Five Years on the Island

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AUSTRALIAN LEARNING & TEACHING COUNCIL
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Overview

Motivation

- Student experiments provide a context for learning modeling and introduce topics in study design

- They also give an appreciation of the practical issues involved in carrying out experiments and collecting data

- However in large classes experiments raise logistical and ethical issues

The Island

- An online environment where students can conduct studies involving virtual human subjects
- A framework that provides a history for each Islander based on geography and climate
- Provides an image of each islander to help engagement and identity
- Added tasks to allow experimental studies
- Current simulation includes 16,579 Islanders

Simulations

The Island is based on three simulations running at different timescales:

Monthly
Responsible for the overall 240-year history of the population

Daily
Keeps track of a small number of medium-term experimental effects that students required

Every 30 seconds
Models a range of physiological processes

Examples of Tasks and Models

- Caffeine and Alcohol
- Glucose/insulin dynamics
- Sleep states
- Microarrays
- Surveys
- Climate

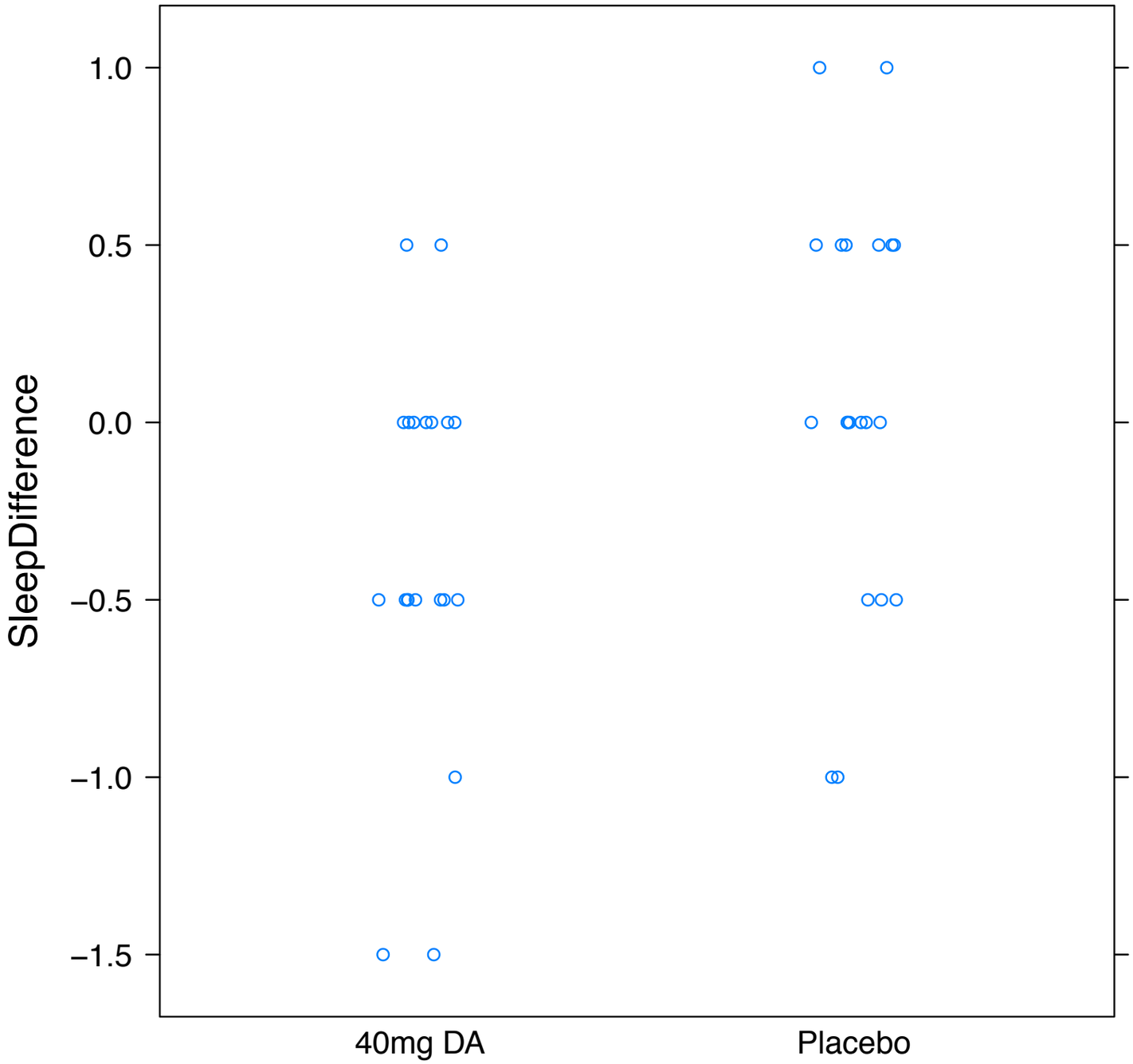
Deliberate Omissions

- The Island doesn't *do* anything…
  - No tools for choosing random samples
  - No tools for applying tasks to multiple Islanders
  - No display of combined data
  - No statistical tools

Student Projects

Effect of Dextroamphetamine use on Sleep

- “Dextroamphetamine is used to treat narcolepsy and ADHD. However, the drug has been known to interrupt sleep patterns by decreasing nightly sleep time. This study seeks to determine whether a 40mg dose of dextroamphetamine causes a decrease in nightly sleep time. Participants in the study received dextroamphetamine or a placebo and were surveyed on sleep patterns.”


SleepDifference
1.0
0.5
0.0
−0.5
−1.0
−1.5
40mg DA
Placebo

Results

- Significant evidence (p = 0.0101) of a decrease in sleep time after taking 40mg of dextroamphetamine

No Effect?

- “I am doing my experimental project and I’m trying to find a change in anything basically after my islanders take marijuana. First I tried to give them cannabis tea and waited ten minutes and measured pulse, IQ and gave them my survey but there weren’t any significant changes between before and after. So today I tried again and gave them a reefer instead, waited 10 minutes and again no changes. Is ten minutes too long or not long enough? I’m using a variety of age and sex so it’s not that they are too young or old. Does it matter that the changes aren’t very good? … Will I lose marks for this?”

Journal of Island Studies

- Accessible through the Island interface, this online journal gives some examples of student projects using the Island.

Islander Genetics

- Each Islander has a pair of chromosomes
- The corresponding genes determine the appearance of the Islanders and contribute to disease susceptibility
- Three “gene array” tasks give students direct access to this genetic information through intensity maps

Eye Colour

- *The genetic basis of eye colour on the Island*
  Ben O'Sullivan and Peter Fardoulys
  University of Queensland

- "The participants were randomly selected from the town of Edwardton. All were 6 years of age or older, so that they could complete the survey. The subjects took the survey, which asked for eye colour, then had their combined chromosome mapped onto a microarray. 10 Islanders of each of the 4 eye colours were recruited, for a total of 40 participants. A one-way analysis of variance (ANOVA) test and a Bonferroni correction was used to determine if any genes varied significantly between eye colour groups."

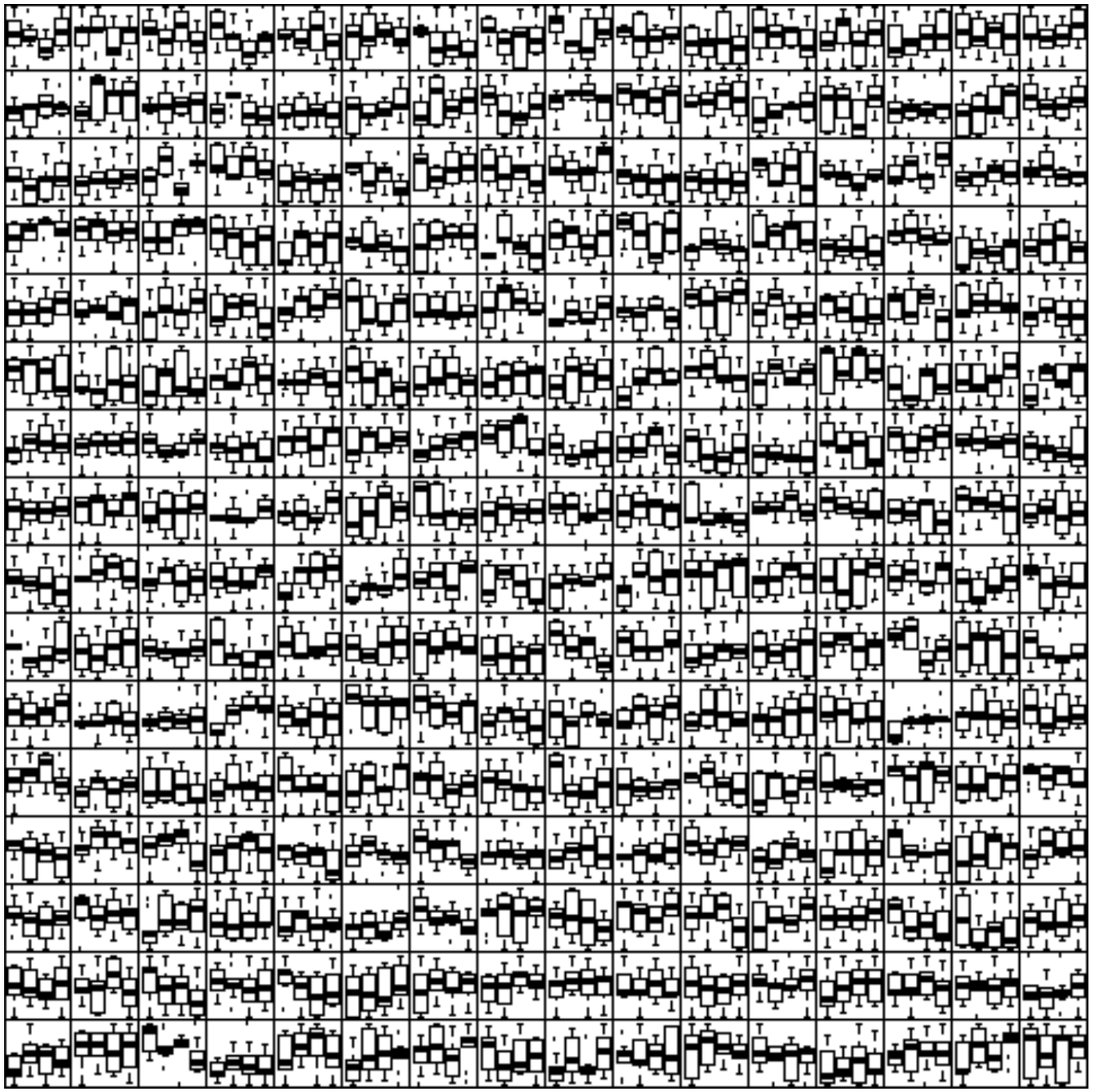


Figure 1. This figure shows side by side box plots of blue, brown, green and purple eye colour, for all 256 Islander genes.

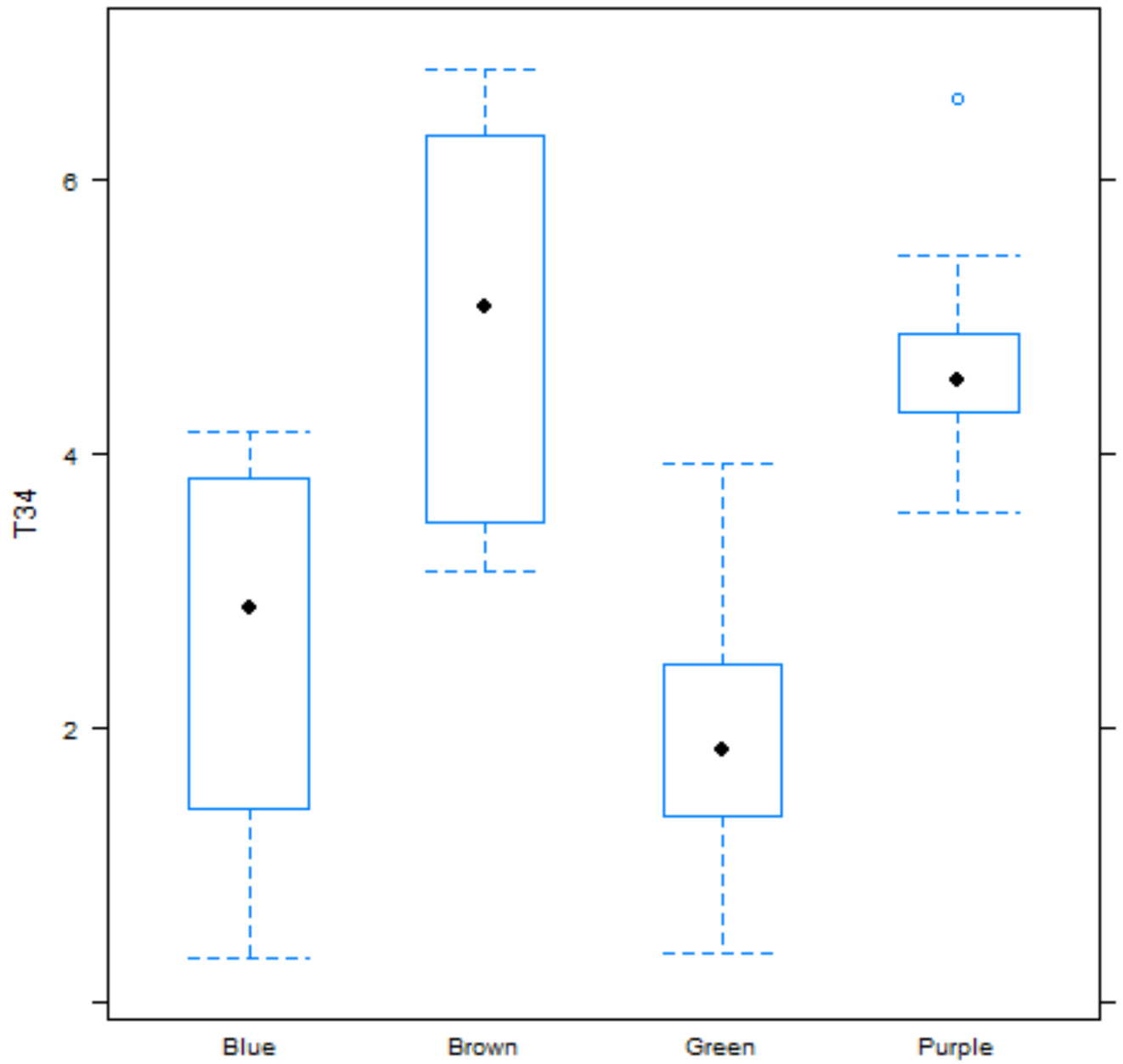


Figure 2. This figure shows side by side box plots for the expression of the T34 gene in the different eye colour groups.

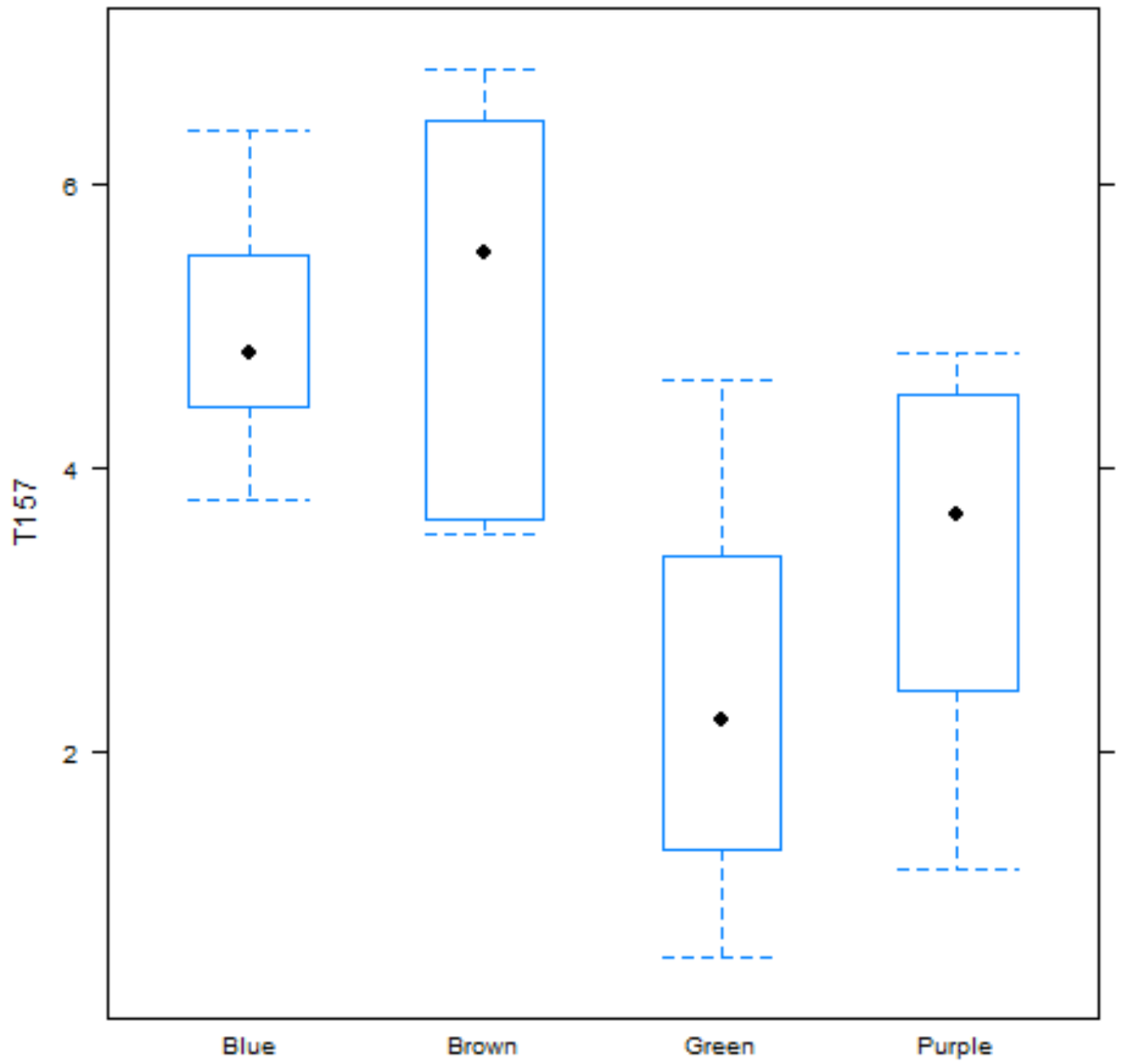


Figure 3. This figure shows side by side box plots for the expression of the T157 gene in the different eye colour groups

Results

- “The individual boxplots of these two genes, T34 and T157, are shown in Figures 2 and 3… After the Bonferroni correction, the p-values for these genes were 0.0002 and 0.0047 respectively. Figures 2 and 3 suggest that combinations of high and low expression of both genes determine eye colour. It will not however, always be possible to confidently allocate a person’s eye colour from the expression of these two genes as there is overlap of the expression of the 4 groups in both genes.”

Conclusion

Current Work and Future Directions

- Extending the historical population simulation to include environment, economy and education
  Michael Bulmer, University of Queensland

- Using the Island to model public health interventions for project learning in biostatistics and epidemiology
  P*eter Dunn & Rachel Cole, University of the Sunshine Coast*

- Improving realism of avatars and biological models to be more relevant to graduate and professional learning
  Susan Telke & team, University of Minnesota

- Using the Island to engage school students in science and statistics
  James Baglin & team, RMIT University

References

- Bulmer, M and Haladyn, JK (2011) Life on an Island: a Simulated Population to Support Student Projects in Statistics. *Technology Innovations in Statistics Education (TISE)*, **5** (1). http://escholarship.org/uc/item/2q0740hv

- Linden M, Baglin J and Bedford A (2011). Teaching clinical trial design and management using an online virtual environment. In *Proceedings of the Australian Conference on Science and Mathematics Education*, http://sydney.edu.au/iisme/conference/2011

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