

# This Week's Citation Classic

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Posner M I & Mitchell R F. Chronometric analysis of classification.  
*Psychol. Rev.* 74:392-409, 1967.  
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This paper sought to extend the method of reaction time analysis, first developed by F.C. Donders<sup>1</sup> for isolation of internal mental processes, to the operations involved in matching, naming, and classifying visual and auditory stimuli. [The *Science Citation Index*<sup>®</sup> (SCI<sup>®</sup>) and the *Social Sciences Citation Index*<sup>®</sup> (SSCI<sup>®</sup>) indicate that this paper has been cited in over 280 publications since 1967.]

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"The paper had two origins. At the University of Wisconsin I had been trying to measure the time to switch attention from vision to audition. In tasks involving identity, cross modality pairs required systematically longer times than intramodality pairs, but this was not the case when other classifications were used. Why did it take longer to determine if a visual and auditory 3 were the same than it did for two visual or two auditory 3s? The second experiment began for a different reason but it led us (by this time I had moved to the University of Oregon and Ron Mitchell was working with me) to ask how quickly people could classify pairs of visual letters as 'same' when they were either exactly identical, 'AA,' or identical only in having a common overlearned response, 'Aa.' The extra time required for 'Aa' was about 80 millisecond or just about the same increase in reaction time as the cross modal pairs over the intramodal ones. We speculated that matches could be made either based on the identity of physical codes or upon the lookup of a learned name code.

"From that point on, the paper really wrote itself. It was simply necessary to run controls providing evidence that we could separate the time course of matching based on exact identity (physical identity) from that based on learning (name identity). The key was the fact that pairs like 'Ab' had times like 'AA' pairs when people were instructed to match on a physical basis and like 'Aa' pairs when people were required to match on name identity. Pairs like 'Aa' took no longer for 'different' responses with physical identity instructions than did pairs like 'Ac.'

"The paper received a cool reception from the journal to which I sent it. It simply didn't fit with the then dominant mathematical models that usually were published in the *Psychological Review*. I was asked to fit the data with exotic functions and otherwise to make it appear more 'theoretical.'

"However, the paper had a strong impact once it was published and many readers seemed to appreciate its simplicity. It has been highly cited for two reasons. First, it has been used as an example of the general coding approach to mental representations. Second, the methods have been used to study the codes of short-term memory, individual differences in availability of names, laterality, effects of brain injury, and a number of other issues. To me it helped direct my thinking toward the isolation of internal mental operations by experiment and later to understanding their neural bases.

"A major error I made in its format was to present the reaction times in terms of tree diagrams. That led readers to believe that these processes were strictly serial while, in fact, they were not. After 15 years of trying to correct this error, it still appears in textbooks. The written word never seems to catch up with a good picture. I have recently published a paper in this field."<sup>2</sup>

1. Donders F C. On the speed of mental processes. *Acta Psychol.* 30:412-30, 1969.  
(Originally published in *Netherland. Arch. Genees Natuur.* 4:117-45, 1869.)
2. Posner M I. Cumulative development of attentional theory. *Amer. Psychol.* 37:168-79, 1982.