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Quantifying the Empirical Growth of Relational Frame Theory Research: A Cautionary Note

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## Abstract

Relational frame theory (RFT) is a modern, contextual behavioral theory of human language and cognition. A recent article by O'Connor, Farrell, Munnelly and McHugh (2017) provided an updated citation analysis of data-based and nondata-based articles citing RFT-related terms as a proxy for the influence RFT has had on the scientific literature. Here, we evaluate the claims made by O'Connor et al. and suggest that caution should be exercised when interpreting some of their findings. Progress has, in many ways, clearly been made but we argue that the analysis of the growth in RFT outputs is more nuanced than at first appears.

*Keywords:* relational frame theory, citation analysis.

Scientific behavior is human behavior. It is the collective enterprise of humans acting socially, of humans cooperating (Hayes, Sanford, & Chin, 2017). Science does however tend to advance rather slowly, which may be evidenced by the cumulative addition of citable outputs in a field's corpus of knowledge. At any time, humans may evaluate and inspect the scientific literature or knowledge base to detect trends and identify areas growing or in need of cultivation.

Within the burgeoning field of behavioral science, perhaps no theoretical account of human language and cognition has contributed as much as relational frame theory (RFT). Now over thirty years old, RFT is still young enough to be considered a contemporary theory of language and cognition. It posits a relational basis to language, which is acquired, refined and maintained as a generalized form of operant behavior. It is surprisingly simple at its core, yet can often be rebarbative and obtuse to the naïve reader. It has spawned one of the most popular and effective forms of psychotherapy, Acceptance and Commitment Therapy (Hayes, Strosahl & Wilson, 2012), inspired numerous other applications (see, Dymond & Roche, 2013), and is part of one of the world's largest professional organizations, the Association for Contextual Behavioral Science, of which *the Journal of Contextual Behavioral Science* is its official organ.

Given such an impressive track record for a young theory, it might be tempting to sit back and appreciate what RFT has done and admire its prescience. However, theories such as RFT are not souvenirs, to be preserved and polished off and passed around the scientific community on special occasions as a sign of how much progress we've made (Hayes, 1996). Instead, theories are tools, intended to be useful only to the extent to which they help guide the behavior of scientists in the goals of prediction and control; as such, theories are dynamic. If they stop evolving, they gather dust and die. Theories are, then, only as good as the

research they generate and the explanations they enable scientists to make, the grants to get, the students to supervise, the papers to publish, and the mouths to feed, etc.

Bibliometric or citation analyses of the articles which make up the extant scientific literature at any one time are a useful method of assessing the contribution made by theories like RFT. For example, armed only with an Internet connection and falling short of a full citation analysis, we conducted a Web of Science (<http://wok.mimas.ac.uk/>) literature search for the terms “relational frame theory” between 2000 and May 2017, and refined by the research areas of “psychology” and “behavioral science”. The search results are shown in Figure 1, which shows a steady upwards trend, with a doubling of output between 2014 and 2016. But, appearances may be deceptive; these data are likely to include many outputs unrelated to RFT. Ascertaining a clear picture of the current state of RFT research requires a more detailed and systematic analysis.

\*\*\*Insert Figure 1 Here\*\*

In 2010, Dymond, May, Munnely and Hoon evaluated the evidence base for RFT by conducting a citation analysis of data-based and nondata-based articles citing RFT-related terms as a proxy of influence or impact in the scientific literature. Citations between 1991, when empirical research on RFT was said to start, and 2008 were analyzed and it was found that RFT had “made a substantial contribution to the literature in a relatively short period of time” (Dymond et al., 2010, p. 97).

It is important to track such progress and in 2017, O’Connor, Farrell, Munnely and McHugh updated the original citation analysis to include citations up to 2016. Substantial growth in output was detected. O’Connor et al. concluded that “over the past seven years the contribution of RFT has grown steadily with 521 articles meeting the RFT citation inclusion criteria. Of the included papers, 288 were Empirical papers (55.3%) and of these 160 were Empirical RFT (30.7%). The review period for the 17 years before the current analysis

revealed 62 Empirical studies, 42 of which were categorized as Empirical RFT (Dymond et al., 2010). Taken together both searches have identified 202 Empirical RFT articles.” (p.155).

News of this considerable growth in empirical output in such a short space of time was widely welcomed, and rightly so. For instance, RFT research was declared to be “up over 1,100% and specific tests of RFT are up over 900%” (Hayes, 2017). A graph of empirical articles on RFT, related empirical and total empirical articles was also tweeted showing the increase of “over 1000% per year in the last 7 years compared to the first 17” (Hayes, 2017).

In the present paper, we suggest caution be exercised when interpreting the findings of this recent citation analysis. Progress has, in many ways, clearly been made but we argue here that the growth in RFT outputs is more nuanced than at first appears.

#### **A cautionary note**

##### **The search terms were too broad.**

In our original citation analysis of RFT research, we used the following three search terms: *relational frame theory*, *relational frames*, and *arbitrarily applicable relations*. O’Connor et al. used those terms and three more: *arbitrarily applicable relational responding*, *derived stimulus relations*, and *derived relational responding*. The authors argued that widening the search strategy to include these additional search terms was undertaken to “avoid the unnecessary omission of RFT citations.” (O’Connor et al., 2017, p. 156). However, it is possible that the search terms may have been too broad. As a result, the search terms used may have had the opposite effect and produced a spuriously high hit rate of RFT related articles. In fairness, the authors acknowledged this possibility (p.156), but it is important to emphasize that apart from *arbitrarily applicable relational responding*, the additional search terms are in fact not specific to RFT; indeed, they are widely used by other

theories of derived stimulus relations and were in use well before the inception of RFT as an empirical enterprise (Steele & Hayes, 1991).

**The definition of the Empirical articles category was too broad.**

Originally, we defined Empirical articles as those which “reported original data involving the direct manipulation of at least one independent variable and measurement of at least one dependent variable.” (Dymond et al., 2010, p. 100). More recently, O’Connor et al. defined *Empirical* as those articles which “cited at least one of the search terms in text and presented original data.” (p. 153). Crucially, this category of Empirical articles “encompassed a range of research designs and was not limited to studies that involved the direct manipulation of an independent variable.” (p.153).

We based our definition of empirical articles on that used by previous citation analyses of the literature on verbal behavior. For instance, Sautter and LeBlanc (2006) only included studies on verbal behavior in their analysis if, “the study was empirical in nature. That is, the study included clearly defined independent and dependent variables and the results were evaluated using a research design.” (p.36). Other citation analyses (e.g., Dixon, Small, & Rosales, 2007; Dymond et al., 2006) have employed a similar definition of empirical articles to classify studies as basic, applied and observational (McPherson, Bonem, Green & Osborne, 1984) or experimental and nonexperimental and conducted in the field or laboratory (Marcon-Dawson, Vicars, & Miguel, 2009).

The definition of empirical articles adopted by O’Connor et al. (2017) is therefore unusual since it abandons a central feature of the scientific method – the manipulation of an independent variable – to classify work as empirical. Of course, it is possible that the inclusion of articles from a wide range of research designs and without the requirement of an independent variable may still have generated a representative view of empirical research on RFT. The key point, however, is that the findings would differ from those of the original

citation analysis, which employed a more stringent set of criteria. It remains unclear why the original definitions, adopted across numerous previous analyses, were not employed by O'Connor et al. Thus, combined with the broader scope of the additional search terms detailed above, it is therefore likely that the results of O'Connor et al. may only partially reflect the state of RFT research since 2008. However, as wish to make clear, the O'Connor et al. analysis used different inclusion criteria from those of Dymond et al. (2010), and thus a degree of caution should be exercised when comparing the two sets of findings.

### **Articles included as Empirical RFT and Empirical Other**

The definitions used for the next level of article categories, Empirical RFT and Empirical Other, were broadly the same in the two analyses. That is, “empirical RFT articles cited at least one of the search terms in text and presented original data from studies that investigated relational framing, defined its specific properties (i.e., mutual entailment, combinatorial mutual entailment, and transformation of stimulus function) or propositions (e.g., relational framing as a generalized operant class, acquired through a history of multiple exemplar training, etc.” (O'Connor et al., 2017, p.153). Articles were assigned to the Empirical Other category if they “cited at least one of the search terms in text and presented original data, but did not meet the aforementioned criteria for inclusion in the Empirical RFT subcategory” (p.154; see also, Dymond et al., 2010, p.100).

O'Connor et al. are to be applauded for providing lists of the Empirical RFT and Empirical Other articles used in their analysis; indeed, such open-access, data sharing practices should be adopted in future bibliometric research. On inspecting these lists, however, several inclusions appear problematic. Indeed, of the 160 articles categorized as Empirical RFT, it is unclear precisely in what way the article by Mason and Lee (2017), which was published in *Behavior Analysis: Research and Practice*, entitled “A Behavioral Phenomenological Inquiry of Maker Identity” was assumed to be testing a specific prediction

or proposition of RFT. The interview-based study, which sought to determine the extent to which “makerspaces are supporting participation by students underrepresented in science, technology, engineering and mathematics (STEM) fields” by taking “a closer look at students’ verbal behaviors”. It is likely that the article was included because it cited one of the search terms (*relational frames*) in the Abstract and employed a qualitative research design, yet its relevance to the central tenets of RFT, which Empirical RFT articles were defined as testing or involving, remains unclear.

A further example of questionable inclusion is Miguel et al. (2015) from the domain of derived relational responding and which was included as an Empirical RFT study. In the paper, Miguel et al. report an experimental analysis of analogical reasoning; however, their findings are conceptualized and explained through the prism of Skinner’s *Verbal Behavior* (1957) and Horne and Lowe’s (1996) naming account. In short, alternative accounts to that offered by RFT. While, Miguel et al. (2015) is incontrovertibly empirical work concerning RFT-relevant processes, in our view, it would be inaccurate to classify it as a study which provides empirical support for RFT.

A final example that the search terms employed by O’Connor et al. may have been too broad and lead to spurious inclusions concerns our own work (May, Hawkins & Dymond, 2013). Our study was presumably included because the terms “derived relational responding” appeared in the abstract. The article describes an investigation of tact-based vocal responses on emergent intraverbal responding in learners with a diagnosis of autism; however, it does not use any of the original search terms in the text, cite any nomenclature specific to RFT, and nor does it conceptualize, analyze, or interpret the findings in terms of the central tenets of RFT. Somewhat surprisingly then, the paper was categorized as an ‘Empirical RFT’ paper, when in fact it could be as readily framed as a study exploring alternative accounts of derived stimulus relations (Horne & Lowe, 1996; Sidman, 1994). There are several such instances of

questionable inclusions in the Empirical articles category; however, it is not our intention to reanalyze all the inclusions but merely to flag anomalies in the final dataset that are indicative of the issues raised above.

The remaining articles on the list of Empirical RFT articles are less problematic. It is notable, however, that many of the articles involved one specific procedure, the Implicit Relational Assessment Procedure (IRAP). If we were to identify the IRAP from either just the title or abstract of articles, then it accounts for 47 articles (or 29% of the total Empirical RFT articles).

\*\*\*Insert Figure 2 Here\*\*\*

O'Connor et al. did not address the startling increase in IRAP research since our citation analysis. Indeed, the growth in research with this one specific procedure is perhaps the most striking change in the time since the original analysis was completed. As a means of visualizing this growth, Figure 2 shows the increase in number of Empirical RFT articles between 2000-2008 (from Dymond et al., 2010) and 2009-2016 (from O'Connor et al., 2017). A considerable number of these articles employed the IRAP, which is ostensibly a “measure of the strength of natural verbal relations, or AARRing [arbitrarily applicable relational responding]” (Barnes-Holmes, Barnes-Holmes, Luciano & McEnteggart, 2017). Studies using the IRAP have focused on implicit, response-latency based measures of attitudes, presenting real-word labels and targets or “verbal stimuli (i.e., verbal as defined by RFT)” (Barnes-Holmes et al., 2017, p.437) and measuring the most relationally coherent response pattern as a proxy for reinforcement history. Such studies may however be considered largely demonstration studies illustrating the utility of the procedure and its applicability to a whole host of attitude targets and concepts rather than empirical investigations of the underlying relational processes. Indeed, while extensive theoretical models have been developed to capture and explain performance on the IRAP (e.g., Barnes-

Holmes et al., 2017), the intensive nature of the procedure, which requires a practice block and several re-administrations of test blocks, as well as the scoring methods, and inferential analyses have led some to question its status as a bottom-up, functionally-based procedural account of arbitrarily applicable relational responding (Cummins, Roche, Tyndall & Cartwright, 2017; O'Reilly, Roche, & Cartwright, 2015). Excepting a small number of studies that have investigated the role of manipulated contingencies on IRAP performances (e.g., Barnes-Holmes, Murphy, Barnes-Holmes, & Stewart, 2010; Hughes, Hussey, Corrigan, Jolie, Murphy, & Barnes-Holmes, 2016), the IRAP studies included by O'Connor et al. are not empirical in the usual sense, insofar as they do not involve full laboratory control over the process underlying test performance. Rather, such processes are inferred from within the framework of the relevant theoretical model, rather than identified directly, by for example, using entirely laboratory controlled stimulus relations in assessments of the test's core processes. In this way, the relationship between IRAP research and other, empirical research on RFT needs to be elaborated.

Despite this, studies using the IRAP were, as O'Connor et al. outlined, only included if they also cited one of the relevant search terms, which rightly reduces the likelihood of a high false positive rate. However, if the IRAP is a "measure derived from RFT" (O'Connor et al., p. 156), then to what extent can it be said to be influenced by or related to the key concepts of RFT when a study which uses the procedure has itself not met any of the search criteria? We would caution that such articles cannot be said to be directly influenced by RFT and should not have met the inclusion criteria.

Further caution is needed when one reviews the 128 Empirical Other articles in O'Connor et al, which has several questionable inclusions. These include, "Thematic analysis of Antonovsky's sense of coherence theory" (Griffiths, Ryan & Foster, 2011), "Natural language acquisition: State inferring and thinking", published in *International Journal on*

*Artificial Intelligence Tools* by Wang and Duan (2016), and “Effects of Video Feedback on Early Coercive Parent-Child Interactions: The Intervening Role of Caregivers' Relational Schemas” (Smith, Dishion, Moore, Shaw & Wilson, 2013). Of course, the inclusion criteria for this category of article were not as stringent as those of the Empirical RFT category as they needed only cite one of the search terms to be included. It is striking, therefore, that an article such as one of those mentioned above might be included in the analysis as an Empirical Other article yet a study using the IRAP which did not cite any search terms was nonetheless omitted.

### **General comments**

There are several noteworthy points to highlight in addition to the above. First, the inter-observer agreement (IOA) score for the Empirical RFT category was the second lowest (86.2%; range 83.7-100%), suggesting some calibration in observer training and/or category definitions may have been needed. This could, in part, have contributed to the questionable inclusions described earlier. Second, Figure 4 indicates one study on “causal” and “spatial” relations, respectively. However, the cited study on causal relations (Tarbox, Zuckerman, Bishop, Olive, & O’Hora, 2011) does not mention the term “causal” and the family of relational frames referred to as “causal” are not defined in any recent accounts of RFT (e.g., Hughes & Barnes-Holmes, 2016). Similarly, we must assume (by conducting a search for the term ‘spatial’ in the list of Empirical RFT articles) that the only study on spatial relations was by Falla and Alós (2016) in their article entitled, “Contextual Control in Visuospatial Perspective-Taking Skills in Adults with Intellectual Disabilities”; yet, this study investigated deictic relations not spatial relations. Does RFT now consider deictic relations to be types of spatial relations? We’re unsure. Recently, however, the first empirical investigation of spatial relations was published by May, Stewart, Baez, Freegard, and Dymond (2017); too late to be included in the present analysis. These points notwithstanding, a list of articles assigned to

relations studied category of Figure 4 would have been helpful. Third, the analytic category recording *country of origin* is in fact *countries of origin* since the countries of *all* authors were recorded and analyzed. This may have led to over-inflation of the geographical sources of RFT based research. It is therefore difficult to conclude that RFT research “has been conducted across five continents” (p.155) when the contributing authors may not have conducted any of the research (this is likely to be the case as there were 202 articles from countries, but only 160 Empirical RFT articles). It may therefore be more appropriate to describe RFT based published research as having contributing authors from across five continents. Finally, with both datasets publicly available, it is possible to reanalyze the O’Connor et al. findings using the criteria of Dymond et al., and further research on this issue is warranted.

### **Conclusion**

Updating a review of the literature enables a research community to delineate the extent to which the nature and scope of the evidence base has changed across time. Consistent with this notion, O’Connor et al. (2007) use their findings to draw direct comparisons with those of Dymond et al. (2010). For example, in response to Dymond et al.’s clarion call to apply RFT-based analyses to atypical populations, the authors conclude that “The current findings, therefore, appear to provide an affirmative response to Dymond et al.’s question as to “whether the applied promise of such interventions is subject to further empirical scrutiny within the domain of atypical language development” (p.11). And, again, in reviewing the breadth of outlets publishing RFT work, O’Connor et al. conclude that “the number of journals publishing Empirical RFT articles has considerably increased ... indicating that reach of Empirical RFT research is spreading beyond its behavior analytic tradition” (p. 13). We encourage the reader to exercise caution when interpreting these comparisons. Irrespective of the relative merit of the approach employed by Dymond et al. or

O'Connor et al., there can be little disagreement, considering the present discussion, that the respective search strategies differed substantially. We argue that the decision to broaden the definition of Empirical RFT articles represents a significant enough change to render comparisons between the two datasets problematic.

In closing, future citation analyses should carefully distinguish between empirical work on RFT and empirical work supportive of RFT. While O'Connor et al.'s analysis was concerned with the latter ("The objective of the current citation analysis is to provide a review of the impact and empirical support for RFT over the last seven years." p.2), we have shown here that some of the content may not be directly supportive of RFT-based explanations and that alternative explanations, from other theories of derived relations, are possible. Continued refinement in literature searches of RFT related terms is important to track and evaluate theoretical developments and perceived impact on a field; we hope that our cautionary comments are helpful to other scientists in this regard.

### **Compliance with Ethical Standards**

**Conflict of Interest:** The authors declare that they have no conflicts of interest.

**Ethical approval:** This article does not contain any studies with human participants performed by any of the authors.

**Informed consent:** This article does not contain any studies with human participants.

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**Figure Captions**

*Figure 1.* Results returned from a search of ‘relational frame theory’ in category 'Topic' in Web of Science from 2000 to 2017 (as at May 2017). The left y-axis represents the number of published items per year, while the right y-axis represents the number of citations per year.

*Figure 2.* Number of Empirical RFT articles from both the Dymond et al. (2010) and O’Connor et al. (2017) citation analyses.