Searching for talent: The information retrieval challenges of recruitment professionals

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Abstract

Recruitment professionals perform complex search tasks in order to find candidates that match client job briefs. In completing these tasks, recruiters have to contend with many core information retrieval (IR) challenges, such as query formulation, refinement and evaluation. However, despite the similarities with more established communities of information professionals such as patent lawyers and healthcare librarians, this community has been largely overlooked in IR research. This paper presents results of a survey of recruitment professionals to understand their information seeking behaviour and their needs regarding IR systems and applications. The findings are discussed in the context of the recruitment industry as a whole and are moderated by insights from professional recruiters.

Keywords

recruitment professional, recruiter, sourcing, search, expertise retrieval, information retrieval, information seeking, system requirements, user study, survey

Introduction

Research into how people find and share expertise can be traced back to the 1960s, with early studies focusing on knowledge workers such as engineers and scientists and the information sources they consult [1]. Since then, the process of finding human experts (or *expertise retrieval*) has been studied in a variety of contexts, both academic and industrial, and has become the subject of a number of organised evaluation campaigns (e.g. the TREC Enterprise Track [2] and the TREC Entity Track [3]). This has facilitated the development of numerous research systems and lab-based prototypes, and led to significant advances in performance, particularly against a range of system-oriented metrics [4].

In recent years there has been a growing recognition that the effectiveness of expertise retrieval systems is highly dependent on a number of contextual factors [5]. This has led to a more human-centred approach focused on the process of *expertise seeking*, in which the emphasis is on how people search for expertise in the context of a specific task. These studies have typically been performed in an enterprise context, with the aim of utilising human knowledge within an organisation as efficiently as possible (e.g. [5, 6]).

However, there is a more ubiquitous form of expertise retrieval that exists beyond the enterprise, and embodies expert finding in its purest, most elemental form: the work of the professional recruiter. The role of the recruitment professional is to find people who are the best match for a client brief, and return a list of qualified candidates in the shortest possible time. Recruiters may not have privileged access to the research prototypes and systems referred to above, but their work involves the

creation and execution of some of the most complex Boolean expressions of any profession. These include nested, composite structures such as the following:

```
Java AND (Design OR develop OR code OR Program) AND
("* Engineer" OR MTS OR "* Develop*" OR Scientist OR
technologist) AND (J2EE OR Struts OR Spring) AND
(Algorithm OR "Data Structure" OR PS OR Problem
Solving)
```

Or exhaustive enumerations of related terms such as:

```
("looking for" OR "in search of" OR "open to" OR
"new job" OR "actively pursuing" OR "pursuing new"
OR "searching for" OR "new opportunity" OR "new
opportunities" OR "available for" OR "in transition"
OR unemployed OR "immediately available" OR
"currently seeking" OR "seeking new" OR "seeking a
new" OR "interested in")
```

Or expressions containing index field lookups:

```
 site:ca.linkedin.com "network engineer" "ccnp"
"wan" "lan" "vancouver" -intitle:"profiles" -
inurl:"dir/ " -inurl:job|jobs|jobs2
```

Over time, many recruiters create their own collection of queries and draw on these as a source of intellectual property and competitive advantage. Moreover, the creation of such expressions is the subject of many social media forums (e.g. [7]), and the discussions that ensue involve topics that many IR researchers would recognise as wholly within their field of expertise (such as query expansion and optimisation, evaluation, etc.). However, despite these shared interests, the recruitment profession

has been largely overlooked by the IR community and their search needs, behaviours and preferences remain relatively unknown. Even recent systematic reviews of professional search behaviour make no reference to this profession [8].

This paper seeks to address that omission. We report on a survey of 64 recruitment professionals, examining their search tasks, behaviours and preferences, and the types of functionality that they value. We report the findings in a manner which facilitates comparison with the results of previous surveys of search behaviour, notably Joho et al.'s survey of patent users [9] which concerns another profession that uses highly optimised, complex Boolean expressions and needs to dynamically balance precision with recall for different search tasks. Our findings can also be compared with Geschwandtner et al.'s survey of medical professionals [10] as this constitutes a further recent, large scale survey of professional information seeking behaviour.

In this paper we first provide a brief overview of the candidate sourcing process and related studies of expertise seeking (Section 2). In Section 3 we describe the methodology of the study and in Section 4 present the results. The issues raised in Section 2 are reviewed in the context of the survey findings, and the implications for systems development are discussed in Section 5.

Recruitment as an IR challenge

In this section, we provide a brief overview of the different tasks undertaken by recruitment professionals and the related search and information retrieval challenges. Recruitment is the process of finding and attracting capable applicants for employment. It can be *proactive* (performing outbound activities to facilitate hiring)

or *reactive* (managing inbound responses to specific job postings). In this study, we focus on the former activity, which is often referred to a *sourcing*.

Recruitment professionals spend approximately 27% of their time actively searching for candidates [17] and need to rapidly evaluate candidate suitability [15]. On average they can be expected to place around two candidates per month [18]. The activities of recruitment professionals range from directly searching for candidates using job boards through to investigating profiles on social networks to make connections with candidates, as well as gaining broader market intelligence on behalf of clients.

Sourcing is a skill that is to some extent emulated by expert finding recommender systems, where machine learning is used to select the best-suited individual to perform a particular task [19]. Modelling a person's ability to complete tasks is also a key factor in crowdsourcing platforms such as Crowdflower or Mechanical Turk [20]. These techniques have been extended to much larger and noisier datasets on social networks where the person's connections can be used as selection variables [21]. This is essentially a microcosm of the sourcing task: find the individual(s) with the skills that best match the job description. However, recruiters also must take into account other variables such as availability, previous experience, remuneration, etc.

Sourcing is also similar to people search on the Web where the goal is to search greater volumes of unstructured and noisy data to return a list of individuals who fit specific criteria [22]. Likewise, the recruiter must apply additional factors to select a smaller, more manageable group of qualified candidates, with returned results needing to be normalised and disambiguated [4]. The gold standard for evaluation in

this instance is recommending one or more candidates that successfully fulfil a client brief.

This survey investigates the search behaviour of recruitment professionals and highlights some of the key commonalities and differences between related professional sectors.

Method

The survey instrument consisted of an online questionnaire of 40 questions divided into five sections[1]. The survey was designed to align wherever possible with that of Joho et al. [9], to facilitate comparisons with patent search. It also incorporated elements of Geschwandtner et al. [10], so that some comparisons with healthcare professional search would also be possible. The five sections were:

1. Demographics: The background and professional experience of the respondents, including age, gender, education, role, job title, and client type.

2. Search tasks: The types of search task that respondents perform in their work, how often they perform them, and what resources they use.

3. Query formulation: How respondents construct search queries and what types of functionality they find valuable.

4. Results evaluation: How respondents assess and evaluate the results of their search tasks, and the challenges this entails

5. Features of an ideal search engine: Respondents' views on any other features and functions additional to those described above.

The survey was designed to be completed in approximately 15 minutes. Prior to administering the survey, a series of qualitative interviews with professional recruiters

[1] Available from http://www.url.to.be.advised

was conducted to customise the survey instrument for the recruitment industry. We also piloted the survey with two recruitment professionals prior to launch, who provided valuable feedback and advice on its content and presentation.

To obtain a large and representative sample we sent out the survey to various interest groups via social media (e.g. LinkedIn) and also engaged the services of SurveyMonkey Audience, who administered it to their panel of HR professionals based in North America. In both cases, we included a qualifying question at the beginning ("Is your primary job function to recruit and hire professionals for your organisation or for clients?") so that non-recruiters could be excluded from the results. The survey opened on 09 June 2015 and completed on 01 August 2015. In total, we received 416 responses, of which 69 were complete. The majority of incomplete responses were due to failing the qualifying question, so these cases contained no usable data. Five other responses were eliminated due to contradictory or nonsensical answers, which left 64 complete responses. Since the number of individuals reached by the survey promotion is unknown, the participation rate cannot be determined.

Results

Demographics

We began our analysis by looking at the demographics of the recruitment profession. Of the 64 respondents, the majority were female (69%), with 54% of respondents aged between 25 and 45 years. In particular, there is a noticeable spike in the 25-31 age bracket (see Figure 1). The age and gender demographics of respondents may also indicate a bias in the survey recruitment process.

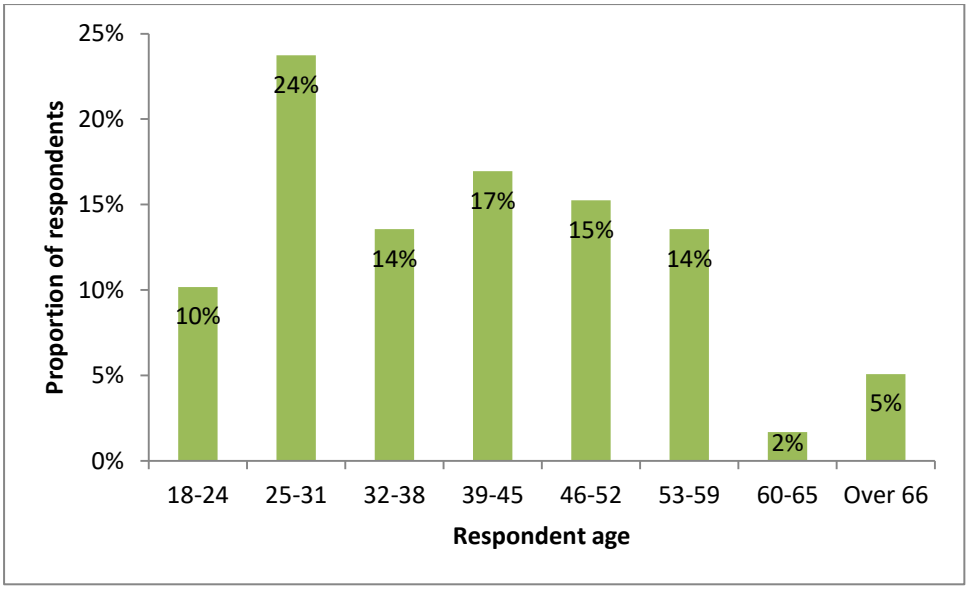

Figure 1: The age of recruitment professionals

The educational background of recruiters surveyed revealed that 29% had Master's degrees and 60% had Bachelor's degrees. The most common degree subjects were professional/vocational (32%) and social science (19%).

Most respondents worked full time (91%). 49% had clients that were external i.e. outside of their organisation. The rest were either internal (34%) or a combination of both (17%).

Job titles for recruitment professionals differ greatly, with variations on *recruitment*, *human resources*, *talent acquisition* and *personnel* being typical. The most common single job title was *recruiter* (15%) followed by *HR Manager* (8%) and *HR Generalist* (7%). Most respondents have several years' experience as a recruiter; with a median of 10 (see Figure 2).

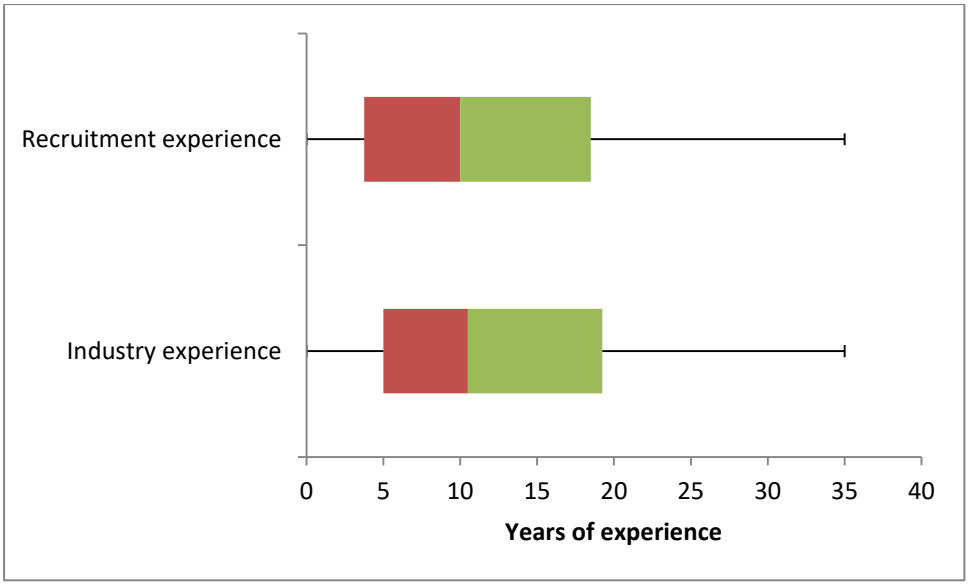

Figure 2: Respondent experience as a recruiter and in the recruitment industry

Search tasks

In this section we focus on the search tasks performed by recruitment professionals. Evidently, candidate search is an important part of a recruiter's work, but not exclusively so. Of the range of services offered by the organisations they represent (which were not mutually exclusive), candidate search (76%) and candidate selection (62%) were the most common (see Figure 3).

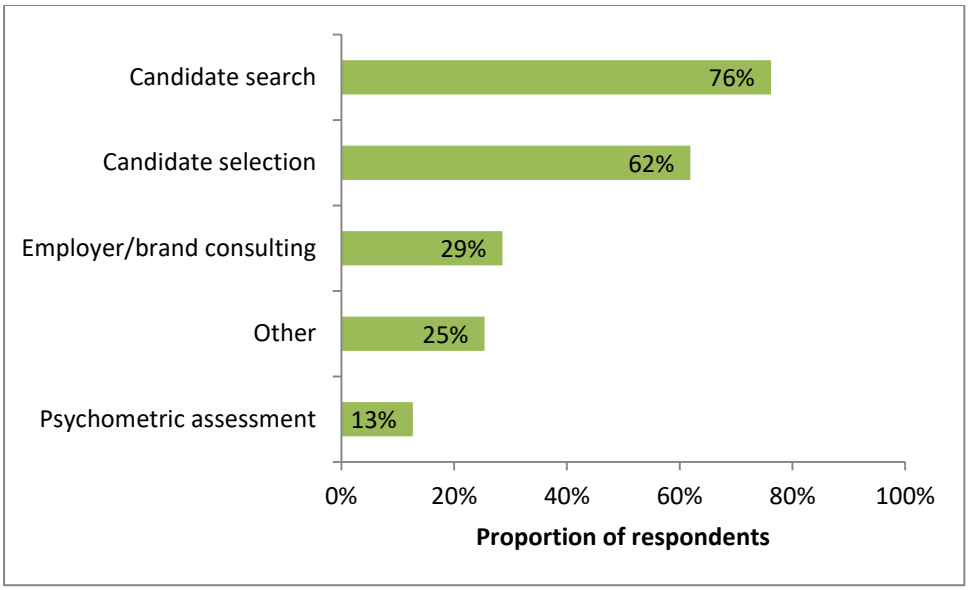

Figure 3: Services provided by recruiters' organisations

Job boards such as Monster[2], CareerBuilder[3] and Indeed[4] were the most commonly used resource that recruiters target when searching for candidates (77%), with a similar proportion (73%) also targeting social networks such as LinkedIn, Twitter and Facebook (see Figure 4).

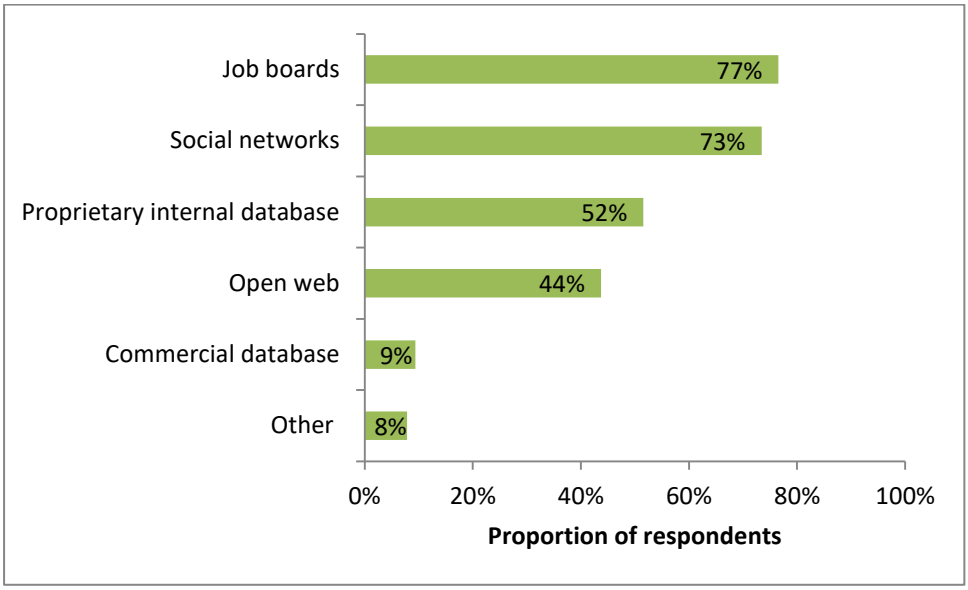

Figure 4: Data sources used by recruiters

We also examined the broader query lifecycle; in particular respondents' usage of previous search queries and the degree to which they are prepared to share their work with others. 19% of respondents always used previous examples or templates to help them formulate their query, and a further 30% often did so (see Figure 5). In total, the majority of respondents (80%) used examples or templates at least sometimes, suggesting that the value embodied in such expressions is recognised by recruiters.

[2] www.monster.com/
[3] www.careerbuilder.co.uk/
[4] www.indeed.co.uk/

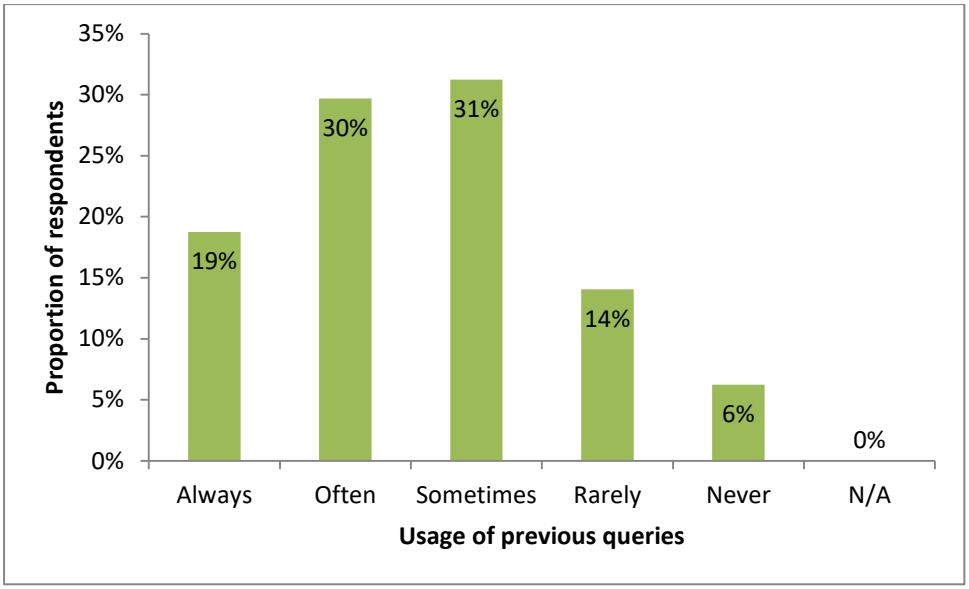

Figure 5: Use of previous examples or templates by recruiters

Most respondents (50%) said they were happy to share queries with colleagues in their workgroup and a further 22% were happy to share more broadly within their organisation. However, very few (5%) were prepared to share publicly, perhaps underlining the competitive nature of the industry (see Figure 6).

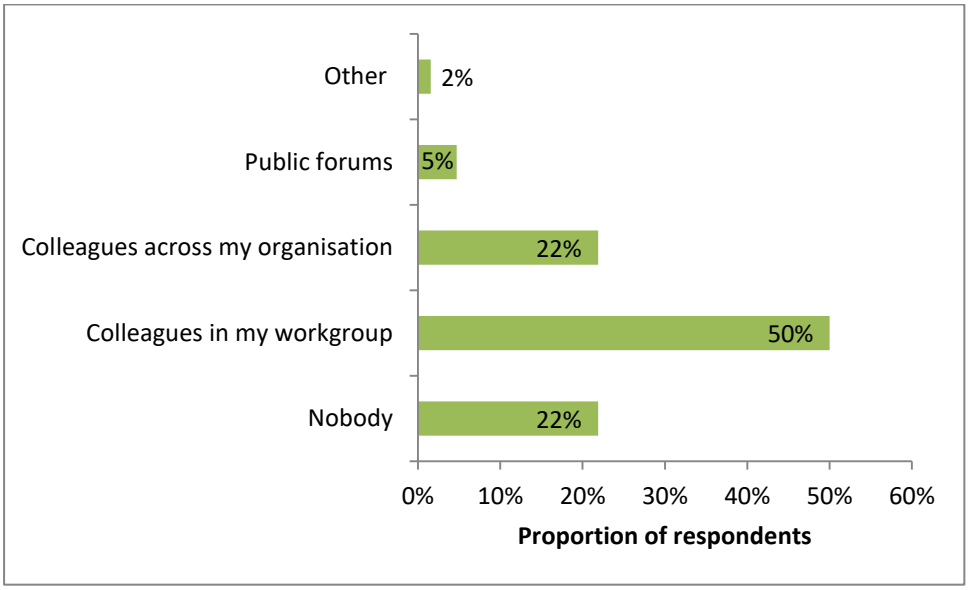

Figure 6: Extent of sharing of queries by recruiters

Table 1 shows the amount of time recruiters spend in completing the most frequently performed search task, the time spent formulating individual queries, and the average

number of queries they use. As in Joho et al.'s survey [9], the variance is large so the measure of central tendency reported here is the median.

	Min	Median	Max
Search task completion time (hours)	0.06	3	30
Query formulation time (mins)	0.1	5	90
Number of queries submitted	1	5	50

Table 1: Search effort (queries submitted and time taken)

On average, it takes around 3 hours to complete a search task which consists of roughly 5 queries, with each query taking around 5 minutes to formulate. This suggests that recruitment follows a largely iterative paradigm, consisting of successive phases of candidate search followed by other activities such as candidate selection and evaluation. The task completion time is substantially longer than typical web search tasks [11].

Query formulation

In this section we examine the mechanics of the query formulation process, looking in detail at the use of a range of functions that recruiters believe are important in helping them complete their search tasks. To achieve this we asked respondents to indicate a level of agreement to statements such as "Boolean logic is important to formulate effective queries", "Weighting is important to formulate effective queries (e.g. relevance ranking)", and "I need to consider synonyms and related terms to formulate effective queries". Responses were recorded using a 5-point Likert scale ranging from strong disagreement (1) to strong agreement (5). The results are shown in Figure 7 as a weighted average across all responses.

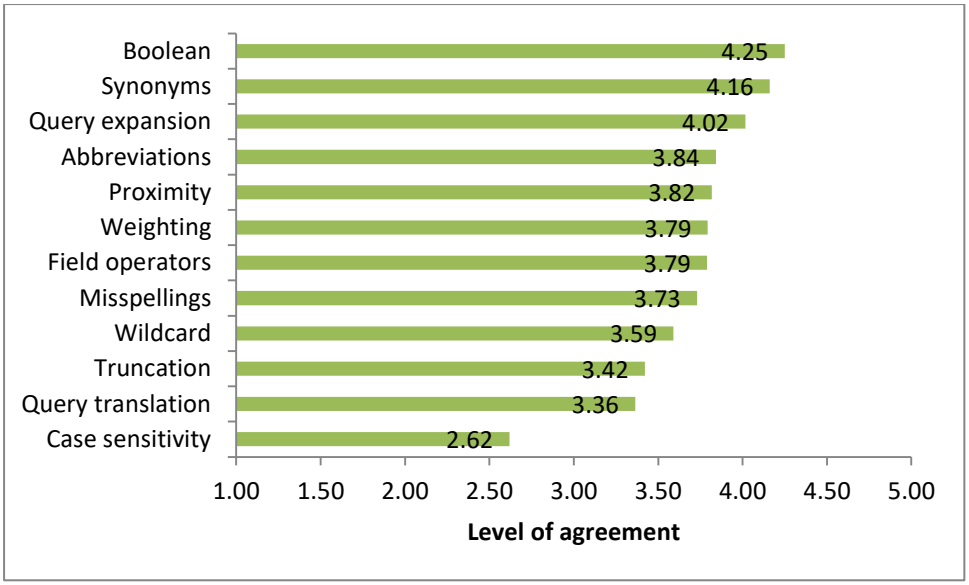

Figure 7: Important query formulation features

The results suggest two observations. Firstly, the average of almost all features is above 3 (neutral) on the Likert scale. This suggests that recruiters are willing to adopt and leverage a wide range of search functionality to complete their task, which would be a marked contrast to the behaviour of typical Web searchers who rarely, if ever, use any advanced search functionality [12]. However, it could also reflect a degree of aspiration to simply try out such features, with no implication that they would ultimately offer any value on an ongoing basis.

Secondly, Boolean logic is shown to be the most important feature, with a weighted average of 4.25. This was closely followed by the use of synonyms (4.16) and query expansion (4.02). Although recruiters value this functionality, the support offered by current search tools is highly variable. On the one hand, support for Boolean expressions is provided by many of the popular job boards, and the challenge of creating and optimising Boolean expressions is the subject of a number of highly active social media forums (e.g. [7]). However, practical support for query formulation via synonym generation is much more limited, with most current systems relying instead on the expertise and judgement of the recruiter.

The lowest ranked feature, and the only one which scored below 3 on the Likert scale, was case sensitivity. This may be due to concerns that inappropriate use of case sensitivity may reduce recall, or it may be simply that automatic case folding is a default for most systems therefore manual intervention is relatively less important. Query translation was the second lowest, possibly because most respondents worked primarily in one language (i.e. English).

The most popular methods were either using a text editor (43%) or simply pen and paper (22%), see Figure 8. This suggests a disparity between the level of complexity in the task and the level of support offered by existing search tools. This is further underlined by the use of taxonomies, which was relatively low (6%), despite the fact that a number of suitable resources exist for HR and related domains (e.g. Human Resources Management Ontology[5]).

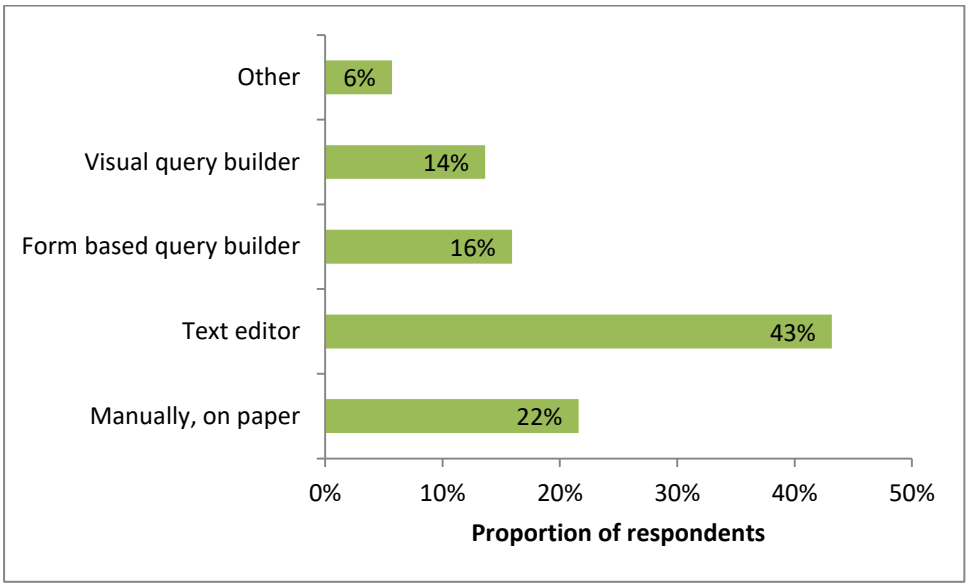

Figure 8: Query formulation methods

Results evaluation

[5] http://mayor2.dia.fi.upm.es/oeg-upm/index.php/en/ontologies/99-hrmontology

In this section we examine the results evaluation process, looking in detail at the strategies that recruiters adopt and the criteria and features they find important in helping them complete their search tasks.

Table 2 shows the ideal number of results returned for the most frequently performed search task, the average number of results examined, and the average time taken to assess the relevance of a single result. As in Table 1, the variance is large so the measure of central tendency reported here is the median. The median time to assess relevance of a single result is 5 minutes and the ideal number of results is 33. However, the number of results examined per query is lower (30), which suggests that recruiters may be less concerned with recall (i.e. ensuring all relevant results are reviewed) and instead adopt more of a satisficing strategy, evaluating only as many results as are required to create a shortlist of suitable candidates.

	Min	Median	Max
Ideal number of results	1	33	1000
Number of results examined per search query	1	30	100000
Time to assess relevance of a result (mins)	1	5	50

Table 2: Search effort (results evaluated and time taken)

Respondents were asked to indicate how frequently they use various criteria to narrow down results. Responses were recorded using a 5-point scale from never (1) to always (5). Figure 9 shows the results as a weighted average across these values. Job function was the most important (4.34), followed closely by location (4.29). These choices mirror some of the factors found to influence expert selection, such as *topic of knowledge* (job function), *physical proximity* (location), *perspective* (industry sector/career level), *familiarity* (previous contact with recruiter) and *availability* [6].

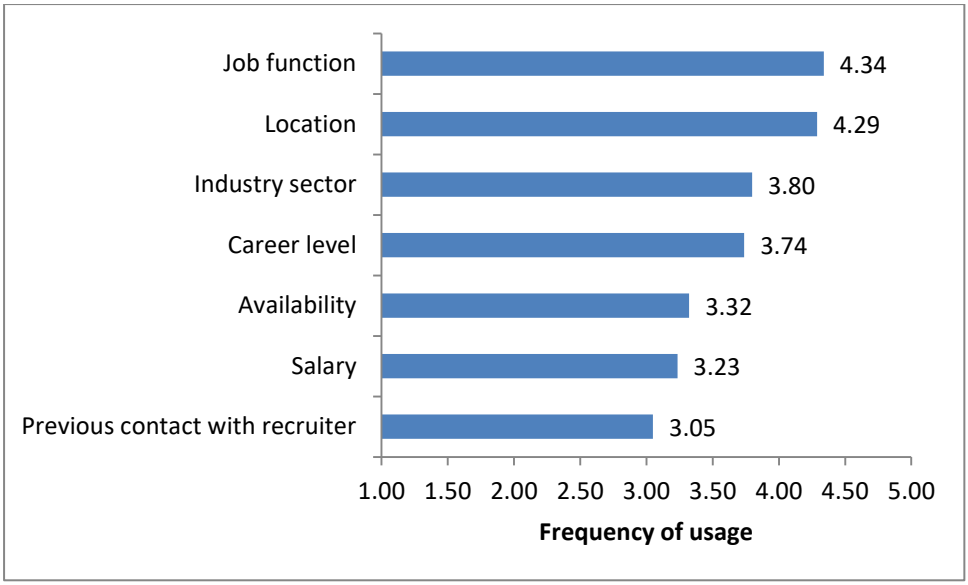

Figure 9: Restriction criteria used in narrowing down results

We also examined recruiters' strategies for interacting with results sets. Figure 10 shows that the most popular approach by far was to start with the result that looked most relevant (56%). However, many others (28%) would simply click on the first result, implying a degree of trust in the ability of their particular search engine to rank candidates. This suggests that for these individuals at least, the weighting function referred to in Figure 7 may be of particular value. The number of respondents who targeted the most trustworthy source was relatively low (9%), implying a degree of ambivalence towards provenance. It also runs counter to the claim that "*source quality is the most dominant factor in the selection of human information sources*" [6].

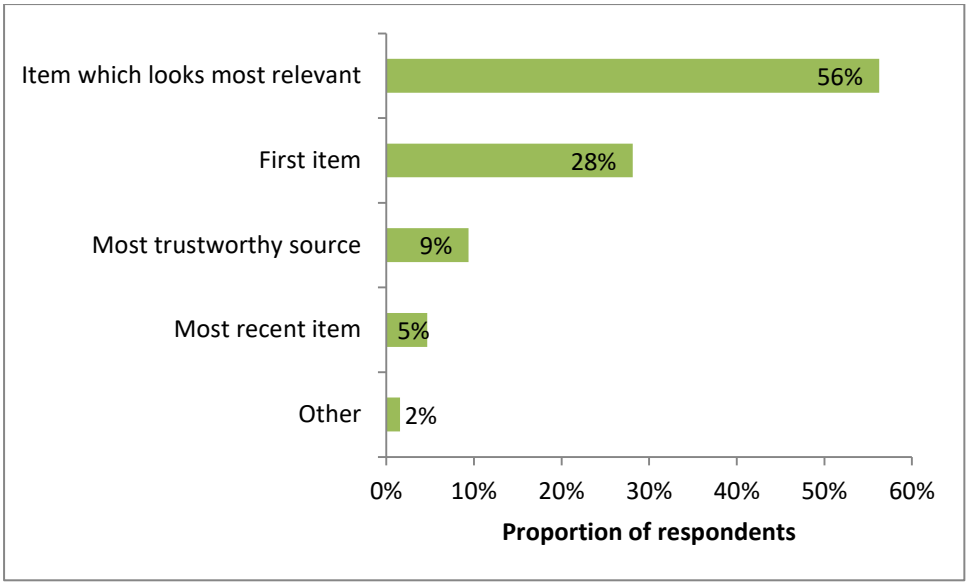

Figure 10: Strategies used when selecting results

When asked how they determined when their search task was complete, 50% of respondents said it was when they found a specific result, a further 38% said they it was when they couldn't find any new relevant results, and 11% said it was when they had used all the allocated time for the task.

Features of an ideal search engine

In this section we examine other features related to search management, organisation and history that recruiters believe are important in helping them complete their search tasks. As before, we asked respondents to indicate a level of agreement to various statements and recorded the responses using a 5-point Likert scale ranging from strong disagreement (1) to strong agreement (5). The results are shown in Figure 11 as a weighted average across all responses.

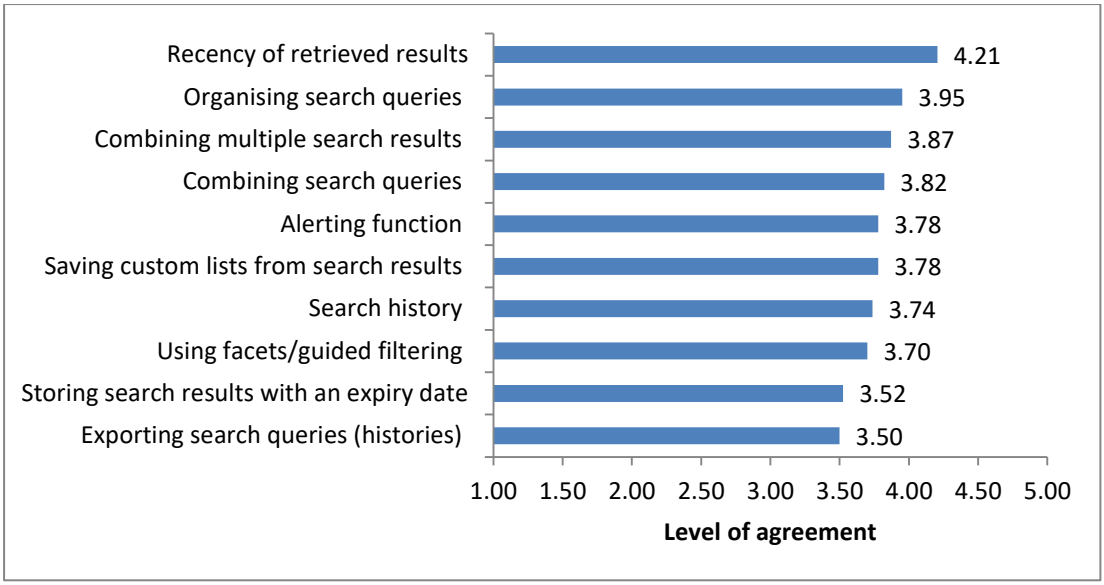

Figure 11: Important search management features

All features scored highly (above 3), with recency of retrieved results the most important (4.21). This reflects the need for recruiters to have confidence that the employment status and profile of the candidates they are selecting are up to date. The least important feature was exporting search queries (3.50), suggesting that the current workflow offers few opportunities for integrating them with other applications.

Concluding discussions

This paper describes the results of a survey of the information seeking behaviour of recruitment professionals. As such, it is the first study of its type, uncovering the search needs and habits of a previously unstudied community in a manner that allows direct comparison with other, well-studied professions, such as patent, medical and academic document search. It also presents a fresh perspective on the task of expertise retrieval, offering a new set of real world 'people search' scenarios.

Sourcing is shown to be something of a hybrid search task. In principle, the goal is to find individuals matching a specific brief, and in this respect it shares many of the characteristics of people search. In practice, however, the objects being

retrieved are invariably documents (e.g. CVs and resumes) acting as proxies for the individuals concerned, so in this respect the workflow also shares characteristics of document search.

There are also important consequences for the IR community as a whole in particular regarding the assumptions underlying many of its research priorities. For example, the prevalent view of much academic IR research assumes that searches are formulated as natural language queries [13], but the findings of this study show that many professional searchers prefer to formulate their queries as Boolean expressions. The key findings of this study are as follows, with verbatim quotes from survey respondents shown in italics where applicable:

Recruiters display a number of professional search characteristics that differentiate their behaviour from web search [14]. These include lengthy search sessions which may be suspended and resumed, different notions of relevance, different sources searched separately, and the use of specific domain knowledge: *"The hardest part of creating a query is comprehending new information and developing a mental model of the ideal search result."*

Recruitment professionals use some of the most complex queries of any community and actively cultivate skills in the formulation and optimisation of such expressions (to the extent that some are referred to as 'Boolean Blackbelts').

Despite the structural sophistication of their queries, recruiters find the selection of suitable terms to be an ongoing, manual challenge: "*The specific job is so new I cannot find terms used on resumes to match.*"

Recruiters' search behaviour is characterised by satisficing strategies, in which the objective is to identify a sufficient number of qualified candidates in the shortest

possible time: *"Generally speaking, it's a trade-off between time and quality of results. [If] I can't identify the required information in the available time... this is because the data is not present in any of my go-to data sources, and working around that limitation isn't the best use of the time.*"

The search tasks that recruiters perform are inherently interactive, requiring multiple iterations of query formulation and results evaluation.

The average time spent evaluating a typical result is 5 minutes. This calls into question the findings of previous research, (e.g. [15]) in which it was claimed that the average duration was as little as 7 seconds. This discrepancy could be explained by the fact that self-reported responses may reflect a (possibly subconscious) desire by respondents to project a more diligent or painstaking approach to their work. However, it could also be an artefact of the methodology used in the previous study, in which eye tracking fixations were used as a proxy for task duration, even though dwell time alone may not accurately reflect the true cognitive boundaries of the evaluation task or account for repeated iterations of attention given to a particular document.

These findings motivate further research into the value of various types of search functionality used by recruiters and the broader task context within which that functionality must be integrated. The evidence suggests that the impact of IR research on search tools currently used by recruiters is modest at best and that their needs may be poorly supported by incumbent tool developers: "*The problem does not lie with the algorithms; it lies with the assumptions made by developers that do not understand how head-hunters think.*" It would appear that the progress being made in other, more consumer oriented search domains (particularly mobile search assistants such as Siri

and Cortana) has yet to be fully reflected in the design of search tools for the professional recruiter.

Respondents to the survey described in this paper reported that they use complex Boolean queries heavily. However, this does not imply that such expressions are the ideal way to articulate recruitment information needs. Instead, it may reflect the fact that recruiters currently *do not have anything better at their disposal*, and Boolean queries are the only way in which to express their requirements in a transparent and repeatable manner.

In our discussions with recruiters some have suggested that the first query shown in Section 1 could be expressed more simply, more concisely and more readably in the form of attribute-value pairs, such as:

```
Role:             Software Developer (+Related Terms = All);
Experience:       Java, J2EE, Struts, Spring;
Skills:           Computer Algorithms, Databases (+Related
                  Terms = 1st degree);
General Skills:   Problem Solving;
```

This formalism could then be automatically augmented by:

Inclusion of domain-specific search criteria, driven by a recruitment ontology;

Presentation of related terms for specific occupations, dynamically filtered according to the current query formulation;

Support for expanding with synonyms and related terms;

Support for truncations, wildcards, misspellings, etc.

This example assumes and perpetuates the role of queries as the prime expression of information need. However, a ‘search by example’ approach may offer a more promising alternative. Assuming that a number of exemplar candidates have already been identified, a recruiter may prefer automatic functionality to “Find people like this”. In this instance, the skill would be in configuring the similarity metrics to optimise their effect on the result set. Moreover, such configurations could themselves be saved and reused in the way that queries are currently.

However, such automated systems may not be the ideal solution for an industry as competitive as recruitment. Successful recruiters pride themselves on being able to “speak the language of search” and locate candidates that others cannot. Whilst a machine learning system may be able satisfy generic sourcing needs, it risks sacrificing transparency for ease of use, and may offer less value to recruiters who view their query formulation skills as a source of competitive advantage.

In conclusion, we would hope that these findings will inspire the creation of new IR test collections and evaluation tasks. There are those in the recruitment profession who share this ambition and call for an opportunity to compare and contrast search strategies in an open and publicly visible forum [16]. It is our belief that the IR community could contribute to this goal and in doing so facilitate the translation of IR research into positive impact on a global industry.

Acknowledgements

We are extremely grateful to Nick Gallimore of mPloyability Ltd. and other recruitment professionals (who prefer to remain anonymous) for their insights in interpreting the data and assistance in drafting this article.

Declaration of conflicting interests

We have identified no conflicting interests in publishing this article.

Funding statement

This work was part funded by Innovate-UK (project number 700497).

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