

Kaiser, H. F.
(1974). An
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*Psychome-
trika*, 39,
31–36.

6043 citations
in Google
Scholar as of
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Psychometric Society, Asheville, NC, July, 2016

The Miscitation Story Begins

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For all articles that have appeared in *Psychometrika* since its first volume in 1936, this highly cited paper by Henry Kaiser is second only to Cronbach's massively cited 1951 article on coefficient alpha.

This Kaiser article suggests a normalized quartimax criterion, bounded between zero and one, to index the simplicity of the factor pattern for a given factor analysis.

Unfortunately, almost all but a very small handful of the citations to Kaiser (1974) appear to be in error.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy: The Root of the Problem

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In his Psychometric Society Presidential Address in 1970 (“A second generation Little Jiffy,” *Psychometrika*, 1970, 35 401–415), Kaiser added a few embellishments to his well-known approach to factor analysis that Chet Harris had disdainfully labeled “Little Jiffy”:

“principal components with associated eigenvalues greater than one followed by normal varimax rotation.”

One such addition in this 1970 paper was a “measure of sampling adequacy” (MSA) that was intended to reflect whether it was reasonable to proceed with a factor analysis in the first place.

Kaiser attributed this MSA to work he was doing at the time with Professors Meyer at Loyola (Chicago) and Olkin at Stanford.

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This MSA is now commonly referred to as the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO-MSA).

It is calculated routinely, for example, in the heavily-used SPSS and SAS factor analysis programs; also, functions for KMO-MSA appear in R, such as in the **psych** package developed by Bill Revelle.

The particular KMO-MSA computed by SPSS and various R functions, is not the exact same measure given in Kaiser (1970); instead, it is a modification meant to improve stability given in a 1974 Kaiser and Rice paper in *Educational and Psychological Measurement* (“Little Jiffy, Mark IV,” 34, 111-117).

The Citation Mixup Arises

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Over the last four or so decades, when the value of the KMO-MSA index is reported (usually taken directly from SPSS output), the reference given for it is most often Kaiser (1974), the factorial simplicity paper, and not the correct citation of Kaiser and Rice (1974), the Version IV Little Jiffy article.

One reason for Kaiser (1974) becoming the inappropriately highly-cited paper it has developed into, may be due in part to an article by Charles Dziuban and Edwin Shirkey from *Psychological Bulletin*, also in 1974: “When is a correlation matrix appropriate for factor analysis” (81, 358–361).

the following sentence appears on page 359: “Kaiser’s (1974) present calibration of the [KMO-MSA] index is as follows:”

No reference, however, appears for Kaiser (1974) in the bibliography for Dziuban and Shirkey (1974) but one is given for an “in press” piece by Kaiser and Rice.

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The mixup of using Kaiser (1974) for Kaiser and Rice (1974) may be a miscitation phenomenon that is difficult to correct.

Two popular SPSS-related user manuals, for example, make this citation error: the *SPSS Survival Manual* by Julie Pallant, and *Discovering Statistics Using SPSS* by Andy Field; the same citation error is also made in other books by Andy Field, such as in *Discovering Statistics Using SAS*.

In hindsight, it is surprising that such a miscitation wasn't caught earlier by an author of these secondary SPSS user manuals.

Not a single statistical package (SPSS, SAS, SYSTAT, Matlab, or R) computes Kaiser's index of factorial simplicity, irrespective of how good or bad the index might be.

Several statistical packages do, however, compute KMO-MSA (SPSS, SAS, and Bill Revelle's **psych** package for R).

Comments by Bill Revelle

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When Bill Revelle was asked why he didn't include a function for Kaiser's index of factorial simplicity in his **psych** R package, he said that he instead included a function for what he thought was a better index (of factorial complexity) due to Richard Hofmann ("Complexity and simplicity as objective indices descriptive of factor solutions," *Multivariate Behavioral Research*, 13, 1978, 247–250).

He also noted that he was never tempted to use Kaiser (1974) in reference to his KMO-MSA function; he gave the three (correct) citations for it of Kaiser (1970), Kaiser and Rice (1974), and Dziuhhan and Shirkey (1974).