A Schema for Relating and Combining Quantitative, Qualitative, Positivist, and Interpretive Research Methods in the Discipline of Information Systems

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Abstract

We provide a schema for delineating relationships between some different research methods and combining them in joint research efforts. The schema has an inductive-deductive dimension, which embodies the formal logic concept of *modus tollens*, and a subjectivist-objectivist dimension, which uses the distinction, from sociology, between first-level constructs and second-level constructs. Using material from the well known, classic 1983 *Communications of the ACM* case study by M. Lynne Markus, we provide a practical "how to" walk-through of the two-dimensional schema, illustrating how to combine quantitative, qualitative, and other research methods.

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1. Introduction

In this essay we provide a schema for delineating relationships between some different research methods and combining them in joint research efforts. Behavioral research in information systems is often categorized as quantitative or qualitative, but may also be identified as positivist or interpretive. Our schema for relating and combining different research methods embodies an inductive-deductive dimension, which we present in such a way as to emphasize the formal logic concept of *modus tollens*, and a subjectivist-objectivist dimension, which uses the distinction, from phenomenological sociology, between first-level constructs and second-level constructs. The schema will go beyond the usual platitudes (e.g., "quantitative research and qualitative research are both legitimate and each has something to contribute" and "the study of information systems can benefit from diverse research approaches") and instead show how different methods from different research approaches can be combined in the same research effort.[1]

The discipline of information systems, a major portion of which examines information systems through behavioral research, provides an interesting case of behavioral researchers using different research methods and attempting, sometimes, to combine them. Electronic information

[1] We will generally use the term "research approach" or "approach" to refer to a general heading or category, and the term "research method" or "method" to refer to a specific method. For instance, a positivist research approach would be a broad category populated by specific statistical methods (PLS, analysis of variance), specific positivist case-study methods (pattern-matching and natural controls), specific interpretive methods (the principle of suspicion), and so forth.

technologies – which include electronic meeting systems, electronic mail, technology-enabled business process reengineering, enterprise systems, virtual team-enabling hardware and software, and mobile computing – have wrought great changes in organizations, and these changes have, in turn, placed a great burden on research that tries to explain them. The burden is so great that, arguably, these changes have had the effect of pushing, to their limits, what statistical research methods are able to deliver to the researchers using them. And these limits, in turn, have had the effect of motivating some of these researchers to seek out and consider new (to them) research methods. This has led information-systems researchers to pursue how quantitative and qualitative forms of research may be combined and the closely related matter of how positivist and interpretive forms of research may be combined.

Information-systems researchers' thinking about these matters has been evolving. A little more than a decade ago in the United States and Canada, it was not uncommon for quantitative researchers in information systems to take the extreme position in which they openly denied the validity of qualitative research. These quantitative researchers proceeded as if quantitative methods constituted the methodological *status quo* and as if all deviations from it required explanation, justification, and approval – in particular, *their* approval. The result was that qualitative researchers found themselves in the position of having to justify the validity of their qualitative research methods to quantitative researchers. Meanwhile, in Europe, it was not uncommon for qualitative researchers in information systems to take the opposite and equally extreme position in which they summarily dismissed all statistical and positivist research as illegitimate and directed their quantitative colleagues to educate themselves in the post-positivist philosophy of science. Today, the unabashed warring-camps mentality among information-systems researchers has, fortunately, mostly died out and been replaced with (at least the appearance of) mutual acceptance of different research methods.

In information-systems research, the understanding which underlies the apparent mutual acceptance can benefit from greater depth. Some quantitative researchers in North America, for example, incorrectly describe qualitative research as suitable only for "exploratory" and "theory building" purposes and reserve the adjectives "rigorous" and "scientific" for quantitative research. And some have condescendingly advised doctoral students who show an interest in qualitative research to do quantitative research for their dissertations and to pursue qualitative research later in their careers – as if qualitative research skills could be easily "picked up" outside of a doctoral program. In this essay, we will put forward the idea of a core of reasoning to be found across all forms of legitimate, empirical scientific research; this, in turn, will provide a basis for moving the current state of affairs from one of grudging acceptance to one of eagerly sought collaboration. The common core of reasoning will be a specific form of the syllogism to be used in the logic of empirical scientific reasoning.[2]

[2] We distinguish between the empirical sciences and the formal sciences. The paradigmatic example of the latter is mathematics, which is concerned solely about the relationships of formal symbols and propositions to one another and which need have no empirical referents. Examples of the former are the natural and social sciences, whose symbols and propositions refer to "real world" entities that are found existing in nature and society and that these symbols and propositions ("theories") are built and tested to explain. Reasoning in the empirical sciences therefore requires methods to relate the symbols and propositions to the empirical referents (the most well known of which are the rules of experimental and quasi-experimental design), which are not needed in reasoning in the formal sciences.

In this essay, we do not reinvent the wheel of justifying qualitative research to an audience of quantitative researchers or *vice versa*. If only for sake of argument, we regard different research methods, including positivist and interpretive methods, with the same validity already accorded to them by their respective proponents. To relate the different research methods to one another so that they can be combined in the same research stream or research program (not necessarily the same published journal article), we treat them like the different pieces of a puzzle that have already been made and are waiting to be fitted together.

In combining different research methods, we will transcend convention by dispensing with traditional proscriptions that would follow from literal or strict interpretations of past philosophical and methodological writings. (One of the authors of this essay takes the following position: "If I don't take the Bible literally, why should I take Giddens or Gadamer literally?") This is important because a literal interpretation of some philosophy of science would, for example, hold that the contrast between the ontology of positivism and the ontology of interpretivism disallows any mixing of positivist and interpretive research. However, actual cases of organizational research which have successfully combined positivism and interpretivism (Kanter, 1977; Lee, 1989, 1991; Nardulli, 1979) serve not only to refute the literal interpretation, but even to reveal how the scholarly study of science, by philosophers and methodologists, is itself a form of empirical research (in this case, empirical research about natives who happen to call themselves "information systems researchers" and whose customs and practices they happen to call "research methods"), which is, like all empirical research, subject to empirical refutation. In other words, we view past philosophical and methodological writings not as bodies of rules, regulations, and other directives whose purpose is to receive our unquestioning obedience and complete submission, but instead as a source of other scholars' wisdom and insights inspiring us to innovate ways of looking at and combining different research methods, whether the differences are seen as quantitative *versus* qualitative, positivist *versus* interpretive, or otherwise.

2. The Schema's Two Dimensions

We emphasize 1) the concept of *modus tollens* from formal logic, which is applicable to all empirical research, whether in the natural, social, or design sciences, and 2) the concept of the distinction, from phenomenological sociology, between first-level constructs and second-level constructs. Using the two concepts to establish two dimensions of a schema, we will be able to map or situate different research methods in the theory-crafting process, where their relative locations will point out where and how they may be combined.

2.1 The inductive-deductive dimension: *modus tollens*

The formal-logic concept of *modus tollens* is useful, first, for posing a necessary condition which all theories must satisfy in order to be considered valid and, second, for bringing out the difference between theory building and theory testing (which the philosophy of science has also called the context of discovery and the context of justification). A form of the syllogism, *modus tollens* consists of the major premise "if p, then q," the minor premise "not q," and the conclusion "therefore not p." The logic of empirical science involves an application of the general concept of modus tollens where p refers to an empirical theory and q refers to a prediction following from the theory, where the major premise, minor premise, and conclusion

are respectively, "if the general theory p is true, then its specific prediction q of what should (or should not) be instantiated and observed in the given setting is true," "the prediction q of what should (or should not) be instantiated and observed in the given setting is not true," and therefore "the general theory p is not true."

Before proceeding, we address a problem in using the term "prediction" to refer to q. This term is commonly used in positivist research, but not interpretive research, even though the latter also uses q in the logic of modus tollens. To avoid this problem, we will occasionally use the term "observational consequence" instead of "prediction," where we define observational consequence as referring to the specific human or social behaviors that should or should not be instantiated and observed in the particular setting (such as a particular laboratory, population, or field setting) where the theory is being applied. "Observational consequence" covers the forms that q can take in both positivist and interpretive forms of research. For example, in interpretive research, p could be a theory about the culture of the Fox Indians in Iowa and, in the particular episode where the Bureau of Indian Affairs takes away control of the local elementary school from the Fox, q would refer to specific behaviors that should or should not be instantiated by and observed in Fox individuals as a consequence of p's being true in this episode. For an example in positivist research, p could be the null hypothesis that the population parameter β_4 is 0 and, in a particular sample taken from the population, q would refer to a specific numerical value that should or should not be observed for the sample-based estimate of β_4 as a consequence of p's (i.e., the null hypothesis') being true. And in historical research, an "observational consequence" would be a "postdiction," which, in the study of history, is the analogue of prediction. For example, p could be a general theory about international relations in crisis situations and, in the particular setting of the Cuban missile crisis, q would refer to what behavior should or should not be instantiated and observed in the actions of the United States and the Soviet Union as a consequence of p's being true; a "prediction" of these actions, now in the past, is a "postdiction," but may also be called an "observational consequence." Henceforth, we will use the terms prediction and observational consequence interchangeably.

As obvious as modus tollens might initially seem, following from it are five counter-intuitive ramifications. First, a general theory p's specific prediction q which turns out to be true can never properly prove the theory to be true. Consider the reasoning "if p, then q," "q," "therefore p"; this might initially appear to be modus tollens, but it is not. Its conclusion "therefore p" does not logically follow from its major and minor premises at all. This erroneous reasoning has the name, "the fallacy of affirming the consequent." The second counter-intuitive ramification is that, regardless of how many predictions of a general theory turn out to be true, the theory can never be proved true. This is because the reasoning "if the general theory p is true, then its predictions $q_1, q_2, q_3, \ldots, q_n$ are true," "all the predictions $q_1, q_2, q_3, \ldots, q_n$ are true," and "therefore the general theory p is true" is nothing but "n" repetitions of the fallacy of affirming the consequent. Instead of the conclusion "therefore the general theory p is true," an appropriate assertion in this situation would be, "the evidence is consistent with the theory," where such validity is always provisional insofar as the theory remains open to being disproved in a future empirical test. Conversely, this also means that an increased number of observations consistent with the theory, accumulated across an increased number of empirical tests, may not somehow translate into evidence showing the theory to be more true, more valid, stronger, etc. The third counter-intuitive ramification, related to first two, is that if a researcher is able to prove

anything conclusively about a general theory at all, it would only be that the theory is false (i.e., the observation "not q," when used as the minor premise along with the major premise "if p, then q," would necessarily lead to the conclusion "not p"). And fourth, a single observation "not q" is logically sufficient to prove the general theory p false ("not p," where the major and minor premises are "if p, then q" and "not q"); the single observation, "Socrates is not mortal," would be logically sufficient to prove the general theory "all humans are mortal" false. As for the fifth counter-intuitive ramification of modus tollens, some preparatory discussion on the provenance of a theory, the context of its discovery, and the context of its justification is required.

The specific form taken by modus tollens in empirical scientific reasoning ("if the general theory p is true, then its specific prediction q for the given setting is true," "the specific prediction q for the given setting is not true" and therefore, "the general theory p is not true") raises the not insignificant matter of where the general theory p comes from in the first place. Modus tollens presumes that the theory it is about to test has already been formulated and put into a testable form. In this sense, modus tollens is useful for addressing how a theory is justified (which has been referred to as the "context of justification") but not how a theory is built, discovered, or developed or otherwise comes into being (referred to as the "context of discovery"). How, then, is a theory built, discovered, or developed, or otherwise come into being in first place?

A major distinction between the context of justification and the context of discovery is that the former, in using the logic of modus tollens, involves deduction whereas the latter, in striving to infer a general statement (a theory) from particular instances, involves induction. The asymmetry between deduction and induction in empirical research can be seen in that, in the former, the conclusion (the prediction of specifics to be observed or not to be observed in the local setting, whether an organization, a laboratory, or a population) follows as a matter of logical necessity from the major premise (the theory) as applied to the minor premise (the data or facts of the local setting), but in the latter, the general proposition (the theory) does not necessarily follow from the observations of data or facts from which it is induced (or, equivalently stated, across which it is offered as a generalization).

The precise manner in which an individual researcher comes up with a theory is not well understood. The psychological processes which unfold in the mind of an individual researcher when creating or contributing to the creation of a theory (or any other artifact, including works of art) are largely unknown. The same can be said about the sociological and historical processes which unfold in a scientific community when its members are creating or contributing to the creation of a theory. One might be tempted to point to the very logical and tidy so-called "rules of scientific method" to provide an explanation of how scientific reasoning proceeds. Typically, in any version of the rules of scientific method, the first step is the individual researcher's observation of a phenomenon for which there is no explanation but is in need of one, a subsequent step is the researcher's posing of a theory to account for the phenomenon, and the last step is the researcher's execution of an experiment to test the theory so as to establish its validity. Any such rules of scientific method, however, still beg the question of how the theory to be tested is derived (or "generalized") from observations in the first place. To say that an individual researcher poses or formulates a theory "based on observation" might very well be true, but the manner of induction by which an individual researcher or scientific community

derives a theory from individual observations has yet to be understood and explained.

To address the question of how theory comes into being, we take the position that it is a non-rational and perhaps even tacit process, distinct from the process by which it is empirically tested; Lee and Hubona (2007) state: "Auyang (2006) provides interesting examples [of where a theory comes from]. There is the famous case of August Kelulé's conceptualization of the benzene ring, in which carbon atoms are bonded to one another so as to form the shape of a hexagon; he conceptualized it when dreaming of 'a snake biting its tail.' …Formulating or building a theory through dreaming or other forms of serendipity is distinct from empirically testing the theory once it has been formed. As long as the theory survives empirical testing, its origin makes no difference."

In this sense, the context of justification is independent of the context of discovery. The deductive logic of modus tollens as used in the context of justification is blind to and independent of whatever inductive processes may have earlier been used in the context of discovery to build the theory that it is testing. There already exist well established and accepted procedures for building a theory systematically, such as Eisenhardt's (1989) case-study procedures or the grounded-theory procedures of Glaser and Strauss (1967) and Strauss and Corbin (2000). However, the independence of the context of justification from the context of discovery means that faithful and even perfect adherence to these or other theory-building procedures would not "count" in demonstrating the validity of a theory. This leads to the fifth and last of our counter-intuitive ramifications of modus tollens: *A researcher has the freedom to depart, whether in small or large measure, from the pronouncements and strictures of any established and accepted set of theory-building procedures* because the validity of a theory is determined not in its context of discovery, but in its context of justification. In this light, the theory-building procedures of Eisenhardt, of Glaser and Strauss, and others, are not methodologies whose scrupulous applications can establish valid theories, but are systematic heuristics useful for building a theory, where subsequent testing of the built theory with the logic of modus tollens would remain a necessary task to be accomplished in establishing the theory's validity.

We have identified five counter-intuitive ramifications of empirical scientific reasoning: Theories can never be proved true; theories can be proved false; an increase in the sample size or the quantity of other evidence consistent with a theory does not provide "more proof" that the theory is true; even a single observation is logically sufficient to prove a theory false; and the context of justification (which involves theory testing) is independent of and considers irrelevant whatever may have transpired in the context of discovery (which involves theory building), thereby freeing researchers from the strictures of any rigid theory-development methodologies. We note that the five counter-intuitive ramifications are blind to whether the reasoning of modus tollens is used in quantitative research, qualitative research, positivist research, interpretive research, action research, design-science research, social-science research, natural-science research, and so forth.

To recognize modus tollens and its ramifications for relating different research approaches to one another and combining them, we will insert an inductive-deductive dimension into our schema, where research approaches that are used in the context of justification fall under

the "deductive" heading and those that are used in the context of discovery fall under the "inductive" heading. We offer a summary description of deduction as involving 1) the logic of modus pollens, where conclusions necessarily follow from the premises, 2) the context of justification, and 3) the research activity of empirically testing a theory. We contrast this to a summary description of induction as involving 1) the logic used in generalizing or inducing a theory from the data or facts of the local setting, 2) the context of discovery, and 3) the research activity of building a theory.

2.2 The subjectivist-objectivist dimension: first-level-constructs *versus* second-level constructs

The next dimension we build into our schema reflects the extent to which natural-science methods and social-science methods do and do not overlap. Some researchers have regarded the natural sciences as the model that the social sciences need to follow if the latter are to become truly scientific. Other researchers have opposed this mindset (some have described it as "physics envy") and have held that few or no natural-science research approaches are applicable to the study of social phenomena. We frame the matter differently from these two extremes. In our view, the natural sciences and the social sciences must both use the logic of modus tollens in the empirical testing of theories because the logic of modus tollens is blind to whether a theory's empirical referents happen to be located in nature or society. However, as we will explain, because the empirical referents of the social sciences contain something additional that does not exist in the empirical referents of the natural sciences, the scientific study of social phenomena requires methods *in addition to* (not necessarily in place of) those of the natural sciences, including those relating to logic of modus tollens.

Alfred Schutz (1962), a philosopher and phenomenological sociologist, frames the matter as one of involving "first level constructs" and "second level constructs." In our reading of Schutz, he points out that the subject matter of the social sciences (which we see as ranging from the level of a single individual to the level of overarching cultures and social structures) contains something that the subject matter of the natural sciences does not: It is the consciousness and meaning that the subject matter has of itself. For the human subjects in a given setting, there are meanings that they have of one another, their immediate (e.g., organizational) setting, and their history. Because these subjective meanings exist in a social scientist's object of inquiry, the social scientist needs to collect data on them as much as the social scientist needs to collect data on any other aspect of the observed, objective reality that he or she is trying to explain; it is in this sense that "subjective meanings are objective reality" (Lee, 2004). For Schutz, these subjective meanings constitute "first level constructs" – constructs created and held by the human subjects whom scientific researchers are observing. These are distinct from "second level constructs" – constructs that the scientific researchers themselves create to explain the behavior of the human subjects they are observing and that they refer to as "theory." The way in which first-level constructs are constituted and the role that they, in turn, play in how social objects (such as a kinship structure, a language, or a society) are constituted are topics falling in the field of study of phenomenology. Organizational researchers and other social scientists have long been familiar with phenomenological concepts under the heading of "the social construction of reality" (Berger and Luckmann, 1966). Recognition of phenomenological concepts can also be found in the work of John Van Maanen (1979), whose "first order conceptions" and "second

order conceptions" coincide with Schutz' first-level constructs and second-level constructs. Van Maanen (p. 520) notes that, for interpretive techniques, "the logic of phenomenological analysis is more likely to be assumed."

Research methods that focus on first-level constructs are appropriately called "interpretive" because the researcher uses them to interpret the first-level constructs, i.e., to interpret what the discourse and behaviors of the observed human subjects mean to the human subjects themselves. Much as one person interprets what is meant by another person whose language and culture are different from the first person's, a researcher interprets what is meant by a human subject whose discourse and behaviors reflect the norms and culture of an organization, community, society, or world that the researcher has yet to come to know. Then, depending on what the researcher observes based on what he or she interprets, the researcher would build a theory to explain the phenomenon. Schutz (1962, p. 54) describes the researcher's situation as follows: "The same overt behavior (say a tribal pageant as it can be captured by a movie camera) may have an entirely different meaning to the performers. What interests the social scientist is merely whether it is a war dance, a barter trade, the reception of a friendly ambassador, or something else of this sort." In Schutz's example, the researcher's interpretation of the first-level constructs will lead to her building a theory (the second-level constructs) with which she can explain the observed war dance, barter trade, reception of a friendly ambassador, or something else of this sort. In this manner, second-level constructs are built on first-level constructs. And because a difference in the first-level constructs (e.g., the observed people understand the overt actions as a war dance rather than a barter trade) makes a difference to the second-level constructs (e.g., a theory about war dances and a theory about barter trades would not be the same theory), a researcher's interpretation of the first-level constructs is pivotal to what he subsequently builds his theory to explain.

To the extent that interpretive methods assist a researcher in observing first-level constructs and thereby contribute to her subsequent efforts of building her own set of second-level constructs, we can say that *interpretive methods* play a role in the *context of discovery* where, *through induction*, a theory (a set of second-level constructs, formed by the researcher) is built on and generalized from data (the researcher's interpretation of the observed people's own first-level constructs). And to the extent that methods associated with the logic of modus tollens in scientific reasoning (such as statistical inference, multivariate analysis, and experimental design) contribute to a researcher's efforts of testing a theory, we can say that *methods associated with modus tollens* play a role in the *context of justification* where, *through deduction*, a theory is empirically tested and its validity provisionally established. Interpretive research has methods available for use in both the context of discovery and the context of justification.

To recognize the roles played by first-level constructs and second-level constructs in relating and combining different research approaches, we will insert a subjectivist-objectivist dimension into our schema. Research methods falling under the "objectivist" heading are those that are associated with the logic of modus tollens in scientific reasoning and that a researcher uses to conduct an empirical test of a theory. Research methods falling under the "subjectivist" heading are those which a researcher uses to interpret the objectively-existing subjective meanings which constitute the first-level constructs. We offer a summary description of "subjectivist" as involving 1) an emphasis on interpretation, which focuses on 2) the subjective

meanings or first-level constructs held by the observed human subjects, and 3) the natural attitude that the observed human subjects take in their everyday lives. We contrast this to a summary description of "objectivist" as involving 1) an emphasis on explanation, which focuses on 2) the scientific meanings or second-level constructs held by the observing scientific researchers, and 3) the scientific attitude that the observing scientific researchers take in their professional lives.

3. Using the Two-Dimensional Schema to Map Different Research Methods

In this portion of the essay, we use the two-dimensional schema to offer a mapping of some of the different research approaches found in the information-systems literature. The spirit in which we use the schema is neither one of attempting an exhaustive accounting of all behavioral research approaches ever used in the study of information systems, nor one of taking a comprehensive snapshot of how some information-systems researchers currently combine, or in the past have combined, different research approaches. Rather, we regard the schema as a canvas on which a researcher can draw up a map of different research approaches in the way that he or she understands them. Guided by her map, a researcher could move from research approach to research approach when engaging in her efforts of building or testing a theory. Just as, in geography, different cartographers can draw up different, legitimate maps of the same territory (e.g., a topographical map, a political map, a road map, a globe), different researchers can draw up different, legitimate maps of the same research methods. The value of such a map would be judged by how well it guides the researcher in his journey to his desired research destination.[3] A good map for a theory-building journey would lead to, for its destination, a theory that not only is able to account for the data that the researcher has, so far, collected, but also is ready for subsequent empirical testing, where the testing would use new data (data not used in building the theory). A good map for a theory-testing journey would lead to a destination where the researcher may conclude that the already built theory has survived, or not survived, the empirical testing. In the following discussion, our mapping of research methods is just one of many possible plausible maps for combining different research methods.

We first examine the research methods used in positivist case studies, which appear in two forms. Theory-testing positivist case studies (research approach I-a) appear in Quadrant II, which is objectivist and deductive. Theory-building case studies (research approach I-b) appear in Quadrant IV, which is objectivist and inductive. We have described elsewhere (2003, p. 817) the positivist case-study as reflecting a synthesis of the following traditions:

> … i) the *empiricist* tradition, which views "the indubitable experience of the external world" as being the "the foundation of human knowledge," and thus relies on "publicly verifiable, observable sensory data, systematically collected and collated, as the route to knowledge" [1]; ii) the *rationalist* tradition, which argues that "the route to indubitable knowledge is … through logical, that is rational principles which are beyond doubt" [1]; and iii) the *critical rationalist tradition*, which holds that it is not "positive evidence" or "confirmation" but rather "negative evidence" or "falsification" through deduction that is at the "core" of science [35]. The three traditions together form the basis of *hypothetico-deductive* logic that we use in our case research approach. The empiricist influence is reflected in the procedures for ensuring systematic

[3] It would not be appropriate to describe some maps as "right" and others "wrong" because, strictly speaking, all maps are wrong. No map can ever perfectly capture the territory that it is a map of. It would be appropriate, however, to describe a map as better or worse than another map or, if judged on its own, as good or not.

> documentation and the rigor of the research process [21,43]. Our underlying premise is that by following the recommended procedures, the study will satisfy the following positivist criteria for rigor: construct validity, internal validity, external validity, and reliability. In addition to the four criteria mentioned above, and consistent with the empiricist ideal of eliminating "speculative assumptions not founded on observation" [35], we adopt a "realist" ontology … focusing on what organizational participants *said* or *did*, rather than on what (we thought) they *meant* through our interpretation of symbols.

Theory-testing positivist case studies, beginning with Markus (1983) and having their principles made explicit by Yin (1993, 1994) and Lee (1989), have been adopted widely by information systems researchers, whether using single or multiple cases (Ke and Wei, 2006; Sarker and Lee 2002; Shanks 2002; Sambamurthy and Zmud 1999). In general, these studies involve deriving theoretical propositions (second-level constructs) from the information-systems literature (an embodiment of the scientific attitude) and then empirically testing the conclusions (e.g., predictions or postdictions) that follow deductively from the theoretical propositions as applied to the data describing the case setting. A researcher can systematically handle data with, among other tools, content analysis. Another case-study procedure for comparing a general theory's case-specific conclusions against the case data is called "pattern matching" (Yin 1994).

Theory-building positivist case studies, appearing primarily in Quadrant IV, often draw on the guidelines of Eisenhardt (1989) or a version of her guidelines adapted by Paré and Elam (1997). Eisenhardt explicitly describes her mode of positivist case studies as one of discovery with a "theory building focus" rather than one of empirical testing. Paré and Elam (1997, p. 547) say, "Eisenhardt suggests that the theory building research must begin as close as possible to the ideal of no theory under consideration and no hypotheses to test since preordained theoretical perspectives may bias and limit the findings." Given that such a "clean theoretical slate" is difficult if not impossible to achieve in practice, Eisenhardt suggests that researchers identify potentially relevant constructs, but not the relationships among them (Paré and Elam, 1997, p. 547). Having identified such *a priori* constructs, consistent with the core values of the empiricist tradition described above, the positivist case study researcher can then proceed with data collection, involving a number of procedures such as theoretical sampling, designing protocols, analysis of within-case and cross-case patterns in order to develop theoretical propositions, and stopping when "theoretical saturation" is reached (p. 557). In this manner, a general theory (a set of second-level constructs) is built by inducing it from (or, equivalently stated, basing it on or generalizing it from) data. It is worth noting that even though this research approach predominantly involves induction, there is also implicitly some degree of deduction used to confirm, extend, and sharpen the emergent hypotheses (p. 546). Information-systems studies that employ this mode of positivist case study include Purao, Rossi and Bush (2002).

Closely related to positivist case-study methods are those of the "exploratory" case studies (research approach II). In the information-systems literature, well-known examples include Caron, Jarvenpaa, and Stoddard (1994), Broadbent, Weill and St. Clair (1999), and Silva and Hirschheim (2007). According to Yin (1993, p. 5), this type of case study is inductive: "[it] is aimed at defining the questions and hypotheses of a subsequent ... study" and this research genre is seen as appropriate when the knowledge about a topic is in a formative stage (Poon and Swatman, 1999). Unlike a theory-building case study, an exploratory case study need not begin with constructs taken from the literature and need not even result in a theory ready to be tested.

It is worth mentioning that some case methodologists have been somewhat critical of researchers pursuing "intuitive" paths in the investigation and indiscriminately mixing subjectivist (focusing on first-level constructs) and objectivist methods (focusing on second-level constructs) within many exploratory case studies; this, in part, may have (rightly or wrongly) given exploratory case study methodology a "notorious reputation" of being uncritical, unscientific, and "sloppy" (Yin 1993, p. 4). In addition, the conclusions of exploratory case studies tend to be positioned as provisional, and they generally serve as a "prelude" to additional research (p. 5). Nevertheless, exploratory case studies remain popular in the IS discipline, and because of the sweep of exploratory case studies from subjectivist methods to objectivist methods, and their potential to contribute to building a theory, we place this genre of case studies in Quadrants III and IV.

Grounded theory (research approach III) has enjoyed much popularity among IS researchers (e.g. Orlikowski 1993; Urquhart 1997). Grounded theory has been described as "paradoxical" in two ways. In one paradox, grounded theory comfortably spans the subjectivist-objectivist dimension, where its data collection can involve extensive field work for the purpose of interpreting the first-level constructs (i.e., how the organizational natives understand themselves and their organization) and where the iterative and self-improving nature of its procedures for coding the data facilitates the emergence of second-level constructs (i.e., "theory"). In another paradox, grounded theory is both inductive (for generating theory from data) and deductive (for correcting and improving the emerging theory when it is not consistent with the most recently coded data). Sarker, Lau and Sahay (2001, p. 39) also recognize this paradoxical nature of grounded theory and provide a characterization of it as practiced by many IS researchers, in which grounded theory lies at the crossroads of objectivist and subjectivist approaches and involves primarily induction but also some deduction:

> [Grounded theory] draws on the strengths of both the positivist and interpretivist approaches. The grounded theory approach can be (and has been) characterized as "interpretive" (Orlikowski, 1993), in that: 1) it uses qualitative and unstructured data that represent the *subjective understanding* of actual members of the new organizational forms (Strauss and Corbin, 1990); 2) it involves *subjective sampling and analysis techniques* (Flick, 1998); and 3) [its] theory-building strategy is *primarily inductive* (Strauss and Corbin, 1990). However, the method also draws on the strengths of positivistic approaches by: 1) providing *systematic coding procedures* (Strauss and Corbin, 1990) designed to eliminate "speculative assumptions not founded on observation," as required by the "empiricist tradition" … (Schweizer, 1998, p. 44), and 2) requiring deductive verification of all findings (concepts and relationships) from the inductive step (Strauss and Corbin, 1990) in a manner that is consistent with the hypothetico-deductive logic of positivism (Ackroyd and Hughes, 1992). Scholars in the field of Information Systems such as Lee (1991) have illustrated the value of using positivist and interpretive thinking in a complementary manner when investigating organizational issues.

In recognition of the expansive methodological range covered by grounded theory, we map it in all four quadrants of the two-dimensional schema.

Another qualitative research approach used by information systems researchers is hermeneutics (research approach IV). The term hermeneutics has two broad meanings; in a "weak" sense, hermeneutics may be used synonymously with any form of interpretive research approach while, in a "strong" sense, it refers to the interpretation of texts and text analogues (e.g., social behaviors and artifacts) relying on: a) epistemological insights from various strands of hermeneutic theory (Prasad 2002; Boland 1991) and b) the hermeneutic circle, an iterative

approach that allows the reader to comprehend parts of the text in terms of the whole, and the text as a whole in terms of its various parts (Lee 1991; Klein and Myers 1999; Harvey and Myers 1995). In both its weak and strong senses, hermeneutics focuses on first-level constructs – that is, the understanding that the organizational natives (the authors) have of their own situation (the text or text analogue) – where the researcher's rendering of the first-level constructs is called his or her "interpretation." Here we use hermeneutics in the "strong" sense of the term. Examples of works that explicitly use the hermeneutic circle to enable interpretation of texts include Davis et al. (1992), Trauth and Jessup (2000), and Sarker and Lee (2006).

Hirsch (1967, p. 170, emphasis added) offers this clarification of hermeneutic interpretation: "Every interpretation begins and ends in **a guess** … the job of validation is **to evaluate the disparate constructions** (i.e., guesses) … brought forward." At the same time, Ricoeur (1991, pp. 159–160, emphasis added) warns us that validation should not be equated with verification:

> As concerns the procedures of validation with which we test our guesses, I agree with Hirsch that they are lot closer to a logic of probability than to a logic of empirical verification. **To show that an interpretation is more probable in the light of what is known (i.e., validation) is something other than showing that a conclusion is true (i.e., verification)** …Validation is an argumentative discipline comparable to juridical procedures of legal interpretation. It is a logic of uncertainty and of qualitative probability … validation allows us to move between the two limits of dogmatism and skepticism.

As such, hermeneutics can be described as primarily inductive (the "interpretive guesses" made by the researcher in building a theory) and occasionally deductive (the researcher's "validation" of the interpretive guesses). In addition, given that the interpretive guesses are often imaginative (e.g., Boland 1991) and also given that the validation process uses a "logic of uncertainty and of qualitative probability" rather than that of "empirical verification," we map the hermeneutic research approach primarily in Quadrants I and III.

One of the most widely used approaches among qualitative information systems researchers is the interpretive case study (research approach V). Interpretive case-study methods emphasize an in-depth understanding of the local context inhabited by the research subjects (Harvey and Myers 1995), draw upon traditions of ethnography, grounded theory, and hermeneutics, and provide a broad set of guidelines for undertaking field-based research (e.g., Walsham 1995). Interpretive case-study research may highlight, among other things, the need to be conscious about "passivity and over-direction" during fieldwork and the need to balance, on the one hand, the researcher's "subjectivity," "objectivity" (more accurately, "intersubjectivity"), and familiarity with, on the other hand, the researcher's distance from the subjects and their context (Walsham 2006, 1995; Prasad 1997). The focus in interpretive case studies, furthermore, is on the subjective understanding (i.e., the understanding that the subjects have of themselves, their context, and their history, which constitutes the "first-level constructs") and on developing a richer "interpretive understanding" (Lee 1991) or "second-order concepts" based on the subjective understanding (Walsham 1995). A researcher can develop this higher-order understanding in two ways: by induction and by elaboration using pre-existing theoretical concepts. Walsham (2006, p. 325, emphasis added), a key proponent of interpretive case studies, describes his *inductive* approach to data analysis in the following manner:

> In terms of learning from the data itself, grounded theory offers one way of doing this… I tend to use a looser approach myself, where I write impressions during the research, after each interview, for example. I generate more organized sets of themes and issues after a group of interviews or after a major field visit. I try to think about what I have learnt so far from my field data. **If this sounds rather subjective... well it is…**

However, according to Walsham (2006), not all studies rely *solely* on the data. Many interpretive case study researchers are "inspired by" existing theory or use theories, sometimes retrospectively, to view their data and to write up their work. In fact, Walsham (1995, p. 77) suggests that " ... research on micro phenomena of IS development and use can, and should, be informed by more general macro theories on the nature of organizations and social processes within them."

Some interpretive case-study researchers may thus use a pre-existing theory (which could be the initial or first-cut version of a theory built for the case setting) as a guide or framework for informing (or in some cases, driving) the data collection and/or the interpretive elaboration about the social phenomenon (e.g., Hirschheim and Newman 1991; Sarker and Sahay 2003). In this way, interpretive case studies can involve some degree of deduction. We thus place interpretive case studies in Quadrant III (subjective, inductive) and to a small extent in Quadrant I (subjective, deductive).

We now turn to two quantitative approaches – exploratory and confirmatory surveys (research approaches VI a and VI b respectively) and laboratory experiments (research approach VII) – and map them in our two-dimensional schema.

Exploratory surveys are often used for "descriptive" purposes (Light, Singer and Willett 1990). Data may be objective or even subjective (i.e., open ended-text) and often objectivist analysis techniques such as content analysis or statistical analysis may be used to aggregate and summarize the data (e.g., Sharma and Bhagwat 2006; Montazemi 2006). Exploratory surveys can be described as helpful to researchers who wish to discover ("fish for") possible relationships among constructs. Exploratory surveys are especially appropriate when the literature does not offer any *a priori* constructs to start with. Because of the focus not only on theory in the form of second-level constructs, but also on induction for building it upon data, we classify exploratory surveys in Quadrant IV (objective, inductive).

Confirmatory surveys, on the other hand, represent "relational" studies, where a pre-existing theoretical framework with well-defined constructs (i.e., a set of independent and dependent variables related to one another in one or more equations) is tested using statistical techniques (Light et al. 1990). Confirmatory surveys are conducted for the purpose of empirically confirming the theoretical framework (i.e., determining whether the data are strong enough to constitute the statement "not q," which would disconfirm the theory p in the major premise "if p, then q" of modus tollens). Confirmatory surveys typically collect data through sampling for the purpose of estimating coefficients (the "betas") of independent variables, where such a coefficient's having a numerical value that the researcher can assert, with confidence, is different from zero would be taken as evidence consistent with the relationship theorized to exist between the dependent variable and the independent variable associated with this coefficient. As such, confirmatory surveys function as statistical experiments. Because of the focus on second-

level constructs (the theoretical framework) and modus tollens, we classify confirmatory surveys in Quadrant II (deductive, objectivist).

Where confirmatory surveys rely on statistical controls to "hold constant" all variables other than the independent variable and the dependent variable in the theorized relationship that is being tested, laboratory experiments use physical controls to accomplish the same. A researcher, for example, can physically constitute a group of research subjects from whom the application of the experimental stimulus (such as the introduction of a new information technology) is purposely withheld and likewise physically constitute a separate group of research subjects to whom the experimental stimulus is administered; the former is known as the "control group" and the latter, the "experimental group." Furthermore, the potentially confounding effects of other plausible stimuli (e.g., the impact of age, income, race, gender, etc.) can be accounted for in how the control and experimental groups are constituted (for instance, by physically constituting each group to have the same distribution of age, income, race, gender, etc., by statistical random assignment, and by stratified random sampling, of which the latter is a combination of applying both physical and statistical controls). With the experimental and control groups, laboratory experiments can use data, observed not only before and after, but also with and without the application of the experimental stimulus, in order to confirm or disconfirm the theory (the relationships theorized between independent and dependent variables) being tested. Thus, given "if p, then q" as the major premise in modus tollens, the observation of "not q" (data inconsistent with the theory) would serve to refute the theory p while the observation of "q" (data consistent with the theory) would serve to confirm or corroborate it. Just as for confirmatory surveys, because of the focus on second-level constructs (the relationships theorized between independent and dependent variables) and the use of modus tollens, we classify laboratory experiments in Quadrant II (deductive, objectivist).

Having established the above two-dimensional schema to map different research methods, we may now proceed with an example of how to combine different research methods in the same research stream.

4. Showing How to Combine Different Research Methods

We will use Markus' case study (1983) of resistance to the implementation of a financial information system to show, if her research in the case study were to be continued and expanded, how different research methods can be combined. Her case study is one of the most highly cited articles in the information-systems research literature and continues to be highly cited today; as such, it can usefully serve as a point of reference with which many information systems are already familiar. Markus' case study also readily lends itself to the following exercise or thought experiment.

Suppose that, today, Markus has just completed her field study of Golden Triangle Corporation and is now presenting her findings in the form of a working paper (with the same content as the 1983 article). Suppose further that, in the working paper, she is presenting her research as a pilot study, after which she is encouraged to expand or "follow up" her case research. Markus or even a different researcher could then proceed to take advantage of the mapping of different research methods in the schema, above, to continue the research.

A candidate for the first additional research approach that her case study can formally adopt would be the theory-testing positivist case study, which is research approach Ia in Quadrant II (deductive, objectivist). Markus' 1983 case study happens to have already been scrupulously reconstructed as a positivist case study (Lee, 1989), but without explicitly using the modus tollens framework and terminology we earlier introduced. In her original study, Markus poses three theories (p. 431, p. 437) to explain resistance to the implementation of MIS (management information systems): the people-determined theory (a person or subunit resists MIS implementation because of "factors internal to the person or group"), the system-determined theory (a person or group resists MIS implementation because of "factors inherent in the application or system being implemented"), and the interaction theory ("people or groups resist systems because of an interaction between characteristics related to the people and characteristics related to the system"). Different predictions follow from the different theories. Consider as examples (the quotation marks indicate Markus' own phrasing):

> If the people-determined theory is true (p_{PF}), then "change the people involved, resistance will disappear" (q_{PFa}) and "job rotation among resistors and non resistors [will diminish resistance]" (q_{PFb}).
>
> If the system-determined theory is true (p_{SF}), then "fix technical problems, resistance will disappear [and resistance will be diminished]" (q_{SFa}) and "improve system efficiency [and] improve data entry [and resistance will be diminished]" (q_{SFb}).
>
> If the interaction theory is true ($p_{PF,SF}$), then "changing individuals and/or fixing technical features will have little effect on resistance" ($q_{PF,SFa}$) and "resistance will persist in spite of time, rotation, and technical improvements" ($q_{PF,SFb}$).

In effect, therefore, Markus' 1983 research pursued multiple applications of modus tollens, the respective major premises of which were "if p_{PF}, then q_{PFa}," "if p_{PF}, then q_{PFb}," "if p_{SF}, then q_{SFa}," "if p_{SF}, then q_{SFb}," "if $p_{PF,SF}$ then $q_{PF,SFa}$," and "if $p_{PF,SF}$, then $q_{PF,SFb}$." As for the MIS implementation at Golden Triangle Corporation, Markus observed instances of "not q_{PFa}," "not q_{PFb}," "not q_{SFa}," and "not q_{SFb}," hence leading to the modus tollens conclusions of "not p_{PF}" (the people-determined theory is false) and "not p_{SF}" (the system determined theory is false). Markus, however, observed instances of "$q_{PF,SFa}$" and "$q_{PF,SFb}$," hence providing evidence consistent with the statement "$p_{PF,SF}$," which is that the interaction theory is true. In this way, Markus' 1983 study perfectly exemplifies the theory-testing positivist case study.

For a variety of reasons, there are researchers who have a preference that research be conducted quantitatively. They can be readily accommodated. One way to achieve this would involve moving the research effort from method Ia to method VIb ("confirmatory surveys"), which is still within Quadrant II (deductive, objectivist). To conduct a quantitative test, Markus or a different researcher could define "resistance" in the form of a dependent variable, Y, "people factors" in the form of one or more independent variables X_{PF1}, X_{PF2}, X_{PF3}, … , and "system factors" in the form of one or more independent variables, X_{SF1+1}, X_{SF2}, X_{SF3}, … . Valid and reliable measures, of course, would need to be created for each variable, where the resulting measures could be expressed in the form of, say, 7-point Likert scales, which could be presented

as questions in a survey administered either in the same company that Markus investigated or in a different organization. The variables would then need to be related to one another according to the people-determined theory, the system-determined theory, and the interaction theory, of which some possible formulations are, respectively,

(1) $Y = \beta_{PF0} + \beta_{PF1} X_{PF1} + \beta_{PF2} X_{PF2} + \beta_{PF3} X_{PF3} + \ldots$

(2) $Y = \beta_{SF0} + \beta_{SF1} X_{SF1} + \beta_{SF2} X_{SF2} + \beta_{SF3} X_{SF3} + \ldots$

(3) $Y = \beta_{I0} + \beta_{PF1, SF1} X_{PF1} X_{SF1} + \beta_{PF1,SF2} X_{PF1} X_{SF2} + \beta_{PF1, SF3} X_{PF1} X_{SF3} + \beta_{PF2, SF4} X_{PF2} X_{SF4} + \ldots$

Note that, in general, there is no *a priori* reason that a relation need be linear or that there need be only one dependent variable. Also note that many statistical studies express the relationships among different variables in the form of a "boxes and arrows" diagram, which is just the visual equivalent of the equation(s) (such as the three equations above). In the terminology of modus tollens, this would be (using all three equations as examples, and where the quotation marks no longer refer to Markus' wording):

> If "the people-determined theory, denoted as equation (1), above, is true" (p_{PF}), then "it will be true that, in empirical testing, coefficient β_{PF1} will be measured as less than zero" (q_{PF1}), which would reflect that, as people factor X_{PF1} increases, resistance Y decreases.[4] Similarly, if p_{PF}, then "it will be true that, in empirical testing, coefficient β_{PF2} will be measured as less than zero" (q_{PF2}), and "coefficient β_{PF3} will be measured as less than zero" (q_{PF3}), …
>
> If "the system-determined theory, denoted as equation (2), above, is true" (p_{SF}), then "it will be true that, in empirical testing, coefficient β_{SF1} will be measured as less than zero" (q_{SF1}), which would reflect that, as system factor X_{SF1} increases, resistance Y decreases. Similarly, if p_{SF}, then "it will be true that, in empirical testing, coefficient β_{SF2} will be measured as less than zero" (q_{SF2}),
>
> If "the interaction theory, denoted as equation (3), above, is true" ($p_{PF,SF}$), then "it will be true that, in empirical testing, coefficient $\beta_{PF1, SF1}$ will be measured as less than zero" ($q_{SF1,SF1}$), which would reflect that, as people factor X_{PF1} and system factor X_{SF1} both increase, resistance Y decreases. Similarly, if $p_{PF,SF}$, then "it will be true that, in empirical testing, coefficient $\beta_{PF1,SF2}$ will be measured as less than zero" ($q_{PF1,SF2}$), and "coefficient $\beta_{PF1, SF3}$ will be measured as less than zero" ($q_{PF1, SF3}$), …

[4] Suppose that X_{PF1} refers to "a person's ability to accept change," where "X_{PF1}=1" indicates the least such ability and "X_{PF1}=7" indicates the most such ability. The theorized relationship between X_{PF1} in and Y (resistance) would therefore be that as ability-to-accept-change X_{PF1} increases, resistance Y decreases (i.e., an inverse relationship), which is the same as theorizing that the true value of the coefficient β_{PF1} is negative. Every other independent variable in our examples is similarly theorized to have a negative coefficient, (i.e., an inverse relationship with Y).

Suppose, for the sake of illustration, that the survey data pertaining to the people-determined theory offer measurements of each coefficient as significantly *greater* than zero, which is the opposite of what was theorized. This would refute the people-determined theory. Suppose also that the system-determined theory is similarly refuted. And for the interaction theory (the third equation), suppose that the survey data offer measurements of each coefficient as significantly less than zero, except for one, for which the coefficient is significantly greater than zero. Because the preponderance of the evidence would be consistent with the interaction theory, it would make more sense to regard the positive coefficient as an anomaly to be further investigated than to summarily reject the entirety of the interaction theory. How might this anomaly be investigated?

Suppose further that the coefficient which measures positively is $\beta_{PF1,\,SF3}$ and the independent variables of interest are X_{PF1} and X_{SF3} (this would be the third interactive term in the right-hand side of the equation (3)), where X_{PF1} designates a person's ability to accept change and X_{SF3} refers to a new information system's ability to satisfy the company's information requirements. An increase in X_{PF1} and an increase in X_{SF3} would mean, *if $\beta_{PF1,\,SF3}$ is measured as significantly greater than zero*, that there is an increase in the resistance Y, which would contradict the negative value originally theorized for $\beta_{PF1,\,SF3.}$ Whereas the tradition for a statistical researcher is to attribute such an anomalous result to the sample's being too small or biased, or perhaps to imperfections in the instruments used for measuring the variables, researchers also have the option of continuing the investigation in a non-statistical way. Specifically, we propose returning to the individuals who were surveyed and then interviewing or otherwise studying them, so as to identify any possible relevant factors, or additional relationships among factors, that were not previously accounted for.

Such an investigation could move us from Quadrant II to Quadrant III (inductive, subjectivist). The same or a different researcher could conduct an interpretive case study (research approach V), which would use the guidelines offered by Walsham and other interpretive researchers earlier mentioned, or a grounded theory study (research approach III), which would use the guidelines of Glaser and other grounded-theorists earlier mentioned. In investigating the subjective understanding and the natural attitude of everyday life – i.e., how the individuals who were earlier surveyed themselves see and comprehend the situation they are in – a researcher could find that they do not see their reactions to the systems implementation as resistant behavior (which lacks a positive connotation) aimed at impeding technological progress, but instead as protective behavior (which has a constructive connation) aimed at saving the jobs of not only themselves but also their colleagues. Indeed, most people do not see themselves negatively (in this example, as people whose resistance holds up progress). This interpretive finding would indicate, to statistical researchers, that there exists more than just one dependent variable (not just resistance to technology, but also acceptance of job-saving tactics) for positivist researchers (in Quadrants II and IV) to consider and therefore to build into their theory. Identification of any new factors, in being based on observed examples, would be inductive.

Then, following the identification of any new factors, a researcher could then conduct a theory-building positivist case study (in Quadrant IV), which could use the guidelines offered by Eisenhardt or Yin as mentioned above, for the purpose of theorizing one or another way of

relating the old and new factors, as variables, to one another. This could include additional equations having protective behavior as a dependent variable in addition to other equations having resistance as a dependent variable. In other words, the researcher could end up with a modification of equation (3) as well as the addition of one or more other equations. And once the theory is formulated, the same or a different researcher could proceed to conduct a theory-testing positivist case study (in Quadrant II), which could use the guidelines offered by Lee (1989), and this theory-testing study could itself be followed by another study administering a quantitative, confirmatory survey (also in Quadrant II).

In the manner of sequential studies like those just described, organizational researchers can fruitfully combine quantitative, qualitative, positivist, interpretive, and perhaps even other approaches in the same research stream. There is no necessity for different methods to be combined in just a single study, particularly a paper submitted to a journal for publication consideration. For combining different research methods, the unit of research is not a single study published by a researcher and his or her co-authors, but instead is a research stream in which individual studies can be conducted by different researchers not necessarily collaborating in the same study.

5. Conclusion

Our extension of Markus' case study shows that combining quantitative, qualitative, positivist, interpretive, and other methods is altogether natural. How is it, then, that there has ever been any question about how, or even whether, this may be done?

Combining quantitative, qualitative, positivist, interpretive, and other methods is ultimately not about methods. It is about social practices – namely, the social practices of natives who call themselves "researchers." They form a society that is diverse in its beliefs, where they see the diversity as differences which divide them into separate and opposing groups. Natives in this society go through the rite of passage that they call "doctoral education," which inculcates into them the mindset that the diversity in their beliefs serves to set them apart from one another. Furthermore, the social and political institutions of this society (dissertation committees, tenure and promotion committees, the journal review process, etc.) reinforce and perpetuate these beliefs from one generation of natives to the next. Combining different research methods requires not only knowledge about different research approaches, but also consciousness about the social and political context which gives or denies meaning to the act of combining the different research methods. And raising this consciousness will ultimately require information systems researchers to research themselves in the context of their own research organizations – a research effort that, fittingly, would likely benefit from combining different research methods.

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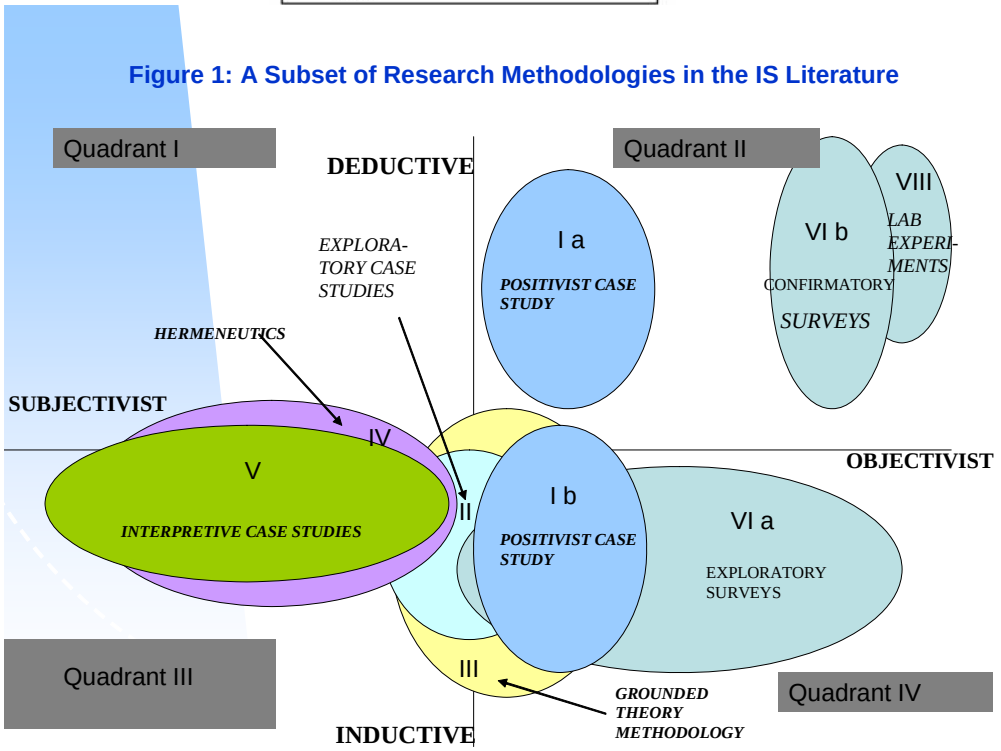
deductive

- using deductive logic in the form of **modus tollens** in the **context of justification**
- to test an **already built, general theory** by judging whether the **data** observed in a specific setting (e.g., a population, an organization, a laboratory experiment) are consistent with
- the **conclusions** (e.g., predictions, postdictions, observational consequences) that necessarily follow from the theory as applied to this specific setting

Figure 1: A Subset of Research Methodologies in the IS Literature



subjectivist

- focusing on **interpretation**, which involves
- **first-level constructs** and
- the **natural attitude** of everyday life of the observed human subjects

objectivist

- focusing on **explanation**, which involves
- **second-level constructs** and
- the **scientific attitude** of the observing social scientists

inductive

- using **inductive logic** in the **context of discovery**
- to **build a new, general theory**, by
- **basing** it on **data** observed in one or more specific settings (such as one or more populations, one or more organizations, one or more laboratory experiments),
- where no theory, based on the data, necessarily follows from the data