



## *Methods of Analysis*

### **Meta-Analysis**

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In other words, the analysts themselves, in so far as they wish for clarification of their own activity, must go on to Meta-Analysis. But what does that mean? (Heinemann, 1953, p. 125)

Meta-analysis was defined in the 1950s along with a range of concepts and practices with the prefix *meta*, which included meta-logic and meta-theory. “In all fields of endeavor when a term is coined or adapted from another field,” Thomas (1984) observes, “there is often a period of confusion as consumers try to sort out what meanings are intended by different authors and speakers. Such is the case with *meta*,” he continues, “as a growing number of authors write about metaanalysis, metacognition, metatheory, metaattention, metalearning, metalanguage, metacriticism, metahumor, and so on” (p. 16). Thomas notes that *meta* “can mean trans-, or changed in position or form (metamorphosis, metastasis); post-, or after (metapneumonic, meaning a condition following pneumonia); behind (metacarpus); beyond (metalinguistics); alternating (metagenesis); later (metazoan); transcending (metapsychosis); reversed (metathesis); higher; between; with; over; and so on” (p. 16).

That said, Glass (1976) uses *meta* to mean ‘at a higher level’ and condenses meta-analysis to “the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings” (p. 3). In tow, the connotation of meta-analysis became statistical analysis and synthesis of a diverse range of studies (Wolf, 1986). Specifically, this means coding, consolidating, and examining results across studies to establish larger samples and effect sizes or more statistically reliable findings. In the process, meta-analysts explore commonalities and variations among the studies. Meta-analysis is often contrasted with meta-synthesis (Walsh, 2005); the former more often quantification of quantitative studies and the latter more often qualification of qualitative studies. Hence, meta-analysis and meta-synthesis are commonly reduced to meta-study and meta-review— ‘systematic review’— or specific methods in the review of research. The result is the tug of quantitative and pull of qualitative preference and a ‘meta-synthesis of meta-analyses’.

Counter to an “analysis of analyses” (Glass, 1976, p. 3), meta-analysis more broadly refers to:

1. An analysis of analysis;
2. A theory of analysis as the analogical unity common to all forms of analysis;
3. A theory of the different forms of analysis;
4. A theory of the corresponding forms of synthesis; and
5. A theory of the interconnection between analysis and synthesis. (Heinemann, 1953, p. 126)

Heinemann’s (1953) fivefold scope responds to an observation that the prevalence of analysis is “by no means restricted to philosophy,” but is also found “in contemporary science, mathematics, physics, biology, medicine, psychology, and education” (p. 124). Part and parcel with scientific methods, analysis became an extremely popular way of reasoning or thinking. He conceived meta-analysis as a “critical appraisal” of methodology— of how this or that method of analysis is consciously formulated for a given study and “unconsciously applied” in others (p.

127). A bit misguided, he also anticipated that “meta-analysis has the specific function of inaugurating the post-analytic era” (p. 130).

Despite claims, neither philosophy nor any other discipline is post-analytic (O'Connor, 1993). Nor is any post-synthetic. In a sense, the opposite is true: methods of analysis have proliferated and predominate research practices across the humanities and sciences alike. Since peaking in the 1960s, logical analysis no longer predominates philosophy but the adoption of a balance of methods of analysis rapidly increased since that time. Adoptions of meta-analysis diffused with incomparable speed since the 1970s. Since 2005 and Google's introduction of its research tools, statistics or stats have become interchangeable with analytics. Nowadays, researchers are more analytic than ever.

In history, much like most other disciplines, analysis is valued over synthesis. Since the 1920s, historical synthesis has paled next to historical analysis. Advocates of synthesis concede that “historians have specialized in limited periods or limited areas [i.e., case studies] in order that they might better employ their historical techniques of analysis and dissection” (Loucks, 1943, p. 148). “But while analysis is a necessary prerequisite,” they qualify, “it is not a substitute for synthesis” (p. 148). Historians are necessarily cautious as many associate synthesis with generalization if not dreaded sweeping generalizations. The practice is to defer synthesis until ‘more facts are found’ or ‘more evidence is generated’ and this tends to be a long time.

Those who value synthesis over analysis or attempt to balance or temper the two have been unsuccessful in contradicting trends. For instance, it has been argued that “synthesis is much more interesting than analysis” (Noyes, 1940, p. 503) and “training in synthesis is much more difficult than training in analysis” (Lawrence, 1964, p. 129). What is gained by arguing this to explain the extreme prevalence of methods of analysis over methods of synthesis? One could just as well make a case that this prevalence is an artefact of the narrowing of meta-analysis to “analysis of analyses.”

If the “analysis of analysis” is fundamental, then it's tempting to personalize it by arguing that every analyst ought to be meta-analytic in a way that every cognition or thought ought to be meta-cognitive. This entails heightened sensitivity toward forms and methods of analysis as well as synthesis. Is the gist of this resolution merely that each thinker ought to think more reflectively while each researcher ought to research more reflexively? Perhaps, but what seems necessary for methods of analysis are the internal second opinion *and* second opinion of the meta-analyst.

These trends and questions suggest the necessity of a much more expansive methodology of meta-analysis than “analysis of analyses.” Unsuccessful in transforming metaphysics into metapsychology, Freud (1937) eventually concludes: “Without metapsychological speculation and theorizing— I had almost said ‘phantasying’— we shall not get another step forward” (p. 225). His use of *meta* refers at times to *behind* (“behind consciousness”) and *above*, as in “speculation and theorizing.” The point is that as analysis reaches its limits, therein meta-analysis is necessary. For example, if analysis is the “process of breaking down the data into their constituent elements, which thereby become new data,” then meta-analysis works behind or above any limitations on the types (e.g., empirical, metaphysical, metadata, etc.) of “new data” compounded.

1. What is *Meta*? What is Analysis?

- a. Thomas (1984, p. 16): During the first century B.C., Andronicus of Rhodes put in order Aristotle's essays on natural sciences, political theory, psychology, physics, theology, and other subjects. In planning a sequence for the books, Andronicus placed Aristotle's writings about "being" and "God" after the books on physics. He signified his placement of these topics by labeling the volume with the Greek word for *after* (*meta*) and the word for *physics* (*phusica*), to produce *after physics* (*meta ta phusika*).... As a consequence, authors periodically created new terms to convey a variety of *supra* meanings, such as metagnostics (transcending ordinary knowledge), metaphenomenal (existing beyond consciousness), metamathematical (beyond the scope of traditional mathematics), and metaempiricism (the science of pure reason). Although the fields of biology, chemistry, and geology today do contain terms that reflect the original definition of *meta* [μετά] as *after* or *behind*, the recent *meta* creations in education and cognate disciplines are not offspring of that original meaning. Instead, they seem in some fashion born of the deviant lineage that Andronicus unwittingly set off. Thus, as readers seek to understand new *meta* terms, they find no help in learning that the Greek *meta* meant *after* and *change*.
- b. Eastwood (1919, p. 416): In order to get the full truth about anything we must regard it in relation to the whole of everything. "Isolate a thing from its relations," said Dr. Edward Caird, "and try to assert it by itself, you find it has negated itself as well as its relations." The thing in itself is nothing.... [Analysis] then, is not an effort to resolve a thing into separate parts, each of which are relatively simple, but an attempt to see the thing in all its intrinsic relations to the whole of which it forms a part.
- c. Noyes (1940, p. 501): Analysis is the process of breaking down the data into their constituent elements, which thereby become new data. The individual datum at one level becomes analyzed into a compound of unlike data at the next lower level. Thus the individual is found to be non-homogeneous. It is therefore no longer an individual. It becomes a crowd.... analysis is also classification—the breaking down of the whole into classes or parts.
- d. (p. 502): If, then, analysis includes both putting likes together and separating unlikes—that is, classification—what is synthesis? If the dividing of unlikes has as its necessary obverse the grouping of likes, why use two terms for what are merely the two aspects of a single process? Evidently that is not the distinction which the names analysis and synthesis are intended to convey. We have said that analysis is the breaking down of data. By that we suggest that analysis is a matter of direction. It is starting with wholes and breaking them down into parts which are heterogeneous in some respect among themselves and homogeneous in that respect within themselves. It is classification of the broader into the narrower. In the hierarchy of classifications it works from the higher to the lower. So examined, synthesis turns out to be merely classification in the opposite direction—from the narrower to the broader, from the hierarchically lower to the higher, the combining of hitherto isolated parts into new wholes.' If analysis is dividing one into one third and two thirds, which are unlikes, synthesis is "putting two and two [likes] together."
- e. Leavis (1948, p. 70): Analysis is not a dissection of something that is already and passively there. What we call analysis is, of course, a constructive or creative process.... It is a re-creation in which, by a considering attentiveness, we ensure a more than ordinary faithfulness and completeness.
- f.

2. What is Meta-Analysis?

- a. Heinemann (1953, p. 124): The Logical Positivists analyse as Formalists the artificial language of science, whereas the followers of Wittgenstein, the Common Usage School, dissect ordinary language. All of them agree that analysis is the chief business of the philosopher. They tend to replace philosophy by analysis and to say with Carnap: "We pursue logical analysis, but no philosophy". This attitude is by no means restricted to philosophy, but is a true expression of the positivistic temper prevailing in contemporary science,

- mathematics, physics, biology, medicine, psychology, and education. In all of them the analytic approach predominates. "Analyse, analyse!" is their categorical imperative. Break up the whole into parts, until nothing but parts, which cannot be further analysed, are left! Thus a dangerous situation arises. This dissection threatens to eliminate philosophical problems, to abolish philosophy, to stifle imagination and creative activity, to destroy the sense of the whole and the search for meaning and to drain the vitality of civilisation. This represents a challenge to 'which we have to respond. It demands of us a reconsideration of the function and limitations of analysis. It is imperative that we should liberate ourselves from its crushing influence. But how?
- i. Should we go to the other extreme and formulate the antithesis to Carnap's thesis by saying: "We pursue philosophy, but no logical analysis?" Quite a few philosophers, such as some Existentialists, have acted on this advice.
- b. Heinemann (1953, p. 126): Meta-Analysis is (A) the formal theory of analysis and synthesis; (B) the systematic statement of the formal rules which govern both of them, in general as well as in specific forms; (C) the elucidation of the different models on which their diverse forms are based; and (D) the study of the consequences which follow from the acceptance of these rules and models, including the question whether they are adequate to a specific case. I now add a few explanations to different points of this definition. (A) The formal theory of analysis and synthesis. It must be clear from the start that meta-analysis cannot be restricted to analysis. It has only too often been forgotten that analysis and synthesis are correlative, that analysis without synthesis remains empty, and that synthesis without analysis remains blind. They are complementary. The one is, however, not simply the reverse of the other. This has unfortunately often been assumed. Yet it is only the case in very specific circumstances, to wit, when the whole is no more than the sum of the parts, e.g. in the case of ideal objects, such as numbers, or of mechanical aggregates, such as heaps of bricks. As soon, however as an organic unity of life, soul, mind, or meaning is given, the whole is 'more than its parts.... For this reason the formal theory of analysis and synthesis implies:
- i. An analysis of analysis;
  - ii. A theory of analysis as the analogical unity common to all forms of analysis;
  - iii. A theory of the different forms of analysis;
  - iv. A theory of the corresponding forms of synthesis; and
  - v. A theory of the interconnection between analysis and synthesis.
- c. Heinemann (1953, p. 127): But, it could be objected, is then meta-analysis not merely a new name for methodology? By no means. Methodology consists in the formulation of rules and in an advice how to proceed in order to solve problems or to find true propositions; whereas meta-analysis consists in a critical appraisal of the very rules which are either formulated in this methodology or which are unconsciously applied in this specific method.
- d. Heinemann (1953, pp. 130-131): The analysis of the modern era was in the service of ratiocination, the result was an atrophy of imagination and reason. The new point in meta-analysis is that it puts analysis in the service of imagination and reason. It is based on both. Imagination, as the faculty of perceiving and constructing images or shapes, whether its objects are present (visualising), or past (memory) or future (imagination proper), is the prerogative of man. Machines may calculate, but they have no creative imagination. Imagination kindles analysis; it is necessary for seeing the problems, for choosing the most appropriate model, for anticipating the result, and for establishing connections with other fields of enquiry. Reason, on the other hand, guides analysis with the help of regulative ideas. Simple elements, atomic facts etc., are regulative ideas of reason, and not, as falsely assumed, the result of rational analysis. Absolute simplicity is outside our reach.
- e. Glass (1976, p. 3): My subject is data analysis at three levels. *Primary analysis* is the original analysis of data in a research study. It is what one typically imagines as the application of statistical methods. *Secondary analysis* is the re-analysis of data for the purpose of answering the original research question with better statistical techniques, or answering new questions

with old data.... My major interest currently is in what we have come to call-not for want of a less pretentious name— the *meta-analysis* of research. The term is a bit grand, but it is precise, and apt, and in the spirit of "meta- mathematics," "meta-psychology," and "meta-evaluation." Meta-analysis refers to the analysis of analyses. I use it to refer to the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings. It connotes a rigorous alternative to the casual, narrative discussions of research studies which typify our attempts to make sense of the rapidly expanding research literature.

- f. Wong & Raabe (1996, pp. 793-794): Various definitions of meta-analysis have been published. For example, similar to the original definition by Glass, Huque defined meta-analysis as "a statistical analysis which combines or integrates the results of several independent clinical trials, considered by the analyst to be combinable." Without any question, statistical analysis is a major part of meta analysis. However, as will be discussed below, meta-analysis involves more than the application of statistical techniques. There is definitely a qualitative component in the selection of studies to be included as well as in the interpretation of results.
- g. Wald & Morris (2003, p. 617): Put simply, meta-analysis is the analysis of many studies that have already been done; teleoanalysis provides the answer to questions that would be obtained from studies that have not been done and often, for ethical and financial reasons, could never be done.
- h. Senior et al. (2016, pp. 3293-3294): Meta-analysis is the accepted standard for quantitatively synthesizing findings in most fields of research. In ecological and evolutionary research in particular, meta-analysis has become increasingly popular over the last two decades. This approach has been applied to topics ranging from the highly ecological, such as drivers of species invasions, to questions in genetics, such as the strength of heterozygosity-fitness correlations. With the meta-analytic approach, data are typically extracted from studies on a topic. These data are then used to quantify an effect size, which is a statistical summary of the magnitude and direction of an effect as estimated by a given study. In general, the main aims of the meta-analysis itself are to (1) estimate an overall effect, the "meta-analytic mean" (and its statistical significance), (2) determine the commonality of reported effects, and (3) explore potential causes of variation between effects.