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The Context of Discovery in the Social Sciences:

The Heuristic Value of Concepts, the Theorizing Approach, and the Goals-Beliefs Heuristic

Abstract: A widely held view in the philosophy of science is that the “context of discovery” (i.e., rules about how new knowledge can be discovered) cannot be addressed scientifically. This article first analyzes a recent attempt to overcome this contention: the heuristic value thesis claiming that social science concepts have a heuristic value for discovering fruitful (i.e., empirically valid and informative) theories. Major problems of this thesis are outlined. We then analyze other heuristics and their usefulness for discovering fruitful theories. The literature about creativity, about heuristics and biases, about the grounded theory approach and artificial intelligence are such alternatives. The recent “theorizing” heuristic seems to be a synthesizing approach. It is argued that none of these heuristics is specific enough to bring about a fruitful theory. It is suggested to change the agenda: try to find *some* theoretical innovation and not *specific* fruitful theories. Applying the bounded rationality model the first step is to explain intensive search that is due in particular to a strong explanatory interest, knowledge stored in memory related to the explanandum of the theoretical innovation one is looking for, and opportunities for search (such as institutional provisions for research). It is hypothesized that these conditions increase the likelihood of theoretical innovations. This is in line with a study showing a positive relation of academic freedom and innovations. The likelihood of finding fruitful theories is extremely low – comparable to the chance of winning a lottery. Although the likelihood of playing and searching for theories is close to zero, it is greater than zero. The only recommendation to reach the goal of finding a fruitful theory is thus intense search behavior of finding some theoretical innovation.

Keywords: artificial intelligence, bounded rationality model, context of discovery, creativity, grounded theory approach, heuristics and biases approach, heuristics for theory discovery, bounded rationality model

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Der Entdeckungszusammenhang in den Sozialwissenschaften:

Der heuristische Wert von Begriffen, der „Theorizing“-Ansatz und die „Goals-Beliefs“-Heuristik

Zusammenfassung: In der Wissenschaftsphilosophie herrscht weitgehend die Ansicht, dass der Entdeckungszusammenhang („context of discovery“), d. h. Regeln über die Entdeckung neuen Wissens, nicht wissenschaftlich behandelt werden kann. Dieser Artikel analysiert zunächst einen aktuellen Versuch, diese These zu widerlegen: die These des heuristischen Wertes von Begriffen („heuristic value thesis“ – HVT). Die These besagt, dass sozialwissenschaftliche Begriffe einen heuristischen Wert für die Entdeckung fruchtbarer (d. h. empirisch zutreffender und informativer) Theorien haben. Die wichtigsten Probleme dieser These werden analysiert. Sodann diskutieren wir andere Heuristiken und ihre Nützlichkeit für die Entdeckung fruchtbarer Theorien. Zu diesen Heuristiken gehören die Literatur über Kreativität, über „heuristics and biases“, über den „grounded theory“-Ansatz und über künstliche Intelligenz. Die jüngste „theorizing“-Heuristik scheint eine Synthese der verschiedenen Ansätze zu bieten. Wir behaupten, dass keine der genannten Heuristiken hinreichend detaillierte Thesen formuliert, die es erlauben, eine fruchtbare Theorie zu finden. Es wird vorgeschlagen, das Forschungsprogramm zu ändern. Es sollte versucht werden, generell theoretische Innovationen zu entdecken und nicht spezifische fruchtbare Theorien. Wenn man das Modell der „bounded rationality“ anwendet, besteht der erste Schritt darin zu erklären, unter welchen Bedingungen eine intensive Suche nach theoretischen Innovationen auftritt. Dieses Suchverhalten ist insbesondere bedingt durch ein starkes Erklärungsinteresse und durch im Gedächtnis gespeichertes Wissen über das zu erklärende Phänomen. Weiter sind Opportunitäten wie Forschungsinstitutionen (etwa die Deutsche Forschungsgemeinschaft) von Bedeutung. Es wird die These vertreten, dass diese Bedingungen generell die Wahrscheinlichkeit theoretischer Innovationen erhöhen. Dies steht im Einklang mit einer Studie, die einen positiven Zusammenhang zwischen akademischer Freiheit und Innovationen zeigt. Die Wahrscheinlichkeit, spezifische fruchtbare Theorien zu finden, ist äußerst gering – vergleichbar mit der Chance, in einer Lotterie zu gewinnen. Obwohl die Wahrscheinlichkeit, in der Lotterie zu gewinnen und eine fruchtbare Theorie zu finden, nahezu null sind, liegen sie dennoch über null. Die einzige Empfehlung, um das Ziel zu erreichen, eine fruchtbare Theorie zu finden, besteht daher darin, *generell* nach theoretischen Innovationen zu suchen.

Schlüsselwörter: Entdeckungszusammenhang, „grounded theory“-Ansatz, Heuristik für Theorieentdeckung, „heuristics and biases“-Ansatz, Kreativität, künstliche Intelligenz, Modell der begrenzten Rationalität

Introduction

A controversy in science and in the social sciences in particular is whether scholars should concentrate on *testing* theories (in the sense of general conditional statements such as theories of learning) or should also deal with the process of *discovering* new fruitful theories, i.e., theories that are correct and have a high informative content. The latter means that a theory has a wide range of application and explains a large class of specific phenomena (such as all specific kinds of crime and not only crime in general). The classic formulation of this controversy is that science should be concerned with the “context of justification” referring to the *test* of theories and not with the “context of discovery” referring to the *discovery* of fruitful theories (see Reichenbach 1938: 6-7; see further Hoyningen-Huene 1987; Schickore and Steinle 2006; Swedberg 2012b: 3-5). It is argued that the discovery of theories is a psychological process, and there are no rules of discovery comparable to rules to test the validity of theories.

Many scientists are dissatisfied with the restriction to the context of justification (see recently Sonntag 2023: 12-13), and there is meanwhile a vast literature about the discovery of fruitful theories. This paper analyzes the extent to which recent attempts to shed light on the context of discovery have found informative rules of discovering fruitful theories. We first focus on the assertion that social science concepts have a heuristic value for finding fruitful theories (Swedberg 2012b, 2016a, 2017a, 2018; see also Sohlberg and Leulufsrud 2018). For example, Zerubavel (2021) claims that social science concepts „sensitize“ scientists to get new (and, it seems to be asserted, valid) insights. What exactly the process is that leads from concepts to theoretical insights or whether concepts lead to discoveries only under certain conditions is not clear. There is only an alleged bivariate relation asserting that concepts lead to theoretical innovations. This thesis will be called the *heuristic value thesis* (HVT). We analyze the major problems of this thesis. If this analysis is correct, one wants to know whether there are better alternative heuristics for discovering fruitful theories. A candidate that is analyzed at length is “theorizing,” mainly based on Swedberg’s work. Finally, we will argue that a problem shift is useful: one should be content with *formulating general conditions* for discovering *some* theoretical innovations. It will be argued that this strategy is comparable to playing a lottery. Even if the probability of discovery is like a lottery (the chance of winning is about 1 : 290 million), not playing it has a chance of zero. Thus, the only chance to find a fruitful theory is intense search behavior.

Some Basics of Concept Formation

The HVT and its critique can best be understood when some basics of concept formation are known. For readers who are not familiar with these basics a brief

introduction will be given.² Then some objections to these basics are discussed, and a short note about criteria for defining concepts is added.

Symbols, Referents, and Semantic Rules

Definitions are sometimes formulated as statements asserting that something “is” of a certain kind. An example is the expression “a person ‘is’ rational if she or he deliberates before acting” (for the different meanings of “rationality” see Opp 2018). Goertz (2020: 2) even holds that concepts “are answers to ‘what is’ questions.” The problem of is-statements is that “is” has numerous meanings. It is a term “which is one of the most philosophically dangerous words” (Stegmüller 1977: 204). Take the “is” in “2 plus 4 is 6” and in “every human being is mortal.” In the first example “is” refers to a mathematical statement that describes an analytic identity, whereas in the second example “is” expresses an empirical law. What could the “is” in the sentence about “rational” mean? A first meaning could be a description of the *usage of a term by a group of speakers*. The sentence could mean that a group of speakers (such as the population of the US) calls a person “rational” if she or he deliberates before acting. This is an empirical proposition about the use of a word. Such a proposition is sometimes called a “real” definition. But “definition” normally means a “nominal” definition in the sense that it is “a convention which merely introduces an alternative – and usually abbreviatory – notation for a given linguistic expression” (Hempel 1952a: 2). The “is” in the previous sentence could thus also mean that “rational” is an *abbreviation* for the sentence “a person who deliberates before acting.” In other words:

Definition of “rational”: A person is *rational* = df. a person who deliberates before acting.

The word “rational” is the *defined expression* (or *definiendum*). This is synonymous with the expression on the right of “=df.” The latter expression (which means “is defined as” or “means the same as”) symbolizes equality of meaning. On the right of “=df.” is the *defining expression* (or *definiens*). It is assumed that the meaning of the defining expressions (on the right of “= df.”) is known. If, for example, “deliberates” is not clear, it needs to be defined as well. The defined expression has thus exactly the meaning of the defining expression.

It is important to note that such a definition is not an empirical statement, it is a convention. As Hempel (1952a: 18) puts it: “... nominal definitions... are

2 For more detailed accounts about concept formation see books on logic and philosophy of science such as Cohen and Nagel 1936: 227-229; Eaton 1931: 294-301; Hempel 1952: 2-6. We will focus on what we call the standard view of definitions. In the social sciences see, for example, Bierstedt 1974; Goertz 2020; Opp 2014: 117-154, 2019; Outhwaite 2011. See in particular the work of Giovanni Sartori (e.g., 1984) and the articles reprinted in Collier and Gerring (2009). In this section nominal definitions (see Hempel 1952) are discussed because they are the subject of the HVT. For disposition concepts that are not addressed in this article see Hempel 1952; Fara 2018.

arbitrary and may be chosen completely as we like” (see also, e.g., Sartori 2009: 91). “Arbitrary” means that it is *possible* to connect any statements before and after the “= df.” expression. This implies that there could be criteria that suggest which possible connections are preferable (see below).

The following implications of the previous account are important. (1) The meanings of defined expressions (such as “rational”) are often taken from a spoken language. But often scientists assign a new meaning to a word or expression, i.e., the pre-existing meanings are eliminated. For example, if “rational” is defined as in the example, it has no longer any other meaning. One meaning in everyday language is that a behavior is “rational” if it has more positive than negative consequences for a person. This is no longer the meaning of “rational” according to the previous definition. Take another example: the term “utility” of an action in utility theory means the overall satisfaction an action brings about. In everyday language “utility” refers to, among other things, satisfaction with material goods such as money. In discussions of utility theory it is sometimes argued that the theory is wrong because the satisfaction with following internalized norms is not considered. This argument does not take into account that “utility” as defined in the theory refers to satisfaction with norm following as well.

(2) It is further important that a definition cannot be true or false (contrary to what, e.g., Goertz 2020: 5, asserts). For example, if “rational” is defined as before, this is a convention and not an empirical statement. If this is denied, the question is how the previous definition can be tested empirically. As will be seen below, conventions cannot be tested. They can only be more or less useful.

(3) It is not correct that in general classifications (i.e., systems of definitions – see below) are „a species of ,theory““ (Gerring 1999: 381). A “theory” (as it is usually defined) is an empirical statement (or a set of empirical statements), whereas a definition is a linguistic convention.

Because these basic facts are often misunderstood, a graphic summary is provided in Figure 1 (for a similar graph see Opp 1970: 90; see also Sartory 2009: 103). In the left column of the Figure, it is shown that symbols (such as circles or lines on a white sheet of paper) are connected (symbolized by a line) with any phenomena (including empirical objects). The phenomena are the referents of the symbols. The line between the symbols and the referents specifies semantic stipulations or rules that assign symbols to phenomena. In the figure the example for symbols is “rational” (understood as a combination of black signs on white paper without any meaning). The symbols are related (see the line) by rules (see the arrow). In the previous definition the phenomena are “a person who deliberates before acting.” The “=df” denotes the semantic rule and, thus, the equality of meaning. The symbols thus have no meaning of their own.

This account of the received view of concept formation is useful because there are numerous misunderstandings about what definitions – and empirical propositions – are about. However, this view is not uncontroversial, as will be shown now.

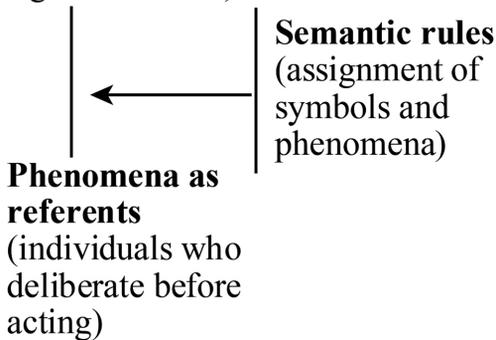
Possible Objections Against the Received View

One objection against the previous account is that *evaluative and descriptive aspects of concepts cannot be separated* (see the discussion in Djordjevic and Herfeld 2021). This implies that facts and values in a science cannot be separated. The implication for the previous account is that a purely descriptive definiens is not possible.

Figure 1: The Components of a Definition

Symbols

(e.g., linguistic signs “rational”)



Phenomena as referents

(individuals who deliberate before acting)

Semantic rules
(assignment of symbols and phenomena)

I strongly reject this view. One argument that invalidates this assertion is that in natural languages, the different components of a concept, in particular descriptive and evaluative meanings, often change over time. An example is the German word “geil.” A long time ago this meant horny and was associated with a negative evaluation. Nowadays, the concept means “awesome” and has a positive evaluative component. If there are continuously such changes in natural languages, why can scientists not deliberately specify to change certain meanings, and eliminate an evaluative component? Take our definition of “rational”: why should it not be possible to purge the concept from other meanings? A research paper may stipulate that a concept will no longer have any evaluative meanings and that the goal is to explain certain facts such as individuals’ deliberation before acting.

It is important that the referents of a concept need not be empirical phenomena, although in the social sciences the referents denote the empirical phenomena. How-

ever, this does not imply that concepts must “correctly capture and describe the world.” This means that concepts must have “descriptive validity” (Goertz 2020: 8). Not the concepts (i.e., the relations between definiens and definiendum – see Figure 1) are valid, but *hypotheses* in which concepts are components can be valid. Take our definition of “rational.” The assignment of the referent to the signs of “rational” is a purely arbitrary act. This is symbolized in the Figure by the line between “Symbols” and “Phenomena as referents.” Only if empirical propositions are formulated with this concept, it is possible to assess the validity of the proposition with the concept, but not only of the concept. For example, it may be held: “most individuals are rational.” The proposition and not the concept “rational” may be valid. (This seems plausible: for most individuals, it happens that they deliberate before they act). There is thus no descriptive (or, as Goertz also calls it, empirical) validity of a concept. There is only the validity of hypotheses formulated with a concept.

The previous account of concept formation is further criticized as “naturalism.” It is claimed that instead an “anti-naturalist” approach is preferable (Bevir and Blakely 2018: 2-9). We will not discuss this school of anti-naturalism but only its views on concept formation (ibid.: 65-87). According to the authors, “naturalists” commit three errors: reification, essentialism, and linguistic instrumentalism. This critique is based on misunderstandings of the received view described before.

The „brute fact“ of *reification* „occurs whenever social scientists strip their concepts of meanings and instead present them as brute facts – demographic, biological, social, or otherwise” (ibid.: 66). The defined expression is indeed often stripped of previous meanings by social scientists. It has only the meaning of the defining expression. What this new meaning is, depends, as will be seen below, on the goals of the scientists. Furthermore, no “brute facts” – whatever this means – are asserted in a new definition. There are no statements about facts involved. In the definition of “rational” only a meaning is assigned. Whether there exist “rational” persons, how “rationality” originates or which empirical consequences “rationality” has is not asserted by the definition. It is also possible to assign the meanings of an everyday (or, equivalently, a natural) language. Furthermore, the “interpretations” of meanings in language communities are not neglected. The definition of “rational” does not in any way impede the investigation of meanings in a language community. A definition may be consistent with everyday meanings, but – again – the assignment of definiens and definiendum is a convention. There is thus no “reification,” as the authors define it.

Essentialism means “stripping away the historical specificity from concepts” (ibid.: 71). Again, definitions may include such “historical specificity” by referring in the definiens to historical phenomena. E.g., “capitalism” may be defined as a certain kind of society. But many different definitions of “capitalism” are possible. Researchers are free to choose what kind of society they want to call “capitalist.”

Linguistic instrumentalism occurs “whenever social scientists divorce their concepts from their own language and from the language of those they study” (ibid.: 76). Again, a definition may include concepts from the language of those they study or from the language of the scientists. But what the assignment is depends on the goals of the defining person. Why this is unacceptable is not told by the authors. There is no argument showing why it should not be possible to create concepts for certain purposes that deviate from everyday meanings. As has been said, natural languages change all the time. Why should not scientists be free to create new concepts for certain purposes (see the next section)?

A Note on Criteria for Defining Concepts

As has been said before, the received view of concept formation leaves it open what a definition refers to. There is, however, one criterion which any definition should meet. This is implicitly granted also by critics of the received view: a concept should have some minimal degree of *precision*. Assume “rational” is defined as an action “that realizes the essence of the nature of persons.” We do not know what the referents of “rational” are. Not only the concept “essence” is extremely unclear. The “nature” is another extremely ambiguous concept too. The question is why a definition is introduced at all.³ In a communication in which the essence-nature definition is expressed, the person faced with the definition will certainly not be satisfied and will require more precise information about what is meant.

“Precision” is a quantitative concept. In the example of the previous paragraph, there is extreme ambiguity. Precision is higher in our definition of the rationality concept, but the defining expression is to some extent still ambiguous. For example, “acting” could mean observable behavior or “inner action” such as thinking. But perhaps the above definition is satisfactory for researchers who are concerned only with observable behavior, such as crime or migration. It is then clear that the concept refers to this kind of phenomena.

Assume it is accepted that a concept should be clear. A procedure to clarify a concept is *explication* (see, e.g., Carnap 1950: 1-18; Hanna 1968; Wagner 2012): the meaning of a concept is reconstructed according to certain criteria. One criterion is a higher precision. If a concept of an author is at issue, “explication” suggests

3 There may be reasons for preferring a relatively ambiguous definition to a clear one. A person might introduce ambiguous definitions because she or he expects other persons to get some fruitful ideas about something when she or he reads the vague definition. The idea might be that the vague definition does not restrict thinking to a clear class of phenomena but stimulates the phantasy without imposing limits. Another goal might be to impress one’s peers. In certain schools of the social sciences the reputation of scholars is positively associated with the ambiguity of their work. Lawmakers may let legal concepts be ambiguous because they want to leave discretion to judges in their decisions which are based on existing laws. We will not discuss those criteria further but concentrate on criteria that are accepted to a large extent in the social sciences.

a clarification that is within the limits of the author's definition of the concept. An example is the analysis of the meaning of Max Weber's "ideal types." He used this expression in different contexts (see in particular Weber 2012). What this expression means is not clear. There is an extensive literature which attempts to clarify its meaning (see, e.g., Burger 1976; Hempel 1952b, 1965: 155-171; Hempel and Oppenheim 1936; Stapley et al. 2022; van Riel 2021; Wagner and Härpfer 2014). One question is whether Weber *defines* the expression. If this is the case, the question is what exactly its meaning is. An example of an "ideal type" is perfect competition. It could be a definition that consists of properties of markets that do not exist in reality such as full information of the market participants and absence of monopolies. However, Weber emphasizes interrelations between properties. For example, the outcome of certain features of perfect competition is that the prices of commodities are equal to the marginal costs. So "ideal types" are theoretical models that show what would happen if certain features were given. There are thus causal relations between a set of variables (see, e.g., Weber 2012: 127). These features are the scope conditions for certain processes. This is the explication by Hempel: "ideal types" are theoretical models. It is not clear what Weber really meant. In the explication, one will suggest different possible clarifications that do not contradict Weber's accounts.

There are numerous criteria that could be applied to define a concept. They depend on the goals a person wants to achieve with a concept. For example, lawmakers want to capture in a definition of a concept, such as "theft" kinds of actions that should be prohibited and punished. The concept should thus have *normative relevance*. Sociologists may define inequality to describe certain features of a society that are regarded by the public as problematic. In everyday language, "inequality" refers to properties that vary across the citizens of a society. However, sociologists will exclude variables such as hair color because differences in hair color are regarded as unproblematic. The concepts should thus have *descriptive relevance*. Gerring (1999: 357) lists a "standard set of criteria, whose demands are felt in the formation and use of all social science concepts." However, it is doubtful that all the criteria Gerring mentions must be realized by every social science concept. For example, "familiarity" of a concept to a lay or academic audience is not a criterion that should always be employed. The concept "SEU" (for "subjective expected utility") was not familiar to anybody before it was introduced to denote a theory.

A criterion that is of particular importance for explanatory purposes is *theoretical relevance* of a concept (e.g., Hempel 1952a). Concepts are theoretically relevant if they are components of a correct theory. To illustrate, let there be two definitions of "reward":

*reward*_s = df. a *subjectively valued object* received by a person after she or he has performed a behavior.

reward_o = df. *some object* received by a person after she or he has performed a behavior.

Assume a scholar wants to formulate a theory that should explain behavior and that includes rewards as an independent variable. Previous theory and research (e.g., from learning theory) suggests that *reward_s* is theoretically relevant: only if subjectively valued objects are received after an action, its frequency increases. The first definition – *reward_s* – is thus theoretically relevant, at least more than the second concept.

The Heuristic Value Thesis and Its Versions

As has been outlined before, the HVT claims that concepts influence the formulation of fruitful theories (see the references in the introduction). Before the HVT can be discussed, several clarifications are necessary. (1) The question is what kinds of theories concepts are supposed to generate. Do concepts generate any theories? (2) Another question is whether the HVT refers to the defining or defined expressions. (3) It is further not clear whether the relation between the concept and the ensuing theory is a logical or an empirical relation. (4) It is not clear what the process (or mechanism) is that leads from the concept to the discovery of a theory. These questions are not addressed in detail by advocates of the HVT.

Do Concepts Generate Any Theories or only True and Informative Theories?

If concepts have a heuristic value, this probably means that concepts do not generate any theory but only true and informative, i.e., fruitful, theories. For example, assume it can be shown that the concept of crime leads to the belief that biological factors bring about crime. The HVT would thus generate a falsified theory. Proponents of the HVT will certainly believe that social science concepts will bring about fruitful theories.

Advocates of the HVT will probably not only believe that concepts bring about valid theories but also *informative* theories. This means, as has already been insinuated, that theories should, first of all, have a wide range of application. For example, it is preferable that a theory does not hold for specific groups, such as students, but for individual actors in general. Second, a theory should explain a *large* class of *specific* phenomena. To illustrate, compare the two versions of a theory:

T₁: If there are properties P, then there is action A₁ or A₂ or A₃ or ... or A_n.

T₂: If there are properties P, then there is action A₁ and not A₂ and not A₃ and not ... and not A_n.

T₁ does not specify in detail the *kind* of action to be explained. The explanandum is *some* action, ranging from buying some food over shoplifting to mass murder. The second theory is much more informative: the explanandum is exactly one kind of action. The occurrence of other actions is excluded. In this article, the informative

content of a heuristic is considered a desirable characteristic of a theory. The major characteristics of “fruitful” theories are thus their validity and informative content. A question will thus also be how specific the explananda of a theory suggested by a heuristic are.

Does the Heuristic Value Thesis Refer to the Defining or Defined Expression?

Definitions consist of a defined and a defining expression (see the exposition before). The HVT will not refer to the defined, only to the defining expression. It is hardly plausible that proponents of the HVT believe that symbols without any reference to some phenomena will lead to the discovery of a theory. For example, not the symbols of the letters in the term „rational” bring about fruitful theories. Only the defining statement “a person who deliberates before acting” could have a heuristic value. This becomes still clearer when we replace “rational” by “rho” (the Greek letter ρ). The latter expression will certainly not be supposed to generate a fruitful theory. The HVT should thus claim:

Heuristic value thesis (HVT): Defining statements of definitions (and not the defined expressions) have a heuristic value (i.e., bring about fruitful theories).

Are there Logical or Empirical Relations between Concepts and Theories?

What kind of relations exist between the defining expression and a possible heuristic effect? There are two possibilities. There might be a *logical implication*: the defining clause could logically imply at least one true theory. The latter is the heuristic “effect.” However, an empirically true proposition can only be logically derived from a defining clause which is empirical and true as well. In this case, the derived proposition would be contained in the defining clause. The derived theory is thus only psychologically new because the defining expression would comprise the theory.

To repeat again, defining expressions are never empirical propositions, they only stipulate the meaning of an expression. To derive a true proposition from the defining expression, the latter *must be asserted as or related to an empirical proposition*. How could this happen with the defining expression in our example, “a person who deliberates before acting”? Here are some possibilities showing how this expression can be reformulated as an empirical statement:

- (1a) All persons deliberate before acting.
- (1b) There are persons who deliberate before acting.
- (1c) If deliberating is more beneficial than spontaneous action, individuals will deliberate before acting.

These are empirical propositions that are not identical with the defining expression of “rational.” The question regarding the HVT then is: *how could defining expressions be reformulated as true empirical propositions?* It seems plausible that only such

empirical propositions and not conventions about how to use terms have a heuristic effect. Whether this is the case is not addressed by proponents of the HVT.

In the example, the defining expression refers to existing empirical phenomena: persons who deliberate before acting. However, there are defining expressions whose referents are not existing empirical phenomena. Two examples illustrate this:

Definition 1: TPS =df. a person with 1000 legs.

Definition 2: Pythagorean theorem =df. “The sum of the squares on the legs of a right triangle is equal to the square on the hypotenuse (the side opposite the right angle) – or, in familiar algebraic notation, $a^2 + b^2 = c^2$. In all right triangles, the sum of the areas of the squares of the cathets is equal to the area of the square of the hypotenuse” (Britannica 2023).

Definition 1 refers to real objects (persons and legs), but we know that such objects do not exist. No true empirical proposition could thus be derived if we assert the existence of TPSs: “there are persons with 1000 legs.” Definition 2 refers to a geometric theorem which has no empirical referents. Definition 2 can thus not be formulated as an empirical proposition. Thus, suggesting logical heuristic implications between defining clauses and theories leads to great difficulties. There is so far no detailed discussion of such a logical version of the HVT in the literature.

Because logical heuristic “effects” are not discussed in the literature, it is plausible that advocates of the HVT have an empirical effect in mind: the claim seems to be that a defining expression empirically *inspires* persons to find new fruitful theories. The HVT thus seems to assert:

Reformulation of the HVT: There is an *empirical effect* of the defining expression of a definition on the discovery of new fruitful theories.

Kinds of Referents and Kinds of Heuristic Effects

The possible defining expressions of a concept are very heterogeneous. The question is whether the HVT is supposed to hold for every possible defining expression or only for specific kinds of such expressions. Table 1 shows in the first column several defined expressions. It is important to remember that these are regarded as linguistic symbols that have only the meaning specified in the column “Defining expression (definiens).” The defined expressions are connected (via “=df.” – see column 2) with referents (column 3). Column 4 shows a short characterization of the kind of referents.

We mentioned already the first three definitions in Table 1. Let us add defined expressions that refer to an empirical theory, called “SEU theory” or “VET,” i.e., “value expectancy theory” (lines (4), (5), (6)). The term “SEU(a_i)” (line (4) and column (1)) has the meaning of the algebraic term in line (4) and column (3). It refers to the sum Σ of the products of p (subjective probabilities) and U (utilities) of outcomes (or, equivalently, perceived consequences) j of an action

i. For example, assume a person considers going to a meeting (a_i). Let there be one consequence j ; to influence the joint decision of the group. The SEU of a_i is the perceived likelihood (p) and perceived utility (U) that this consequence occurs if a_i is performed. Again, the SEU term refers to empirical phenomena. In contrast to the phenomena of lines (1) and (2), definition (4) is part of a theory – see line (6). This theory is called “value expectancy theory.” It asserts: if the SEU of an action a_i is larger than the SEU of any other action a_k , then a_i is performed – see line (6), column (3). In the example a person will attend the meeting, if the SEU of this action is larger than the SEU of any other perceived behavioral alternative. This theory is abbreviated as “value expectancy theory.” This is a relatively well confirmed social psychological theory (e.g. Feather 1990; Nagengast et al. 2011; Wigfield et al. 2016). The major assumptions of this model are included in the bounded rationality model, developed by Herbert Simon (see below). According to line (6) in Table 1, “value expectancy theory” is abbreviated as “VET.”

Which kinds of defining expressions of Table 1 (column 3) could have which heuristic effects, i.e., what is the fruitful theory that is expected to be discovered when one reads the defining expressions in the third column of Table 1? The question thus is how to find an explanandum and the true independent variables, and how are both related? This question is not answered in the literature. Wouldn't one expect that those who propose an empirical heuristic effect of concepts specify what kinds of referents will have which empirical heuristic effects (specifying the explanandum and the correct independent factors)?

We discussed already the possible heuristic effects of some defining expressions in Table 1. Regarding lines (4) to (6), the only effect that seems plausible is that someone formulates definition (4) and then has the idea that the action with the highest SEU is chosen. In this example, the question is whether definition (4) has not been found due to a pre-existing theoretical idea that overall utilities are relevant for behavioral choices. This would not be a heuristic effect of a concept but an effect from a theory to set up a definition. This process is described below.

Table 1: Examples for Definitions with Different Kinds of References

Defined expression (definiendum)	Assignment symbol	Defining expression (definiens)	Kind of reference
(1) Rational	=df.	A person who deliberates before acting	Empirical phenomena
(2) TPS	=df.	A person with 1000 legs	Empirical phenomena
(3) Pythagorean theorem	=df.	In all right triangles, the sum of the areas of the squares of the cathets is equal to the area of the square of the hypotenuse (see text).	Mathematical theorem
(4) SEU (a_i)	=df.	$\sum_{j=1}^n p_{ij}U(O_j)$	Empirical phenomena
(5) VET	=df.	Value expectancy theory	Linguistic abbreviation
(6) Value expectancy theory	=df.	[If $(SEU(a_i) > SEU(a_k))$], then a_i	Empirical phenomena (theory)

What Is the Process from the Concept to the Theory?

The HVT asserts a *bivariate relation*: a defining expression has an empirical effect on the discovery of a fruitful theory. Unclear is what the process is between these factors and whether the relation holds only under certain conditions. Is it required that the defining expression is first published in some printed medium, then read? This seems plausible, so that the assumption is that someone perceives the defining expression. The question is what the next step is: will the respective person immediately be able to formulate the new theory or does it take time and if so, how much time? Is it relevant what happens during that time – e.g., what kind of search process occurs? What these conditions might be is not clear. This is another severe weakness of the HVT. In what follows, we will explore those conditions.

The Reverse Process: From Theories to Definitions

Assume a scholar is interested in explaining under which conditions individuals deliberate before acting and under which conditions they act spontaneously (without deliberating). Would our scholar really start with a definiens of a concept? Why should she or he call a person who deliberates before acting “rational” (Table 1, line 1)? The scholar is interested in finding general factors that lead to deliberation. There is no incentive to begin with introducing conventions about new concepts. Let the scholar be a social psychologist P, who observes that people sometimes deliberate before buying something and sometimes decide spontaneously. These facts generate a theoretical interest: P wants to find conditions for those behaviors. There is no need to set up any definition at this point. Instead, when seeking

conditions P might explore the ideas stored in her or his memory and, in addition, ask people who deliberated and acted spontaneously about their reasons. Assume P found that for those who deliberated advantages of deliberating were relatively high, compared to a spontaneous decision. Assume P observed that this was the case for people who bought a house. They might have expected negative consequences of a spontaneous decision. P will then formulate this idea in a more precise way:

Verbal formulation of the theory: If the overall utility of a behavior *i* is higher than the overall utility of any other perceived behavioral alternative *k*, then behavior *i* is performed.

P might be dissatisfied with this formulation of the theory and try to clarify how exactly people proceed to compare overall utilities. P's reasoning might then lead to the idea that the "overall utility" of behavioral consequences of each behavioral alternative was relevant. An extension of the previous verbal formulation of the theory might be that this overall utility depends on the utility and subjective probability of each consequence. Then P might arrive in several steps at the definiens of "Value expectancy theory" (line 6, column 3). Only then – after the formulation of the theory – clear definitions might be introduced such as further clarifications of concepts such as "utility."

In contrast to the HVT, the example describes a process in which some explanatory interest gives rise to all kinds of search activities that might lead to the discovery of a new theory. It is not the case that some definitions give rise to the inspiration to formulate a new theory. Definitions may be introduced *after* a fruitful theory has been discovered. This process is *the opposite of what the HVT asserts*.

To arrive at a fruitful theory, there are thus two processes: one is the process asserted by the HVT; the other process assumes, in contrast, that there is at first an explanatory interest that leads to the formulation of a theory. Then definitions are introduced, if clarifications are useful. To summarize:

Process 1: Definitions *lead to* (or contribute to) the discovery of fruitful theories (HVT).

Process 2: Cognitive systems of persons *lead to* the discovery of fruitful theories, which *lead to* definitions.

Note that the first process is only a bivariate hypothesis: a definition leads to a theory. The second process consists of several steps. Such a process will be discussed later.

Empirical evidence is lacking that tests these propositions. However, the second process is much more plausible. In empirical research, it is common that scholars have found a puzzle and think about finding an explanation. Only at a later stage there might be a need to clarify concepts and introduce definitions.

A question that will not be addressed and that is not a topic of the HVT literature either is how scholars arrive at certain definitions. This is – as theory discovery – a matter of inspiration. There are no clearly formulated algorithms specifying how one arrives at theoretically fruitful definitions.

Other Possible Heuristic Effects of Social Science Concepts

So far, it was analyzed whether the heuristic effects of concepts were new fruitful theories. Social science concepts could have other heuristic effects: they could inspire the discovery of innovative experimental or other methods of social research or of new statistical techniques. An inspiration might also lead to the discovery of new phenomena (a new tribe in the Amazon rainforest). Another heuristic effect could be to find ideas about relevant initial conditions – if a theory is applied to explain certain singular phenomena. There are no clear hypotheses or empirical evidence for the conditions under which such effects occur.

Conclusion

The previous analysis indicates that the HVT is highly problematic. Its major problems are the following. (1) It is not clear whether the heuristic “effect” is a logical or empirical one. We assumed the latter is meant. (2) It is not clear which kinds of definitions have which heuristic effects. It is highly implausible that all defining expressions (see Table 1) have a heuristic effect or have the same heuristic effect. (3) The HVT does not inform about the kind of theory that is to be found under which conditions. (4) It is more plausible that not definitions lead to theories but that theories are discovered and that then definitions are formulated – if a clarification of concepts is regarded as useful. (5) The mechanism that shows how definitions are supposed to lead to theories is not specified. Our knowledge of discoveries suggests that finding theories is normally a complex time-consuming process that will be discussed in detail later.

A Plausibility Test of the Heuristic Value Thesis: Did Typologies Inspire the Formulation of New Fruitful Theories?

There are numerous classifications or typologies (in the sense of systems of definitions) in the social sciences. A well-known classification are the pattern variables by Talcott Parsons (see the summary in Parsons 1951: 57-58). For example, Parsons distinguishes types of action-interests. There may be “1. Cognitive interests (in ‘knowing’). 2. Adjustive interests (in securing gratification from objects). 3. Integrative interests (in minimizing and resolving conflicts).” Other typologies are the dimensions of societies by Dodd (1942) and the types of regimes by Linz (2000). Merton’s types of deviant behavior are another typology (Merton 1957, see also Blalock 1969: 30-32 and his general discussion of typologies 30-35; Harary 1966). Gibbs (1965) proposes a classification of norms.

If definitions have a heuristic effect, these (and other) classifications should have led to numerous fruitful theories. Apparently, this did not happen. An illustration is the discussion of the pattern variables between Parsons (1960) and Dubin (1960). The latter raised the question about the theoretical import of the pattern variables. Parsons aims at answering Dubin's questions but fails to show in detail how the concepts of his conceptual system could be combined to a fruitful theory. This is an example that the HVT could not be confirmed. There is no other evidence either that typologies ever led to empirically true and informative theories.

Parsons even explicitly proposed as a strategy for theory construction: one should start with a conceptual system and then proceed to the formulation of theories (see, e.g., Parsons and Shils 1951: 4). This strategy raises the following questions. (1) There are numerous possible classifications of actions, attitudes, goals, etc. Which classification will prove theoretically productive? (2) What is the procedure of combining concepts of a classification (e.g., the pattern variables) that results in a fruitful theory?⁴

Sometimes, typologies are not conceptual systems, they refer to kinds of causes of a phenomenon, i.e., to a theoretical model. An example is Max Weber's *types of rationality* (Weber 1976: § 2). He writes that „social action“ can be „instrumentally rational“ („zweckrational“), „value rational“ („wertrational“), „affective“ („affektuell“), and „traditional“ („traditional“). This „typology“ is not a conceptual system but a set of theoretical propositions. Weber proposes hypotheses about how to explain social action.

Ideal types in the social sciences are often not conceptual systems either, but theoretical models (e.g., Hempel and Oppenheim 1936; Lazarsfeld 1937; Hempel 1952b; recently van Riel 2021). As has been outlined before (p. 369), an example of an ideal type is perfect competition. This exists if markets have certain properties such as many buyers and sellers, the absence of transaction costs and the existence of full information of the market participants. This is a theoretical model in which scope conditions are specified that lead to certain market processes and outcomes.

We can thus conclude that existing conceptual systems have not so far led to fruitful theories. This is not consistent with the HVT.

4 A biographical note: When I was an assistant of René König at the University of Cologne from 1963 to 1967, Talcott Parsons gave a talk, and a group of assistants (including me) were allowed to ask him questions in König's office. I asked two questions: One was whether he thinks that the first step of finding a fruitful theory is the construction of a conceptual system. He answered this question in the affirmative. My second question was what the procedure was from the concepts to discover the fruitful theory. He reflected a moment and then said, that this was a good question.

Alternatives to the Heuristic Value Thesis

Even if the HVT were an effective device for finding fruitful theories, the question arises which *alternatives* could exist. Heuristics, i.e., methods to discover new knowledge, or, in general, the context of discovery are the subject of a vast literature. In this section, we will briefly discuss to what extent this literature about the context of discovery contains successful methods of discovery.

The Embeddedness of Concept Formation in Sociological Theory and Research: The Argument in Merton's Course on Theorizing

It seems that Robert K. Merton was the first sociologist who addressed the topic of theorizing (i.e., the process of discovery) extensively in lectures from 1942 to 1954 at Columbia University. These lectures were never published, but the material was available in the archives of Columbia University. Richard Swedberg (2019) analyzed these archives and describes Merton's ideas in great detail. Of interest here is the role of concepts in social research. Swedberg's analysis comes to two conclusions. One is that concepts were always "closely linked to the variables in the study" (ibid.: 91). If there are "variables in the study," this means that there are already hypotheses and that, in addition, definitions seem useful. Merton seems to have in mind the process described before: a first step is the formulation of a hypothesis or theory which then is improved by introducing new concepts or new definitions. But how to proceed from the variables to the fruitful definitions is not outlined. We find no rules either about how definitions – if they are introduced – might lead to the improvement of theories.

Merton criticized Parsons because his work consisted largely of concepts and not of "empirical generalizations" (ibid.: 100). This suggests that the process begins with a concentration on finding hypotheses and not first on finding concepts. There is no indication that concepts defined without being related to theory (or empirical research) could have heuristic values. This coincides with what has been described before: often theories come first, then – if they are regarded as fruitful – concepts are defined.

Explanations of Creativity

One might expect to find informative algorithms for the discovery of fruitful theories in the literature about the explanation of creativity. This literature has a long history (see, e.g., Joas 1996; Kaufman and Glăveanu 2019; Kaufman et al. 2019; Kaufman and Sternberg 2019; Simonton 2004, 2019). We will not go into the problems of defining creativity. For the purpose of this article it suffices to proceed from the basic definition that "creativity" refers to the provision of new knowledge.

In the literature on creativity, we do not find the algorithm we are looking for. In the book by Polya (1945, see also the discussion in Swedberg 2014a: 129-134), one of the classic works on heuristics, we find the following advice in the Preface: “Your problem may be modest; but if it challenges your curiosity and brings into play your inventive faculties, and if you solve it by your own means, you may experience the tension and enjoy the triumph of discovery.”

A problem with these rules and propositions is that they do not imply anything about the specific kind of new knowledge that originates under the conditions mentioned. Furthermore, the likelihood of the discovery, if the conditions are realized, is not specified. Take the prediction by Polya: how many of those scientists who are curious, activate their inventive faculties and own the means mentioned will really “enjoy the triumph of discovery”?

Ayala (2009: 10036) summarizes our general knowledge about the conditions for new and valid ideas in his analysis of Darwin’s scientific method:

“Scientists like other people come upon new ideas in all sorts of ways: from conversation with other people, reading books and newspapers, inductive generalizations, and even dreams and mistaken observations.”

He mentions, among others, Newton who “is said to have been inspired by a falling apple.” The hypotheses about the diversification of species “came to Darwin while riding in his coach and observing the countryside.” This is in line with Merton’s analysis of the *serendipity pattern* (Merton 1957: 103-111). Each scholar has experienced that ideas often come up unexpectedly and in quite different situations. For example, the falsification of some hypothesis may instigate thought processes that lead to new valid ideas – but also to new wrong ideas. But – again – what the conditions for specific kinds of valid ideas and fruitful theories in particular are unknown.

“Creativity” is also the subject of a book by Abbott with the title “Methods of Discovery. Heuristics in the Social Sciences” (2004). According to the title, we would expect that the author proposes clear hypotheses about how to find fruitful theories (or other innovations). But Abbott writes already at the beginning (2004: XII, see also p. 84): “Creativity cannot be taught.” There are thus no procedures to create new and fruitful theories.

Nonetheless, as we will see later, ideas of the creativity literature are useful when we suggest changing the agenda (see the section below). Here we will apply a general theory to suggest conditions that are expected to increase theoretical knowledge in general.

Heuristics and Biases

The previous argument that there are so far no informative and valid hypotheses or algorithms that enable us to discover fruitful theories is confirmed by the heuristics

and biases literature (e.g., Kahneman et al. 1982; Gilovich et al. 2002; Gigerenzer and Gaissmeier 2011). One fact that this literature shows is that individuals apply numerous shortcuts (or heuristic rules) that are largely biased. This means that they give invalid results. These errors are committed in everyday life as well as in science. The history of theories that were later falsified confirms this hypothesis.

Another literature promises “How to Solve It” (e.g., Michalewicz and Fogel 2000; Polya 1945). Polya is concerned with heuristics for mathematics. Michalewicz and Fogel’s subject is science in general. But the problems they address are very specific. They discuss, e.g., optimization algorithms with computers where there is a clear problem and a set of possible solutions. It is not clear how these approaches can be used to generate fruitful theories.

The Grounded Theory Approach

A widely discussed strategy of discovery in qualitative sociology is the *grounded theory approach* (Glaser and Strauss 1967; Corbin and Strauss 2015; Strübing 2014). It consists of “systematic, yet flexible guidelines for collecting and analyzing qualitative data to construct theories ‘grounded’ in the data themselves” (Charmaz 2006: 2). These “guidelines” are not designed to construct theories as defined by “positivists” (i.e., general conditional statements). The goal is to enhance “understanding.” But nonetheless, it is possible that the grounded theory approach has found rules that inadvertently lead to fruitful theories in the “positivist” sense. When we assume that the discovery of a general, fruitful theory enhances our “understanding,” then it is to be expected that the grounded theory approach will also lead to the discovery of fruitful theories. Due to limitations of space, it is not possible to analyze in detail the extensive work about this approach. But we could look at *explicit* formulations of rules of advocates of qualitative sociology designed to lead to discoveries. For example, Kleining and Witt (2001) suggest such rules. To illustrate, rule 4 is: “The analysis directs itself toward discovery of similarities” in sets of data (ibid.: 10). Which similarities lead to which fruitful theories remains an open question. The other rules are similar.

In a handbook about qualitative analysis in the social sciences Strauss (1987: 8), one of the authors of the 1967 book on the grounded theory approach (Glaser and Strauss 1967), suggests “rules of thumb ... for achieving better comprehension of social phenomena – through the development of some level of theory.” The author suggests eight such rules (ibid.: 241-242) which are not based on an informative general algorithm for theory discovery. To illustrate, the first rule is to collect some data which, as the second rule suggests, should be coded “in the usual fashion.” The next rule suggests “to write theoretical memos incorporating your initial ideas and the results of your coding.” Nothing is said about how to code data. Apparently, one needs some criteria or a theory that suggests how the coding should happen. It

is also left open what the “theoretical memos” based on the data should look like and how they are arrived at.

These writings indicate that qualitative sociologists have not so far formulated informative rules to find fruitful theories. Otherwise, we would have at our disposal revolutionary theoretical innovations that are confirmed by rigorous empirical research.

Artificial Intelligence: A New Technology to Discover Fruitful Theories?

The development of artificial intelligence (AI) has already developed to an extent that it is not implausible that it can also be a heuristic for the development of fruitful theories. Herbert Simon is one of the pioneers of developing AI (for an overview see Frantz 2003). He analyzed in detail the functioning of computers and compared it with human thinking (see in general Simon 1977a and the chapter 1977b, see also 2019). Of particular interest in this context is his critique of Popper’s thesis (see Popper 1959) that discovery is a creative intuition and thus has no logic. In other words, discovery is not the subject of science. This is the old thesis that the concern of science is the context of justification (i.e., the test of theories) and not the context of discovery (e.g., Reichenbach 1938: 7-8). Simon (1977c) rejects this claim by inventing a sequence of letters and shows that there is a “law discovery process” which consists of “recoding ... sets of empirical data” (ibid.: 331). Simon rejects the argument that discovering alternative hypotheses is limited. There is no “genuine reason to deny that ‘revolutionary’ hypotheses are the product” (ibid.: 335).

The claim thus seems to be that AI can overcome the old limitation of science to the context of justification. However, the simulation always proceeds from a given set of data. The “discovery” is to detect a certain pattern in the dataset. But a fruitful theory transcends the given data. Heider’s theory illustrates this. Even if we know, say, 1000 cognitive elements and combine them in almost infinite ways, the theory that explains change of elements and actions uses new theoretical concepts and relations between the concepts (e.g., Heider 1983: 150-151).

This argument is confirmed in an extensive review of “Scientific discovery in the age of artificial intelligence” by Wang et al. (2023). Of interest in this context is the discovery of “generative models” which “can estimate the underlying data distribution of a complex system and support new design” (ibid.: 48). The “discovery” is always about analyzing existing data sets and combining the data in some way that the computer program executes. This is not the process of discovering new fruitful theories. This can be illustrated again with Heider’s theory. The theory was first stated in a short article (1946). The theory goes beyond a mere combination of data. New concepts and their relations are proposed.

The “Art of Theorizing” – A Synthesizing Approach to the Discovery of Social Theories?

An alternative approach to the HVT and to each of the other heuristics is the methodology of *theorizing*. Its major advocate is Richard Swedberg (see, e.g., Swedberg 2012a, 2012b, and the discussion of Swedberg’s article in the same issue of *Sociologica*; 2014a, 2014b, 2014c, 2016a, 2016b, 2017b, 2020, 2021; see also the discussion by Anicker 2019; Carleheden 2016; Styhre 2022; Tutic 2015). The theorizing approach can be briefly characterized as follows:

“Roughly speaking, the expression ‘to theorize’ refers to what one does to produce a theory and to the thought process before one is ready to consider it final. While theorizing is primarily a process, theory is the end product” (Swedberg 2014b: 1; see for more details 2012b: 14-15).

Swedberg’s claim is that “we need to shift our main concern from theory to theorizing” (2014b: IX). The subject thus is the “context of discovery” – the subtitle of this book (2014b). This “scientific enterprise” consists “of three elements – you go from (1) theorizing, to (2) theory, to (3) the testing of theory” (2012b: 4). This is an approach that does not focus on specific factors relevant for discovery. It includes everything that might promote theoretical (and other) innovations. A second characteristic of the approach is that it is open to different philosophies of science. It uses insights from advocates of Analytic Philosophy such as the writings of Karl Popper and of Pragmatism such as the writings of Charles S. Peirce (e.g., Swedberg 2012a).

Swedberg discusses in numerous publications quite different suggestions for theorizing which have been proposed or discussed by various authors from different disciplines (e.g., 2014a). Examples are authors such as Andrew Abbott (a sociologist), George Pólya (a mathematician), and Herbert Simon (an economist). Analyses by major classical sociologists such as (in alphabetical order) Émile Durkheim, Robert K. Merton, and Max Weber are part of the theorizing approach as well.

It is not possible to discuss all those recommendations or actions that might lead to innovations. The question in this article is to what extent “theorizing” consists of informative rules to discover specific fruitful theories. It is most likely to find an answer to this question in Swedberg’s summary of “basic rules” (2012b). They first consist of two “phases”:

Phase #1: The Prestudy or The Theorizing and Early Discovery Phase

- - Observe – and Choose Something Interesting
- - Name and Formulate the Central Concept
- - Build Out the Theory
- - Complete the Tentative Theory, including the Explanation

Phase #2: The Main Study or The Phase of Major Research and Justification

- - Draw up the Research Design

- - Execute the Research Design
- - Write up the Results” (2012b: 10).

How informative are the rules suggested in these phases? Assume a researcher “observes” that some people follow the penal code, whereas others violate it. Furthermore, let the researcher “choose” this as “something interesting.” Next a “central concept” is formulated that seems to refer to the explanandum. There are numerous definitions of crime in the literature. “Phase #1” does not give any suggestion about which definition is to be chosen. Next, the researcher is advised to “build out the theory.” Again, there is no rule about *how* to build a fruitful theory. If there are no informative rules to answer this question, the next step of phase #1 cannot be taken either: “complete the tentative theory.”

The next phase #2 can only start if the questions of the first phase are answered. To “draw up the research design” is only possible if the theory to be tested is formulated. The following steps “execute the research design” and “write up the results” also presuppose that a theory has been found.

The proposals included in the two phases are formulated in more detail as four rules (see the table in 2012b: 17). Most important in the present context are rules #3 and #4, referring to the last two steps of phase #1: build a theory and complete the tentative theory. The rules are:

Rule # 3 Build Out the Theory

Give body to the central concept by outlining the structure, pattern or organization of the phenomenon. Use analogies, metaphors, comparisons – and all in a heuristic way to get a better grip on the phenomenon under study.

Rule # 4 Complete the Tentative Theory, including the Explanation

Formulate or model a full tentative theory of the phenomenon, with special emphasis on the explanation that constitutes the natural end of the theorizing process.”

These rules are too uninformative to yield specific fruitful theories. Rule #3 first suggests defining the central concept (in terms of the author: to “give body to the central concept by outlining the structure, pattern or organization of the phenomenon.” Take as the phenomenon to be explained crime. What is meant by the “structure” of crime? Should one try to get data about the distribution of a kind of crime (such as tax evasion) among young and old people, or across Western countries? “Pattern or organization of the phenomena” might refer to find the extent to which crime is organized. Assume all these recommendations are followed. How does one get from there to a theory?

Next, we are told to “use analogies, metaphors, comparisons – and all in a heuristic way to get a better grip on the phenomenon under study.” Before analogies etc. can be applied there must be some preliminary theoretical ideas. Where do they

come from? But assume that scholars believed that physical abnormalities lead to crime. This was a major view a long time ago. As long as scholars believe in the truth of this proposition there is no need to apply analogies. But now assume there is research that falsifies this proposition. Only then is there a need to find a new theory. Then it makes sense to apply analogies etc. The open question is which of the numerous possible analogies etc. one can think of should be applied. Which ones lead to a fruitful theory? What we know today is that two factors are important determinants of crime. A crime such as tax evasion decreases if there is a strong internalized norm that prohibits this crime and if there are relatively high expectations of severe and likely punishment. How does one arrive from the falsified to the accepted (and – from the perspective of today – true) proposition?

Rule #4 surprisingly assumes that not a true and informative, but a “full tentative” theory is discovered. There is thus only a claim that the rules lead to *some* innovative theory which is “tentative.” For example, Cesare Lombroso (a major proponent of the biological explanation of crime who was born in 1835) might have applied the rules and discovered the now falsified biological theory. The last part of Rule #4 suggests that the discovery of *something* new is the “natural end of the theorizing process.” Then the “context of justification” enters the scene.

The “key” to theorizing is *abduction* (see rule #2, 2012b: 17) – an “important but vague concept,” based on the work of Charles S. Peirce (see also Swedberg 2012a). Swedberg quotes a “central passage” (taken from Peirce 1957: 244) that characterizes abduction. The starting point are facts. “Abduction” refers to the process of finding an explanatory hypothesis that seems preferable to other hypotheses. Abduction exists as long as the preference for the explanatory hypothesis “is not based upon any previous knowledge.” In other words, abduction “invents or proposes hypotheses” (Burks 1946: 303). Swedberg also argues that abduction is a “kind of scientific intuition, that is, as the kind of intuition that a scientist or scholar is partly born with and partly develops through hard work and the cultivation of one’s imagination” (2012b: 18). Abduction does thus not allow the logical derivation of fruitful theories (see also Yu and Zenker 2018; Schurz 2016). There is no indication either that there is an empirical effect of performing abductive procedures on the discovery of a fruitful theory.

This conclusion about abduction holds for the procedure of theorizing in general. As Swedberg puts it:

“... the act of theorizing is deeply personal in the sense that you can only theorize well by doing it yourself and drawing on your own experiences and resources” (Swedberg 2012b: 2).⁵

5 In a personal communication (January 9, 2024) Swedberg wrote to me: “There will naturally never be a final heuristic formula, just as it will never be possible to formulate rules for how to predict the stock market or the winning lottery number.”

This statement confirms our previous analysis: the “own experiences and resources” are *somehow* to be combined when new fruitful theories are to be discovered. But how those cognitive elements or resources must be combined to yield a fruitful theory remains an open question. This is also confirmed when Swedberg concedes that such rules may lead to problematic discoveries (2014a: 27): “It is important to realize that the risk you take, if you want to say something new, is always failure.”

A good conclusion to this section is the discussion in chapter 6 of Swedberg’s book “The Art of Social Theory” (2014a). The title of the book suggests that the discovery of “social theory” is an art, not a logical or clear empirical procedure. He writes about books which address heuristics, including his own book: “Books in heuristics should in other words be used for inspiration, but what they advocate should not be copied” (2014a: 144). The conclusion is: “Develop Your Own Heuristic Rules!” – which is the heading of a section on p. 144. But whether and when a fruitful – or a wrong – theory is found is an open question.

Changing the Agenda: Applying the Bounded Rationality Model to Explain the Dynamics of Intuition and Creativity: Designing a Theory Lottery

Explaining the Search for Fruitful Theories

We conclude from the previous discussion that an informative heuristic for finding specific fruitful theories does not exist so far. It has first been shown in detail why the heuristic value thesis – the assertion that concepts can be used as a device for discovering fruitful theories – is highly problematic. Other heuristics and particularly the recent theorizing approach do not provide algorithms for finding a specific fruitful theory either. It thus seems that scholars are right who assert that so far there is no progress in finding rigorous, detailed, and informative heuristics for the context of discovery.

There are even logical reasons why it is not to be expected to find an algorithm for discovering specific fruitful theories. Popper (1957: V) asserted that for logical reasons the growth of knowledge cannot be predicted (for a discussion see Lagerspetz 2004): *if we had at our disposal an algorithm that predicts what a fruitful theory would look like, we would already have the theory.* For example, Alexander Fleming discovered Penicillin in 1928. If we could have predicted the discovery of Penicillin in, say, 1900, we would know Penicillin already. Thus, predicting a discovery such as a new fruitful theory implies that we know the theory already. This argument alone suggests that the search for an algorithm to discover specific fruitful theories is doomed to fail.

If there are no bright prospects for informative algorithms which lead to the discovery of fruitful theories, we might consider a *change of the agenda*: we might reduce our aspiration level. We could give up the search for an algorithm to discover *specific* fruitful theories. Instead, we could aim at specifying conditions that are *likely* to

bring about *some* new theoretical knowledge referring to the phenomena to be explained, without predicting the exact theory. For example, Lin et al. (2023) found in their study that on-site collaboration is more likely to yield innovations than other kinds of collaboration. But what exactly the innovations will be that are to be expected is left open.

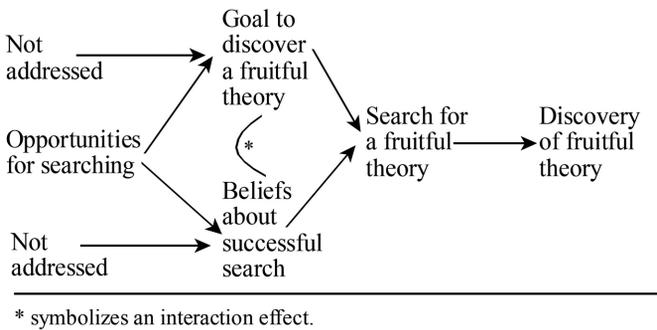
This change of the agenda is a degenerative problem shift in the sense that the search for an informative algorithm (to find *specific* fruitful theories) is replaced by the search for a much less informative algorithm (find *some* fruitful theory). But it is preferable to apply a heuristic with some or even a very low likelihood of discovery than applying no heuristic at all.

What could and should be the procedure to find such a heuristic? One possibility is to apply a factor approach: one lists ad hoc single factors that are supposed to lead to the discovery of a theory (see, e.g., Simonton 2004). An alternative procedure is to apply a general theory of human behavior that has been widely accepted in the social sciences. Such a theory is the bounded rationality model (BRM), based on Herbert Simon's work (1955; for a summary see 1997a: 118-129; see also Viale 2012). This theory specifies in general the factors that determine specific actions. Because the theory is relatively well confirmed it gives more reliable suggestions for explaining action than listing ad hoc factors.

The BRM shares assumptions with VET (that has been mentioned before) but contains additional hypotheses, as will be seen below. The assumptions that both BRM and VET share are that individuals perform the action that they regard as most beneficial for them. The kind of action that is chosen depends on the individuals' goals (or, equivalently, preferences or interests) and their beliefs about which actions best realize their goals.⁶ There are no restrictions on which goals or beliefs are relevant. It must be empirically determined whether goals are, for example, to adhere to moral norms, to conform to expectations of reference persons, or to benefit others (being altruistic). The beliefs (that must be determined empirically as well) are influenced by the existing opportunities.

6 The major difference between VET and the BRM is that VET models in more detail the impact of the beliefs and utilities (i.e., preferences) of behavioral consequences of a behavior. These details are not needed for the following argument.

Figure 2: The Bounded Rationality Model of Search and Theory Discovery



The literature about the discovery of a fruitful theory or of finding new theoretical knowledge suggests the following hypotheses (for a summary see Figure 2). A necessary condition is an intense *search for a fruitful theory*. This is the first step of a discovery. There are two factors that influence behavior in general and search behavior in particular. One variable is the *goals* (or preferences) of an individual. Regarding theory discovery the goal is to find a fruitful theory.⁷ The second variable is the *beliefs* about how to best proceed to achieve one’s goals. In the present case, it is the belief in how a theory can best be discovered. For example, a scholar could believe that studying the scientific literature related to the explanandum is likely to influence the discovery of the theory sought. The individual will choose those search actions that, in her or his opinion, are best suited for a successful search. Goals and beliefs have an *interaction effect* (which is symbolized in Figure 2 by the arc with the star). This means that the causal effect of the goals depends on the beliefs and vice versa. For example, if there is no goal to find a theory (i.e., the goal intensity is zero), the opportunity or beliefs have no impact on search behavior. Similarly, if there are no opportunities, intense goals will not affect search behavior.

Which goals and beliefs individuals have first depends on their learning history. We will not address the relevant factors for learning but assume that there are certain pre-existing goals and beliefs when search will occur. This is symbolized in Figure 2 by the two arrows with “Not addressed.” The existing *opportunities* an individual is faced with are important for realizing the goals and for the intensity of the goals. Extensive opportunities raise the aspiration level. The opportunities further increase the beliefs for a successful search. We have further added the assumption to the

7 Discovering a theory may not be the primary goal. For example, a scholar might be interested in a university career, and discovering a fruitful theory is only a means (i.e., a secondary goal) to make a career. Nonetheless, without finding a fruitful theory there is no career. Thus, for the career person the same factors are relevant as for the scientist with an intrinsic motivation.

BRM that search has a causal impact on the *discovery of a fruitful theory*. This step will be discussed in the next section.

This model can be applied to *explain social processes*. It is plausible that individuals continue actions such as searching for a theory as long as they do not reach their goals. We can illustrate this with the social psychologist Fritz Heider, who proposed a new theory, namely balance theory. This theory is widely accepted (e.g., Heider 1946, 1958). Heider explained the change or stability of cognitive elements such as goals, attitudes, norms, perceived behavior and other beliefs. In his autobiography (Heider 1983) he writes that he had the goal to find a general theory that could explain certain isolated hypotheses. This search lasted decades. During this time, he studied an extensive literature related to cognition and had extensive contacts with colleagues. Apparently, these actions were believed to contribute to finding his theory. Important is that he did not change his goal to discover the theory.

Heider's autobiography confirms hypotheses by Herbert Simon that searching for a theory is a cognitive or deliberation process (e.g., Simon 1989, 1995). The BRM assumes "satisficing." This is a "choice mechanism that will lead to ... a path that will permit satisfaction at some specified level of all of its needs" (Simon 1956: 136). How is this level determined? Simon borrows from psychology the idea of the aspiration level (Simon 1997b: 296). It is hypothesized that an individual who starts searching without success will not give up but that "the standards are gradually lowered" (ibid.). There will be cases in which the costs to continue searching after a failure to reach one's goal are so high that search is given up. But assume there is an intense goal to find a theory and that there is some expectation of success. We would then expect that a scientist will continue to search. He or she will engage in further search actions such as reading new literature or conducting explorative studies to find the theory (see, e.g., the confirmation of the BRM by Caplin et al. 2011).

We can illustrate this again with the social psychologist Fritz Heider. As a university professor he had stored numerous theories and empirical studies of the social sciences in his memory and tried to combine the elements of his belief system so that he finally found his theory of cognitive balance. But which existing beliefs were combined in what way and have led to the discovery of the theory is an open question.

That existing opportunities are a decisive factor for search behavior is meanwhile common knowledge. Many of these opportunities are created by institutional provisions. Universities provide time for research, and they expect scholars to publish. There are large libraries, and there is money for guest professors, talks and conferences. The possibilities to spend a year at an Institute for Advanced Study offer search time at low costs for the scholars. Funding organizations such as national science foundations give time and money for search behavior. If those conditions

for search are given to a high extent, then there will be extensive search behavior (see the model in Figure 2).

Under What Conditions Does Search Bring About Fruitful Theories?

The question dealt with so far is how search behavior can be explained (see Figure 2). The model further suggests that intensive search raises the likelihood that some fruitful theory is discovered. As has been said, the likelihood of finding the desired theory after intense search is extremely low. There have been millions of researchers who have engaged in intense search behavior, but only very few researchers were successful. Regarding Heider's theory it can be explained why he engaged in intensive search behavior, but it cannot be explained why he discovered balance theory. There have been probably millions of researchers who engaged in a life-long search to find a theory similar to Heider's theory but have not been successful.

Regarding the *size* of this probability we can only say that it is greater than zero and that it is close to zero. This is the difference to a normal everyday behavior such as buying some commodity in a supermarket. Here there is a clear set of behavioral alternatives one can select: the individual can choose among a set of commodities. The likelihood of finding the good with the desired qualities is relatively high. In the search for a new fruitful theory there is no limited set of alternatives that can be chosen from. Nonetheless, searching is a necessary condition for a discovery. Applying the BRM is thus a heuristic to find the right intuition. It could be called the *goals-beliefs heuristic*: the direct causes of searching are goals to find the fruitful theory and the beliefs, based on the opportunities mentioned before. But how search can lead to the desired theory is not specified.

To further illustrate the meaning of the low probability of discovery after searching one could compare the goals-beliefs heuristic with a lottery. The goal of finding a fruitful theory resembles the goal of playing a lottery to become rich. Although there are various lotteries that differ regarding the probability of winning, winning is always extremely unlikely.⁸ For example, in the American Powerball lottery the probability of winning the jackpot is 1 in 292.2 million. Much more likely is being involved in a plane crash (1 in 11 million) or being attacked by a shark (1 in 3.7 million). Although these probabilities are extremely low, they are positive. The probability of winning without playing the lottery is zero.

There are two common properties of trying to win a lottery on the one hand and searching for a fruitful theory on the other. Both actions have the goal of getting a high reward (money or a fruitful theory), and there is a low likelihood of reaching these goals. In other respects there are clear differences between playing lotteries and finding fruitful theories. In particular, playing a lottery is a quick decision,

8 I submitted the question to chatGPT: "How likely is it to win in a lottery?" The following is based on the answer from this program. See <https://chatgpt.com/c/ada738b2-c0fc-4059-9a85-7e71f4829cbd>.

compared with the time and effort to formulate a fruitful theory. Nonetheless, a comparison of playing lotteries and searching for fruitful theories is meaningful because it makes us aware of the extremely low probability of being successful in winning – finding the right number or the “right” theory.

Can the goals-beliefs heuristic be tested? One test could be on the macro level. A proxy for all societal factors that might bring about fruitful theories is *academic freedom* of a collective such as a society. A proxy for the discovery of fruitful theories could be the *number of innovations* in the respective collective. Audretsch et al. (2024) conducted such a study with data from 157 countries between 1900 to 2015. “Innovations” were measured as patent applications (i.e., a measure for the quantity of innovations) and patent citations (i.e., the quality of innovations). It seems plausible that the latter measures are a proxy for the discovery of fruitful theories. The authors summarize the results of their study in the following way: “We find that improving academic freedom by one standard deviation increases patent applications by 41% and forward citations by 29%.” To be sure, this is not a rigorous and perfect test of the previous hypotheses. But given the previous hypotheses we would have predicted the findings of the study by Audretsch et al.

Conclusion

The conclusion of the previous discussion is disappointing. Given an intense goal to find a fruitful theory, given a strong belief of successful search, and given extensive opportunities for search behavior, there is only a tiny likelihood of discovery. But the likelihood is greater than zero. Not searching has a probability of zero. However, the research about the correlation of academic freedom (i.e., opportunities for discovery) and innovations suggests that those who want to find new theories and have resources at their disposal are well advised not to stop searching.

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