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Where Do Theories Come From? An Inference-to-the-Best-Explanation Theory of Theory Building (IBET)

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Abstract:

This paper presents a theory of theory building and testing called IBET that is based primarily on Lipton's 2004 book "Inference to the Best Explanation". First, IBET argues that theories are ideas invented (not discovered) by people to explain how some part of the world works. Second, IBET argues that the goal in theory building is to abduce from the available evidence (including data, the literature, and the theory builder's personal beliefs) an explanation that provides the researcher with their best understanding of why the phenomena of interest occur. Finally, IBET distinguishes between abductive testing of theories, where the information used for theory building is used for testing, and independent-data testing, where independently collected data are used for assessing the validity of a theory. In the last quarter of the paper, IBET is compared to three rival theories of theory building: (a) Grounded Theory, (b) Eisenhardt's theory building from case studies, and (c) Shepherd and Suddaby's recent advice on theory building. The conclusion is that IBET seems to provide a more in-depth, broad-scope, explanation of theory building than these rival theories.

Keywords: Theory, Theory Building, Theory Testing, Philosophy.

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1 Introduction

In a 1973 TV interview, Nobel-laureate physicist Richard Feynman was asked why scientists do research. His answer was: "It has to do with curiosity. It has to do with people wondering what makes something do something. ... What we are looking for is how everything works; what makes everything work" (Feynman, 1973). Consistent with Feynman's view, the philosophical stance of this paper is that *scientists do research because they want to understand how the world works*.

How do scientists gain this better understanding of how the world works? A broad-brush answer is shown in Figure 1, where the arrows mean "influences". Based on (1) *Information* gathered from many sources, scientists (2) *build* new theories to explain how the world works, (3) *test* to see whether the new theories are a good fit with both reality and the world's stock of knowledge, then (4) share their insights with the world. Note that in Figure 1, only the Theory-building step (step 2, in bold) results in new explanations of how the world works.

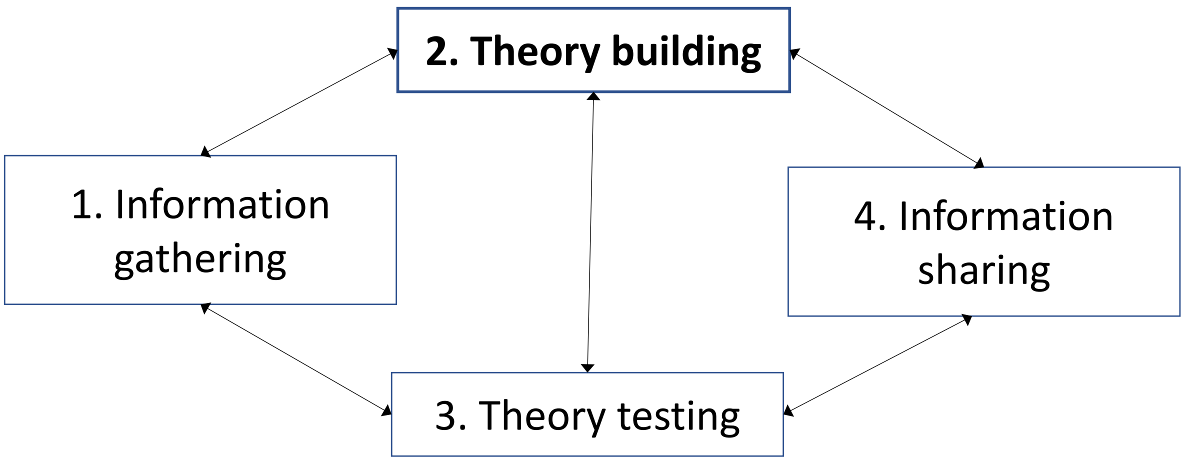

Figure 1. Key Research Activities

Given the importance of theory building to scientific endeavors, there has (until lately) been surprisingly little discussion or advice in the Information Systems (IS) literature on what theory building is or how to do it. When questions about research methodology—which includes theory building—are raised, IS researchers have typically turned to the management and social-science research literatures (e.g., Campbell and Stanley (1966), Glaser and Strauss (1967), Dubin (1969), Bacharach (1989), Eisenhardt (1989), Strauss and Corbin (1990), Sutton and Staw (1995), Weick (1995), Yin (2003), Tabachnick and Fidell (2013), Rubin and Babbie (2017), and Jaccard and Jacoby (2020) (listed here in chronological order)). These works provide guidance on what research is, what theories are, how to build theory, how to test theory, and so on. In particular, when theory building is discussed, scholars often reference "grounded" theory building (Glaser & Strauss, 1967) and Eisenhardt's (1989) theory building from case studies. Yet probably fewer than 10% of IS research papers claim to build theory this way. In the vast bulk of published IS research—which generally focuses more on theory testing than theory building, and where the "boxes and arrows" models tested are often presented "up front", near the start of the paper—it is often not made clear how theory building was done.

However, in the last decade, the situation has begun to change. In a recent flurry of papers, authors such as Weber (2012a, 2012b), Avison and Malaurent (2014), Compeau and Olivea (2014), Lee (2014), Rivard (2014), Mueller and Urbach (2017), Markus and Rowe (2018), Hassan, Mathiasen, and Lowry (2019), Hirschheim (2019), Niederman and March (2019), Rivard (2020), Lee (2020), and Mueller (2020) (listed here in chronological order) have reopened discussions about theory, theorizing, and theory building. Yet despite all the scholarly wisdom evident in the above-mentioned works (from management, sociology, and IS), none provides the depth of explanation of where theories come from that I have been searching for.

Thus, in a search for a deeper explanation, I turned to the philosophy literature hoping for answers. Philosophers have been asking questions such as "What is knowledge?", and "Where does knowledge come from?" since the time of Socrates and Aristotle (approx. 350BC), so they should have developed some pretty good answers by now. Here, at last, I found a plausible "deeper" explanation of theory building, at least from a scientific-realist/pragmatist perspective. That explanation builds heavily on insights from the philosophy-of-science literature on *abduction* and *inference to the best explanation* (IBE) (e.g., Peirce (1934), Harman (1965), Thagard (1978, 2007b, 2019c), Douven (2002, 2017), Lipton (2004), and Williamson (2016, 2020) (listed here in chronological order)). Of these works, Lipton's (2004) book, *Inference to the Best Explanation*, provides what is probably the most comprehensive and readable treatment of IBE, so it was selected as this paper's prime reference on IBE.

Developing the ideas above, the purpose of this paper is to answer the question: *Where do theories come from?* And the answer offered here is a new theory of theory building that builds heavily on insights from the philosophy-of-science literature on abduction and inference to the best explanation (IBE), particularly Lipton's (2004) book, *Inference to the Best Explanation*. These IBE-based insights are interesting because although they work with concepts such as *reality, concept, theory, explanation, cause, understanding*, and *test* that have been discussed by many of the scholars mentioned above, IBE approaches the topic of theory building from a more fundamental perspective.

Since the new theory presented below builds on IBE, it was decided to call it the "IBE Theory of theory building and testing", or IBET for short. As shown in Table 1, most of this paper (sections 2-5) is devoted to presenting details of IBET. The most important section is section 3, which provides a summary of Lipton's (2004) arguments. Once that presentation of IBET is complete, the last quarter of the paper (section 6) compares IBET to three strong rival theories of theory building: (a) grounded theory building, (b) Eisenhardt's (1989) theory building from case studies, and (c) Shepherd and Suddaby's (2017) recent advice on theory building. The purpose of these comparisons is to help readers assess IBET's contribution to knowledge.

Table 1. Sections and the Purpose of each Section in this Paper

Section heading	**Purpose of the section**	**IBET definitions and propositions discussed**
2. IBET's definition of "theory"	To present the definition of theory used in this paper. This definition does NOT come from Lipton (2004). It is NOT claimed that this definition is better than others, it is simply the definition used in IBET.	Sub-definitions D1-D7, Figure 2
3. IBE-based Theory of Theory Building (IBET)	To present a succinct summary of Lipton's (2004) theory of theory building, which he calls "Inference to the Best Explanation" (IBE). Lipton's is one of several philosophical works on abduction and IBE. It was chosen because it is both accessible and thorough. The four key definitions are of: IBE (D8), explanation (D9), cause (D10), and mechanism (D11).	Definitions D8-D11; Propositions P1-P6
4. Theory testing	To distinguish two different goals for testing during and after theory building.	Definitions D12-D14, Figure 3.
5. Summary	To summarize key points in IBET. Lipton (2004) does NOT use the term "IBET".	D1-D14, P1-P6
6. How Does IBET Compare to Rival Theories of Theory Building?	To help readers assess IBET by comparing it to three highly regarded rival theories of theory building from the social sciences.	
7&8. Contribution & Conclusion	To summarize the key "take away" messages in this paper.	

2 IBET's Definition of "Theory"

Since the term "theory" has been used by many different authors in many ways (Markus, 2014; Markus & Rowe, 2018; Hassan et al., 2019), those who use the term need to define what they mean when they use it. This section defines "theory" as used in this paper.

One way of defining the concept of theory used in this paper is shown in Figure 2. Figure 2 is an annotated version of Gregor's (2006, p. 630) Figure 1, showing interrelationships between her five types of IS theory. The arrows mean "necessary for" or "can sow the seeds for" (Gregor, 2006, p. 629). Highlighted in bold in Figure 2 is IBET's concept of theory. Since IBET theory is causal and testable, but not necessarily predictive, explanation, it is a supertype of Gregor's EP theory (which requires *both* explanation and prediction). Note that although IBET's concept of theory focuses on explanation, it does not correspond to Gregor's (2006) concept of a Type II Theory for Explaining. This is because testability "is not of primary concern" (p.624) in Gregor's (2006) Type II Theory. The percentages in brackets in Figure 2 are from Gregor's (2006) sample of 50 papers from two top IS journals in 2003-4. In that sample (Table 9, p. 632) she found that EP theory (a subtype of IBET theory) was the most common type of theory used (66%).

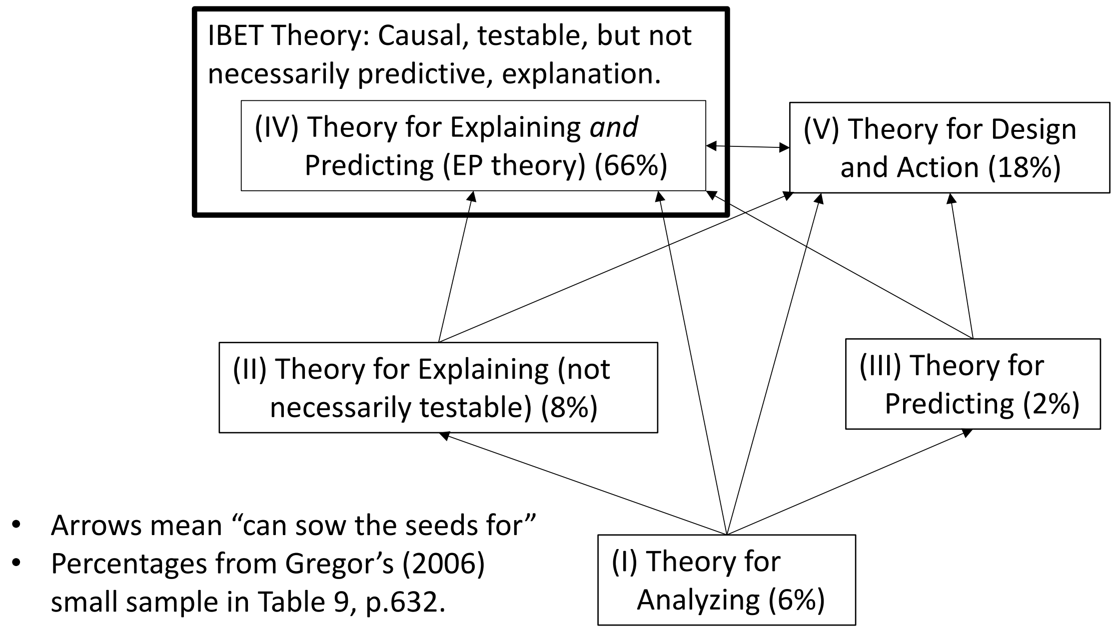

Figure 2. Gregor's (2006) EP Theory is a Subtype of IBET Theory (based on Gregor (2006, Fig. 1, p. 630)).

A second way of defining the concept of theory used in this paper is in words. To that end, the following bundle of concepts (numbered Definitions D1-D7 for later reference) partially defines the scientific-realist/pragmatist-based concept of "theory" adopted in this paper. This definition is consistent with, but not an explicit part of, Lipton's (2004) arguments. Of course, no definition can capture the full semantic richness of any concept (Laurence & Margolis 1999; Rosch 1999; Murphy 2004; Thagard 2019a, Ch. 4), but provided it is understood that definitions are *always* incomplete, attempted definitions and partial definitions can improve communication between author and reader.

D1: Theories are ideas (or bundles of ideas) invented by people to explain how some part of the world works.

Comments:

1. Definition D1 is a deliberate simplification of many more complex definitions with which the reader is probably already familiar. Its focus on explanation makes it consistent with Lipton (2004), Popper (1974, p. 197), Harman (1965), Salmon (1989), Thagard (1978, 2019c), Williamson (2016, 2020), and many authors in McCain and Poston (2017).
2. A concept very close in meaning to an IBET theory is a hypothesis. In this paper, a hypothesis is an untested theory or an untested proposition based on a theory. (The latter idea is consistent with Gregor's (2006, p. 628) usage when she says that researchers can "test hypotheses deduced from" a Type IV (EP) theory.) The essence of a hypothesis is that it is untested.
3. D1 deliberately does not mention prediction. Of course, it is often possible to make predictions based on the explanations that D1 calls theories (e.g., hypotheses for theory testing make predictions), but prediction is not treated as a defining characteristic of an IBET theory.
4. D1 deliberately does not mention testing (which is defined later in this paper, see D12-14). Although testing is an integral part of IBET, and authors such as Jaccard and Jacoby (2020, p. 27) say "Scientific theories are grounded in empirical tests of theoretical propositions", testing (or testability) is not treated as a defining characteristic of an IBET theory.

D2: Theories normally seek to explain regularities in the universe, i.e., how classes of things work not how single things work. For example, Barney's (1991) Resource-based Theory argues, at least implicitly, that in all firms the prime source of competitive advantage is control over scarce resources.

Comment: Despite D2, it is possible to restrict the scope of claimed applicability of a theory to a single thing (e.g., why did President Kennedy decide not to invade Cuba during the Cuban missile crisis?) (Allison & Zelikow, 1999)). The position taken in IBET is that any attempted answer to the latter question would be a theory (because it meets the requirements of D1).

D3: Theorists may claim universal validity for their knowledge claims, as many natural scientists seem to do, or they may limit themselves to knowledge claims about how some restricted part of the universe is thought to work. Restrictions on the scope of claimed applicability of a theory are called boundary conditions.

Comment: Lipton (2004) does not discuss boundary conditions; the concept comes from Dubin (1969), and is emphasized by Bacharach (1989), Gregor (2006), and Rivard (2020). Defining boundary conditions for theorized knowledge claims is important in the social sciences because institutions and social norms differ greatly in different social settings (e.g., in different organizations or countries) so theories valid in one context may not be valid in another. Within the scope defined by the boundary conditions, a theory is, however, normally posited to be universally true.

D4: Theories are not "discovered" in the sense that water might be discovered on Mars, because there are no theories "out there" waiting to be discovered. Rather, theories are creations of the human mind; they are the product of personal sensemaking.

Comment: D4 conflicts with the view of theory building implied in the title of Glaser and Strauss' (1967) "Discovery of Grounded Theory". In IBET, theory building is viewed as a creative human activity, not a discovery activity.

D5: Theories are never true in the sense that 1 + 1 = 2; they are just attempts by human beings to explain how some aspect of the world works. This means that theories are always subject to revision or even abandonment in the future (Kuhn 1962; Laudan 1981; Lipton 2004, p. 178; Worrall 1989, p. 104; Williamson 2020, p. 60) and can never be "proven" true.

Comment: D5 means that it never makes any sense to use the words "proof", "proven", or similar terms when discussing IBET theories. Rather, in IBET, the best we can hope for when testing a theory is to show that it appears to be a good fit with both (a) reality, and (b) the stock of human knowledge.

D6: It is helpful to talk about an individual's or the research community's confidence in the validity of a theory. Such confidence is an attribute of the would-be believer(s), not the theory.

Comments:

1. Initially, a theory may be pure speculation in some researcher's mind. At this stage, IBET says that it is a theory, but confidence in its validity is low. Eventually, after much research—by either or both of the original research team and other teams—a theory may be supported by massive amounts of evidence (e.g., Darwin's (1859) theory of evolution through natural selection). By this time, many people's confidence in the validity of the theory is high.
2. Consistent with Bayesian arguments (see Lipton, 2004, Ch. 8), as more evidence accumulates that supports a theory, confidence in that theory's validity rises (Worrall 1989, p. 105). Likewise, as evidence supporting deeper explanations of parts of a theory emerges, confidence in the original theory's validity rises (Thagard, 2007a). For example, the discovery of DNA provides deep support for Darwin's theory by revealing the mechanism through which traits are passed on to future generations.

D7: Acceptance of theories is a social phenomenon**.**

Comment: For example, for 40 years most of the earth-sciences research community rejected Wegener's (1912) theory of continental drift (Hallam, 1975). Yet today it is widely understood as an early formulation of the now almost universally accepted tectonic-plate theory (Thagard, 1992, Ch. 7). In this case, new evidence (e.g., Heezen & Tharp (1965)), made a critical difference.

The above definition, consisting of sub-definitions D1-D7, captures some of the constellation of concepts that philosophers and practicing scientists have often associated with the concept “theory”. It is not claimed that this definition is correct and that other definitions are wrong, nor that this definition is complete: in fact, the definition is extended by several concepts from Lipton (2004), namely, explanation, cause, and mechanism, presented in the next section. However, because of the huge diversity of views on what theories are, it is important that the meaning of the term “theory” as used in this paper is defined as clearly as possible. To that end, Figure 2 and sub-definitions D1-D7 constitute IBET’s initial definition of “theory”. Importantly, this definition (D1 in particular) is framed to be consistent with the philosophical concept of Inference to the Best Explanation, discussed next.

3 An IBE-based Theory of Theory Building (IBET)

We now return to the core question addressed in this paper: Where do theories come from? As noted earlier, an excellent answer to this question is presented in Lipton’s (2004) 200-page book *Inference to the Best Explanation* (IBE). Lipton’s thinking about IBE is summarized in the following series of definitions (D8-D14), one assumption (A1), one logical inference (L1), and six propositions (P1-P6). To begin, here is Lipton’s (2004) definition of IBE:

D8: Inference to the Best Explanation (IBE) means: “Beginning with the evidence available to us, we infer what would, if true, provide the best explanation of that evidence.” (Lipton, 2004, p. 1**)**

Comments:

1. The definition of “theory” in Figure 2 and D1-D7 was framed so that IBE, as defined in D8, is a synonym for “theory building”.
2. The concept of rivalry or Darwinian competition between various potential explanations is central to IBE (Williamson 2020, p. 64). Criteria for judging which explanation is best are discussed below (see P3).
3. When theory building, the “evidence” referenced in D8 consists of all relevant information available to the researcher, including self-collected data, insights from the literature, and personal beliefs (Thagard, 1992; Williamson, 2020). Such information is, of course, interpreted by the theory builder(s) with all the problems that this entails.
4. The type of inference in D8 is a type of induction, called *abduction* (Douven, 2017). Another type of induction is enumerative induction, which is a knowledge claim based simply on extrapolation from what is already known (e.g., “The sun has risen every day in recorded history, therefore, I predict it will rise tomorrow”). The distinction is that enumerative induction makes no attempt to provide an explanation of why the prediction is made, it just predicts more of the same, whereas abductive induction requires an explanation.
5. As Popper (1974, p. 90) was at pains to point out, all inductive inferences assume the uniformity of nature (Hume, 1777), and all are therefore subject to refutation in the future. This refutability is not a threat to IBET because IBET’s concept of “theory” (D5) says that all human knowledge claims are subject to refutation in the future.
6. The word “explanation” in D8 has so many meanings (e.g., see Lipton (2004, Ch. 2), Thagard (2019c, Ch. 5), and Woodward (2003)) that it requires definition. After much careful thought, Lipton (2004, Ch. 2), Salmon (1989), Thagard (2019c), and many others have concluded that causal models of explanation are often the most suitable (though not always) for IBE. Hence D9.

D9: In many cases, to “explain a phenomenon is simply to give information about its causal history (Lewis, 1986) or, where the phenomenon is itself a causal regularity, to explain it is to give information about the mechanism linking cause and effect.” (Lipton, 2004, p. 30).

Comments:

1. A “causal history” is a list of causes of the phenomenon of interest plus “the causes of its causes, and so on” (Skow, 2014, p. 450).
2. Thagard (2019c, Ch. 5) presents a helpful discussion of explanation that distinguishes four distinct types of explanation, all of which may be useful in theory building:

(1) narrative, e.g., the Big Bang explanation of the creation of the universe;

(2) deductive, e.g., Hempel's (1965) scientific explanations are deductive;

(3) mechanistic, e.g., turning the pedals on a bicycle causes it to move forward;

(4) eliminative, e.g., explaining why some concepts (e.g., superstitions or alchemy), should be eliminated from both our language and belief systems.

Of these, mechanistic explanations are those that Lipton (2004) says often provide the best explanations (hence the use of the words "causal regularity", "mechanism", and "cause" in D9). Thagard's (2019c, Ch. 5) also has important sections on causality and emergence (the latter concerning properties of a whole that are not properties of its parts, e.g., bicycles have emergent properties) that go beyond the scope of this paper.

3. D9 does not mention understanding, but philosophers are increasingly linking explanations and understanding (e.g., both Lipton (2004) and Thagard (2019c) do). The difference between these two concepts is that explanations may be written down, whereas understanding—in the meaning intended here—cannot; understanding is something that happens inside the human brain. Thagard (2019c, Ch. 5) makes this distinction when he says that:

> *Explanations have psychological effects, making people feel that they understand something. This feeling of understanding is in part emotional, ranging from quiet satisfaction to excitement that something important and previously unintelligible fits in with other things that are now known.* (p.121)

Pursuit of understanding is, of course, what Feynman, in the opening quotation, says motivates scientists to do research.

4. Definitions of "cause" and "mechanism" as used in D9 follow.

D10: The concept "cause" in D9 may be illustrated by the conjunction of the two following concepts: (1) being in the sun, and (2) feeling warm. The explanation of why a person sitting in the sun feels warm is that being in the sun causes a person to feel warm (note the one-way directionality: feeling warm does not cause being in the sun).

Comments:

1. Lipton (2004, p. 30) says "The notion of causation is indispensable to philosophy, ordinary life and much of science," but because there is no "fully adequate analysis of causation," he chose not to try to present "a full philosophical account" in his book. Thus, he chose just to illustrate the meaning of "cause" through examples such as that in D10.
2. It is easy to scour the philosophy literature looking for suitable succinct definitions of "cause". For example, Menzies and Price (1993, p. 187) say: "an event A is a cause of a distinct event B just in case bringing about the occurrence of A would be an effective means by which a free agent could bring about the occurrence of B" (Gregor (2006, p. 617) presents a similar definition). But the difficulties that Hume (1777), Salmon (1984, 1989, 1998), Russell (1912), Woodward (2003), the many contributors to the 770-page Oxford Handbook on Causation (Beebee et al., 2009), and Markus and Rowe (2018) all experienced in trying to define "cause" (or causal explanation) suggest that—for the purposes of his book—Lipton's decision to rely just on examples was a wise one.
3. Lipton (2004) also says that for most causal explanations it is not necessary to explain the causes of the causes, for example, what happens inside the sun that produces radiant heat, nor how radiant heat makes a human body feel warm. In some contexts, however, either or both additional explanations would be required. (Such additional explanations are part of what Lipton in D9 calls a "causal history".)

D11: The term "mechanism" in D9 may also be illustrated by an example. Why do we experience sunrises? A good answer is based on a model where the earth spins on its axis once every 24 hours whilst simultaneously moving in an elliptical orbit around the sun every year. This planetary-rotation model outlines the mechanism (the spinning of the earth) that causes us to experience sunrises every day. (It also helps us predict—in a way that is much more convincing than the enumerative inductive inference made earlier (see D8, comment 4)—that there will be sunrises every day for the foreseeable future.)

Comments:

1. As with "cause", it is easy to scour the philosophy literature looking for suitable definitions of "mechanism". For example, Glennan (2017, p. 17) says: "A mechanism for a phenomenon consists of entities (or parts) whose activities and interactions are organized so as to be responsible for the phenomenon." This is similar to one of Thagard's (2019c, p. 123) definitions, which says: "Mechanisms provide causal links by specifying parts whose connections and interactions produce changes." However, because a more complete definition is difficult, this paper follows Lipton and uses examples (bicycle, planetary rotation) to convey the meaning of the concept "mechanism".
2. Supporting Lipton (2004), Thagard (2019c), and many others, Bhaskar (1975, Ch. 3), as part of his Critical Realism, also argues that the job of science is to identify "generative mechanisms" that cause the phenomena (events) of interest.

Philosophers who argue that IBE is a good description of what most of today's researchers and scientists do when theory building—which is the position taken in this paper—tend to accept the above definitions (D8–D11) plus a bundle of related knowledge claims that make up the theory advocated in this paper (IBET). These claims include:

A1: The real world exists independently of the researcher and in widely accepted theories the things that those theories refer to probably exist in something like the way that the theory says they do.

Comments:

1. Assumption A1 is the scientific-realist ontological assumption (Chakravartty, 2017; Ladyman, 2002, Ch. 5; Putnam, 1975; Thagard, 2019c; Worrall, 1989) mentioned in the introduction to this paper. In his book *Scientific Realism*, Psillos (1999, p. xvi) describes scientific realism as "the best game in town." In a similar vein, social scientist Maxwell (2012, p. 3), argues that realism has arguably been the dominant metaphysical position in the philosophical literature for the last thirty years. However, not all philosophers agree. For example, Van Fraassen (1980) argues that even widely accepted theories need not be "literally true" (p. 10).
2. A realist argues what we human beings see as we look at the world is just our brain's interpretation of signals received through our senses (Seddon, 2021), but despite this, the real world exists "out there." Of course, many theoretical constructs (e.g., electrons), cannot be seen, heard, smelt, tasted, or felt, but for a realist, if there is strong evidential support for the theory constructed around them, the objects described by the constructs probably exist (Ladyman, 2002, p. 158-9; Thagard, 2019a, Ch. 4)).

P1: Human beings can only ever see or collect data about small parts of the real world, so most researchers make inductive inferences about the world based on their observations of small parts of the world (plus their own beliefs and understandings of what others have reported in the literature).

Comments:

1. Proposition P1 is the first empirically testable knowledge claim made in this paper. The reasoning behind P1 is that because we human beings are not omniscient, we all make inductive inferences from things we know to the wider world. For example, if I burnt my hand last time it was close to the fire, it makes sense for me to infer, inductively, that all fire probably burns. Lipton (2004) says that making inductive inferences seems natural to us. Thagard (2019b) says that this is how humans and animals learn. From an evolutionary perspective, induction probably feels natural because it increases our chances for survival (Lipton 2004, p. 127); perhaps our brains are "hard wired" for making such inferences.
2. To test P1, all that one needs to do is to collect a sample of studies and see what proportion contains implicit or explicit claims that their findings apply to settings other than those from which data were collected. In the IS literature, one study that has done this is Seddon and Scheepers (2012). They analyzed claims made by authors of 112 papers in two top IS journals published in 2007 and 2008. They report: "In the current sample of 112 papers, 87 were empirical studies that collected and analyzed data in some way. All 87 were written as if some aspects of their results were generalizable to settings outside the sample they actually studied" (p. 8). This is quite strong support for P1, albeit from only a single sample from the IS literature.

P2: One frequently useful pathway to developing a good explanation is what Lipton (2004, p. 34) calls a "contrastive explanation." This is an answer to a question of the form: "Why P rather than Q?" The choice of Q (which Lipton calls a "contrast" or "foil") signals the aspect of "Why P?" that is of interest to the questioner. If the cause of P is not the cause of Q, we have the beginnings of a relevant explanation.

Comments:

1. Lipton (2004) illustrates the use of a contrastive explanation in his Chapter 5, on the discovery by a Dr. Semmelweis, of the cause of the then-often-fatal disease called "childbed fever" in a teaching maternity hospital in Vienna, Austria, in 1844-8. The problem was that there were two wards in the same hospital and many more mothers in Ward 1 contracted childbed fever and died than mothers in Ward 2. After considering and rejecting many potential explanations, Semmelweis concluded that the childbed fever was caused by the doctors (including himself). The doctors routinely conducted autopsies of women who had died the previous day, then, after washing but not sterilizing their hands, they examined heavily pregnant women in Ward 1 (the ward where childbed fever occurred so often). They never examined patients in Ward 2. Further, after Semmelweis required the doctors to disinfect their hands with chlorinated lime before examining the mothers to be, the incidence of childbed fever in Ward 1 dropped dramatically, to a level similar to that in Ward 2. The story is nicely told in a paper by Semmelweis (1983), originally written in German in about 1860.
2. The point of the Semmelweis story is that the cause of the childbed fever was discovered after considering and rejecting many potential explanations, and by continuing to ask the question: Why did childbed fever occur much more frequently in Ward 1 than in Ward 2? Semmelweis' answer, his theory, was that the cause of childbed fever was "cadaveric particles" and that the mechanism that brought cadaveric particles into contact with the women who died in Ward 1 was examinations by doctors who had washed but not sterilized their hands after performing autopsies. Sadly, yet consistent with D7, the medical establishment in Vienna did not accept Semmelweis' theory. In fact, in 1849, Semmelweis' employment contract was not renewed.
3. Eisenhardt (1989, 1991) advocates the use of multiple comparative case studies for posing and answering "Why P rather than Q?"-style questions when theory building.
4. Tsang and Ellsaesser (2011) provide a good discussion of contrastive explanation.
5. P2 could be tested by observing theory builders in action or retrospectively.

L1: The term "inference to the best explanation" is not really accurate (Lipton 2004, Ch. 4). What IBE really means is inference to the best *available potential* explanation (where such inferences are also informed by the researcher's background data and beliefs): "According to Inference to the Best Explanation, then, we do not infer the best actual explanation; rather we infer that the best of the available potential explanations is an actual *explanation*" (Lipton, 2004, p. 57).

Comment: Logical inference L1 is just that, a logical inference. Simple logic says that when making abductive inferences, researchers can never be sure that they have chosen the best explanation because that explanation may not yet have been considered. All that a researcher can do in practice is to choose the best from those available at the time.

P3: *Best* explanations are those that help researchers achieve the greatest *understanding* of the phenomena of interest, normally by providing details of mechanisms (see D9-D11) that cause those phenomena. Best explanations convincingly rule out rival explanations, explain more phenomena than rival explanations, are empirically testable, and are consistent with widely accepted related theories.

Comments:

1. Lipton (2004) distinguishes between what he calls the "most likely" and the "most lovely" explanation. The goal in pursuing the most-lovely explanations, he says, is to achieve the greatest possible *understanding* of the phenomenon. The explanation that provides the greatest understanding will then normally also be viewed by the researcher as the most likely. In other words, Lipton (2004) argues that it is researchers' pursuit of the greatest understanding that guides their theory building. By contrast, Thagard (1992, 2019c, Ch. 3) argues that best explanations have "explanatory coherence." By this, Thagard (1989, 1992, 2007a, 2019c) means

that the explanation fits with everything else that the theory builder knows. These two views may be reconciled by treating explanatory coherence as an essential requirement for a researcher's sense of greater understanding.

2. A best explanation should also be "elegant and unified, not arbitrary, gerrymandered, ad hoc, or messily complicated. It should be informative and general. In brief, it should combine simplicity with strength" (Williamson, 2016, p. 266).
3. The decision about which explanation is best is a judgment made initially by the theory builder and later independently assessed by other researchers (including reviewers) (Thagard, 1992).
4. Often it is not possible to decide which explanation is best. In that case, the choice is said to be underdetermined (Ladyman, 2002, Ch. 6; Lipton, 2004, pp. 5-6). In such cases, all that the theory builder can do is to search for additional evidence of support, or otherwise, for the various explanations being considered (as Semmelweis did).
5. P3 could be tested by analyzing published scientific papers to identify reasons given by authors when proposing new theories (Why do they think their theory is best?).

P4: Inference to the best explanation is the best explanation of what theory builders do.

Comments:

1. P4 is THE key proposition in IBET.
2. The reasoning behind P4 is that of all the various explanations of what scientists do that Lipton (2004), Thagard (2019c), Williamson (2020), and many other philosophers (e.g., those in McCain and Poston (2017)) have considered, IBE was the one they thought the best. For example, Lipton (2004) says:

   > *Inference to the Best Explanation gives a better description of our inductive practices than other accounts on offer, either because it avoids some of the misdescriptions those other accounts give, or because it goes beyond those accounts, correctly describing aspects of our inferential life about which they are silent.* (Lipton 2004, p.126)

3. For his part, Thagard (2019c) is so convinced of the correctness of P4 that he uses IBE logic repeatedly throughout his 2019 books with no attempt to explain why (e.g., IBE is mentioned twelve times in his Chapter 4 on "Reality").
4. Ladyman (2002, p. 196) does not himself take a position on the validity of IBE but says: "The realist places great emphasis on the power of scientific theories to explain the phenomena that they describe. Indeed, for many, explanation is the primary goal of the scientific enterprise."
5. The force that motivates researchers to create new theories is their insatiable desire for a greater understanding of what makes the world work (see the opening quotation from Feynman).
6. P4 could be tested by observing theory builders in action or retrospectively. In one example of the latter type of study, Thagard (1978) found that five famous scientists—one being Darwin (1859)—used IBE-like logic when justifying their theories.

P5: Theory building is best viewed as a community endeavor, not the work of a lone individual or group. Once a new theory has been published, other researchers and research groups will normally conduct additional tests of interesting theories. These are likely to lead to new insights, rival theories, and/or refinement of the existing theory.

Comment: P5 could be tested by choosing various key theories and examining the extent to which various groups of researchers contributed to their development. For instance, the gradual acceptance of Barney's (1991) resource-based view of the firm might be a good example to study.

P6: The IBE-based theory (IBET) proposed in this paper—which consists of Figure 2, Definitions D1-D14, Assumption A1, Propositions P1-P6, Logical implication L1, and Figure 3 below—applies to scientific-realist/pragmatist theory building and testing in *any* discipline.

Comments:

1. P6 is a boundary condition statement for IBET, as required by D3.
2. Although Lipton was a philosopher of science, and all his examples come from the natural sciences (not the social sciences), his arguments seem to apply to any theory building, at least for the types of theory envisaged in definitions D1-D11 in this paper.

3. Thagard (2007a, p. 44) provides cautious support for P6.
4. P6 could be tested by observing theory building (with "theory" as defined by Figure 2 and D1-D11) in different disciplines. Avgerou (2013) presents a discussion of "Social mechanisms for causal explanation in social theory based IS research" (the title of her paper) that provides grounds for believing that P6 is valid for socially oriented realist theory building in IS research.

4 Theory Testing

Confidence in new theories grows as various empirical tests provide support for those theories. In fact, it is argued in IBET, that in assessing the validity of theories it is important that new theories satisfy two criteria: (a) that they are a good fit with reality (however reality is observed), and (b) that they are a good fit with the world's existing stock of knowledge (which is the result of countless other researchers' attempts to understand how aspects of the world work). Thagard (2019c, p. 94) says that criterion (a) is a *correspondence* theory of truth, and criterion (b) is a *coherence* theory of truth. The term "probable truth", however, would be more accurate than just "truth". In IBET, such fit assessment is called testing, where testing is defined as follows:

D12: Any comparison of a theory with (a) reality, and/or (b) the world's existing stock of knowledge is a test. Test outcomes range from "no support" to "compelling support" for a theory (or group of theories).

With regard to testing, it is important to distinguish two different goals. These two goals are evident in the testing shown in steps 3 and 6 in Figure 3. In steps 2 and 3 in Figure 3, the theory builder conjectures or invents new theories that hopefully explain the phenomena of interest (in step 2), then tests to evaluate the explanatory power of those theories (in step 3). This process iterates until the theory builder feels that they have found an acceptable theory (steps 4 and 5). Testing in step 6 comes later, once an apparently valid theory has been developed. In step 6, the theory builder and others test the theory using new data from other contexts. If these additional tests also support the theory, most researchers' confidence in the validity of the theory grows (see any discussion of Bayesian statistics).

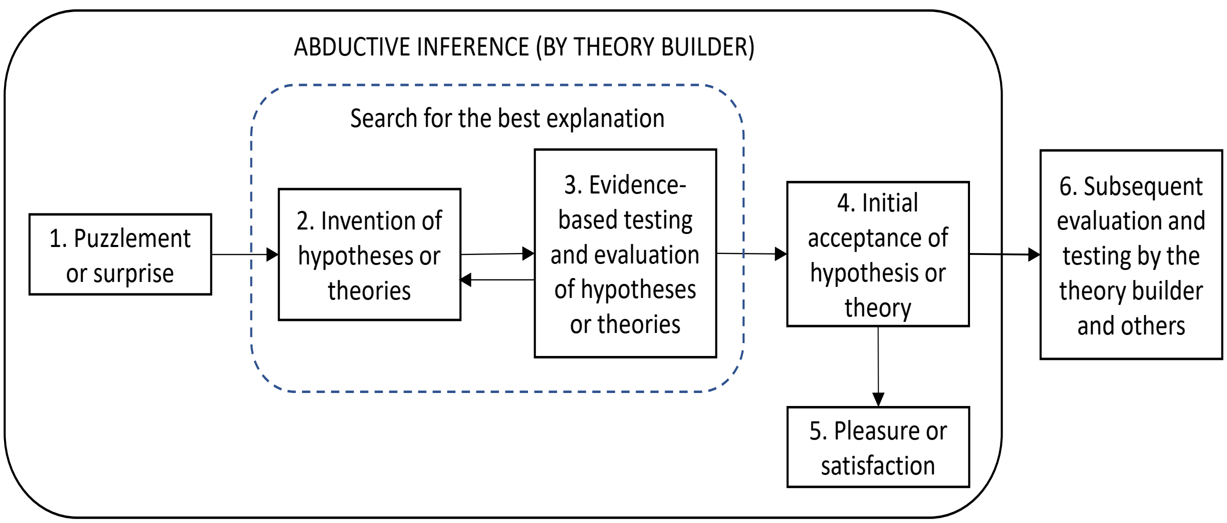

Figure 3. The Process of Abductive Inference (minor revision of Seddon (2021, Fig. 1))

Lipton (2004, Ch. 10) describes the steps-2-and-3 process of creating theory to fit the available evidence (the evidence being both data and relevant other theories) as "accommodation". With accommodation, Lipton (2004, p. 164) says, "a theory is constructed so as to ensure that it, along with the normal complement of auxiliary statements, entails the evidence." Here "entails" means "implies" or "results in". In IBET, the step-3 testing of a theory developed to accommodate certain evidence, using that same evidence, is called abductive testing:

D13: Abductive testing is testing to assess whether a theory constructed to explain a given set of evidence, including the literature, is consistent with that evidence. Abductive testing is performed in step 3 in Figure 3. If the theory builders have done their work well, the fit will be good.

> **Comment**: Theories proposed through (a) grounded theory building, (b) theory building from case studies, and (c) statistical analysis of a dataset, that are tested using the same data that were used for theory building, all use abductive testing.

In contrast to abductive testing, Lipton (2004, Ch. 10) also explains that new theories may, of course, be used to make predictions (e.g., IBET hypotheses may be predictions based on a theory, see D1, comment 2). With respect to predictions, both Lipton (2004) and Worrall (1989, pp. 101-2) say that positive tests of predictions are generally regarded as more convincing than accommodative (i.e., abductive) testing. This is because theory builders may overfit their theories to accommodate their evidence. In fact, Lipton (2004, p. 168) calls a theory that overfits the evidence (intended or not) a “fudging explanation”. To reduce this risk of overfitting, some researchers sometimes put some data aside in holdout samples. In IBET, testing of hypotheses or predictions deduced from a theory *with data not used in theory building* is called independent-data testing.

> **D14:** Independent-data testing is the testing of hypotheses deduced from a theory of interest using evidence that was not used in abducing the new theory. Independent-data testing is performed in step 6 in Figure 3.

A good example of an IS study that uses both types of testing is Venkatesh, Morris, Davis, and Davis’s (2003) 54-page UTAUT paper. The first 37 pages (70%) of that paper are devoted to theory building, including detailed fit assessment of eight rival models (Venkatesh et al., 2003, Table 7, pp. 442-445) using questionnaire data from a sample of 215 users from four firms. Venkatesh et al.’s (2003) new model (theory), UTAUT, is then presented. To demonstrate how well the model fits the data, results from abductive testing are presented in Table 17 (Venkatesh et al., 2003, p. 462). (Venkatesh et al., (2003, p. 461) describe this abductive test as a “preliminary test”). In this test, a high model fit (Adjusted R^2) should be interpreted as meaning that Venkatesh et al. (2003) have done a good job of fitting (accommodating) their model to their data. However, Venkatesh et al. (2003) then present results from an independent-data test of their model. (They describe this independent-data test (Table 21, p. 465) as a “cross-validation of UTAUT”.) This test involved collecting additional questionnaire data from a sample of 133 users from two more firms. In this independent-data test, a high model fit suggests that the UTAUT model is likely to be valid in other corporate contexts. This second test gives readers much more confidence that the model is probably valid in many corporate settings than the fit data from the four initial firms (their Table 17). Of course, since 2003 there have been many further step-6-in-Figure-3 tests of UTAUT by many different researchers. Thus, today, most IS researchers have high confidence in the probable validity of UTAUT, at least in a corporate context.

5 Summary: IBET in a Nutshell

Summarizing, the IBE-based Theory of theory building and testing (IBET) just presented (D1-D14, P1-P6, A1, and L1, plus the simple process model in Figure 3) is based primarily on insights from the philosophy-of-science literature, particularly Lipton (2004). IBET argues that theories are ideas (or bundles of ideas) invented by people to explain how some part of the world is thought to work. Theories are never 100% true and are always subject to revision. Further, following Lipton (2004), Thagard (2019c), and Williamson (2016, 2020), IBET argues that the explanations offered in new theories are the results of attempts by researchers to infer the best explanations they can from a combination of first-hand data, insights from the literature, and their personal beliefs. According to both Lipton (2004) and Thagard (2019c), such explanations may frequently be described in terms of mechanisms that cause the phenomena of interest. Finally, IBET argues that there are two types of theory testing: abductive testing and independent-data testing. Abductive testing—testing using data that were used in theory building—is the preliminary fit-assessment part of theory building; it happens in step 3 in Figure 3. Independent-data testing—testing using data that were not used in theory building—helps members of the research community assess and possibly revise their confidence in the probable general validity of the tested theory (within the boundary conditions specified by the theory builder); it happens in step 6 in Figure 3.

6 How Does IBET Compare to Rival Theories of Theory Building?

> *An essential feature of theory building is comparison of the emergent concepts, theory, or hypotheses with the extant literature*. (Eisenhardt, 1989, p.544.)

The central concept in IBE is the notion of a best explanation. What grounds do we have for believing that the new theory proposed in this paper, IBET, is the best explanation (or even a good explanation) of theory building? To answer this question, we now follow Eisenhardt's advice (above) and compare IBET to three highly regarded rival theories of theory building: (a) the Grounded Theory approach to theory building, (b) Eisenhardt's (1989) advice on theory building from case studies, and (c) Shepherd and Suddaby's (2017) recent advice on theory building

6.1 How Does IBET Compare to Grounded Theory Building (GT)?

Over the past 50 years, a group of closely related theory-building techniques has emerged under the banner "Grounded Theory" (GT). Glaser and Strauss (1967), Glaser (1978, 1992, 2002), Strauss and Corbin (1990), Gioia, Corley, Hamilton (2013), and Charmaz (2014) have become important guides for theory builders, particularly in the social sciences. In what follows, the commonly used abbreviation "GT" is used to distinguish the method, Grounded Theory, from the products of the method, theories. GT has become so widely referenced that in July 2021, there were over 146,000 Google Scholar citations to Glaser and Strauss's (1967) first book, "The Discovery of Grounded Theory".

In the years since 1967, there have been many clarifications and refinements of the various GT methods, but the core idea has not changed. The core idea is that when using GT, theory is built iteratively based on patterns the researcher identifies in the data through a process of constant analysis and comparison of codes, concepts, and relationships identified in the data, and that data collection continues until no new insights into the phenomenon of interest are revealed (termed "saturation"). The term "grounded" in GT is used to indicate that concepts used are based on, or "grounded" in, the data, not based on some "grand theory" (Mills, 1959), "theories of the middle range" (Merton, 1967), or just personal opinion. It is for this reason that researchers using GT are encouraged to keep their minds open to insights from the data, rather than letting preconceived ideas (e.g., those from the literature) color their thinking.

Comparing IBET and GT:

1. Both argue that theories *explain* phenomena of interest. GT says this is based almost solely on finding patterns in the data. IBET says that researchers' understandings of the literature can also make a major contribution to their sensemaking.
2. GT does not argue that theory building is a creative process; IBET does.
3. Both argue that theories are built iteratively.
4. Both argue that theories are built using abduction (see Haig (1995) for this claim for GT).
5. Early versions of GT adopt a realist ontology, although Charmaz's (2014) Constructivist GT does not. Holton & Walsh (2016) describe their philosophical stance as critical realism (Bhaskar, 1975), which is a realist position similar to IBET's.
6. As a method of building theory, GT has a much stronger focus on (a) conceptualization from data, and (b) relationships between those concepts, than IBET. According to Glaser (2002, p. 24): "GT provides a systematic way to conceptualize carefully." IBET is keenly aware that concepts are used in theory building (e.g., see the care taken in defining terms in this paper (see D1-D14)), but places much less emphasis on data as the starting point for conceptualization.
7. Most variants of GT provide more detailed prescriptions on how data analysis should be performed (coding, memo-ing, and sampling, e.g., see Charmaz (2014), Figure 1.1, p. 18), than IBET. These prescriptions have helped researchers overcome criticisms from reviewers that their GT-based work lacks rigor, but they are not essential in IBET.
8. GT pays little explicit attention to rival theories, yet rivalry between competing explanations is of fundamental concern in IBET.

Conclusion: GT certainly provides one way of building theory, and the fact that it has been used by so many people suggests it is very useful for guiding theory building. However, most theories in the world (e.g., those in the natural sciences) were developed without using GT techniques. Therefore, IBET's claim that theory building is a creative activity that seeks to develop the best explanations possible for phenomena in the world seems to provide a much more general, more fundamental, explanation of what theory builders do than GT. IS researchers might therefore find IBET more useful than GT for conceptualizing, guiding, and explaining their own theory-building practices.

6.2 How Does IBET Compare to Eisenhardt's (1989) Theory Building from Case Studies?

Like Glaser and Strauss (1967), Eisenhardt's (1989) paper on theory building from case studies has been widely referenced. For example, in July 2021, there were over 64,000 Google Scholar citations to this paper. Most of Eisenhardt's paper is devoted to explicating a process (which she calls "a roadmap" (Eisenhardt, 1989, p. 532)) that theory builders may use to develop theory from multiple case studies. The main difference between Eisenhardt's (1989) process and IBET's (Figure 3) is that IBET argues that theory building builds on any sources of insight, including both data and the literature, whereas Eisenhardt says that she relies just on the data.

However, IBET's core insight is not its process model (Figure 3), but rather, its concept of inference to the best explanation (see D1-D14, P1-P6, A1, and L1 earlier in this paper). The goal of this section is therefore to compare Eisenhardt's advice on theory building at this more fundamental level to that in IBET. This is a little difficult because Eisenhardt (1989) never defines "theory" in her paper, never explicitly explains her goals in theory building, and never explicitly explains how the theories she discusses are actually conceived. So we must read between the lines.

First, Eisenhardt (1989) shares this paper's views about the importance of theory building: "Development of theory is a central activity in organizational research. Traditionally, authors have developed theory by combining observations from previous literature, common sense, and experience" (p. 532).

Second, she also argues that theory building is both difficult to do and difficult to describe. In the following quotation she describes trying to build theory from case-study data:

> *Analyzing data is the heart of building theory from case studies, but it is both the most difficult and the least codified part of the process. Since published studies generally describe research sites and data collection methods, but give little space to discussion of analysis, a huge chasm often separates data from conclusions. As Miles and Huberman (1984, p.16) wrote: 'One cannot ordinarily follow how a researcher got from 3600 pages of field notes to the final conclusions, sprinkled with vivid quotes though they may be*.' (p. 539)

Third, Eisenhardt (1989) also recognizes the role of abductive testing:

> *From the within-site analysis plus various cross-site tactics and overall impressions, tentative themes, concepts, and possibly even relationships between variables begin to emerge. The next step of this highly iterative process is to compare systematically the emergent frame with the evidence from each case in order to assess how well or poorly it fits with case data. The central idea is that researchers constantly compare theory and data—iterating toward a theor closely fits the data. A close fit is important to building good theory because it takes advantage of the new insights possible from the data and yields an empirically valid theory.* (p. 541)

Fourth, Eisenhardt's (1989) goals in theory building seem to be similar to IBET's. She uses terms like understanding the "why" of what is happening, which is highly consistent with Lipton's (2004) goals:

> *At this point, the qualitative data are particularly useful for understanding why or why not emergent relationships hold. When a relationship is supported, the qualitative data often provide a good understanding of the dynamics underlying the relationship, that is, the "why" of what is happening. This is crucial to the establishment of internal validity.* (p. 542)

In the quotation above, the term "internal validity" seems to mean that the abductive test results suggest that the conjectured—Eisenhardt says "hypothesized"—explanation is consistent with the data.

Finally, and consistent with Lipton's advice about contrastive explanations summarized in P2 (Why P rather than Q?), Eisenhardt (1989, 1991) presents a strong case in favor of comparing case studies of similar organizations and looking for differences when developing theory.

Conclusion: It is clear from the quotations above that Eisenhardt (1989) and Lipton (2004) were attempting to solve much the same problem: where do theories come from? And the fact that Eisenhardt (1989) has been cited by so many people suggests it is a very useful guide for theory building. However, Lipton's (2004) concept of IBE is both more general and more in-depth than Eisenhardt's. It is more general because it is thought to apply to any theory building, not just theory building from case studies. It is more in-depth because in addition to recognizing that theory building is a creative activity that seeks to construct the best explanations possible for phenomena in the world, Lipton (2004) also argues that good explanations often identify mechanisms that cause the world to work the way it does. Eisenhardt (1989) does not. In short, IBET provides a more general, more fundamental, explanation of what theory builders do than Eisenhardt's explanation. IS researchers might therefore find IBET more useful than Eisenhardt's (1989) guidelines for conceptualizing, guiding, and explaining their own theory-building practices.

6.3 How Does IBET Compare to Shepherd and Suddaby's (2017) Advice on Theory Building?

Shepherd and Suddaby (2017) recently published a "systematic review of the literature on theory building in management" that "integrates the various individual components of theory building into a coherent whole" (p. 60). In the first 85% of their paper (pp. 60-78) they use Grounded Theory-style logic to identify common patterns in 58 theory-building studies published in the management literature. (This is close to the type of study proposed in P3, comment 5.) In the last few pages, in a section titled "Pragmatic Empirical Theorizing", Shepherd and Suddaby suggest that authors of theory-testing papers who discover interesting unplanned findings should be encouraged to propose new theory to explain those findings, rather than revising their original model to achieve better fit (which Shepherd and Suddaby call HARKing, i.e., "Hypothesizing After the Results are Known").

Comparing IBET and Shepherd and Suddaby's conception of theory building:

1. Shepherd and Suddaby (p. 75) say that, "A theory can be conceptualized as a statement of concepts and their relationships that specifies who, how, and/or why a phenomena occurs within a set of boundary assumptions conditions (see Bacharach, 1989; Gioia & Pitre, 1990)." IBET largely agrees (because of the "how" and "why"), though IBET emphasizes explanation and understanding, over "concepts and their relationships," as the key defining characteristics of theories (see D1).
2. Shepherd and Suddaby in the quotation in (1) say that theories need boundary conditions. IBET agrees (see D3).
3. Shepherd and Suddaby (p. 75) also say that theories offer "a coherent explanation of a phenomenon." IBET strongly agrees (see D1).
4. Shepherd and Suddaby (p. 61) say that theory building is "a creative process that requires" "considerable imagination." IBET agrees (see D4).
5. Shepherd and Suddaby (pp. 61-65) argue that theory building is normally triggered by a conflict, paradox, or challenge of some kind. IBET says that theory builders are motivated by their desire to understand how the world works. These two views are compatible.
6. Shepherd and Suddaby (p. 68) say that "powerful theorizing involves skillfully weaving together prior knowledge (i.e., existing literature) and emerging knowledge (i.e., new empirical observations)." IBET agrees (see D8, comment 3).
7. Shepherd and Suddaby (p. 68) say that "identifying and naming constructs is an essential part of theorizing because constructs are a source of agency or causality." IBET agrees (e.g., see the care in defining the many concepts in this paper).
8. Shepherd and Suddaby (p. 77) say that broader, simpler theories are better. IBET says that theories that provide the greatest understanding are best (see P3, comment 1, "most lovely explanations," and P3, comment 2, on simplicity and strength).
9. Shepherd and Suddaby (p. 77) say that "A theory with explicit mechanisms is a better theory." IBET agrees: Identifying causal mechanisms that explain the phenomena of interest is a core concept in IBET (see D9 - D11).
10. Shepherd and Suddaby (p. 79) say "Pragmatic theorizing promotes abductive reasoning as a practical compromise of induction and deduction and more realistically captures the authentic process by which theorizing occurs." IBET does not regard abductive reasoning as any sort of compromise, but strongly agrees that theory building is abductive (see D8, comment 4, and Figure 3).
11. From an IBET perspective, what Shepherd and Suddaby call HARKing (p. 79) is a type of theory building, where, for example, modification indices from a structural-equation modeling tool are used to guide revision of an initial model to achieve greater fit. However, as soon as a model is changed to improve fit, ethical researchers need to disclose that their test results are abductive tests, not independent-data tests. This warns readers to treat the test results with caution.

Conclusion: The expression "IBET agrees" occurs repeatedly in the comparison above. In other words, although Shepherd and Suddaby do not cite the philosophy-of-science literature (other than Peirce (1934, 1958)), their views on the fundamentals of theory building are very similar to those of philosophers such as Lipton (2004), Thagard (2019c), and Williamson (2016, 2020). However, compared to Shepherd and Suddaby, IBET provides a deeper, richer, more detailed view of theory building by:

- providing a more sharply focused definition of theory that (a) emphasizes explanation and understanding over concepts and relationships, and (b) includes more detailed explanations of key concepts such as abduction (D8), explanation (D9), cause (D10), and mechanism (D11) than Shepherd and Suddaby;
- recognizing that theories are never true (D5) and offering the Bayesian-based concept of confidence in the validity of a theory in its place (D6);
- emphasizing the usefulness of contrastive explanations when theory building (P2);
- explicitly surfacing that IBET is a realist explanation of theory building (A1) (this being a boundary condition for the applicability of IBET, see P6);
- explicitly considering the role of testing in theory building, and distinguishing between abductive and independent-data testing (D12-D14);
- proposing that theory building is best viewed as a community endeavor (P5).

7 Contributions of this Paper

This paper makes three contributions to the IS literature:

1. The key contribution is in drawing IS scholars' attention to the philosophy literature's concept of Inference to the Best Explanation (IBE), particularly Lipton (2004) and Thagard (2019c). Lipton's (2004) insights provide the foundation for IBET, the theory of theory building and testing presented in this paper. IBET seems to provide a more general, more in-depth, explanation of theory building than the explanations offered by the three leading rival works on theory building reviewed above. Further, although some IS scholars may disagree, IBE seems to be relevant to all researchers who believe the world exists independently of themselves, including both the so-called positivists and interpretivists.
2. Since Lipton (2004) never explicitly defines "theory", the second contribution of this paper is its conceptualization of "theory". This definition (Figure 2 plus D1-D11 (with D8-D11 coming from concepts discussed Lipton (2004))) is more sharply focused and detailed than many definitions in the literature, yet as Thagard (2019a) points out, is necessarily incomplete. Because IBET's definition is framed to be consistent with Lipton's (2004) concept of IBE, readers who decide to use IBE to frame their own theory building may find it useful to adopt or refine IBET's definition of "theory".
3. The third contribution of this paper is the distinction between abductive testing and independent-data testing (Figure 3 plus definitions D13 and D14). Lipton (2004, p. 11) alludes to this distinction when he says: "many people feel that only a prediction can be a real test, since a theory cannot possibly be refuted by data it is built to accommodate," but he does not himself propose two types of testing. In framing IBET, it was decided that the distinction could be made simply and usefully by recognizing two types of testing.

8 Conclusion

The goal of this paper is to help IS scholars answer the question: *Where do theories come from?* The answer offered here is IBET. IBET is my high-level interpretation and integration of the work of many authors, particularly from the philosophy-of-science literature, but the primary source is unquestionably Lipton (2004). IBET is not a recipe for theory building like that in Eisenhardt (1989) or Charmaz (2014) Figure 1.1. Rather, it attempts to reveal and explore the fundamental logic, or principles, of theory building.

In creating IBET, many choices were made about how to conceptualize theory (Figure 2 and D1-D11), explain theory building (D8-D14 and P1-P6), and conceptualize the theory-building-and-testing process (Figure 3 and D8-D14). Presented in what is intended to be a concise, straightforward style, it is hoped that the resultant theory of theory building and testing, IBET, provides (a) new insight into where theories come from for scientific-realist/pragmatist-oriented IS scholars, and (b) a convenient conceptual framework for shared understanding of the realist-oriented theory-building process that could aid reviewers, editors, and authors as they strive to improve the theoretical content of both their own and their colleagues' work.

Finally, and consistent with P5, IBET, like all theories, must be regarded as work in progress. Further testing and suggestions of improvements from other researchers, and/or suggestions of alternative stronger theories, are needed. For example: (1) In what circumstances is the definition of "theory" in Figure 2 and D1-D11 inappropriate or unhelpful? (2) Is IBET a valid explanation of interpretive research (where the phenomena of interest are people's interpretations of the socially constructed and constantly evolving world they inhabit)? (3) Can multiple explanations of the "same" phenomena, when viewed from different perspectives, be accepted as "best" explanations (from those various perspectives)?

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