

## Commentary

Discussion on “Website Morphing” by  
Hauser, Urban, Liberali, and Braun

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These comments are a tribute to an impressive paper and suggestions for clarification of some fairly minor issues.

*Key words:* website morphing; Gittins index

*History:* Received: November 13, 2008; accepted: November 17, 2008. Published online in *Articles in Advance* February 24, 2009.

I would like to congratulate Hauser et al. (2009) on their paper. It brings together expertise in website and software design, psychological profiling, marketing research, statistical modeling, hidden Markov models, and adaptive Bayesian procedures in an impressive, practical, and effective way.

My book (Gittins 1989) on what became known as Gittins indices is now 19 years old, and it is very pleasing to have the opportunity to acknowledge one of the best papers since then that applies that theory. I particularly like the simple notion of an expected Gittins index, which Hauser et al. (2009) put to very effective use.

In recent years I have left these developments to others, so I have just a few detailed comments.

1. I would like to avoid confusion as to how the index  $G_{rmm}$  is, in principle, to be derived from Equation (1): The Gittins index for morph  $m$  with known cognitive segment  $r$  is the value of  $G_{rmm}$  for which the two terms inside the curly brackets on the right-hand side of Equation (1) are equal.

2. As the authors say, index values depend importantly on the discount parameter  $a$ . Note that the authors use  $a = 0.999999$  in Table 1, Figure 3, and Appendix 3.

3. I am puzzled by the authors' statement on page 7, “It is a valid fear that such exploration might lead to costly false morph assignments more so than a null strategy of one website for everyone.” In expectation, and with suitable priors and discount parameter, the index strategy with morphing is optimal and beats any strategy of one website for everyone. The simulation is still interesting, of course, but the authors might wish to elaborate.

4. The authors have told me that their calculations of index values for values of  $a$  that were very close to 1.0 were very time consuming. With luck, any future calculations could be shortened by making use of the approximations for such  $a$  values that are set out in §7.4 of my book. It would be interesting to know, for example, whether the limiting behaviour described in the display (7.15, p. 169) was observed.

## References

- Gittins, J. C. 1989. *Allocation Indices for Multi-Armed Bandits*. John Wiley & Sons, London.
- Hauser, J. R., G. L. Urban, G. Liberali, M. Braun. 2009. Website morphing. *Marketing Sci.* 28(2) 202–223.