Study of some Editor-in-Chief decision schemes

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It is difficult for editors-in-chief (EIC) of journals to make a final decision on acceptance or rejection of submitted articles when referee reports arrive too late. This paper studies the probability that an EIC makes different decisions (on acceptance or rejection) of submitted papers, dependent on the order in which referee reports arrive and where the EIC makes a decision before a third (late) referee report arrives. We study two decision rules. One rule, which we define as the “50-50” rule, lets the EIC decide “accept” in 50% of the cases and decide “reject” in 50% of the cases when the first two referees disagree. The other rule, called by Bornmann and Daniel the “clear-cut” rule lets the EIC decide “reject” in all cases where the first two referees disagree. Dependent on the order in which the referee reports arrive, we prove that in the “50-50” rule, the EIC makes different conclusions in 37.5% of the cases. In the “clear-cut” rule, the EIC makes different conclusions in 25% of the cases. Both models are based on an equal chance for acceptance or rejection advise of the referees. The model is then extended to one where the chance for agreement between two referees is higher than the chance for disagreement. This paper is dedicated to Professor Eugene Garfield (Ph.D.) on the occasion of his 85th birthday. The paper focuses on some challenges of Editors-in-Chief. Professor Eugene Garfield is founding Editor-in-Chief of the prestigious journal “The Scientist” and he endorsed the foundation in 2007 of the new journal “Journal of Informetrics” (founded by this author).

Introduction

Despite increasing importance given to citation analysis and analysis of downloads in the evaluation of scientific papers, peer review remains the cornerstone for such evaluations. This is certainly the case in the pre-publication period of a paper, where peer review is about the only way to decide whether or not a paper can be published (usually after minor or major revisions). It is, therefore, important to appoint “the right” referees for a paper but this is a difficult task for the editor-in-chief (EIC) of a journal. But even when good referees for a paper are appointed, the problem can arise of conflicting reviews (e.g. one referee recommends rejection while the other referee recommend acceptance – to name just the most extreme possibilities), in which case the EIC, normally, appoints a third referee, but, certainly in this case, time (publication delay) is becoming a problem. For more on this we refer to the extensive book by Weller¹ – see also Fletcher and Fletcher² where one advocates the use of even more than 3 referees (of course, hereby seriously increasing the problem of publication delay and referees’ workloads).

This author has personal experience, as editor-in-chief (EIC) of the Elsevier journal “Journal of Informetrics” (see the reference list for the URLs of the journal’s website³ and the journal’s EES (Elsevier Editorial System)⁴, that it often takes a long time before referee reports on submitted papers arrive. This is, of course, due to the heavy work-load of referees amongst which we can give the example of colleagues who have accepted the task to review several papers.

Usually (see also Weller¹), an EIC accepts (or should accept) a paper when two appointed referees agree on acceptance (usually after minor or major revision but that is not important here). We can denote this by YY → Y (Y = yes = accept). Similarly an EIC rejects (or should reject) a paper when two appointed referees agree on rejection. We can denote this by NN → N (N = no = reject). In these cases, a third referee’s opinion is not needed. But in this case we can think of a third referee, being appointed at the same time as the first two referees and where an EIC decision might be changed dependent on the order in which referee reports are received and where the EIC takes a decision after receiving the advise of the fastest two referees. So, in the YY and NN cases we will also add a third referee in our study.

A third referee is, usually (but see also further), also needed in case the first two referees disagree (i.e. a YN or NY situation). But also here we will study how an EIC’s decision can be changed if the order of arrival of the referees’ reports is changed.
We will consider two decision rules for EIC’s. That YY leads to Y as EIC’s decision and NN leads to N as EIC’s decision is clear and will be assumed in both decision rules (cf. also Weller1, Chapter 6). The cases YN and NY (i.e. where the first two referees disagree) are more difficult.

One rule lets the EIC decide and we will assume here that the EIC decides Y (accept) and N (reject) in 50% of the cases. Therefore we call this rule the “50-50” rule and looks fair based on the EIC’s own judgement of the submitted paper.

The second rule gives no freedom to the EIC in the YN or NY cases: here the EIC always decides N (i.e. reject). This is also studied by Bornmann and Daniel5 and called the “clear-cut” rule. So in this rule, the EIC only accepts a paper in the YY case.

In both decision rules we will study the effect of the order of arrival of three referee reports on the EIC’s decision, when a decision is made based on the reports of the first two referees (the two fastest ones).

It should be clear that, when the EIC waits until the three referee reports arrive, the decision of the EIC cannot be changed if we have different orders of arrival of the three referee reports. Indeed YY \rightarrow Y and NN \rightarrow N, no matter what is the advice of a third referee. The case YNY yields Y in any order and similarly NYY \rightarrow Y, YNN \rightarrow N and NYN \rightarrow N in any order. These four cases describe all situations YN and NY as advise of the first two referees followed by Y or N of the third referee: then changing the order of the referees does not change the decision of the EIC.

The next section studies the case of the “50-50” rule (under randomness hypothesis for Y and N). This is the more complex rule. We prove that a switch of the third referee with one of the other referees leads to a different decision of the EIC in 37.5% of the cases.

The third section studies the “clear-cut” case (under randomness hypothesis for Y and N). Now a switch of the third referee with one of the other referees leads to a different decision of the EIC in 25% of the cases.

The Bornmann and Daniel data seem to indicate that YY and NN appear more or less equally but that these occurrences each are about the double of the combined occurrences of YN and NY. Furthermore, in the YY case the third referee advises Y in twice as much cases than a N advice. Similarly, in the NN case, the third referee advises N in twice as much cases than a Y advice. Finally in the combined cases YN and NY, the third referee advises Y or N in more or less the same number of cases.

These, fairly logical assumptions are studied in the fourth section, both for the “50-50” rule and the “clear-cut” rule. Now a switch of the third referee with one of the first two referees and a decision of the EIC after the receipt of the first two referees leads to a change in decision of the EIC in \frac{7}{30} of the cases (≈ 23.3%) in the “50-50” rule and in \frac{11}{60} of the cases (≈ 18.3%) in the “clear-cut” rule.

The paper closes with conclusions and suggestions for further research.

**Study of the “50-50” decision rule**

The randomness hypothesis assumes that YY, NN, YN and NY are equally possible (first two referees) and that the third referee advises Y or N in an equal way. The “50-50” rule assumes YY \rightarrow Y (\rightarrow is EIC’s decision), NN \rightarrow N, NY and YN combined yield Y or N as EIC’s decision in the same number of cases. We have the following result.

**Proposition 1:**

Under the randomness hypothesis and applying the “50-50” rule we have the decision scheme below, yielding a fraction of 0.375 (i.e. 37.5%) of EIC’s decision changes, when the third referee switches with one of the other two referees and where the EIC makes a decision after receiving two referee reports.

**Proof:** We have the following decision scheme: the numbers in the boxes refer to the probabilities of occurrence, EIC means: decision of the EIC, "EIC" means: EIC’s decision if 3rd referee switches with one of the two other referees, \rightarrow means: 3rd referee advise.
3rd ref.

YY \stackrel{\text{EIC}}{\rightarrow} Y

⇒ no decision change EIC

Y \frac{1}{2} ⇒ no decision change EIC

“EIC” N \frac{1}{2} ⇒ decision change EIC

N \frac{1}{2} ⇒ no decision change EIC

“EIC” Y \frac{1}{2} ⇒ no decision change EIC

Y \frac{1}{2} ⇒ decision change EIC

“EIC”

3rd ref.

YY \stackrel{\text{EIC}}{\rightarrow} Y

⇒ no decision change EIC

Y \frac{1}{2} ⇒ no decision change EIC

“EIC” N \frac{1}{2} ⇒ no decision change EIC

N \frac{1}{2} ⇒ no decision change EIC
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\[ \begin{array}{cccccc}
N & \frac{1}{2} & \Rightarrow & \text{no decision change EIC} \\
3^{\text{rd}} \text{ ref.} & & & & & \\
N & \frac{1}{2} & \Rightarrow & \text{no decision change EIC} \\
Y & \frac{1}{4} & \Rightarrow & \text{decision change EIC} \\
\end{array} \]

\[ \begin{array}{cccccc}
N & \frac{1}{2} & \Rightarrow & \text{decision change EIC} \\
EIC & & & & & \\
Y & \frac{1}{4} & \Rightarrow & \text{decision change EIC} \\
\end{array} \]

\[ \begin{array}{cccccc}
Y & \frac{1}{4} & \Rightarrow & \text{no decision change EIC} \\
\text{(combined)} & & & & & \\
N & \frac{1}{4} & \Rightarrow & \text{decision change EIC} \\
Y & \frac{1}{4} & \Rightarrow & \text{no decision change EIC} \\
EIC & & & & & \\
Y & \frac{1}{4} & \Rightarrow & \text{no decision change EIC} \\
\end{array} \]

\[ \begin{array}{cccccc}
Y & \frac{1}{2} & \Rightarrow & \text{no decision change EIC} \\
3^{\text{rd}} \text{ ref.} & & & & & \\
N & \frac{1}{2} & \Rightarrow & \text{decision change EIC} \\
Y & \frac{1}{4} & \Rightarrow & \text{decision change EIC} \\
\end{array} \]

\[ \begin{array}{cccccc}
Y & \frac{1}{4} & \Rightarrow & \text{no decision change EIC} \\
\end{array} \]
We explain this decision scheme by two examples

\[
\begin{array}{c|c|c|c|c|c}
\text{YY} & \frac{1}{4} & EIC & \rightarrow & \text{Y} & \rightarrow & \text{N} \frac{1}{2} & \text{"EIC"} & \rightarrow & \text{N} \frac{1}{2} \\
\end{array}
\]

decision change EIC

is explained as follows: in \(\frac{1}{4}\) of the cases we have YY as advise of the first two referees. Then the EIC always decides Y. In \(\frac{1}{2}\) of the cases the 3rd referee advises N. If we replace one Y in YY by N then, in the “50-50” case, the EIC decides N in \(\frac{1}{2}\) of the cases, hence a decision change of the EIC.

\[
\begin{array}{c|c|c|c|c|c}
\text{YN} & \frac{1}{2} & EIC & \rightarrow & \text{Y} & \rightarrow & \text{Y} \frac{1}{2} & \text{"EIC"} & \rightarrow & \text{Y} \frac{3}{4} \\
\text{NY} & \frac{1}{2} & \rightarrow & \text{Y} & \rightarrow & \text{Y} \frac{1}{2} & \text{"EIC"} & \rightarrow & \text{Y} \frac{3}{4} \\
\end{array}
\]

(combined)

no decision change EIC

is explained as follows: the combined cases YN and NY occur in \(\frac{1}{2}\) of the cases. In the “50-50” rule, the EIC decides Y in \(\frac{1}{2}\) of the cases. In \(\frac{1}{2}\) of the cases, the 3rd referee advises Y. If we replace, in YN or NY, one letter by Y we have in \(\frac{1}{2}\) of the cases YY and in \(\frac{1}{2}\) of the cases YN or NY remains the same. In the YY case, the EIC always decides Y and in the cases YN or NY, the EIC decides Y in \(\frac{1}{2}\) of the cases. So, altogether, the EIC decides Y in \(\frac{3}{4}\) of the cases, hence no decision change of the EIC.

All the other schemes are explained similarly. Since each scheme excludes all the other ones and by independence of the occurrences we have that the EIC changes his/her decision due to a switch of the 3rd referee with one of the two other ones in a fraction of cases, equal to

\[
\frac{1}{4} \frac{1}{4} \frac{1}{4} + \frac{1}{4} \frac{1}{4} \frac{1}{4} + \frac{1}{4} \frac{1}{4} \frac{1}{4} + \frac{1}{4} \frac{1}{4} \frac{1}{4} + \frac{1}{4} \frac{1}{4} \frac{3}{4} + \frac{1}{4} \frac{1}{4} \frac{1}{4} = \frac{3}{8} = 0.375
\]

In the next section we still keep the pure randomness of Y and N but we will study the “clear-cut” rule (cf. Bornmann and Daniel\(^5\)).

**Study of the “clear-cut” decision rule**

The randomness hypothesis of section II is kept but now the “clear-cut” decision rule applies: we have YY \(\rightarrow\) Y, YN \(\rightarrow\) N, NY \(\rightarrow\) N, NN \(\rightarrow\) N, where \(\rightarrow\) means the EIC’s decision (denoted \(\text{EIC}\) below). We have the following result.

**Proposition 2:**

Under the randomness hypothesis and applying the “clear-cut” rule we have the decision scheme below, yielding a fraction of 0.25 (i.e. 25%) of EIC’s decision changes, when the third referee switches with one of the other two referees and where the EIC makes a decision after receiving two referee reports.

**Proof:**

We have the following decision scheme (same notation as in Proposition 1).
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3rd ref.

\[ YY \xrightarrow{\text{EIC}} Y \]

- \( Y \frac{1}{2} \Rightarrow \text{no decision change EIC} \)
- \( N \frac{1}{2} \Rightarrow \text{decision change EIC} \)

3rd ref.

\[ NN \xrightarrow{\text{EIC}} N \]

- \( Y \frac{1}{2} \Rightarrow \text{no decision change EIC} \)
- \( N \frac{1}{2} \Rightarrow \text{no decision change EIC} \)

(combined)

\[ YN \xrightarrow{\text{EIC}} N \]

- \( Y \frac{1}{2} \Rightarrow \text{decision change EIC} \)
- \( “EIC” \)
- \( “EIC” \)

\[ NY \xrightarrow{\text{EIC}} N \]

- \( Y \frac{1}{2} \Rightarrow \text{no decision change EIC} \)
- \( N \frac{1}{2} \Rightarrow \text{no decision change EIC} \)

- \( N \frac{1}{2} \Rightarrow \text{no decision change EIC} \)
With the same argument as in Proposition 1, we have that the EIC changes his/her decision due to a switch of the 3rd referee with one of the two other ones in a fraction of cases, equal to

\[ \frac{1 \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{4}}{1 \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{4}} = \frac{1}{4} = 0.25 \]

Hence, in this “clear-cut” model the EIC changes decision n 25% of the cases (still large but only in \( \frac{2}{3} \) of the cases compared to the “50-50” rule in Section II).

Repeating the randomness hypothesis

Bornmann and Daniel\(^5\) is very informative on the relation between the numbers of Ys and Ns of referees’ reports of the same paper. It is clear that Y and N do not appear randomly. We can say that – roughly (and in this case), the cases YY and NN (first two referees’ advises) each occur about twice as much as the combined YN, NY cases. Analogously, in the case YY (first two referees), the third referee advises Y in twice as much cases than N. Similarly, in the case NN (first two referees), the third referee advises N in twice as much cases than Y. Finally, in the combined YN, NY case (first two referees), the third referee advises Y or N, each in about 50% of the cases. We consider this as an interesting observation, based on the Bornmann and Daniel data. It is an interesting problem (but not easy to study) to find out if this YY or NN-dependency is also valid in other cases of referees’ judgements.

In the next subsections we will study the “50-50” rule and the “clear-cut” rule under the assumptions given above.

Study of the “50-50” rule under the Y-N conditions formulated in this section

We now have Proposition 3 for the “50-50” rule using non-randomness of Y, N (as explained above in this section) and in the same notation as in the other Propositions.

Proposition 3:

Under the modified randomness hypothesis (as described above) and applying the “50-50” rule, we have the decision scheme below, yielding a fraction of \( \frac{7}{30} \) (i.e. 23.33…) of EIC’s decision changes, when the third referee switches with one of the other two referees and where the EIC makes a decision after receiving two referee reports.

Proof:

We have the following decision scheme (in the same notation as in the other propositions)

As in Proposition 1 we can conclude that the EIC changes his/her decision due to a switch with one of the two other referees in a fraction of cases, equal to

\[ \frac{2 \cdot \frac{1}{5} \cdot \frac{1}{3} + \frac{2}{5} \cdot \frac{1}{3} + \frac{1}{5} \cdot \frac{1}{2} \cdot \frac{1}{4} + \frac{1}{5} \cdot \frac{1}{2} \cdot \frac{1}{4}}{\frac{1}{5} \cdot \frac{1}{2} \cdot \frac{1}{4} + \frac{1}{5} \cdot \frac{1}{2} \cdot \frac{1}{4}} = \frac{7}{30} = 0.233 \]
3rd ref.

YY \frac{2}{5} \xrightarrow{\text{EIC}} Y

- Y \frac{2}{3} \Rightarrow \text{no decision change EIC}

- “EIC” \xrightarrow{N \frac{1}{2}} \Rightarrow \text{decision change EIC}

- \text{“EIC”} \xrightarrow{Y \frac{1}{2}} \Rightarrow \text{no decision change EIC}

3rd ref.

NN \frac{2}{5} \xrightarrow{\text{EIC}} N

- N \frac{2}{3} \Rightarrow \text{no decision change EIC}

- “EIC” \xrightarrow{N \frac{1}{2}} \Rightarrow \text{no decision change EIC}

- \text{“EIC”} \xrightarrow{Y \frac{1}{2}} \Rightarrow \text{decision change EIC}

- \text{“EIC”} \xrightarrow{Y \frac{1}{2}} \Rightarrow \text{decision change EIC}
No decision change EIC

EIC

3rd ref.

Y3/4 ⇒ decision change EIC

N1/2 ⇒ no decision change EIC

EIC

P1/2

YN1/5

NY1/5

(combined)

“EIC”

Y1/2

“EIC”

N1/4 ⇒ no decision change EIC

N3/4 ⇒ decision change EIC

“EIC”

Y3/4 ⇒ decision change EIC

“EIC”

N1/2 ⇒ no decision change EIC

Y1/4 ⇒ no decision change EIC

“EIC”

Y3/4 ⇒ no decision change EIC

“EIC”

N1/4 ⇒ decision change EIC
We see that this fraction is much less than the one of 0.375 in Proposition 1, due to the fact that the 3rd referee is more in line (in general) with the first two referees based on the assumptions in this section and hence there are less EIC’s decision changes.

Next we study the “clear-cut” rule under the assumptions of this section.

**Study of the “clear-cut” rule under the Y-N conditions formulated in this section**

We now have Proposition 4 for the “clear-cut” rule using non-randomness of Y, N (as explained above in this section) and in the same notation as in the other Propositions.

**Proposition 4:**

Under the modified randomness hypothesis (as described above) and applying the “clear-cut” rule, we have the decision scheme below, yielding a fraction of \( \frac{11}{60} \) (i.e. 18.33\%\%) of EIC decision changes, when the third referee switches with one of the other two referees and where the EIC makes a decision after receiving two referee reports.

**Proof:**

We have the following decision scheme (in the same notation as in the other propositions).

We can now conclude that the EIC changes his/her decision due to a switch with one of the two other referees in a fraction of cases, equal to

\[
\frac{2}{5} \cdot \frac{1}{3} + \frac{1}{5} \cdot \frac{1}{2} = \frac{11}{60} = 0.1833\ldots
\]

We again see that this fraction is much less than the one of 0.25 in Proposition 2, again due to the fact that the 3rd referee is more in line (in general) with the first two referees based on the assumptions in this section and hence there are less EIC’s decision changes.

The obtained results are close to the ones obtained in Bornmann and Daniel5.

**Conclusions and open problems**

We noted that it is not an exception that referees’ opinions might be contradicting. Hence the decision of the EIC may be changed if the order in which referee reports are received changes.

What is the fraction of EIC’s decisions that change when a decision is taken on the basis of two referee reports and where a third referee switches with one of the other referees? This depends on the EIC decision rule.

One rule is called the “50-50” rule in which the EIC chooses acceptance and rejection in a fraction 50\%-50\% in case the first two referees disagree. Supposing randomness in referees’ acceptance (Y) or rejection (N), we have that in this case the EIC changes decision in 37.5\% of the cases, when the third referee switches with one of the other ones.
3rd ref.

YY \[ \begin{array}{c} 2 \\ 5 \end{array} \] \xrightarrow{EIC} Y

- \( \begin{array}{c} 2 \\ 3 \end{array} \Rightarrow \) no decision change EIC

- \( \begin{array}{c} 1 \\ 3 \end{array} \Rightarrow \) decision change EIC

3rd ref.

NN \[ \begin{array}{c} 2 \\ 5 \end{array} \] \xrightarrow{EIC} N

- \( \begin{array}{c} 2 \\ 3 \end{array} \Rightarrow \) no decision change EIC

- \( \begin{array}{c} 1 \\ 3 \end{array} \Rightarrow \) no decision change EIC

3rd ref.

YN \[ \begin{array}{c} 1 \\ 5 \end{array} \] \xrightarrow{EIC} N

- \( \begin{array}{c} 1 \\ 2 \end{array} \Rightarrow \) decision change EIC

- \( \begin{array}{c} 1 \\ 2 \end{array} \Rightarrow \) no decision change EIC

NY \[ \begin{array}{c} 1 \\ 5 \end{array} \] \xrightarrow{EIC} N

(combined)

- \( \begin{array}{c} 1 \\ 2 \end{array} \Rightarrow \) no decision change EIC
Another rule is called “clear-cut” rule (Bornmann and Daniel\textsuperscript{5}). Now the EIC rejects a paper in case the two referees disagree. Under the same randomness assumption, the EIC changes decision in 25\% of the cases (where there is a referee switch as described above).

It is noted in the Bornmann and Daniel\textsuperscript{5} data that Y-N randomness is not quite the case. Logically YY and NN are occurring more than YN and NY (a second Y is more likely than a conflicting case, and the same for a second N). Roughly, the Bornmann and Daniel\textsuperscript{5} data indicate that YY and NN each occur about twice as much as the YN, NY combined. Likewise a third Y (third referee) after YY occurs in twice as much cases than a N of the third referee. The same with the NN case: a third N after NN occurs in twice as much cases than a Y of the third referee. In the combined YN, NY case, the third referee gives a Y or a N is about 50\% of the cases.

In this model, and under the “50-50” rule, the editor changes decision (after a referee switch) in 23.3\% of the cases (hence much smaller than the 37.5\% in the randomness case). Under the “clear-cut” rule we find, in this model, a decision change in 18.3\% of the cases, again much less than the 25\% in the randomness case. This is in agreement with the 18.8\% in the Bornmann and Daniel\textsuperscript{5} data.

EICs’ decisions, based on referee reports are not generally known to the informetrics community (only the author of a submitted paper is informed on this and, of course, only on his/her paper). Therefore, a study as Bornmann and Daniel\textsuperscript{5} is very rare and valuable. The probabilistic dependence of a second Y and of a third Y (after YY), and similar for N is evident and logic but should be studied further, both theoretically and in practise (if data are available form the journal publisher) on different types of journals and we could then see if the obtained Y, N fractions in Bornmann and Daniel\textsuperscript{5} still apply.

Of course other EIC decision rules exist (see e.g. Schultz\textsuperscript{6}) and also here one should study probabilities of EIC’s decision change when there is a switch of referees.

References

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