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MetaBUS as a vehicle for facilitating meta-analysis☆,☆☆

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ABSTRACT

To address new research questions and get a clearer picture of research, scientists and practitioners in human resource management have come to rely heavily on meta-analyses. However, meta-analyses may take months or years to produce and are becoming increasingly difficult to produce as the corpus of available research grows exponentially. We describe how the metaBUS platform can assist in tackling two central challenges to conducting meta-analyses. In addition, we provide a detailed description of the platform, with information on all fields included in the database. Next, we provide recommendations for three use cases: generating literature search terms by using the metaBUS taxonomy, conducting metaBUS queries to locate findings and generate first-pass meta-analyses, and identifying relevant findings that might have gone overlooked during traditional literature searches. We demonstrate a new software and a cloud-based interface that allow users to leverage the platform. We conclude with implications, limitations, and future directions.

Meta-analyses are often highly cited scientific works, with many viewing them as authoritative summaries of a field (Cooper & Hedges, 2009). They can provide building blocks for knowledge development and theory building (Chan & Arvey, 2012), benchmarks and baselines for future studies, correlation matrices for use as input to structural equation modeling, estimates of generalizability, identification of moderators and outliers, and prior distributions for Bayesian analyses (Steel, Kammeyer-Mueller, & Paterson, 2015). Meta-analytic summaries can also assist in settling long-lasting debates as they allow us to see effect sizes largely clear of the haze from sampling error. Also, many consider meta-analyses the basis for evidence-based practice, bridging the research-practitioner gap (Bosco, Steel et al., 2015; Rynes, Giluk, & Brown, 2007). As Marler and Fisher (2013) described, the "evidence-based management (EBM) movement is intended to motivate research syntheses that will permit more effective use of research data" (p. 19). Pfeffer (2007) expressed a similar sentiment, "The huge body of knowledge created by management science in the past 50 years, however, is more than capable of being transformed into real world applications of benefit to business and society" (p. 1334). Despite these potential advantages, there are many fundamental and serious challenges to the timely creation of quality meta-analytic reviews. In this paper, we focus on two particular challenges that may begin to be addressed by leveraging the metaBUS platform.

The first challenge, following the specification of topic scope and inclusion-exclusion criteria (Cooper, 2010), lies in generating a list of relevant search terms (Rothstein, 2012), often submitted to electronic search engines. The process is often highly

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cumbersome, owing to the "vocabulary problem…variability in word usage" (Furnas, Landauer, Gomez, & Dumais, 1987, p. 964). The problem's severity is reduced to some degree by the availability of optical character recognition (OCR) technology and full-text document search. Indeed, the presence of multiple phrasings of a given concept is likely to appear within an article's body of text. However, for non-OCR documents, only a very limited body of text is available for searches (e.g., titles; abstracts; keywords). This text often follows suggestions set forth in the Publication Manual of the American Psychological Association (2010), to "include in the abstract only the four or five most important concepts…you think your audience will use in their electronic searches" (p. 26).

The use of full-text searches is also problematic due to the high prevalence of false positives returned. As an example, the letter string 'age' occurs in 956 distinct words in the English language according to the MRC psycholinguistic database (Wilson, 1988) including "management," "percentage," and "language." Results of full-text queries must then be laboriously hand-culled to remove studies without pertinent data. Unfortunately, sorting through false positives is, at the present time, a necessity for a "full-blown systematic review and meta-analysis" (Rothstein, 2012, p. 137), yet also reminiscent of "archaeology: academic teams searching for buried artifacts and working tirelessly to reveal their true meaning" (Ip et al., 2012, p. 4). As summarized by Spellman (2015), "Our keyword system has become worthless, and we now rely too much on literal word searches that do not find similar (or analogous) research if the same terms are not used to describe it" (p. 894). Still, however, comprehensive literature searches rely on the specification of an exhaustive list of search terms.

A second challenge for meta-analysts, following the specification of search terms, is the sheer amount of resources required to conduct a literature search. As described by Rothstein (2012), the resources required will vary as a function of project purpose. Indeed, conducting a thorough systematic review is one of many reasons to conduct a literature search, and typical search procedures can last anywhere from a few days to six months or more. Literature reviews serving research methods projects (e.g., a review of questionnaire response rates), for which tens of thousands of observations are readily available, might purposely target only a few outlets and be less threatened by a lack of search comprehensiveness. Some substantive topics might be so frequently studied and appear in literatures so vast as to make the task of a "full-blown" review unfeasible given even plentiful resources. Additionally, the project scale for some topics may escalate to the point where forecasts of return on investment make the undertaking unattractive for even relatively large teams. In such cases, it may be advantageous to have estimates available, even if derived from a limited sampling frame.

Ultimately, comprehensive literature searches require significant resource investment because there exists no large-scale search engines that operate at the level of individual research findings (to our knowledge, this is currently the case for all social sciences). Indeed, as described in existing guidelines for conducting searches (e.g., Cooper, 2010; Rothstein, 2012), databases are often used to locate relevant sources (e.g., journal articles), which must be filtered for mundane characteristics such as whether the article is empirical and, if empirical, whether it contains data pertaining to the concepts of interest or simply referred to concepts by name as justification for the importance of an ancillary research question, as a distal implication, and the like.

After a research team has overcome these challenges, the meta-analysis provides only a snapshot in time on a particular topic, one that is rarely updated more frequently than every five to ten years. What is worse, when updates are conducted to include the newly accumulated findings, the starting point for the update is often a blank slate. Around the world, groups of researchers may also be duplicating each other's efforts, making the entire process highly redundant and wasteful. This sad state of affairs is at odds with the modern research climate of data sharing, which has many clear benefits (e.g., Borgman, 2012). Despite all these obstacles, evermore of our journal space is being dedicated to systematic reviews, with an exponential increase in their publishing (Tebala, 2015), attesting to their usefulness. We appear to be spending an increasing amount of our efforts and resources reiteratively summarizing slices of our field rather than conducting core research. As described by Ferris, Hochwarter, and Buckley (2012), "Where we are now is an uncomfortable spot – we have broadened the base of theory in the organizational sciences without a commensurate increase in explanatory power, or what we know about how people behave in organizations" (p. 103). Concomitantly, criticisms of our field's inability to bridge science and practice abound (Rynes et al., 2007), an unimpressive situation for an applied discipline.

The purpose of the present manuscript is to describe how users may leverage the metaBUS platform to at least partially overcome two central challenges in conducting meta-analyses: the specification of search criteria for comprehensive literature search and facilitated location of research findings for rapid summary. The remainder of our manuscript is organized as follows. First, we provide rationale for the need of platforms like metaBUS. Next, in order to familiarize the user with this resource for human resource management (HRM) research, we provide an anatomy of metaBUS by describing processes involved in the semi-automated extraction of findings, database content, manual coding processes, and a new cloud-based software. Next, we provide recommendations for using metaBUS to address three use cases. We conclude with a discussion of data sharing and science-practice gap implications, limitations, and future directions for the metaBUS platform.

1. Improving and facilitating meta-analyses

As described by Schmidt and Hunter (2015), our field stands to realize great benefit from more efficiently summarizing and curating research findings. As they write, "We need a new type of journal…that systematically archives all studies that will be needed for later meta-analyses.... failure to have such a journal system in place is retarding our efforts to reach our full potential in creating cumulative knowledge" (p. 30). This is being sporadically recognized, with research curation efforts being built or at least discussed in several other research disciplines (Elliott et al., 2014; Ip et al., 2012; Lefebvre, Glanville, Wieland, Coles, & Weightman, 2013; Tsuji, Bergmann, & Cristia, 2014). However, there has not previously existed a system for curating the findings

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