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ICIS 2008 Proceedings. 202.

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CRITICAL REALISM-BASED EXPLANATORY CASE STUDY RESEARCH IN INFORMATION SYSTEMS

Le réalisme critique Pour la conduite d'études de cas en systèmes d'information

Completed Research Paper

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Abstract

Critical realism has been proposed as an alternative philosophical paradigm to positivism and interpretivism, but few papers have offered guidelines or suggestions for applying this philosophy to actual research methodologies. This article proposes a set of methodological principles for conducting and evaluating critical realism-based explanatory case study research within the information systems (IS) field. The principles are consistent with the ontological and epistemological assumptions of critical realism, which are discussed along with a brief comparison to the contrasting assumptions from positivism and interpretivism. Examples from published case study articles in the IS research literature are discussed in order to demonstrate each principle in more detail.

Keywords: Case study research, causal explanation, critical realism, philosophy, methodology

Résumé

Cet article propose un ensemble de principes méthodologiques pour la conduite et l'évaluation d'étude de cas basées sur le réalisme critique, et ce dans le domaine des systèmes d'information (IS). Les principes sont compatibles avec les fondations ontologiques et épistémologiques du réalisme critique, qui sont examinées et ensuite comparées avec celles du positivisme et de l'interprétivisme.

Introduction

Critical realism has emerged as a viable philosophical paradigm for conducting social science research. As proposed by Bhaskar (1975) and others, critical realism (CR) is positioned as an alternative to the more prevalent paradigms of positivism and interpretivism. We argue that CR-based research methodologies can be extremely beneficial for investigating complex organizational phenomena in a holistic manner to derive in-depth causal explanations which take into account the breadth of environmental and organizational factors which generate them. CR-based research addresses recent calls for generating MIS theories which are systems-oriented (Lee 2004) and able to identify the mechanisms which connect “chains of indeterminate events and complex interactions” (Grover et al. 2008, pg. 45). Potentially, CR could become a preferred paradigm to approach complex phenomenon, such as those often pursued in information systems, because it enables theorists and researchers to build more detailed explanations of a given set of phenomena or events without resorting to methods more suited for the natural sciences. CR presents an opportunity to extend and enhance existing research approaches, and this article seeks to establish clear methodological guidance for those seeking to adopt this paradigm.

A significant amount of CR literature has emerged among researchers in a variety of social science disciplines including sociology (Pawson and Tilley 1997; Steinmetz 1998) and economics (Downward et al. 2002; Lawson 1997), as well as business disciplines such as management (Fleetwood and Ackroyd 2002; Tsoukas 1989) and marketing (Hunt 1990; Sobh and Perry 2006; Zinkhan and Hirschheim 1992). Within MIS, a number of researchers have called for more CR-based studies (Carlsson 2004; Dobson et al. 2007; Dobson 2001; Mingers 2004; Smith 2006) including a small number of recently-published empirical studies (de Vaujany 2008; Kirsch 2004; Morton 2006; Mutch 2002; Volkoff et al. 2007).

Despite the increasing frequency of these calls for research, very few publications have explicitly provided principles and guidelines to assist researchers in conducting and evaluating CR-based empirical studies. There are a limited number of examples in other social science disciplines (e.g. Layder 1990; Sayer 1992; Yeung 1997) but few within the organization sciences.

This article offers a set of methodological principles for conducting and evaluating CR-based case study research in MIS research. Although CR is capable of accommodating a variety of methodological choices, the focus of this paper is the conduct of case study research because of the fit between the explanatory goals of CR and the capabilities of the case study method. Comparable guidelines exist for the conduct of case study research applying the positivist paradigm (Benbasat et al. 1987; Dubé and Paré 2003; Lee 1989) and the interpretivist paradigm (Klein and Myers 1999; Walsham 1995). The proposed methodological principles illuminate key aspects of what has been a largely philosophical discussion of CR in the extant literature, and transform the philosophical concepts into an actionable methodological approach for conducting IS research. We discuss how these methodological principles are extensions of the ontological and epistemological assumptions of critical realism, which we distinguish from the corresponding assumptions of both positivism and interpretivism in order to provide a basis for comparisons by current adherents of these paradigms.

The article proceeds in three parts. First, critical realism is discussed as a philosophical paradigm, comparing it briefly to positivism and interpretivism. Next, the ontological and epistemological assumptions of critical realism are discussed, detailing how the two are intertwined. We then present methodological principles for conducting case study research from a critical realist perspective based on the ontological and epistemological assumptions developed in the preceding section. The description of each principle includes a post hoc assessment of one or more recent studies in MIS that applied the CR philosophy. We conclude with a brief discussion of implications for researchers interested in conducting other forms of CR-based research as well as opportunities for further exploration of the CR paradigm.

Philosophical Paradigms and Critical Realism

In the conduct of scientific research, the actions of researchers are guided by the systems of belief by which they generate and interpret knowledge claims about reality (Chua 1986). These systems of belief, or paradigms (Guba 1990), can be defined by their answers to three sets of questions involving ontology, epistemology, and methodology. Ontology refers to assumptions about the nature of reality; epistemology refers to the evidentiary assessment and justification of knowledge claims; and methodology is concerned with the process or procedures by which we create these knowledge claims (Chua 1986; Guba 1990; Orlikowski and Baroudi 1991). Whatever paradigm is adopted in a given research effort, the assumptions upon which it is built must be consistent in order to generate theoretical knowledge that is both valid and beneficial for subsequent research and practice.

Mainstream research in MIS falls primarily under two such coherent paradigms: positivism and interpretivism. Positivism is largely concerned with the testing, confirmation and falsification of generalizable theories concerned with an objective, readily apprehended reality and oriented towards improved prediction (Chua 1986; Orlikowski and Baroudi 1991). Interpretivism instead focuses on the subjective meanings which participants assign to a given phenomena within a specific, unique context (Klein and Myers 1999; Orlikowski and Baroudi 1991; Walsham 1993). Both paradigms have been successfully utilized to conduct research projects generating rigorous, usable theories within the MIS field (Weber 2004). Additionally researchers may adhere to assumptions consistent with the critical theory paradigm, which is becoming more visible within MIS, but the focus here will be on the dominant paradigms in IS research positivism and interpretivism.

Critical realism has emerged as a viable alternative philosophical paradigm for conducting social science research. Despite the common appellation, contemporary critical realism differs significantly from other critical realist philosophies developed in the early 20th century by authors such as Roy Wood Sellars, Santayana, and others, which was based on a largely epistemological philosophy of knowledge and perception (Moore 1922). Based primarily on the writings of Roy Bhaskar (1975; 1998), contemporary CR is an ontologically-based philosophy of science that attempts to answer the question "what must reality be like to make science possible?" (Bhaskar 1975; Danermark et al. 2002). The primary focus of CR is on the assumption that the theories which are generated by the conduct of scientific research must revolve around the objective reality which comprises the world, even though humans are often unable to fully understand or observe this reality and our knowledge of the objective reality is fallible. This is why CR has been described as "ontologically bold, but epistemologically cautious (Outhwaite 1987). As such, CR-based research focuses on answering the question of what reality must be like in order to explain the occurrence of a given set of events.

The paradigmatic assumptions of CR are manifest in several fundamental characteristics which differ from both positivism and interpretivism (see Table 1). Due to space limitations, a full comparison of these philosophical differences is beyond the scope of the current paper. Instead, in the remainder of the paper, we will discuss the specific ontological, epistemological, and methodological characteristics of CR in more detail. We will especially focus on the linkages between these assumptions and the ways in which they are manifest in the methodological principles by which one conducts CR-based research.

Table 1: Comparison of Philosophical Paradigms (adapted from Healy and Perry 2000; Lincoln and Guba 2000; Orlikowski and Baroudi 1991)

	Positivism	Interpretivism	Critical Realism
Ontology	Objective reality, unproblematically apprehended	Reality socially constructed by humans via subjective meanings, symbolic action, and social politics	Objective, stratified reality (consisting of structures, mechanisms and events), but imperfectly and fallibly apprehended
Epistemology	Empirical testing and verification of predictive theories via hypothetical-deductive methods; findings assumed true until falsified	Knowledge generated by understanding the meanings and actions or subjects; findings "created" by researcher based on this understanding	Knowledge retroduced to theories regarding underlying reality which explain observable events; findings probably true, but mediated by humans

Methodology	Researcher assumed to be unbiased (value-free); generalizability to target population; primarily quantitative methods, such as surveys, experiments	Researcher's biases part of study (value-laden); primarily qualitative methods such as ethnographies based on hermeneutics, dialectics	Researcher controls for bias via triangulation (value-aware); multiple methods including case studies (for idiographic studies) and surveys or statistical methods
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It is important to note that we are not attempting to criticize existing research and philosophical paradigms. Longshore-Smith (2006) has argued that both positivism and interpretivism suffer from “persistent theory-practice inconsistencies” that lead to conflicting or inconclusive results a wide array of IS research and that can be at least partially resolved by the adoption of CR assumptions. We concur with this view and suggest that CR, based on its unique ontological and epistemological assumptions, offers researchers an alternative for conducting explanatory research to generate deep causal explanations for complex organizational phenomenon related to the socially situated creation, implementation and use of IS and the artifact.

Critical Realism Ontology

Ontology is concerned with the nature of objects being studied, including the nature and characteristics of the various entities which exist in the world, and whether this reality exists objectively or subjectively relative to humans (Chua, 1986; Orlikowski and Baroudi, 1991). Ontologically, critical realism is based on the following basic principles: objective reality, a stratified ontology, and an open systems perspective (Bhaskar 1975; Bhaskar 1986; Bhaskar 1998; Collier 1994; Danermark et al. 2002). We discuss these assumptions and provide a comparison to the related assumptions of positivism and interpretivism further in this section.

Objective Reality

Reality is represented in realist philosophies as being fully objective and existing independently of our knowledge of it. This directly contradicts the philosophy of interpretivism, which suggests that reality is to a large degree dependent on the interactions of humans and does not have an objective component that exists independently of them.¹ Instead, interpretivism holds that reality is embedded in the nature and use of symbols such as language, actions, and routines (Smircich and Morgan 1980). Thus, the goal of interpretivist research is to find out how actors have chosen to represent and interact with their views of reality through an interpretation of these symbolic modes.

Both critical realism and positivism hold that reality is an objective structure that exists independently of humans’ knowledge and social construction of it. In so doing, it is possible to construct knowledge that represents or mirrors reality as it objectively exists. However, positivism depends on the ability to develop an appropriate set of constructs and an accurate set of instruments, independent of any influence or bias on the part of the researcher or subjects, to capture the essence of a phenomenon (Orlikowski and Baroudi 1991). There is an assumed direct correspondence between these constructs and the conceptual objects or events they are designed to represent. There is also an assumed correspondence between these constructs and the instruments used to measure them. As such, the theories generated by positivist research can be validated against reality by assessing the correspondence among the conceptual objects, operational constructs, and the instruments used to represent them.

Critical realism extends this notion by suggesting that the world is not reducible to the conditions that humans use to access them. In other words, humans experience only a portion of the objective world and the objective nature of the world is not easily and unproblematically apprehended, characterized, and measured. The theories which are the product of scientific practice are part of a transitive dimension of science consisting of the knowledge generated by humans to explain and understand the objective world, which itself belongs to an intransitive dimension (Bhaskar 1975). These theories cannot be directly measured against the objective world, but can only be compared with each other to see how well each explains the observable phenomena being studied.

¹ This is a somewhat simplified characterization of the interpretivist paradigm. See Denzin & Lincoln (2004); Morgan and Smircich (1980); Chua (1986); Orlikowski and Baroudi (1991) for more discussion of positivist and interpretivist philosophical paradigms.

Stratified Ontology

CR assumes a strong ontology that views reality as being specifically composed of structures (and the parts which comprise them), which have causal powers and liabilities or “the fundamental dispositional properties of things” (Lloyd, 1986 referencing Harre and Madden, 1975, p.86). These causal powers, or mechanisms, interact with other entities’ powers and liabilities and the contextual environment to generate actual events and observable experiences. A key component of CR is the stratification of reality into three distinct domains (Bhaskar, 1975). The domain of the real consists of the structures and mechanisms that comprise the objective reality. The next domain, the actual, includes the events that are enacted by the causal powers and liabilities (mechanisms) inherent in the structures and mechanisms themselves. The final domain, the empirical, consists of those experiences which we are able to perceive and measure empirically as evidence of (but independent of) events. These experiences and events are the starting points from which causal explanations are developed with the critical realist paradigm.

The stratified ontology of CR contrasts with the ontological assumptions of positivism and interpretivism. The distinction of experiences, events and structures is a distinguishing factor between CR and empiricist philosophies such as positivism. Positivism assumes a flat ontology that reduces reality to a Humean conjunction of cause with effect with little regard for the mechanisms which link them (Joseph 1998). Interpretivism would deny the existence of a stratified ontology altogether in that experiences exist within the meanings assigned by the participants. Social structures are generated through, and do not exist separately from, human action thus prohibiting objective and universal assessment (Orlikowski and Baroudi, 1991).

These domains are summarized in Table 2. In this section, we discuss each of these elements of the CR ontology in more detail.

Table 2: Stratified Ontology of Critical Realism (Bhaskar, 1975, pg. 13)

	Domain of Real	Domain of Actual	Domain of Empirical
Structure, Mechanisms	X		
Events	X	X	
Experiences	X	X	X

Structure

Structure is defined as the set of rules, resources, roles, and relationships that “enable and constrain observable social activity, which in turn reproduces and transforms these structures” (adapted from Mingers, 1989, pg. 189). This definition includes the roles played by agents (which Bhaskar defines as ‘position-practice system’) as well as the explication of the relationships between these agents, the rules of action within the social system, and the various resources available (Porpora 1998)². In CR, the structure of an entity or system is part of the objective world we seek to understand.

The relationships among the components of a social structure and the emergent properties which result from these relationships and interactions are a key element of the structural definition of a social system. It is these relationships and interactions that ultimately create and reproduce the structures themselves. The properties, capabilities, and powers that can be ascribed to a given social structure depend on not only those aggregated from the components, but also on the synergistic effects resulting from the pattern of organization among them and their interactions. Thus, the powers and properties of a given structure emerge from the interplay between the powers and properties of the parts themselves, but do not enable the structure to be defined simply by identifying the characteristics of the parts. Archer (1995) argues that the entities at one level are distinct from their parts and are irreducible to this set of parts. “[E]xplanation of why things social are so and not otherwise depends on an account of how the properties and powers of the ‘people’ causally intertwine with those of the ‘parts’,” (Archer 1995, pg. 15).

² See Sewell (1992) and Porpora (1998) for more on structure, especially in relation to Giddens’ Structuration Theory. A detailed comparison of Structuration and CR is beyond the scope of the current paper.

Mechanisms

Conceptually, mechanisms are the generative powers inherent to the structures discussed above, enabling or limiting what can happen within a given context (Sayer 2000; Smith 2006). These generative powers or liabilities are “dispositions, capacities, and potentials to do certain things, but not others” (Fleetwood 2004, p. 46), which may or may not be activated depending on the specific contextual conditions and the influence of other generative powers which may be activated in the same historical context. The result of the enactment of these mechanisms typically results in changes or solidification of the social structure, described as morphogenesis and morphostasis, respectively (Archer, 1995). These mechanisms are not considered as variables but rather as hypothesized explanations, or miniature theories (Stinchcombe 1998), of the processes that bring about the observable and theoretical events which we seek to study. In other words, mechanisms fill in the “black box” between events, showing how and/or why one thing leads to another (Anderson et al. 2006; Pawson and Tilley 1997; Sayer 1992).

Unfortunately, there is no universal, unambiguous definition for *mechanism*. One recent article cited 28 different definitions of mechanisms from social science research including several that were contradictory and excluding a number of regularly cited definitions (Mahoney 2003). Another article (Mayntz 2004) listed examples of mechanisms identified by social researchers including norms, voluntary agreements, the French Revolution, and Rational Choice Theory. Mechanisms have been defined as tendencies (Fleetwood 2004; Longshore-Smith 2006; Sayer 1992), theories or bits of theory (Elster 1989; Gambetta 1998; Salmon 1984; Stinchcombe 1998), processes (George and Bennett 2005; Hedström and Swedberg 1998; Mahoney 2003), and as a combination of entities and their activities (Hedström 2005; Hernes 1998; Machamer et al. 2000). Complicating understanding further, the terms mechanism and structure have been conflated or used synonymously in the CR literature (Bhaskar 1975; Mingers 2006; Porpora 1998). Relevant to the perspective presented here, we identify mechanisms as the hypothesized powers and liabilities inherent in social structures, which may or may not be enacted in a given context, and which cause or generate actual events which are manifest as empirical experiences.

Events and Experiences

An *event* can be defined as a specific happening or episode. We often delineate such events with reference to some change in the state or properties of some entity. However, it is also possible for a specific non-change as indicative of an event which we seek to explain. Similarly, *experiences* are composed of those events and contextual properties which we are able to directly observe, typically through our sensory perceptions.

As combinations of mechanisms are enacted, events occur (or do not occur) within the structure. Consistent with the assumption of an objective reality, these events may not be easily amenable to experience, although they may have some actual effect (or non-effect). It is possible that no discernible change can be observed because of the counteracting effects of two or more mechanisms (Gambetta 1998). It is also possible that the outcome of one mechanism may exacerbate the effects of another mechanism, further varying the direction, magnitude, or perceptibility of actual events. As such CR recognizes that *observable* events that can be measured, i.e. experiences, are likely to be only a subset of the actual events generated within a given social structure. Therefore, ontologically, events occurring within a given structure are independent of the experiences which we are capable of empirically observing and measuring (Bhaskar 1975).

Open Systems Perspective

Critical realism adopts a view of reality as an open system (Bhaskar 1998) which is beyond our ability to control directly. Within many of the sciences, it is possible to design laboratory experiments as more or less *closed systems* in which contextual conditions and exogenous influences are controlled in order to ensure a common environment for replicated investigations. As such, it is possible within these closed experiments to isolate the specific causes of a given outcome event or state change. Positivism depends on the constant conjunction of these cause-effect relationships. This allows for the creation of universal laws based on a view of causality in terms of empirical regularities and predictability.

Unfortunately, social systems and other complex phenomena seldom exhibit such experimental closure. These social systems cannot adequately be constrained in the real world as can be done with laboratory experiments. Each event is not only dependent on the mechanisms available as part of the current social structure, but is also dependent on continuously changing contextual conditions and the changing properties of components with these structures. As

these mechanisms are enacted, the social structure is modified as a result of their effects (Archer 1995) making common contextual conditions the exception rather than the rule. Instead, because the boundaries of real world social systems are typically fluid and permeable, we are unable to assume that the mechanisms that were enacted in a given system and its environmental context will generate the same events in the future. Thus causality in CR is related to the tendency of mechanisms to act within a specific contextual environment (Sayer 1992). This open system assumption thus deflates the need to find empirical regularities or universal laws in the conduct of research.

Critical Realism Epistemology

Epistemological assumptions are concerned with the notion of what counts as acceptable truth by specifying the criteria and process of assessing truth claims (Chua 1986). One's epistemological assumptions determine how to present knowledge claims, how to evaluate the truth or validity of these claims, and how these claims are to be measured against existing knowledge.

We can compare the epistemological assumptions of critical realism with those of positivism and interpretivism. Positivism assumes that an event is explained only when it can be deduced from or as an instance of existing universal laws, which enables predictions and control of the events under investigation (Chua 1986; Orlikowski and Baroudi 1991). The dependence of positivism on the hypothetico-deductive model thus focuses on an attempt to develop more universal laws based on regularities and causal relationships, from which subsequent lower-level hypotheses can be developed (Chua 1986).

Interpretivism is not as concerned with explanation as much as *understanding* the meaning behind an event. Interpretivism assumes that human actions and symbols are understood by accounting for their subjective meanings from the standpoint of the research participants themselves, including those of the researcher. Thus all of the knowledge claims created under this philosophy are unique to the setting, participants, and researcher since the reality these claims address is constituted from the language, beliefs, and norms of the participants.

Critical realism seeks to explain the objective reality through both the experiences observed and interpreted by the participants and the analysis of other objective data. Thus, knowledge claims developed or created by CR researchers are focused on the identification of those elements of reality (structure and mechanisms) which must exist in order for the events and experiences under examination to have occurred. These knowledge claims are based on several epistemological assumptions inherent to CR which we discuss in this section: socially mediated knowledge, explanation rather than prediction or understanding, explanation by mechanisms, unobservability of mechanisms, and multiple possible mechanisms (e.g. Bhaskar 1975; Collier, 1994; Sayer, 1992).

Mediated Knowledge

CR defines scientific knowledge as belonging to the transitive and intransitive dimensions (Bhaskar 1975). The intransitive dimension includes the objective world that we seek to explain. This dimension is largely independent of our senses and experiences and thus is not subject to much revision over time. The transitive or epistemological dimension includes our theories about this world that have been developed as the result of previous scientific inquiries (Collier 1994). Theories and knowledge constituting this dimension are subject to revision as they achieve a closer proximity to reality (or verisimilitude). However, CR also acknowledges that a perfect match between theories and reality is unlikely, which results in a base of knowledge that is fallible but presumably less so over time.

Our knowledge of reality is formed in the transitive dimension through our sensory experiences and a priori and ongoing theoretical interpretations borne out of our interactions with others in the social structures to which we belong (i.e. other researchers, disciplinary groups, co-workers, etc.). As such, CR assumes that our knowledge of the structures and mechanisms which generate the events under study is mediated by these interactions and our own interpretations. Thus, all knowledge in CR is value aware, focused on multiple value-aware perceptions of a single objective reality (Healy and Perry 2000). This is fundamentally different from the positivist belief in a single, value-neutral reality or the interpretivist belief in multiple value-laden viewpoints and thus multiple realities.

Explanation rather than Prediction

The goal of a CR study is *explanation* of a certain event, or class of events (if regularities exist) more so than the ability to make *predictions* about future events (positivism) or to understand the social/cultural meanings behind the events (interpretivism). An explanation attempts to stipulate the factors which are presumed to cause a given outcome (Yin 2003). As such, explanation in CR is historically-oriented, seeking to identify the causes of a phenomenon (i.e. mechanisms) that we presuppose to have existed.

Prediction requires that we are able to control the conditions preceding a given phenomenon in order to reproduce a given outcome. However, the limitations introduced by an open systems view of the world (as discussed in the ontology section) include the recognition that regularly occurring events are the exception in reality because the available mechanisms and their effects are seldom common across multiple events. Prediction may be possible in closed or semi-closed systems (Lawson 1997); however this is often more of the exception rather than the rule. Therefore, the lack of closure in complex social systems (e.g. organizations or sociotechnical systems common in IS studies) makes it far more difficult (if not impossible) to predict the events which result from a given initial event or change in structure (Bhaskar 1975).

Explanatory theories (Gregor 2006), such as those resulting from CR-based studies, do not necessarily attempt to predict what will happen in future historical periods. Instead, we restrict our conclusions to an explanation of a preceding phenomenon occurring in a complex social system (Bhaskar 1975). Although it is possible that there may be some predictive value arising from the theories produced from such studies, the intent is to explain without necessarily proposing testable propositions and predictions about the future (Gregor 2006).

Unobservability

In critical realism, the justified belief in the existence of a mechanism is often constrained by the fact that these mechanisms are often neither observable nor measurable. These mechanisms, and the structural components from which they are generated, are often identifiable only through the effects manifest in the resultant events and experiences. Bhaskar (1975) argues that, consistent with the notions of stratified ontology, the actual events which occur are distinct from our ability to experience them and from the underlying structures and mechanisms that interact to generate them. Thus, our knowledge claims may be based on not only observable entities (i.e. structures and mechanisms), but also unobservable ones. This contrasts with positivism, which is primarily concerned only with events that can be observed, thus committing what is called the “epistemic fallacy” by critical realists.

The mechanisms are neither *necessarily* observable nor *necessarily* unobservable. Some philosophers specify that these mechanisms are indeed necessarily unobservable (George and Bennett 2005; Mahoney 2003) and thus knowledge of their existence can only be justified through their effects. Others are not so restrictive, acknowledging that the underlying structures and mechanisms are often unobservable but not requiring them to be so (Sayer 1992). One explanation for the debate over observability is the fact that the description of these mechanisms is “often bound to contain concepts that do not occur in empirical data”, which essentially makes them “typically unobservable” by humans (Bunge 2004). Other philosophers have described these mechanisms as elements of an intransitive dimension of reality that are “often unobservable” (Keat and Urry 1982) or “may well be unobservable” (Mingers 2004). Bhaskar (1998) argues that it is rare that such mechanisms “are actually manifest and rarer still that they are empirically identified by men... They are not unknowable though knowledge of them depends upon a rare blending of intellectual, practico-technical and perceptual skills.” (pg. 34-5)

These mechanisms may ultimately be empirically identifiable as new instruments or measures are developed in subsequent research or subsequent phases of a single research program. However, their existence as well as the effects which they produce may be sufficient as explanations of a given outcome without the capacity to directly measure or observe them. An example of this is the existence of viruses and their capacities to carry diseases, which was hypothesized far in advance of the development of powerful microscopes and other instruments capable of providing visual evidence of their existence and actions.

Multiple Possible Explanations

The events studied in a given research program are the result of the enactment of a given set of mechanisms. In many cases, there will be multiple possible sets of mechanisms which may combine to produce the observable

experiences. Because CR acknowledges that the underlying structure and mechanisms are situated within an open system, the elements which comprise a given structure are subject to the influence of a wide variety of possible external effects. This influence may alter or counteract the effect of a mechanism realized in different time periods as new contextual conditions are encountered. As various combinations of these mechanisms are hypothesized, it may be possible to arrive at multiple explanations of an event that are subject to both multifinality (similar initial conditions and mechanisms leading to varying end effects) and equifinality (dissimilar conditions and mechanisms leading to similar end effects). As such, any explanation of observed outcomes occurring within any complex open system, including social systems such as organizations or business networks, requires a deep examination of a relatively large set of structural and contextual factors in order to tease out multiple possibilities for the combined effects of multiple mechanisms. Thus, care must be taken in identifying the effects of hypothesized mechanisms and eliminating “what will always constitute a plurality of possible causes in open systems” (Bhaskar 1993, pg. 133).

The resulting analysis attempts to validate or support the individual and interacting effects of these hypothesized mechanisms with respect to empirically observed events. This competition between alternative explanations emphasizes a pragmatic basis for comparison. Previous literature has identified three criteria for evaluating the ‘best’ explanation: *consilience*, or the ability to explain more facts than alternatives, particularly beyond the context in which the mechanisms were identified originally; *simplicity*, in terms of the fewest assumptions and scope constraints required by the theory; and *analogy*, or the use of familiar ontological elements (i.e. structures and mechanisms) from existing explanations (Thagard 1978). Thus, the ‘best’ explanation we can identify at a given point in time is the set of mechanisms which may combine to generate the most accurate and understandable, but simplest representation of the ‘real world’, recognizing that tradeoffs may be necessary between these criteria in assessing rival theories in practice.

Critical Realism Methodological Principles

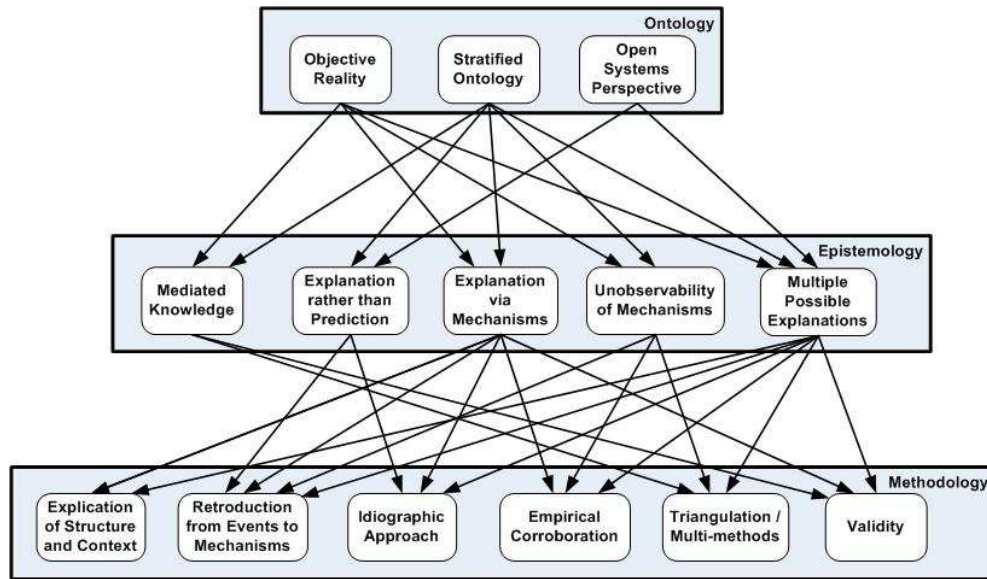


Figure 1: Key Relationships between Ontological, Epistemological and Methodological Principles

The methodology, or practical means by which we attempt to understand the world (Trochim 2001), chosen to conduct a research project must be consistent with the ontology and epistemology underlying it. Taken together, these three philosophical aspects comprise a researcher’s theoretical paradigm or framework (Lincoln and Guba 2000), which guides the researcher’s beliefs and feelings about the world as well as the manner in which it can be understood. The ontological and epistemological assumptions of the critical realist paradigm have necessary implications for the methodology applied to explicate a phenomenon of interest. Consistent with our focus on case study research, we describe a set of methodological principles that inform the selection, deployment and interpretation of methods appropriate within the CR paradigm. Based on an in-depth review of the CR literature and our experiences conducting CR-based case study research, six methodological principles are identified that are derived directly from these ontological and epistemological assumptions. Each author has conducted a longitudinal

CR-based case study that produced detailed explanations of causal mechanisms behind the resilience of open-source software ecosystems (Wynn 2007) and the coordinating process in IT governance (Williams 2007). The methodological principles and the key ontological and epistemological relationships are presented in Figure 1.

A number of researchers have proposed models describing the process of creating causal explanations following the tenets of CR. Initially, Bhaskar (1975) proposed the RRREI model which includes the stages of resolution, redescription, retroduction, elimination, and identification. This model was oriented towards the natural sciences. He later revised the model for the social sciences as DREI which includes the stages of description, retroduction, elaboration and elimination, and identification (Bhaskar 1986)³. These models have been reconciled (Collier 1994), and extended to include additional stages (Danermark et al. 2002). The methodological principles presented here are not a refinement to prior stage models or a normative recommendation for a specific CR-based case study methodology. However, the principles are consistent with the various models proposed for developing causal explanations, and in application, these principles are likely to transcend any particular methodological approach to CR-based research and will be applied across multiple stages in these models.

We use the term principle in a manner similar to Klein and Myers (1999). CR is a relatively new philosophy for conducting research in the social sciences, supported by a diverse body of literature. We seek to offer general guidance to IS researchers in the form of fundamental ideas derived from the core assumptions of CR to assist in conducting and evaluating research based on this paradigm. Each principle is described and related to the core ontological and epistemological assumptions of CR. Then, we analyze its application relative to recent studies in the IS literature. A summary of the principles is presented in Table 3.

Table 3: Summary of Methodological Principles for Conducting CR-based Case Study Research

Methodological Principles
Explication of Structure and Context: Identify and describe key components of the social structure and its contextual environment including components parts and their relationships, resources, rules and roles, significant actions (agency), and the cultural system of the target environment.
Retroduction from Events to Mechanism: A creative process which posits the existence of causal mechanisms that must exist within a social structure to produce the phenomenon of interest.
Idiographic Approach: Analyzing a particular case or limited number of cases in explicit detail to investigate the causal processes in terms of individual, structural and contextual influences which produced observed events.
Empirical Corroboration: Use data from empirical observations to ensure proposed causal explanations are clearly and accurately described in terms of generating outcomes within the given context, and offer better explanatory power than other potential mechanisms that have been identified.
Triangulation / Multi-methods: Using multiple perspectives in the form of multiple data sources, theories, investigators and methods to avoid potential biases in the research process.
Validity: Ensuring the quality of the hypothesized explanations is sufficient to allow readers to accept the conclusions reached within a given research project. This incorporates four dimensions including descriptive, interpretive, and theoretical validity and generalizability.

Explication of Structure and Context

The description of causal tendencies, i.e. the explication of mechanisms which generate experiences and observed events, is central to CR. Components of the structure, variations in contextual influences produced in open systems, and potentially other activated causal mechanisms interact to produce a highly complex causal chain leading to the phenomena of interest. A common focus of CR case study research is “identifying the structures whose combined states result in the exercise of agential powers, which bring about the outcomes which need explaining,” (Carter and New 2004, p.14). As such, explication of these components of the social structure is highly recommended for a complete understanding of the social system being investigated. Explanation includes unpacking this interplay between resources, structure and agency, and its environment. In addition to an elaboration of the rules, resources,

³ See Collier (1994) and Steinmetz (1998) for a more comprehensive discussion of the RRREI and DREI models.

roles, and relationships that comprise the social system of interest, CR-based researchers should explicitly discuss the properties of the components which combine to produce the emergent properties of the structure as a whole.

Explicating the structure and context involves breaking down the phenomena into its constituent parts and describing their relationships. We begin with rich descriptions of the complex and composite events (Danermark et al. 2002). We also describe the events, component parts and relationships in terms of existing theories and frameworks that provide leverage for potential explanations (Bhaskar 1975). The process of explicating the structure and contextual environment exposes potential causal factors, e.g. the fundamental properties and tendencies to do certain things, and their relationships specifically related to the object of study. A variety of methods can be applied to this process within longitudinal case study research to identify, describe and relate the structural components and contextual influences involved. A thorough discussion of these methods is beyond the scope of this paper, however one may think in terms of data reduction and presentation (e.g. Miles and Huberman 1994), stratified and template coding (e.g. Glaser and Strauss 1967; Strauss and Corbin 1990), and other widely accepted techniques in case study research (e.g. Eisenhardt 1989; Pettigrew 1990).

A full accounting of the powers and liabilities derived from the social structure may prove to be extremely complex, if not unwieldy, as we transcend levels of explanation. Parsimony, and limitations of time and resources, may dictate that one must refrain from a complete description of the structural parts and contextual influences comprising a specific research project, instead focusing on those parts which are most relevant for the given research objectives. Thus, we further suggest that this discussion be limited where practical to the structural elements and contextual influences which provide the most explanatory relevance with respect to a given phenomena or event. Certainly other properties may be useful for the purposes of identifying and eliminating rival explanations, so there must be a balance of parsimony and completeness in order to support the explanatory validity of the resultant theories or hypotheses explaining the phenomena of interest.

An excellent example of explicating the structure and contextual influences which give rise to and activate causal mechanisms is presented in Morton's (2006) longitudinal case study of strategic information systems planning (SISP) in a multi-divisional public-sector organization. A very rich case description is presented along with an explicit and detailed analysis of the social structure highlighting three specific relationships that which provided the basis for manifestation of the causal mechanisms. In each case, the structural elements were identified in terms of the departmental units and how they were related, the operational purview and autonomy of each unit, the relationships of overall governmental policy and department objectives with the individual units. The analyses of three key structural relationships offer an explication of how the various mechanisms emerged from the different levels of the social structure.

Retroduction from Events to Mechanisms

The principle of retroduction from events to mechanisms emerges from the critical realist focus on explanation, the use of causal mechanisms as the basis for this explanation, and the knowledge that these causal mechanisms may or may not be observable empirically. In retroduction, "we take some unexplained phenomenon and propose hypothetical mechanisms that, *if they existed*, would generate or cause that which is to be explained," (Mingers 2004, pg. 94, emphasis in original). Retroduction is largely a creative process for the researcher in which various explanations are proposed which describe a causal mechanism, set within a social structure, that must exist in order to produce the observed events. In essence the researcher conducts what Weick (1989) described as 'thought trials' to identify and describe the elements of the causal mechanism and the contextual influences responsible for its activation. The retroduced mechanism presents a logical argument explaining how the phenomenon of interest came to be. In other words, we seek to answer the question "*What properties must exist for [the phenomenon of interest] to exist and to be what [it] is?*" Or...more briefly: What makes [the phenomenon of interest] possible?" (Danermark et al. 2002, emphasis in original, p.97).

Specific guidance for retroducing mechanisms is problematic at best given the inherently creative and inductive nature of the process. The objective is to identify the most complete and logically compelling explanation of the observed events given the specific conditions of the contextual environment. Retroduction is likely to occur in an iterative manner during the stages of data collection and analysis involving corroborating interviews, high-order coding, within and cross-case analyses, and process modeling.

An example of retroduction in IS literature can be seen in Volkoff et al (2007). The authors applied the intensive process of open, axial and selective coding from grounded theory to generate a CR-based process theory of

technology-mediated organizational change. Specifically, the authors identified the embeddedness of organizational routines, roles and data into the enterprise system as the key mechanism which explains the observed organizational changes over time. The mechanism of embeddedness, which emerged from the intensive analysis process, describes how and why each embedded organizational element takes on a material aspect which fundamentally alters how employees performed their work.

Idiographic Approach

Research can either be nomothetic, that is concerned with discovering some common properties and general patterns associated with a population as a whole (Sayer 1992), or idiographic where the focus is on how a particular set of circumstances evolved in a particular case or a limited number of cases. While nomothetic research may adopt the case study method, case study research in IS and organization sciences is typically idiographic. The idiographic case identifies distinct events within the context of a specific setting, with each event being investigated individually and temporally to identify the effects of environment, context, structure and individual influences. In CR terms, the purpose of this analysis is to investigate the causal processes which have produced a given set of events and the structural and mechanistic elements that combined to generate them. The emphasis is on the intensive study of a limited number of cases, often a single case, in an attempt to build an explanatory theory that matches the empirical facts as closely as possible (Sayer 1992; Tsoukas 1989). This intensive study of a particular setting often results in an in-depth, contextually relevant analysis of a complex organizational process (Bengtsson et al. 1997). In so doing, idiographic studies are effective for providing concrete explanatory details regarding a limited number of events. As a result qualitative, idiographic studies are the dominant approach to CR research because of their ability to enable researchers to develop detailed context-sensitive causal explanations of specific phenomena.⁴

The realist case study articles published to date have typically been idiographic by design. For example, Kirsch (2004) examines the control settings occurring within two case studies of organizations engaged in the design and implementation of custom developed information systems projects. The resulting findings may thus be limited in scope to other organizations engaged in similar projects (pg. 393), but the theoretical discussion of control changes across the life of such a project are clearly relevant and applicable to the two cases investigated by the researcher.

Empirical Corroboration

The causal mechanisms identified through retrodution are hypotheses about the real, those things that may not be directly observable but that must exist to explain observed events. We are likely to be confronted with a number of causal explanations which explicate the phenomenon of interest. “[It] is the job of substantive science to discover which [mechanisms] actually do [exist],” (Bhaskar 1975, pg. 146). Validation of these knowledge claims includes the empirical search for either the mechanism itself or its effects. Thus we seek to use data from our empirical observations to assess the proposed causal explanations from two perspectives: 1) confirming that the proposed mechanism is clearly and accurately described in terms of generating outcomes within the given context, and 2) offers better explanatory power than other potential mechanisms that have been identified. Bhaskar describes this as the process “in which the reality of mechanisms postulated are subjected to empirical scrutiny,” (1975, p.15).

Empirically, CR researchers seek to corroborate the extent to which the causal explanations hold within the context studied (Sayer, 1992) by using the full spectrum of data describing the social structures, conditions, agency and events. The application of accepted analytical methods, compelling logic, creativity and intuition to the empirical data generates confidence that the hypothesized theoretical mechanisms approximate the real social structures. This may involve assessing the activation and operation of the causal mechanism from the perspectives of multiple participants involved in the observed events. Researchers may also evaluate the extent to which the proposed causal explanation holds across multiple cases and events within a given or similar context. One means of corroboration is to identify related events that should have occurred, related to the event that is the focus of study, if the proposed mechanism existed and was activated. To the extent that study data confirms the related events, the proposed causal mechanisms are corroborated. It may also be appropriate to evaluate the explanatory potential of the proposed

⁴ A detailed examination of CR-based nomothetic research designs is a potential subject for future research. See de Vaujany (2008) for an example.

mechanism based on how actors' perspectives change over time by testing and refining the description of the mechanism based on longitudinal data.

This last point emphasizes the value of longitudinal research within the paradigm of CR. Understanding changes over time is instrumental to unwinding the specific nature of the social structures, capturing the full range of contextual influences involved in activating the causal mechanisms, and explicating how and why the mechanisms bring about the observed events. Thus, methodologically we can use the unfolding of events temporally and longitudinal data to corroborate the proposed mechanisms by developing confidence that we have captured the essence of the mechanism and its efficacy relative to alternative explanations.

In order to gain confidence that hypothesized mechanisms approximate the real, we seek to apply rigorous empirical scrutiny. The description of a mechanism is a statement of causes for some empirical event. Runde (1998) offers a checklist for testing these causal explanations. This checklist of four key questions is presented in Table 4. Other criteria could be used to guide empirical corroboration. However, by applying the proposed checklist to the mechanisms identified through retroduction, we can gain greater confidence that the proposed mechanisms provide causal explanations of empirically observed events, provide thorough explanations, and address the full context of the generative structures underlying the mechanisms.

Table 4: Checklist for testing mechanisms (derived from Runde 1998)

Causal Test Question
Are the causal factors of the phenomenon actually manifest in the context?
If the causal factors were part of the context, were those factors causally effective?
Do the causal factors provide a satisfactory explanation to the intended audience?
Does the proposed mechanism provide causal depth?

The description of the research design, the data analysis and the application of prior theory in Kirsch's (2004) article on control methods in IS projects provides a robust example in IS research of empirically corroborating proposed causal explanations. Previous theory was used to inform the analysis of control modes and contextual factors that influence control choices. Temporal bracketing of events was applied to expose causation of why control methods changed at project phase transitions. A comparative case design with literal replication permitted Kirsch to conduct within case and cross-case analysis in two organizational settings to test empirically the proposed mechanisms. Longitudinal data collection involving a variety of project participants supported rich and consistent explanations generated from multiple perspectives. Finally, the analysis involved a variety of techniques including stratified coding as recommended by Strauss and Corbin (1990) and multidimensional matrices as per Miles and Huberman (1994) to expose causal factors, develop the full causal explanation and corroborate the proposed causal mechanisms. The proposed mechanisms provide a causally specific, deep and satisfactory explanation of how and why controls change across project phases.

Triangulation and Multi-method Approaches

CR posits both the existence of an objective reality that can only be fallibly accessed by humans, and the ability of science to approach this reality in a hopefully progressive manner. The use of triangulation in the conduct of research is consistent with these core assumptions and the practice of science. The purpose of triangulation is to control for the influence of various biases on the research process and the results generated by the process. Four ways in which this can be done is by using various combinations of data sources, theories, investigators, and methods in the conduct of a program of research (Denzin 1978). Data triangulation involves the collection of data from different participants, times, and places. Multiple data sources can be useful for avoiding any bias that may result from interpreting the responses of a single class of participants. Theoretical triangulation includes the investigation of empirical data using alternative theoretical perspectives, thus enabling the researcher to explore rival explanations. Theoretical triangulation can be utilized either at the outset of a research project as the initial conceptual frameworks are created or as the resulting hypothesized mechanisms are identified, or both (Healy and Perry 2000). Investigator triangulation reduces any personal biases emanating from the researcher(s) that may otherwise influence the interpretations applied to a given set of data (Denzin 1978).

A CR-based case study should ideally include a comprehensive approach to triangulation, including as many types as possible that are appropriate for the phenomenon of interest and the particular “why and how” questions being investigated. At a minimum for case study research, this should include methodological triangulation. In so doing, the researcher avoids examining the phenomenon through a limited viewpoint, instead opting for wider perspective (Mingers 2004). However, the ability to combine these methods can be problematic due to cultural, psychological feasibility, and practical reasons (Mingers 2001). Thus, researchers must carefully weigh the potential incremental benefits of richness versus the potential costs of complexity resulting from the deployment of multiple methods of triangulation. To date, existing CR-based case study research in MIS has not fully embraced comprehensive triangulation techniques. This highlights the difficulties and costs associated with such techniques.

Volkoff et al (2007) included multiple data sources including informants at different levels of the organization, different functional areas, and different locations. Data was also captured from interviews, participant observations, and informal conversations. To address investigator triangulation, the authors each participated in the interview process and the subsequent coding of the transcripts. The authors discuss alternative theories, but not to the degree of an empirical analysis of the existing data from these perspectives. Kirsch (2004) also included data triangulation in the form of multiple respondents and a review of project data. The author cites Yin (2003)’s recommendation for employing multiple sources of evidence as one means for increasing construct validity as the rationale for their data collection efforts. Additionally, the author describes the use of a scribe to assist in the data collection and analysis efforts. We can thus identify in both studies a limited degree of triangulation, encompassing data-, investigator-, and within-methods triangulation. However, this limited approach to triangulation does not detract from either study in terms of richness or explanatory power.

Validity

The concept of validity is concerned with the best available approximation to the truth or falsity of a given proposition or inference (Cook and Campbell 1979; Trochim 2006). Based on the critical realist paradigm as presented so far in this paper, we can restrict our concern to an assessment of the approximate truth of the proposed mechanisms and the causal explanations they entail. Our focus is thus on ensuring that the quality of the hypothesized explanations is sufficient to allow the reader to accept the conclusions reached within a given research project. Thus, the design and conduct of the research must be capable of addressing and nullifying any issues that would otherwise threaten our ability to draw valid inferences about the observable events we seek to explain. The emphasis given to validity as a separate principle is intended to be indicative of its transcendent nature with respect to the other principles rather than as an afterthought to be considered in isolation. Certainly, much of the value of triangulation and empirical corroboration includes their contributions to the overall validity of a research effort.

Based on its clarity and fit within the ontological and epistemological guidelines proposed within the framework developed in this research, we propose to use the typology defined by Maxwell (1992) as the base criteria for evaluating the validity of CR-based case study research (see Table 5)⁵. We do not claim that these are the only appropriate criteria for all CR-based research, only that these are more closely aligned with the philosophical paradigm presented here. Frameworks such as Leininger (1994) or Healy and Perry (2000) may be employed gainfully within a specific CR research program, in accordance with the specific wishes of the researcher.

The potential threats to each type of validity can be addressed by the design of the research study itself. Table 5 identifies several possible means for addressing these threats within CR-based case studies. For instance, participant checks (enabling the participants to review transcripts prior to analysis) enable the researchers to ensure that the subjects’ words and meanings are faithfully captured. Enabling the participants to review the coding categories and findings further enables the researchers to be assured that the meanings they interpret from the data are consistent with what the participants intended.

The theoretical validity of the explanations resulting from a given research study can also be evaluated in terms of their ability to describe the causality linking a given mechanism to the observable events (Runde 1998). Criteria of evaluation are discussed in the section on empirical corroboration.

⁵ We exclude evaluative validity as this is not typically of central concern in MIS research.

Table 5: Validity Typology for CR-Based Case Study Research (Maxwell, 1992)

Validity Type	Description	Possible Means for Addressing Threats
Descriptive	Accuracy of the researcher's account of observable words/actions	Interview recordings/transcripts; participant checks; multiple observers where feasible; triangulation
Interpretative	Redescription of meaning of participants' words/actions by researchers	Participant checks; intercoder reliability tests; participant review of findings; multiple informants
Theoretical	Validity of constructs and relationships used as explanation	Expert or participant review of coding categories; comparison to alternative theories; Causal evaluation of explanations; triangulation
Generalizability	Extent to which results can be applied to settings other than those studied	Purposive replication logic; contextual analysis

Volkoff (2007) addresses several of the validity claims listed above through the research design employed. The authors recorded and transcribed interviews and observation field notes captured from a broad theoretical sample of participants across the organization to ensure that the meanings of the participants were being captured accurately and meaningfully. The authors used multiple observers and coders to enable a more faithful interpretation of the participants' words and actions. The authors description of the process by which they arrived at the concept of embeddedness and the relationships/effects which arise from the embedding of organizational routines into the enterprise software (p. 838) provide an explanation of how they arrived at this explanation. Elaboration of the consequences of embeddedness on organizational change, as well as a comparison to alternative theoretical frameworks (p. 845) further defines the concepts and relationships of such a theory. The authors acknowledge that their study has limited generalizability beyond the current setting, but recognize that similarities across the entire class of enterprise software make the resultant theory "likely to apply to other installations," (p. 846).

Conclusions

This paper makes several contributions to IS research. First, we have identified and explicated the core ontological and epistemological assumptions of CR, including an attempt to differentiate corresponding assumptions of positivism and interpretivism. In so doing, we have established a reference base which adherents of each paradigm can utilize as they attempt to gain an understanding of an alternative viewpoint. Second, we have identified a set of six methodological principles which are consistent with and derived from these assumptions. Although CR is potentially applicable to a wide range of methodologies, we have restricted our proposed principles to case study research, is particularly well-suited for CR-based attempts to develop explicit causal explanations of the complex social, organizational, and interorganizational phenomena encompassing the IS field. Finally, we have demonstrated the value of the principles and how they can be applied in evaluating IS research following the CR paradigm.

The methodological principles presented are not intended to be viewed as exclusive doctrine with respect to the application of critical realism to MIS research. Some of the principles presented highlight the challenges of adopting the CR paradigm for conducting case study research in IS due to the complexity the underlying concepts and lack of specificity in specific methods to operationalize the principles. Other researchers may wish to enhance the principles identified in this article or to propose additional principles toward the conduct of specific research projects. This is especially true for research conducted under alternative forms of realism (e.g. scientific, structural, convergent), as our focus has been on satisfying the assumptions of mainstream critical realism. Also, they are not presented as a set of step-by-step procedures for designing and executing CR-based research. Rather, they are presented as general guidance for researchers adopting the critical realist paradigm toward the conduct and evaluation of explanatory case study research within MIS.

The CR paradigm offers significant opportunities for developing explicit causal explanations of complex phenomena in Information Systems research. It is our hope that this article will entice other researchers to explore critical realism more closely as a means to further develop additional knowledge of the causal factors impacting the MIS field in organizational practice.

Acknowledgements

We would like to express our thanks to Jo Ellen Moore, David Salisbury and Marie-Claude Boudreau for reviewing prior versions of this paper and making very helpful suggestions to improve our work. Likewise, we appreciate the very insightful comments from the ICIS reviewers, associate editor and track chair.

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