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## The Game of Cipher Beads\*

S. S. Kutateladze\*\*

*Sobolev Institute of Mathematics, pr. Akad. Koptiyuga 4, Novosibirsk, 630090 Russia*

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**Abstract**—Comparison between the various impact factors of a few Russian journals demonstrates the deficiencies of the popular citation indices.

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Since recently there has been much ado invoked in science by incessant attempts at replacing expertise with numerical manipulations. Of especial relevance to the Russian mathematical community are the following indices:

- MCQ, the Mathematical Citation Quotient of the American Mathematical Society which utilizes the database of *Mathematical Reviews* (abbreviated to MR);
- IF or ISI, the classical impact factor of the Institute for Scientific Information which is a part of the Thomson Reuters Corporation;
- RISC, the Russian Index of Scientific Citation (cp. [1]) which rests upon the database of the Scientific Electronic Library ;
- MNRU, the impact factor of the All-Russia Mathematical Portal Math-Net.Ru which uses its own database (cp. [2]).

These indices are calculated for each journal one by one. Let  $Q_{N,k}$  be the number of citations in year  $N$  of the articles published in the journal in year  $N - k$ . By  $P_N$  we denote the number of the articles published by the journal under study in year  $N$ . Note in passing that  $N$  is the number of a year in the Gregorian calendar, and so  $N$  is at least six since  $N$  is greater than thousand. In this notation  $MCQ_N$ , the MCQ of the journal in year  $N$ , is calculated as follows:

$$MCQ_N = \frac{Q_{N,1} + Q_{N,2} + \cdots + Q_{N,5}}{P_{N-1} + P_{N-2} + \cdots + P_{N-5}}.$$

Denote the impact factor in year  $N$  by  $IF_N$ . By definition,

$$IF_N = \frac{Q_{N,1} + Q_{N,2}}{P_{N-1} + P_{N-2}}.$$

Thus, MCQ and IF are defined by the same scheme covering the different time spans of the relevant databases (cp. [3]). The first takes the citations of the previous five years; whereas the second, of the last two years. The RISC and MNRU impact factors are calculated by the classical two-year formula for IF suggested by Eu. Garfield, the founder of the Institute for Scientific Information (cp. [4]). It is worth observing that all four indices use the different although intersecting databases.

Let us assume that all articles in some journal are of the same high quality and have the same number of citations. Assume further that the number of articles in any volume is the same every year. In other words, suppose that  $Q_{N,k}$  and  $P_N$  are independent of  $N$  and  $k$ . In this model case, the MCQ and IF of the journal must coincide with one another as well as with the remaining two indices. Some fluctuations are

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\*The text was submitted by the author in English.

\*\*E-mail: sskut@member.ams.org

inevitable in practical situations, but the trend to coincidence should prevail for sufficiently full databases. However, we observe nothing like this for the real indices. The discrepancies in their actual values for a particular journal seem improbable for random fluctuations. For instance, IF is twice as much as MCQ for a few outstanding mathematical journals.

By way of illustration let us compare the current impact factors of the two pairs of prestigious journals on algebra and logic (see Table 1).

**Table 1.**

Journal	IF	MCQ
J. Algebra	0.630	0.64
J. Pure Appl. Algebra	0.666	0.59
J. Symb. Logic	0.609	0.31
J. Pure Appl. Logic	0.613	0.30

Using MCQ, it is possible to conclude that the two logical journals are twice as “feeble” as their algebraic counterparts. In fact, the practical coincidence of the IF and MCQ of the two algebraic journals demonstrates most likely that the articles of these journals primarily attract the scientists that publish their papers in the journals covered by MR. At the same time, more than a half of the citations of the two logical journals appears in the sources that are not scanned by MR. Therefore, the scope of influence of the logical pair on the flux of scientific information is substantially broader than that of the other pair. Moreover, the narrow audience is hardly a merit of any scientific journal.

The differences in databases greatly effect the calculation of the indices of Russian periodicals (cp. [5]). Let us take a look at the current values of the above-mentioned indices for a few authoritative journals of the Russian Academy of Sciences (see Table 2). The first four of them publish papers in all areas of mathematics, and the fifth is interdisciplinary.

**Table 2.**

Journal	IF	MCQ	RISC	MNRU	Founded in
Sb. Math.	0.359	0.44	0.113	0.399	1866
Russ. Math. Surv.	0.309	0.35	0.103	0.382	1936
Sib. Math. J.	0.208	0.18	0.108	0.269	1960
Math. Notes	0.251	0.18	0.030	0.244	1967
Theoret. Math. Phys.	0.622	0.12	0.107	0.601	1969

The obvious conclusion is in order that, taken *per annum*, all indices under consideration primarily characterize the respective databases, slightly reflecting a minor part of few phenomena of the real functioning of science.

The dynamics of citation indices may be more informative. For instance, look at the impact factors IF and MCQ of the *Russian Journal of Mathematical Physics*: (see Table 3).

V. P. Maslov, Editor-in-Chief of this journal, indicates that a few publications on economic applications of the ideas of mathematical physics might be a reason for the almost two-times raise of IF in 2007. Incidentally, MCQ neglects this phenomenon completely.

Traffic congestion never reflects the artistic gifts of jammed drivers. By analogy, there are insufficient grounds to correlate rather arbitrary numerical indices of the dynamics of scientific information in

**Table 3.**

Year	IF	MCQ
2003	0.291	0.23
2004	0.348	0.19
2005	0.394	0.26
2006	0.493	0.34
2007	1.012	0.35

a particular database with the quality of publications, all mystical hypotheses of the bureaucracy of science notwithstanding.

Science is not the glass bead game despite whatever ciphers.

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