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Embrace•perform•model: Complexity theory, contrarian case analysis, and multiple realities☆

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ABSTRACT

This essay describes tenets of complexity theory including the precept that within the same set of data X relates to Y positively, negatively, and not at all. A consequence to this first precept is that reporting how X relates positively to Y with and without additional terms in multiple regression models ignores important information available in a data set. Performing contrarian case analysis indicates that cases having low X with high Y and high X with low Y occur even when the relationship between X and Y is positive and the effect size of the relationship is large. Findings from contrarian case analysis support the necessity of modeling multiple realities using complex antecedent configurations. Complex antecedent configurations (i.e., 2 to 7 features per recipe) can show that high X is an indicator of high Y when high X combines with certain additional antecedent conditions (e.g., high A, high B, and low C)—*and* low X is an indicator of *high Y as well* when low X combines in other recipes (e.g., high A, low R, and high S), where A, B, C, R, and S are additional antecedent conditions. Thus, modeling multiple realities—configural analysis—is necessary, to learn the configurations of multiple indicators for high Y outcomes and the negation of high Y. For a number of X antecedent conditions, a high X may be necessary for high Y to occur but high X alone is almost never sufficient for a high Y outcome.

For every complex problem, there is a solution that is simple, neat, and wrong. (H.L. Mencken)

1. Introduction: beyond rote applications of regression analysis

The end is near. Time now for a new beginning! This essay elaborates on the perspective that the current symmetric-based dominant logic in research in the management sub-disciplines is less informative and less theoretically useful than the alternative logic of asymmetric testing (McClelland, 1998; Woodside, 2013a, 2013b). The contribution here provides details of why and how to use this relatively new theoretical stance and analytics in the management sub-disciplines.

The dominant logic in research in papers submitted to leading journals in the fields of marketing, management, finance, and international business includes question-and-answer surveys using 5 and 7 point scales and analyses of the resulting data using structural equation modeling; for example, about 7 of 10 submissions to the *Journal of Business Research* employ these features. The use of structural equation modeling (SEM) became popular in the 1980s and has grown to become central in the dominant logic in crafting and testing models well into the 21st century. SEM combines and extends factor analysis and multiple regression analysis (MRA). SEM and MRA are symmetric tests that report on the "net effects" of variables on a dependent variable with a set of independent variables.

Along with using SEM/MRA and structured scale measures, the current dominant logic includes the following features: collecting survey data via scaled responses from one person per organization with the respondent answering the questions one-time only; useable response rates less than 20% of the surveys sent to potential respondents; presentation of the fit validities of one-to-five sets of empirical models with no testing for predictive validity with holdout samples (see Gigerenzer and Brighton (2009) for a review of problems associating with not testing for predictive validity with holdout samples and how to do so); reporting of empirical models that include both significant and non-significant terms; no testing or reporting of contrarian cases in these papers—no recognition that the direction of impacts is the opposite of that found in the models reported for some of the respondents; and thus, no recognition of why the resulting models (empirical findings) explain little of the variance in the dependent variable (adjusted R^2's most frequently less than 0.20).

Even though SEM reports are usually elegant to contemplate, the limitations of employing the current dominant logic in the management sub-disciplines are tellingly severe. The limitations include requiring respondents to transform their beliefs and evaluations to 5 or 7 point scales, the operational step of collecting answers from one person per organization or household rather than seeking confirmatory/negative

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answers from two or more respondents in the same organization (for an exception, see Cheng, Chang, & Li, 2013), modeling using net effects symmetric tools such as MRA or SEM when patterns of relationships in the data are asymmetric, and testing only for fit validity and not testing for predictive validity. However, describing such limitations is insufficient to achieve useful innovations to theory construction and testing. Proposing and showing useful research analytic innovations are necessary steps for achieving change—especially in moving early-career academic researchers away from using MRA and SEM only and to embrace the use of asymmetric theory construction and testing.

Question surveying from a distance severely limits the collection of contextual information; context is one of the two blades in Herbert Simon's metaphor of human decision making. "Human rational behavior is shaped by a scissors whose blades are the structure of task environments and the computational capabilities of the actor" (Simon, 1990, p. 1). Simon's scissors metaphor supports calls for "direct research" (Mintzberg & Campbell, 1979)—to include the study of context as well as to craft isomorphic models of real-life thinking processes in these contexts (Woodside, 2011, 2013b). Asking questions alone to describe and explain decision processes requires a respondent to interpret the question, retrieve relevant information usually from long-term memory, edit the retrieved information for relevancy and self-protection, and report in a format and style usually to appear sane and accurate to some degree; responses following these steps quite often have little relationship to reality (Bargh & Chartrand, 1999; Nesbitt & Wilson, 1977). Verbal responses in answering questions require subjective personal introspections (SPI); SPI's frequently include accurate information only to a modest degree (Woodside, 2006) and frequently both attitudes and beliefs expressed following SPIs serve as poor predictors of future behavior.

The theoretical and practical value of asking respondents to convert their SPI thinking into 5 or 7 point scales joins with the lack of contextual data collection to result data of highly questionable value. As Mintzberg (1979) ruminants aloud to himself and to us:

> "Hmmmm …what have we here? The amount of control is 4.2, the complexity of environment, 3.6." What does it mean to measure the "amount of control" in an organization, or the "complexity" of its environment? Some of these concepts may be useful in describing organizations in theory, but that does not mean we can plug them into our research holus-bolus as measures. As soon as the researcher insists on forcing the organization into abstract categories—into his terms instead of its own—he is reduced to using perceptual measures, which often distort the reality. The researcher intent on generating a direct measure of amount of control or of complexity of environment can only ask people what they believe, on 7-point scales or the like. He gets answers, all right, ready for the computer; what he does not get is any idea of what he has measured. (What does "amount of control" [or "trust"] mean anyway?) The result is sterile description, of organizations as categories of abstract variables instead of flesh-and-blood processes. And theory building becomes impossible. (Mintzberg & Campbell, 1979, p. 586)

Woodside (2013a) compares and contrasts the use of symmetric (e.g., MRA and SEM) versus asymmetric (e.g., analysis by quintiles and by fuzzy set qualitative comparative analysis) whereby symmetric tests consider the accuracy in high values of X (an antecedent condition) indicating high values of Y (an outcome condition) and low values of X indicting low values of Y where asymmetric tests consider the accuracy of high values of X indicating high values of Y without predicting how low values of X relates to values of Y. Might not seem that different but symmetric tests rarely match well with reality except for testing the association of two or more items to measure the same construct (coefficient alpha is a symmetric test and researchers seek high coefficient alphas (e.g., $r > 0.70$)). Asymmetric tests reflect realities well given that the causes of high Y scores usually differ substantially from the causes of low Y scores (i.e., the principle of causal asymmetry, see Fiss, 2011); examples of this principle appear later in this essay.

Following this introduction, this treatise includes three complementary parts. First, tenets in complexity theory provide a useful foundation for analyzing data—the nearly rote statements of main effects and rote applications of multiple regression analysis (MRA) appearing in most academic studies in management-related sub-disciplines ignore the complexities inherent in realities and apparent (with a little digging) in the data sets of academic studies. Second, contrarian case analyses confirm that substantial numbers of cases which display relationships that are counter to a negative (or positive) main effect between X and Y occur—even when the effect size of the reported X–Y relationship is large. For example, when X associates positively with Y with a correlation of 0.60 ($p < .001$), the same data set includes cases of high X and low Y and cases of low X and high Y; researchers ignore these contrarian cases in most reports even though examining such cases is highly informative. Third, using configural analysis of complex antecedent conditions, modeling of the multiple realities is possible and insightful—modeling the existence of a net effect of X for different numbers of additional independent variables offers a meager portion of the meal-of-information extractable by drilling deeper.

The study here is valuable in describing how complexity theory serves as a useful foundation for building and testing theory beyond the now dominant logic of applying MRA perspectives of net effects of main and interaction terms. Embracing a complexity theory perspective (CTP) provides a vision for explicit consideration of hypotheses counter to the dominant logic of presenting one theory per study. Thus, a CTP expands on Armstrong, Brodie, and Parsons' (2001) observation that advocating of a single dominant hypothesis lacks objectivity relative to the use of exploratory and competing hypotheses approaches—even though their "publication audit" of over 1700 empirical papers in six leading marketing journals during 1984–1999 indicates that 3 of every 4 studies use only the single, dominant, hypothesis perspective.

The study here is valuable in describing how contrarian case analysis is useful in probing complexity theory tenets and building and testing new theory by developing compound outcome statements—descriptions and examples of such statements appear in Section 3. The study here is valuable in bridging configural analysis using fuzzy set qualitative comparative analysis (fsQCA) with complexity theory in sub-disciplines of management (e.g., finance, marketing, organization science, and strategic management); such bridging expands on the contributions of Ragin (2008) in sociological methods, (Fiss, 2007, 2011; Meier & Donzé, 2012) in organization science, and (Chung & Woodside, 2011; Schuhmacher, von Janda, & Woodside, 2013; Woodside, 2013a, 2013b; Woodside & Zhang, 2013) in marketing.

Following this introduction, Section 2 presents tenets in complexity theory. Section 3 describes how contrarian case analysis and findings show that cases occur contrarian to main effects having large effect sizes—most researchers usually ignore such contrarian cases both in formulating theory, examining data, and in predicting fit validity. Section 4 reports on models of the multiple realities that occur within each of several data sets. Section 5 concludes with the call to recognize the need to perform and report multiple models showing how high X associates with high Y in more than one model/path (being done to some extent now using MRA), how *low* X also associates with high Y in more than one model (rarely being done), and how models of the negation of Y are not the mirror opposites of models of high Y—"causal asymmetry" (Fiss, 2011; Fiss, Marx, & Cambré, 2013) occurs whereby complex antecedent conditions indicate that the negation of Y are not simply the opposites of the recipe of simple conditions in the complex antecedent statements indicating high Y.

2. Complexity theory tenets

The literature on complexity theory is expansive and heads in several discernable directions. Anderson (1999) provides advances in theory