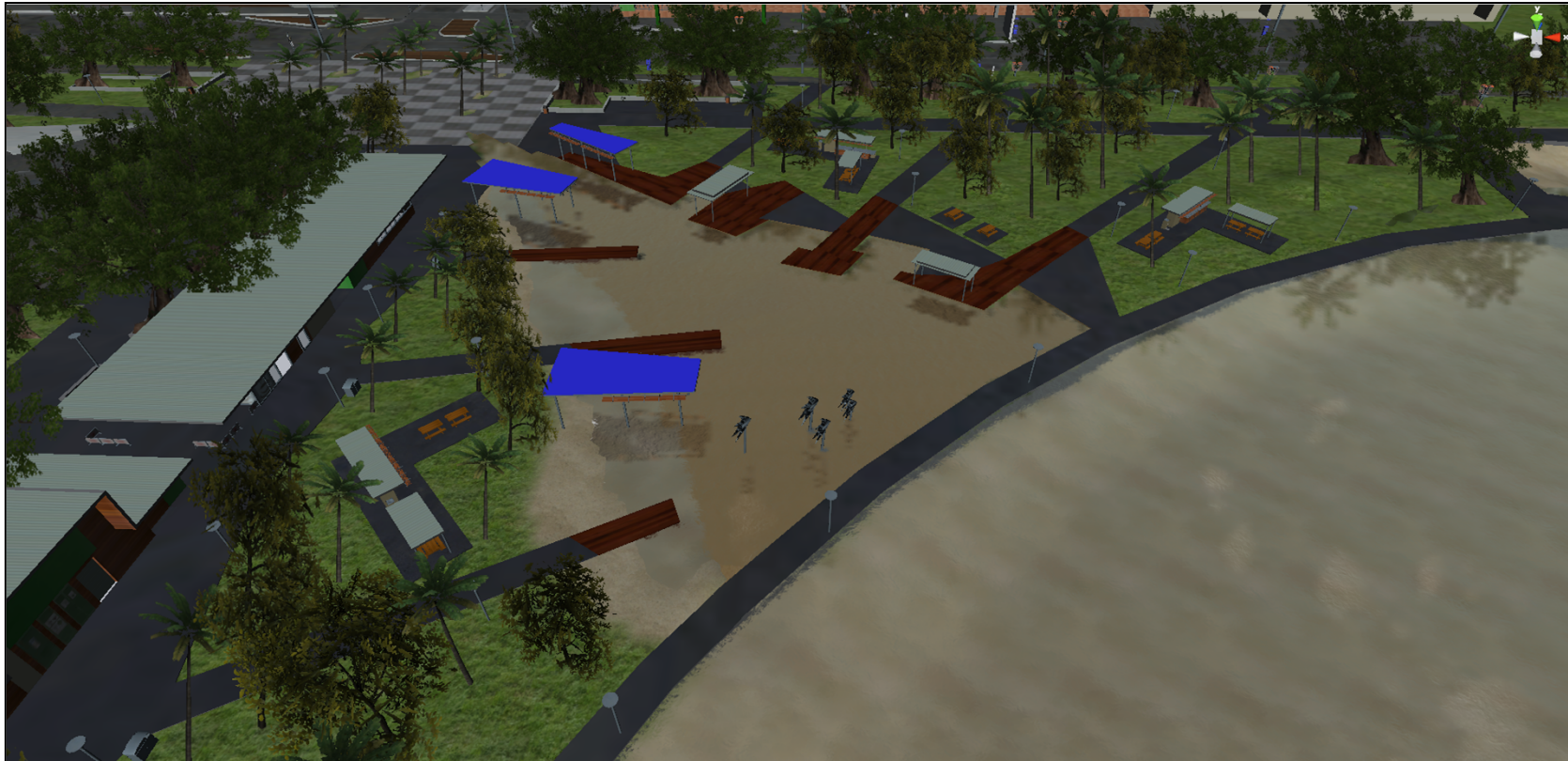
- Wander free, groom, read book, use mobile



Reinforcement Matrix

Reinforcer	Cool Down Time	Reinforcement Value		
		Avatar 1	Avatar 2	Avatar 3
Money	10	5	2	4
Confectionery	10	1	4	0
Encouragement	5	3	1	5

- Random behaviour
 - Weighted by behavioural probability matrix
 - Min reinforcement period = animation cycle



Polygonal Zoning

- Travel required for location specific behaviors
- Behaviours assigned to zones or locations



Zoning and AI

- Random walking - natural avoidance
- Points of interest
 - Drink fountain, BBQ, vending machine
- Define polygonal zones
 - Associate zones with location specific behaviours
 - Select zone for a selected behaviour
 - Move to zone

 - Display intention



Conducting a Study: Scenarios

- Random configuration
- Or lecturer defined scenarios

- Character configuration
 - Behavioural matrix
 - Reinforcement matrix

 - Location
 - Orientation
 - Initial behaviour

Data Collection and Assessment



- Time stamped event logs
- Recams – observation, reflection
- Technical data - text or graphical formats
 - Behavioural probability matrix
 - learning rates



Safe Virtual Environment

- Free from the supervisory and ethical considerations
- Engage with the entire experimental process
 - Experimental design
 - Administration of methodologies,
 - Data collection
 - Analysis
 - Reporting



Questions

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