

# ***Arguments for the adoption of a heuristic approach to IS Research***

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## **Abstract**

*The concept of heuristic developed by philosophers of science depicts a theoretical way of investigating the world of models and the problematic relations models may have to other models, to theories, and to empirical data. The heuristic is a set of abstractions elaborated as stories, interpretations, speculations, metaphors, and other forms of abstract speculations. The heuristic is a device for connecting entities through problem-based methods that allow for the assessment of the validity of theory. In this paper we describe a set of heuristics as a guide for IS research to develop a progressive problem shift. Positive and negative heuristics as a guiding framework in terms of evaluating a hypothetical critical realist research program are developed and presented as a set of methodological rules for the establishment of a progressive problem-shift.*

**Keywords:** Research, Theory, Heuristic, Critical Realism, Philosophy, Sophisticated Falsification

## **Introduction**

In this paper we agree with Lakatos that if the field of IS research is to develop a progressive problem shift then it ought to maintain a core of theory from which auxiliary theories are derived, and that theories consist of a core of hard propositions and a periphery of protective propositions. We argue that a field, when it exhibits characteristics of a positive problem shift, has core theory that provides conditions for the formation of original or unique theory. Where there is a progressive problem shift the pragmatic value of good research is, as James (1909) says, the cash value of those theories that have led to practical consequences that benefits humanity.

A heuristic provides an abstract guide for a research program. A research programme is the sum of scientific achievement rather than isolated hypotheses and the result of many sub-processes of inquiry, testing and dis-proofs (Lakatos 1970). A single research programme may span more than one field of research. In IS it is common for research programmes to involve researchers from other fields. Mingers (2001) says that IS provides a nexus for diverse research fields that range from technology to semiotics. A problem arises from the introduction of differing views from various traditions. Lakatos (1980) says that if these views are merged to build some ad hoc theory then the research programme runs the risk of generating a negative problem shift. That is, the research programme ceases to be empirically progressive and is no longer predictive in successive hypotheses (Lakatos et al. 1999).

Another problem that occurs is the use of language and differing definitions of concepts as applied in competing fields. Quine (1960) says our facility for capturing the concept of some object as a phrase is tied to the complex of understandings, experiences, and contexts a person holds at the time that they encounter the object, but that phrases are further affected by the environment in which the object is situated. Thus, a seemingly similar object may elicit a different phrase when encountered by the same person but in a different environment, at a different time when they have different experience, or by a different person at the same time and place or at a different place or time. Therefore, we state that a heuristic is spatiotemporally dependent.

The elaboration of a heuristic presents the opportunity for many possible abstract speculations to act as guides, thus a research programme contains 'methodological rules.' There are those that instruct the researcher on what paths to avoid ('negative heuristic') and those to pursue ('positive heuristic'). We argue that the positive heuristic has pragmatic value as a guide towards a progressive IS research program. To illustrate the formation of positive and negative heuristics we shall examine a hypothetical case of a research programme that adopts Critical Realism. Morton (2006b) says that Critical Realism is a philosophy of social science.

## **Research Programmes**

Lakatos (1970) says that a research programme ought to be seen as the sum of scientific achievement, rather than as isolated hypotheses. To this we would add, that a research programme that is the sum of scientific achievement also encompasses theories that either emerged from the efforts of researchers or were co-opted from other research programmes. A research programme typically contains a hard core, a protective belt of auxiliary hypotheses, and a heuristic (positive or negative) that guides the path the research programme will take. Take a research programme founded on Critical Realism (Bhaskar 2009), which is a theory of knowledge or epistemology, in which there exists a reality that is outside human perception, and that causative events may therefore be unobservable. A core idea of Critical Realism is that understanding of the structures that generate such unobservable events provides the basis for understanding the social world. For example, a researcher is required to observe an experiment with the understanding that events they are measuring are caused by unobservable laws and mechanisms. Critically, the experimenter tries to see the distinction between what exists in the 'real,' the 'actual,' and that is shown to exist through evidence provided by empirical research. The core theory in a Critical Realist research programme, that there is some knowledge that is unobservable and therefore cannot be measured directly in an experiment, shifts disputed theory into auxiliary hypothetical terms such that evidence must be provided against that which can be generated empirically. Understanding of the laws and mechanisms that cause phenomena to exist grows as disputed theory is improved.

A research field may be composed of multiple research programmes. For a field of research to remain healthy and progressive - in the sense that it is generating new research, new theory, and that it is growing epistemologically - it holds that it must contain a range of research programmes that may be in a progressive or degenerative state. For an individual research programme in a field of research to be considered as progressive, it ought to demonstrate a progressive problem shift. That is, the research programme has a series of hypotheses that replace each other with the passing of time and that result in an increase of knowledge (Lakatos et al. 1999). The research programme is empirically progressive, but if anomalies appear in hypotheses and they are not satisfied through alterations in subsequent hypotheses, then the research programme displays a degenerative problem shift.

We contend that it is highly improbable that a research field will contain only progressive research programmes. For a research field to be healthy it must contain a balanced mix of progressive and degenerative research programmes, and research programmes will contain a mix of weak and strong hypotheses.

Each field of research contains core theories that help to define the research programmes that comprise it. This is different from adopting, say, a multi-method approach to research such as that promoted by Mingers (2001). A theory within a research field ought to represent some novel set of facts to explain the occurrence of phenomena. As knowledge of phenomena increases or as new and novel facts are disclosed, then new theory is required to take account of them. In the case of the natural sciences, theories that explain spacio-temporal relations that exist between force and motion are well understood and accepted. These are core theories on which auxiliary theories about the nature and relations that exist in phenomena were built over time: they have predictive value.

## **The Critical Realist Research Programme**

For the purpose of illustrating the formation of a research programme within the research field of IS, and one that illustrates the impacts of a positive and negative heuristic, we have chosen to use a hypothetical Critical Realist research programme. The hypothetical research programme is one that is based on actual Critical Realist research programmes and contains elements that are held to be reasonable in their appearance in the programme. Critical Realism has been selected in this instance for the reason that it represents a mode of thinking for the researcher rather than a purely methodological approach.

In our hypothetical case, the researcher investigates the explanatory potential of Critical Realism by its application on a research programme concerned with some practical outcome (Peirce 1998), for example, broadband implementation. In order to understand the important social and physical aspects of the adoption process, the researcher argues for a meta-theoretical position that is supported by Critical Realism. To utilise the explanatory potential, the researcher invokes three Critical Realist frameworks proposed by Pawson and Tilley (2007), Danermark, Ekstrom, Jakobsen and Karlsson (2002) and Archer (1998). Danermark et al. (2002) describe the 6 stages in Critical Research programmes as a progression, from a concrete initial description through the application of abductive reasoning, making use of different theories and frameworks and leading to an analytical resolution. The researcher suggests that this abduction results in useful abstractions that can be used to understand the relationship between agency-micro and structure-macro. Furthermore, the researcher contends that the abduction results in an enrichment of their research programme, by enabling the invocation of core theories of various research programmes though intermediary auxiliary theories.

Archer's (1995) model presupposes the existence of social networks as an ensemble of structures and mechanisms, and a distinction between agency and structure. In response, the researcher contends that this distinction assists their research programme in understanding the relationships between technological innovation and socio-political concerns. Pawson and Tilley's (2007) model suggests that a typical Critical Research programme allows for a 'peopling' of a transformation model, by giving a greater focus to their patterns and expectations. In their model, Pawson and Tilley (2007) argue for a greater individual or micro participation than the methodology supported by Archer (1995) that focusses more on structure or macro.

The researcher incorporates the approach used by Dobson et al. (2011), who investigated the potential of utilizing Critical Realism as a core theory to guide their research programme. Dobson et al. advocate the

use of a mixed methods approach, utilising different frameworks powered by the research field's core theory and from other core theories. Due to Critical Realism's insistence on depth realism, their application of Critical Realism necessitates focal points of varying socio-economic perspectives. Thus, the research incorporates core theories from fields such as politics, anthropology, and economics. The mediation between the core theories of different research fields is performed by respective auxiliary theories, which introduce their contextual debates within the Critical Realist research programme.

## **Falsification of theory in Critical Realist research programmes**

The application of a Critical Realist research programme, within the context of an IS research field that encompasses core and auxiliary theories from other research fields, results in competing claims for paradigmatic worlds. Furthermore, Critical Realism Theory has as one of its core ideas, that there are three strata to natural and social reality: real, actual, and empirical. Within the strata are objects with causal power. While relevant core theory may be applied to the phenomena of social and natural sciences, applications across the strata must vary.

White (2002) says culture is the product of human social interaction, thus it is variable in its appearance. Studies of social situations tend to be localised, and descriptive or interpretive, whereas the natural sciences are based on universally accepted and generalised laws that hold true except in known circumstances. The surety of a core theory provides, for the natural sciences, predictive power that is lacking in the social sciences, as acknowledged by Dobson et al. (2011). The result of the disequilibrium between research fields that have allowed differing degrees of rigour is witnessed across the Critical Realist sanctioned strata. This leads to a research programme that contains simultaneously weak and strong hypotheses. At some point in the research programme the need to negotiate relative strengths of the hypothetical positions the researcher has derived from their abductive reasoning processes will arise, in order to establish truth in the observations the researcher has recorded. The process of negotiation suggests a need to filter positions and it is likely that, in some cases, some hypotheses will be found to be without merit.

Popper's version of strict falsification holds largely well in natural sciences where evidence can be corroborated and repeated (Popper 1959). As such, the laying down of a falsificationist criterion against a theory can be utilised to establish the veracity of a research programme. However, in an IS research programme – in this instance the Critical Realist's research project that yields both strong and weak hypotheses depending on the nature of the phenomena they describe - the adoption of falsificationism (naïve or sophisticated) as a core validating theory within the research field risks rendering the research programme itself false, with little possibility of appeal. The metaphysical aspects of the research programme, when inspected through the scientific lens, present particular problems of objective observability, but they retain descriptive and interpretive power in the social sphere. Moreover, the competing paradigms in the natural and social spheres of the Critical Realist's programme attempt to establish epistemological relevance through the application of idiosyncratic metaphysical principles, to separate truth from falsehood. From the Critical Realist viewpoint the research programme needs to address a two-pronged challenge: (1) that of losing the contribution of its core theories to the pool of knowledge, and (2) establishing veracity against two competing standards to counter the negative problem shift. Fox (2009) addresses this specific weakness when he says that Critical Realism is a philosophy that provides a unifying direction for the combination of a number of contributing theories, methods and tools. In combination, they reveal causal mechanisms and contexts that reveal required research outcomes: for quantity analysis software in his case. Fox asserts that Critical Realism is not in competition with other theories but that it provides methodological rules that govern the progress of a research programme.

The strength of a research programme is governed by how robust its core theories are. IS has adopted theories that deal with most aspects of human experience. Often those theories are used in combination to create new theories in order to gain greater understanding of phenomena and by so doing, build epistemological foundations for the development of new theory. Lakatos (1980) proposes that a theory, *h*, to be corroborated, needs to undergo a severe test of its validity using empirical methods. The question arises as to what is being tested, because a theory can never be proven wrong if there is one who demands that it be accepted (Quine 1960). Lakatos points to the evidence, *e*, upon which *h* is based such that a

theory,  $h'$ , acts as a touchstone theory. We argue that one theory or the other will show a greater propensity,  $p$ , to demonstrate an accurate portrayal of reality, thus  $p(h,e,h')$ .  $p$  is measured in any form of objective probability test and  $e$  is provided as a statistically reported form of  $h$  or  $h'$ . In other words, that  $e$  represents an abstracted form of reality described by  $h$ . The test for the Critical Realist engaged in a social research programme is to be able to provide evidence that is objective and can be abstracted as  $e$ . In strictly descriptive or interpretive studies this becomes difficult and the predictive power of theory is weakened or non-existent. For example, Fox (2009) seeks to demonstrate that the use of ICT in the analysis of factors that affect the productivity of cost management companies through the application of unstructured interviews. This appears to present a contra-view to the assertion that  $e$  is weakened. However, his research set out to illustrate the veracity of Critical Realism rather than to develop a hypothesis about ICT use in property cost management.

The core theories of a research programme are subject to attack at any time. Successful attack on a core theory may result in its falsification and this may cause irreparable damage to a research programme. For example, the Critical Realist researcher engaged in a social research programme runs the risk of having their core theories attacked because of the difficulty in having them corroborated. Any alternative hypothesis,  $h'$ , may be used to falsify or invalidate the researcher's findings and this may prove to have dire effects on the research programme. To be effective as an attack,  $h'$  must be more than a mere restatement of the facts or a denial of  $e$ . But, there is nothing to prevent the attacker from analysing the evidence from which  $e$  was derived and arriving at an alternative,  $e'$ ,  $p(h,e',h')$ , where  $e'$  is an alternative abstraction or world, built on the same body of evidence as  $e$ . It is probable that  $e'$  will find as much favour as  $e$ . What then is the researcher to do?

A theory cannot be exempt from attempts at its falsification. In a research programme, a distinction exists between core theory and accompanying auxiliary theories. Judging the merit of core theories in a research programme by subjecting its auxiliary theories to a validating theory, one that holds the authority to render the research programme false, is problematic (Lakatos 1970). For instance, a rejection of the Critical Realist researcher's core theories can hinder scientific progress or the possibility of future ad-hoc auxiliary theories that address anomalies. Auxiliary theories protect core theories from falsification by taking the brunt of attacks that might have been directed at the core. Thus, core theories in a research programme remain unscathed even if auxiliary theories are successfully attacked and falsified. Therefore, allowance must be given for auxiliary theories to be attacked and falsified.

## Constructing a Positive Heuristic

Judging the progress of a research programme through a historical lens provides an opportunity to regard any anomalies in auxiliary theories as attritive attempts in perfection instead of providing markers for the falsification of theory. The guidance a positive heuristic provides is as a safeguard against the downfall of the research programme itself. Instances of non-clarification in auxiliary theories, in the case of the of the Critical Realist research programme, can still yield results for the researcher. Gödel's incompleteness theorems show that no system is entirely internally consistent, thus it may be argued that it is not logically valid that a historical perspective ought to lend a positive heuristic to the research programme. However, by doing so permits a steering away from the justificationist methodology of applying varying degrees of internal consistency and evidentiary requirements, or arguments for parsimony through Occam's razor, to establish the truth in a research programme.

As a field of research, IS obtains of multiple disciplines to build theory, and those are applied through research programmes. The case of the multi-faceted Critical Realist approach represents a microcosm of the IS field, as it is influenced by methodological approaches derived from competing philosophical attitudes to reality, ranging from realism to positivism (Fox 2009; Morton 2006a). The involvement of the human actor in a technological sphere introduces new kinds of issues and produces hybrid quasi-objects with attributes that are empirical and tangible, as well as contextual and virtual (Sayer 1992). Theories dealing with complex IS artefacts may not be verifiable or falsifiable to the level a strict positivist may require (Peirce 1958), however, the inability to do so does not prevent progress towards constructing a positive research heuristic for the research programme.

Complex IS artefacts, such as the quantity analysis software described by Fox (2009), can be subjugated to the historical lens to prevent a temporal negative problem-shift from affecting the core research

programme. For instance, debate around the application and use of auxiliary theories surrounding the use of ICTs throughout the organisational hierarchy may range from its bounding, to organisational impacts, that can then be separated from other auxiliary theories. The division between auxiliary theories from core theory allows researchers from dissimilar fields to develop the discourse further: to build a progressive problem-shift. Moreover, the crafted historicity for the research programme allows for auxiliary theories to be introduced in the debate. Thus, the hypothetical Critical Realist research programme can exist in a possible discourse initiated by a positivist researcher and critiqued by a social constructivist. The aim of the positive heuristic is to provide guiding principles for researchers of either stripe towards a progressive enlargement of the research programme within IS.

Morton (2006a) says that Critical Realism is useful in those cases where a strict adherence to natural science methods may prove to be problematic. For example, he says it may be difficult to apply controlled experiments in the organisational context, where there are complex sets of relations or where results are not considered predictable. He says there is no prescribed method for conducting Critical Realism research. So on what basis does the researcher construct a positive heuristic ('methodological rules') for a research programme?

Critical Realist ontology and epistemology must align to methods that are applied in practice (Sayer 1992) so that objects that are perceived to be causal mechanisms are in-phase observations of reality. Pragmatically, the researcher bases their construction on those factors that can be measured or assessed objectively. Peirce (1958) says "in order to ascertain the meaning of an intellectual conception one should consider what practical consequences might conceivably result by necessity from the truth of that conception; and the sum of these consequences will constitute the entire meaning of the conception." While Critical Realism may provide the basis for developing epistemological or ontological frameworks for the understanding of phenomena, it does not do the same for the construction of a progressive problem-shift. To establish the conditions for a progressive problem-shift, the researcher must look elsewhere, and it is there where the researcher is obliged to construct a positive heuristic.

To construct a positive heuristic the Critical Realist researcher chooses to reflect on precedents presented in their data and build comprehensible frameworks. The researcher then abstracts the truth of them (both data and frameworks) and conceives of those abstractions as methodological rules that may be applied in future research endeavours. It is for this reason that Dobson (2001) says that case studies in Critical Realist research are important, that they provide the researcher with the opportunity to delve vertically into the subject and identify factors that lead towards the establishment of causal relations in observations between agents, culture, and social structures, which can be investigated with interpretive techniques. The researcher must be tasked with determining the truth-value of their results if they are to contribute towards a positive heuristic. It is not enough to simply point to objects and say "it is so," the researcher needs to build sets of relations with their objects and consider what implications are presented as a result. They must be guided by the 'methodological rules' they have constructed in their selection of objects and definition of relations.

For the Critical Realist researcher, the hypothetical case demonstrates that methodological rules are derived from instances where the programme delivers practically useful results, and supported by the Critical Realist frameworks. The six-stage framework described by Danermark et al. (2002) establishes a means by which observations are categorised as abstract concepts. Archer's (1995) model provides structures and mechanisms to facilitate the researcher's understanding of complex relations between technology and various socio-political phenomena. Pawson and Tilley's (2007) model facilitates the researcher's requirements as a Critical Realist researcher to maintain a focus on patterns and expectations exhibited by study participants. The approach advocated by Dobson, et al (2011) provides support for these heuristics. In the case, the researcher may feel confident about incorporating theories from diverse fields, such as politics, anthropology, and economics, with the understanding that there also exists the requirement to interrogate the theories in light of observations and evidence, through severe testing of the hypotheses.

## **Constructing a Negative Heuristic**

For Lakatos (1976), scientific discovery is more than just the application of logic (or in this case sociological reasoning) to science or the scientific method. Scientific discovery also involves the

application of heuristic to ensure that discovery proceeds and is not encumbered by the ancillary distraction of weak ad hoc theories. Thus, Lakatos draws from Polya (1945) who describes two types of argument: Where  $A \rightarrow B$  and  $B$  is false, then  $\neg A$  is concluded (a demonstrative syllogism); and,  $A \rightarrow B$  where  $B$  is true, then it follows that  $A$  is more credible (a heuristic syllogism). In the latter case, the falsification of core theory is not held through the simple presentation of contradictory evidence, but rather that a research programme seeks to be guided by principles, and that weak or strong ad hoc theories are regarded as more or less credible. This draws significant parallels to Peircean abduction that Aliseda (2006) defines as, a reasoning process invoked to explain a puzzling observation. Peirce (CP, 5.189) provides an example that illustrates a practical application of abductive logic:

The surprising fact,  $C$ , is observed.  
But if  $A$  were true,  $C$  would be a matter of course.  
Hence, there is reason to suspect that  $A$  is true.

Conversely, we argue that if fact  $C$  were observed and that it is surprising because it presents counter to our expectations, then we might have reason to question whether  $A$  were indeed true. Thus a potential demonstrative syllogism is represented as:

The surprising fact,  $C$ , is observed  
But for  $C$  to be a matter of course then  $B$  must be false  
Then there is reason to suspect that  $A$  is false

Therefore in constructing a negative heuristic (in this case the demonstrative syllogism), the Critical Realist researcher becomes aware of those instances where data ( $C$ ) are outside the scope of expectations and must decide on how to handle such anomalies. The researcher must consider the practical effects of their theory under threat ( $B$ ) and address the potential threat to the core theory that drives the research programme ( $A$ ).

In the case of the hypothetical research programme, core theories are provided from a range of fields that include politics, anthropology, and economics. As well, there are theories which emerge from fields with a strongly positivist foundation, such as electrical engineering and computer and information sciences. These fields come with associated auxiliary theories that come under attack, but they contain a hard core of theory that is protected. The question that emerges within the context of building a negative heuristic is, in a mixed methods research programme such as this, whether theories from one field that come under attack therefore threaten core theories in another field?

Lakatos (1970) tells us that a research programme must maintain an internal consistency and part of the work of the researcher is to ensure that competing claims for validation of theories from diverse fields are balanced against the overriding need to ensure a progressive problem-shift. The negative heuristic alerts the researcher to internal inconsistencies, for example, when political exigencies threaten the economic viability of the subject of our hypothetical case. In this case, the researcher redirects the modus tollens towards the weaker theories, and from those build a stronger core theory. The successful researcher, one that provides a progressive problem-shift, seeks to turn examples of counter-evidence around by resolving apparent anomalies in evidence.

Rather than the modus tollens being seen as a purely destructive influence on the research programme, a negative heuristic represents an opportunity for the researcher to create novel new auxiliary theory with which to further consolidate and strengthen core theory. Dobson et al. (2011) report that the application of Critical Realism “has proven to be difficult, partly because Critical Realism provides little practical guidance as to methodological development and even less guidance as to the role of technology within its complex arguments” (2011). However, Lakatos draws a practical distinction between method and theory, where experimentation is the means by which “sophisticated falsification adumbrates a new theory of learning” (Lakatos and Musgrave 1970), that is, sophisticated falsification creates a sketch outline for the creation of new theory. So, rather than a research programme becoming threatened through the appearance of internal inconsistencies as a result of conflicting theories from diverse fields, such occurrences provide the opportunity for the researcher to create novel new theory.

## Conclusion

We investigated a research programme carried out by a hypothetical researcher utilising three prevalent methodologies in the field of Critical Realism, to explore the role of heuristics within a Critical Realist research programme, and how a progressive problem-shift may be asserted. While the auxiliary theories and hypothesis utilised in a programme may be strengthened or disproved, the researcher's attempt at historicity allows for the strengthening of a core theory within the field of IS research. The Critical Research programme carried out by the researcher argued for a meta-research perspective, involving both underlying structure and agency, to construct a framework of understanding of the complex interplay of socio-political and technological issues. As such, the adoption of Critical Realism provides the researcher with grounds for their theories to be tested against the modus ponens as well to guide their research programme, by accepting a stratified reality.

To be progressive, research programmes need to stimulate growth of knowledge in areas of method, episteme, forecast, and so on. Adoption of a sophisticated approach to the acceptance and falsification of theory incorporates both a positive and a negative heuristic. In adopting Critical Realism as an approach and philosophy provides the researcher with a range of possible methods of experimentation to test weak auxiliary theories and thus to create robust core theory. Thus, in the research programme, increasing core strength creates a progressive problem-shift.

"Popper's methodological falsificationism is both conventionalist and falsificationist but he 'differs from the [conservative] conventionalists in holding that the statements decided by agreement are not [spatio-temporally] universal but [spatio-temporally] singular; and he differs from the dogmatic falsificationist in holding that the truth-value of such statements cannot be proved by facts but, in some cases, may be proved by agreement... The methodological falsificationist realises that in the 'experimental techniques of the scientist, fallible theories are involved, in the 'light' of which he interprets the facts. In spite of this he 'applies' these theories, he regards them in the given context not as theories under test but as unproblematic background knowledge 'which we accept (tentatively) as unproblematic while we are testing the theory'" (p. 106, Lakatos 1970).

The approach of the sophisticated falsificationist proposed by Lakatos is one that suits the Critical Realist researcher. The researcher who has chosen to adopt a sophisticated approach to the acceptance and rejection of theory in their research programme paves the way for weak theories to be refined and improved, through rigorous and severe testing by experimentation. This provides a progressive problem-shift, where the methodological approach that is often applied assumes a theory is correct, until such time that evidence has been brought to light that proponents of the theory can no longer support it.

The question regarding what action the researcher should take in the face of a research programme that exhibits conditions of a degenerative problem-shift is beyond the scope of this paper and will be addressed in a subsequent paper. This is an important issue and will tend along the lines of conservative, anarchic, and rational approaches to applying corrective measures to a research programme.

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