

# The Interplay of Philosophy of Science, Statistics, and Storytelling

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## Abstract

There is a Copernican Revolution happening in statistics. It is something that affects the interplay of science, statistics, and the kinds of storytelling they do. Professor David Trafimow is taking on the venerated null hypothesis and the p-value method of testing significance. He has gone so far, as a journal editor to ban the null hypothesis from consideration. Authors using p-value arguments are asked to revise and resubmit their work. Such as stir has been created that the Canadian Statistical Association and now the American Statistical Association have convened special meetings to come out with proclamations. Even if they support professor Trafimow, it will be many years, many changes in statistics books, and mean retraining statistics teachers. It will mean a different understanding of philosophy of science, statistical accounts, and enroll my own field, storytelling. The chapter includes a series of YouTube video interviews with Professor Trafimow.

## Introduction

Why is storytelling relevant to philosophy of science and to statistics? For me, storytelling is more than written or spoken narrative and counternarratives. The theme of the chapter is how new changes in science and statistic reasoning (dropping null hypothesis, alternatives to p-value tests) will change the ways of storytelling in academic writing. The purpose of the chapter is to give some historical review of the newest Copernican Revolution in statistical argumentation, and to show how storytelling can contribute to new ways of storytelling statistics and philosophy of science.

## What is Philosophy of Science?

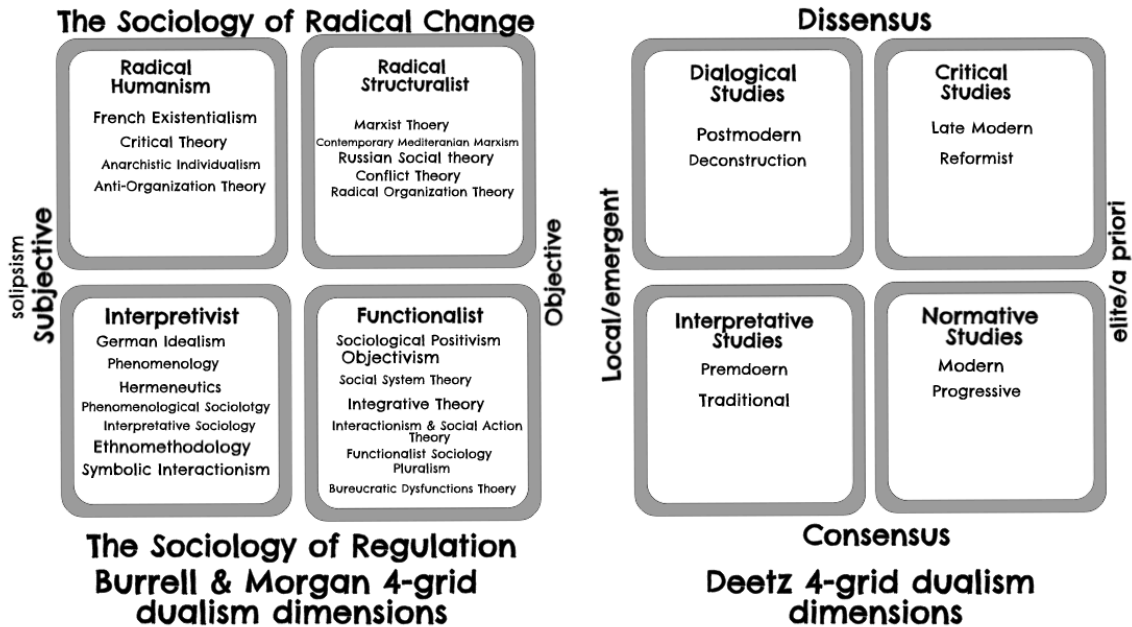
There is more than one philosophy of science. The most known is philosophy of science concerned with methods, theory foundations, and implications of 'empirical science'. Thomas Kuhn's (1962/1970) evolutions of normal sciences where scientists elaborate on, or detract from some central, more or less, within

accepted theory. As we will explore in a later section, Kuhn viewed model building as fundamental to normal science evolution (Barnes, 2008). In Kuhnian paradigm (which has some twenty meanings) revolutionary science, anomalies refute the accepted theory of normal science, breaking it down, until there is a paradigm shift overturning its accepted theory. Whitehead (1933:1968: 143) put it this way:

“The emphasis of science is upon observation of particular occurrences, and upon inductive generalizations, issuing in wide classifications of things according to their modes of functioning, in other words according to the laws of nature which they illustrate.”

Kuhn, by contrast to Whitehead, questioned this “notion that scientific knowledge was the result of a slow and steady process of incremental accumulation” (Prasad, 2005: 6). Since then Latour (1987) and many others are questioning if the “scientific method strictly follows the logical principles of deduction, induction, and falsification” (IBID). Rather, it is a “random, and creative element in science, as well as the key role of constructs and interpretive frames in coming up with scientific categories” (Prasad, 2005: 6). The implication is that positivism is no longer adhering to rigid scientific method protocol.

Burrell and Morgan (1979) theorized philosophy of science in 4-paradigm clusters, each a mix of quite different paradigms. I want to contrast it with an alternative conception of philosophy of science by Deetz (1996). I will suggest that both have made multi-paradigms into a 4-paradigm grid.



**Figure 1: Contrast and Comparison of Burrell & Morgan 4-grid dualisms with new grid-dualisms proposed by Deetz (drawing by Boje, 2018 combines Burrell & Morgan tables pp. 22, 27,29, 30, & 121)**

Putting the 4-grid models side by side (and including all the (sub) paradigms of each one, allows some interesting contrasts. Deetz (1996: 191) concludes that Burrell and Morgan's (1979) four-paradigm in past decades has gained "almost hegemonic capacity to define the alternatives in organizational analysis." The Burrell and Morgan (1979: 22) dualistic-dimensions of contrast are subjectivist—objectivist and the 'sociology of radical change'—"The sociology of regulation'. I added 'solipsism' because it is included in Burrell and Morgan (1979: 29 figure) on their 'subjective' side of the dualism. Solipsism holds that the self can know nothing but its own modifications and that the self is the only existent thing. Following Habermas (Critical Theory), they characterize solipsism as "occupying the most subjectivist region of the subjective" (IBID. 229).

Deetz's criticism is that the 4-paradigm grid reproduced the world as view from mainstream "sociological functionalist" definitional-authority of its particular version of "philosophy of science" tradition of separate objects of study, but equal in a loose yet reified classification categories that obscured important conceptual differences in research orientations, and led to poorly formed conflicts and

discussions (Deetz, 1996: 191-192). For example, the Frankfurt school of 'Critical Theory' critique of humanism, found itself categories in the grid as among 'radical humanists' and "lost in some hole in paradigmatic space" (Deetz, 1996: 192). Another result of the 4-paradigm grid is functionalist sociology was protected from necessary critique and could normalize its paradigm (of hidden values explanations), and have control over any emerging paradigms (to fit into the functional 4-paradigm grid). Then Deetz raised a more important concern that the 4-paradigm grid dimensions of contrast is missing other dimensions of genuine difference in research programs. For example, the contests for meaning in discourse theory and how language constitutes objects in the world (Deetz, 1996: 192).

The 4-paradigm grid [paradigm clustering] led to debates over paradigm compatibility and incommensurability (Willmott, 1993) and appropriate use of the paradigms (Hassard, 1991, 1995).

The basic dualism problem with the dimensions of the 4-paradigm grid remains and continues to normalize existing and emerging theories and methods into functionalist-conceived paradigm dualisms. The subjective-objective dimension is a dualism as old as "Western theoretical writing", amounts to "flogging a dead horse", but serves to create and sustain hierarchies of research programs privileging codified quantitative studies as objective and marginalizes qualitative or interprets studies as subjective. (Deetz, 1996: 193). This hierarchy gets reproduced in universities in promotion and tenure processes and in journal review processes in academies. Deetz's point is the subjective-objective duality is "socially contrived" [language game] in "positivism"-values rather than "natural fact" (deetz, 1996: 193). So-called "interpretivists" are "often labeled as 'subjective' yet their method is oftentimes a better claim to objectivity because it allows alternative language games and the possibility of alternative constructing arising from existing communities denying both research community conceptions and preferred methods as privileged and universal" (Deetz, 1996: 194).

We can all agree that the subjective-objective dualism has sustained "rather misleading conflicts and equally misleading presumed relations between social-called qualitative and quantitative research" (Deetz, 1996: 194). The association of

'subjective' with 'qualitative-multiplicity' and 'objective' with 'empirical science' as well as with 'numeric-multiplicity' marginalizes "rigorous interpretive work" that does not meet the definition of "purely impressionistic musing" (IBID. 194).

There is another important issue, triangulation. The subjective-objective duality serves to "retain the dream of triangulations as if different research programs simply provided additive insights into the same phenomenon" while hiding the real conflict (IBID. 194). The reason triangulation is an oversimplification of multi-paradigm reach is the each mode of analysis is "producing and elaborating different phenomena for different reasons" (IBID. 194).

The larger question is how to free numeric-multiplicity and empirical science from the pretenses of the Burrell and Morgan functionalist ontology.

"Many human questions admit of numerical answers, and these answers should be good ones. But when codification, counting, and statistical reduction are separated from the full process of constituting objects, determining problems and influencing communities, when only one slice of the research process is claimed as science, research loses relevance and critical parts of the process are not investigated" (Deetz, 1996: 195).

Concerning the second dualism ('sociology of radical change'—'sociology of regulation'), Deetz is critical of the 'sociology of radical change'—'sociology of regulation' dualism because it "tended in most usages to assume the presence of a coherent dominant group or orders, and the primary conflict initiating change was class conflict" (Deetz, 1996: 197). This dualism marginalizes dominant discourses that are often disorganized and disjunct micro-processes (e.g. "technology, consumerism, careerism, environmental destruction, and exclusive concern with economic growth") while privileging a group versus group conflict (IBID. 197).

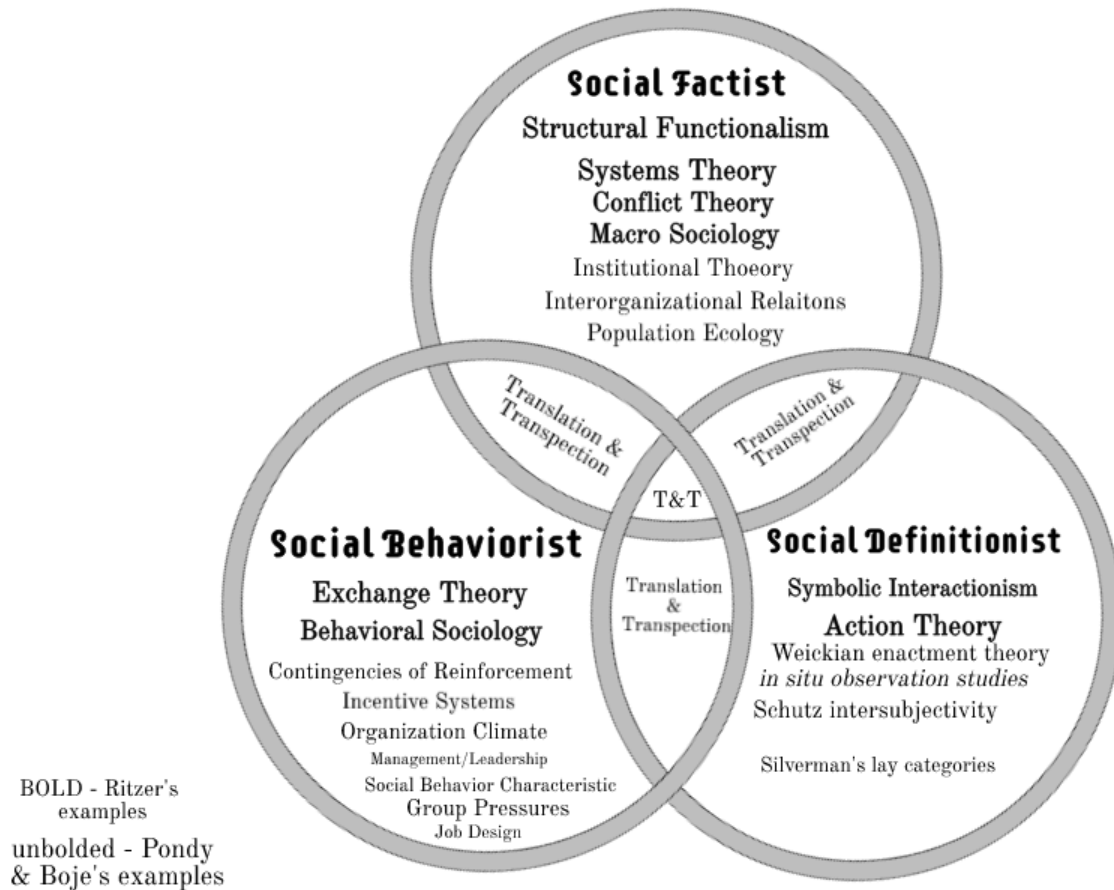
Deetz's solution is to replace the 4-paradigm grid dimensions with two alternative dualism dimensions. Subjective—objective is replaced by local/emergent—elite *a priori* dualism. The 'sociology of radical change'—'sociology of regulation' dualism is replaced by dissensus-consensus dualism. And several new paradigms are included in the 4-paradigm grid clusters.

In sum, Deetz is writing within the linguistic turn, making the claim that objective-subjective is not only a dualism that is socially constructed language game, it is also a rhetorical move installing subjectivist-objectivist duality in order to justify functionalist and neo-positivistic philosophy of science of both positivistic-“subjective humanists” and “hardcore abstracted empiricists” research programs and marginalizing all competing programs. An alternative way to frame objective-subjective is the insider-outsider split to demonstrate the political motivations of the difference.

Deetz, however, in my view, has not solved three key philosophy of science problems. First, his solution to the problem of dualistic dimensions is to replace them with two other dualistic dimensions.

Second, his new dualistic dimensions are a periodizing ‘grid’ approach of premodern, modern, late modern, and postmodern paradigm clusters. As I have written about before, the epoch succession approach is highly problematic narrative of history. Most postmodernists have abandoned it, since modernism was not succeeded by a postmodern epoch. The solution in has been to focus on postmodern theory rather than postmodern epoch shifts. As Latour (2012) puts it, ‘we have never been modern.’ As Cajete points out so-called pre-modern [traditional] has its own philosophy of ‘Native Science’, one that privileges storytelling as its methodology of choice.

Third, in multi-paradigm work, the focus needs to be the in-between. Pandy and I (1980” 83) were developing a multi-paradigm approach to solve the problem of how to manage inquiry founded on a multiplicity of paradigms. We worked with Ritzer’s (1973) three paradigms operating within sociology: social factist, social behaviorist, and social definitionist. Instead of dualistic dimensions, we took a Venn diagram approach, so we could focus on the in-between translation work needed to accomplish multiple-paradigm inquiry. Like Deetz, we did not abide the usual approach to triangulation.



**Figure 2: Pandy and Boje’s Multi-paradigm approach to Translation and Transpection (T & T) building on Ritzer (bold) paradigm clusters**

We chose multi-paradigm inquiry as our frontier program for organization theories shown in the figure above. Instead of ‘triangulation’ attempts at integration, we wanted to develop a strategy of cross-paradigmatic [dialectical] communication, including the subject’s own insider perspective. We focused on Maruyama’s (1974) ‘translation and transpection process (T&T) and his multi-causal paradigm with its deviation-counteracting and deviation-amplifying process loops. Instead of monopolization (one paradigmatic theory, method, and viewpoint) of organization theory, we chose de-monopolization: “making each party aware that others use different paradigms and different logics” (Pandy & Boje, 1980: 97). De-monopolization is the first phase of translation and transpection The second phase ‘transpection’ is where one party brackets their own paradigm and is able to

thinkin in the other's paradigm. In the third phase, translation, one party who understands is able to communicate their point of view in the concepts and language familiar to the other party. These phases include transpecting from one's own paradigm, into the other paradigms, and then back to their own. If you have ever tried translation programs, from your language, to another language, and back again, you can attest to just how difficult translation and transpection is.

In the next sections, I want to define statistics, and empirical science, and then develop an alternative approach to triangulation that incorporates translation and transpection.

### **What is Statistics?**

Statistics is a branch of mathematics dealing with the collection, analysis, presentation, organization, and interpretation of trends and variabilities in masses of numerical-data. Statistics has no factual (observational or experiential) content. And laws or axioms about mathematics are not about reality. "As far as the laws of mathematics refer to reality they are not certain; and as far as they are certain they do not refer to reality" (Einstein, 1953: 189). What I call 'numeric-multiplicity' has a broken connection to qualitative-multiplicity (Boje, *in press*). Numeric-multiplicity propositions have analytic logical grounds, but are not grounded in sensemaking empirics or in existential experience. Empirical science sets up conditions for empirical disconfirmation of both kinds of multiplicity. Numeric-multiplicity is axiomatized deductive logical reasoning and it involves proofs that use inductive reasoning.

Descriptive statistics sum up dataset attributes such as the mean, median, and standard deviation. Statistical inference from numeric-multiplicity is based on statements of statistical significance about patterns in the dataset. Statistics is about the probability of observing a particular result. Numeric-Multiplicity is a powerful method used widely throughout the scientific process.

Another reason triangulation is unrealistic is that numbers are not so simple. Gephart (1988) for example pioneered the field of ethnostatistics in three notions: (1) what do numbers mean? (2) Are the statistical programs used in empirical science conforming to the assumptions and limits that mathematicians would



subscribe to? (3) What are the storytelling (rhetorical) interpretations being used to convince readers to accept the significance of the study?

Qualimetrics attempts to bridge quantitative and qualitative in an alternating series of deduction, induction, deduction, abduction inquiries, a trilectical of three kinds of knowledge structuration (1) qualitative fieldnotes and observations, (2) quantitative data about frequencies of dysfunctions and (3) financial consequences of the hidden costs and dysfunctions not currently shown in regular accounting reports (Savall & Zardet, 2008: 206). I want to stress that both Ethnostatistics and Qualimetrics are focused on getting at the grounded meaning in qualitative-multiplicity, rather than the kinds of simplifying text-analysis software platforms that are proliferating (we will review those in a section below).

Let's explore the meaning of numbers? With the advent of relativity theory, the post-Euclidian geometry, and quantum physics, 'numbers' require more complex interpretation. Whole integer numbers were easier than what we have today. Real numbers for example, represent quantities along an imaginary line, such as -11, -4, -3, +12, +99 etc. as well as, fractions, and irrational numbers in algebra, like the square root of two. The square root of a negative number, such as  $\sqrt{-77}$  is an imaginary number. An irrational number is defined as any 'real' number multiplied by an imaginary unit, such as  $X^2 = -1$ . There are even transcendental numbers that are no longer algebraic, such as the root of a nonzero polynomial equation, or the transcendental numbers  $\pi$  and  $e$ . Clearly, Einstein is right, and any certainty ascribed to numeric-multiplicity does not refer to 'reality' in either the sensemaking empirical world or in Heidegger's (1962) ontological Being-in-the-world.

Empirical science and statistical methods have become so intertwined that scientific disciplines have their own statistical techniques (biostatistics, econometrics, geo-statistics, etc.).

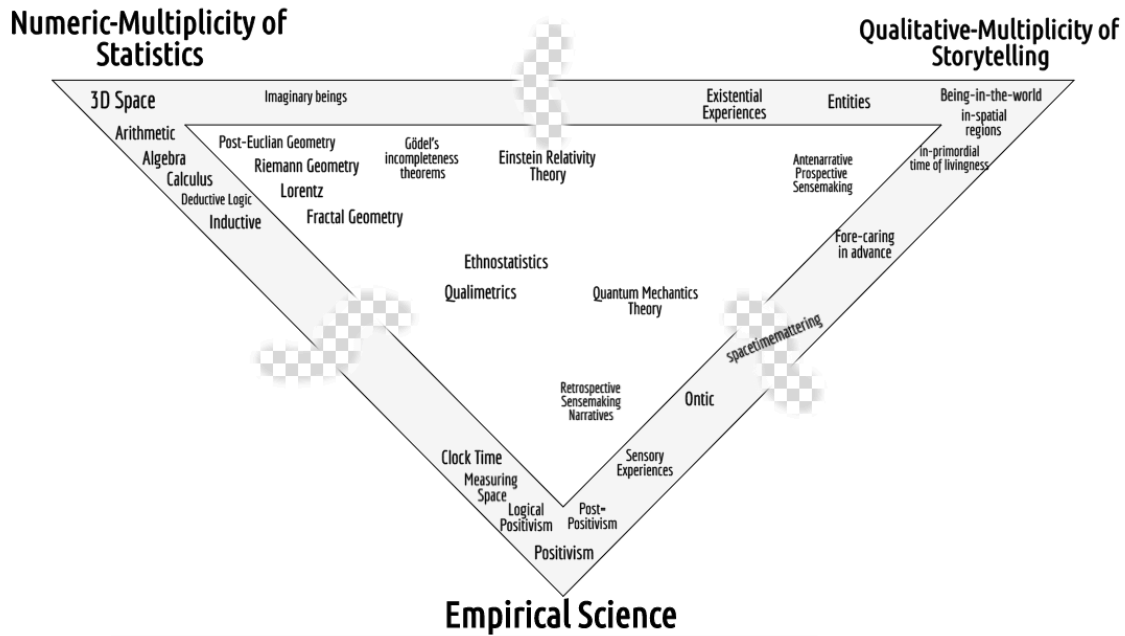
**What is Storytelling?** Science tells a statistical story. Statistics tells stories with numbers in what I term 'numeric-multiplicity'. Storytelling as 'qualitative-multiplicity' tells the reader the relevance and significance of empirical science and statistics to the current situation of the world people live in. Qualitative-multiplicity

research is about relations, process, contextual interpretations, and situatedness rather than abstract or pure logic categories.

Prasad (2005: 6) regards post positivist research as more artistic and craftsman-like than scientific. Qualitative-multiplicity research focuses on “narrative genres such as history, literature, and philosophy” (IBID.). It also focuses on living story webs of relationship, and on deeper antecedent ‘antenarrative’ processes (Boje, 2001, 2008, 2011).

Storytelling includes the struggle of a qualitative-multiplicity of narratives (& counternarratives), living stories webs of relationship, and antenarrative process. Living stories are never alone, never just the one, because each participates in an entire webwork of living stories. A living story has a place, a time, and it’s material mattering in relation to other places, other times, and a community of others telling it differently, or at least unraveling something any one living story is telling and not telling. Narrative has a reputation of trying to retrospectively erase, reduce, supplant living story webs, and just boil it all down to some single monological view (Bakhtin, 1981), where as [living] story is always polyphonic, requiring more than one, and then another, and more besides (Derrida, 1980). There is more to storytelling than just the narrative and counternarrative dialectic, and the multiplicity of living story webworking. There are pre-narrative and pre-story processes, which I call ‘antenarratives’ (Boje, 2001, 2008, 2014). Ante means ‘before’ and has the second meaning of a ‘bet.’ Antenarrative is ‘before’-narrative (& story) coheres, and it’s a ‘bet’ of prospective sensemaking about the future that is arriving, and how it will change both present and past. Such antenarrative processes are cared for in acts of forecaring.

What I want to do next is look at the relation between numeric-multiplicity of statistics, qualitative-multiplicity of storytelling, and empirical science.



**Figure 3: The broken Triad of Numeric-Multiplicity of Statistics, Qualitative-Multiplicity of Storytelling, and Empirical Science** (Drawing by D. Boje, 2018, used by permission)

Rather than triangulation, I propose a model of the broken triad (indicated by checkerboard breaks in the triangle image). For example, numeric-multiplicity statistics, per se, has no factual (empirical) content to reach directly to empirical science. Empirical science therefore demands empirical evidence to validate statistical axioms. This can come from experimentation in empirical science grounded in positivism or post-positivism, or from storytelling (qualitative-multiplicity) grounded in ontology.

Each corner of the triad has important differences making triangulation impossible. Space and time are conceived differently in the two multiplicities and in empirical science. Numeric-multiplicity develops axioms (implicit definitions) about a three-dimensional space in Euclidian geometry and spaces where planes intersect in Riemann geometry (Einstein, 1953: 190). The truth of numeric-multiplicity axioms and theories is logically prior to any experimental or observational validating evidence. Lorentz strange loops, Gödel's (1931) incompleteness theorems, and fractal geometry violate many of the Euclidian axioms, such as line being shortest distance between two points (Hofstadter, 1979). Numerical-

multiplicity, when doing axiomatized deductive mathematic proofs rests upon the alleged self-evidential character of the axioms (Hempel, 1953: 151).

Reichenbach (1953: 100-101) works out an inductive approach to meaning verification that works for quantum mechanics. "I have shown that the usual language of science includes the convention that unobservables follow the same physical laws as observable; in particular, that they satisfy the principle of causality, which for observables is an empirical law."

What he calls "*extension rules*" "extend the range of laws from observables to unobservables" (Reichenbach, 1953: 100) which in quantum mechanics includes wave/particle duality. For example, in quantum physics position and momentum cannot both be predicted simultaneously from initial conditions of double slit experiment. "Quantum physics does not admit of a normal system" (Reichenbach, 1953: 100). So the extension rule has to be used. This is consistent with Niels Bohr's principle of complementarity that both a wave and a particle description of the observational apparatus are necessary. Werner Heisenberg's (1928) principle of indeterminacy, by contrast, relied on calculating algebraic matrices of non-communicative Hilbert space vectors.

My point here is that in statistics, as well as in 'empirical science' there are transcendent concepts and variables that are not grounded in observation or experience. There are unobservables, irrational and transcendent numbers. Kneale (1953) contributes to cross-paradigm communication, to translation and transpection. He discusses the making of transcendent hypotheses in empirical science and in statistics. It may be possible, in some instances to translate numeric-multiplicity laws into qualitative-multiplicity, although the converse is not always the case. We can count the number of stories gathered in different places and times and sort out themes. However, once we start to develop averages, means, and standard deviations of those themes, we are being reductionistic. By contrast, empirical science objects are often just empty space, since, for example in molecular and quantum physics, we are theorizing unobservables, and even places between entities. In quantum physics we have no clear observation directly of waves and wave-motions at the subatomic level. It cannot be established by 'direct induction.'

It is deduced from Planck's constant, Heisenberg's matrix calculations, or Bohr's principle of complementarity. The point is that the triangulations of numeric-multiplicity, qualitative-multiplicity storytelling, and empirical science of behavioral or sociological phenomena has many gaps between the paradigms, and more important, each has its own version of transcendent hypotheses. "Transcendent hypotheses of the kind we have been considering were first introduced into physics by the Greek atomists" (Kneale, 1953: 358). They hypothesized at the level of unobservables, and had no experimental means to verify their ideas. Nor is it "ordinary induction from facts from in experience because no other method is admissible in natural science" (IBID. 358). Kneale makes the point that Newton distrusted transcendent hypotheses, yet used them in his speculations about gravity and laws of motion. In current approaches to model building transcendence resides in the hypotheses, the variables and in the arrows between them. Existential hypotheses are being used in empirical science, statistics, and in the qualitative-multiplicity storytelling. And the cross-paradigm transcendence has little to do (except in living story ethnography) with the subject's own transcendent views. Living stories, for example have no independent meaning, and have counterparts in the living story web of relationships. The novelty of a new or even an old theory in empirical science, statistics, or storytelling (narrative & metanarrative work), has little to do with direct induction of the layperson's own terminology.

In my field of storytelling, there is attention to historical hypotheses, to epoch by epoch theories of historical changes, such as Deetz's (1996) model of paradigms (premodern, modern, late modern, & postmodern). Historians develop inductive hypotheses that reconstruct past events, creating a narrative of history. Archeologists develop their history of Stonehenge, which they submit to methods of historical criticism (Kneale, 1953: 363).

Kneale develops a theory and method of *consilience* induction, which has something to contribute to multi-paradigm inquiry. It is about what happens when a law or theory from one paradigm is applied to different paradigm system.

"It often happens that we make a tentative generalization in some field of study without reposing much confidence in the result of our

induction but discover later that what we have conjectured is entailed by some well-established laws and immediately regard our generalization as itself established beyond reasonable doubt” (Kneale, 1953: 365).

This can happen with transcendent hypotheses of one paradigm theorizing to some other paradigm system. In organization theory, for many decades mechanistic principles from engineering were applied to re-engineer social systems, and are still being used, despite objections that humans are not machines. Despite repeated refutation, mechanistic principles are still in wide use in management and organization. Kneale’s suggestion for such a cross-paradigm hegemonic situation is to focus on the number of supposed laws ( $L_1$ ,  $L^2$ , and  $L_n$ ), which are shown to be consequences of a transcendent hypothesis. “each of these supposed laws has its own evidence, consisting of a number of instances from which it was originally established by primary induction” (IBID. 365). The connective transcendent hypothesis between two or more paradigms cannot be more probable than each of the individual laws ( $L_1$ ,  $L^2$ , and  $L_n$ ). However, it can be the case, in the long accumulation of evidence, that since the overall hypothesis entails these varied laws from different paradigms, and communicates them, it can have greater probability than each individual law and its range of evidence. “This is the consilience of inductions which fit together into a theory...” (IBID. 366).

Methods of triangulation that are supposedly ‘solving’ multi-paradigm communications obstacles by collapsing meaning down to the lowest common language terms, seems to me, to be wholly unsatisfactory. What is more fruitful is translation and transpection communicative processes that include explorations of transcendent hypotheses of each paradigm and the subjects themselves.

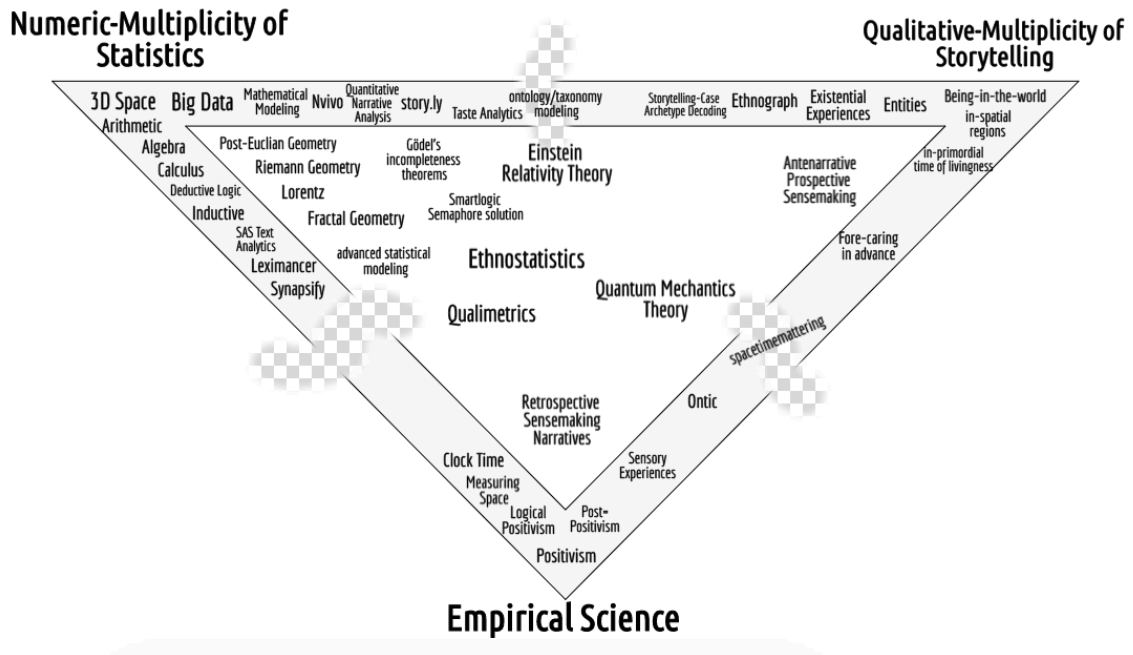
In the next section I want to explore how model building has ten hold in empirical science, as well as in storytelling, in ways that puts statistics to uses that are problematic for multi-paradigm inquiry.

## **Historical and Theory Background**

There are important historical changes happening, as Numeric-Multiplicity

combines with so-called 'Empirical Science' as ways to do quick and easy text analysis of Qualitative-Multiplicity. According to Barnes (2008) quantitative modeling of qualitative phenomena became popular after WWII with massive investments by the Military-Industrial-Complex (MIC), which has morphed into the current Military-Industrial-Academic Complex (MIAC). MIAC enfolded diverse performances, ideas, inanimate material objects, people, and entire academic disciplines into a larger composite, one product of which was a new regime, 'mathematical modeling' (including simulation) for the production of knowledge about global warfare, arms race, ballistics, and so on. Post-WWII, the MIAC has incorporate Internet capabilities into it modeling, across diverse fields such as economics, geography, and biology. The Numeric-Multiplicity model building, used Empirical Science data sets, and eventually, developed language semantic analysis algorithms using dictionaries to model texts (spoken, written) Qualitative-Multiplicity to get at 'supposed' stories data had to tell. Models became agential, agents participating in all three aspects of the broken Triadic (Figure 1). In other words, models migrated from purely mathematical algorithms into both Empirical Science (Kuhn's 1962/1970) normal science, and are taking over storytelling analysis Qualitative-Multiplicity.

This can be verified in the proliferation of textual analysis software companies. I have mapped out some of the text analysis software platforms claiming to do this.



**Figure 4: Big Data Modeling changes to the broken Triad of Numeric-Multiplicity of Statistics, Qualitative-Multiplicity of Storytelling, and Empirical Science (Drawing by D. Boje, 2018, used by permission)**

With over 100 text analysis companies competing for shares in the big data market, there are ‘standards wars’ as companies struggle for preeminence of their standard over all others. I have listed some of these in the above figure, and sorted them according to their location in the ‘broken Triad.’ Ethnograph was developed by anthropologists (Boje, 2001) to do location and retrieval of textual statements in larger data sets. Mathematical modeling approaches such as Nvivo allow text data to be put into visual models. It is part of a trend in quantitative data analysis (QDA) approaches. Woodside and Suresh (2016) ‘Storytelling-Case Archetype Decoding and Assignment Manual’ (SCADAM) say it gives its users “a clear definition of a story and application of the DOF [degree of freedom test] instrumentation immediately after the story listening creates an early sense of the performance metrics of story capture and allocation of time” (59, bracketed additions mine). SAS Text Analytics advertises itself as a comprehensive Text Analytics software suite that uses “advanced statistical modeling, natural language processing and advanced linguistic



technologies to discover patterns and trends from any text in any format.”<sup>1</sup> Smartlogic Semaphore solution says it provides “ontology/taxonomy modeling and information visualization”. The Smartlogic solution content intelligence platform includes commercial text analytics, natural language processing, rule-based classification of metadata (IBID.). Leximancer’s slogan is “text in, insight out” and says, “Text is more than a collection of words. Text tells a story.”<sup>2</sup> “ Leximancer adds, “No human bias in analysis.” (IBID. Some of the QDA approaches are all about story. Taste Analytics, for example, says it provides predictive modeling to find the stories that the data is trying to tell by using artificial intelligence, including a robust analytics engine and robust statistical NLP algorithms that can ingest any type of unstructured data and quickly identify trends, patterns, and outlying themes (IBID.). One more example of the encroachment of Numeric-Multiplicity algorithms and text-analysis empirical data software onto storytelling of Qualitative-Multiplicity. Smart Munk’s software, called ‘Story.ly’, claims to reduce complexity in rich datasets by automatically extracting meaning from any kind of text (customer service feedback, online forums, interviews via phone, online forms, and so on).<sup>3</sup> It also promises process of product development optimization by seeing insights in the story in smart online reports.

One of the assumptions of ‘Big data’ (aka text analytics) is that it can convert unstructured text data into meaningful data for statistical analysis using entity modeling and machine learning technique. Kimble & Milolidakis (2015) debunk several myths about big data, which I will briefly summarize:

**Myth 1: Big data gets at meaning.** In fact, Big data uses mathematical models where the empirical data (text, speech, etc.) are decontextualized, taken out of its meaning-situation, to fit into the available model algorithms.

**Myth 2: Big data is objective.** In fact, Facebook and Twitter (& other social

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<sup>1</sup> Predictive Analytics Software Accessed Jan 19 2018 at <https://www.predictiveanalyticstoday.com/top-software-for-text-analysis-text-mining-text-analytics/>

<sup>2</sup> Leximancer Software. Accessed Jan 19 2018 at <https://info.leximancer.com/>

<sup>3</sup> Smart Munk Software, Story.ly accessed Jan 19 2018 at <http://www.smartmunk.com/wp/>

media) do not represent 'all people' and some users have multiple accounts used by multiple people and some bots pretend to be people.

**Myth 3: Big data is free for anyone to use.** In fact, using social media data without permission raises ethical concerns. Users are not aware of the uses their posts are being put to in different contexts, the profits generated, and so on Nor is it free. For example, Facebook users are an unpaid workforce. The value of the data posed is assessed to be \$81 per person.

**Myth 4: Big data makes managers more rational and determinate.** Big data promises to turn indeterminate situations into determined situations using IT-intensive practices. Managers can then behave more rationally, be more calculable, and forecastable to their superiors or to system software.

Next, we will look at the storytelling accounts given in statistical studies to convince readers of the significance of the study.

**Statistical Story** The United Nations Economic Common for Europe (2005) put out a book on 'Making Data Meaningful: A guide to writing stories about numbers.' (Geneva: United Nations). A "statistical story" reveals "statistics are not just numbers" (3).

"A statistical story is one that doesn't just recite data in words. It tells a story about the data. A statistical story conveys a message that tells readers what happened, who did it, when and where it happened, and hopefully, why and how it happened" (3).

The United Nations Economic Common for Europe (UNECE) (UNECE, 2005: 6) gives advice on how to write a statistical story: "First and foremost, you need a story to tell. You should think in terms of issues or themes, rather than a description of data. That means that you need to find meaning in the statistics."

Second, is to used the journalist's 'inverted pyramid' putting your one or two main conclusions up top about the data's general message, followed by secondary points in creasing order of importance throughout the story (6). "It should contain few numbers" (6). Avoid jargon.

Third, apply good writing techniques: keep paragraphs short, with three about three sentences. The theme sentence should contain no numbers. "Large

numbers are difficult to grasp. Use the words millions, billions or trillions. Instead of 3,657,218, write ‘about 3.7 million’ (7). Use compelling headings and subheadings, and embedded quotes, and graphs are a plus. Graphs tell a story.

Storytelling is about both qualitative-multiplicity and numeric multiplicity (Boje, *in press*). Storytelling is a method of inductive, deductive, or abductive reasoning. Inductive storytelling argues what is true is based on individual case examples. Deductive storytellers argues what is a true conclusion steps from premises. Induction storytelling is the Peircean notion of a intuitive flash of insight.

Storytelling plays a fundamental role in communicating science and statistics through data stories. Storytelling with numbers, graphs, tables can clarify underlying conceptual frameworks, descriptive and inferential thoughts (Pfannkuch, et al., 2005: 1).

Effective data storytelling more than just the structure of stories (IBID. 3). Numerical-multiplicity storytellers have to communicate nuances of meaning, substitute natural-language for jargon, and get beneath the tip of the iceberg to the patterns of the data-story, its ‘spread’ and ‘shape’ (IBID. 3).

In New Zealand, the Ministry of Education (2007) rolled out a new statistics curriculum, that required teachers to increase not only their skills in data analysis but also in communicative capability (Pfannkuch et al., 2005: 3). This old curriculum split out data-description, covered in early years of schooling, from data-inference (e.g. from sample to population), covered in later years. Their recommendation: “When we are just beginning to learn how to reason comparatively we have to keep the principle of statistical inference, the link between sample and population, to the forefront” (Pfannkuch et al., 2005: 12).

Storytelling mimics the way our brains store information (descriptive, inferential, & contextual). Storytelling is not just descriptive and inferential, it can also contribute to contextual understanding. Episodic descriptive storytelling (I notice is sensory: what one is seeing, hearing, tasting, smelling, & touching). Inferential storytelling is about comparison using inductive, deductive, or abductive reasoning (I wonder if more cases will hold the trend, or from these premises I draw

a particular conclusion). Contextual storytelling fills in the blanks with confirmatory experience missing from the storytelling (I know from experience what to expect will happen, or why it turned out this way). In indigenous storytelling details and sequences are often left out of a living story, since it is part of training, to be able to fill in the blanks and problem solve, in tersely told stories (Boje, 1991). Western narrative trends to leave little to the contextual wonderment. “Contextual knowledge plays an important role in the data-dialogue” in the storytelling reasoning from data-stories (Pfannkuch et al., 2005: 14).

“Data storytelling is the process of translating data analyses into layman's terms in order to influence a business decision or action” (Kumar, 2014, online).

Data analytics emphasize the importance of narrative to make sense of complex data. Data storytelling is useful in helping audiences understand the point.

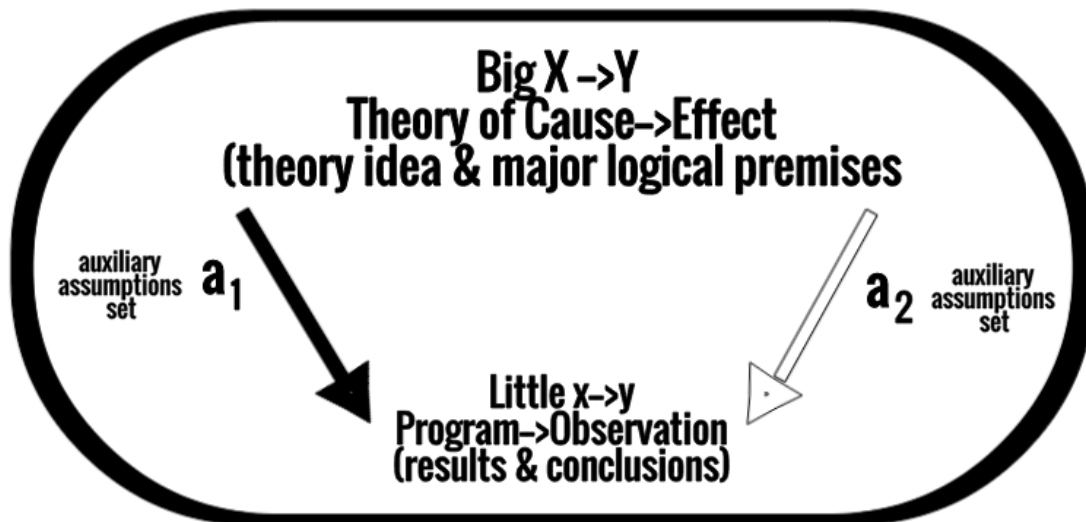
Numeric-multiplicity storytelling means telling stories about what resides within quantitative information that an audience can care about and understand. Do stories live in your data? Storytelling is done in mixed media, live talk, dramaturgy, pictures, diagrams, animated graphic, podcast, radio, YouTube, web page, printed book or report, and so on.

### **The New Copernican Revolution in Statistics**

A long-standing accepted inferential procedure is being problematized and declared invalid. It is the equivalent of a Copernican Revolution, because knowledge claims of prior and current research, are being called into question.

**The p-Value tells a a story.** For people who understand them, p-values tell a story. Since David Trafimow is challenging the p-value, we will need another way of telling story of significance. “The role of a statistics teacher is to enable students first to recognize that there is a story, then to enable them to tell the story through the tools of analysis and communication” (Pfannkuch, Regan, Wild & Holton, 2005: 1).

The p-value (probability value) is the level of marginal significance within a statistical hypothesis test representing the probability of the occurrence of a given event. P-value is used to reject points of the smallest level of significance at which the null hypothesis would be rejected.



**Figure 5: Theory of Cause and Effect (Big X→Y) and program of observation (Little x→y) with Trafimow’s auxiliary assumption sets**

Big [X-Y] cause-effect general theory. And the is a Measurement Principle we will call little (x->y) program->observation experiments and metrics

There are entangled double loops between the social and the economic factors and between the quality and functioning of quantitative (& financial) economic performance. Big [X-Y] cause-effect general theory and Empirical Science ‘Measurement Principle’ of little (x->y) program->observation experiments and metrics become entangled with each other and with various explored and unexplored assumption sets. Changing ‘construct validity’ away from the usual ( $p < .05$ ) & null hypothesis testing in causal modeling (e.g. structural equation modeling, cluster analysis, etc.) changes all the other validities.

**Table 1: How 9 Types of Validity are Affected in Organizational Research Methods by David Trafimow's Copernican Revolution in Causal Modeling \**

- **CONSTRUCT VALIDITY:** Does (little x->y) measure adequately tap (Big X->Y) deductive theory? The Copernican Revolution in Construct Validity changes all remaining kinds of validity, and gives science a new storytelling of the empirical world.

- **FACE VALIDITY (1st Wave Grounded Theory):** Does test/experiment/observation (little  $x \rightarrow y$ ) 'resemble' (inductive inference) of the real world 'actual' phenomenon in its spacetime mattering? (This is the epistemic [inductive] fallacy of assuming theory of Idea subsumes the ontological without actually doing falsification of **a1** and **a2** auxiliary assumption set).
- **CONTENT VALIDITY:** Does (little  $x \rightarrow y$ ) measure adequately accomplish inquiry into (Big  $X \rightarrow Y$ ) deductive theory? (Without committing epistemic fallacy)
- **DISCRIMINANT VALIDITY:** Does (little  $x \rightarrow y$ ) measure diverge from measures of other groups that (Big  $X \rightarrow Y$  theory) does not predict?
- **2nd & 3rd Waves of Grounded Theory (aka Nomological) Validity:** Does the prior theory and research on (Big  $X \rightarrow Y$  theory) match the abductive inference (little  $x \rightarrow y$ ) program & observations?
- **CONVERGENT VALIDITY:** Do 2 or more (little  $x \rightarrow y$ ) measures both purporting to measure (Big  $X \rightarrow Y$ ) theory have high empirical correlation?
- **CONCURRENT VALIDITY:** Do (little  $x \rightarrow y$ ) test results, at the same time, match results of an accepted measure of (Big  $X \rightarrow Y$ ) theory?
- **PREDICTIVE VALIDITY:** Does past (little  $x \rightarrow y$ ) result predict future repetitions of performance?
- **CRITERION VALIDITY (combines concurrent & predictive validities):** Does measure (little  $x \rightarrow y$ ) measure relate to an outcome?

The smaller the p-value, the larger the significance because it tells the investigator that the hypothesis under consideration may not adequately explain the observation" (Wikipedia, P-value). The uses of p-values dates back to 1770s, when first calculated by Pierre-Simon Laplace. It was formally introduced by Karl Pearson in chi-squared distribution test (Pearson, 1914: xxxi-xxxiii, 26-28, Table XII). The p-value was popularized by Ronald Fisher (1925) who proposed the level  $p=0.05$ . Professor David Trafimow (2003, 2009, 2014) has declared both p-value and null hypothesis to be invalid. "As the standard null-hypothesis significance-testing procedure does just that, it is logically invalid" (Trafimow, 2003" 526). One reason, in "Bayes' theorem yields  $p(\text{HoF})$ , but in practice, researchers rarely know the correct values for 2 of the variables in the theorem" (IBID.). In their editorial, Trafimow and Marks (2015: 1) banned authors from submitting null hypothesis significance testing procedure (NHSTP), decline it invalid, and therefore authors would no longer be required to perform the test. Articles performing p-value tests would not be automatically desk rejected, "but prior to publication authors will have

to remove all vestiges of the NHSTP (p-values, t-values, F-values, statements about 'significant' differences or lack thereof, and so on" (p. 1). In addition, NHSTP, since it fails to provide the probability of the null hypothesis, confidence intervals cannot be used to accept or reject the case for samples are capturing population parameters. In statistical hypothesis testing, the p-value for a given statistical model, when the null hypothesis is true ( $p(F|H_0)$ ), the statistical summary between the sample mean and compared groups would be same or greater magnitude than actual observed results. The p-value is used in statistical hypothesis testing in fields of organizational research such as management, marketing, economics, finance, psychology, and sociology.

Trafimow challenges the use of null hypothesis testing as a *reductio ad absurdum* argument adapted to statistics, its claim improbable. Null hypothesis is a dualism, since it assumes rejection of a null hypothesis implies a single correct alternative, which is questionable since as Trafimow put it, there may be many auxiliary hypotheses to eliminate. Further, Trafimow brings into question the notion of statistical significance that is naively quantified by conditional probability  $\Pr(X|H)$ , the likelihood the observation of continuous random variables to be zero, or  $\Pr(X=x|H)=0$ .

What is being widely critiqued is accepting alternative hypotheses to the null hypothesis, for any p-value less than .05 without other supporting evidence. Trafimow (2003, 2009) takes this skepticism a step further, actually banning p-value and the null hypothesis, as an index of the strength of evidence for a theory.

Trafimow and Rice (2009: 261), have to respond to challenges, such as supporters of null hypothesis procedures, who "... argue that the procedure is good enough because they believe that the probability of the data if given the null hypothesis correlates with the probability of the null hypothesis if given the data." Trafimow and Rice reject the correlation method as unimpressive and failing to give compelling justification for computing p values in dichotomized process, to reject or retain null hypothesis.

Trafimow (2014: 15) says, “Quantitative and qualitative researchers use different methods and have different goals. At the level of methods, quantitative researchers criticise qualitative researchers for not performing null hypothesis significance tests.” However, Trafimow rejects the null hypothesis and the p-value test finds this argument invalid, because the qualitative goal is not to find causal mechanisms, it is to describe personal or subjective experience.

The interpretation of p-value statistic has indeed taken the form of asking whether it is valid, and as Giles Deleuze (1968/1994: 176), might put it, more fictive than real.

The fictiveness of the p-value is tied to matters of representation and interpretation of statistical procedures and techniques. My storytelling point is that the p-value statistic has lost its claim to validity, and is becoming fiction, or worse, we can discuss the metaphysics of the p-value and the null hypothesis testing of a theory.

David Trafimow has appeared to give testimony to statistical associations in Canada, Netherlands, and in the US, since these groups must give guidance to statisticians on what to be about the p-value and null hypothesis controversy, and issue some kind of statement or proclamation, for or against. Could it be that Pearson (1914) and Fisher (1925) have committed some kind of historical error.

By invoking the ‘problem of p-values and null hypotheses; Trafimow opens inferential statistics to the challenge of metaphysics, a path being taken beyond the empirical statistical equation domain of significance to being confident in the validity of a particular concept, or entirely theory. In other words, the immanence of p-value to transcend its statistical solution in relation to claiming the validity of the theory, is an inference of synthesis, the fictive or erroneous knowledge being legitimated, or not.

What is being revealed in this synthesis is the movement from a statistical result to a declared knowledge solution to a theory problem in fields as diverse as medicine, psychology, sociology, management, accounting, and finance. The null hypothesis p-value (NHSTP) crisis of synthesis is also a problem of dialectics, the



antinomy between statistical procedure and nominal representation of valid theory claims by authors of research articles, and editorial policies of research journals. We should speak of a dialectics of p-value (& null hypothesis), as “any know of circulation of opposing representations which would make them coincide in the identity of a concept, but the problem element in so far as this may be distinguished from the properly mathematical element of solutions” (Deleuze, 1994: 178). P-value statistic is a weak solution to transcendence of a circulation of representations of calculations to a theory concept (or propositions, or hypothesis).

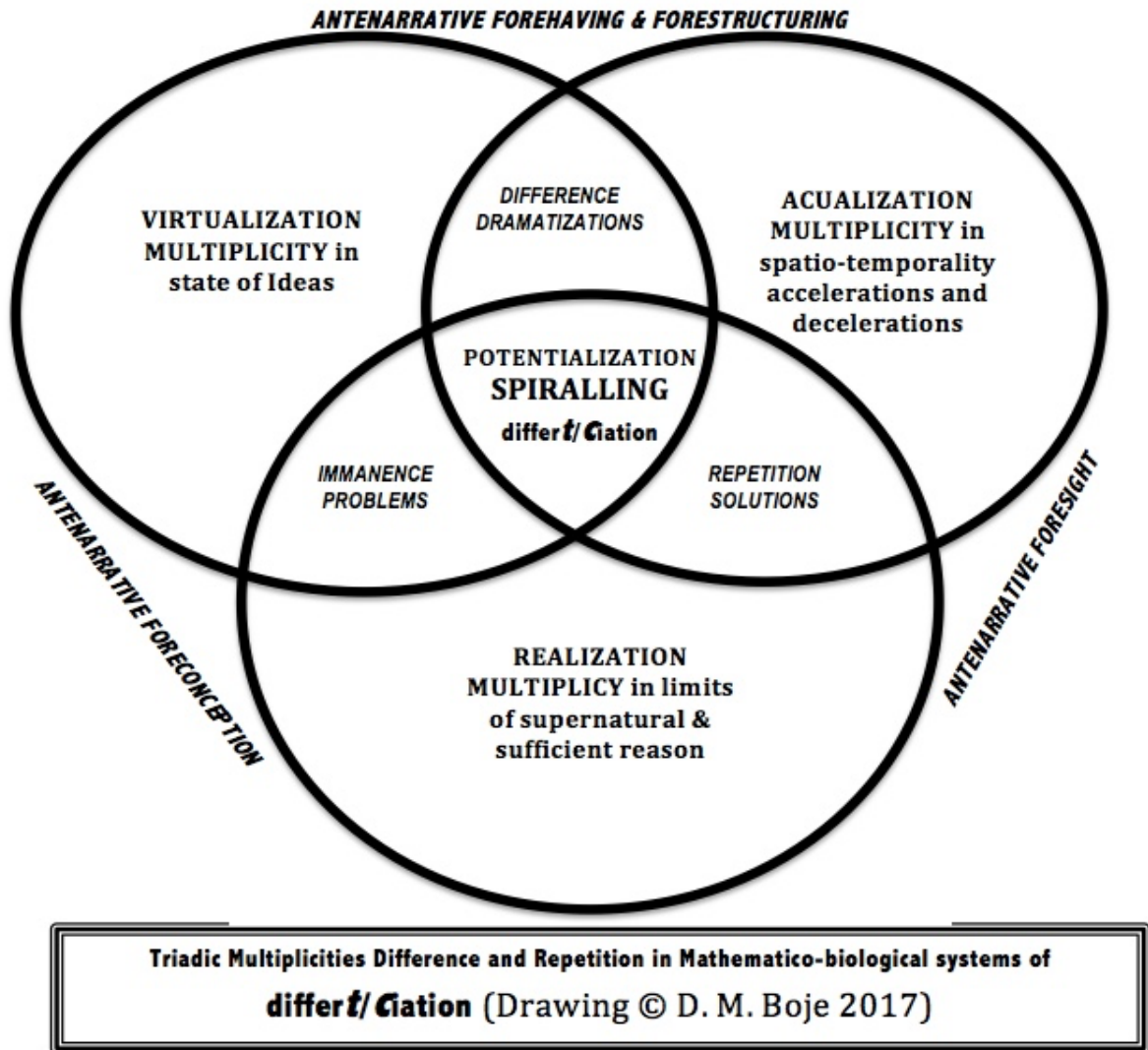
The Idea connections constituted as valid in relation to p-value is dialectical to the theory Idea, its inference of ‘real’ and ‘valid’ relations Being-in-the-world (Heidegger, 1962). The ideal continuity between statistical technique and testable theory, efficacy is engendered in a Platonic dialectic relation to mathematics itself. This is a problem, already and “always dialectical” to uphold, or not, the association between p-values and hypothesis of a given theory, in a “dialectical order” (Deleuze, 1994: 179). The dialectical problem is duplicated in the synthesis between the mathematically order and the Idea order, and inferences about Nature. In organizational research methods, there are ethnostatistics implications (Gephart, 1988, 2006). Ethnostatistics is the study of how people and organizations use statistics. The use of p-value and null hypothesis testing by researchers using statistics in organizational research is a matter for ethnostatistical investigation of inferential sensemaking. “The synthesis of the problem and its condition: the p-value has lost its groundedness, and can no long lay claim to significance, or characterise proof of objectivity of research method, in order to give “sufficient reason” verify theory (Deleuze, 1994: 180).

Both mathematical theory and the social science theory have a problem in being able to fulfill all the dialectical requirements of the inferential circle of number and existential domain inter relationality between statistics, Idea, and Nature having the requisite continuity to be valid connection.

The dialectical Idea is a system of connections across domains (p-value statistical elements) and genetic elements of the order of Ideas, presupposed in propositions under scientific considers as “fields of solution in which dialectical

Ideas of the their order are incarnated” in other scientific domains (Deleuze, 1994: 181).

Therefore, p-value poses a [statistical] dialectical problem of the first order to statistical solutions in relations to dialectical Ideas which it incarnates.



**Figure 6: Triadic Multiplicities and Antenarrative Connections of Mathematio-Biological Systems of differT/Ciation (© D. M. Boje 2017).**

Deleuze (1994: 221) theorizes a dialectical half of differenTiation (*action or process of differentiating*) and the French "*la différenciation*" aesthetic spatio-temporal actualization, differenTiation, which he combines as 'differT/Ciation': "The entire idea is caught up in the mathematio-biological system of different/ciation. I

have added my theory of antenarrative process of pre-qualitative and pre-quantitative dramatizations into the differentiation and differentiation of a potentization spiral, 'differentiation.'

Forecaring is where the philosophy of science comes into play. I take an ontological standpoint, how fore-caring is something worked out in space, in time, in the mattering of the world (Boje, 2014), what Baradian new materialists call *spacetime mattering* (their inseparability) in the intra-action of materiality with discourse. Such an approach to storytelling is about changes taking place in philosophy of science. It is first of all, a change from Newtonian mechanistic science to quantum physics. Second, it is a change from in the way we understand validity. Third, it is a change colleagues and I call the fourth wave of Grounded Theory (GT).

David Trafimow is forecaring, acting in advance, to bring about a revolution in statistics, one that has implications for changing philosophy of science.

Statistical storytelling advice (I adapted it from Cairo, 2014; Kumar, 2014; Few, 2009; Pfannkuch et al., 2010). Cairo (2014) says for good data storytelling, it should be: truthful, functional, beautiful, insightful, and enlightening. Storytelling is the most powerful way to put numeric ideas into the world today.

1. KISS. Tell it simply in terms familiar to the audience. Bring attention to the message, not to the numbers. Tell the data-story in a way people can understand. Tell the message first, then put together related support data. Be functional, constraining (not dictating) form. You don't tell a numeric story to a group of statisticians as you do to an English department. Strip down the statistical storytelling, just enough specific details for the audience to get the message. Too much detail, and the audience gets distracted. Make the story action, what action you intend from the audience. If you must present complexity, build it piece by piece. What are next steps? Storytelling makes complexity accessible. It can also be about causation.
2. Seamless integration of words and images. Use visual display form more general audiences. Visually display numeric-multiplicity, and then speak

- about it. In other words don't display an image on the scene while you are talking about it. In numeric-multiplicity the data story can be visualized in multiple ways. The story gets into the brain more effectively on channel at a time. Kumar (2014, online) puts it this way "Data storytelling feels more quantitative; I imagine needing to collect, clean, manipulate, and analyze the data before crafting the story. Storytelling with data, however, feels more fluid, with the story and the data coming together concurrently."
3. Tell insights the audience doesn't already know. Tell it in a new way that the audience does not expect. Be counterintuitive and enlightening in the visualization of the data.
  4. True storytelling sticks. The audience cares about true stories. True stories must somehow engage emotions, so people care. Visualization (infographics) should be truthful. Keep it evidence-based. Most visuals lie or present half-truths.
  5. Context matters. Quantitative stories is more than throwing numbers at people. Tell where the numbers come from and how they were adjusted. The meaning in comparing numbers (trends, patterns, exceptions), comparing these numbers to other numbers. Tell it in a visually beautiful way, but keep in mind the purpose. In indigenous living story, many things are glossed and tersely told, or things just left out because the purpose of elder's telling it is so the young ones get an education in contextual reasoning.
  6. Be grounded. Alfred North Whitehead uses the term concrecence, being concrete. Hegel was about the spirit moving from the abstract to the concrete. People are grounded in the world of their experience. Had the story of Enron been told in concrete, rather than abstract terms, perhaps more employees would have blown the whistle, and fewer people lost their retirement incomes. Connect the data-story in concrete and personal ways that involve the audience.

## **Conclusions**

Here is not one but many philosophies of science. An these are changing. Models are incorporating more and more heterogeneous concepts and variables from several paradigms. It is therefore necessary to attend to cross-paradigm communication. I have suggested that greater attention to transcendent hypotheses be part of that communication. Further, time and space for translation between paradigm participants should happen. And this needs to include subject participants.

Approaches to paradigm clustering such as those of Burrell and Morgan (1970), Deetz (1996), and my own work (Pondy & Boje, 1980) need to be more attentive to understanding subtle differences between paradigms included in clusters. Static clusters set up hegemonic dualities among clusters.

Finally, storytelling, empirical science, and statistics are intertwining paradigms in new ways. Some of these new ways allow for cross-paradigm inquiry. Others are using models with problematic combinations of paradigm conceptions. Here is where translation and transpection is especially useful. To be able to communicate one's own paradigm into the language and concepts of other paradigm, and back again, into one's own paradigm, is difficult but can advace cross-paradigm communication.

From ethnostatistics, we realize that statistics has its stories and its storytellers. Empirical science has its storytelling about the numbers being used, the way numbers are manipulated in statistical packages, and how to interpret the science and statistics generated. We have looked at ways scientists and empirical scientists do data-storytelling in ways that communicates to wider audience.

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## Appendix A: Videos for further study

**Note:** Study guides are available at <http://davidboje.com/655>

**Part 1 of 6, Boje interviews David Trafimow's on his ban on P value significance testing: (13 minutes) Part 1 of 6 part series Boje and colleagues**



**interview David Trafimow about his COPERNICAN REVOLUTION of how statistical validity is done, moving away from p-value .05 significance tests and null hypotheses to a new frontier of construct validity.**

[https://www.youtube.com/watch?v=dsp\\_hSIsacQ&t=5s](https://www.youtube.com/watch?v=dsp_hSIsacQ&t=5s)

**Part 2 of 6 Copernican Revolution causal modelling, Boje interviews Trafimow alternative to p-value test. (33 minutes) David M. Boje interviews David Trafimow on his better alternative to the absurd .05 p-value test for significance that he has banned in his own journal. The new test is called a priori test and can be used to estimate beforehand size of sample needed.**

<https://www.youtube.com/watch?v=EZJyRmdCFw8>

**Part 3 of 6, Trafimow talks about the lag between knowing p value no use and changing the teaching and publishing habits. (37 minutes). Organizational statistics taught to grad students in errant p-value way, though a better way of construct validity is here and now (see Part 2).**

<https://www.youtube.com/watch?v=DbQ6D0kpp38m>

**Part 4 of 6 Boje asks Trafimow some Deleuzian Questions: (32 minutes) Is he pulling the curtain back on the Wizard of Oz, exposing the phantasm of p-value? Study guides on Copernican Revolution of these changes to construct validity**

<https://www.youtube.com/watch?v=a71oa0H6Hvl>

**Part 5 of 6, Boje interviews Trafimow on Revolution of Science Method and Boje concludes with Deleuze (19 minutes) project to reverse the negative dialectic of Plato and Hegel with Multiplicity, spirals and rhizomes.**

<https://www.youtube.com/watch?v=oVBtKdUUWfk>

**Part 6 Boje concludes the series on David Trafimow's Copernican Revolution of p vale with how it affects 9 kinds of validity This is because construct validity affects the other 8 kinds of validity. Study guides on Copernican Revolution of these changes to construct validity**

<https://www.youtube.com/watch?v=1vV0nDGY38Q&t=103s>