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Appendix

Here I consider the worst case, autoconvolution (the association of the item with itself). If **f** is an item vector consisting of N elements, all of which are random samples from a normal distribution with mean 0 and variance $1/N$, and **g** is an "associative" vector consisting of the autoconvolution of **f** with itself, then if X, Y, and Z are normally distributed random variables, the expectation E of the dot product ($\cdot$) of **f** and **g** is $E(\mathbf{f} \cdot \mathbf{g}) = f_1(N)\, E(X^3) + f_2(N)\, E(X^2Y) + f_3(N)\, E(XYZ)$.

Because $E(X^iY^jZ^k \ldots) = 0$, if any i, j, or k. . . is odd (the expectation of the product of random variables in the product of the expectations and, for a normal distribution, the expectation of any odd power is zero) then $E(\mathbf{f} \cdot \mathbf{g}) = 0$. The same result would hold if the association was between two different items (i.e., **f** and some other list item).

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Postscript: Reply to Macmillan and Rotello (2006)

Bennet Murdock
University of Toronto

The main point of my comment was to try to highlight the importance of relating work on remember–know judgments to more traditional work on recognition memory. The TODAM model I suggested was an example. In their reply, Macmillan and Rotello (2006) did not comment on this, so I do not know whether they agree.

I may have misunderstood the STREAK model. On the basis of Figures 4 and 5 in Rotello, Macmillan, and Reeder (2004), I assumed that, as is generally the case in signal-detection type models, the decision axes were the same as the memory axes (global and specific strength). I now realize that they may have assumed a change of basis. Perhaps global and specific strengths are the memory axes, but the criterion lines (planes) oblique to the memory axes form the basis vectors for the decision system. If so, then observations from the memory system must be mapped onto the decision space to permit remember–know (R–K) judgments. If this is correct, then it is quite reasonable to use sums and differences as the basis for decision. However, this is a rather different model. Not only is there a change of basis (a rotation of the memory vectors through an angle [θ]), but the basis vectors are offset by Co and Cr (the offsets of the old–new and R–K criterion cuts from the means of the new- and old-item distributions, respectively). Consequently we have a function (sums and differences), an offset, and a change of basis. The change of basis is frequently used in work on vector spaces (Murdoch, 1970), and the change is described by the so-called "β" matrix; namely,

$$\beta = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}.$$

These three functions are order dependent, so the order in which these operations are done affects the outcome, but STREAK does

not say what the order is. Consequently, my sense is that you cannot simulate STREAK and be sure you are doing it correctly. As I said in my original Comment, you do not have to simulate STREAK to make predictions, and the original Appendix B along with the Dunn equations in Macmillan and Rotello's reply make it possible to estimate parameters as well; however, my feeling is that simulation deepens your understanding of what is really going on in the model.

Macmillan and Rotello objected to the claim that my TODAM model is simpler than STREAK. What I said was "has a simpler decision mechanism than STREAK because the decision criteria are orthogonal not oblique" (p. 650), and this is true. It is even truer if the decision axes in STREAK are different from the memory axes. Macmillan and Rotello were also unhappy with the fact that none of the technical machinery of TODAM had been involved in the R–K application; but my article was a comment and there was no room. They might consult my TODAM2 article (Murdock, 1997) for further information. They said it was not clear that the TODAM model could fit rating data. All the technical machinery is available in the TODAM2 article, and it would not be hard to do. They also say that "Murdock lays out a new model rather than improving on old ones. . ." Well, TODAM is not exactly a new model (see Murdock, 1982), and I always thought that extending an old model to explain new effects was a good thing to do.

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