

The University of York

Department of Computer Science

Submitted in part fulfilment for the degree of BEng.

Evolutionary agent-based simulation modelling of human life-history evolution

Caleb J. H. Riley

Version 0.01, 2016-November-15

Supervisor: Daniel W. Franks

Number of words = 2001, as counted by `wc -w`.
This includes the body of the report only.

Abstract

This is an abstract. Should be about 500 words long.

Contents

1	Introduction	9
2	Literature Review	10
2.1	What is Menopause?	10
2.2	Modelling techniques	10
2.2.1	Deterministic Models	10
2.2.2	Stochastic Models	10
2.3	Theories to explain evolution of menopause	10
2.3.1	Mother Hypothesis	11
2.3.2	Grandmother Hypothesis	11
2.3.3	Male Preference	11
2.3.4	Reproductive Conflict	12
2.4	Male preference and modelling	12
3	Problem Description/Analysis	13
4	Design and Implementation	14
5	Results and Evaluation	15
6	Conclusion	16

List of Figures

List of Tables

1 Introduction

This should be about 1000 words long.

2 Literature Review

This should be about 3000 words long.

2.1 What is Menopause?

2.2 Modelling techniques

Deterministic vs stochastic – computers provide new methods

2.2.1 Deterministic Models

2.2.2 Stochastic Models

2.3 Theories to explain evolution of menopause

The evolution of prolonged life after reproduction. [1]

Overview paper reviewing previous research into the presence of and theories for the existence of long post reproductive lifespans (PRLS).

Found in Humans, Killer Whales/Orcas and Short finned pilot whales.

Non-adaptive hypotheses:

- extended lifespans caused by improvements in medicine
- males preferring younger females

Adaptive hypotheses:

- mother hypothesis - to look after previous offspring rather than having new ones.
- grandmother hypothesis - to look after grandchildren to enable daughter(in law) to have more children.

2.3 Theories to explain evolution of menopause

- reproductive conflict hypothesis - grandmothers children competing with children

2.3.1 Mother Hypothesis

2.3.2 Grandmother Hypothesis

2.3.3 Male Preference

Why Men Matter: Mating Patterns Drive Evolution of Human Lifespan [2]

There is a lack of a wall of death - females dying immediately after menopause - when using a two-sex model opposed to a one-sex model.

Older males prefer younger females in the model as females their own age may be post-reproductive.

This preference reinforces post-reproductive lifespans as females are not reproducing due to the lack of male interest - thus the biological need for them to remain reproductive is diminished.

My Thoughts

There seems to be no accounting for the fact that male preference for younger females could have developed after the evolution of long post-reproductive females.

Indeed it seems that the evolution of a longer period of female reproduction would occur as those who remained fertile for longer would likely be still reproduced with, producing offspring with genes that can reproduce for longer. This extended period of reproduction would also probably result in more offspring than those who stopped reproducing at a younger age.

The statistical model is poorly explained - it is unclear how male preference has been implemented.

Patriarch hypothesis. [3]

Notes

My Thoughts

Mate Choice and the Origin of Menopause. [4]
Notes

2.3.4 Reproductive Conflict

Example 1.

Admittedly, this is a very simplistic description of what really happens, but the point is that TeX operates with glue and boxes. Letters are not the only things that can be boxes. One can put virtually everything into a box, including other boxes. Each box will then be handled by LaTeX as if it were a single letter.

2.4 Male preference and modelling

3 Problem Description/Analysis

This should be about 1500 words long.

4 Design and Implemenation

This should be about 2500 words long.

5 Results and Evaluation

This should be about 2500 words long.

6 Conclusion

This should be about 1000 words long.

Bibliography

- [1] D. P. Croft, L. J. Brent, D. W. Franks, and M. A. Cant, "The evolution of prolonged life after reproduction," *Trends in Ecology & Evolution*, 2015. [Online]. Available: <http://www.sciencedirect.com/science/article/pii/S0169534715001044>
- [2] S. D. Tuljapurkar, C. O. Puleston, and M. D. Gurven, "Why men matter: Mating patterns drive evolution of human lifespan," *PLOS ONE*, 2007. [Online]. Available: <http://dx.doi.org/10.1371/journal.pone.0000785>
- [3] F. Marlowe, "The patriarch hypothesis," *Human Nature*, 2000. [Online]. Available: <http://dx.doi.org/10.1007/s12110-000-1001-7>
- [4] R. A. Morton, J. R. Stone, and R. S. Singh, "Mate choice and the origin of menopause," *PLOS Computational Biology*, 2013. [Online]. Available: <http://dx.doi.org/10.1371/journal.pcbi.1003092>