Statistical practice under a qualitative mental model
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Dan Spitzner, March 1, 2024

Good morning, and thank you for attending this session. It is an honor to be surrounded by the energy of this conference, to have this opportunity to share ideas, and to be part of the greater exploration of knowledge and knowing.

It must be acknowledged that I am an unusual participant in this conference, since my formal training is in statistics and my academic appointment is in a traditional statistics department. Nevertheless, I feel I can relate, at least to a substantial extent, to the theme of this conference, to the situation of being denied access. I, too, find it disheartening when my creative energies go toward finding paths around frustrating hurdles, rather than toward doing the work of meaningful scholarship. In a way, I am situated in the belly of the beast. Today's dominant statistical communities maintain rigid conventions, and show little interest in maintaining robust and expansive critical traditions. I hope to assure you, though, that I have a genuine interest in qualitative inquiry, and moreover that I have a genuine interest in the possibility of co-liberation. . . co-liberation from the constraints that powerful institutions have placed on qualitative *and* quantitative knowledge.

I come here with an idea that I call "statistics under a qualitative mental model." It may not make sense at first glance, but my task is to show you how it makes sense, describe to you what it is, and along the way try to plant some seeds of inspiration around the idea.

As a starting point, I invite you to consider the possibility of *realignment* between methodology and worldview. Statistics under a qualitative mental model proposes just such a thing. It makes a distinction between a researcher's *practice* of methodology and the *mental model*[1] they bring to it. Here, I draw the term "mental model" from the literature on mixed methods research. It describes the assumptions, values, and experiences a researcher brings to research practice. Other, roughly synonymous and perhaps more familiar concepts are *paradigm* or *worldview*. So, what I propose is a realignment of statistical practice. My idea is to switch out statistics' traditional alignment with science, and replace it with a worldview that is socially-inclusive[2], one that prioritizes community over individualism (Spitzner, 2021). In mixed methods terms, what I aspire to is a *single-paradigm* (Teddlie & Tashakkori, 2003, p. 20) approach to multi-methodological inquiry.

My hopes for statistics under a qualitative model are bolstered by the existence of non-traditional quantitative methodologies that embrace elements of the very idea. I call them *upended* quantitative methodologies, to reflect their unorthodox conceptual foundations. As part of my efforts I have surveyed an array of such methodologies, and learn that many exhibit a recognizable overlap with guiding principles and practices of qualitative methodologies (Spitzner, 2023b). Some of what I have found is as follows:

- Upended quantitative methodologies center *ethical criteria* in the formulation of re-

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[2] Mental model: reference to a researcher's "set of assumptions, understandings, predispositions, and values and beliefs" (Greene, 2007, p. 53).

[2] Socially inclusive worldview: emphasis on "unity, cohesion, civic engagement, togetherness, or bridging the gap between 'us' and 'the other'" (Koikkalainen, 2011, p. 2).

search goals. They recognize that scientific perspectives are not well suited to accommodate such criteria.

- These methodologies furthermore prioritize the use of *contextualized* analytical or interpretative tools. For example, Indigenous statistics (Walter & Andersen, 2013; Kukutai & Walter, 2019) is a quantitative methodology that embraces cultural context as a preventative reaction to traditional studies that tend to produce deficit narratives and victim-blaming of marginalized communities. It is intended for interpretation through a constructivist ontology (Walter & Andersen, 2013, p. 53), the ontology commonly paired with qualitative methods.

- Another theme among upended quantitative methodologies is that they espouse *theory* in the implementation of research processes. For example, queer data, a perspective that reinterprets statistical practices connected to data about LGBTQ people, is described as a "clash between queer theory and actual people" (Guyan, 2022, p. 11).

- Upended quantitative methodologies also—just like qualitative methodologies—take seriously the *complexity, multidimensionality, and co-constituted nature* of research phenomena. Examples can be found in developments around *new materialist* perspectives, which recognize that material reality and discursive practices are entangled (Barad, 2007). Exciting recent scholarship asserts the relevance of an accompanying methodology known as *diffractive analysis*, about which I will say more later.

Among their other impacts, upended quantitative methodologies weaken the distinction between qualitative *versus* quantitative modes of inquiry, and demonstrate the plausibility of statistics under a qualitative mental by implementing many of its broad elements. Yet, these methodologies don't go all the way. Where they succeed is in recontextualizing the framework for applying statistical tools; but, where they fall short is in uncritically accepting the detailed tools and interpretations of *statistical analysis* itself. . . that is, the way the numbers are actually crunched.

For example, such is the case in Indigenous statistics, whose proponents assert that they are "not questioning the validity of ordinary least squares regression, factor analysis, chi-square correlation, or the myriad of other statistical tools" (Walter & Andersen, 2013, p. 56). For these researchers, what gives meaning to traditional statistical-analysis tools is their general social acceptance and political power within the dominant culture, which Indigenous researchers warn are to be underestimated "at their peril" (p. 134). The upended methodologies that do attend to the nuances of statistical techniques tend to retain the language of traditional science, as well as other key scientific ideas, especially around statistical modeling and testing. This is prominent, for example, in the approaches of the *quantitative criticalists*, a community that draws inspiration from European critical thought (Stage, 2007).

As can be gleaned from these examples, there is more work to do, and this work is to be done at a very fine-grained level: statistics under a qualitative model is to extend the recontextualization achieved by upended quantitative methodologies all the way to how the numbers are actually crunched. This brings us to the forefront of my efforts at developing this idea.

There are several angles by which to consider the path forward, and perhaps some relatively straightforward guidelines, such as the following: take a hands-on attitude toward statistical analysis; place greater emphasis on close and critical examination of raw data—any data, be it words or numbers—than on automated algorithms (see Smith, 1997, p. 77); when creating visual displays of data, remain cognizant of the influences of traditional scientific perspectives on the rhetoric of data-visualization (see D'Ignazio & Klein, 2020, p. 81; Hullman & Diakopoulos, 2011; Kennedy *et al.*, 2016).

On the other hand, a path forward is far from straightforward when it comes to contextualized statistical analysis that would inform decision-making, or be put toward general purposes of inference. As a canonical example, consider, "How is research to inform the question of whether an intervention is effective?" In my pondering of this path, the troublesome issue for statistics under a qualitative mental model appears to center on the use of *mathematical models*. Here, I am thinking of bell curves, linear regression models, and other similar mathematical abstractions. Mathematical models are the bread-and-butter of traditional statistics; thus, it is not surprising that they bear large responsibility for the decontextualization of that methodology. What I seek is a methodology for statistical inference that does not use mathematical models.

I am now moving into the core sections of my talk. As I do so, I offer a "heads up" that some pieces dive into theory, though we are a little ways from that, and in the meantime I will shortly introduce a concrete example to anchor us. Other good news is that there will be *no math* in what is to come.

In seeking a statistical methodology that does not use mathematical models, I am particularly inspired by scholars in the legal community, Anders Nordgaard and Brigitta Rasmussen (now Rådström), who describe a similar challenge: they assert that it is the duty of a court to perform "the ultimate evidence evaluation of all information in the case combined" (Nordgaard & Rasmusson, 2012, p. 1), regardless of whether such information is in the form of numbers or words, or whether any mathematical model is used. We will see the relevance of this idea in a moment.

First, I introduce the concrete example that I promised. It is a study that *does* depend on a mathematical model, but whose general framework serves as a helpful starting point for diving into these ideas. Exploring phenomena in family medicine, Anna Dion and colleagues from McGill University, are interested in the perspectives of recent women immigrants to Canada as they relate to having unmet postpartum healthcare needs (Dion *et al.*, 2022). Some of the factors studied include, for example, the perceived value of referral services, access to mental health services, and risks of postpartum depression, among others. Anchoring the study is the use of a specific measurement tool, the *cognitive map*, which is a spatial layout of factors connected by arrows. While engaging research participants in mapping exercises, each participant identifies factors they perceive as relevant; they then connect factors to each other by arrows, and score the connections according to their perception of a negative or positive impact of one factor on another. For instance, the graphic shown displays a hypothetical participant's cognitive map. Within, one can see embedded in each arrow the participant's score, on a scale of minus five to plus five.

Among the goals of the analysis is the identification of complete pathways—from factor to factor—of perceived connections from the situation of being a recent woman immigrant to Canada to the situation of having unmet postpartum healthcare needs. One way to achieve

this is to adopt a suitable mathematical model, then use a mode of statistical thinking called *Bayesian analysis* to calculate a quantity known as *strength-of-evidence* in each connection between factors.

I have just introduced a new concept: strength-of-evidence. This is an inference concept in which legal scholars are particularly interested. For example, when assessing whether distinct samples of forensic material are from the same source, strength-of-evidence is a commonly used analytical technique for assembling and reporting a summary of evidence (see, Spitzner, 2023a). In a courtroom setting, an expert witness may report strength-of-evidence as a number, such as a probability; they might report strength-of-evidence as a verbal category, such as "weak" or "strong" evidence, or through other reporting devices (Thompson & Newman, 2015; Spitzner, 2023a).

In the present context, the graphic shown displays a cognitive-map summary of hypothetical study results. Embedded in each arrow is a verbal strength-of-evidence score, categorized as weak, moderate, strong, or very strong evidence of a positive or negative impact of one factor on another. It is subsequently possible to combine scores into an assessment of strength-of-evidence across any complete pathway of perceived connection.

With this study framework to anchor us, let me now guide you in seeing how the study could have been carried under a qualitative mental model.

Nordgaard and Rasmussen (2012) take pains to clarify that strength-of-evidence assessments, such as those to which I referred in the cognitive-map study, are the products of logical reasoning, not necessarily mathematical models, and do not rely on a particular form of their inputs. That is, strength-of-evidence can be assessed just as easily from words as it can from numbers.

How is this done in practice? In personal correspondence with Brigitta Rådström, she states that the Swedish National Police use verbal strength-of-evidence assessments "in daily practice in the lab," despite that most crime-scene investigators "have no statistical background." When two competing forensic theories are at hand, investigators will weigh each relevant piece of evidence—in whatever form it happens to arrive—on a verbal strength scale. For example, one piece of evidence might be assessed as "high strength for theory A," and another piece of as "moderate strength for theory B." Once all pieces of evidence are assessed, a logical framework derived from Bayesian thinking is applied to combine the assessments into an overall strength-of-evidence for or against each theory. No bell curves, no linear regressions; not a mathematical model in sight.

It is not hard to imagine this same procedure being applied in the cognitive-map study. Nevertheless, when contemplating such a task, I cannot help thinking about the advantages of qualitative inquiry, and that the very measurement tool of a cognitive-map may get in the way. Is not a qualitative approach such as *grounded theory* already adept at generating theoretical themes and codes from participant data, as well as factors that might illuminate pathways to an outcome? Could verbal strength-of-evidence assessments have a useful role?

To help us contemplate these questions, I turn to the history and theories of qualitative methodology. Here we see that answers depend on one's particular approach to grounded theory.

Some clues are found in a brief history of grounded theory laid out by Cara Meixner, a participant at this conference (Meixner, 2008). Importantly, there are lessons to be drawn from a difficult period in the 1990's, one of disagreement between Anselm Strauss and Barney

Glaser, the two original innovators of grounded theory: Strauss opened himself to constructivism, while Glaser maintained a footing in positivist perspectives. As a methodologist interested in qualitative mental models, I tend to side with Strauss, and take his conflict with Glaser as a caution that if evidence assessment is to play a role in grounded theory, it is best handled with a light touch.

As grounded theory navigated the postmodern turn, Leonard Schatzman's introduction of *dimensional analysis* appears to have made room for explicit considerations of evidence. Schatzman writes, "to tell a complex story, one must designate objects and events..., indicate a condition or two for whatever action or interaction is selected to be central to the story, and point to, or imply, one or more consequences" (Schatzman, 1991, p. 308). In particular, taking into account the *consequences* of interactions gives rise to contemplation of evidence of those consequences. Verbal assessments of strength-of-evidence could seem to play a role here. If so, they would benefit from the breadth of considerations that qualitative analysis takes in. As Meixner writes, Schatzman was interested in "in locating a theory of analysis that expounded processes occurring within and outside the research process" (Meixner, 2008, p. 95). The credibility of evidence assessment would be enhanced by this broader view, escaping the narrow tendencies of traditional quantitative analysis. In other words, this particular approach to grounded theory appears to be fertile ground for statistics under a qualitative mental model.

On the other hand, a role for evidence-assessment is less clear in situational analysis, Adele Clarke's innovation on grounded theory, which resists the production of theories, favoring instead the postmodernist aim of "grounded theoriz*ing* through the development of sensitiz*ing* concepts and integrated analytics" (Clarke, 2005, p. 29, original emphasis). In this vastly multi-dimensional approach to inquiry, with its emphasis on the "heterogeneity of positions taken in a situation" (Clarke, 2005, p. 25), the act of selecting discrete elements of a phenomenon and assigning them evidence scores, verbal or otherwise, seems out of step.

I'll now move outside of grounded theory to consider diffractive analysis, which, though neither a qualitative nor quantitative methodology, is another vastly multi-dimensional approach to inquiry.

Acknowledging the non-fixity of material-discursive forces, diffractive analysis is implemented as "reading insights through one another" (Barad, 2007, p. 30), in an aspiration to highlight entangled structures within ever-changing phenomena, wherein there is no frame of reference. The metaphor behind diffraction is the interference patterns that emerge when waves, say on the surface of a pond into which a rock is thrown, come upon other waves or come upon some barrier. Applying the metaphor to inquiry, the waves originate from a *diffractive apparatus*, a kind of corpus of data in a potentially boundless range of forms; the data are *read diffractively*, which is to say that they are read through one another, in a manner that sets up interferences; the patterns that subsequently emerge emphasize the differences between insights, and thereby illuminate a phenomenon in an ongoing process of becoming.

Interesting patterns in diffractive analysis often arise through interference between extraordinarily varied data types. These could include, for example, interview transcripts, manipulated photographs, media reports, television shows, and the researcher's embodied memories of experiences with the phenomenon[3]. Education researcher Ezekiel Dixon-Román takes this further by examining interferences between *methodologies*, among which include

quantitative methodologies (Dixon-Román, 2017). Applying the resulting diffractive apparatus to study the SAT, he discredits the notion that the test measures innate, fixed ability, and uncovers its entanglement with a complex system of social reproduction.

Here we find a place for statistics under a qualitative mental model. With quantitative insights incorporated into a diffractive apparatus, be it through a traditional statistical analysis or through verbal strength-of-evidence, the truth-telling often attributed to numbers and logic would not stand in a diffractive analysis, but may contribute insight by way of its interferences with distinct knowledge claims. There could be hardness in the numbers, and coldness in the logic, which would set up hard, cold barriers for waves to crash into, or perhaps find their way through. There could be softness, too, perhaps in the blind innocence of a mind engaged in mathematical puzzling, or in a hope that inquiry can be truly emancipatory. In any case, the emerging interference patterns would highlight the complexity and entangled character of numbers and logic, disrupting their typically-presumed monolithic status of revealing the world, showing them instead to be in a state of becoming with the world.

Now back to my earlier questions. Does statistics under a qualitative mental model make sense? Yes, if it is understood as a realignment of statistical practice with expansive and contextualized ways of knowing. What is statistics under a qualitative mental model? It is a critical quantitative methodology that eschews automated algorithms and mathematical models in favor of socially-aware research practices. Have I planted a few seeds of inspiration around the idea? Well, I hope so. I look forward to your questions and insights.

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[3]See Lenz Taguchi and Palmer, 2013, as an example of such a mix.

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