

Retrieval by Accumulating Evidence in ACT-R

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1 Introduction

This document contains instructions on how to use the RACE/A module for ACT-R 6. The module contains code that implements the RACE/A theory as described by (Van Maanen, 2009 Chapter 2). (Van Maanen & Van Rijn, 2008, 2009; Van Maanen, Van Rijn, & Borst, in press) describe models that use this lisp implementation of RACE/A.

2 Installation

Copy the file `race.lisp` into the modules directory of ACT-R 6. To use RACE/A in your ACT-R model, set `:race-enabled t`.

3 RACE/A Parameters

:race-enabled This parameter enables the RACE/A retrieval set hook (set at `t`). It defaults to `nil`. If `:race-enabled nil`, then the normal declarative memory and visual modules are used.

:race-ratio Represents the decision criterion above which a chunk is retrieved. The default value is 0.95.

:race-freq The activation during a retrieval is updated with a certain frequency, controlled by `:race-freq`. It should be noted that a change in the update frequency influences not only the temporal precision of the activation, but also other aspects of the retrieval process, such as the retrieval time (i.e., a higher update frequency means a faster retrieval). The default value is 200 Hz.

:race-a The RACE/A decay parameter influences the drift of the RACE/A process, and influences the speed of decay if there is not increase in activation. The default value is 0.7.

:race-b A scaling parameter that scales the amount of spreading activation and external activation. The default value is 0.7.

:race-saliency RACE/A parameter governing the perceptual/external influence. The effect of this parameter is scaled by `:race-b`. It defaults to 0.

:race-trace Enable trace information on RACE/A activation values. Default is `nil`.

4 Other relevant parameters

4.1 *sgp parameters*

:rt The retrieval threshold parameter (`:rt`) represents an activation value that is always added to the retrieval set. This way, it creates a minimum retrieval time, for instance if for the remainder the retrieval set consists of only one chunk.

:lf The retrieval threshold parameter (`:rt`) and the latency scaling factor (`:lf`) together determine the maximum time available for a RACE/A process. This is computed using the default ACT-R latency equation. If the maximum time is passed, the buffer state is set to failure.

:ans The activation noise is used to compute a noise factor at every activation update. Adds stochasticity.

:visual-attention-latency If RACE/A is being used to compute the time needed to retrieve visual information, make sure this parameter is set to 0, because it may otherwise interfere with the RACE/A process. That is, it will overwrite the buffer contents if the RACE/A process took shorter than the value at which **:visual-attention-latency** is set.

4.2 yet other parameters

(add-sji (j i a)) The spreading activation (a) between two chunks (i and j) influences the activation dynamics and the retrieval time.

(set-base-levels (i a)) The initial baselevel activation (a) of a chunk (i) determines the activation starting point of the chunks for the first RACE/A process. If **:bll** is nonnil then **(sdp)** should be used (see the ACT-R documentation for further details).

5 Effects on other modules

For RACE/A to work properly, some adaptations had to be made to the declarative and the visual module, those adaptations automatically come into effect when you put 'race.lisp' in the modules directory and set **:race-enabled t**. Below is a list of changes to these modules.

5.2 Visual module

(proc-display)

If RACE/A is enabled (i.e., **:race-enabled** is set at **t**), then **(create-new-sjis)** is called.

(create-new-sjis)

If an item exists in the visicon, and if that item contains a feature which also occurs as a chunk in declarative memory, then a new association is created with value **:race-saliency**. Currently, this is only implemented for text and color features.

(move-attention)

If RACE/A is enabled (i.e., **:race-enabled** is set at **t**), then **(move-attention)** performs a RACE/A process to place a chunk in the visual buffer.

6 References

- Van Maanen, L. (2009). *Context effects on memory retrieval: Theory and applications*. Doctoral Thesis, University of Groningen, Groningen.
- Van Maanen, L., & Van Rijn, H. (2008). The picture-word interference effect is a Stroop effect after all. In V. Sloutsky, B. Love & K. McRae (Eds.), *Proceedings of the 30th Annual Meeting of the Cognitive Science Society* (pp. 645-650). Washington DC.
- Van Maanen, L., & Van Rijn, H. (2009). The locus of the gratton effect in picture-word interference. In A. Howes, D. Peebles & R. Cooper (Eds.), *Proceedings of the 9th International Conference on Cognitive Modeling*. Manchester, UK.
- Van Maanen, L., Van Rijn, H., & Borst, J. P. (in press). Stroop and picture-word interference are two sides of the same coin. *Psychonomic Bulletin & Review*