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*An Inquiry into the Epistemic
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**AN INQUIRY INTO THE EPISTEMIC PROPERTIES OF ENTREPRENEURS'
THEORIES OF ACTION**

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ABSTRACT

Boundedly rational managerial actors struggling to process information often use a limited set of “theories of action,” or simple rules. However, simple rules may have a hierarchical structure, with some simple rules guiding others. Assuming the existence of such “keystone rules,” we establish the complexity of determining an efficient set, and therefore the necessity of using meta-heuristic approaches. We explore the development of “keystone rules” among entrepreneurs as a genetic algorithm, where the computationally hard problem of picking rules is solved by social calculation. We find that the emergent keystone rules among the observed entrepreneurs do not match existing “scientific” theories but have particular epistemic properties. The identification of keystone rules could fill a theoretical gap between the rational decision and the social construction perspectives.

Keywords: entrepreneurship, simple rules, theory, cognition, evolution

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“I think the basics of being an entrepreneur are still very much the same as when I started Virgin 40 years ago. Entrepreneurs should be open-minded, prepared to listen, and also expect to experience rejection and setbacks. It helps to know your limitations and surround yourself with people who have skills you may lack. Also, a vital part of being entrepreneurial is being decisive and being prepared to take risks - don't be afraid to follow your guts”

Richard Branson, 2010

INTRODUCTION

The division of epistemological labor in management studies has evolved towards a self-evident truce where scholars produce theories according to the scientific method and practitioners practice. As a result, practitioners frequently profess their own theories that may, or may not, be rooted in the scientific method. Scholars have an ambivalent view on practitioners' expressed theories, in particular *theories of action* (Argyris & Schön, 1978). Those are considered interesting *objects* of epistemological analysis—i.e., the object of a scientific inquiry—that will focus for instance on their material or symbolic origin. However, per se, they are usually not seen as having any scientific validity.

This dichotomy between research-based and practice-based theories results from two apparently opposed traditions. On the one hand, the decision science perspective, acknowledging limited rationality, rightfully considers actors' theories of action as inherently sub-optimal and, not surprisingly, has demonstrated a wealth of biases in actors' decision-making processes (e.g., Cyert & March, 1963 [1992]; Levinthal & March, 1993). On the other hand, social constructionists shun notions of optimality of decision-making but focus on the various social factors and processes influencing the construction of mental and social representations. They approach actors' theories of action mainly as cultural and institutional elaborations, whose value are independent of their “correctness” (Weick, 1979).

Yet, a few alternative perspectives have started to challenge the idea that practitioners' theories of action have little epistemic value. The psychology literature has demonstrated that heuristics can

be surprisingly accurate (Todd & Gigerenzer, 2003). Similarly, the strategy literature has demonstrated that “simple rules” can be efficient under conditions of uncertainty (Bingham, Eisenhardt, & Furr, 2007; Miller, 1993), and can be the foundation of the cognitive architecture that drives managerial action (Gavetti & Rivkin, 2007). More recently, studies in strategy have explored the emergence of simple rules, for instance Bingham and Eisenhardt, have considered mid-range rules of the type “enter countries with lots of pharma activity” (2011:1444).

Both the simple rules approach and the social constructionist approach to strategy-making consider theories of action mainly through a bottom-up focus. They study detailed micro-processes and identify the emergence, presence, and consequences of simple rules (Davis, Eisenhardt, & Bingham, 2009). However, cognitive processes have long been modeled as hierarchically nested structures (e.g., Argyris & Schön, 1978; Gavetti, 2012), consisting of both detailed micro-processes and more abstract governing “meta rules.”

So far, little research has explored the epistemic characteristics of those theories of actions as *meta-rules* that could play an architectural role in generating cognitions and actions. The beliefs expressed in the opening citation by Richard Branson exemplifies a widespread empirical phenomenon occurring in business practice in general, and in the entrepreneurship context in particular: that a *limited* set of higher order theories of action could have significant effects on entrepreneurs' activities. These rather common expressions among entrepreneurs, which we will revisit here, raises the possibility that, among all possible rules¹, a limited set could have a disproportionate impact on orienting action, but also on learning and on sense making, hence exert architectural effects. Accordingly, we will label them *keystone* rules.

Our conceptual and empirical exploration of such phenomena rests on two fully acknowledged *assumptions*. First, we will assume cognitions and beliefs to have a hierarchical (e.g., metaphorically

¹ Since theories of action take the form of rules expressed in a natural language, we will indifferently refer to them as rules in the rest of the text.

pyramidal) structure whereby individual actors, e.g., entrepreneurs, rely on a few semi-permanent rules that operate at the highest-level of cognitive process (Fishbein & Ajzen, 1975). In particular, we will conceptualize this highest level as a “bundle” that, per the most fundamental interpretation of bounded rationality (Simon, 1947 [1997]), will be small—to the point where we can stylize it as a handful. This does not imply that cognition processes and depth are actually so limited, but rather that a small set of keystone rules can guide various mechanisms such as learning and self-selection. Although we model actors' top-level beliefs as a small bundle of keystone rules, it could still be the case that actors manage a rich and large spectrum of cognitive processes..

A second major assumption is the possibility to attribute an epistemic property to rules, e.g. to decide whether a rule is efficient or is fad, a fashion, or is just plainly wrong. Such an assumption may seem overly rationalistic, but we will show that its resolution requires a “social calculation”, therefore bridging into a social-constructionist perspective. Establishing this continuity, or link between a rational and social constructionist perspective, is one of the intended contribution of this paper. Our approach draws on an epistemic culture perspective (Knorr Cetina, 1999), but rather than taking an a priori social construction basis, we will start here with a rationalist assumption and land later into social construction. It also relates to the *epistemic logic* perspective in the philosophy of knowledge and beliefs (Hendricks & Symons, 2009).

Assuming that a bundle of keystone rules drives action and that the epistemic property of rules can be assessed individually, we seek to explore the epistemic property of bundles of keystone rules. We first conceptually explore the problem of selecting a small bundle of rules out of the tens of thousands of potential rules, which we demonstrate constitutes a hard combinatorial problem (e.g., Rivkin, 2000). Hard combinatorial problems occurs in various other scientific areas with similar combinatorial characteristics (e.g. selecting a small set from a large possible set), and it has been demonstrated that such problems can only achieve a local optimum solution through strategies that

are meta-heuristical (e.g., Blum & Roli, 2003), such as genetic algorithms. We thereafter identify the entrepreneurial context as a *natural* setting of such genetic algorithms: entrepreneurs are selected; they get a chance to express their own theory depending on their success; and their voice leads to the collective elaboration of a theory of action.

Second, in an empirical illustration, we explore entrepreneurs' explicit theories of action. We gathered and selected archival interviews of entrepreneurs, selecting instances where they appear to express such keystone rules. In addition, we subsequently conducted primary interviews to explore further the nature of the theories that entrepreneurs expressed, the weight that these actors assign to their theory, and their perceived rationale. The analysis consisted of a two-level categorization of the expressed rules, leading to the identification of a corpus of theories of action that are candidates for keystone rules. We then conduct an epistemic analysis of keystone rules to identify their negative and positive epistemic properties: fuzziness, inconsistency, counter-factual, as well as polymorphic and self-fulfilling.

In the third section, of inductive nature, we build on these observations and their evolutionary nature to observe distinct bundles confirming that distinct logics may arise in the entrepreneurship context, for which keystone rules play the role of quasi assumptions. The evolutionary clusterization around keystone assumptions suggests that entrepreneurs' logics follow an epistemological dynamic similar to the one described by Thomas Kuhn (1970), hence we propose to label *paradigm* such bundles of keystone rules.

Although we do not claim causation or confirmation, this exploration potentially contributes to several literatures. First, the bundles that emerges are functionally similar to bundles previously identified in the entrepreneurship literature, such as the causation vs. effectuation logics (Sarasvathy, 2001a), suggesting to reinterpret them through a paradigmatic lens. Second, it contributes to the emerging literature on simple rules and heuristics (Bingham *et al.*, 2007) by suggesting both the

importance of simple rules and their architectural dimension. This study should encourage the study in practitioners' paradigms, even if their high-level architectural position makes them less liable to micro-level observations and validation.

HOW TO DETERMINE AN OPTIMAL SET OF KEYSTONE RULES ?

To determine the bundle of rules with maximum epistemic quality, we first review the motivation to *assume* that actors view their world through a limited set of rules. Then, we explore why the selection of such bundle constitutes a hard combinatorial problem, and how the chatter among entrepreneurs regarding keystone rules might constitute a relatively efficient approach to a *social calculation* (Callon & Muniesa, 2005).

Assuming the existence of a keystone rules

The core idea of bounded rationality is that humans have limited cognitive resources, such as memory, process, attention, etc. (Simon, 1947 [1997]). This imposes constraints on the number of items that actors can be exposed to, memorize, pay attention to, and process. This insight remains one of the principle tenants of organization theory, in particular the attention-based view of organizational life, whereby the limited attentional capabilities of actors drive outcomes (Ocasio, 1997, 2011).

While such constraints are acute for all managerial actors, they may be even more acute for particular types of actors, such as entrepreneurs. In entrepreneurial contexts, in particular early in the life of a new venture, individuals often must act with limited cognitive support under conditions of high uncertainty. Decisions occur without the help of a significant organizational structure to process and manage information, which March and Simon defined as the central activity of organization (March, Simon, & Guetzkow, 1958 [1993]). Furthermore, entrepreneurs have often not been exposed to the large and structured body of knowledge delivered in business schools.

Therefore, when it comes to their theory of action, entrepreneurs are particularly likely to rely on a relatively small set of simple rules. Such small rule sets do not necessarily imply that entrepreneurs are inhibited by these rule sets. In contexts of high uncertainty, small sets of “simple rules” may actually be superior at processing highly ambiguous signals (Bingham *et al.*, 2007; Davis *et al.*, 2009). In the strategy literature, this has been expressed as the potential superiority of *small world* representations whereby “a simplified and less accurate goal structure may lead to superior performance” (Levinthal, 2011:1521).

However, a small set of rules does not mean that all “simple rules” are equal. Cognitive science has demonstrated that rules get organized into complex stratified structure (Hodgkinson & Healey, 2008), which has often been assumed to have some sort of hierarchy, for instance of a pyramidal style (e.g. Gavetti & Rivkin, 2007:432). Similarly, work on strategy in dynamic environments highlights both the value of simple rules and the fact that rules have an internal hierarchy, some being more or less abstract, or some rules being learned before other rules, implying a cognitive hierarchy to such rules (Bingham & Eisenhardt, 2011).

Given the potential existence of a hierarchy of simple rules, we make the assumption that bounded rationality puts a limiting constraint on the rules at the apex of the cognitive structure, the generative rules that lead to other simple rules. This assumption is consistent both with the essence of the Carnegie tradition, as well as more symbolic and social constructionist perspectives when, for instance, identifying logics of action as small set of principles that drive action (DiMaggio, 1997; Thornton, Ocasio, & Lounsbury, 2012). Proving this assumption is not the purpose of the current study, and we acknowledge the first of our foundational assumptions: *actors generate their world through a short bounded set of high-level simple rules.*

This assumption does not require that cognitions are actually so limited, but rather that because actors face limitations, they use a set of high-level *keystone rules* that orient various mechanisms such

as learning and selection of lower-level simple rules. On an ongoing basis, actors instantiate a fundamentally large range of cognitions—although they rely on a limited set of keystone rules—hence our assumption is compatible with rich cognitive and social processes such as (vicarious) learning, social construction, communication, etc.

The above assumption does not qualify the actual size of the bundle of rules. However, as we observe in the sub-section below, size does not matter except within the constraints of bounded rationality. This assumption is supported by the observation that, in practice, entrepreneurs state keystone rule bundles that range from one to a dozen rules of action. Assuming such sets exist, our inquiry will now focus on the *epistemic properties* of such bundle of keystone rule.

The hard problem of determining an optimal keystone rules set

The corpus of theories from which entrepreneurs can draw to build a bundle of rules is a large one. In particular, it includes the theories already available and verified in the management science literature (the “traditional” epistemology). In terms of order of magnitude, the potential available rules in the management science literature alone can be estimated by multiplying the number of hypotheses produced by all journals (assuming articles are actually developing new knowledge) over half a century, suggesting thousands if not tens of thousands of seemingly “valid” rules. In addition, the explorable set contains also all rules used in pedagogy or in practice that are not yet validated in traditional epistemology. Finally, the explorable set contains any other rules that may emerge from experience or social construction, either individually or collectively. Already, the set of possible theories is tremendously large, at least compared to the bundle an individual entrepreneur can cognitively accommodate.

This discrepancy, a fundamental interpretation of Simon’s bounded rationality idea, constitutes the major constraint on the determination of the optimal bundle of rules. To some degree this stands at odds with science in our positivist tradition which predominantly consists of the

establishment of independent relationships (e.g., $X \Rightarrow Y$) and then empirically verifying whether or not such hypotheses hold. In this approach, the determination of *truth* amounts to a binary outcome of an individual test. Collectively, the traditional epistemology amounts to accumulating the sequential verifications of such unitary hypotheses.

However, once the total set of validated hypotheses have been established, little is known about which subset of hypotheses would be cognitively efficient for actors in practice, *assuming they are cognitively constrained*. The reason is that by contrast to individual hypothesis testing (e.g., is hypothesis A true, or not?), selecting an optimal subset amounts to a *combinatorial* problem (e.g., how to select an optimal A, B, C among a large set of theories?). Such a selection has long been identified as a particularly intractable problem (e.g. Rivkin, 2000). Specifically, combinatorial problems are hard to optimize because evaluating the validity of a limited size bundle (e.g., 3 rules) to be picked out of a large set of validated theories (e.g., out of 10,000 validated rules) implies showing that it is better than *any* other combination. In practice, the bundle would have to be compared to an outstandingly large alternative set (e.g., for 3 out of 10,000, the alternatives amounts to roughly 10^{12} , or a trillion comparisons) which implies non-human time and scales.

Notice that the larger the set to select (e.g., from 3 to 10 to 100), the larger the combinatorial challenge. The only case when the combinatorial is not divergent in practice is the choice of only one rule (one would still have to parse all possible rules), or the consideration of all rules simultaneously (which would amount to full rationality). Interestingly, combinatorial convergence contributes to the assumption that actors rely on a small set: whatever the size one chooses, the problem is intractable in all cases except the in the case of full rationality, that does not require rules. The idea that actors could manage more than a handful of theories, e.g., assuming a complex and rich set, would still generate divergent combinatorial solutions, only more intractable.

Finally, the only case where such a hard problem would be solvable is if the rules were to be

disconnected from each other, non-interdependent. In which case, one might imagine that actors could sort the rules depending on the size of the effect on the outcome (Combs, 2010) and retain only the most important rules. This unstated assumption of traditional epistemology is reflected when our science translates into pedagogy: a large bundle of rules is fed to students/practitioners (usually based on the instructors' beliefs about their rank-ordered importance), with the secret hope that if they cannot instantiate them all, at least the most important rules would be retained. This not only assumes a sorting mechanism based on an importance-based ranking, but more importantly that complex interactions do not occur. However, factors in management science are interconnected in a complex web that make the problem actually highly combinatorial (Rivkin & Siggelkow, 2003).

Overall, it appears that a small optimal bundle of theories can neither be exhibited nor validated by a positivist approach. Then, how should one make such a selection of a few rules out of a large set? Sciences that have been confronted with similar combinationally difficult problems have explored alternative solutions, for example, Genetic Algorithms (GA, Holland, 1975). In practice, a GA requires a massively large group of actors experimenting with various combinations of rules, exchanging those rules among themselves, and assigning a reproductive advantage to individuals that over-perform. GAs have been demonstrated to converge efficiently towards local optimum, given that absolute optimality remains out of reach in most cases. Local optima are defined as solutions for which no local improvement exists, i.e., no better strategy by changing only a few parameters by small amounts.

Genetic algorithm have already been invoked in organizational studies as a solution to select sets of routines (Bruderer & Singh, 1996) or sets of strategy rules (Rivkin & Siggelkow, 2003). GA are most commonly performed in computer simulations, where agents enact rules, perform, exchange their rules, etc. until they converge onto a (probably local) optimum. However, the context of entrepreneurship provides an unusually superior set of *natural conditions* for a GA solution to rule

development, specifically a small set of “keystone” rules. The expression of keystone rules (by direct discussion or intermediated by the press) is the exchange mechanism; entrepreneurs' experiences provides variations (initiating or removing rules); and the selective pressure of entrepreneurship occur through the death of firms, or the exit of entrepreneurs. Finally, reproductive advantage conditions occur since voice is given through priority to successful entrepreneurs (Aldrich, 1999:chap. 4). The “ecology of memes” perspective (Weeks & Galunic, 2003) corroborates such an interpretation as it identifies types of explicit beliefs as being subject to evolutionary processes which would occur jointly to the evolution of entrepreneurs. Overall, one can interpret the *entrepreneurship context as constituting a natural genetic algorithm where both individuals and their beliefs are co-selected*. Therefore, the emergence of a small bundle of rules that are commonly cited by entrepreneurs suggests that such rules are shared and their evolution suggests they are adaptive, at least relative to the constraints that entrepreneurs have in carrying and exchanging rules.

This formal reasoning suggests that the rules that emerge from entrepreneurs exchanging their keystone rules would constitute a locally optimal bundle. This reasoning does not validate per se the bundle as being optimal, as no method exists to actually validate optimality in such massively combinatorial problems. To be clear, a positivistic approach can be applied to theories of action (e.g., evidence based management in Pfeffer & Sutton, 2006), but would at best determine, which of a selection of sets is more efficient (e.g., which, of two sets [A, B, C] vs. [D, E, F], is more efficient). However, this approach is completely mute about whether this is even a local optimum. For instance [A, B, C] being better than [D, E, F] does not preclude [A, B, D] from being even more efficient—yet again not even a local optimum (and so on).

The identification of keystone rules could suggest a richer view of how boundedly rational individuals sort and develop keystone rules as well as how such rules emerge, filling a theoretical gap between the rational decision and social construction perspectives. Relative to rational decision

approaches that viewed entrepreneurs' theories as systematically biased, the bounded rationality constraint is now externalized and made a defining constraint of theory construction. Moreover, the emergence of shared beliefs that was considered by social constructionists as an institution devoid of optimality now has the status of a mechanism to resolve a hard problem: the identification of a bundle of theories of action that can actually be instantiated by actors.

AN EMPIRICAL EXPLORATION

To enrich the conceptual development of our theory that entrepreneurship embodies the natural conditions of a Genetic Algorithm, we conduct an empirical exploration of keystone rules in the entrepreneurial context. Specifically, we explore entrepreneurs' explicit theories of action, based on archival and primary interviews, which we categorize to identify the most common ones. Finally, we discuss the epistemic properties of the elicited keystone rules.

Context

We chose to focus our exploration of keystone rules in the context of entrepreneurship, because it is particularly favorable to observe a genetic algorithm. First, the role of entrepreneurs, by contrast to various managerial positions in existing firms, is to exhibit a high level of individual agency. Second, acute evolutionary pressure occurs in entrepreneurial contexts (Aldrich, 1999). Finally, because society gives voice to entrepreneurs, particularly successful ones, a clear dissemination and selection mechanism may drive the development of keystone rules.

Because communication is of utmost importance in a successful evolutionary social process, we focus on the keystone rules as they are explicitly *expressed* by entrepreneurs. We do not ignore that the expression and actual usage of rules may differ²; however, rules that remain private to individuals will be hampered to contribute to a collective calculation (Callon & Muniesa, 2005). Vicarious

² The discussion section will revisit the tradeoff between studying expressed – i.e., exchanged – rules vs. studying rules in use.

learning is also possible, whereby actors observe other actors, even though their rules are not explicitly expressed. This situation is less likely to lead to transmission in the context of entrepreneurship, as entrepreneurs tend to work isolated from each other. Finally, a rule may be never expressed, because of social desirability reasons, but be clearly at work (e.g., selfishness, greed). We will discuss this concern below, as the presence—or absence—of socially stigmatized rules might constitute an epistemic characteristic of the set of rules.

Sources of data

To explore the possibility of keystone rules, we conducted a qualitative study, first gathering a set of archival documents, and then conducting primary interviews within a sample of American and French entrepreneurs.

Keystone Rules in the Wild: Archival Interviews - We explored a large sample of entrepreneurs' interviews in the press, searching by keywords (e.g., “entrepreneurs”, “interview”), and by sources (e.g., MIT Entrepreneurship Review). We searched for press articles where keystone rules were spontaneously expressed, vs. those cases where theorizing is prompted by the interviewer's questioning. Out of the tens of articles where keystone rules appeared spontaneously, we selected a representative sample of 20 interviews to be coded in the qualitative analysis. Since coding and theorizing were iterative, the cutoff was based on theoretical saturation, i.e., when adding interviews did not alter significantly the inductive pattern.

Semi-structured Interviews – In parallel to collecting secondary interviews, we conducted many unstructured interviews with entrepreneurs around those issues. It helped us design a semi-structured protocol of interviews (see Appendix A), intended to probe the existence of keystone rules and explore the logic as expressed by entrepreneurs.

Sampling

Such qualitative data collection entails a difficult boundary selection problem. On the one hand,

fostering variance for comparative purposes, for instance by sampling entrepreneurs to contrast across cultures or across types of entrepreneurship was beyond the objective of the current study, which is to identify the construct and its properties. On the other hand, narrowing on all dimensions was not appealing nor practical, given the objective to check for generalizability.

In the process, the data collection (archival and primary interview) converged onto a reasonably bounded community of entrepreneurship that surrounds the institutions of international business schools. These entrepreneurs were mostly well educated, male, with some level of international variance (mainly US, France and a few other countries), had engaged into scalable entrepreneurial projects (i.e., with greater ambitions than small “mom-and-pop” enterprises, and entailing significant investments or revenues).

Analytic approach

We performed nested levels of coding, using Atlas TI, a qualitative data analysis software, allowing both openness in the initial phase, as well as comprehensiveness and rigor in the later classification phase. We began by identifying a large breadth of expressed theories at a first level, using an open coding of basics rules, using in-vivo codes (Strauss, 1987). This first pass of analysis demonstrates a large spectrum of rules with apparently little similarity across individuals. We summarize the pattern of citation of level one rules in Table 1.

----- Insert Table 1 roughly here -----

Then, at a second level, we conducted an axial analysis by searching for relationships between categories in order to assemble them into higher order themes that aggregate and generalize related rules (Glaser & Strauss, 1967). This selection and identification was conducted in a grounded theory approach, i.e. we gave precedence to meaningful associations over quantitative counts. This process of abstracting rules into higher-level categorization operated both as a tool for recurring passes of analysis, as well as producing a final categorization, once saturation was obtained. To illustrate how

it converged into a selection of keystone rules, we provide an intermediary grouping of rules (Table 2) that was built by simply aggregating rules by related content.

----- Insert Table 2 roughly here -----

This intermediary grouping was subjected to additional transformation. First, additional associations were conducted across the groupings (e.g., Irrationality and Autonomy were consolidated into a meta-rule “be self-determined to the point of irrationality.” Second, some groupings (e.g., “Not from school”, “Attention, Strength”) were not retained in the final bundle of keystone rules discussed here, mainly for substantive reasons explained below (these groupings also had less occurrences than all the retained keystone rules). In this process, we also took into account metrics to guide the selection of rules based on their salience. Table 3 illustrates the basic metrics used when working on the groupings: the count of all mentions, the count of the number of appearance (i.e., one if appears in a text, otherwise zero), and the ratio of appearance.

----- Insert Table 3 roughly here -----

Considering the grouping “Attention,” which bundled rules stating what entrepreneurs should pay attention to, it aggregated “attention to customers” and “attention to employees.” This grouping was useful in the initial phase, but it appeared overly general (it aggregates any idea of “paying attention to something”). Hence, we decided to reconsider this meta-rule by breaking it back into separate substantive attention (customers vs. employees). Quantitatively, the threshold that we considered for retaining a meta-rule is that it be mentioned at least in 50% of the cases. It turned out that neither “attention to customers” nor “attention to employees” came close to this threshold. Regarding the grouping about “strength,” it was also eliminated simply because of its very low occurrence ratio. Overall, this process allowed extracting from a broad set of expressed theories of action, a kernel of meta-rules, summarized in Table 4.

----- Insert Table 4 roughly here -----

Findings

Dominant meta-rules - Three meta-rules emerged strongly, mentioned in more than half of the cases, and hence constitute good candidates as keystone rules in this entrepreneurial sample. These will be the ones for which we will provide further substantive details and epistemic analysis.

The first most common meta-rule states that the entrepreneur should embrace the possibility of failure. It appears as the aggregation of three relatively distinct sub-rules. The first one suggests that entrepreneurs should expect failure. Notice that the wording often varies, for instance, failure is sometimes evoked as “mistakes”; the concept of failure appears at firm level, individual level, or innovation / product level. The second rule concerns learning from the failure that has been predicted to occur from the first rule, with a large proportion of actors stating that failure matters in that it is a crucial path to learning. The third rule states that one must find the strength to try again after failure, both regarding the humiliation of the first failure, and the possible repeat of such failure. Overall, this cluster about failure echoes the generous literature in entrepreneurship research regarding failure (e.g., Shepherd, Wiklund, & Haynie, 2009).

The second most common meta-rule concerns the idea that entrepreneurs be undeterred by negative feedback, even though the difficulty of accepting and learning from such feedback is acknowledged. This rule is often complemented by a sub-rule that entrepreneurship requires a significant amount of irrationality. This second meta-rule complements tightly the first meta-rule, whereby entrepreneurs have to stick to their guns not only regarding long run market selection (i.e., possibility of failure) but also regarding short run interactions (i.e., the possibility that the rest of the world disagree with the venture). The scientific literature has explored related issues, for instance on the relationship between optimistic overconfidence and performance (e.g., Simon & Shrader, 2012).

The third most common meta-rule concerns the motivation for becoming an entrepreneur, associating success with “passion” (i.e., a deep emotional motive quite distinct from expecting

monetary rewards), mainly as a mediator of the persistence in the entrepreneurial effort. It echoes an abundant literature linking entrepreneurs with passion (e.g., Cardon *et al.*, 2009; Chen, Yao, & Kotha, 2009). A typical counter-example to this rule would be that entrepreneurs act out of greed, which is reflected in the data when some interviewees clearly contrast passion to money. While being present, the idea that entrepreneurs act out of greed is exceptionally expressed. This points to the issue of social desirability, that we discuss below.

Note that the two latter meta-rules are also expressed in various ways, but with no clear sub-structure, as opposed to the first meta-rule. Accordingly, the summary of Table 4 only sub-divides the first rule.

Rule properties: negative epistemic properties of keystone rules - Our investigation suggests that rules have important epistemic properties, both positive and negative. We start with their main negative characteristics: fuzziness, internal contradiction and externally invalidity.

Fuzzy categories – All rule categorization is somewhat subjective because of semantic issues (Bingham *et al.*, 2007). Many of the keystone rule expressions tend to be imprecise, embedded in everyday language. For instance, the meta-rule regarding failure will sometimes be worded as “failure,” other times as “error,” still other times as “mistake,” and so forth. Sometimes, they are descriptive, associating a characteristic with the nature of the entrepreneur (e.g., “an entrepreneur is a risk-taker”). Sometimes, they are normative, associating the same characteristics with success. In addition, sometimes they fall into a symbolic range (e.g. the “be foolish” rule by Steve Jobs as an example of a rule falling into our “self-determined to the point of irrationality” keystone rule category).

Inconsistencies - Inconsistencies and biases have been at the heart of the study of heuristics (Kahneman & Tversky, 1979). Accordingly, our study of keystone rules unearths various inconsistencies, beyond the fuzziness already identified above. The most obvious example occurs on

the issue of rationality. The meta-rule #2 that entrepreneurs should exhibit some stubbornness and resistance to outside influences is dominant, yet simultaneously, the rule also persistently mentions that entrepreneurs should learn from feedback. Most entrepreneurs who had mentioned “do not listen to advice” when explicitly asked about it, acknowledge the benefit of feedback and advice. This creates a contradiction whereby the natural rule expression exhibits interesting inconsistencies, at least across actors and sometimes at the level of individuals. These apparent inconsistencies signal that keystone rules may exhibit ambidexterity (Tushman & O'Reilly, 1996) or strategic paradox (Smith, Collins, & Clark, 2005), two—apparently contradictory—aspects that can be integrated into a single keystone rule.

Factual Inaccuracies – By some interpretations, rules may appear factually untrue, or at least controversial. For instance, the idea that entrepreneurs should be “risk-takers” emerges frequently among entrepreneurs, yet research has demonstrated that entrepreneurs are indeed more risk averse than non-entrepreneurs (Hongwei & Ruef, 2004). Similarly, the rule “be self-determined to the point of irrationality” could be interpreted as a typical case of optimistic overconfidence, which has been shown to lead to detrimental outcomes (Simon & Shrader, 2012). Finally, even though passion has intuitive appeal, its actual effects have been difficult to pin down (Chen *et al.*, 2009).

However, notice that each rule allows multiple interpretations. For each rule, as exemplified above, probably one could find a contradiction to a specific expression of the general idea. Hence, attempts to determine the validity of the rule in its general expression would prove difficult, and many of their derivations could be easily rejected in a classical scientific epistemology.

Rules *properties*: *p*ositive *e*pistemic *q*ualities and *r*ationality - Although our exploration of keystone rules suggests negative epistemic properties that—a priori—create challenges to their attributed validity in the classical scientific sense, our analysis suggests some positive epistemic properties that might make them useful and adaptive.

Cognitive Dimensioning and Generativeness – By construction, we have probed the apex of the belief system of entrepreneur. Both in the archival data and in our primary interviews, entrepreneurs spontaneously exhibit the desire to organize and communicate their beliefs in a tiered system: a high portion of them identify a small set of belief as being “fundamental”. This signal is consistent with our assumption that boundedly rational individuals form and use a set of keystone rules to guide the many more actionable heuristics that have been identified by research in specific contexts.

This tiered schema has strong parallels to the idea of second-order learning (Argyris & Schön, 1978), whereby some cognitions play a disproportionate and generative role in the rest of the cognitive structure (Alessi, 1987). The keystone rules we observe (acceptance of failure, role of passion and self-determination up to irrationality), if acted upon, orient the selection of learning mechanisms and simple rules and thereby potentially have significant consequences on entrepreneurs' performance trajectories.

Polymorphism – In the ambiguities of their formulation, each keystone rule potentially carries a spectrum of beliefs, adaptable to the specific context. For instance, the “be prepared to meet failure” theory of action has the flexibility to be interpreted differently across actors but also differently intra-individual. For instance, one actor might mention this idea in a manner that might appear precise (“Entrepreneurs like risk”) but then moves smoothly around the spectrum of the meta-rule, and ‘explains’ the previous sentence as meaning that “they should not fear failure”, finally stating that the key point is to “be able to recover”. Therefore, what could be measured as an isolated cognition if trying to capture a narrow idea is actually the source of a large spectrum of cognitions, which are subsumed within the keystone rule. Hence, such keystone rules can be viewed less as a bundle of isolated and well-defined theories, but more as exemplars of a polymorphic and broad idea.

Self-fulfilling - The keystone rules also have the property of being self-fulfilling prophecies—or as

being “performative” (MacKenzie & Millo, 2003). For instance, the statement that entrepreneurs “do it by passion (not for money)” could be challenged by outside observers as disingenuous (i.e. would entrepreneurs do it without the hope for money?). However, its expression implies a strong desirability dimension that will affect the dynamics of actors and beliefs in the field. For example, since our interviews incorporated actors who are also in position to judge and select entrepreneurs (i.e., venture capitalist), the keystone rules appear as having an influence on who is likely to be funded and who is not. Therefore, the proportion of entrepreneurs who profess that they are motivated by passion is bound to grow, just out of a selection mechanism. Alternatively, as new entrepreneurs hear from successful, experienced entrepreneurs that they need act out of passion rather than money, they may reinterpret or reinforce their willingness to “make a difference” or “achieve a vision” rather than make money.

Obviously, this self-fulfilling property relates to the narrative nature of the communication by which keystone rules are spread and assembled—the emergence of an entrepreneurial GA at the field level—and would constitute ante-narratives in the sense of Boje (2001). More generally, the genetic algorithm amounts to an *institutionalization* of the field: the process by which a social calculation (as in Callon & Muniesa, 2005) helps resolving cognitive limitations, and then becomes enforcing by itself (an iron cage in Weber, 1904), triggering isomorphism (DiMaggio & Powell, 1983 [1991]) across actors—here a relative homogenization of beliefs across individual entrepreneurs. This isomorphism might then be reinterpreted, not as an exogenous norm anymore, but as a powerful endogenous social resolution of a hard cognitive problem.

Summary of findings

The keystone rules of entrepreneurs appear as hybrid objects, exhibiting ambidexterity in multiple dimensions. On a traditional epistemology axis, the rules have the usual limitations of naïve theories, as practitioners are subjects to inaccuracies and inconsistencies. At the same time, they exhibit

interesting properties by being cognitively dimensioned, generative, polymorphic, and self-fulfilling.

From a structural point of view, the analysis suggests that theories of action in the entrepreneurial field are like memes, hosted, selected and varied in an interaction between individual entrepreneurs and the institutional environment they belong too (here a mainstream entrepreneurial context). The resulting objects have the hybrid properties implied by the GA, one of the few means to elicit a locally optimal belief set, while being simultaneously elaborated in a collective manner, hence having potentially undergone deep alterations due to the social construction processes.

INDUCTION: THEORIES OF ACTION AS PARADIGMS

The above empirical section offered a grounded *illustration* of the nature of keystone rules. It also provides the impetus to conduct a theoretical induction to revisit the evolutionary nature of the processes leading to the emergence of keystone rules.

Evolutionary process implications on selection level

We observe a rich mechanism of exchange for entrepreneurial theories of action. Entrepreneurs disclose that they did not elaborate nor test most of their theories. Rather, they heard them from *other* entrepreneurs, in a stereotypically contagious manner (Galaskiewicz & Burt, 1991). The archival exploration demonstrates the common occurrence of entrepreneurs telling the world—hence their peers—about their grand theories through the press. Furthermore, their theories are more likely to be diffused if they originate from successful entrepreneurs—who are given a greater voice than unsuccessful ones.

These characteristics, inasmuch as they confirm the assumptions that entrepreneurs keystone rules might collectively evolve as in a genetic algorithm, fits the framing proposed by Galunic and Weeks (2003), whereby memes—ideas, beliefs, assumptions, values, interpretative schemes, and know-how—can evolve in an organizational context, similar to genes in biological systems. Memes

therefore vary, are selected through recombination, and are retained. However, if memes are the result of an evolutionary process, here framed through the VSR framework, scholars have not discussed how this could imply efficiency, in particular towards highly combinatorial problems. Instead of recognizing that memes might be efficiently selected, the literature has treated them as such fads and fashion (Abrahamson & Eisenman, 2008), embodying irrationality—or at best institutionalization. By contrast, this study reestablishes an intrinsic nuance when considering evolutionary phenomena: on the one hand, selection occurs within some efficiency constraints, while at the same time the process can be noisy and self-fulfilling; overall, if its rationality can never be ascertained, it cannot be assumed away.

Through this evolutionary lens, let us consider one of the most fruitful lines of enquiry in evolutionary biology, the question of the selection level. It appears that biological selection may occur both at the level of species (a bundle of genes), as was originally theorized by Darwin (1859) as well as at the individual gene level, as advocated by Dawkins (1976). As selection operates at multiple levels in nature, by analogy, in our context, the question is whether the selection occurs at the rule level, or at the *bundle of rules* level. Traditionally, the memes and simple rules perspectives have considered rules in a unitary manner. Even if rules are understood to fit into contexts of cultural or normative nature, the focus is on the rule and what could lead to its emergence. Evolutionary perspectives suggest that indeed rules might evolve not so much for their individual “fit” but because of a collective fit, i.e., interactional effects leading to co-occurrence or incompatibility of rules.

In the empirical illustration, the set of rules that emerges differs from alternative possible sets that have appeared in previous literature, such as the effectuation or the causation clusters (see Sarasvathy, 2001a). For instance, Sarasvathy identified a “causation” cluster of rules of entrepreneurship that underlies business school education to include, for instance, the need to

“construct a business plan” and the belief that the goal of a venture is to “maximize shareholders’ returns” (Sarasvathy, 2001a:251). Without getting into more comparisons, one interpretation of why such rules appear so rarely in our empirics could be that the emergence of rule bundles is the result of specific contexts or circumstances influencing the selection of each rule.

An alternative interpretation, however, could be that a rule may emerge in presence of specific other rule, or may be hindered if another one were present. In other words, because of interaction across rules, rather than individual rules being the unit of selection, the bundle of rules is the unit of selection. For instance, there could be a rationale for “passion” to appear conjointly to “embracing failure”; and “failure” may make sense conjointly to “self-determined up to irrationality.” In addition, there could be a rationale for “passion” to exclude “maximization of returns” and for “embracing failure” to be contrary to “construct a plan.” Such interactional effects shape the emergence of rules in ways that have not yet been studied. Overall, this leads us to propose the following:

P1: Keystones rules will be selected as a bundle, with positive and negative interactions among rules shaping the emerging set.

A paradigmatic structure

By definition, the emergence of keystone rules constitutes a complex phenomenon. On the one hand, as with all practitioners’ beliefs, keystone rules are probably biased or socially polluted in various ways. A social-constructionist perspective might even suggest that at most, one can establish the material and social conditions of their emergence. On the other hand, the data and the above induction suggest that they can have positive properties that would make them adaptive to the constraints on the rationality of actors.

The possibility that keystone rules are selected at bundle level has implications for the dynamic of changes. Selection of the optimum set could depend on the environment, but the possibility of

changing an isolated rule depends on the interaction with other rules, so that a bundle could continue to dominate even though some individual rules are not the most efficient anymore. The change could occur only once the environment has changed enough for an alternative set to be more efficient. Furthermore, because of interaction across rules, any alternative would likely be a different bundle, i.e. differ by many rules simultaneously, imposing a rather rapid change, as compared to a linear model where change would occur progressively, progressively one rule at a time.

Such a rapid change occurs because of convergence of GAs towards local optima, which implies a reasonable stability, with solutions being robust to small context changes. Conversely, because the solution may hold even when conditions shift gradually, this implies that once a solution representing a better local optimum appears in the population, it is likely to be significantly different from the previous solution. In addition, the change would occur relatively rapidly as the tension to change has accumulated and can finally be released all at once and as a bundle.

All those dynamics result in what has been labeled *punctuated equilibrium* of systems with evolutionary dynamics (Eldredge & Gould, 1972). This phenomenon has already been demonstrated in organizational studies, for instance in technological change (Anderson & Tushman, 1990), cognitive change (Barr, Stimpert, & Huff, 1992) (Lant & Milliken, 1992), strategic renewal (Huff, Huff, & Thomas, 1992), organizational structure (Ambos & Birkinshaw, 2010) or organizational activity systems (Siggelkow, 2002), and likely applies to the change in rule bundles.

Perhaps even more accurately, as we are studying *theories* of action, the concept of scientific *paradigm*, as proposed by Kuhn (1970) could apply, except that instead of probing actual scientists, we have been probing entrepreneurs as “naïve scientists”. Kuhn shifted the representation of science from one where valid theories accumulate rationally and gradually (Popper, 1934 [2002]) to one of a social practice where changes occur very marginally for long periods (“normal science”)

before major *paradigmatic* changes occur rapidly, when the core set of assumptions that “provide model problems and solutions for a community” are wholly altered (Kuhn, 1970:10). Our study suggests a similar dynamic in the theories of action among entrepreneurs. Our field might have entertained a Popperian metaphor whereby the practitioner should thrive for a goal of perfect rationality informed by the sum of a large body of scientifically validated rules. Such a perspective is advocated most explicitly by an *evidence-based management* perspective (Pfeffer & Sutton, 2006) that exhorts managers to embrace the scientific method and the results of empirical validation as the basis for management practice.

By contrast, and consistent with a Kuhnian perspective, we suggest that actors such as entrepreneurs may be under the spell of a small bundle of beliefs, elaborated collectively to identify an efficient theory of action that changes only periodically, hence a dynamics of punctuated equilibria. By implication, an organizational field such as entrepreneurship could be analyzed as a set of communities acting according to different *paradigms* (i.e., bundles of keystone rules) that mesh social construction and rational decision-making, in a theoretical hybridization that warrants further research. We therefore propose:

P2: Keystone rule bundles aggregate the rational efficiency of large population of actors into a social calculation, therefore exhibit paradigm dynamics evolving in a sequence of punctuated equilibria.

DISCUSSION

Entrepreneurial paradigms: previous appearances in literature

The current study has some similarities with the effectuation perspective (Sarasvathy, 2001a). First, by focusing on the constraints on elaborating optimal rule sets, we study a key mechanism towards the elaboration of a normative theory at the heart of the *effectuation* paradigm (Sarasvathy, 2001a). Second, even though our empirical illustration does not match the one used for the effectuation

study (i.e., we follow a qualitative empirical exploration, as opposed to the quasi-experimental lab protocol of Sarasvathy (2001b)), both nevertheless rely on observing practitioners (qualified as “experts” in effectuation research, and here as “experienced”) and elaborating on their mental models.

Regarding the substantive findings, effectuation research identifies a dichotomous contrast between two paradigms: causation vs. effectuation. Sarasvathy took up a position against a prevalent world view based on predicting and planning the future—i.e., *causation*—and posited that actors would use an alternative controlling the future without planning for it—i.e., *effectuation* (Sarasvathy, 2001a). The causation logic (Sarasvathy, 2001a:249) entails to start from a goal; determine effective means; take into account constraints on means; select (usually a maximization of expected returns). The alternative effectual logic can be summarized by its five *effectuation principles* labeled idiomatically as follows (Sarasvathy, 2008): “patchwork quilt” (e.g. use existing means); “affordable loss” (e.g. commit only what one can afford to lose rather than plan expected returns); “bird-in-hand” (e.g. focus on those willing to commit something to the project); “lemonade” (e.g. embrace surprises); “pilot-in-the-plane” (e.g. focus on what one can control and act on).

Concerning the mapping from those principles to the keystone rules that we elicited, the overlap is not perfect. First, the “embrace possibility of failure” keystone rule implies both “lemonade” (embrace surprises) and “affordable losses.” Second, the “self-determined to the point of irrationality”, with its sub-rules of “not listening to advice” and “being irrational”, has strong similarities to the key idea of ‘not to attempt to plan the future’. Regarding the mapping of the other elements, some of the effectuation principles could appear further down the pyramid of beliefs—typically for instance the focus on existing means was mentioned in our interviews—but do not appear in our empirical analysis as keystone elements. Reciprocally, the element of passion (not money) that appears in our keystone rules does not seem, a priori, to have an equivalent in the

effectuation paradigm.

However, effectuation research provides an interesting similarity to this study by clearly structuring the epistemology of action around two distinct bodies of beliefs (causation vs. effectuation). By doing so, it supports the need of a distinct construct such as a *paradigm* of action as constituted by a bundle of keystone rules. In the view of effectuation scholars, some actors are under the spell of a causation paradigm, and some others of an effectuation paradigm. Such a binary structuration of the logic of action has already been evoked in previous organizational studies, for instance “theory X vs. theory Y” study that contrasted the world views of managers as a binary possibility of either “workers intrinsically hate work” vs. “workers find satisfaction in work” (McGregor, 1957). Along the same line, Miles’ “theories of management” (Miles, 1975; Yoder *et al.*, 1963) proposed a three-tier model (Traditional vs. Human Relations vs. Human Resources) and formalized dimensions to qualify those heuristics (assumptions, policies, expectations).

In that sense, effectuation *principles* may not match clearly the *keystone rules* that emerge in our sample but they embody a *paradigm*, and can be clearly contrasted with the canonical paradigm of business schools, i.e., causation. Using that framework, we can reinterpret all three paradigms as they could be decomposed in terms of keystone rules as summarized in Figure 1.

----- Insert Figure 1 roughly here -----

When comparing the elements of the three paradigms, a pair-wise contrast appears. As intended originally by Sarasvathy, effectuation and causation can be contrasted by the differences between: “constructing plans” vs. “embracing surprises” and “planning for (affordable) losses”; “focusing on resources at hand” vs. “deriving resources from the goal and the planning that it entails”; “focusing on what one can control and those willing to commit” vs. “optimizing action plans by a maximization logic”. Furthermore, effectuation claims agnosticism towards goals, by contrast with the central role of objectives in the causation paradigm.

In a similar manner, the paradigm that emerges from this study can be contrasted with the causation paradigm: “doing by passion” vs. “maximization logic” (and its hint of monetary rewards); “embracing failure” and “possibility of irrationality” vs. “the construction of a plan” and “following an optimization logic”. The notion of resources did not emerge as a keystone belief in the current paradigm, whereas it appears both in the causation and effectuation paradigms.

Overall, the paradigm that emerges here resembles very much effectuation in its contrast to the causation paradigm. The notable differences are that effectuation puts an emphasis on using resources at hand (just absent here) and that the current paradigm put a substantive emphasis on the goal being derived from intrinsic motivations (hinted to be emergent in effectuation). On that basis, the two approaches are very compatible even though substantive differences remain. The most important difference is that rather than suggesting a specific keystone rule bundle, as the effectuation perspective does, we explore the potential for multiple bundles, the characteristics of bundles, and how bundles emerge and change. In our view, the effectuation bundle may be an empirically valid bundle but one of many bundles that may exist currently or may exist in the future.

Contribution to existing literatures

This study contributes to several management scholarship perspectives. To the managerial cognition literature, this paper contributes by suggesting the importance of keystone rules and their bundling into paradigms, and by focusing on a hierarchy of simple rules. Furthermore, this study suggests specific characteristics and peculiarities of keystone rules, in particular relative to their emergence, that may not be grounded in experiential or vicarious learning (Bingham *et al.*, 2007; Bingham & Eisenhardt, 2011) but rather on social calculation. It also contributes to institutional theory by revisiting the social construction interpretation of shared beliefs in a given field (here entrepreneurship). It proposes a structuration mechanism (Barley & Tolbert, 1997; Giddens, 1979) linking individuals to a field construction, in a way not devoid of function even when it may appear

somewhat irrational (e.g., Abrahamson & Eisenman, 2008; Staw & Epstein, 2000). In a larger sense, the set of keystone rules—a paradigm—can also be reinterpreted in term of logic of action (DiMaggio, 1997) similar to the logic identified and advocated by Sarasvathy, i.e., opposed to the causation institutional logic that permeates business schools and large established firms (2001a).

Limitations and future research

One limitation of the current qualitative approach is that it only attempted to observe the existence and character of keystone rules; it did not attempt to measure and quantify the cognition, as we gave priority to the emergence of grounded theory and the formal reasoning necessary to interpret it. Future research might explore further ways to measure and validate the meta-rules beyond just observing their emergence. If establishing validity in absolute sense will be difficult (i.e., finding the optimal bundle), one can nevertheless conduct comparative studies of different bundle, both for descriptive purposes (how the bundle evolve with culture, with experience, etc.) and for limited normative purpose (which of bundle A or B is more efficient).

Furthermore, the current study has assumed bounded rationality on the number of rules, which points to the difficulty of embracing simultaneously multiple paradigms that differ intrinsically. It may be that additional rules could be handled by an actor, but prove are difficult to learn, enact, and practice when they belong to conflicting paradigms. For example, the causation paradigm may remain intrinsically incompatible with the effectuation paradigm if the interactional effects of rules across those paradigms are negative. Future studies could explore the conditions and context that make a paradigm most relevant. Context (entrepreneurial vs. organizational), education, intelligence, stress, etc. may all be factors that could determine the relevance and breadth of keystone rule sets. Some practice oriented studies have already suggested the existence of, and described, such clusters (e.g., Denning, 2013; Raynor & Ahmed, 2013), which may constitute an interesting empirical basis to further study management paradigms.

CONCLUSION

In the same way as computer science emerged out of the computational constraints of machines and their inability to model the world perfectly, management science may benefit by embracing the limitations of managerial actors. The current study suggests a deep link between the search for rationality and social construction. It also underlines the fact that bounded rationality creates an difficult problem that our classical epistemologies are ill-suited to address. By observing entrepreneurs acting as naïve scientists, it appears that they may be as much the subject of paradigmatic dynamics as formal scientific communities, with punctuated equilibria and clusterization of beliefs. Managerial actors appear, more then ever, close to us, scholars, paradoxically, the more that we model them as simplistic agents with limited cognitive capacity. Our hope is that reasoning at the level of keystone rules as they agregate into managerial paradigms can help us better understand how boundedly rational practitioners deal with such a complex world.

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APPENDIX A: INTERVIEW PROTOCOL

- I. Provide us your Age, Profession, Company and Brief bio.
 - A. ... do you have an experience as Entrepreneur and/or an Investor in Entrepreneurial firms?
- II. If
 - A. Investor: "when you choose to invest on an entrepreneur, what characteristics are you interested in?"
 - B. Entrepreneur: "imagine the possibility that a young person, close to you, may become an entrepreneur. What advice would you give to that person?"
 - C. In both cases, *after* collecting initial response : "You don't need to provide more than necessary, but I want to make sure I capture your philosophy of entrepreneurship. Anything else?"
- III. If the person cited only a limited number, and no generic knowledge (such as "learning everything that can be taught in an MBA"), explore:
 - A. "you mention only a few principles, but what about the myriads of other things one would actually use?"
 - B. ... "e.g. learning entrepreneurship in a formal manner like in books or at school"
 - C. ... "or e.g. all the technical knowledge necessary in each business?"
 1. If the person minimizes this: "do you assume they are absolutely useless, or just that they will be taken care of?"
 - D. "Let us go in details about those principles." List a few of the top ones and ask: "Could you give some details about why those are important, how they could be crucial to the entrepreneur's action?"
 - E. "Regarding those rules, how did you establish them?" [try to go one by one]
 1. ... if not mentioned :
 - a) "Did you read or hear them from someone?"
 - b) Did you test them yourselves?
- IV. If morally desirable characteristics were mentioned (e.g. "have passion", "be honest"):
 1. "This characteristic seems morally desirable, such as X, Y. Maybe you did mention it even though it might unfortunately actually work the other way?"
- V. Look at the master list, and try to identify a few that are not cited. Ask "Consider a few qualities that you did not mention but are sometimes mentioned by other entrepreneurs. What do you think about ..."

TABLES

Table 1. Rules (level 1) by Source

TOTALS:	Count	%	T	P: 2:	EP 3:	(P 4:	fP 5:	.P 6:	SP 7:	IP 8:	(P 9:	IP10:	P11:	P12:	P13:	P14:	P15:	P16:	P17:	P18:	P20:	P21:	P22:	P24:	P25:	TOTALS:	
3	2	9%	T-Attention-Customers	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	
7	5	23%	T-Attention-People	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	3	0	0	0	7	
1	1	5%	T-Autonomy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
2	2	9%	T-Autonomy-DoListen	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
12	8	36%	T-Autonomy-NoListen	0	1	0	0	2	3	0	0	0	0	0	1	1	0	0	0	0	2	1	1	0	0	12	
3	2	9%	T-Brave	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	3	
2	2	9%	T-Complement oneself	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
2	1	5%	T-Creative/Innovative	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	
2	2	9%	T-Curiosity	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	
3	3	14%	T-Decisive	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	
1	1	5%	T-Ego aside	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
1	1	5%	T-Ethics	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
2	2	9%	T-flexible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	
2	1	5%	T-Focus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	
1	1	5%	T-Grounded, Make oriented	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	3	14%	T-Hard Work	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	3	
6	3	14%	T-Have low cost base	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	6	
5	2	9%	T-Idea matter ... or not?	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	5	
3	2	9%	T-Intuitive	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
1	1	5%	T-Irrationality-Deal with ambiguity, u	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	2	9%	T-Irrationality-Fodlish	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	
1	1	5%	T-Irrationality-Karma	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	3	14%	T-Irrationality-Luck	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	3	
1	1	5%	T-Irrationality-No forward	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Irrationality-Serendipity	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Know Domain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
3	3	14%	T-Know your limit, ask for help	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	3	
3	2	9%	T-Leadership	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	3	
16	8	36%	T-Learning not from school	0	0	0	1	0	0	0	2	2	1	0	0	0	1	0	0	5	2	0	0	0	2	16	
1	1	5%	T-Limitations	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Long Term	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Manager-Not	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	
5	4	18%	T-Manager-OK	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0	0	0	0	1	5	
10	7	32%	T-Mistake-Learn from	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	3	1	2	0	0	0	0	10	
12	11	50%	T-Mistake-Relentness	1	0	0	1	1	0	1	0	0	0	1	1	1	1	0	0	0	1	2	0	1	0	12	
8	7	32%	T-Mistake-Risk Takers78521	1	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	8	
16	12	55%	T-Mistakes-do them	2	0	0	1	2	2	0	1	1	0	2	1	0	1	0	0	1	0	1	0	1	0	16	
2	2	9%	T-Mistakes-Risk-No	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2	
5	4	18%	T-Motivation-Money	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	5	
0	0	0%	T-Motivation-Passion-Non	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	10	45%	T-Motivation-Passion-Yes	0	0	0	3	0	0	1	0	0	0	1	2	0	0	0	1	2	1	2	1	2	0	16	
1	1	5%	T-no Hobby	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-No need for status	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Not for the faint hearted	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	2	9%	T-not person, can be taught	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1	1	5%	T-Open-minded	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
5	5	23%	T-Personality type	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	5	
2	2	9%	T-purpose	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	
1	1	5%	T-Questions authority	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	2	9%	T-Resistant/Energy	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	
1	1	5%	T-Resources	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
1	1	5%	T-Search Opportunities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1	1	5%	T-Simple idea	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Smart	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Start Early?	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Thinking long term	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
1	1	5%	T-Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
2	2	9%	T-Vision	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	
198	22	100%	TOTALS:	10	1	3	16	19	9	2	5	3	5	11	15	3	10	2	3	16	14	21	7	11	12	198	

Table 2. Grouping of Heuristics

Grouping	Count	Heuristics
TD-Mistakes	56	[T-Mistake-do them] [T-Mistake-Learn from] [T-Mistake-Relentness] [T-Mistake-Risk-No] [T-Mistake-Risk-Takers]
TD-Motivations (Passion vs. money)	27	[T-Motivation] [T-Motivation-Money] [T-Motivation-Passion-Non] [T-Motivation-Passion-Yes]
TD-Autonomy	21	[T-Autonomy-DoListen] [T-Autonomy-NoListen]
TD-Not from school	21	[T-Autonomy-DoListen] [T-Autonomy-NoListen]
TD-Attention	14	[T-Attention-Customers] [T-Attention-People]
TD-Irrationality	14	[T-Irrationality-Deal with ambiguity, uncertainty] [T-Irrationality-Foolish] [T-Irrationality-Karma] [T-Irrationality-Luck] [T-Irrationality-No forward] [T-Irrationality-Serendipity]
TD-Strength	8	[T-Brave] [T-Not for the faint hearted] [T-Resistant/Energy]

Table 3. Meta-Heuristics (level 2) by Source

Count	%		P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	TOTALS:
16	70%	*TD-Mistakes	4	0	0	1	5	3	1	3	1	1	0	4	3	2	3	0	0	4	3	6	0	3	0	0	47
12	52%	*TD-Motivations (passion	0	0	0	3	1	0	1	0	0	0	0	1	2	0	1	0	1	2	2	4	1	2	0	0	21
11	48%	*TD-Autonomy	1	1	1	0	2	3	0	1	0	0	0	1	1	0	0	0	0	2	1	1	0	0	0	0	15
7	30%	*TD-Attention	0	0	0	0	0	2	0	0	0	0	0	1	1	0	1	1	0	0	1	3	0	0	0	0	10
8	35%	*TD-Learning not from sch	0	0	0	1	0	0	0	0	2	2	1	0	0	0	1	0	0	5	2	0	0	0	2	0	16
6	26%	*TD-Irrationality	0	0	0	5	1	0	0	3	0	0	0	1	0	0	0	0	0	1	0	0	0	2	0	0	13
5	22%	*TD-Strength	0	0	0	0	3	0	0	1	0	0	0	0	2	0	0	0	0	1	0	0	0	0	1	0	8
23	100%	TOTALS:	5	1	1	10	12	8	2	8	3	3	1	7	9	3	6	1	1	13	10	14	2	7	3	0	130
15	65%	autonomy+irrationality	1	1	1	5	3	3	0	4	0	0	0	1	1	1	0	0	0	1	2	1	1	2	0	0	28

Table 4. Description of Keystone Rules

Rule (level 2)	Rule (level 1)	Example citations
Embrace possibility of failure	Be prepared to meet failure	“One of the most important attributes to being a successful entrepreneur is the ability to learn how to be wrong and fail fast” (Th)
	Learn from your failure	“Make the mistakes and learn from them. So what if your business fails? Your next one will be even better than your first, and the next one after that will be even better again. Essentially, treat it as a learning experience, one that teaches lessons money could never buy. And over time wisdom shall enable more fruitful outcomes” (Gu)
	Be able to reboot after failure	“The trait of not quitting, ever. You can never give up as an entrepreneur. If their first business goes under, they start another one. If their seventh business goes under, they start another one, and so on.” [Bro)
Do it by passion (not money)		“In my view wanting to be an entrepreneur just for the purpose of getting rich is not a strong enough motive to survive the journey ahead” (Kha)
Be self-determined to the point of irrationality	Do not listen to advice	“The difference between founders and professional managers is that founders are stubborn about the vision of the business” (Bez)
	Be Irrational	“the best [entrepreneurs] are a bit contrarian, sometimes unreasonable” (Bot)

FIGURE

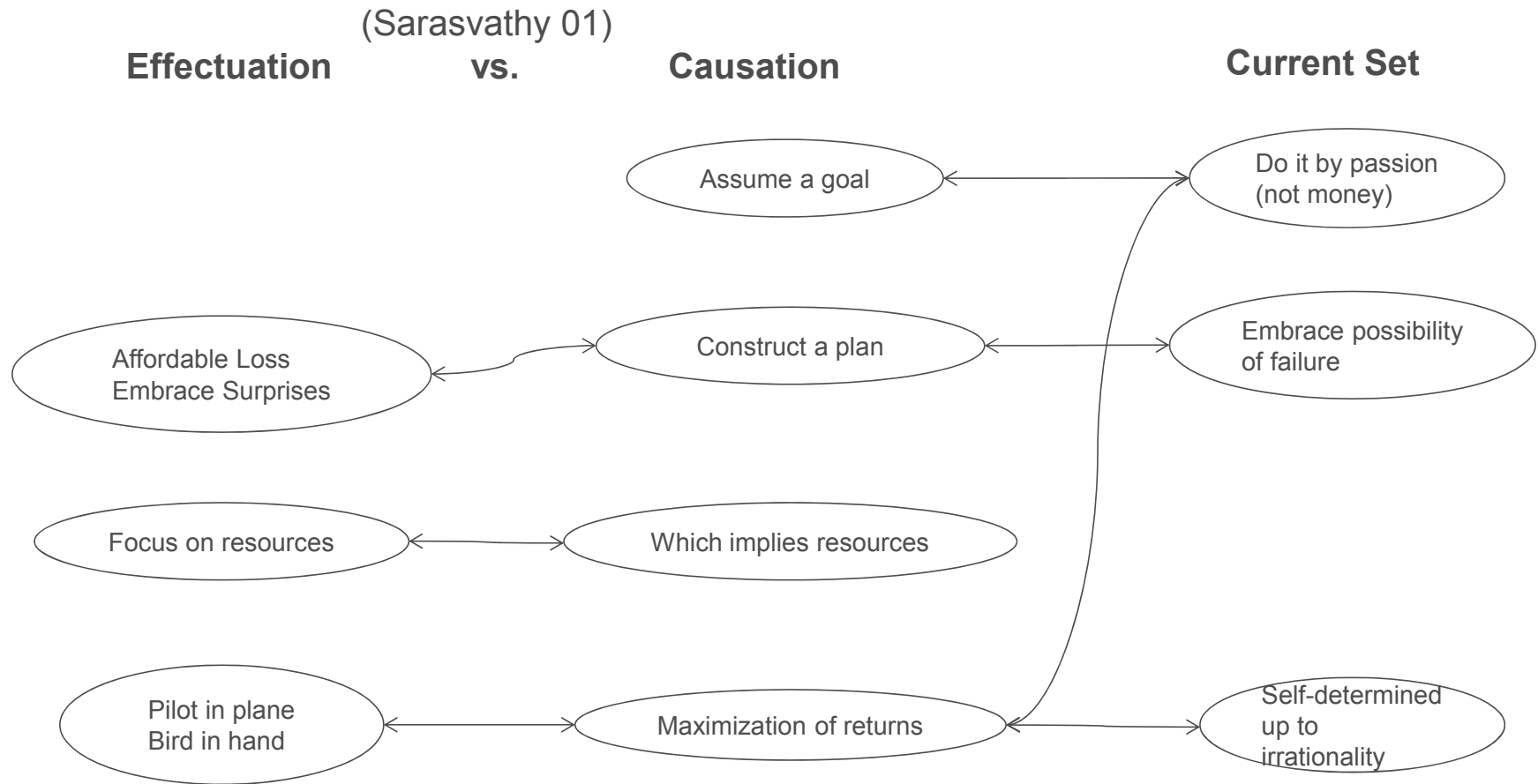


Figure 1. Comparison of Three Exemplar Paradigms

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