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BEYOND THE DISCOURSES OF QUANTITATIVE AND QUALITATIVE METHODS: A META-SCIENTIFIC EVALUATION

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ABSTRACT: The dichotomization between quantitative and qualitative research methods can be a pedagogical way to differentiate between research methods. However, there seem to be ontological and epistemological roots that lead to the hierarchization and dichotomization of such methods. Behavior Analysis seems to have an ambiguous or conflicting stance when it comes to the choice of a method, stating that our questions should guide the choice of a given method and, concurrently, that we should prioritize the use of quantitative and experimental methods of research. This manuscript aims to conduct a metascientific analysis of the quali-quanti dichotomy, its implications for science, in general, and more specifically for Behavior Analysis. We argued that this dichotomy a) favors the selection and valuation of methods in isolation and independently of the research questions to be answered, b) creates hierarchical relations involving research methods and, in extension, the individuals that use those research methods, c) facilitates the *a priori* determination of the reliability and validity of scientific papers without an effective analysis of these, all of which d) can compromise the integrity of the scientific process.
Key words: qualitative research methods; quantitative research methods; science; behavior analysis.

The scientific literature has several ways to categorize research. Some of them include their nature (e.g., basic vs. applied), aims (e.g., to explore, to describe, to explain), and procedures (e.g., experimental, bibliographic, case study). Within this context, the quantitative-qualitative differentiation is one of the most used within the humanities and social sciences (Alves-Mazzotti & Gewandsznajder, 2002; Ferreira, 2015; Loftus & Rothwell, 2010; Mineiro et al., 2022; Rodrigues et al., 2021), including Behavior Analysis (e.g., Burney et al., 2024; Jarmolowicz et al., 2021).

The contrast when discussing quantitative and qualitative research methods tends to make them oppositional approaches to knowledge production. Although this differentiation may be regarded as pedagogic when teaching about scientific research, a more detailed observation may suggest that this difference is not based on a didactic approach. Instead, this distinction appears to be based on ontological and epistemological assumptions that suggest that humans and non-humans consist of ontologically different phenomena and, therefore, it is necessary to investigate them using different methodological strategies compatible with their specificities (Carrara, 2014; Günther, 2006).

From a behavior-analytic perspective, the claim that human behavior has a different nature than other natural phenomena does not hold. Skinner (1953), for instance, sees behavioral relations as a natural phenomenon that can be studied scientifically—whether from a psychological, sociological, anthropological, or historical perspective. Therefore, the use of either quantitative or qualitative methods would be appropriate, depending on the research questions. Nevertheless, our field has substantially used and endorsed quantitative methods (e.g., Austin & Carr, 2000; Jarmolowicz et al., 2021; Shimp, 2007). If the object of study in Behavior Analysis is behavioral phenomena, and if the best method is the one that best meets the objectives of a study, what controls the behavior of our community members to support the qualitative-quantitative dichotomy in our current scientific practices? As will be discussed throughout the text, the qualitative versus quantitative dichotomy is not reflected in the difference between single-subject versus group designs, or between descriptive statistics and inferential statistics. As we will demonstrate, the qualitative versus quantitative dichotomy is grounded in the opposition between quantifiable (numerical) and non-quantifiable (verbal) data.

Within Behavior Analysis, this dichotomy is perhaps especially expressed in the methodological hierarchy that prioritizes experimental methods and quantifiable data over descriptive methods and verbal data. Although hierarchization does not necessarily imply dichotomization, in our assessment, this hierarchy translates into the opposition between quantifiable data (derived from experimental research) and non-quantifiable data (derived from descriptive research with the production of verbal reports) in academic practice. Supporting our argument is the body of work that consistently defends the legitimacy of using verbal data and interpretation in behaviorist studies (e.g., Alter et al., 2008; Donahoe, 1993; Leme et al., 2009; Malavazzi & Micheletto, 2021).

Taking into account the philosophical and scientific questions aforementioned, our aim in this paper is to conduct a metascientific analysis of the quali-quanti dichotomy, its implications for science, in general, and more specifically for Behavior Analysis. To do that, we will: (1) examine the literature on research methods and contextualize the philosophical origins and the current assumptions that maintain this hierarchical dichotomy in place, also emphasizing its consequences for the quality of research on both ends; (2) use the concepts of stimulus equivalence and relational frames to illustrate how this hierarchy negatively impacts how we assess knowledge produced from qualitative approaches, the individuals who primarily use qualitative methods, and also the scientific advancement in general, and (3) illustrate with two studies from Behavior Analysis that to make a distinction of methods based on the dichotomy is unproductive; instead we should be controlled by our philosophical assumptions and our research goals and questions.

Qualitative *versus* quantitative: Originating and contemporary contingencies

According to Loftus and Rothwell (2010), the classification of research as qualitative or quantitative is based, among other aspects, on the characteristics of the data produced and analyzed during the study. Quantitative research would rely on necessarily quantified data (i.e., in numerical form) to evaluate phenomena of interest, while qualitative research would focus on necessarily textual data. Beyond this simplistic differentiation, it is important to note there are significant philosophical assumptions underlying the conceptualization and use of qualitative and quantitative research. According to Loftus and Rothwell (2010), the origin of this dichotomy dates back to Descartes himself. From a Cartesian perspective, the material world and the mental world would be of different substances and, therefore, to study them, it would be necessary to employ different methodological strategies. Later, this dualism of substance translated into the dichotomy of objective versus subjective, or more specifically, into the dichotomy of non-human phenomena versus human phenomena.

It is worth remembering that the 17th century was the stage for the modern scientific "revolution". In that century, mathematics came to be considered the language of science, and the quantitative-experimental method was elected as the only possible path for knowledge production (Köche, 2011). Since the universe was considered a perfect machine, the explanation of natural phenomena depended on uncovering the mathematical laws that governed them—and this discovery would only be possible through experimental and mathematical procedures. This quantitative and experimental science would enable the attainment of truth. To achieve this, the scientist, in their professional practice, should strive for objectivity and neutrality. In other words, when producing knowledge, the scientist should get rid of their values, beliefs, desires, expectations, and prejudices to access, without bias, the truth about the workings of the universe (Köche, 2011).

The scientist's subjectivity, under this paradigm, would be a threat to scientific objectivity and neutrality (Laurenti, 2014). Being an obstacle to scientific research, subjectivity could not be considered a legitimate object of study for science. This was assumed because subjectivity and other human phenomena would not have the characteristics to be amenable to mathematical and experimental study. Human processes were considered complex, chaotic, intentional, creative, and spontaneous, while natural phenomena were deemed as simple, mechanical, and orderly (Laurenti, 2012). For modern science, only the latter would be eligible for scientific investigation (Köche, 2011; Laurenti, 2012). This ontological split between nature and humanity enabled a dichotomous categorization of scientific disciplines: on one side were the natural and mathematical sciences, titled "hard" sciences, and on the other, the human and social sciences, called "soft" sciences. The former would correspond to true science, while the latter would be merely marginal disciplines (Laurenti, 2012).

The modern science paradigm, as the predominant model of scientific practice, persisted through the 17th, 18th, and 19th centuries (Laurenti, 2014). From the 19th century onward, and especially in the 20th century, the foundations of modern science were the target of numerous criticisms that led to the emergence of a new scientific paradigm and the decline of the previous one (Köche, 2011). Under postmodern or contemporary science, the universe is no longer seen as a perfect machine governed by infallible and immutable mathematical laws. It is now admitted that the universe has a probabilistic, unfinished, and mutable nature, such that the laws created about it are also mutable. Postmodern science no longer seeks truths, not due to methodological or technological limitations, but because in a constantly changing world, all knowledge produced is necessarily provisional (Köche, 2011; Laurenti, 2012, 2014). Similarly, under the contemporary paradigm, scientific objectivity is redefined. Given the impossibility of the scientists purging themselves of their subjectivity and being neutral in their professional practice, objectivity is now ensured by explicitly stating the values and beliefs that participate in and influence the scientific process (Laurenti, 2012, 2014). Furthermore, in the face of an unfinished and probabilistic reality, the limits of the quantitative-experimental method were recognized, as well as its inadequacy for studying all phenomena. Thus, methodological pluralism began to be defended and valued, and quantitative-experimental methods came to be seen as just one of the possible ways to investigate phenomena (Köche, 2011; Laurenti, 2014).

In the wake of these discussions (Köche, 2011; Laurenti, 2014), the human and social sciences began to argue that their object of study was *sui generis* and, therefore, required its own methodologies, which were essentially qualitative (Ferreira, 2015). According to Ferreira (2015), human beings possess specific and essentially qualitative characteristics, given that they are historical beings and products of a complex, mutable, and plural social reality. In light of these assumptions, qualitative methods emerged as those that allow for the most adequate and in-depth study of human phenomena, capturing their specificities and enabling a holistic, contextual, and interpretive approach to investigation (Alves-Mazzotti & Gewandsznajder, 2002; Ferreira, 2015; Loftus & Rothwell, 2010; Mineiro et al., 2022; Rodrigues et al., 2021). According to Loftus and Rothwell (2010), qualitative studies do not aim to explain the phenomena under investigation but to understand them, decoding their meanings—the explanation of phenomena is, from this perspective, a specific attribute of quantitative studies (Loftus & Rothwell, 2010; Rodrigues et al., 2021). Moreover, while in the natural sciences there is a detachment between the knower and the known, who are of different species, in the human and social sciences, the complicity and solidarity between the knower and the known (both human) are inescapable and should be recognized and valued (Ferreira, 2015; Loftus & Rothwell, 2010; Mineiro et al., 2022). Finally, it is admitted that the human and social sciences are "ideological" (Ferreira, 2015, p. 114), which means that the values and principles of the scientist participate in and influence the entire process of knowledge production, from conception to the publication of qualitative results.

This ontological claim by the human and social sciences regarding their object of study was accompanied by a diversification and intensification of the use of qualitative methods—especially from the 1970s onward (Alves-Mazzotti & Gewandsznajder, 2002). This movement enabled the consolidation of this type of methodological strategy in the scientific context and its acceptance within the scientific community (Loftus & Rothwell, 2010). For Alves-Mazzotti and Gewandsznajder (2002), it is even possible to speak of the emergence (and current prevalence) of a "qualitative paradigm." After all, recent decades have witnessed the development of numerous qualitative research strategies (ethnography, single case study, multiple case study, action research, life history, phenomenology, among others) and their widespread use even in disciplines traditionally characterized by the use of quantitative methodologies, like the health sciences (Alves-Mazzotti & Gewandsznajder, 2002).

However, by arguing that their object of study was ontologically different from the phenomena studied by other disciplines, the human and social sciences also endorsed and reaffirmed the split between nature and humanity defended by modern science (Laurenti, 2012). As claimed by the latter, qualitative methodologies are grounded, in their origin, on the assumption that human phenomena are complex, spontaneous, and creative—unlike natural phenomena, which are simple and determined (e.g., Ferreira, 2015; Mineiro et al., 2022). Although concurrent with the decline of the modern paradigm, the rise and consolidation of qualitative methods cannot be considered evidence of the overcoming of this scientific model. On the contrary, they represent the preservation of one of the fundamental characteristics of modernity. It is curious to note, in this sense, that upon gaining prominence in the

scientific context, thanks to the recognition of the weaknesses of the modern paradigm, the human and social sciences used this visibility to reaffirm modern premises and not to discuss new philosophical assumptions for science.

Similar to what is observed in relation to qualitative research, contemporary descriptions of quantitative methodologies also seem to preserve modern elements (e.g., Duarte, 2022; Goodman, 2011; Mistry et al., 2016; Mohajan, 2020). For Mohajan (2020), for example, "quantitative research explains phenomena by collecting numerical unchanging detailed data that are analyzed using mathematically based methods" (p. 53). Moreover, according to the literature, research of this nature is more rigorous, precise, accurate, and reliable than other methodological choices, including those of a qualitative nature (Goodman, 2011; Mistry et al., 2016; Mohajan, 2020). This is because quantitative studies repeatedly employ experimental strategies and the researcher "conducts the inquiry in an unbiased and objective manner" (Mohajan, 2020, p. 53), to prevent any values, biases, or prejudices of the scientists from influencing the knowledge production process (Duarte, 2022; Mistry et al., 2016; Mohajan, 2020). Additionally, quantitative methodologies have the capacity to lead to generalizations that transcend geographical locations or temporal markers (Duarte, 2022; Goodman, 2011; Mistry et al., 2016; Mohajan, 2020). Mistry et al. (2016) further state that quantitative studies stem from a "quantitative worldview" (p. 214) and offer research reports that are more formal, impartial, technical, and accurate. The main disadvantage of quantitative methodologies would be their difficulty or insufficiency in capturing the complexity of human phenomena (Mistry et al., 2016).

As can be observed, the characterization of quantitative research also preserves the division between nature and humanity. Furthermore, it maintains a hierarchy between qualitative and quantitative research, in which the latter is seen as having a degree of rigor, validity, and reliability that the former lacks. This methodological hierarchy, with its overvaluation of numerical evaluation, also descends from and is captive to modern science. Furthermore, the very dichotomy of qualitative versus quantitative seems to be grounded in typical assumptions of modernity, as it revisits the modern version of the Cartesian dichotomy of human versus non-human phenomena (Loftus & Rothwell, 2010).

It is worth noting that, in the literature, there are papers that argue for the non-existence of a dichotomy between qualitative and quantitative research. In these publications, these methodological modalities are seen as complementary and not incompatible with each other; their combined use can be beneficial in the investigation of different phenomena (e.g., Ferreira, 2015; Pereira & Ortigão, 2016; Rodrigues et al., 2021). Although meritorious, this proposal primarily involves overcoming this dichotomy from a methodological rather than a philosophical perspective. In other words, the philosophical premises underlying qualitative and quantitative methodologies persist, even in this proposal, in their dichotomous form (e.g., Loftus & Rothwell, 2010).

Moreover, even though quantitative methods are also employed in the humanities in contemporary times (e.g., Mohajan, 2020), the predominance of qualitative research in some of these disciplines is easily observable. Considering the Brazilian context, for example, the field of education produces predominantly qualitative research; quantitative evaluations are infrequent and incipient (Duarte, 2022; Ferreira, 2015; Gatti, 2004; Pereira & Ortigão, 2016; Rodrigues et al., 2021). There is a clear rejection of numerically based methodologies in education, which are considered excessively technicist, simplistic, and reactionary (Gatti, 2004; Pereira & Ortigão, 2016). According to Gatti (2004), this rejection occurs due to "reified ideological reasons" (Gatti, 2004, p. 13). In Brazil, master's and doctoral education programs often do not include discussions about quantitative methods in their curricula. As a result, Gatti (2004) states that educational scientists have little interest in investigations of this nature, face difficulties in planning and executing quantitative research, and lack the repertoire to critically evaluate the results of quantitative studies. For some authors, the low number of quantitative studies ultimately compromises the very recognition of the human and social disciplines as science and their authors as scientists (e.g., Duarte, 2022; Pereira & Ortigão, 2016)—an assumption that, it is worth emphasizing, is grounded in modern premises.

On one hand, the scenario observed in the field of education provides empirical evidence of the existence of the qualitative versus quantitative dichotomy, and on the other hand, it exposes some consequences of this dichotomization for scientific practice. The qualitative versus quantitative dichotomy favors the prioritization or rejection of methodological strategies *a priori*, as well as facilitates the essentialization of these strategies. Methods become more or less adequate not based on

the research problem they aim to address but due to their characteristics *per se*. This *a priori* selection of the method inverts fundamental stages of the scientific process and, at the limit, can compromise the results (Carrara, 2014).

Science, as a basic process of knowledge, is characterized by new knowledge production; this knowledge is produced as answers or solutions to scientific questions (Botomé & Kubo, 2002). The strategies that will be used to find these answers must necessarily be determined by the question being asked (Carrara, 2014). This is because the validity and quality of a method are given by its ability to answer the proposed question. Selecting the method before knowing the research problem is akin to defining the treatment before knowing the disease; although the treatment may eventually be effective, it has a high chance of not being so. Indeed, Cano (2012) warns that, as previously seen in education, in the social sciences, the emphasis on qualitative methods led to a methodological restriction that often either limits which objects are investigated by students and professionals in the field or favors the use of strategies that are not adequate for studying the phenomena of interest. Considering also that the *a priori* selection of methodological strategies is typical of the modern paradigm (Köche, 2011), the occurrence of this practice in contemporary times can be considered another remnant of that period.

The qualitative versus quantitative dichotomy and its modern foundations also seem to impact the extent and detail of methodological reporting, especially in qualitative studies. As mentioned, quantitative inquiries are characterized by accurate, technical, formal, objective, and impartial reports (Mistry et al., 2016). In contrast, qualitative research often presents incomplete, imprecise, or even absent methodological reports (Duarte, 2004; Taquette & Minayo, 2017; Weiner et al., 2011). It is common, for example, to find a lack of information about participants, data collection, and data analysis (Duarte, 2004; Taquette & Minayo, 2017; Weiner et al., 2011). According to Cano (2012), the conceptualization and teaching of qualitative methodologies often seek to emphasize their opposition to the supposed technicism and objectivism of quantitative methods. In doing so, the teaching of qualitative methodologies often defines this type of research not as science but as "art" (Cano, 2012, p. 117). Being art, therefore, the planning, execution, and reporting of qualitative research would follow different rules.

For Duarte (2004), the skepticism toward qualitative research is due, at least in part, to the absence of detailed descriptions regarding the method used in such research. This is because, as Ollaik and Ziller (2012) clarify, the reliability and validity of a study are conditioned by the transparency with which it is conducted and with which its results are reported. This transparency allows the scientific community to evaluate, among other aspects, whether the method employed permits and supports the conclusions obtained in the study. In other words, determining the value of scientific results depends on an assessment of how they were produced (Ollaik & Ziller, 2012)[1]. Since qualitative research often omits which methodological strategies were employed (Duarte, 2004; Taquette & Minayo, 2017; Weiner et al., 2011), estimating the value of their conclusions becomes unfeasible. Finally, it is important to note that the insufficient methodological description observed in qualitative research cannot be considered the sole responsibility of the authors of these studies. Reviewers and editors who approve the publication of texts with these characteristics, as well as all others responsible for teaching and for the dichotomization of qualitative and quantitative research, are co-responsible for this scenario.

Behavior Analysis and quali vs quanti dichotomy

As a scientific discipline, Behavior Analysis also reproduces the qualitative vs. quantitative dichotomy in its knowledge production processes (e.g., Austin & Carr, 2000; Jarmolowicz et al., 2021; Shimp, 2007). However, maintaining this dichotomy runs counter to the field's own assumptions. As discussed, the opposition between qualitative and quantitative methods is rooted in the ontological and

[1] A few words of caution: There is considerable discussion in the meta-scientific and philosophy of science literature regarding the nature of scientific enterprises and the best way to characterize it (e.g., Lewontin & Levins, 2007; Sheehan, 2018). To make it clearer, our commitment in this paper is to pursue methodological and philosophical paths that allow us to part with reductionist and fragmented worldviews and, consequently, with the dichotomy underpinning the premise that grounds and is expressed through the opposition between qualitative and quantitative methods.

epistemological distinction between human and nonhuman phenomena. Skinner (1953) vehemently denied this distinction.

It is worth reiterating that, from a Skinnerian perspective, human and nonhuman phenomena share the same physical nature—what we could call the principle of the organic unity of nature—and can be studied using equivalent methodological strategies. Similar to the hard sciences, a behavioral science (i.e., a science of human phenomena) must also be concerned with predicting and controlling its object of study, as well as describing the laws that specify its functioning. This is because, as observed in relation to other natural phenomena, "a vague sense of order emerges from any sustained observation of human behavior" (Skinner, 1953, p. 17). Given regularity, the description of laws is not only scientifically possible but also necessary for any intervention on the object of interest (Carrara, 2014; Skinner, 1953). Indeed, guided by these premises, Behavior Analysis has consistently advanced in describing behavioral laws and producing useful technologies for predicting and controlling behavior (e.g., Heward et al., 2022).

Moore (2017) emphasizes that "science is, to a large extent, the operant behavior of scientists" (p. 77). Thus, scientific knowledge is the product of behavior that, like any other, occurs under the control of environmental variables (Burton, 1980; Laurenti, 2012, 2014; Moore, 2017). In principle, the philosophical assumptions described by radical behaviorism should control the scientific practice of behavior analysts (Skinner, 1963). Maintaining the qualitative vs. quantitative dichotomy, however, contradicts these premises (e.g., Skinner, 1953). What, then, controls the behavior of behavior analysts to sustain this dichotomous practice?

Considering that qualitative strategies rely primarily on verbal data, we might question whether suspicion regarding these data is underpinned by research that highlights the lack of correspondence between doing and saying. That is, maybe Behavior Analysts started valuing quantitative studies more than qualitative ones upon noticing that people frequently say they will do "X" even though they actually do "Y." However, a brief investigation into the history of Behavior Analysis can help us to undermine this hypothesis: there is consistent literature investigating say-do correspondence and showing that there is usually low verbal correspondence (e.g., Israel & Brown, 1977; Israel & O'Leary, 1973; Israel, 1978), especially in the say-do sequence. The behavior-analytic studies about verbal correspondence began in the 1970s (e.g., Lloyd, 2002; Wechsler & Amaral, 2009), years after the publication of seminal books and papers such as "The behavior of organisms" (Skinner, 1938), "Superstition in the pigeon" (Skinner, 1948), and "Schedules of reinforcement" (Ferster & Skinner, 1957), all of which relied heavily on experimental/quantitative approaches. This shows that decades before the studies of verbal correspondence demonstrated that we frequently do not do what we say we will do, behavior analysts were already conducting mostly quantitative experimental studies, contradicting the hypothesis that this was a choice based on data from the field.

We could also argue that the added value of experimental studies stems from the field's methodological tradition, given that behavior analysis, from its inception, has been based on the experimental analysis of non-human organisms. Some institutional conditions and disputes may underlie these preferences. For example, Skinner completed his doctorate outside of the psychology department, in the Department of Physiology, which was strongly influenced by specific forms of applying experimental methods. Furthermore, in the early years, it was not easy to publish and be read (and heard) within the psychology field, given the particularities of experimental and single-subject designs (Small N Designs) (Cruz, 2011; 2014; 2016). The very inclusion of behavior analysis within the natural sciences, defended by Skinner (1938, 1953) and repeatedly reaffirmed by behavior analysts (Azoubel, 2019), may have favored the choice of quantitative and experimental methods as the first choice. Since the natural sciences are traditionally characterized by quantitative methods (Alves-Mazzotti & Gewandsznajder, 2002; Mohajan, 2020; Gil, 2008), the use of these methods may have been understood as one way to ensure the field's natural science status. Historical data suggest that the methodological concerns of the emerging behavior-analytic communities were crucial to the creation of the first behavior-analytic experimental journals and decisive in differentiating the field from other psychological disciplines (Cruz, 2016).

To mention more historical context, Rutherford and Pickren (2010) and Rutherford (2003; 2009) argued that the atmosphere of technologically driven urban reform and also the political consolidation of institutions (education included) were major factors in the United States at the time Skinner and

experimental analysis of behavior (first) and applied behavior analysis (later on) emerged and consolidated. That said, on the one hand we have the necessity of intragroup cohesion for its strengthening as a field (thinking about resources and relationships as important antecedent and consequent conditions, e.g., Guerin, 2020); on the other, the institutional, political and cultural contingencies in place contributed to the consolidation of the aims and methods of the field as such.

In any case, it is worth reaffirming that, from a radical behaviorist perspective, it is impossible to assume that the behavior-analytic community's maintenance of the quali vs. quanti dichotomy is neutral or that it occurs in the absence of any interests or values (Burton, 1980; Laurenti, 2012, 2014; Moore, 2017; Skinner, 1953, 1957). We reaffirm that the origin of this dichotomy is based on premises denied by radical behaviorism, which affirms, instead, the organic unity of nature. In this sense, it seems paramount that we develop scientific and philosophical research that helps explain the survival and even the defense of this practice in our scientific community.

Arbitrary relations and possible effects identified in the quali vs quanti dichotomy. According to the stimulus equivalence (SE) paradigm (Sidman & Tailby, 1982; Sidman, 1994), physically dissimilar stimuli, whether verbal, auditory, visual, or tactile, can become substitutable in controlling behavior. That is, they can become interchangeable with each other on some occasions (de Rose, 1993). By teaching at least two relations between two or more sets of stimuli, some relations that were not explicitly trained can emerge. For instance, by teaching students that (A) quantitative methods are (B) objective and then telling them that (B) objective methods are (C) scientific, they can derive, without further training, that (A) quantitative methods are (C) scientific, and that (C) scientific methods are (A) quantitative.

Furthermore, when stimuli become equivalent, a function attributed to only one of the stimuli in the class is shared with the other members, i.e., there is a propagation of functions to all members of the same class, without the need for this relationship to be directly trained (e.g., de Rose et al., 1988; Dougher et al., 1994). For example, if a university student learns that science is important for the advancement of society (reinforcing function), they might want to conduct a quantitative study for their honors project based on their previous learning that quantitative methods are scientific.

Another account that can be useful in this discussion is Relational Frame Theory (RFT; Hayes et al., 2001). According to RFT, an explicitly reinforced or derived history of stimulus relations or frames (coordination, comparison, opposition, hierarchy, etc.) enables the transformation of functions (e.g., Törneke, 2011). That is, functions established for one of the members of a class can transform according to the type of relation initially established (e.g., Hayes et al., 2001). For instance, by teaching students that qualitative methods are the opposite of quantitative methods, and also teaching that quantitative methods are objective, neutral, and scientific, without further training, the student can derive that qualitative methods are subjective, biased, and non-scientific.

The previous sections of this manuscript have shown us that at least three types of relations were probably established, either in a direct or derived way: *equivalence/coordination*, as when students learn that qualitative methods are used to comprehend human phenomena; *opposition* (e.g., learning that qualitative is the opposite of quantitative, or that objective is the opposite of subjective), and *hierarchy,* such as when a person learns that objective methods are better than qualitative methods. Even though one might believe those relations are just words with no other impacts on behavior, the extended literature on SE and RFT shows that those types of relations can have very real effects on behavior.

Imagine an individual, Paul, who learned, as an undergraduate student, that qualitative methods are the opposite of quantitative methods, that quantitative methods are objective, more rigorous, more precise, and more accurate, and that science can contribute to the advancement of society. Paul then decides to do a PhD in Data Inequality and chooses a program focused on quantitative skills training. In this program, the previous learning about quantitative methods gets strengthened, as discourses about quantitative methods being better than qualitative methods are common. During his PhD, Paul has minimal contact with researchers who conduct qualitative studies and rarely reads qualitative papers. Paul starts to act as a reviewer for journals and sometimes receives qualitative studies to review, as his chosen dissertation topic was attainment gaps in education (analyzing data sets from different cities/districts through statistical measures).

Now imagine a second person, Tim, who is from the field of education, and has learned (directly or in a derived way) that qualitative studies aim to comprehend human phenomena, as opposed to quantitative methods, which aim to explain nature. Tim learned that it is impossible to be neutral and, therefore, having learned that quantitative studies assume they are neutral, chooses to carry out a qualitative study for their PhD. Tim writes a manuscript for a journal that accepts both quantitative and qualitative studies, and Paul is one of the reviewers. When Paul reads the manuscript, he is under the control of some sets of rules in terms of what is scientific research and what is needed in each section of a paper. Paul notices that, based on the description of methods, he could not replicate this study, something deemed necessary in all scientific inquiry. Paul could respond differently depending on what is controlling his behavior: under the control of the rule that "every study needs to be described in enough detail to be replicated", he could recommend the study be rejected. However, under the control of the learning that "qualitative studies are less rigorous, less precise, and less accurate," he could recommend the study to be accepted, since "it does not need to be *as good as* a quantitative study."

In both cases, Paul could comment about this experience with his colleagues. They could laugh and make jokes. The jokes could be not only about *the paper* but also about the qualitative *researchers*. Having derived, based on the history of his group interactions, that qualitative research is less precise, less accurate, and less rigorous, and having learned that qualitative researchers conduct qualitative research (equivalence/coordination relation), he can negatively judge the quality of the paper and also the researchers who conduct such studies. This prejudicial behavior could have real effects in terms of, for example, opportunities to act as reviewer/editor, being invited as a guest speaker at events, winning prizes, and having papers accepted for publication/published/rejected.

Even though this is anecdotal, it is unfortunately not rare to overhear researchers defending their perspective (either quali or quanti) at the expense of the other perspective. Moreover, the comments extend beyond the products of research and describe people, which can be seen as a form of prejudice (e.g., Mizael & de Rose, 2017). Therefore, from the point of view of relational responding, researchers who defend a *lack of a dichotomy* between qualitative and quantitative research and a stance where they are complementary and not incompatible are preventing negative relations from being established for both qualitative and quantitative research methods. That is, this perspective treats qualitative and quantitative research methods as *different*, which does not necessarily lead to a derivation where either of them is regarded as negative. Additionally, by saying they are complementary, the importance of using both is highlighted, which could lead to derived relations such as "as important as," "as good as," and "as relevant as."

Behavior Analysis Beyond the Dichotomies: Implications for Knowledge Production

In light of the philosophical and scientific scenarios described, it remains for us to point out some implications of abolishing the quali vs. quanti dichotomy for knowledge production practices among behavior analysts. To this end, we will mention some examples of research areas in which we have experience and which have been gaining momentum in recent years. We hope to demonstrate how problematic the decision-making process regarding the procedures to be used would have been if based on the dichotomy we are criticizing.

Exploratory research is an empirical modality of research relevant for the initial understanding of a range of problems (Gil, 2008); it is carried out in situations where the subject matter is new or little studied and when the aim is to gather information that helps to initially characterize it (Gil, 2008). Some exploratory research can be a collective enterprise, such as the need to better understand historical evolution, changes over time, and ways of interpreting rules and prescriptions outlined in public policies, or yet, if we are interested in understanding the effects of a particular political, economic, social, or cultural prescription on the behavior of subjects in a given space and time.

As a first example, Guazi (2020, 2022) developed a broad research program whose central objective was to identify contingencies responsible for the scientific behavioral patterns of Brazilian researchers and doctoral students. Guazi (2020) conducted extensive semi-structured interviews with six researchers (three juniors and three seniors) from different fields of knowledge, seeking to identify behavioral elements that shed light on the current state of the design of scientific policies by Brazilian governmental and scientific controlling agencies.

In general terms, the pattern found by the researcher demonstrated that a sensitive change occurred over time in Brazilian scientific institutions. This was shown by the fact that senior researchers—at the time of the interviews with an average age of 77 and at least 45 years of career—seemed to have a greater sense of satisfaction with their work; and their scientific behavioral patterns seemed to be more controlled by pleasurable and natural consequences of the work itself. This contrasted with the junior researchers (at the time with an average age of 32 and at least two years of career), who were largely less satisfied with the state of their work and more controlled by arbitrary consequences such as deadlines and norms set by the institution in which they worked and/or developmental and funding agencies.

This general trend identified by Guazi (2020) allows us to evaluate some characteristics of educational and scientific policies outlined by government and funding agencies. Furthermore, it allows us to estimate the implications of these policies on the behavioral patterns and mental health of scientists. The fact that the research was predominantly conducted through interviews and interpretation of transcripts is exclusively related to the needs previously delimited in the respective research project. More specifically, the number of participants, the way in which data were collected, and the type of analysis were adequate for an exploratory study. However, discussing the validity of these scientific conclusions in light of the quali-quanti dichotomy could overshadow the objectives of the study and the "novelty" of the object under investigation. After all, more important than the nature of the procedures used is the coherence between the methods employed, the general agenda of the research project, and the integrity with which the study was conducted (Carrara, 2014).

Documentary research, here taken in its procedural classification (Gil, 2008), also allows us to exemplify our thesis that methods derive from problems and aims. In his doctoral research, focusing on different documentary sources regarding phenomena and processes of a political nature, Fernandes (2020) examined relations of dispute between proposals for reactionary and emancipatory control of the political direction of education in Brazilian society. The analysis involved the delimitation of relevant political and social actors—representative social movements from both sides of the political spectrum and involved in the debate, public agents with various levels of involvement and sectors, researchers and the press, documents linked to public policies, materials from hegemonic and counter-hegemonic press, and the delimitation and analysis of bibliographic material produced by counter-control actors, and then ways of inferring and describing social contingencies produced and producing the political dynamics in question. In the end, this project was an example of the analysis of control and counter-control processes involving disputes over the direction of governmental controlling agencies and cultural practices of our time, materialized in educational policy agendas.

Considering the materials that composed the analysis and the goal of describing the control and counter-control relations among the political actors in dispute, the documentary analysis of bill projects, press archive materials, and scientific literature informed the functional assessment conducted. Given the characterization of the information consulted in each documentary source, inferences were made that allowed the identification of actors, antecedents (social, political, cultural, economic contexts), control and counter-control behavioral patterns, and consequences. Actors of reactionary control intervened in the public debate through editorials in the press, development of think tanks, public protests, interviews, and funding of and pressure on political campaigns. Actors of emancipatory counter-control, in turn, conducted all sorts of research on the motivations of their antagonists, built collectives of education professionals to influence the public debate, signed editorials in the media, participated in public hearings, and proposed bill projects. Here, as in the previous example, the research illustrates how the methods employed were dictated solely by the research agenda itself.

In both cases mentioned, the problems and aims of the research delimited the investigation strategies. No less important for our goal in this paper, they were two typically behavioral-analytical studies, because they promoted the identification of dependency relations between environmental and behavioral events of different actors, in their respective contexts. Both promoted data collection that allowed the functional assessment of contingency relations and their contextualization in social, historical, economic, cultural, and political conditions, each in accordance with their declared purposes.

In our view, these studies resonate with the philosophical assumption discussed previously regarding the organic unity of nature and the consequent scientific view that, without an ontological distinction between methods, the choice is dependent on the purposes of the investigation. Naturally,

different research aims in the same or different fields of knowledge imply specificities of form, content, and investigation methods. Experimental or applied behavior analysts focus on diverse problems and contexts. Their decisions about paths to follow in the basic and applied scope allow possibilities of investigation around different objects, problems, and goals that, in turn, inform the possible methods to be adopted.

Concluding Remarks

Our goal for this paper was to shed light on the philosophical premises underlying the quali-quanti dichotomy and to illustrate its incompatibility with good scientific practice, as an exercise in metascientific analysis. As seen, the survival of this dichotomy depends on the modern assumption that human and non-human phenomena are substantially different, so that their investigation necessarily requires distinct methodological strategies. In the academic-scientific routine, this dichotomy favors the selection and valuation of methods in isolation and independently of the research questions to be answered, in addition to favoring hierarchical relations involving research methods and, by extension, the individuals that use those research methods.

Furthermore, this dichotomy facilitates the *a priori* determination of the reliability and validity of scientific papers without an effective analysis of these. Ultimately, the dichotomy generates biases, favors reductionist approaches, and compromises the integrity of the scientific process. The analyses undertaken also encourage questions about whether, in fact, the modern paradigm of science has been overcome. Considering the survival of several typically modern assumptions, perhaps contemporaneity is the stage not of a new paradigm (the post-modern), but of a period of transition or updating of the previous paradigm.

Within the scope of Behavior Analysis, maintaining the quali-quanti dichotomy contradicts basic assumptions of the philosophy of this science, especially the principle of the organic unity of nature. As illustrated throughout the text, the dimensions of behavioral relations and the research questions arising from their investigation make the dichotomy obsolete. In fact, the decision to maintain it has the risk of restricting relationships between people and research groups, limiting the scientific education of our researchers, and limiting research and work opportunities. These are some possible consequences with potential to damage the scientific integrity of our community.

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Author's Note

Beyond the Discourses of Quantitative and Qualitative Methods

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