

## A10.1 - Optimum Foraging Time in App Market

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The *information foraging* model borrows concepts from optimal foraging theory in order to model information retrieval behavior for information such as text, video, audio or images. (Pirolli and Card, 1995, Trepess)

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The rate of currency intake (i.e. information) is given by Holling's Disk equation

$$R = \frac{g(t_w)}{t_B + t_w}.$$

- 1) A linear relation between the number of patches foraged and time between foraging.
- 2) The average time between patches  $t_B > 0$ .
- 3) Average gain per patch  $g(t)$ , i.e. cumulative amount of new information encountered in search a result list.
- 4) Average patch processing time  $t_w > 0$ .

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All pathes have the same information gain which follows logarithmic distribution

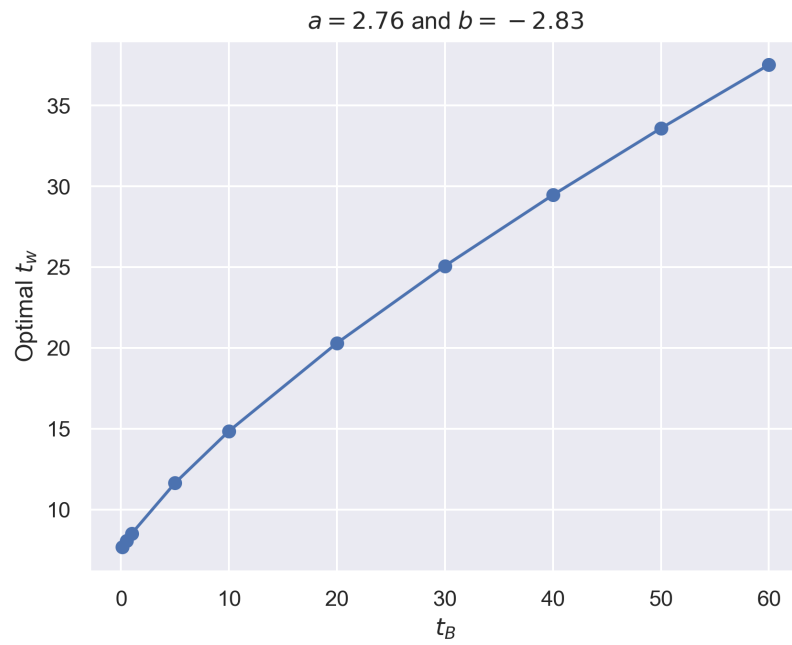
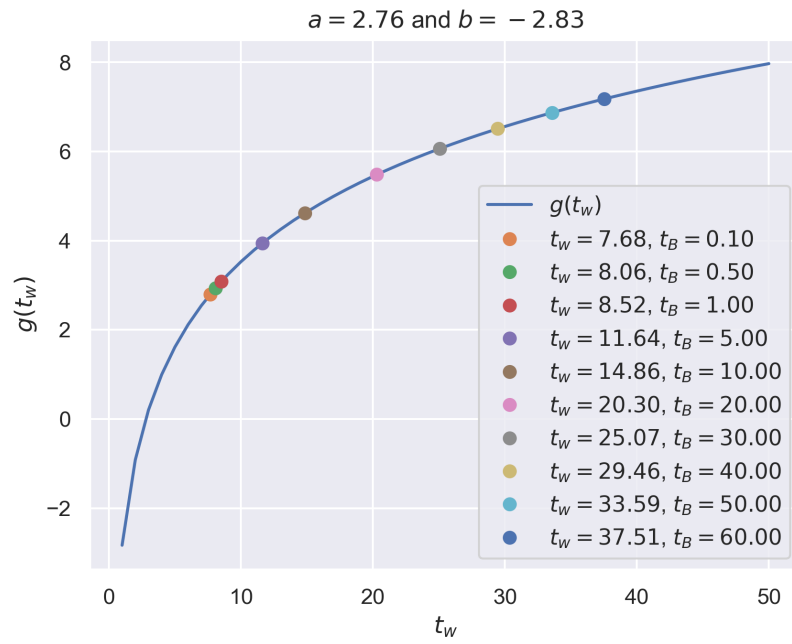
$$g(t) = a \ln t + b$$

where  $a$  and  $b$  are real numbers. The optimal amount of time  $t_w$  that should be spent foraging per patch can be solved from the equation

$$\begin{aligned} R(t_w) &= \frac{d}{dt_w} g(t_w) \\ \frac{a \ln t_w + b}{t_B + t_w} &= \frac{a}{t_w} \\ \frac{a \ln t_w + b}{t_B + t_w} - \frac{a}{t_w} &= 0 \\ at_w \ln t_w + bt_w - at_w - at_B &= 0 \end{aligned}$$

Given some numerical values for the constants  $a$  and  $b$ , the root can be solved using Newton's method.

## Results



The patch model was used to obtain the optimal foraging times  $t_w$  for given values of  $a$ ,  $b$  and  $t_B$ .

## References

Pirolli, P. and Card, S., 1995. Information foraging in information access environments. In: *Proceedings of the sigchi conference on human factors in computing systems*. ACM Press/Addison-Wesley Publishing Co., pp.51–58.

Trepess, D., *The glossary of human computer interaction*. [online] Available at: <<https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/information-foraging-theory>> [Accessed 9 Dec. 2018].