

Users are not influenced by high impact and core journals while searching

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Abstract. Much attention has been paid recently in analyzing the interaction between the user and the search system. Interactive information retrieval researchers have become more interested in studying the user behavior in academic search engines in order to improve ranking and to better understand the user expectations. In our previous work, we analyzed the user behavior towards Marcia Bates' search stratagems such as 'footnote chasing', 'citation search', 'keyword search' and 'author search'. In this paper, we propose to examine in more detail the user behavior towards journal paper search known as the 'journal run' stratagem. We study the frequency and the stage of 'journal run' use in a social sciences academic search engine log. We found that the journal run is mostly used at the end of retrieval sessions and has an approximate usefulness of 55% measured by the presence of positive user actions in the log. Moreover, we include typical journal metrics in our case study and test whether there is an influence of the journals' impact factor (IF) and coreness of a journal on the overall session conduct. We found that the metric IF and coreness of a journal do not have a measurable impact on the journals utilization of social sciences users.

Keywords: Log Analysis, Interactive Information Retrieval, Stratagem Search, Journal Run, Information Behavior, Social Sciences Users.

1 Introduction

Much attention has been paid recently in analyzing the interaction between the user and the search system. In fact, researchers have moved from considering only the current query and result set to focus more on the user's past interactions and the analysis of whole retrieval sessions. Research approaches in interactive information retrieval aim to understand the user searching behavior in order to improve the ranking of results after submitting a query and enhance the user experience within an IR system.

Digital Libraries (DLs) users behave differently when interacting with the system as underlined by Marcia Bates who highlighted different concepts such as moves, tactics, stratagems, and strategies. According to Bates [1] *footnote chasing* is defined as checking the cited references and related material of a work backward in time. *Citation searching* refers to a forward chaining of works

citing the seed document through a citation index. *Keyword searching* consists of looking up the indexing terms representing research topics. The fourth stratagem *author searching* is defined as looking for specific author names to investigate more written material from a concrete author. *Journal run* is defined as the subject access to issues and volumes of a specific journal. Bates describes this stratagem as follows: "Journal run consists of reviewing contents pages of core journals in an area. (...) [This] technique, by definition, guarantees complete recall within that journal, and, if the journal is central enough to the searcher's interests, this technique also has tolerably good precision." [2]. In fact, a recent study shows that the journal run stratagem is often utilized as exploratory search functionality in DLs [3].

Scientific searchers are often over-flooded with a variety of papers and for each submitted query they are confronted with a list of ranked relevant documents. They browse documents or reformulate their queries until clicking on one or more item(s) that interest(s) them. By clicking on this particular document and if this document is published in a journal, the user can get more details about the article such as the authors, the keywords describing covered topics and the source. If the source is a journal and the user browses its content, then we talk about "journal run" (see Figure 1 as an example). In general, there is a strong demand and need for user support while navigating through scholarly document collections (esp. for area scanning, journal run and author search; see the same argument in [4]). This paper seeks to address the journal run stratagem and to analyze its usage in an academic search engine in the social sciences, the sowiprot search engine. In this context, we want to understand better the user behavior toward this specific stratagem performed by real DL users.

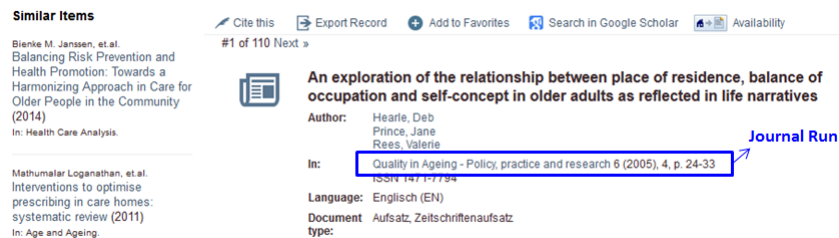


Fig. 1. Sample of an interface presenting a journal run

In particular, we address the following research questions:

RQ 1: Which usage patterns can be observed from clicked journal papers?

We focus on analyzing the usage pattern of "journal run" in real retrieval sessions in terms of frequency of their use and the stage of appearance. Furthermore, we want to study the success of sessions which cover journal papers

exploration behavior. We examine the interactions of the users in the sowiport DL in order to measure the usefulness and the precision of sessions containing journal runs. We determine the session success based on the presence of positive actions proposed recently by Hienert and Mutschke [5]. To be more specific, we measure the number of positive actions before and after journal run occurrence in a retrieval session.

RQ 2: Do journal properties like impact measures and coreness influence the click behavior in real life retrieval?

We aim at investigating whether the journal papers clicked by users are influenced by the journal reputation (in terms of impact measures) or the coreness (in terms of journal publication frequency). Among the most used metrics to identify the relevance and the reputation of a journal is the impact factor (IF)¹. Coreness of journals is measured according to Bradford zones [7].

The remainder of this paper is organized as follows. In the next section, we present an short overview of papers addressing stratagems and journal run in particular. In Section 3 we analyze the user behavior towards journal run and how using journal run affects the quality of the whole session search. Then, we verify whether the journal properties impact metrics and coreness have an influence on the clicked papers. Finally, we summarize our findings and present some perspectives relevant for future work.

2 Related Work

Bates [1] has specified different types of user behavior towards a search system, among them we cite: *moves*, *tactics*, *stratagems* and *strategies*. A move refers to a basic action performed by the user. A tactic uses additional moves along with a search. As for stratagems, they indicate complex and multiple moves/tactics having knowledge of a particular search domain. A strategy is a combination of moves, tactics and stratagems as a plan to pursue during the search session.

Some approaches studied the user behavior towards tactics, moves or stratagems. For instance, Schneider and Borlund [8] studied the effectiveness of using stratagems in constructing and maintaining thesauri vocabulary and structure. Mahoui and Cunningham [9] specified the importance of understanding the information of DL users in creating useful and stable search systems. They analyzed transaction logs to study usage patterns of CiteSeer in terms of query and search patterns. Xie [10] analyzed the users' search behaviors and their relationships with their information needs by specifying a hierarchical level of users' goals. Shute and Smith [11] identified 13 knowledge-based tactics arranged into three categories: broaden topic scope, narrow topic scope and change topic scope.

We notice that many research works have been proposed in the literature that analyzed the information-seeking process of a search engine usage. A transaction

¹ The IF is the result of Garfield's work with citation indexes and has been adopted by the Institute for Scientific Information's (ISI) as the ratio of the number of citations of articles published in years Y-1 and Y-2 by indexed journals during the year Y [6].

log is defined as a file of the transactions (communications) between a system and its users. A specific type of transaction logs are the ones describing sessions' search extracted from academic search engines.

For instance, Carevic and Mayr [12] proposed bibliometric-enhanced search facilities such as "journal run" or "citation search" and their possible integration in DLs. In their position paper, they argue that bibliometric-enhanced stratagems can facilitate domain specific search activities by applying bibliometric measures for re-ranking and/or rearranging DL-entities like documents, journals or authors. They propose different types of stratagem implementations like "extended journal run", "context-preserving journal run" and extended versions of citation search. In [3] the authors presented a first approach on gathering a deeper understanding on the usage of stratagems by conducting an online survey with 128 respondents from twelve different fields of research. The survey showed a general need for a contextual ranking in exploratory search which the authors tested using a journal run scenario in which the respondents were asked to arrange the content of a journal run based on two contextual features and four non-contextual features like date or title. The results of the survey showed that the respondents assess the ranking features based on contextualisation noticeably higher than the four non-contextual features².

Hemminger et al. [14] studied the information seeking behavior of academic scientists by conducting a survey at the University of North Carolina at Chapel Hill. They found that journal search has been considered the primary source of information with 56.04% of searches at daily basis which indicates a higher usage compared to book, proceedings and other types of resource. Ortega [15] studied the relationship between usage metrics and bibliometric indicators for authors using different academic systems such as Google Scholar and ResearchGate. He examined the information-seeking behavior of scholars in the fields of social sciences and humanities [16]. According to his study, he found that electronic journals were rated as the third most important resource, and that users look for multiple journals related to their keywords rather than just one.

3 Case Study

In this section, we first provide details about the dataset that we used for our analysis and then we describe the analyses in order to answer the research questions raised in Section 1.

3.1 Dataset

In order to analyze the utilization of the stratagem journal run, we used the digital library sowiport which was a publicly available DL dedicated to the Social Sciences. It contained more than nine million records, full texts and research

² A recent empirical study shows the effectiveness of simple contextual browsing features in a real-live DL [13].

projects included from twenty-two different databases whose content is in English and German [17].

In Table 1, we give an overview of the dataset by presenting the number of log entries, total sessions and a subset of sessions with stratagems (incl. Keyword Search, Citation Search, Footnote Chasing and Journal Run) as well as those with journal run only. The data we used was collected from September 2016 to May 2017³. After a filtering process, we mapped the transaction activities of the 3,377,000 log entries to a list of 58 different user actions which cover all types of activities and pages that can be carried out/visited within the system (e.g. typing a query, visiting a document, selecting a facet, exporting a document, etc.). For each action, a session id, the date stamp and additional information (e.g. query terms, document ids, and result lists) are stored.⁴

Table 1. Statistics of the filtered dataset

	Number
Log Entries	3,377,000
Total Sessions	208,557
Sessions with Stratagems	105,789
Sessions with Journal Run	22,721

Searching the sowiport DL can be performed through an *All fields* search box (default search without specification), or through specifying one or more field(s): title, person, institution, number, keyword or year. The main action types are divided into two categories: "Query"-related (search keyword, search person, advanced search, ...) and "Document"-related (see document details, access source, mark as favorite, ...) actions. Another categorization of actions was proposed in [5] by specifying search interactions and successive positive actions that we will use later (see Section 4) to measure the quality of sessions and the impact of the stratagem use.

3.2 Journals in this study

In this study, the journal run was performed in 22,721 individual sessions. In total, the number of journals accessed is 2063 unique journals. For these 2063 journals, we extracted their sizes according to the number of papers indexed in sowiport. Then, we considered two bibliometric journal indicators: the *Impact Factor* from 2015 and the *SCImago Journal Rank* from 2016. The impact factor (IF) is the measure used in the Journal Citation Reports⁵. The SCImago Journal

³ The dataset can be downloaded at <https://git.gesis.org/amur/SUSS-16-17>

⁴ An overview of the user actions in the transaction log is given in [18].

⁵ <https://clarivate.com/products/journal-citation-reports/>

Rank (SJR) is used by SCImago Journals⁶ and considers both the number of citations received by a journal and the importance of the journals where these citations came from by using a principle similar to PageRank [19]. The measure SJR is among four measures used by Scopus which is the largest abstract and citation database of peer-reviewed literature.

3.3 Measurements

To answer the first research question described in Section 1, we analyze the sessions with the mentioned stratagem "Journal Run" using measures used in our previous work [20].

For a session S during which a set of interactions $\{I\}$ is performed by the user, we define:

- $Strat$ is the stratagem "Journal Run",
- Pos is a positive interaction present in our data set among the following set $\{P\}$ described in [5]:
`goto_fulltext, goto_google_scholar, goto_local_availability, goto_google_books, view_description, export_cite, export_bib, export_mail, to_favorites, export_search_mail, save_search, save_search_history, save_to_multiple_favorites.`

To answer the second research question, we measure the precision of a stratagem before ($Precision(Strat)_b$) and after ($Precision(Strat)_a$) so we verify if it has an influence on the conduct of a session. We verify if we can find more positive actions after using a stratagem comparing to the number of positive actions before its utilization.

$$Precision(Strat)_b = \left(\frac{|Pos \in \{P\}|}{|I|} \right)_b \quad (1)$$

$$Precision(Strat)_a = \left(\frac{|Pos \in \{P\}|}{|I|} \right)_a \quad (2)$$

To have an overview of a stratagem benefit, we measure the *Usefulness* as the percentage of successful sessions in terms of positive actions among all the sessions including both of the studied stratagems. This measure is inspired from the *Global Usefulness* measure proposed by [5]:

$$Usefulness(Strat) = \frac{|s_{Strat}^+|}{|s_{Strat}|} \quad (3)$$

where $s^+(Strat)$ indicates session success in terms of positive actions occurrence after using a specific stratagem, and $|s_{Strat}|$ represents the number of sessions using a stratagem (footnote chasing or citation search) no matter the type of user's interactions (positive or not).

⁶ <http://www.scimagojr.com/>

4 Results

In this section, we present the analysis of journal run use on the session search conduct and the impact of journals' metrics and coreness on their usage.

4.1 Journal Run Usage

To answer the first research question described in Section 1, we analyzed the sessions with journal run activity having at least one clicked document.

While searching sowiport, the user typically checks the document content and metadata such as title, keywords, source. By clicking on the source (a journal in this case), the user expresses his interest in the source and can then browse other documents from the same journal. Regarding the Journal Run usage illustrated in Figure 2, we found that it is the most used stratagem with 39.78% among other stratagems namely Keyword Search, Author Search, Citation Search and Footnote Chasing. Journal Run was performed in average 1.85 times per session.

We consider, at this level, the position of the journal run in a session. In most of the sessions, the users accessed a journal after viewing a document. Journal run is distributed at different positions in the session and was mostly performed at the end of a session (see Figure 2). In fact, it was performed as the last action in a session for 37.61% of the studied sessions. This result is in line with the findings in [12] where the authors highlighted the need for an extended approach regarding journal run. In fact, an improvement of the user experience could be achieved by a journal-based re-ranking of results instead of a document-based one.

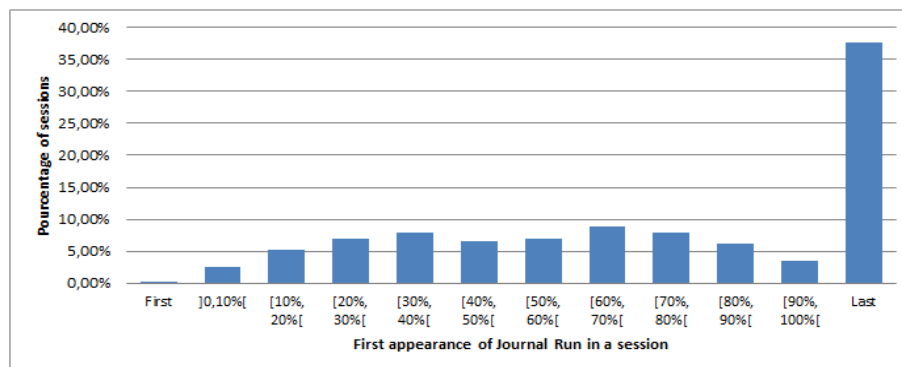


Fig. 2. Position of Journal Run in the search sessions

In order to answer the first research question mentioned in Section 1, we examined the usage behavior and found that the utilization of journal run is not

similar compared to the other stratagems. Mostly users browse journal papers at the end of sessions and rarely in the middle. For the other stratagems, Citation Search and Footnote Chasing are mostly used in the middle and the end of a search session (compare [20]), while Author Search and Keyword Search are mostly used in the middle and the beginning.

In order to study the impact of journals on the search behavior based on the academic search engine sowiport, we considered the measures shown in Section 3.3 using the equations 1, 2 and 3. The results of the measures are summarized in Table 2. We notice that the users of journal run lead to successful sessions with a percentage of 55.83%. In the rest of the sessions, the users do not perform positive actions (e.g. exporting citation, adding to favorite, etc.), they rather perform browsing actions by viewing the journals and many users access the external link of these journal. In fact, the percentage of positive (27.42%), non-positive (17.76%) and neutral (54.82%) impacts are measured by the number of sessions having more positive actions after performing a journal run, those having more positive ones before its usage and the sessions having equal number of positive actions before and after its usage respectively.

Table 2. Evaluation of Journal Run usage effects on the session conduct

Measure	Value
$Precision(Strat)_b$	0.043
$Precision(Strat)_a$	0.096
Gain in Precision ⁷	5.32
$Usefulness(Strat)$	55.83%
Positive Impact	27.42%
Neutral Impact	54.82%
Non-positive Impact	17.76%

4.2 Impact of Journals Metrics and Coreness

After analyzing the user behavior toward journal run, we here focus on the second research question mentioned in Section 1. We observe the potential effect of journal indicators (IF, SJR) and coreness of journals (according to their sizes based on Bradford Zones [7]) on the users click behavior.

In Figure 3, we present the distribution of journals using the IF, Bradford Zones and the frequency of their real usage in sowiport. In Figure 3.a we categorize the journals according to their IF values considering high IF with $IF \geq 3$, medium IF for $1 \leq IF < 3$, low IF are the journals with $IF < 1$ and those that have no IF. In Figure 3.b we group according to Bradford zones. We notice that among the 2063 accessed journals in our dataset, based on these zones, 63

⁷ Gain is computed as the percentage of increase between the precision-after and the precision-before.

are core journals, 262 journals are in zone 2 and 1738 journals are zone 3 (the periphery). Similarly, Figure 3.c shows three categories of journals according to their frequency of usage (number of views) where 80% have a frequency lower than 20 ($f < 20$), 10% have an intermediate frequency ($20 \leq f < 50$) and 10% have high frequency ($f \geq 50$) with the highest frequency reaching 883.

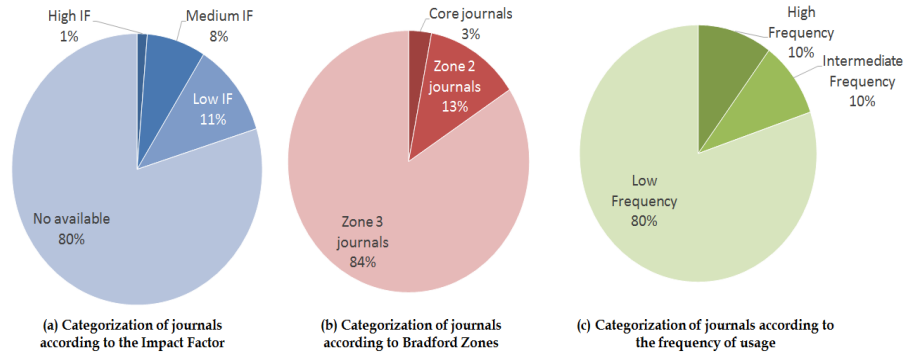


Fig. 3. Categorization of the journals accessed in our dataset according to impact factor (a), Bradford Zones (b) and usage frequency (c)

In Table 3 we describe the amount and the reputation of the journals in each Bradford Zone in terms of presence of indicators (IF and SJR), and the mean value of each indicator. We notice that 50% of the Core and Zone 2 journals have indicators (IF and/ or SJR) while only 30.44% of Zone 3 journals have an IF or SJR.

Table 3. Amount and reputation of journals for each Bradford zone

Zone	Presence of IF/SJR	Mean IF	Mean SJR
Core journals	50.73%	1.635	1.102
Zone 2 journals	50%	1.392	0.717
Zone 3 journals	30.44%	0.949	0.604

On the one hand, we measure the Pearson correlation between IF and SJR and we found a positive correlation with $R = 0,82$. We conclude a strong positive linear relationship between these two metrics. On the other hand, Figure 4 shows the relation between the impact factor and the size of journals. We notice that there is a very weak positive linear relationship (with $R = 0,22$) as the journals with high IF do not necessarily have a large size, and journals with a small

size can have high or low IF as well. For instance, the "American Journal of Psychiatry" with the highest IF of 5.68 in our journal set was clicked only once in the filtered log.

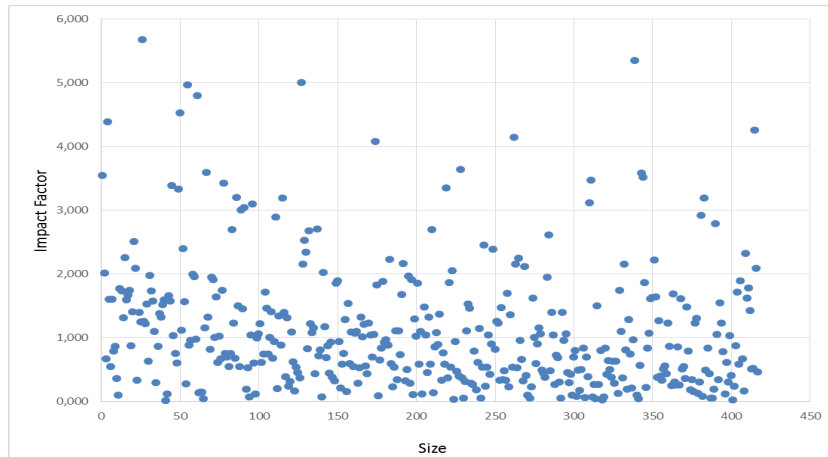


Fig. 4. Relation between the impact factor and the size of journals

In Figure 5, we study the impact of size and the reputation of journals on the frequency of their usage. In order to answer our second research question, we considered only sessions with positive actions to measure the effect of journal indicators (IF) and coreness. We found that 27.42% of the journals lead to successful sessions.

For the successful sessions⁸, we controlled the size (Bradford Zones) of the journals and found 7.66% core journals, 23.92% zone 2 journals and 68.42% zone 3 journals. In Figure 5, we present the relation between the journals' usage frequency and their corresponding IF (5.a) and size (5.b). For a better visualization, we eliminated the top two most clicked journals ("Kölner Zeitschrift für Soziologie und Sozialpsychologie" and "Zeitschrift für Pädagogik") in Figure 5. From Figure 5.a, we measured the *Pearson correlation* (R) and found that users are not influenced by the impact factor of the journals (there is no linear relationship with $R = -0.07$). The users are rather interested in journals that answer their information need and are relevant to queries they submitted. We notice that 3.82% of the frequently used journals have a high IF, 22.24% have a medium IF, 33.00% have a low IF and 40.93% are without IF. As for the size of journals (Figure 5.b), we notice also a non-linear relationship between the size and the frequency of usage of journals ($R = 0.223$).

⁸ Successful sessions are those having a higher number of positive actions (saving, exporting, downloading) after clicking on a journal than before.

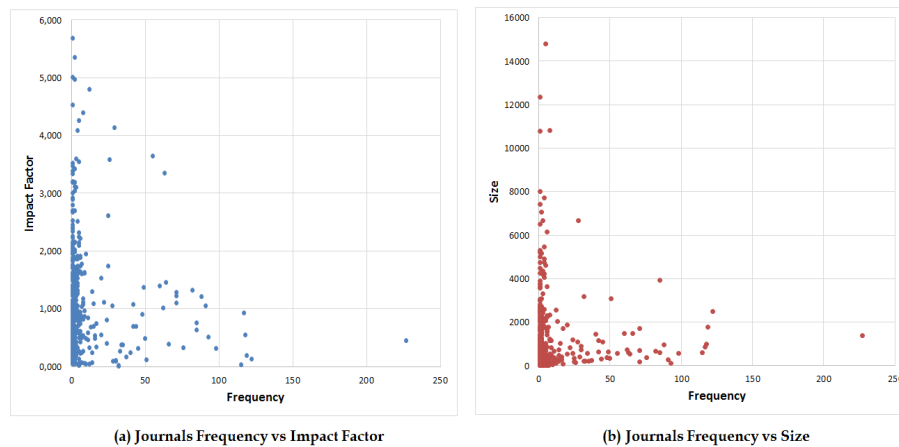


Fig. 5. Relation between the usage frequency of journals and their size (a) and impact factor (b)

In summary, we studied in this section the distribution of journals in terms of size (Bradford zones), usage frequency and journal metrics. We measured the impact of the journal run using the presence of positive actions (e.g. adding a paper to favorites or exporting a citation) before and after using this stratagem. We found that more than 50% of sessions contain positive actions and more than 60% of clicked journals lead to a positive effect. This means: the number of positive actions after using a journal run is higher than the number of positive actions before its usage. We conducted this analysis in order to check which journal metric has an impact on the sessions' success, and we found that the impact factor is not a criterion that affects the journal run whereas the size of the journal has a slight influence. In fact, users tend to click on journals that answer their information need and are relevant to the submitted queries regardless of their reputation or indicator (such as IF). This can be also explained by the fact that users, after finding a relevant journal (with high, medium or low impact factor), they access its external link (leave the retrieval system) and do not perform many interactions after the journal run. We also found that similar indicators from the same source (such as IF and SJR) correlate better than indicators from different sources (such as IF and size) as discussed before by Ortega[15].

5 Conclusion

In this paper, we investigated the usage of a specific search stratagem – the Journal Run – in an academic search engine. In fact, studying the user behavior towards stratagems can enhance the user-system interactions and lead to more useful academic search engines [12].

First, we examined the frequency and stage of use of the journal run as well as its impact on sessions. Then, we examined the impact of journal reputation and size on the usage of journals. We found that journal run is more often performed by the users at the end of the sessions, unlike other stratagems that are more present in the middle of the session [20]. The journal run is in the 3rd position in terms of sessions' success metrics (Precision, Usefulness and Positive Impact) after Citation Search and Footnote Chasing.

In addition, we analyzed the journals' distribution using their different indicators such as Impact Factor, coreness and usage frequency in the same digital library. We also measured the correlation between these indicators to study the influence and impact of the journals' properties (such as the Impact Factor and Bradford Zones) on the sessions' success. We found that the frequency of usage of the analyzed journals is not related to the Impact Factor within these sessions and that the size of the journal has an insignificant correlation. Thus, the users are more likely to click on journals that are relevant to their current information need and their choice is not strongly influenced by the other journal properties.

Regarding future work, we need to investigate if similar patterns can be observed in other domains, e.g. Natural Sciences, and if the users' level of expertise has an impact on their search behaviors (e.g. practitioners, students, researchers, professors). In addition to log analysis, we need to do user studies in order to compare user feedback with the findings of this study.

6 Acknowledgement

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