DUALITY IN A VOLCANIC TEMPLE:
A CRITICAL ASSESSMENT OF MANAGEMENT'S NEVER-ENDING CRISIS

Édison Renato Pereira da Silva

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Orientador: Domício Proença Júnior

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DUALIDADE NUM TEMPLO VULCÂNICO: UMA ANÁLISE CRÍTICA DA INTERMINÁVEL CRISE DO MANAGEMENT

Édison Renato Pereira da Silva

Abril/2014

Orientador: Domício Proença Júnior

Programa: Engenharia de Produção

Esse trabalho articula uma avaliação crítica e uma reinterpretação, a partir do olhar da engenharia de produção, à maneira pela qual o campo do Management lida com sua crise, que é formulada indistintamente como uma crescente distância entre rigor e relevância, pesquisa e prática, ciência e prática ou teoria e prática. O problema pode ser melhor entendido como uma coexistência conflituosa entre uma proto-ciência do Management e uma proto-profissão do Management sob a mesma área disciplinar acadêmica, cada proto-disciplina lutando por espaço e recursos para sua evolução. Explica-se e discute-se o fundamento epistêmico deste conflito, apontando para sua raiz em uma interpretação errônea e enviesada da obra de Herbert Simon, utilizando para isso as perspectivas epistêmicas de Billy Koen e de Joan van Aken, por um lado, e um desenvolvimento sobre a estrutura epistemológica de Mario Bunge, por outro. Aponta-se que há mais de uma lacuna se originando da lacuna fundamental entre proto-ciência e proto-profissão, chamando especial atenção para o potencial inaproveitado da Gestão Baseada em Evidências em auxiliar a resolver a crise. Dessa maneira, a tese contribui para a discussão dos fundamentos epistêmicos de ciências e profissões discutindo o Management como objeto de análise, e contribui para o persistente problema do Management com a sua reconceitualização em novos fundamentos mais alinhados com os da engenharia de produção.

Abstract of Thesis presented to COPPE/UFRJ as a partial fulfillment of the requirements for the degree of Doctor of Science (D.Sc.)

DUALITY IN A VOLCANIC TEMPLE:
A CRITICAL ASSESSMENT OF MANAGEMENT'S NEVER-ENDING CRISIS

Édison Renato Pereira da Silva

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Department: Production Engineering

This thesis articulates a wide ranging critical assessment, from a Production Engineering's perspective, of Management's enduring crisis, which is framed variously as an essential, growing and undesirable distance between the result of academic activities and the needs of practice. Such crisis is indistinctively framed as a gap of some sort ─ a gap between rigor and relevance, or a gap between theory and practice, or research and practice, or science and practice. The thesis proposes that this never-ending crisis of Management is caused by conflicts between a proto-science and a proto-profession that, for historical reasons, are under the same academic discipline, but which have different and diverging epistemic foundations. It also argues, with the benefit of an external look from Production Engineering, that there are many gaps in what is hitherto understood as "the gaps" between rigor and relevance, research and practice, theory and practice. It discusses the epistemic foundations for sciences and professions applying a development of Mario Bunge's epistemological framework to contrast Herbert Simon's influence to Management with the potential benefits from an alternative foundation provided by an adaptation of Billy Koen's philosophy of engineering. It gives special attention to Evidence-based Management as a contemporary and seemingly promising solution that ultimately fails to deliver a way to deal with the gaps because of its unresolved epistemic foundations.

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LIST OF ABBREVIATIONS AND ACRONYMS

AACSB - Association to Advance Collegiate Schools of Business

CAPES - Brazilian Federal Agency for Support and Evaluation of Graduate Education

DSR - Design Sciences Research

EBMgt – Evidence-based Management

EBMed - Evidence-based Medicine

EBSE – Evidence-based Software Engineering

MS – Mapping Study

SLR – Systematic Literature Review

WoS – Web of Science

1 Introduction

1.1 Motivation

Volcanus is the Latin name of the Roman god Vulcan, the equivalent of Hephaestus in Greek Mythology. Volcanus is the Greek god of blacksmiths, craftsmen, artisans, sculptors, metals, metallurgy, fire ─ and volcanoes. And he is also the god of engineering. He designed Hermes' winged helmet and sandals, the Aegis breastplate, Aphrodite's famed girdle, Agamemnon's staff of office, Achilles' armor, Heracles' bronze clappers, Helios' chariot, the shoulder of Pelops, and Eros' bow and arrows.

The Wikipedia defines a volcano as "an opening, or rupture, in the surface or crust of the Earth or a planetary mass object, which allows hot lava, volcanic ash and gases to escape from the magma chamber below the surface"[1]. Not surprisingly, volcano comes from Volcanus.

Engineering is the most prominent Temple of Volcanus. This thesis argues that Management is the temple of volcanoes. It proposes that the main gap, and the many associated gaps faced by business schools in particular, and by the field of Management in general, are craters that can spill disintegrating lava, and dense, suffocating smoke that burns, blinds and chokes any who comes too close to the rifts. The temple of Management in academia is divided, and a house divided cannot stand. The thesis points out the incompleteness and maps out troublesome misunderstandings in Management's current epistemic foundations. It discusses dualities in such volcanic temple: the very duality between what should be a Temple of Volcanus but is currently nothing more than a temple of volcanoes, and dualities that stem from the division between science and profession within Management.

[1] http://en.wikipedia.org/wiki/Volcano (21/02/14).

1.2 Context

The crisis of management research in the 20th Century is a well-discussed topic. This issue has received significant attention in management journals and forums for at least 36 years, since Susman & Evered (1978) first stated most sincerely that there was a crisis in the field of Management.

The crisis has been variously described and differently explained over the decades. There is but a diffuse common understanding that the crisis is about a growing distance between the reality of management in organizations and the theories and models of academic research. However, whether or not such distance is a problem remains the subject of several heated debates. On the one hand, some argue that the irrelevance to practice of academic research jeopardize business schools' *raison d'être* (e.g., Pfeffer & Fong, 2002; Datar, Garvin & Cullen, 2010; Augier & March, 2011). On the other hand, in the past half century business schools grew richer and more powerful (e.g., Dulek & Fielden, 1992; Bennis & O'Toole, 2005). A synthesis of both positions would argue that business schools are a commercial success that delivers little or no value to its customers (Bennis & O'Toole, 2005; Koskela, 2011). Happily, Scott Adams' comic Dilbert has some humor to add to this stressful discussion (Figure 1).

Figure 1 - Scott Adams' Dilbert comic.

Source: http://dilbert.com/strips/comic/2013-10-04/ (06/jan/14).

As this discussion involves a significant amount of money and a significant share of business schools' academic muscles, the literature on the topic is unsurprisingly vast. Some defend business schools (Datar, Garvin & Cullen, 2010; Augier & March, 2011), others condemn them (Daniel, 1998; Mintzberg, 2004; Khurana, 2007;

Mintzberg, 2009; Pearson, 2009; Skapinker, 2008, 2011). Several authors point out to successful experiences in changing the situation for better ─ of "bridging the gap" (Mintzberg, 2004; Datar, Garvin & Cullen, 2010). Some historical accounts of management in the 20th Century are more neutral and confine the crisis to a few pages (George, 1972; Wren & Bedeian, 2008; Witzel, 2012), and some press charges of abandoning the inventiveness and open-mindedness that used to characterize management in the "golden age of American Management" (1920-1970) against current management researchers (Hopper & Hopper, 2009).

This thesis largely benefits from a systematic appreciation of such books and the humungous amount of papers on the crisis. As there are many histories of North American schools of business (of which Daniel, 1998, Khurana, 2007 and Augier & March, 2011 are perhaps the most comprehensive), the thesis will not be yet another history of the crisis. The purpose of this thesis is to question some enduring assumptions on the nature of management and its crisis. It is an external look into the issue, a critical assessment from a sister engineering discipline, Brazilian Production Engineering. The thesis questions the consequences of understanding management and its crisis from a philosophy of engineering's point of view, using Billy Koen's Discussion of the Method (Koen, 2003) as its epistemic foundation and a development of Mario Bunge's (1983) epistemological categorization as a useful descriptor of its results.

1.3 What is Management, by the way?

The thesis is about dualities in the volcanic temple of Management. And here is another one: the duality between "Management" and "Business". The most powerful organization for researchers is the (US) Academy of *Management*; the most powerful organization for educational institutions is the Association to Advance Collegiate Schools of *Business.* Educational institutions are called *Business* Schools, but the content they teach is *Management* ─ although their most famous course is the Master of *Business* Administration, the MBA. Also, one of the world's most respected educational institutions in the field is the MIT Sloan School of *Management*, which also declares itself as a *Business School*.

The Category Description from ISI Web of Science reads:[2]

> "Management covers resources on management science, organization studies, strategic planning and decision-making methods, leadership studies, and total quality management".
>
> "This category [Business] covers resources concerned with all aspects of business and the business world. These may include marketing and advertising, forecasting, planning, administration, organizational studies, compensation, strategy, retailing, consumer research, and management. Also covered are resources relating to business history and business ethics".

The difference between Business and Management is not clear-cut. In this thesis we will refer to Management as the academic discipline which involves Business Schools from the anglo-saxon world, but which also involves other institutions, including the Academy of Management and the many institutions that publish journals under Web of Science's Management category (the activity of managing will be referred to as "management", without capital letter). Perhaps the main reason for adopting "Management's never-ending crisis", although it would be perfectly acceptable to say, "Business Schools' never-ending crisis", is that the above-mentioned institutions also take part in the crisis.

Maybe the difference between Management and Business is one of scope: Business involves more than simply the acts of managers managing people in organizations.

[2] http://admin-apps.webofknowledge.com/JCR/static_html/scope_notes/SOCIAL/2012/SCOPE_SOC.htm#PC (28/feb/14).

"Business", or to run a business, involves technology, involves the design of technical systems, including the financial system, the information technology system, the manufacturing system, the product design system ─ all of which are part of Business administration, but not of Management. According to Web of Science's category description, Management seems somewhat limited to leadership, decision-making, strategic planning, quality management and whatever "management science and organizational studies" is. Business involves more, "all aspects", although design of technical systems is largely ignored by the field's description. And where is this design, an intrinsic part of Business and a major concern of Management? It is neither in Business nor in Management, but it is present in both ISI Web of Science's categories Industrial Engineering and Manufacturing Engineering[3]:

> "Engineering, Industrial includes resources that focus on engineering systems that integrate people, materials, capital, and equipment to provide products and services. Relevant topics covered in the category include operations research, process engineering, productivity engineering, manufacturing, computer-integrated manufacturing (CIM), industrial economics, and design engineering".
>
> "Engineering, Manufacturing covers resources on the conversion of raw materials into end-use products or processed materials. Topics in this category include computer-integrated manufacturing (CIM), computer-aided design (CAD), and computer-aided manufacturing (CAM); design of products, tools, and machines; quality control; scheduling; production; and inventory control".

In that sense, Management, and even Business, are progressively limited to social systems design, with little or no concern for the technical aspects. Koskela (2011) argued that Management left "production" aside. The thesis goes beyond and argues that not only "production", but other design aspects, particularly those of technical systems, are given less concern.

[3] http://admin-apps.webofknowledge.com/JCR/static_html/scope_notes/SCIENCE/2012/SCOPE_SCI.htm#IK (28/feb/14).

1.4 Objectives

Brazilian Production Engineering seems largely unaffected by the half-century long crisis of Anglo-Saxon business schools and related institutions. In that sense, there could be little or no interest for a production engineering thesis to investigate the reasons and consequences of a crisis in another discipline. But Management and Production Engineering share the legacy of Frederick Winslow Taylor. The Institute of Industrial Engineers, the world's largest professional society of industrial engineers, derives from the early Taylor Society, founded by Taylor and Gilbreth to promote Scientific Management (Emerson & Naehring, 1988). In stark contrast, since 1959 two Reports from Ford and Carnegie foundations reformed the nature of management as an academic discipline (Gordon & Howell, 1959; Pierson, 1959, respectively). Business schools decided to ban Scientific Management and to exorcise Taylor from their Temple. Taylor has, indeed, even been called recently "the Demon" (Hoopes, 2003). The charge? Scientific management and every other topics business schools taught until 1959 were not scientific enough, according to the Reports' standards. This thesis can also be seen as an answer to what has been done to the founding fathers of Management and of Industrial Engineering. And to the similar charges pressed against many other brilliant minds such as Peter Drucker, Eliyahu Goldratt and Shigeo Shingo.

The thesis argues that the charges pressed against nonscientific authors and nonscientific knowledge and methods in the field of management are shortsighted. It exposes the hitherto unquestioned assumption that, within professional disciplines, scientific knowledge and the scientific method are some sort of superior stance. This assumption relies on a misuse of Herbert Simon's epistemic foundations for what he calls "sciences of the natural and sciences of the artificial". The thesis makes use of Billy Koen's philosophy of engineering and of Joan Van Aken's philosophy of management to expose the incompleteness and consequent misuses of Simonian epistemic foundations. It shows that the crisis is not between rigor and relevance, research and practice, academia and the external world, as the literature suggest; rather, the thesis argues that it is a crisis within academia, an identity crisis, a crisis between Management, the proto-science and Management, the proto-profession ─ a development of Mario Bunge's (1983) epistemological categorization. It seeks to show that the incompleteness of Simon's epistemic foundations left room for

distortions of his ideas, and it concludes that management researchers seeking for a solution for such wild goose chase (Koskela, 2011, presented above) are digging in the wrong place.

1.5 Relevance to Brazilian Production Engineering

The thesis serves as an alert to Brazilian Production Engineering. An alert against the over-simplistic descriptions of engineering as mere application of science. An alert against conditioning the progress of engineering to the progress of science. An alert against understanding that the role of production engineering research is to create more and more publishable papers for scientific journals.

This thesis is relevant for Brazilian Production Engineering from another point of view. Management journals reflect the field's crisis, and Brazilian Production Engineering research is progressively submissive to Management journals. In Brazil, the quality of research is evaluated according to the Qualis system of the Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES). Each Qualis subfield has its own specific rules for ranking journals, but most of them mirror ISI Web of Science's Impact Factor ranking, with few ad-hoc adjustments, including Engineering III area, of which Production Engineering programs are part. Journals outside ISI Web of Science invariably end up receiving lower Qualis scores, with rare exceptions. Moreover, all graduate programs in Brazil are evaluated by CAPES each three years ('Avaliação Trienal'), and research quality is the preponderant criterion in a program's final score, which conditions governmental funding (Silva & Proença Jr., 2011). In that sense, governmental funding for all graduate programs in Brazil, particularly those from public federal universities, depends upon publication in selected journals 'that count', that is, highly-ranked journals according to Qualis system, which invariably means journals listed in ISI Web of Science with high Impact Factor. Production Engineering's Qualis ranking mainly draws upon four ISI Web of Science categories: Industrial Engineering, Manufacturing Engineering, Business and Management. The key issue is that Business and Management categories are bigger than Industrial Engineering and Manufacturing Engineering, and as a natural consequence, their median Impact Factor is higher. As top Business and Management journals are harder to get published in, they tend to be research-oriented, that is, to have a strong "devotion to theory" (Hambrick, 2007) ─ what even influential researchers admit in papers published in such top journals to be "too much of a good thing" (Hambrick, 2007). This "incestuous closed loop" (Hambrick, 1994: 13) biases top journals and reinforce the very crisis they arguably seek to solve. To be a top production engineering researcher

means to publish in top management journals, and top management journals are in crisis.

Another way of seeing the relevance of the thesis to Brazilian Engineering is to consider it a reply to what was once said by the head of a highly-reputed institute of engineering research: that they should create a graduate program on “scientific engineering”. The thesis explains why scientific engineering is nothing short of a contradiction in terms.

1.6 The Thesis at a Glance

An original contribution is a requisite for any doctoral thesis. This thesis submits that its results meet this requirement. The thesis' contributions are the following:

PART I: The nature of the so-called gap in Management

Context: There is a problem in the field of Management, a "never-ending crisis" (see Susman & Evered, 1978; Dulek & Fielden, 1992; Bennis & O'Toole, 2005; Koskela, 2011). This problem is not clearly defined. It is about a growing distance, a "gap", but it is not clear whether it is a gap between theory and practice, research and practice, science and practice, rigor and relevance or even researchers and practitioners. Management scholars do not acknowledge such indefinition as to what they mean by "the gap" as a problem that calls for solution: they indistinctively refer to the problems as "the gap" and do not realize that each problem definition has consequences to its subsequent problem solving (see the introduction of Part I for details).

The first contribution of the thesis is to diverge from the above-mentioned problem definitions and to argue that "the gap" is between a proto-science of Management and a proto-profession of Management, each of which with its own objectives, participants, academic incentives systems and epistemic foundations (see chapter 2 for details). Proto-science and proto-professions are concepts drawn from Bunge's (1983) demarcation criteria for science (see section 3.3 for details). The thesis proposes a framework that differs sciences from professions (see section 2.3 for details), greatly inspired in Koen's (1985; 2003) contributions to philosophy of engineering (see chapter 4 for details).

The second contribution of the thesis, which stems from the first contribution, is to argue that "the gap", the proto-science ─ proto-profession gap, lies within academia, that is, that the gap is within the academic discipline of Management. This diverges from current problem formulations (theory-, research-, science- practice gap), which all see unity within academia. This is why, poetically, the thesis argues that Management is a temple of volcanoes: the gap is within academia and spells lava in those who seek to remedy it, especially from the professional, but also from the scientific side (see chapter 3 for details).

PART II: The Sciences and The Artificial of Herbert Alexander Simon

The key issue in the proto-science ─ proto-profession gap is each proto-discipline's epistemic foundations. By "epistemic foundation" it is meant a discipline's criteria for knowledge demarcation, production, accumulation and evaluation, that is, the set of criteria generally accepted for defining what can and cannot be included in a discipline's body of knowledge (demarcation criteria, like Bunge's (1983) for scientific disciplines or Koen's (2003) for engineering and, arguably, for all professions), the set of criteria, methods and tools generally accepted for creating knowledge (knowledge production methods and criteria), for accumulating knowledge (including what counts as a "contribution" to the community, the venues in which such contributions are expected, and the pathos and ethos of such communications), and for comparing different data and information (evaluation criteria) (see the introduction to Part II for details).

The field of Management's current epistemic foundation is largely based upon Simon's dichotomy between Sciences of the Natural and Sciences of the Artificial. In that sense, the common understanding is that Management is a Science of the Artificial, which in the bottom line means that management is a science (see chapter 4 for details). The third contribution of the thesis is to argue that the dominance of a scientific epistemic foundation inspired by Simon's dichotomy helps explain the dominance of the proto-science over the proto-profession.

There are alternatives to Simon's dichotomy: van Aken's dichotomy between explanatory sciences and design sciences, an amendment to Simon's, and Koen's denial of a scientific nature for engineering, a rupture with Simon. The fourth contribution of the thesis is to argue that Koen provides a fruitful alternative to solve Simon dichotomy's misunderstandings. Koen's contribution is, hence, a more profound dichotomy, which contrasts with Simon's Natural-Artificial Sciences and with van Aken's Explanatory-Design Sciences, which are both dichotomies between *kinds* of science: Koen's dichotomy is Science-Not Science (Science-Engineering in his book, Science-Profession in the thesis' framework) (see section 4.3 for details).

The fifth contribution of the thesis is to argue that Management scholars profane the contribution of Simon not only because of the misunderstandings that stem from the intrinsic incompleteness of his dichotomy, but also that some consequences of Simon

are opportunistically ignored. Simon (1996) argues that design is the core of professions (including management). Simon (1977) includes design (of alternative solutions to problems) as part of what he calls "organizational decision making" (the other core component being choice among designed alternatives). A consequence of Management's overemphasis on science due to its scientific epistemic foundation is that Management overemphasizes decision-making narrowly understood (top managers choosing between alternatives) to the loss of design (usually by low or middle managers and management consultants). "Decision sciences" is a subfield of Management. "Design sciences", van Aken's proposal, is no more than a promise (and, in light of Koen, a contradiction in terms) (see chapter 5 for details).

PART III: Digging in the wrong place

The sixth contribution of the thesis is to argue that there is more than one gap in "the gap", the proto-science ─ proto-profession gap. From such foundational gap comes the (professional) researcher-practice gap, the (scientific and professional) research - practitioner gap, the practitioner - (professional) research gap, the (scientific and professional) researcher - (scientific and professional, respectively) research gap, and the (professional) researcher-practitioner gap. The thesis argues that Management fails to acknowledge and hence to remedy the foundational proto-science ─ proto-profession gap, and all the gaps that follow (see chapter 6 for details).

Evidence-based Management (EBMgt) is among other current academic trends following Management's scientific epistemic foundation. Hence, in accordance with the scientific epistemic foundation, Evidence-based Management sees science as intrinsically superior to non-science The seventh contribution of the thesis is to argue that, as a consequence of the above, Evidence-based Management's supporters feel they should lecture to practitioners and proto-professional researchers. This puts EBMgt supporters in a superior position of discourse to proto-professionals, instead of an equal standing in which dialogue has a role to play. Ultimately, EBMgt supporters think they have a lot to teach to proto-professionals, but little or nothing to learn from them (see chapter 6 for details).

The eight contribution of the thesis is to argue that the problem is not with Evidence-based Practice, or with Evidence-based Management, or even with Evidence-based Management's supporters. The root cause for this problem is the dominance of the

scientific epistemic foundation. Evidence-Based Practice changed Medicine for better (see chapter 6 for details), and the same happened in Software Engineering (see chapter 7 for details). Moreover, in its very beginnings, Evidence-Based Management was a promising aid for the evolution of both the proto-science and the proto-profession. It was a methodological proposal aimed at reducing research biases. The problem came later, when an alternative proposal anchored at the scientific epistemic foundation changed EBMgt's focus, introducing the superiority of science over non-science and relegating methodological developments for an appendix (see chapter 7 for details).

CONCLUSION

The thesis argues for the need for a change in the dominance of the scientific epistemic foundation over both the proto-science and the proto-profession of Management. It calls for the replacement of Simon's dichotomy between *kinds of science*, in which Management sees itself as a science (of the artificial), for Koen's dichotomy between *equal-standing sciences and professions*, in which the conflicts between the proto-science (and its scientific epistemic foundation) and the proto-profession (and its professional epistemic foundation) becomes apparent ─ *and hence, solvable*. This is why, poetically, the thesis argues that Management is currently a temple of volcanoes, but that Management (the proto-profession) should become once again *a Temple of Volcanus*: a temple of the mythological god of engineering, a temple in which the father of our dear Production Engineering, the great Frederick Winslow Taylor, can once again have his rightful place.

1.7 Thesis Structure

This thesis argues that a root cause for the half-century long crisis of management is the field's current epistemic foundations, which comes from misunderstandings of Simon's intrinsically incomplete distinction between sciences of the natural and sciences of the artificial. In other words, the growing distance between academic research of management and the practice of management is a consequence of an overemphasis on science over non-scientific elements of management.

This is a quite polemic argument, for a quite controversial issue, in which a lot is at stake. The "bridging the gap" debate is about business schools' legitimacy, not only within academia but also before the world of practice. As the thesis' author needed to score publication points to become a respectable and desired academic, the quite straightforward and polemic argument presented above had to be softened and salami-sliced to several papers to be published in whatever journals the field of Production Engineering values (which, in its turn, means Management journals).

Given this context, the thesis is constructed as a mosaic of six papers written during the research years of the doctoral passage. The papers were grouped into three pairs (Parts I, II and III). For each paper, a prologue and an epilogue are provided that explain the paper's motivation, context, and its role in the thesis as a chapter. Hence, each of the following chapters (except for the conclusions) is composed of a prologue, a full paper, and an epilogue. Each prologue explores poetically the duality in the volcanic temple. They aim at introducing the respective paper and its context. The epilogues are less poetic and more rational. They add additional comments and connect the paper with each other as well as with the thesis' main arguments (see section 1.6 for a summary). In the beginning of Parts I, II and III, brief notes on the existing literature help set the context to which each chapter seeks to contribute. Table 1 provides a blueprint of each of the thesis' sections.

Table 1 - Thesis Summary

Part / Chapter	Prologue	Main Argument	Epilogue
Part I	A reinterpretation of "the gap" as a proto-science – proto-profession gap		
2. "The True Divide"	The temple of volcanoes and the Temple of Volcano. The duality between Science and Profession.	The gap is between the proto-science and the proto-profession of Management.	Introducing and further exploring the Science-Profession framework.
3. "The Gap Lies Within"	Lava burns unequally the proto-science and the proto-profession. The duality between admiration and aversion.	The gap is within academia.	Is the proto-science of Management a pseudoscience? Exploring Bunge's demarcation criteria.
Part II	A discussion of Management's epistemic foundations.		
4. "Simon Meets"	The epistemic foundations of the volcanic temple. The duality between the Sciences and the Artificial.	Simon's epistemic foundations are incomplete and hence lead to confusions Van Aken and Koen help expose.	What are the consequences of Koen's dichotomy to Management's epistemic foundations?
5. "The Yin-Yang"	The profanation of the Temple of Volcanus. The duality between Decision and Design.	Simon's epistemic foundations were opportunistically used, overemphasizing choice in decision to the loss of design.	Industrial Engineering drives out those who profaned the temple. Design still lives in Industrial Engineering.
Part III	There is more than one gap; a critic of EBMgt and its emphasis on scientific epistemic foundations.		
6. "Of Gaps and Bridges"	The volcanic temple and The temple of Asclepius. The duality between discourse and dialogue.	There is more than one gap originating from the fundamental gap between science and profession. And EBMgt fails to bridge any of them.	Locating the gaps within the Science-Profession framework.
7. "A Tale"	The ant and the grasshopper. The duality between hope and delusion.	EBMgt focused on advertising and selling to practitioners. EBSE focused on methodological developments.	EBMgt as the chosen one.

Source: The author

Part I argues that there is something wrong with the way "the gap" is perceived, as a gap between rigor and relevance, research and practice, or theory and practice. Chapter 2 argues that the gap can be better understood as a gap is between Management, the proto-science and Management, the proto-profession; that is, a gap between two competing initiatives, one aiming at turning management into a science and another aiming at a turning it into a profession (hence, it is argued that Management is neither a science nor a profession). The paper on chapter 3 argues that this "gap" is within academia, not between the academic discipline and the practice of management. It concludes that the coexistence of two different academic disciplines under the same academic roof lead to conflicting policies, values and derisive consequences for supporters of both initiatives.

Part II explores reasons for the situation described in Part I. It explains that a root cause for the crisis is the problem with Management's epistemic foundations, which stem from the intrinsic incompleteness of Herbert Simon's distinction between "Sciences of the Natural" and "Sciences of the artificial" and from misunderstandings of Simon's contributions. Chapter 4 explores the intrinsic incompleteness of Simon's epistemic contribution to management by comparing it with Koen's to engineering and to van Aken's to Management. Chapter 5 addresses misunderstandings of Simon's epistemic contribution by exposing the opportunistic misuse of Simon's concept of organizational decision making, reducing its breadth to a mere choice among alternatives, which in its turn leads to the loss of design in Management.

Part III addresses consequences of Parts I and II, arguing that alleged solutions to "the gap" are doomed to fail, unless the issues Parts I and II explored, which have to do with the way the problem is formulated, are considered. Chapter 6 argues that there is more than one gap stemming from the fundamental and insurmountable Science-Profession gap, each of which calling for specific dialogical bridges in the field of Management, to connect (proto-)scientific researchers, (proto-)professional researchers, practitioners, the public and policy makers. It explains that (proto-) scientific researchers aim at lecturing, rather than dialoguing with (proto-)professional researchers and practitioners, because they follow the scientific epistemic foundation and see themselves as having a lot to teach, but little or nothing to learn from practitioners' nonscientific competence. Chapter 7 further explores a consequence of the arguments presented in chapter 6. It compares the development of Evidence-based Management (EBMgt) with that of Evidence-based Software Engineering (EBSE), to

show that EBSE aimed at strengthening its research methods without adhering to a scientific canon, whilst mainstream EBMgt abandoned methodological rigor to focus in spreading its discourse to practitioners.

The picture that emerges in the concluding chapter shows that the science-oriented epistemic foundation that dominated Management since 1959, coexisting with a profession-oriented initiative that lacks a distinctive epistemic foundation, is a root cause for the half-century long crisis. It proposes that a house divided cannot stand: it is of the nature of scientific disciplines to be less relevant for professional practice, or even not relevant at all. Hence, the dream of getting the best of both worlds, being both scientific (instead of proto- or pseudo-scientific) and directly relevant for practice (up to the point in which students decide to pursue an academic degree on management the science because of its practical importance, or to the point in which companies fund business schools for its short-term business potential) is an impossible dream. The picture painted in this thesis is of a temple of volcanoes. The hope to which the thesis expects to contribute is the reconstruction of a Temple of Volcanus.

1.8 Method

The author spent a significant amount of time in his undergraduate and graduate education studying research methodology (Lacerda et al., 2007a; Lacerda et al., 2007b) and developing a method for systematic mapping, that is, a method for conducting literature searches which adopts procedures for mitigating research biases (Silva, 2009; Silva & Proença Jr., 2013).

In this thesis, a systematic mapping following Silva & Proença Jr. (2013) was adopted (see Appendix 1 for details). Several personal dialogues with key thinkers from the fields of Management and Philosophy of Engineering complemented the literature survey based on systematic mapping. These included:

(1) a two-month visit to Professor Joan van Aken (emeritus professor and colleagues from the Innovation, Technology, Entrepreneurship and Marketing Group (ITEM Group) of the Eindhoven University of Technology.
(2) Participation in several international conferences (Academy of Management 2012 Meeting, Boston, USA; 2012 Forum on Philosophy, Engineering and Technology, Beijing, China; 2013 Society for Philosophy and Technology Meeting, Lisbon, Portugal; participation in a conference of the Management Models for Innovation-oriented Organizations project in 2011 is also noteworthy).
(3) A dialogue with professor Billy Koen, which included a one-day meeting that took place in his house in 2012 and several personal communications by e-mail.

1.9 Limitations

The most significant limitations of the thesis derive from isolation from the subject. The thesis is based in an outsider's view on Management and its crisis. It makes use of literature reviews and some first-hand experiences in an Academy of Management conference, in a 2-month visit to the Netherlands and in participation in the Evidence-based Management discussion group through a mailing list; no structured interviews were carried out. For this reasons, conclusions are limited to what is possible to infer from the existing literature on the topic. In terms of the literature survey, a broad literature search was conducted as part of the Systematic Mapping method (Silva & Proença Jr., 2013). Of course it is impossible to affirm the elimination of biases, but the adoption of procedures to mitigate bias tend to increase the literature review's quality (see Appendix 1 for details).

PART I: THE NATURE OF THE SO-CALLED GAP IN MANAGEMENT

Part I aims at providing an alternative framework for the identity crisis business schools face. This contribution is in direct dialogue with Daniel (1998), Mintzberg (2004, 2009), Khurana (2007) and Pearson (2009), among others. The position such contributions express is that management failed to become a science or to become a profession ─ hence, management is neither a science nor a profession. "The true divide" (chapter 2) and "The gap lies within" (chapter 3) takes a different approach. We agree with the view that management is neither a fully developed science nor a profession, but we make use of Bunge's (1983) demarcation criteria to explain that management is both a proto-science and a proto-profession, and such coexistence and competition is the true nature of the identity crisis ─ of the so-called "gap". "The true divide" (chapter 2) addresses the history of the crisis and Bunge's (1983) demarcation criteria to re-conceptualize the nature of "the gap" as a gap between the proto-science and the proto-profession. "The gap lies within" (chapter 3) explains that such gap is, poetically, a volcano which expels lava ─ that is, that conflicts between proto-professionals and proto-scientists under the same academic roof is a problem to the development of both proto-disciplines.

A recurrent argument throughout the thesis is that the irresolution or indistinction about the nature of "the gap" is a major impediment for dealing with the issue properly. Contrary to what seems to be the literature on the gap's current choices, this thesis seeks to define the problem clearly before solving it. Table 2 illustrates that there is confusion about the nature of the gap ─ whether it is between theory and practice, science and practice, research and practice, rigor and relevance, researchers and practitioners, or even academics and practitioners. The thesis frames the gap in a novel way ─ the gap between the proto-science and the proto-profession ─ and it also explains that science, research and theory are very different concepts. This is yet another way to frame the context of the thesis' contribution.

Table 2 - Distinctive ways the literature frame "The Gap"

The gap is between…	References
Theory – practice	1. Allen, J. M. (2011). How front-end loading contributes to creating and sustaining the theory-practice gap in higher education programs. *Asia Pacific Education Review*, *12*(2), 289-299. 2. Donmoyer, R., Libby, P., McDonald, M., & Deitrick, L. (2012). Bridging the theory-practice gap in a nonprofit and philanthropic studies master's degree program. *Nonprofit Management & Leadership*, *23*(1, SI), 93-104. 3. Holmstrom, J., Ketokivi, M., & Hameri, A. -P. (2009). Bridging practice and theory: A design science approach. *Decision Sciences*, 40(1), 65-87. 4. Hutt, M. D. (2008). Engaging Corporate Partners To Bridge The Theory-Practice Gap. *Journal Of Supply Chain Management*, *44*(2), 68-71. 5. Moisander, J. & Stenfors, S. (2009). Exploring the edges of theory-practice gap: Epistemic cultures in strategy-tool development and use. *Organization*, *16*(2), 227-247. 6. Ven, A. H. V. D. & Johnson, P. E. (2006). Knowledge for theory and practice. *Academy of Management Review*, 31(4), 802-821.
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Academics - practitioners	1. Schiele, H. & Krummaker, S. (2011). Consortium benchmarking: Collaborative academic-practitioner case study research. *Journal of Business Research*, 64(10), 1137-1145. 2. Rynes, S. (2007). Let's create a tipping point: What academics and practitioners can do, alone and together - afterword. *Academy of Management Journal*, 50(5), 1046-1054.

Source: The author

2 The True Divide: Management – the Proto-Profession and the Proto-Science[4]

2.1 Prologue

This chapter sets the tone for the first and foundational duality in Management: the duality in an academic discipline originally conceived as a profession like engineering, as a Temple of Volcanus, that became a chaotic temple of volcanoes, of gaps expelling lava and smoke, hostile and blinding to whoever tries to remedy them.

"The True Divide" also expresses another duality, which arguably help explain the never-ending crisis of Management: the duality between science and profession, between a proto-science and a proto-profession fighting for their own evolution under the same academic discipline.

2.2 Full Text

Abstract

We provide a different interpretation for the so-called gap between academic research and practice of Management. We argue that since the 1959 Foundation Reports, Management has been the coexistence of a Proto-science and a Proto-profession under the same academic discipline, struggling with each other for their own evolution, each of which with its own evolutionary logic, body of knowledge, demarcation criteria, aims, methods, values and academic incentives systems. The so-called gap in management is then between the proto-science and the proto-profession of Management, each of which with its own research and practice, not simply between research and practice or theory and practice. As we see the gap as a natural phenomenon, we conclude by discussing the real challenge to Management: whether or not a bridge should and could be created over the (proto-)science-(proto-)profession gap, and how might such bridge look like.

[4] This paper was originally written in October, 2013 by the author, as a paper to be submitted to *Organization*. It has not been submitted yet, as it still calls for further adjustments aimed at making it publishable in the journal.

1. Introduction

Oh no! Yet another paper on "the gap"?

It is said that a well-defined problem is halfway to being solved. But is the problem of "the gap" in Management well defined? This paper provides an alternative interpretation for the "wild goose chase of Management research" (Koskela, 2011). To aim at contributing to such endless discussion involves some degree of courage: Could there be something new to say? Many important journals have devoted special issues to "the gap", such as the *Journal of Management Inquiry* (1997, vol. 6 issue 1), the *Academy of Management Journal* (2001, vol. 44 issue 2) and the *British Journal of Management* (2001, vol. 12, issue S1; 2011, vol. 22 issue 3). Many books cover this topic, including the invaluable contributions given by those that take a predominantly historical approach, such as Daniel (1998), Wren & Bedeian (2008), Hopper & Hopper (2009), Witzel (2012) and Augier & March (2011), and by others that make use of history to develop their arguments, such as Mintzberg (2004), Khurana (2007) and Datar, Garvin & Cullen (2010). Relevant articles also appear in regular issues, both in the so-called "practitioner journals", such as Behrman & Levin (1984), Bennis & O'Toole (2005) and Khurana & Nohria (2008) and in the so-called "academic journals", such as van de Ven (1989), Cohen (2007), Jarzabkowski & Whittington (2008) and Fincham & Clark (2009).

Despite the overwhelming flow of publications on "the gap" each year, we think there is something we could add to this debate. A fundamental clue that there is something wrong with the way the problem is defined is the fluent redescription of the gap as "rigour-relevance" (e.g., Kieser & Leiner, 2009; Vermeulen, 2005; Worrell, 2009), "researcher-practitioner" (e.g., Anderson, Herriot & Hodgkinson, 2001; Hodgkinson, 2006; Hueffmeier, Krumm & Hertel, 2011), "theory-practice" (e.g., Daniel, 1998; Jarzabkowski, Mohrman, & Scherer, 2010; Rynes, Bartunek & Daft, 2001; Starkey & Madan, 2001) or "research-practice" (e.g., Bansal *et al.*, 2012; Empson, 2013; Rousseau, 2006), among others. This suggests a measure of irresolution or indistinction as to what is being named, and hence, understood.

Our contributions are the following. First, in section 2 we argue that Management's current situation expresses the unrecognized struggle between the proto-science and

the proto-profession of Management. Both are confined to the same academic discipline, to the same house. And yet each yearns to go its own separate way. Each has a body of knowledge and demarcation criteria of its own, that support different aims, methods and heuristics (in the sense of Imre Lakatos). Currently, academic incentives systems overvalue the proto-science to the loss of the proto-profession of Management. In section 3 we argue that this is the root cause of the gap; and that efforts to describe it otherwise, e.g., as the gap between "theory and practice" or "research and practice" misrepresent the problem. The real gap, we argue, is between the proto-science and the proto-profession. Our concluding comments discuss some implications of the proposed "science-profession gap".

2. The Proto-science and the Proto-profession of Management

Inspiration for this section comes from, among others, Henry Mintzberg's characterization of Management as neither science nor profession, but as practice (Mintzberg, 2004; Mintzberg, 2009). Other authors, such as Bailey & Ford (1996), Khurana (2007) and Tranfield & Starkey (1998), present similar arguments to conclude that Management is not a science, whereas others such as Leicht & Fennell (2001), Trank & Rynes (2003) and Rynes, Giluk & Brown (2007) argue that Management is not a profession. Our argument is different. Management certainly involves practice, but we characterize its current stage as coexistence, under the same academic discipline, of a Proto-profession and a Proto-science, each struggling for its own evolution.

2.1. Philosophical Roots

Bunge (1983), in his "*Treatise on Basic Philosophy"*, deals with the problem of finding a definition for Science and establishing criteria for considering a field scientific. He defines twelve conditions for a discipline to be considered scientific (Bunge, 1983: 202-203). He then defines five kinds of disciplines: (a) *"science"* is a research field that completely satisfy all conditions; (b) a "*non-scientific discipline"* is "any research field that fails to satisfy even approximately all of the twelve conditions"; (c) "*semiscience"* or "*protoscience"* is "a research field that satisfies

them approximately"; (d) "*emerging"* or "*developing"* field is "evolving towards the full compliance of them all"; (e) "*pseudoscience"* or "*fake"* or "*bogus"* science is "any field of knowledge that is non-scientific but is advertised and sold as scientific" (all passages, Bunge, 1983: 203). Considering the criticisms on the contributions of Management to science in general (e.g., Bennis & O'Toole, 2005: 104; Ghoshal, 2005) and on the very idea of Management as science (e.g., Bailey & Ford, 1996; Khurana, 2007: 91-100; Mintzberg, 2009: 10), we make use of Bunge's terminology to characterize Management, on the one hand, as a Proto-science, struggling for its evolution as a mature scientific discipline (Bunge, 1983). On the other hand, we made creative use of Bunge's prefix to characterize Management as a "Proto-profession", struggling for its evolution as a mature Profession.

2.2. Historical Origins

The Proto-profession and the Proto-science of Management have different historical origins. What we call the "Proto-profession" of Management was created by pioneers such as Frederick Winslow Taylor and the couple Frank and Lilian Gilbreth. It is generally agreed that Scientific Management and the formalization of general principles for Management catalyzed a radical change, the transformation of a craft into something more akin to a Profession (Daniel, 1998; Hopper & Hopper, 2009; Khurana, 2007; Witzel, 2012; Wren & Bedeian, 2008). On the contrast, the Proto-science of Management was mainly a product of the so-called 1959 Foundation Reports from Ford and Carnegie (Gordon & Howell, 1959; Pierson, 1959, respectively), although Daniel (1998: 163) argues that the 1959 Foundation reports were based in a previous one, the Kozelka Report (Kozelka, 1954), commissioned by the Association to Advance Collegiate Schools of Business (AACSB), published five years earlier. Historians of Management agree that the 1959 Foundation Reports and their consequences represented a significant change in the academic discipline of Management, a "scientific turn" (Daniel, 1998; Hopper & Hopper, 2009; Khurana, 2007; Witzel, 2012; Wren & Bedeian, 2008), what we see as evidence for the birth of the Proto-science.

Khurana (2007) argues that the scientific turn Ford and Carnegie foundations promoted, and numerous business schools followed, meant the abandonment of the promise of Management as Profession Khurana (2007: 291). We see it rather

differently: the emergence of the so-called "Management Science" was an attempt to create a Science out of an ongoing professionalisation project, but instead of replacing professional ambitions for scientific, the 1959 turn created conflicting coexistence, resulting in endless disputes between participants of each Proto-discipline (including, but not limited to, the crisis that later became known as "the gap"). Each Proto-discipline works for its own evolution, under the same resource base and academic identity, but with markedly different aims, methods and criteria to demarcate what should or should not belong to the (Proto-)professional and the (Proto-)scientific knowledge base. Therefore, the promise of Management as Profession was not abandoned: It had to coexist with the promise of Management as science under the same academic discipline, with negative consequences for both projects.

2.3. Sciences and Professions

Professions and Sciences are both academic disciplines, but their differences are significant up to the point that they cannot be taken one for another. Whereas it is widely accepted that Science is a human endeavor aimed at creating more and better knowledge, the mission of a Profession is not simply to create "more and better knowledge". Koen (2003), a masterpiece of Engineering, praised by the US National Academy of Engineering's former president William A. Wulf as "the best description of Engineering that I have ever seen", defines the mission of Engineering as "causing the best change in a poorly understood situation within the available resources" (Koen, 2003: 28). That a Profession has its own body of knowledge, its own rules for deciding what should or should not be included in it (the demarcation criteria), and that the nature of such body of knowledge and demarcation criteria is non-scientific seems settled by the contributions of, e.g., Abbott (1988), Bunge (1983), Ferguson (1992), Koen (2003) and Vincenti (1990). Engineering, like any other Profession, has a body of knowledge of its own. For instance, Vincenti (1990: 235) defines six types of engineering knowledge, in which "scientific knowledge" is not a category, and six knowledge generating activities, of which "transfer from Science" is but one activity, and not even the most important one. Hence, if one accepts the way Engineering sees itself and allows for the generalization from Engineering to other Professions, as Simon (1969) did, it is possible to conclude that Engineering, like any other Profession, is not Science, not even applied Science.

Another way of seeing the issue might help make the difference between Professions and Science clear. Professions are the product of two independent, yet related, vectors. One aims at the growth of its *own* body of knowledge ─ what we call "knowledge stream"; the other aims at "causing the best change in a poorly understood situation within the available resources" (Koen, 2003: 28), using the Profession's body of knowledge as an input, among others, for action ─ what we call "practice stream" (the terms "practice stream" and "knowledge stream" are borrowed from Andriessen (2007), even though he uses them in a rather different way).

Science, on the contrary, is the product of a single vector: Science only has a knowledge stream. Having practical implications is not part of the scientific mission; neither it is a criterion for allocating resources or demarcation. Science evolves by developing more and better knowledge about the world, even if such knowledge finds no transfer to any Profession. In a Profession, the practice stream is ultimately more important than the knowledge stream: The mission of any Profession, again, is "to cause the best change in a poorly understood situation within the available resources" (Koen, 2003: 28). Developing more and better knowledge can be crucial for such mission, but it cannot be more than means to the practical ends that define a Profession.

A consequence of the fact that the demarcation criteria of professions is not scientific is that knowledge streams of the Professions and of Science are intrinsically different. In other words, as Professions can include heuristics, rules of thumb, practical considerations, quantitative data, insights and all other Vincentian knowledge categories, all of which unacceptable by Science, methods and procedures used by the Professions for producing more and better knowledge need not be limited to what is considered "scientifically valid", or part of the scientific method.

3. The Gap is Between Science and Profession

Two common characterizations for the gap, "theory-practice" and "research-practice" both fail to describe the its nature because the Proto-science and the Proto-profession have their own theories and conduct their own research. On the one hand, research under the (Proto-)science (if it is *de facto* aiming at becoming Science one day, not merely a case of pseudo-science) must use the scientific method, whereas research

under the Proto-profession can use *whatever means necessary* for knowledge production (as both Koen, 2003 and Vincenti, 1990 argue and exemplify). On the other hand, theories under the (Proto-)profession, such as Goldratt's Theory of Constraints (e.g., Goldratt & Cox, 1992), Shingo and Ohno's Toyota Production System (e.g., Ohno, 1988; Shingo & Dillon, 1989) or even Taylor and Gilbreth's Scientific Management (Gilbreth, 1911; Taylor, 1903; Taylor, 1911) are non-scientific, heuristic in nature (Koen, 2003), yet no less valuable or useful under the Profession's value system. In fact, as Koen (2003) and Vincenti (1990) argue, from an Engineering (generalizing, Professional) viewpoint, even scientific theories are taken as heuristics *on equal standing*, without any intrinsic superiority of scientific theories over heuristics with different origins. Sciences, on the contrast, can only demarcate inclusively theories approved by the scientific demarcation criteria in use, such as those in Bunge (1983), Popper (1934/2002) or Lakatos (1978). Thus, if one is eager to continue seeing the gap simply as "theory-practice", it would be necessary to add, "the gap between theories from the Proto-science of Management and practice", in order to do justice to the previously mentioned and to other researchers working under the Proto-profession, whose contributions are not, by any means, divorced from practice. Likewise, "research-practice gap" needs to be detailed as "the gap between research under the Proto-science of Management and practice". Our proposal, the "(Proto-)science-(Proto-)profession gap", or simply "science-profession gap", is perhaps a clearer and shorter way to describe this issue.

The "science-profession gap" of Management is not a problem in itself. Rather, we see it as a natural phenomenon, a separation that occurs between a Science and a Profession, as with Physics and Engineering, Biology and Medicine, Political Science and Law. The real problem is whether or not a bridge should connect the (Proto-)science and (Proto-)profession of Management, and how might such bridge look like (section 4). Again, Engineering benefits largely from Science, but cannot be confounded with it (Koen, 2003; Rogers, 1983; Vincenti, 1990). The invention of rational Medicine is generally credited to the Greco-Roman tradition, with special emphasis on Hippocrates and Galen (French, 2003; Kelly, 2009; Magner, 1992). In such surveys of the history of Medicine, neither the origins nor the current state of the Profession are confounded with Science, although all highlight the numerous improvements that stem from the relationship with Biological Science. What is peculiar in the case of Management is that the (Proto-)science and the (Proto-

)profession share the same origins and coexist under the same academic discipline. From Sociology of Professions' point of view, this is a rather unique opportunity to witness the specialization, evolution and separation between the Profession and the Science of Management.

4. Concluding Comments

This paper argued that "the gap" in Management is not between "rigor and relevance" (Kieser & Leiner, 2009; Vermeulen, 2005; Worrell, 2009), "researcher and practitioner" (Anderson, Herriot & Hodgkinson, 2001; Hodgkinson, 2006; Hueffmeier, Krumm & Hertel,, 2011), "theory and practice" (Daniel, 1998; Jarzabkowski, Mohrman, & Scherer, 2010; Rynes, Bartunek & Daft, 2001; Starkey & Madan, 2001) or even "research and practice" (Bansal *et al.*, 2012; Empson, 2013; Rousseau, 2006). Rather, we framed it as a gap that has to exist between a Science and a Profession, hence the "science-profession gap" that is also found between, say, Physics and Engineering, Biology and Medicine, Political Science and Law. Management was characterized as a Proto-science and a Proto-profession under the same academic discipline, struggling with each other for two distinct missions: To evolve as science and to evolve as Profession. This concluding section discusses four implications of our arguments.

The first implication is whether "the gap" is to be bridged or to be closed. Some authors suggest that the gap is to be closed, not bridged (e.g., Burke, Drasgow & Edwards, 2004; Rousseau, 2006: 265; Rousseau, 2012b: 20). The gap between Science and Profession admits no closure because, as we argued in section 2, Sciences and Professions have different demarcation criteria, use different methods, have different aims and evolve in different ways. "Closing the gap" would necessarily mean the elimination either of the Proto-science or of the Proto-profession. However, as Professions can, and usually do, benefit from sciences and vice-versa, a bridge between them is desirable.

Second, it should be noted that although collaboration between the Proto-science and the Proto-profession of Management is desirable, it is not indispensable for each discipline's development. Taking Engineering as an exemplar, Koen (2003) shows that Engineering existed before Science, and even in modern days Engineering has to

accomplish its mission ("the best change in a poorly understood situation within the available resources") even when Science is not available or when it is not the best heuristic to be used ─ for instance, the man went to the moon without the exact temperature, pressure, gravitational field, and composition of the moon: without science, how do you apply it? (Koen, 2003: 86).

Third, A bridge between the (Proto-)science and (Proto-)profession of Management, if any, depends on the acknowledgement that collaboration between them is interdisciplinary in nature. One of the many prerequisites for interdisciplinary research is mutual respect and recognition of alterity. Management, the (Proto-)science and Management, the (Proto-)profession have different aims, methods, value, incentive and funding systems that may clash and collide when collaboration is attempted. This is not a specificity of Management ─ the same tension applies to collaborations between biological scientists and medical professional practitioners or researchers, physicists and engineers or engineering researchers, political scientists and attorneys or law researchers. In any case, overcoming the intrinsic problems of interdisciplinary collaboration between Sciences and Professions depends on recognition that despite their differences, both sides deserve the same academic respect and have something to learn from the other. If scientists see themselves as intrinsically superior to professionals or vice-versa, the most that can happen in collaborative projects is both sides irritating each other (this is perhaps what Kieser & Leiner, 2009 had in mind in their paper diagnosing and discussing collaboration between academics from the (Proto-)science and professionals in Management).

Finally, we differ from those who see the gap's existence as a problem in itself. *The gap is not a problem: the problem is what to do with the gap*, with the natural, growing gap between the evolving and specializing (proto-)science and (proto-)profession. The real issue, in our view, is whether or not a bridge will exist between what one day may become two different academic disciplines. The common origin of both suggest an affirmative answer; the instances of mutual lack of respect between "irrelevants" and "fads and fashionists and Heathrow literature producers and consumers" a negative. A bridge, if any, depends first on a clear diagnosis of the problem, to which this article tried to contribute, and second and most important on a change of attitude, which depends more on the readers than on the authors themselves.

2.3 Epilogue

"The True Divide" introduces a framework for understanding the relationships between sciences and professions (section 2.3 of the paper, "Sciences and Professions"). Within such framework, scientific disciplines have a knowledge stream, and professional disciplines have both a knowledge and a practice stream. It seems opportune to further expand on this framework, which was an ancillary consideration for the paper, but it is central to this thesis' argument.

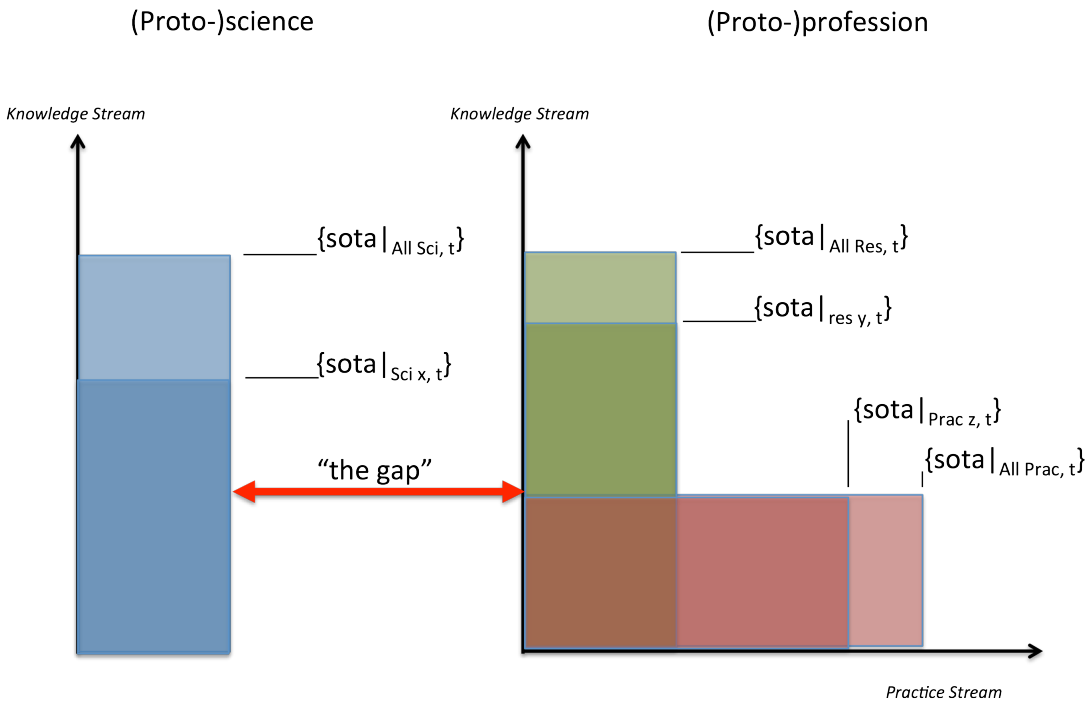

Figure 2 - The Science-Profession Framework

Source: The author, inspired by Koen (2003), Bunge (1983) and Andriessen (2007)

Figure 2 provides a graphical representation of the framework. It is based on Koen's (2003) State of the Art (sota), which he defines in its simplest sense as "the set of heuristics used by a specific engineer to solve a specific problem at a specific time" (KOEN, 2003:42). There can be sotas of single people (researchers, practitioners, scientists) and of groups. Therefore, to characterize scientific disciplines the framework distinguishes between the state of the art of a scientist x at a given time ($\{sota|_{Sci\ x,\ t}\}$) and the state of the art of all scientists at a given time ($\{sota|_{All\ Sci,\ t}\}$). The state of the art of all scientists is the state of the art of science, that is, the sum of

all scientific knowledge. To be a scientist is to take part in the mission to expand the state of the art of science. It is part of the mandate of a scientist to be up to date with the scientific sota, that is, to have $\{sota|_{Sci\ x,\ t}\}$ as similar as possible to $\{sota|_{All\ Sci,\ t}\}$.

A professional discipline is analogously defined. There can be the state of the art of a specific researcher y and of a practitioner z, and the state of the art of all researchers and of all practitioners. It is expected that the sets of practitioners and researchers from within a profession intersect. The issue here is the size of the intersection. In a professional discipline in which research is closely related to practice, a larger intersection would be expected. In a professional discipline in which "a gap" is present, a shorter intersection would be expected. "The gap" between the proto-profession and the proto-science, to which the papers in Part I refer to, is the gap between both disciplines, marked by the arrow. Science and profession may grow apart from each other as each field specializes and evolves. However, As chapter 6 will show, there are many other gaps in "the gap" besides this fundamental one.

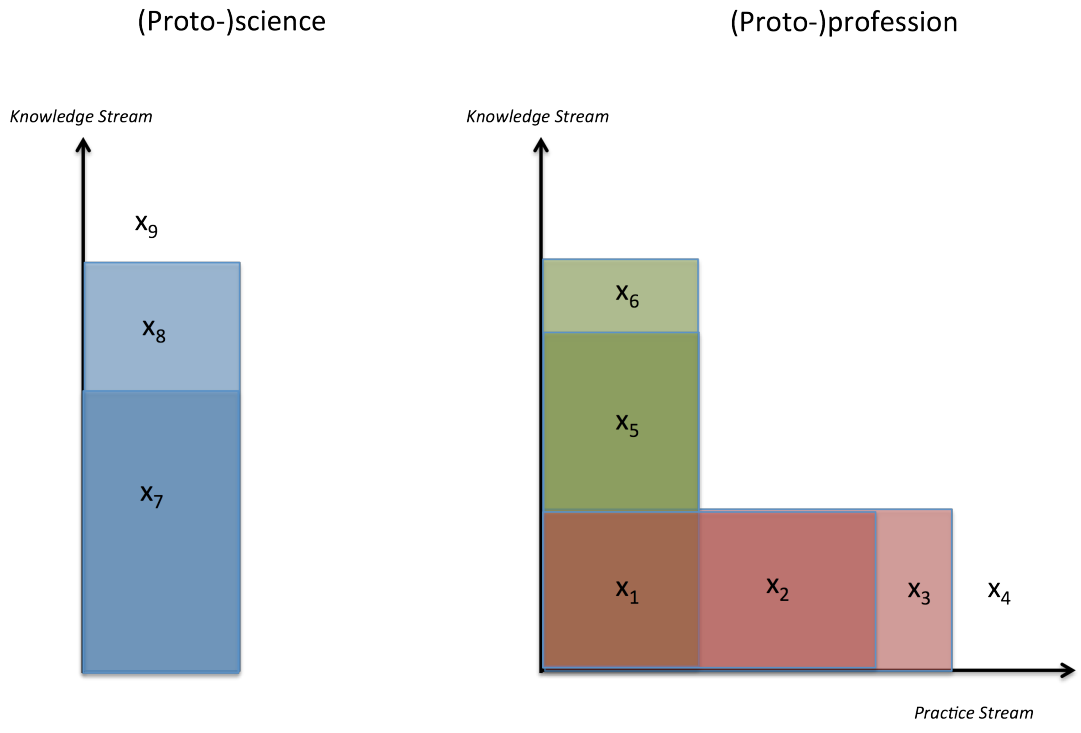

Figure 3 - Subsets in the Science-Profession Framework

Source: The author, inspired by Koen (2003)

Figure 3 further scrutinizes the framework by considering its logical subsets. X1 marks the common fund of knowledge of a professional discipline ─ such as anatomy

in medicine, or calculus or physics in engineering. X2 represents the heuristics practitioners know and researchers don't (X5 is the logical opposite). X3 represents the heuristics that a specific practitioner is familiar with, but not the reference, "practitioner z". When a practical problem calls for the expansion of practitioner z's state of the art, he or she will perform research. If a specific course of action has already been devised and tested by another practitioner (X3), practitioner z would incorporate this heuristic to his or her arsenal. However, there can be such cases to which there is no course of action. Such is the case of X4, X5 or X6. Professional research can come handy in such situations, providing possible solutions to the problems practitioners face (X5 or X6). Further, there are situations to which professional research fail to provide (x4). Such problems call for expanding the profession's state of the art to address practical needs. Science, then, plays its role. Transfer from science expands a profession's state of the art, whenever scientific knowledge is available (X7 and X8). There might be cases in which it is not (X9), cases in which more scientific knowledge is necessary (teleportation can be a good example; the mechanisms of cancer, another). However, as Koen explains, engineering (and arguably all professional disciplines) needs not only to provide "the best change", but it needs to provide it *now*, within the available resources, time included. Most problems do not allow practitioners to wait for a scientific breakthrough. And that is the place of creativity and innovation in a professional discipline, a discipline that makes use of whatever means necessary to provide the best possible change to a situation such as X4.

This chapter, and so will the next one, sought to discuss a few consequences of the above framework to the field of management ─ without being too theoretical or philosophical. Both chapters portray management and the debate on the gap as failing to acknowledge the very basic assumptions of the proposed framework: that there can be professional and scientific research, that there are many instances of professional research on management, that the failure to acknowledge the epistemic distinction between the proto-science and the proto-profession dooms the development of both. This chapter introduced the framework and exposed the volcano; the next one will show that everything is happening within the volcanic temple of management.

3 The Gap Lies Within Academia – Between Management, the Profession and Management, the Science[5]

3.1 Prologue

"The Gap Lies Within" shows the volcanoes within the temple of Management. It further explores the gap between Science and Profession (as discussed in "The true divide", previous chapter) and it shows that this gap is within academia. Moreover, it works as a thermometer for the lava the volcano expels, a lava that burns whoever comes too close to the rift. Lava that burns even the founding fathers of Modern Management - Frederick Taylor included. Lava that burns the most significant contemporary authors on the practice of Management − among those are Eli Goldratt, Shigeo Shingo and others. Lava that curiously, but not surprisingly, burns differently each side. Lava merely discourages Proto-scientists from collaborating with practitioners ("beware of collaborative research!", Kieser & Leiner, 2012). Lava ruins academics under the proto-profession's reputation. The forces of Volcanus are corrupted. Could there ever be hope for the sons and daughters of the mythological engineer?

"The Gap Lies Within" is also the first chapter to mention and discuss – yet briefly – Evidence-Based Management (EBMgt) and Design Sciences Research (DSR). Both are perhaps the two most promising approaches to overcome the never-ending crisis. "The gap lies within academia" briefly sketches DSR as an addendum to the main argument, presented in section 3, that the gap lies within academia. "Simon Meets Koen and Van Aken" (chapter 4) will discuss the epistemic underpinnings of DSR in more detail. EBMgt will return in "The Yin-Yang of Decision and Design" (chapter 5), "Of Gaps and Bridges" (chapter 6) and "A Tale of Two Evidence-based Approaches" (chapter 7).

[5] This paper was originally written in October 2013 by the author, as a paper to be submitted to *Organization*. It has not been submitted yet, as it still calls for further adjustments aimed at making it publishable in the journal.

Design Sciences Research is the good son of Volcanus. Joan van Aken first introduced it (van Aken, 1994, in Dutch; van Aken, 2004, in English), inspired by Herbert Simon's Sciences of the Artificial (cf. "Simon Meets Koen and van Aken", chapter 4). As an engineer with years of practical experience before joining academia, Van Aken sees management as a branch of engineering concerned with designing organizations. His contributions aim at adapting engineering concepts from the technological to the sociotechnical world. His personal quest ─ in which he acknowledges to be a lone wolf ─ is to transform management in engineering. Van Aken is the craftsman who aims at creating a temple of Volcanus from a temple of volcanoes.

Evidence-based Management (EBMgt) is a contemporary and seemingly promising solution that ultimately fails to deliver a way to deal with the gaps because of its unresolved epistemic foundations. EBMgt was originally a methodological proposal aimed at developing better methods for knowledge production and accumulation. Since Rousseau (2006) it changed its focus to promoting scientific findings from the proto-science of Management among practitioners. It remains unclear whether EBMgt will develop as a solution to deal with the gaps, as a methodological proposal aimed at developing research methods, or as an initiative to popularize science.

The duality "The gap lies within" express is between admiration and aversion. Admiration for Taylor and other professional researchers by those in the proto-professional side, aversion for the very same people by those in the side of the proto-science. The field of Management is not only filled with gaps, it is filled with animosity and hatred, with lava that burns from within and spews from various places at surprising moments.

3.2 Full Text

Abstract

This paper proposes that the distance between management research is better framed as a "science-profession gap" that lies within academia, not between academia and the external world of organizations, as the alternative formulations "theory-practice" or "research-practice" imply. It explains that as Management, the science controls the academic incentive systems, doing research under Management, the profession is "fighting the system". Academic researchers under the profession are called names and their contributions are despised. It discusses the case of Design Sciences Research, a promising approach that can play a major role in developing Management, the profession. The conclusions discuss whether an alleged bridge to the gap, Evidence-based Management, can actually contribute to establishing a more prolific relationship between academic scientific researchers and professional academic researchers and practitioners.

1. Introduction

It is widely accepted that the history of Management research since the second half of the 20th Century is a history of crisis: the crisis of irrelevance, the growing distance between academic research and the world of organizations. In the beginning of the 21st Century, two among the most prominent attempts to change this situation are Design Sciences Research (DSR) and Evidence-based Management (EBMgt). DSR has its roots on Simon's (1969) Sciences of the Artificial, in which the Nobel Prize winner saw engineering, medical and business schools, among others, as schools of design (Simon, 1969: 110). The first article on EBMgt, Tranfield, Denyer & Smart (2003) was concerned with developing more and better methods for knowledge production and evaluation. Later, EBMgt changed its focus from improving research to "closing the gap" (following Rousseau, 2006), and it has received considerable publication space, both in academic journals (e.g., Rousseau, 2006; Rousseau & McCarthy, 2007; Rynes, Giluk & Brown, 2007; Rousseau, 2009; Briner & Rousseau, 2011) and in books (Locke, 2009; Latham, 2011; Rousseau (ed.) 2012).

This paper aims at an alternative formulation for the half-century long crisis of Management. Rather than seeing "the gap" as a distance between academia and the world of organizations, as previous formulations such as "researcher-practitioner" (e.g., Anderson, Herriot & Hodgkinson, 2001; Hodgkinson, 2006; Hueffmeier, Krumm & Hertel, 2011), "theory-practice" (e.g., Daniel, 1998; Jarzabkowski, Mohrman, & Scherer, 2010; Rynes, Bartunek & Daft, 2001; Starkey & Madan, 2001) or "research-practice" (e.g., Bansal *et al.*, 2012; Empson, 2013; Rousseau, 2006) imply, we see it as a distance within academia, which leaves some academic researchers on one side, and other academic researchers, consultants and practitioners on the other. What we call the "science-profession" gap, then, differs from previous research that see all academic researchers inhabiting one world and practitioners another 'very separate world' (Stiles, 2004: 160; Rynes, Giluk & Brown 2007; Saunders, 2010: 244). It acknowledges that it is unfair to label all management academic scholars irrelevant: many management researchers do not grow distant from practice ─ in fact, their research findings have direct influence in practice. We explain why such researchers are called names ("management gurus", in the worst sense of the expression) and their contributions labeled as irrelevant and bogus ("heathrow literature"; Fendt & Kaminska-Labbe, 2011: 219; van Aken, 2004: 223). This issue is important both for general management research and more specialized areas that draw from that, such as strategic management, project management and innovation management.

The paper is structured as follows. In section 2, we show that the gap is within academia, between the science and the profession of Management, not between academia (research, theory) and practice. Section 3 supports this argument by discussing Design Sciences Research, an academic, systematic approach to knowledge production and application under Management, the profession. Finally, our concluding comments discuss Evidence-based Management's claim to be a bridge to "the gap" and suggests that without acknowledgement of what gap is to be bridged, it cannot be more than empty promise.

2. Historical Context

It is widely recognized by historians of Management that the so-called 1959 Foundation Reports from Ford and Carnegie (Gordon & Howell, 1959; Pierson, 1959,

respectively) generated a significant change in the academic discipline of Management, a "scientific turn" (Daniel, 1998; Hopper & Hopper, 2009; Khurana, 2007; Witzel, 2012; Wren & Bedeian, 2008) ─ although Daniel (1998: 163) argues that the 1959 Foundation reports were based in a previous one, the Kozelka Report (Kozelka, 1954), commissioned by the Association to Advance Collegiate Schools of Business (AACSB), published five years earlier. The consequences of the 1959 Foundation Reports are well-known and still perceived today: a growing distance between many academic contributions in Management and the practice of Management in organizations ─ what became known as "the gap", although the different formulations, such as "research-practice", "theory-practice" or "academic-practitioner", suggest a measure of irresolution as to what is being named and hence understood.

The problem with previous denominations for "the gap" is that all fall into a generalization trap. In its century-long history, there are many examples of management research that collaborated significantly to practice, contributions that did not suffer from "the gap". Such is the case of pioneers like Taylor, Fayol, Frank and Lilian Gilbreth, Maslow, Herzberg and many others.

The 1959 Foundation Reports accused contributions such as theirs of not being scientific enough, or even not scientific at all (Bennis & O'Toole, 2005; Daniel, 1998; Koskela, 2011). As Business Schools taught such non-scientific knowledge, they were characterised as "trade" (implying, bad) schools. Then, Business schools gradually started changing their knowledge production methods, products and faculty background. The position the Foundation Reports (and also the 1954 Kozelka Report) express seems to be in line with the hitherto common understanding of what academic disciplines were and should be. One of the roots of this understanding was Vannevar Bush's 1945 report to president Roosevelt, *"Science, the Endless Frontier"* (Bush, 1945), which saw Professions as fields of mere application of (basic) sciences (the "applied sciences"), and which concluded that public investments should be focused in such basic sciences, rather than in the applied fields. In light of Bush's report and the consequent creation of the National Science Foundation (NSF), the only logical step for any academic discipline was to self-declare as Science: Sciences would receive funding, fields of application would not. Again, as did the NSF, Ford and Carnegie foundations provided funding for business schools eager to adopt their "scientific" model. It took some time before alternative accounts of Engineering (and

of Professions), such as Simon (1969), Rogers (1983), Koen (1985), Ferguson (1992), Vincenti (1990) and Mitcham (1994), among others, could be generally accepted, and hence provide an alternative view to the "applied sciences" discourse.

3. The Gap lies within Academia, Between Science and Profession

The facts in which the Foundation Reports, and those that agreed with them, based their charges were correct: Many contributions, even from highly reputed researchers, were indeed non-scientific. In light of the scientific demarcation criteria, as the Reports and their supporters stated, such contributions were indeed less valuable than any one scientific theory. What Bush (1945), Kozelka (1954), Gordon & Howell (1959) and Pierson (1959) failed to perceive, and what many others still fail to perceive today, is that in a Profession's demarcation criteria, *"scientific" is not a synonym for "academic", and "non-scientific" is not a synonym for "bad" or "less valuable"*.

The problem persists. However outdated this narrow understanding of an academic discipline might be, as the profession and the science of Management share the same academic roof and Management, the science dominates the incentives systems, all contributions are measured using the scientific ruler. Contributions from well-known, accomplished academic scholars from a profession's perspective, such as Peter Drucker, Michael Porter and Igor Ansoff or, more recently, Clayton Christensen, W. Chan Kim and Renée Mauborgne, are still taken as "less valuable" or even non-academic for being non-scientific, regardless of their importance for the development of Management, the profession. Rather than rigorous, unbiased judgment, this reception indicates the hitherto victory of the science over the profession in the dispute for the academic incentives system. With Management, the science dominating hiring and promotions, conducting academic research under Management, the profession was, and still is, "fighting the system", as Dulek & Fieldsen (1992) would say.

Notwithstanding, the profession also had, and still has, its victories. Those who dare to "fight the system" benefit from professional respectability and financial benefits that can come with it. Professionals value and use their contributions regardless of whether they are scientific or not. That research under the profession is expected to be

more easily appreciated and applied by practitioners than research under the science is a corollary of the proposed way of framing the gap ─ but it is not by any means obvious for those who do not see the intrinsic difference in working under a science or a profession.

The fact that there is another, yet outside academia, incentives system for academic researchers under Management, the profession can explain why some still dare to "fight the system". Researchers within and outside academia contribute with theoretical approaches to the Profession, such as Rakesh Khurana (as in Khurana, 2007; Khurana & Nohria, 2008) and Kenneth and William Hopper (Hopper & Hopper, 2009). Others contribute with useful non-scientific, even fashionable frameworks, such as Clayton Christensen and his disruptive innovation (Christensen, 1997; Christensen & Raynor, 2003), W. Chan Kim and Renée Mauborgne's Blue Ocean Strategy (Kim & Mauborgne, 2005), and Nassim Taleb and the many possible applications of his Black Swan theory to Management (Taleb, 2007).

As expected, fighting the system is not without derogatory consequences. The more perceived and criticized one is the need for publishing scientific papers in highly-ranked academic journals as one of the most important requisites for hiring and promotions (Bennis & O'Toole, 2005; Certo, Simon & Brymer, 2010; Judge *et al.*, 2007). The less perceived and criticised is the habit, among some academics, of despising contributions under the profession and calling their authors names. On the one hand, many academics included on lists of "Management's most influential thinkers" (such as Thinkers50), or even those who show strong relationships with practical applications by, e.g., publishing in practitioner-oriented journals, are called "Management gurus" in the worst sense of the expression, as a synonym of charlatans, of bogus academics, of fake scholars (being succinct, Hoopes, 2003 calls "Management gurus" false prophets, and refers to Taylor as "the demon"). This directly contradicts the way such "gurus" are referred to in many works by those working under the profession ─ researchers inside academia and out, consultants and practitioners (e.g., Crainer, 1998, editor of London Business School's *Business Strategy Review* and co-founder of the Thinkers50; Greatbatch & Clark, 2005, both academics; Thomas, 2006, a business consultant; Kennedy, 2007, a business and management writer). On the other hand, instead of citing and discussing such contributions (perhaps learning from them, or even recognizing that there might be something to learn from them), academics under the science of Management insult

them with terms such as "Heathrow literature", "airport literature" or "guru literature" (Fendt & Kaminska-Labbe, 2011: 219; van Aken, 2004: 223), literature that deserves nothing more than inattentive, careless reading (or even no reading at all), literature aimed at amusement and distraction instead of inspiration for and application by the profession. Again, that some academics create and appreciate contributions under the profession whereas others despise them and call their authors names is a corollary of the proposed framework ─ but it is not by any means obvious for those who do not see the intrinsic difference in working under a science or a profession. The gap lies within academia, between science and profession.

Education also provides evidence to our claims. The proposed science-profession gap within academia also allows for an alternative interpretation of the abundant criticism against the "traditional" MBA (e.g., Baruch, 2009; Datar, Garvin & Cullen, 2010; Mintzberg, 2004; Navarro, 2008; Rubin & Dierdorff, 2009; Rubin & Dierdorff, 2011; Rubin & Dierdorff, 2013). In our view, the key problem is that traditional MBAs teach the science of Management to students working on, or interested at, the profession of Management. To return to the comparison with Engineering and Medicine, problems would be expected whether the education of engineers were restricted to Physics taught by Physics professors (or even Engineering taught by Physics professors). The same applies for Biology and Medicine and, arguably, to Management and its two disciplines. Another evidence for our diagnosis is that we could not find comparable criticism to the PhD programs of Management. A possible explanation is that PhD programs teach the science to future researchers, and as, at least since 1959, the academic incentives system strongly encourages science, the vast majority of Management PhDs will choose to dedicate their career to the science, not the profession.

4. Design Sciences Research is not Science: is it Research Under the Profession?

A rather recent approach gaining momentum in methodological discussions is "Design Sciences Research" (e.g., Boland & Collopy, 2004; Denyer, Tranfield & van Aken, 2008; Koskela, 2011; Romme, 2003; Van Aken, 2004; Wastell, 2010; Wastell, Sauer & Schmeink, 2009; its roots can be traced back to Simon's (1969) 'Sciences of the artificial'). Design sciences research is another exemplar of research under the

Proto-profession, and it can be a significant contribution for its evolution (for the sake of consistency with our argument, we use "design disciplines", instead of "design science", from this point on). The development of more research following the design disciplines approach could promote the evolution, specialization and possible separation between two (possible) academic disciplines, "Management, the Science", and "Management, the Profession", that once had a common origin and that, as shall be discussed in the concluding section, may or may not be connected by a bridge.

When van Aken (2004: 224) characterizes management research as "explanatory" or "design" Sciences, he provides great inspiration for our argument that the gap between science and profession is within academia. In many ways, we agree with van Aken's diagnosis that both approaches now coexist in the field of Management, but what is perhaps our most significant point of disagreement is whether or not both "explanatory" or "design" approaches *can* indefinitely coexist. We see the rupture as inevitable if the Management, the science and Management, the profession evolve and specialize, whereas van Aken would perhaps argue for indefinite coexistence, as also the precursors of "Mode 2" suggest (Gibbons, Limoges, Nowotny & Schwartzman, 1994; Nowotny, Scott, & Gibbons, 2001).

We also differ from van Aken and others on the Design Sciences approach in the sense that, in our view, the tension is between science and profession, not between explanation and design. Professions also conduct explanatory research for the sake of more and better knowledge. For instance, when one wants to investigate an accident or when one wants to expand the state of the art of the profession, as a shot in the dark that could possibly anticipate radical innovations of some sort. Conversely, Sciences also conduct research on design. This is the case, for instance, of research on cognition-in-action (e.g., Hutchins, 1995) or of ethnographies of professional practice (e.g., Vinck, 2009), both instances of what Cross (2001) would call "research on design". Nonetheless, such scientific approaches to design are not aimed at practical application, because practical application is incidental and outside the domain of science, neither a requisite nor an objective of scientific activity.

5. Concluding comments: Is Evidence-based Management "The Bridge" to "The Gap"?

As this paper reframed "the gap" as a gap within academia, between science and profession, it seems opportune to discuss a self-declared "bridge" to the previous formulations of the gap: Evidence-based Management (EBMgt).

We wonder how might a bridge connecting the science and the profession of Management look like. A primary requisite is that such bridge must operate two ways, one leading from the profession to the science, and the other in the opposite direction. Although this might seem obvious, it is questionable whether some EBMgt supporters are aiming at a two-way bridge. Despite its self-declaration as a bridge to the gap, recent publications on Evidence-based Management emphasize its role as a one-way bridge that leads from science to profession, with little or no emphasis on what Management scientists could learn from the profession. For instance, the recently published "Oxford Handbook on Evidence-based Management" (Rousseau (ed.), 2012) reads, "Evidence-based Management (EBMgt) is the systematic, evidence-informed practice of management, incorporating scientific knowledge in the content and process of making decisions. Part of a broader movement to make better use of scientific knowledge in everyday life, EBMgt is an evolution in management practice and the way professional managers are educated" (Rousseau, 2012b: 3). This, however, directly contradicts the attitudes towards professionals of the "broader movement" (that finds in Evidence-based Medicine, EBMed, its successful case). In defense of EBMgt, it might be argued that the *Handbook* was aimed at practitioners, rather than academics, so the emphasis was placed on the track leading from Science to Profession, not the other way around. Even so, one of the most widely-known Evidence-based Medicine manuals aimed at practicing physicians defines EBMed as "Evidence-based Medicine requires the integration of the best research evidence with our clinical expertise and our patient's unique values and circumstances" (Straus *et al.*, 2011: 1).

This might suggest a fundamental difference in attitude towards professionals: Whereas in Medicine such bridge implies an equal standing between "best research evidence" and "our clinical expertise and our patient's unique values and circumstances", EBMgt seems to imply a top-down approach, with the preponderance of "scientific knowledge" over other possible types of professional knowledge. In the

field of Engineering, Vincenti (1990) already warned against the trap of taking "scientific knowledge" as superior, or even taking "transfer from science" as the most important knowledge production activity in Engineering (generalizing, in a Profession). Again, in defense of EBMgt it might be argued that they explicitly mention that "scientific knowledge" is but one of four types of knowledge (they call it "facets") to be used in EBMgt, the other three being organizational facts, reflective and thoughtful judgment processes, and ethics and stakeholder considerations (Rousseau, 2012b: 8-15). However, "thoughtful judgment processes" is an activity, not a knowledge category, aimed at making use of "a number of repairs to overcome cognitive limits and biases" (Rousseau, 2012b: 12) of practitioners. Moreover, "organizational facts" and "ethics and stakeholder considerations" influence which scientific theory to adopt, *not whether Science should or should not be adopted at all*. The "evolution in management practice" EBMgt advocates to be is achieved, after all, by the incorporation of scientific knowledge in practice.

The need for recognition of alterity and mutual respect is evident by the lack of any parallel in the field of Medicine for the insults "management guru" and "Heathrow literature". It can also be further exemplified by the contrast between Evidence-based Medicine's careful use of the word "research" in its definition ("best *research* evidence"), and Evidence-based Management's persistent use of "scientific" to qualify knowledge to be used in practice ("incorporating *scientific* knowledge…"). This is another evidence of Medicine's recognition that both the Biological Science and the Medical Profession conduct systematic, insightful research. By taking "research" and "scientific" as synonyms, EBMgt is but another instance of many management scholars' science-oriented value system, either taking the profession's research findings as intrinsically inferior for all purposes (non-scientific "Heathrow literature", section 3 of this text) or even lacking any recognition that the profession of management may conduct research at all.

Hence, it is questionable whether Evidence-based Management, despite of its claim, can actually bridge "the gap". Before any attempts to "bridge the gap", it is necessary to acknowledge the fundamental differences between Management, the science and Management, the profession. Further, it is also necessary to acknowledge that Management, the science is not intrinsically superior to Management, the profession ─ with implications both for the current academic incentives systems and to the way management scientists approach the world of professional practice. If management

scholars in general, and Evidence-based Management supporters in particular, fail to recognize that there are management researchers inhabiting the very different "world of practice" (Rynes, Giluk & Brown, 2007) and that there is something to learn from them, Evidence-based Management and any other initiatives to bridge the science-profession gap that lies within academia cannot be more than empty promises.

3.3 Epilogue

Having read the two papers that compose Part I, a question might emerge: does the proto-science of management actually exist? Isn't it a pseudoscience?

First, it is necessary to disclaim bias. From a Production engineering viewpoint, research under the proto-profession, such as Taylor's, Ohno's and Goldratt's, is indeed more vigorous and fruitful than research under the proto-science. Mintzberg seems right when he states that management is certainly not a science (Mintzberg, 2009: 10), but it might also not be fair to say management is a pseudoscience comparable to creationism, reflexology or Ayurvedic medicine.

The issue here is of the demarcation criteria being used. Let us consider Mario Bunge's:

> "A family of scientific research fields is a set every member R of which is representable by a 10-tuple
>
> R=< C, S, D, G, F, B, P, K,A,M>,
>
> Where, at any given moment,
>
> (i) the *research community* C has the same general characteristics as those of any research field; [a system composed of persons who have received a specialized training, hold strong information links amongst them, and initiate or continue a tradition of inquiry; Bunge, 1983: 198]
>
> (ii) the *host society* S of C has the same general characteristics as those of any research field; [complete with its culture, economy, and polity, that hosts C and encourages or at least tolerates the activities of the components of C; Bunge, 1983: 198]
>
> (iii) the *domain* D of R is composed exclusively of (certified or putatively) real entities (rather than, say, freely floating ideas) past, present, or future;
>
> (iv) the general outlook or philosophical background G of R consists of: (a) an ontology of changing things (rather than, say, one of ghostly or unchanging entities); (b) a realistic epistemology (instead of, say, an idealistic or conventionalist one), and (c) the ethos of the free search for truth, depth, and system (rather than, say, the ethos of faith or that of the bound quest for utility, profit, power or consensus);
>
> (v) the formal background F of R is a collection of up to date logical and mathematical theories (rather than being empty or formed by obsolete formal theories);
>
> (vi) the specific background B of R is a collection of up to date and reasonably well confirmed (yet corrigible) data, hypotheses and theories, and of reasonably effective research methods, obtained in other research fields relevant to R;
>
> (vii) the problematics P of R consists exclusively of cognitive problems concerning the nature (in particular the laws) of the members of D, as well as problems concerning other components of R;

> (viii) the fund of knowledge K of R is a collection of up to date and testable (though not final) theories, hypotheses, and data compatible with those in B, and obtained by members of C at previous times;
>
> (ix) the aims A of the members of C include discovering or using the laws of the D's, systematizing (into theories) hypotheses about D's, and refining methods in M;
>
> (x) the methodics M of R consist exclusively of scrutable (checkable, analyzable, criticizable) and justifiable (explainable) procedures, in the first place the scientific method;
>
> (xi) there is at least one other contiguous scientific research field with the general characteristics noted with reference to research fields in general;
>
> (xii) the membership of every one of the last eight components of R changes, however slowly at times, as a result of scientific research in the same field as well as in related fields of scientific inquiry" (BUNGE, 1983: 202-203).

Bunge provides detailed criteria for determining whether a field is scientific or not. He then provides additional explanation for using the definition:

> "Any research field that fails to satisfy even approximately all of the above twelve conditions will be said to be nonscientific. A research field that satisfies them approximately may be called a semiscience or protoscience. And if, in addition, it is evolving towards full compliance of them all, it may be called an emerging or developing science. On the other hand any field of knowledge that is nonscientific but is advertised and sold as scientific will be said to be pseudoscientific (or a fake or a bogus science). The difference between science and protoscience is a matter of degree, that between science and pseudoscience is one of kind. The difference between protoscience and pseudoscience parallels that between error and deception" (BUNGE, 1983: 203).

As mentioned in "the true divide", that management is not a science is quite clear from Bunge's (1983) demarcation criteria. To be succinct, as shown in "the gap lies within academia", the host society S of C discourages and does not tolerate the activities of components of C. The formal background F is not a collection of up to date logical and mathematical theories. The methodics M consists of a different set of methods, not necessarily scrutable (checkable, analyzable, criticizable) and justifiable (explainable) procedures. The true question appears to be whether it should be framed as a proto-science or as a pseudoscience. As Bunge explains, this is mainly a difference in kind. Although it is true that management scholars advertise and sell their activities as science to perceive benefits within academia and out, many acknowledge that management still has a long way to consolidation as a science (Mintzberg, 2004; Khurana, 2007; Mintzberg, 2009; Pearson, 2009). To use Bunge's terms, self-recognition of management certainly involves error —, which this thesis seeks to remedy —, but it is questionable whether it also involves deception.

PART II: THE SCIENCES AND THE ARTIFICIAL OF HERBERT ALEXANDER SIMON

Part I of the thesis, "The nature of the so-called gap in management", proposed that "the gap" that generates Management's never-ending crisis is between a proto-science and a proto-profession, each of which with its own supporters, methods, academic incentives systems and epistemic foundations. Part II, "The Sciences and the Artificial of Herbert Alexander Simon", addresses the epistemic foundations. It mainly explores the contributions of four authors: Herbert Simon and Joan van Aken's contributions to Management, Billy Koen and Walter Vincenti's to Engineering.

The key issue in the proto-science ─ proto-profession gap (Part I) is each proto-discipline's epistemic foundations (Part II). By "epistemic foundation" it is meant a discipline's criteria for knowledge demarcation, production, accumulation and evaluation, that is, the set of criteria generally accepted for defining what can and cannot be included in a discipline's body of knowledge (demarcation criteria), the set of criteria, methods and tools generally accepted for creating knowledge (knowledge production methods and criteria), for accumulating knowledge (including what counts as a "contribution" to the community, the venues in which such contributions are expected, and the pathos and ethos of such communications), and for comparing different data and information (evaluation criteria).

Simon was the recipient of the 1979 Nobel Prize for Economics, for his contributions to microeconomics, more specifically for introducing the concepts of bounded rationality and of "satisficing" in organizational decision-making. But that was not the sole reason for Simon's influence in the field of Management. Simon led by example: since 1949, he was a professor of administration and chairman of the Department of Industrial Management at Carnegie Tech. When the 1959 Reports came by (Gordon & Howell, 1959; Pierson, 1959), Simon was in a privileged position to make business schools different. His 1969 book, "the Sciences of the Artificial", provided an epistemic foundation ─ it is not too much to say, provided *the* epistemic foundation ─ for management academics to justify their place and deal with their problems within the academic system. In Simon's terms, there were sciences of the natural and sciences of the artificial (such as Management, Engineering and Medicine), both sciences, both equal in terms of academic respectability. There was no more need for "physics envy": Simon created the artificial.

As it is usual with giants, there are many Simons. The following pair of texts emphasize *duality* in Simon's contribution. Duality in continuity and rupture. Duality in the natural and the artificial. Duality in decision and design. Duality in the worship of his name and the profanation of his ideas. Duality in the contributions that paved a way for contemporary management research and that led to many misunderstandings.

Part II acknowledges Simon as a trailblazer in providing an epistemic foundation for the field of management, but argues that the intrinsic incompleteness and several misunderstandings of Simonian epistemic foundations led to conceptual errors, and such errors led, in turn, to significant practical problems.

"Simon meets Koen and van Aken", the first of the two chapters, addresses the intrinsic incompleteness of Simon's epistemic contribution. It puts into dialogue three epistemic foundations, of Simon, of Billy Koen and of Joan van Aken. It is a philosophical essay that explores the continuity-rupture and natural-artificial dualities in Simon. It is a meeting of three great minds: Simon and van Aken, a prosaic meeting of continuity, and Simon and Koen, a poetic meeting of rupture.

"The Yin-Yang of Decision and Design", the second one, addresses misunderstandings of Simon's epistemic contribution. It exposes Evidence-based Management's opportunistic reduction of Simonian "decision making" to merely choice among alternatives. It explores duality in Simon's understanding of decision

and design as inseparable, yet different concepts, and criticizes duality in the worship of Simon's name and in profanation of his ideas.

The contributions of Part II to Management's current debates are twofold. First, it further explores van Aken's epistemic contributions to refashioning or updating Simon's epistemic foundations. Simon's dichotomy between sciences of the natural and sciences of the artificial are arguably incomplete, and led to confusions van Aken seeks to clarify. In that sense, van Aken's dichotomy between explanatory sciences and design sciences (van Aken, 2004; van Aken, 2005) is an amendment to Simon's Natural-Artificial dichotomy. Second, Part II provocatively argues that amendments are not enough to solve the problems with Management's epistemic foundations. Part II introduces Koen's (chapter 4) and Vincenti's (chapter 5) contributions to philosophy of engineering and explores their applicability to the field of Management. Therefore, Part II distinguishes three possible worldviews for Management's epistemic foundations by the meeting of three great minds. Each worldview allows for different interpretations of Management's current issues and problems, which will be discussed in what concerns Evidence-based Management in Part III.

4 Simon Meets Koen and van Aken[6]

4.1 Prologue

"Simon Meets Koen and van Aken" is more than a meeting that never was. It is about the epistemic foundations of the volcanic Temple's dualities.

The purpose of "Simon Meets Koen and van Aken" is to create a dialogue which could only happen in a text. Simon represents the mainstream of management's epistemic foundation. Koen represents the alleged best description of engineering and of engineering epistemic foundation. Van Aken represents a breath of fresh air in the old canons of management science. The meetings between Simon and Koen and between Simon and van Aken aim at questioning Simonian epistemic foundations by revisiting and shedding new light to what is arguably Simon's original intentions with "sciences of the natural" and "sciences of the artificial".

This is a text in which much is understated. It is a philosophical essay, submitted as a book chapter to a book in philosophy of engineering. Hence, it discusses engineering, not management. However, it is part of the thesis' argument that in this text, what is valid for engineering is valid for management.

Van Aken is a self-declared lone wolf, an engineer in the field of management. Koen is an engineer in the field of philosophy. Simon is a Nobel Prize winner. Their meeting had to be brief, but the meeting's results seem promising.

The duality "Simon Meets Koen and van Aken" is between the Sciences and the Artificial. It is the clash of two relationship modes between the Sciences and the Artificial. The Simonian Sciences of the Artificial, to which van Aken agrees and amends, versus the Koenian Sciences *in* the Artificial.

[6] This paper was originally written in March, 2013 by the author, by Prof. Roberto Bartholo and by Prof. Domício Proença Jr. as a book chapter to "Philosophy of Engineering: East and West", an upcoming book edited by Springer. An earlier version was submitted and presented at the 2012 fPET in Beijing, the Forum for Philosophy, Engineering and Technology.

4.2 Full Text

Abstract

Herbert Simon's perception of the fundamental unity of design activities, and the associated notion of sciences of the natural and of the artificial, are put into dialogue with some of the works of Billy Koen and Joan van Aken through the device of "three blind certainties": (1) that engineering is applied science; (2) that engineering is one of the sciences of the artificial; (3) that the advancement of engineering comes from the advancement of science. Simonian vocabulary is a stepping-stone of these three blind certainties. Koen offers a Rortyan redescription that redefines the possibilities of our understanding of engineering, proposing a vocabulary of his own to expose these certainties. Van Aken qualifies, but reaffirms these certainties, refining Simonian vocabulary, to broaden its reach in support of an agenda for design research. As Koen is rarely perceived in this light, some final remarks clarify his relevance, and then the dialogues between Simon and Koen, Simon and van Aken are adjudicated.

1. Introduction

Herbert Simon's landmark *The Sciences of the Artificial* argued for the unity of all design activities, crossing disciplinary boundaries to make explicit their shared nature. He was able to distinguish two worlds, that of the natural and of the artificial, each of which would have its own sciences.

When Simon divides the sciences of the natural and the artificial and states the scientific unity of design activities, he engages into an academic-political debate. His goal is to offer the *apologia* of design activities, to declare they should be valued as much as the natural sciences, being neither identical in method or in content nor inferior in worth or academic respectability. His was an unequal, doomed struggle at a time when Physics and Chemistry ruled knowledge, and were seen as the pathfinders of Vannevar Bush's (1945) *Endless Frontier*.

Simon's Nobel Prize derives from his contributions to "the decision-making process of economic organizations". His writing on the sciences of the artificial won a measure of academic recognition, but his proposals for a curricular reform of design

teaching and learning did not prosper. What has remained is the understanding that design had to be a science to gain academic respectability.

And what did all this mean for engineering?

Attempts at an answer stand on three blind certainties, with which we have become familiar over the last four decades: (1) that engineering is applied science; (2) that engineering is one of the sciences of the artificial; (3) that the advancement of engineering comes from the advancement of science. The prime task of contemporary philosophy of engineering is to question truths maintained by inertia – such as these.

Two authors help us to question these certainties, Billy Koen and Joan van Aken. Koen exposes them: *all is heuristics*, and engineering is not science, although it may adopt science as one of its heuristics. Van Aken renews them, subdividing the Simonian sciences of the artificial into *explanatory* and *design* sciences. Remarks on the relevance and opportunity of Koen's contribution and an adjudication of van Aken's and Koen's dialogue with Simon close the text.

2. Simon Revisited

For the purposes of this chapter, Simon offers two capital propositions, alluded above – (i.) he distinguishes two different but equally worthy types of *sciences*, those of the natural and those of the artificial and (ii.) he acknowledges the unity of a number of disciplines and practices as sharing the nature of being all *design activities.* So:

> "A natural science is a body of knowledge about some class of things, objects or phenomena in the world: about the characteristics and properties that they have; about how they behave and interact with each other. (SIMON, 1969/1996: 1)
>
> "(…) you will have to understand me as using "artificial" in as neutral a sense as possible, as meaning man-made as opposed to natural. (…) We speak of engineering as concerned with "synthesis," while science is concerned with "analysis." Synthetic or artificial objects and more specifically prospective artificial objects having desired properties are the central objective of engineering activity and skill. The engineer, and more generally the designer, is concerned with how things ought to be how they ought to be in order to attain goals, and to function. Hence a science of the artificial will be closely akin to a science of engineering but very different (…)" (SIMON, 1969/1996: 4-5)

And:

> "Engineers are not the only professional designers. Everyone designs who devises courses of action aimed at changing existing situations into preferred ones. The intellectual activity that produces material artifacts is no different fundamentally from the one that prescribes remedies for a sick patient or the one that devises a new sales plan for a company or a social welfare policy for a state. Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design". (SIMON, 1969/1996: 110)

It can be seen how Simon serves as a stepping stone for our current three blind certainties: (1) that engineering is an application of science for given purposeful aims; (2) that the science of engineering is queen of the sciences of the artificial; and (3) that advances in engineering are advances in the sciences of the artificial.

3. Rupture and Continuity

3.1 Koen meets Simon – Engineering is not Science: Engineering is heuristics

The relevance of a meeting is not restricted to the strength it might add to preexisting understandings. Meetings can be important and fertile precisely when they lead to rupture, when they lead to the deconstruction of established truths and to the formulation of new perspectives, discourses or even just pose new questions. Such is the case of the meeting between Billy Koen and Herbert Simon.

Simon establishes the identity of engineering as a result of the "synthetic or artificial" objects which it produces in pursuit of a given goal, and understands that this is a kind of science. Koen argues that engineering is defined by its method, not by the objects it produces. For Koen, the method of engineering is "the use of heuristics to cause the best change in a poorly understood situation within the available resources" (Koen, 2003: 28), understanding heuristics as "anything that provides a plausible aid or direction in the solution of a problem, but is in the final analysis unjustified, incapable of justification and potentially fallible." (Koen, 2003: 28)

This strikes at the very foundations of those three blind certainties about engineering.

If, as Koen says, engineering uses anything that *might plausibly* help achieve its ends, it uses more content and skills than those of science, and hence one cannot say (1) that engineering is applied science. If, as Koen says, engineering is the opportunistic use

of heuristics, then it has no Popperian demarcation criteria, cannot be taken *per se* as scientific, and hence one cannot say (2) that engineering is one of the sciences of the artificial. If, as Koen says, any heuristics are *ultimately* unjustifiable and fallible, the advancement of engineering follows the success and failure of engineering projects, which may or may not correspond to advancements in science, and hence one cannot say that (3) the advancement of engineering comes from the advancement of science.

3.2 Van Aken meets Simon – Design is science, engineering included

When meetings add to preexisting understandings, they can do more than confirm old certainties; they can refashion them to new perspectives, adding issues, renewing explanations, enlarging contents. Such is the case of the meeting between Joan van Aken and Herbert Simon.

Simonian sciences of the natural and of the artificial are concerned with the characteristics, properties, behaviors and interactions of "objects or phenomena in the world" and with "prospective artificial objects" which aim at the fulfillment of a given goal, respectively.

For van Aken, the Simonian pair "natural/artificial" is not sufficient to circumscribe the key issue related to design. He proposes a new perspective for the non-"empirically void" sciences: the pair "explanatory/design", an idea "strongly inspired by Simon's *The Sciences of the Artificial"*. For van Aken, the mainstream of research in design science aims "at describing, explaining and predicting in order to understand the setting of construction or improvement problems and to know the properties of the 'materials' to be used"; however, its ultimate mission remains to "develop design knowledge, i.e. *knowledge that can be used in designing solutions to problems in the field in question*." (all passages, van Aken, 2004: 225, emphasis in the original). He remarks that his definition is more inclusive than that of Simon, in that he deals with both construction and improvement problems, while "Simon primarily discusses construction problems" (van Aken, 2004, note 5: 242).

Van Aken, with Berends and van der Bij, applies this understanding to the research practices of academic and professional schools, distinguishing their mainstream paradigms. The explanatory paradigm would be "based on Lakatos" (Van Aken, Berends & Van der Bij, 2012: 60; they use Lakatos' chapter in Lakatos & Musgrave,

1970/1991; cf. Lakatos, 1978), while the design paradigm would articulate both explanatory and designerly components, for diagnosis and the identification of alternative treatments: "Engineering research produces not only generic explanatory knowledge on, say, the properties of materials one can use to build a bridge but also generic design-oriented knowledge on alternative constructions for bridges, such as solution concepts or exemplary designs. Generic knowledge in both medicine and engineering is to a large extent developed on the basis of series of similar cases in which the knowledge in question is developed and tested." (Van Aken, Berends & Van der Bij, 2012: 62)

Van Aken's stand on the three blind certainties is not a rupture. He qualifies the first, (1) that engineering is applied science, saying, "I prefer to avoid the term 'applied sciences', as this term suggests that the mission of these sciences is merely to apply the basic laws of the explanatory sciences". He praises the "impressive body of knowledge developed by the design sciences themselves" (both passages, Van Aken, 2004: 225). For him, the design sciences, engineering included, are not merely a non-scientific application of explanatory sciences; there is science in design, with its own theoretical-explanatory-designerly *corpus*. Van Aken states that medicine, management and engineering are design sciences, and hence, implicitly agreeing (2) that engineering is a science of the artificial under his reformed Simonian format. As for the advancement of engineering, and of all design disciplines, van Aken clearly supports that it is embedded in (3) the advancement of explanatory and design sciences by grounding and field-testing design propositions.

4. Final Remarks

As non-native English speakers, it puzzles us that Koen's message on the method of engineering (Koen, 2003) is so often disqualified at first blush, misunderstood or reduced to a tautology. First blush disqualification seems to stem from a commonplace understanding of heuristics as *mere* rules of thumb. This understanding forgets what the *Webster's Collegiate* or the *Oxford English Dictionary (OED)* record. The use of heuristics as synonymous with *ad hoc* or tacit approaches is c. 1960 according to the OED. In philosophical tradition, heuristics has a much broader meaning.

For us, Koen's use of the word heuristics has a philosophical intent. So, it is reasonable to understand his use of heuristics according to the philosophical tradition, which agrees with the first meaning to be found in dictionaries, as anything that might lead to solving a problem or, as Koen proposes, and we repeat here, "anything that provides a plausible aid or direction in the solution of a problem, but is in the final analysis unjustified, incapable of justification and potentially fallible." (Koen, 2003: 28).

Misunderstanding Koen admits variety, but what concerns us most is the attempt to read his propositions with a reduced understanding of heuristics. Such a reading sets aside anything that is not rule-of-thumb in engineering, leading to the mistaken conclusion that engineering is heuristics "plus a lot else that is not heuristics". This fails to appreciate Koen's extensive efforts at showing that all knowledge we do possess is, and should be acknowledged as, heuristics. He weaves a delicate tapestry with the items of his presentation: Arithmetic, Mathematics, Deduction, Certain, Position, Logic, Truth, Progress, Causality, Consciousness, Physical Reality, Science, Perception and Argument. Koen's philosophical intent is dramatically expressed in the concluding remarks of the item "Engineering, Philosophy and the Universal Method": "*What we most desperately need is a New Renaissance Philosopher to engineer our world based on the search for the best heuristics for human survival.*" (Koen, 2003: 226, emphasis on original). Such an ambitious and comprehensively woven construct is incomprehensible if composed only of "rules of thumb" as its threads.

Finally, to grasp Koen's thesis in short form as "engineering heuristics are those heuristics engineers use" does offer the appearance of a tautology, and its symmetry is seductive. This is not a perversion of what Koen says, only an instance of losing sight that a sentence is not just what it says, but what it provokes us to think about as we hear it. It requires a literal fundamentalist to declare this sentence a tautology. Koen's provocation aims at not letting us confine engineering to any one given set of heuristics, not even to the inventory of all heuristics engineers have ever used. The heuristics engineers use is an open set. Hence, if the question were to be, "what are engineering heuristics?", the answer would be, without any tautology, "engineering heuristics are heuristics engineers use." They are only *engineering* heuristics after this use. An unsuspected consequence is that *anything* that engineers use are heuristics as far as engineers are concerned.

Engineers may use science, but they do so by taking it as just another heuristics. Does this mean that the reliability or accuracy or predictive quality of scientific knowledge is not considered when an engineer chooses to use it? Of course not. Engineers are educated in science and in all the various threads of Koen's tapestry. But engineers are not educated for science – or they would be scientists, and this is not a tautology either. Good engineers use science without prejudice, as *heuristics.* They remain alert to the idiosyncrasy of their individual projects. In the pursuit of their project, they may use any science or any non-science as heuristics. And it is a hallmark of good engineering that they may choose whichever seems to promise the best results, blending different heuristics, even choosing non-science over science if that promises a better result. It might even be said that the art of the engineer is the ability to fashion a blend that achieves the best change possible. The primary concern of engineers is to carry the project through. Engineers are both practitioners, willing to borrow heuristics from *anyone,* including scientists, and researchers, capable of creating heuristics *of their own*, without becoming scientists as a result.

Van Aken writes prose; Koen makes poetry.

Van Aken meets Simon under the banner of continuity. He lends new breadth to Simon's propositions, enlarging Simonian horizons, making possible additions to Simonian discourse. Simon's original vocabulary is renewed. Simon's original intent is expanded, seeking to make explicit the scientific content of design sciences. He supports a research and intervention agenda that aims at bridging the so-called "research-practitioner gap" of management. Van Aken emulates the design process of engineering in management (van Aken, Berends & van der Bij, 2007, 2012). For him, the content and method of design sciences are the key, articulating how knowledge in management should be sought, obtained and disseminated (Denyer, Tranfield & van Aken, 2008). Management and engineering would be both the application of natural sciences and of explanatory and design sciences of the artificial, as well as the production of a body of scientific knowledge of their own.

As a Rortyan redescriptor of Simonian vocabulary, Koen's descriptive metaphors give birth to a new vocabulary, of his own, hoping "that by the time [he] has finished using old words in new senses, not to mention introducing brand-new words, people will no longer ask questions phrased in the old words" (Rorty, 1989: 78, gender changed to refer to Koen). Simon's words are subverted, new names arise through Koen's

refiner's fire – the redescription of a new world of meaning: the world of engineering and engineers.

Following the same Rortyan inspiration, we decline from adhering to perennial metaphysical truths as self-standing authoritative arguments. Rather, we agree that "what counts as a possible truth is a function of the vocabulary you use, and what counts as a truth is a function of the rest of your beliefs" (Rorty, 1989: 172). Therefore while we question them, we do not wish to amend blind certainties nor to replace them. Neither do we wish to assess the perspectives of Simon, Koen or van Aken as true, or false, or somewhere in-between. In Rortyan terms, truth is not "out there", but inside the vocabularies we use. In this perspective, the main issue here is to appreciate vocabularies that enable us to establish fruitful relations with the world and, particularly, meaningful relations with the world of engineers.

4.3 Epilogue

"Simon Meets Koen and van Aken" is not simply the meeting of three great minds. It is the meeting of three epistemic foundations, each of which based in a dichotomy, some more conservative, some more radical. Simon's dichotomy is between Natural and Artificial Sciences. Van Aken's dichotomy is between Explanatory and Design Sciences. Koen's dichotomy is between science and non-science.

The field of Management's current epistemic foundation is largely based upon Simon's dichotomy. In that sense, the common understanding is that Management is a Science of the Artificial, which in the bottom line means that management is a science. The biggest question that could be asked to "Simon meets Koen and van Aken" is about the consequences of Koen's dichotomy to Management's epistemic foundations.

Currently, mainstream management research uses a distorted version of Simon's original proposals, which emphasizes the supposed scientific basis of the disciplines of the artificial instead of the difference Simon stresses between the disciplines of the natural and of the artificial. Simon attempted at healing physics envy by explaining that Management, Engineering, Medicine and other professions are different from Physics and can only indirectly be compared to Physics, but it seems that his attempt ended up creating some sort of "scientific pride" among management scholars, who could then follow Simon and argue that management was indeed scientific, but of another kind of science.

"Simon meets Koen and van Aken" leaves implicit that Koen provides a fruitful alternative to solve Simon dichotomy's misunderstandings. Koen's contribution is a more profound dichotomy, which contrasts with Simon's Natural-Artificial Sciences and with van Aken's Explanatory-Design Sciences, which are both dichotomies between *kinds* of science. Koen's dichotomy is between *Science and Non-Science* (Science-Engineering in his book, Science-Profession in the thesis' framework ─ see section 2.3 for details). Koen's contribution is thought-provoking because it provides an alternative to the scientific view of scientific knowledge as a superior form of knowledge.

A consequence of Koen's (2003) contribution is the equality between scientific epistemic foundations and professional epistemic foundations (see section 8.1 for

further discussion on the issue). Koen's (2003) contribution is, perhaps for this reason, largely misunderstood. A first way to interpret his argument is to infer he means that "it is ok to be nonscientific", or "it does not make a difference whether a discipline is scientific or non-scientific". However, this is not Koen's point (2003). As Bunge (1983) explains, "nonscientific" is a category that includes too much ─ sheer magic, pseudosciences, proto-sciences, and professions. Koen discusses engineering, which is one among other professions. What Koen (2003) gives us is that engineering (arguably, professions) have its (their) own epistemic foundation, and that from an engineering (professional) viewpoint, such epistemic foundation is better than a scientific one, because it allows for the inclusion of nonscientific heuristics, which are at times preferable to heuristics drawn from science. Another way of seeing Koen's (2003) contribution to Management is to realize that Koen's (2003) dichotomy makes the (proto-)science-(proto-)profession gap of Management apparent ─ *and hence, solvable*.

5 The Yin-Yang of Decision and Design[7]

5.1 Prologue

This is a sad chapter. It states the obvious to any engineer and engineering student: that decision is different from design, and that knowledge and training for decision is different from knowledge and training for design. But to state the obvious, and to repeat it several times, seems very much needed in the case of Management.

This chapter exposes a profanation in the Temple of Volcanus. It portrays the abandonment of one of Volcanus' most distinguishing features: his ingenuity, his creativity, his ability to design, and not only to choose among alternatives someone else designed. And this is precisely the charge against Management scholars in general, and Evidence-based Management supporters in particular. It represents not simply the profanation and the abandonment of Volcanus, of design. It represents the profanation of Herbert Simon's memory. EBMgt praise Simon as the inspiration, as the mentor, as the founding father (e.g., Rousseau (ed.), 2012). EBMgt even tried to raise Simon from the dead and channel him (Rousseau, 2012a). Zombie Simon should have said, "put design in the agenda". But that, which is the main takeaway of *The Sciences of the Artificial* (Simon, 1969/1996), was not what EBMgt heard. The word *design* appears in only one of the 23 chapters of *The Oxford Handbook of Evidence-Based Management* (Rousseau (ed.), 2012): predictably, in the ugly duckling chapter of Van Aken & Romme's (2012) "A Design Science approach to Evidence-Based Management". Which is, as the name suggests, not EBMgt itself. Rather, it is a Design Science proposal to change EBMgt, to make it more design-centric. It seems the other authors either did not have the opportunity to read or declined to take into

[7] This paper was originally written in April, 2013 by the author, by Prof. Roberto Bartholo and by Prof. Domício Proença Jr. as the first section of paper submitted to a special issue on "Teaching Evidence-based Management" from Academy of Management Learning and Education. It has not been resubmitted yet.

account what van Aken and Romme's had to say – which looks ill for a handbook and its editorship, but there it is.

"The Yin-Yang of Decision and Design" explores a duality in decision and design in Simonian terms. For Simon, modern organizations are decision-making entities, in which manual labor will be progressively automatized. Humans will be responsible for improvisation, for solving problems that may arise, for making decisions about the best course of action. Simonian organizational decision-making process, however, does not simply mean choice among a given set of alternatives someone else designed, as it is now the reality of most CEOs. CEOs are called upon for making the hard choices. Not the hard designs. Teaching in Executive MBAs is the apex of a Business School faculty's career. It means higher payment, it means access to powerful people. If CEOs are usually too busy and should not be bothered with problems, constraints, resources ─ only with a set of solutions calling for a choice ─ why would Executive MBAs teach design? Why would Executive MBas teach knowledge needed for design? Why would faculty involved in Executive MBAs do research on design? Those are the questions that disrupted the intrinsic duality between decision and design, that profaned Simon's memory, and that profaned the Temple of Volcanus.

5.2 Full Text

1. Introduction

The purpose of this paper is to argue for the need to account for the continuous mutual interaction between decision and design, for which the imagery of the Yin and Yang seems particularly apt. The *Oxford English Dictionary* traces decision from the Latin *decidere*, to cut off, cut the knot, decide, determine – *decaedere,* to cut; and design from the Latin *designare*, *dissignare*, to mark out, trace out, denote – making or establishing a sign, with a wide variety of developments (plot, purpose, draw, among others), all contained in the English word *design*. One depends and to some extent corresponds to the other: to cut off, one might mark where to cut off or to cut off by that mark; to mark is in effect to segregate from others, cutting off from indistinction. One decides to, and where, to mark; and by marking, one expresses a decision. Thus we should not expect decision without design or design without decision. This brief etymological recapitulation has to take into account the specifics of the field of management and organization studies. We seek support on the work of Herbert Simon, and then comply with EBMgt terminological practice for the term "decision". We then consider that knowledge for design is different from knowledge for decision. This is followed by a discussion of "Simonian decision-making" as the core of EBMgt.

2. Management is both Decision and Design

Simon sees modern organizations as decision-making entities. It must be emphasized that Simonian decision-making is more inclusive than conventional contemporary usage. Simon is opposed to perspectives that elect to make the final moment of decision-making by an individual (what he calls "choice") the *whole* of decision making. According to Simon's landmark *The New Science of Management Decision* (1977), "[d]ecision making comprises four principal phases: finding occasions for making a decision, finding possible courses of action, choosing among courses of action, and evaluating past choices" (Simon, 1977: 40). Further:

"The first phase of the decision-making process – searching the environment for conditions calling for decision – I shall call intelligence activity (borrowing the military meaning of intelligence). The second phase – inventing, developing, and analyzing possible courses of action – I shall call design activity. The third phase – selecting a particular course of action from those available – I shall call choice activity. The fourth phase, assessing past choices, I shall call review activity" (Simon, 1977: 40-41).

Simonian decision-making admits, in fact it requires, the interweaving of the phases, and he emphatically alerts against taking his analytical structure as either a hierarchical or a chronological sequence:

"Generally speaking, intelligence activity precedes design, and design activity precedes choice. The cycle of phases is, however, far more complex than this sequence suggests. Each phase in making a particular decision is itself a complex decision-making process. The design phase, for example, may call for new intelligence activities; problems at any given level generate subproblems that, in turn, have their intelligence, design, and choice phases, and so on. There are wheels within wheels within wheels." (Simon, 1977: 43).

Simon does not discuss the review activity. He observes "that seeing that decisions are executed is again decision-making activity" (Simon, 1977: 43), and thus that "[e]xecuting policy, then, is indistinguishable from making more detailed policy" (Simon, 1977: 44). This subsumes review into the implementation of current decisions – itself decision-making, as well as into ensuing decision-making after implementation, rather than taking it as an activity of its own in terms of Simonian decision-making. As review is either a requisite for, or concurrent with the implementation of Simonian decision-making, the four activities are reduced to three.

Simonian intelligence activity admits the same treatment – realizing that a policy is required is again decision-making activity, indistinguishable from making (preliminary) policy. Simonian decision-making takes intelligence as a either a precondition for, or concurrent with, the realization of the need for policy. This leads, logically, to another reduction, from three to *de facto* two activities: design and choice.

No further reduction is possible, for although there might be a measure and instances of design in every choice, and a measure and instances of choice in every design, they

do not coalesce. Designing and choosing are not the same thing. They have irredeemable natures of their own, because they aim at different results. Thus design and choice, design and decision, emerge as the sole self-standing activities of Simonian decision-making.

Simonian decision-making is *organizational*. At any one moment in time, under routine or normal operation, decision-making at the top of the hierarchy might correspond to a lot of decision with just a bit of design. Further down the organizational hierarchy, design might account for more and more. This corresponds to a dialogue with situated decisions received from above and directed below. In abnormal situations, this might change radically and unpredictably, with many more decisions being necessary from operators – constraining the upper levels to the terms of operational expertise, or with demands for (re)design of policies, operations, strategies and structures from the top (Roberts, 1990; Weick & Sutcliffe, 2007). The Yin-Yang of decision and design captures this varied, relational, situated ecology of couplings. Design and decision interweave, pairing with each other in proportions and arrangements that admit variety within any one level and according to circumstances.

The Yin-Yang of decision and design admits all possible pairings without sequential presumption, and, most fortunately, expresses that even in the plenitude of design or decision, there remains a seedling of the other at the core – designing for decision, deciding on design. From a Simonian perspective, these pairings would appear as "wheels within wheels within wheels" as in his biblical quote (Ez: 1-16). So we may say that Simonian decision-making is multilevel and nonlinear, with instances of design *cum grano cisere* and decision *cum grano signis* – design with a grain of decision and decision with a grain of design. And the knowledge and skills, the learning and teaching required for design and decision are not the same.

3. Knowledge for design is different from knowledge for decision

Despite the oft-remarked fact that Evidence-based Management (EBMgt) is still at its beginnings, we benefit from the recent publication of *The Oxford Handbook of Evidence-based Management* (Rousseau (ed.), 2012) to circumscribe the types of knowledge and method related to decision in EBMgt. Rousseau presents the four facets of EBMgt, which can serve as an exemplar of the knowledge needed for decision in EBMgt:

> "1. Use of the best available scientific findings
>
> "2. Gathering and attending to organizational facts, indicators and metrics in a systematic fashion to increase their reliability and usefulness
>
> "3. On-going use of critical, reflective judgment and decision aids in order to reduce bias and improve decision quality
>
> "4. Consideration of ethical issues including the short- and long-term impact of decisions on stakeholders.
>
> "These facets are implemented in ways that surmount the limitations and constraints that operate on unaided human judgment. EBMgt's features are intended to improve information quality while providing cognitive aids and decision tools to repair and develop practitioner judgment and decision making." (Rousseau, 2012b : 4-5).

And, also from *The Handbook*, we can take Briner & Denyer's (2012) review in pursuit of their opening question "How do experts know what they know and what they don't know?" (Briner & Denyer, 2012: 112), leading to an appreciation of systematic reviews in the multi-methodological field of Management and Organizational Studies. They conclude that a "purpose-systematic-review", guided by principles or a guiding logic have more potential to inform the quest for the best available evidence for making decisions, while reminding that these must be integrated with the judgment and experience of researchers and practitioners (Briner & Denyer, 2012: 127-128).

This is quite comprehensive in presenting facets and method, in showing that EBMgt decision admits scientific, organizational, experiential, and ethical knowledge, which is conflated to allow choosing between alternatives – and in explaining how the making of a decision is supported by the integrated use of a focused purpose-systematic-review.

The oft-remarked maturity of Engineering as a design discipline suggests a different presentation order, beginning with the method. We benefit from Koen's (2003) seminal *Discussion of the Method* to offer the engineering method as "the use of heuristics to cause the best change in a poorly understood situation within the available resources" (Koen, 2003: 28). Koen's understanding of heuristics is all-inclusive: anything that might help cause the desired change, which means that a variety of scientific or non-scientific knowledge belong to engineering. Engineering should not be misconstrued as mere applied science. It may use scientific or non-scientific knowledge solely on the grounds of which is judged more likely to cause the best change. Koen's understanding of best relates to the notion of the state-of-the-

art of engineering. And his understanding of resources comprises anything that might lead to different results, that is to say, a definition that includes any element that violates *ceteris paribus* in the execution of the same project by different teams or in different circumstances (e.g., time, money, skills, competence).

Engineering has been described as being inherently evidence-based (van Aken & Romme, 2012: 46). Engineering practice presumes constant and variable interweaving of design and decision, because every project is different, situated. Each project requires adaptation of existing knowledge, decision or design intentions to the specific circumstances and constraints of its conception, and further to the idiosyncrasies of its implementation. As a project develops, engineers pursue a given *engineering vision,* engaging on whichever particular combination of design and decision seems the more promising. A substantial part of the organizational, experiential and ethical issues in engineering are contingent at the moment of commission and acceptance, emerging as constraints that endure throughout a project.

Engineering design and decision embrace an open-ended number of facets. Engineering admits selective recourse to existing knowledge, as well as research and discovery in the course of a project. Engineering routinely extrapolates existing knowledge in the very act of adaptation to the circumstances and in the consideration of the constraints and (best) use of the resources of a given project. This might correspond to *normal* engineering, in which a degree of adaptation suffices, leading to incremental enlargement of the state of the art; and *radical* engineering, in which invention is required, leading to disruptive innovation.

Vincenti's (1990) aptly named landmark *What engineers know and how they know it* attempts to offer a comprehensive overview of engineering knowledge and its generating activities, exemplified on Table 3. This table also serves to point out how Engineering considers the possibility of having to *create* knowledge in order to design under constraints, deciding how to pursue the best change possible. Engineers may consider, conceive, concoct, consolidate or commingle designs when deciding and decisions when designing at any one specific instance of a project.

Table 3 - Summary of Knowledge Categories and Generating Activities

Generating Activities	**Categories**					
	Fundamental design concepts	Criteria and specifications	Theoretical tools	Quantitative data	Practical considerations	Design instrumentalities
Transfer from Science			X	X		
Invention	X					
Theoretical engineering research	X	X	X	X		X
Experimental engineering research	X	X	X	X		X
Design practice		X			X	X
Production				X	X	X
Direct trial (including operation)	X	X	X	X	X	X

Source: Vincenti (1990: 235).

Legend: Columns and lines correspond to their short description; X marks which knowledge generating activity produces which knowledge categories, e.g., Experimental Engineering Research (a generating activity) can produce Theoretical Tools (a knowledge category).

Choosing among alternatives may admit the use of a black box approach. If a decision maker is willing to decide solely on the different inputs and outcomes of alternative courses of action, then alternatives can be reduced to black boxes. By this device, acceptance that whatever happens inside the black boxes is (partially or completely) unknown produces a decision-making situation *cum nihil grano signis*. Knowing what goes inside black boxes may lead to better decisions, but decision makers can choose to decide solely on (the best available) evidence about of inputs and outcomes. Whatever makes up an alternative, whatever might be inside each black box, is somebody else's problem. This presumes that there are somebody elses responsible and accountable for what is inside the black box of a given alternative. Those somebody elses are supposed to *design* choice-worthy (clear, reliable, sound) alternatives (black boxes) that produce (the best possible, desired) outcomes given certain (necessary, sufficient) inputs because they know how the black boxes (should) work, and how to implement an alternative (providing inputs, operating the inwards and converting black box output into outcomes) once a decision has been made.-

Benefiting from Vincenti (1990), Koen (2003) and, to a lesser extent, on Schmidt's (2012) recent communication on *"*What makes Engineering, Engineering*"*, we affirm that knowledge for design is different from knowledge for decision on two complimentary counts.

On the one hand, "what designers know" cannot be limited to a know-that of expected outcomes and necessary inputs to a system. A great part of what designers know is "know-how" (knowledge-how cannot be reduced to a form of knowledge-that: Ryle, 1945). Knowing-that is the distinctive line between the ignorant and the informed; knowing-how distinguishes the skilled from the incompetent (Schmidt, 2012). Informed professionals can make good decisions given a set of decision aids and high-quality evidence on expected outcomes and necessary inputs, but this does not make them competent in designing alternatives and their implementation.

On the other hand, "how designers know it" cannot be confined only to Vincentian knowledge-that generating activities, such as transfer from science. Formal education through teaching, self-study and theoretical or experimental research in engineering can teach what Vincenti (1990) calls *prescriptive know-how*: for instance, operational principles, normal configurations and technical specifications (Vincenti, 1990: 217). But what Vincenti calls *tacit know-how* is "mostly learned on the job rather than in

school or from books" (Vincenti, 1990: 217) – and is indistinguishable from the acquisition of skills or even from professional experience, from learning.

Tacit knowledge is of the utmost concern in engineering research and in the education of engineers. Tacit know-how derives not only from first hand practice, but also second-hand, through communication, emulation, instruction, example – including design, production and operation. It "may not be ─ typically is not [developed] ─ by designers themselves" (Vincenti, 1990: 217). Engineering research and education prioritizes the record, criticism, distillation and codification of tacit into explicit knowledge. This seeks to minimize reliance on the talent of individual genius by "replac[ing] 'acts of insight' (that are unteachable) by 'acts of skill' (that can be taught)" (Vincenti, 1990: 168). As Vincenti points out, "the success of this effort is fundamental to the ability of modern engineering to advance on so wide a front and with such sureness ─ persons of genius are, after all, always in short supply" (Vincenti, 1990: 168).

From that perspective, engineering education must include teaching, the formal contact with a selected body of scientific knowledge and training on the application of procedures that would allow transfer from science. Engineering education and practice must also include all other Vincentian knowledge generating facets. In particular, direct trial deserves a few additional remarks. The capability of deciding by doing is crucial to the design skills of engineering, and it also plays many roles in learning how to design for decision or implementation. Direct trial in hands-on problem-solving is acknowledged as playing a capital role for educating and adapting the engineer for the 21st Century by the US National Academy of Engineering, e.g., the difficulty of finding the correct balance between the grasp of theoretical, scientific, or mathematical knowledge and direct, hands-on knowledge of devices and systems (NAE, 2005: 116 ff.; for Management, cf. Wren, Halbesleben & Buckley, 2007).

4. Discussion: EBMgt risks overemphasizing decision to the loss of design

Simonian decision-making, with its two irreducible activities of Simonian design and Simonian choice does not prevail in EBMgt literature, which uses decision (and making decisions) in the meaning of the dictionary. That might be reasonable when the issue is to seek intelligibility by practitioners and researchers. So EBMgt's use of decision corresponds to the end result of the trajectory described in the *Oxford English Dictionary*, which gains the character of the "action of deciding" and "final and definite result" over the past few centuries. *Webster's Collegiate*, a current reference, has *decision* as "1a: the act or process of deciding; 1b: a determination arrived at after consideration: conclusion – to make a decision". This understanding of decision is identical to Simonian *choice* and, coherently, EBMgt describes decision as *choosing among alternatives*.

Thus, when one reads, for instance, on the first line of Rousseau's introductory chapter of *The Oxford Handbook of Evidence-Based Management*: "Evidence-based management (EBMgt) is the systematic, evidence-informed practice of management, incorporating scientific knowledge in the content and process of making decisions" (Rousseau, 2012b: 3), we argue that Simonian *choice* is meant. Rousseau substantiates our understanding by the examples of "Frances Tan" and "Normand Mathieu" that follow. She emphasizes the bounded rationality of the (individual) decision maker following Simon (1997), that must choose between (a workable number of) alternatives, following Schwarz (2004), leading to (necessarily simple) decision supports that can be referred to when making a choice – e.g., Yates' (2003) checklist. As a result of this concern for the final moment of Simonian choice by the (individual) decision maker, both the design that produces alternatives and the design that implements a choice are taken for granted. While this serves to focus on those elements that seem amenable and of interest to all managers, perhaps to ease the dissemination of EBMgt among practitioners, it risks overemphasis on Simonian choice over Simonian design – to adopt EBMgt's own terminology, leading EBMgt to risk overemphasizing decision to the loss of design. This would seem to constrain EBMgt to a partial grasp of management, with consequences for its influence on practice, research, teaching and learning.

While the very top managers might appear to manage by choosing among given alternatives alone, this is not the case. Often, they endeavor to come up with designs of their own: additional alternatives or implementation designs that their deep knowledge and position suggests might be superior or required, against the judgment of those somebody elses whose job is to offer them alternatives. In some cases, these designs become the stuff of anecdotes. For instance, Winston Churchill's military fantasies about icebergs converted to aircraft carriers or merchant ships, or his preference for an invasion of Norway, not France, were a waste of valuable thinking resources – his own and those that had to argue against them. In others, it reveals that those at the top alone have the grasp of the whole picture, larger than the fragmentary perspectives of those who design alternatives. Churchill's imposition of the dispatch of the whole of Britain's armored force to the desert in 1940, because regardless of risk, that was the only place Britain could be actually *fighting*. Franklin Delano Roosevelt's specification that light carriers, less capable but faster to build than fleet carriers, should be built and delivered in 1942 regardless of the ensuing delay of fleet carriers, because capability was required *now*.

Further, not all management students will be top managers. Some will be supervisors, first-level managers, middle managers, consultants or entrepreneurs. And for all of the latter the issue is not so clear cut, because they are the ones who must not only decide among the alternatives that come to them, but also design alternatives for their superiors or themselves. They must also design the implementation of the choices of their superiors, or their own – and sometimes, even carry out the implementation of those choices themselves. And then, people are not born top level managers. Top level managers do not become top level managers as soon as they leave school – or finish their MBAs. Quite the contrary – top managers emerge from a lifelong process that cumulates decision and design of alternatives and of implementation – this is often what qualifies them to be top managers. This suggests that EBMgt's overemphasis on decision means it risks taking management by halves, because knowledge needed for decision is different from knowledge needed for design.

5.3 Epilogue

The main argument of "The Yin-Yang of Decision and Design" is that Management (and EBMgt) risks overemphasizing decision to the loss of design, because knowledge for design is different from knowledge for decision. However, it failed to provide evidence that Management is *de facto* setting design aside. It did not provide any evidence because, first, this paper was written as a theoretical section for a larger paper. A second and most serious reason is that such evidence would be a terrible indictment against the actual way Herbert Simon's contributions were considered, particularly one of his most cited quotes:

> "Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design". (SIMON, 1969/1996: 110)

But this is a thesis from a Production Engineering Program, under the blessings of Volcanus, and here is the evidence.

Table 4 - Number of entries for selected keywords

Keywords	Business	Management	Business OR Management	Industrial Engineering	Manufacturing Engineering	Industrial OR Manufacturing
Total of WoS Category	446.081	489.680	809.690	202.314	203.828	364.710
TI=Design	4.189	15.663	17.690	13.274	18.505	28.194
TI=Design *	4.291	15.792	17.895	13.440	18.642	28.465
% Design	0,94%	3,20%	2,18%	6,56%	9,08%	7,73%
%Design*	0,96%	3,22%	2,21%	6,64%	9,15%	7,80%
TI=Decision	7.458	14.172	18.572	3.121	1.739	4.087
TI=Decision*	7.485	14.226	18.639	3.139	1.754	4.116
% Decision	1,67%	2,89%	2,29%	1,54%	0,85%	1,12%
% Decision *	1,68%	2,91%	2,30%	1,55%	0,86%	1,13%

Source: Data compiled from ISI Web of Science (06/jan/14)

Table 4 shows the number of entries in four Web of Science's categories: Business, Management, Industrial Engineering and Manufacturing Engineering. The word 'design' appears in the title of 7,73% of all papers published under the Industrial and Manufacturing Engineering categories combined. On the other hand, in the categories Business and Management combined, only 2,18% of all papers had "design" on their title. On the other hand, the word "decision" is part of the title of 1,12% of all papers

published in the two engineering categories considered, whereas 2,29% of all business and management papers had "decision" in the title. Therefore, it becomes clear that "design" is not so much an issue for Business and Management than for Industrial and Manufacturing engineering journals. It also becomes clear that decision receives more attention than design in the field of Business and Management (18,5 thousand papers with decision in the title versus 17,5 thousand with design).

A time series analysis of publications on decision and design in the categories Business & Management and Industrial & Manufacturing Engineering combined is also revealing. Chart 1 provides an overview of publications, further explored in the following five charts.

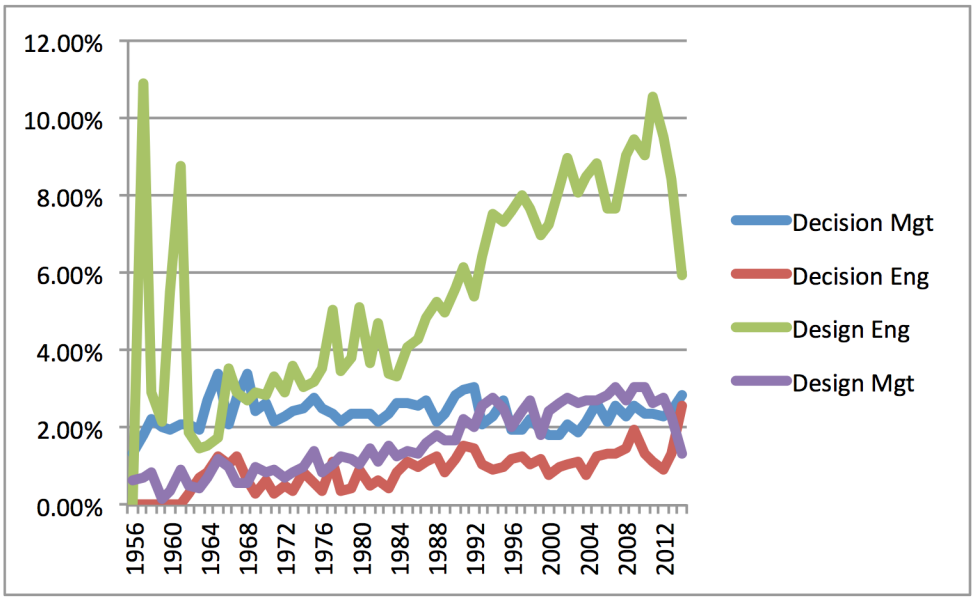

Chart 1 – Overview of the comparison between Management and Engineering, for decision and design

Source: Data compiled from ISI Web of Science (06/jan/14)

NOTE FOR ALL CHARTS: values refer to the percentage of publications with decision* (or design*) in the title, per year, in each combined field. For instance, 3,41% of all papers published in Web of Science's Business or Management categories in the year 1965 had "decision*" in the title; 1,29% had "design*". In the same year, in the fields of Industrial and Manufacturing Engineering 1,72% had "design*" in the title, and 1,16% had "decision*".

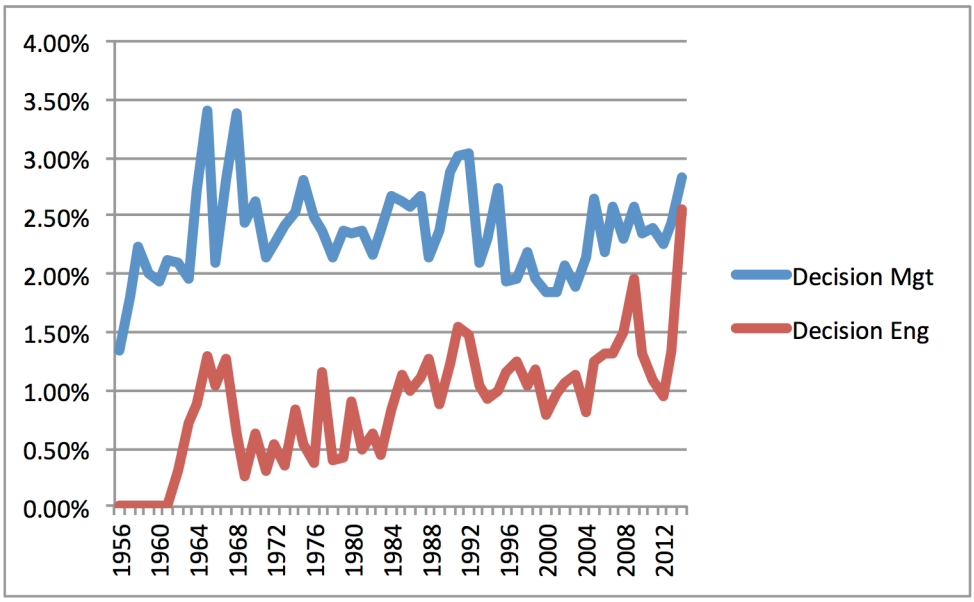

Chart 2 - Evolution of Publications on Decision, for Business & Management and Industrial & Manufacturing Engineering

Source: Data compiled from ISI Web of Science (06/jan/14)

Charts 2 and 3 show that publications on decision are more predominant in Business & Management and publications on design are more predominant in Industrial & Manufacturing Engineering.

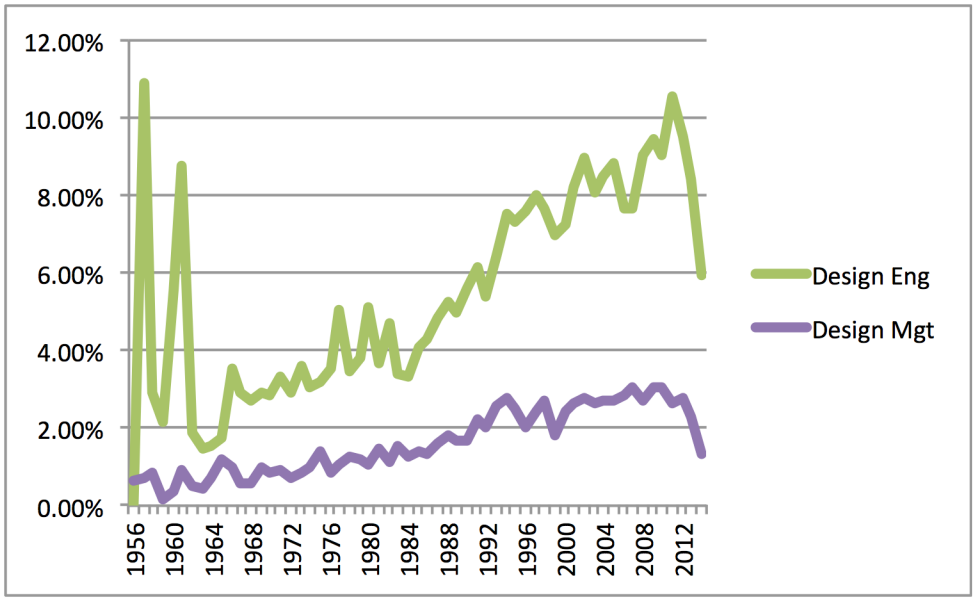

Chart 3 - Evolution of Publications on Design, for Business & Management and Industrial & Manufacturing Engineering

Source: Data compiled from ISI Web of Science (06/jan/14)

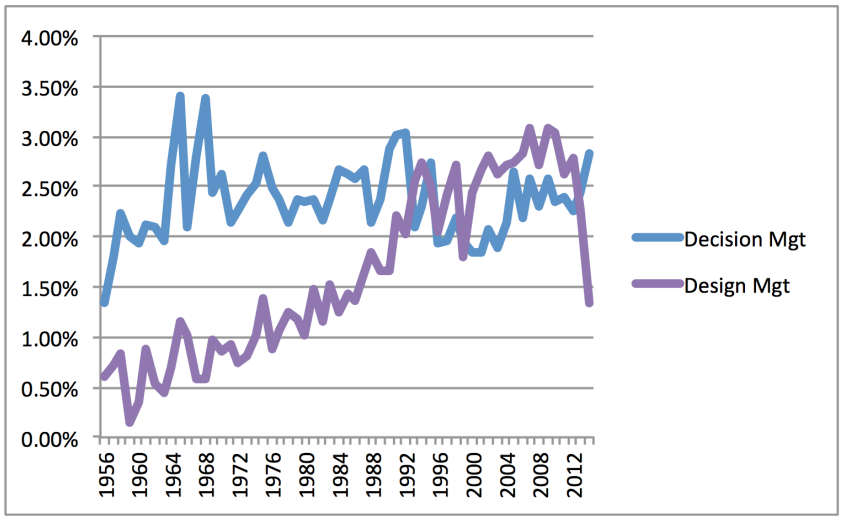

Chart 4 - Comparison between publications in Decision and Design within Business & Management categories

Source: Data compiled from ISI Web of Science (06/jan/14)

Charts 4 and 5 are most interesting. It shows that in Business and Management categories combined, design had increasingly received publication space, and publication space for papers with "decision" in their title have remained the same. It was in 1993 that publications with decision and design equalized. Perhaps this is a good sign, a sign that the field of Management is catching up with the need to take design into account. The contrast with Industrial & Manufacturing Engineering, however, portrays a different picture. Publications in design have also increased in Industrial & Manufacturing Engineering, with a slight increase in publications concerning decision.

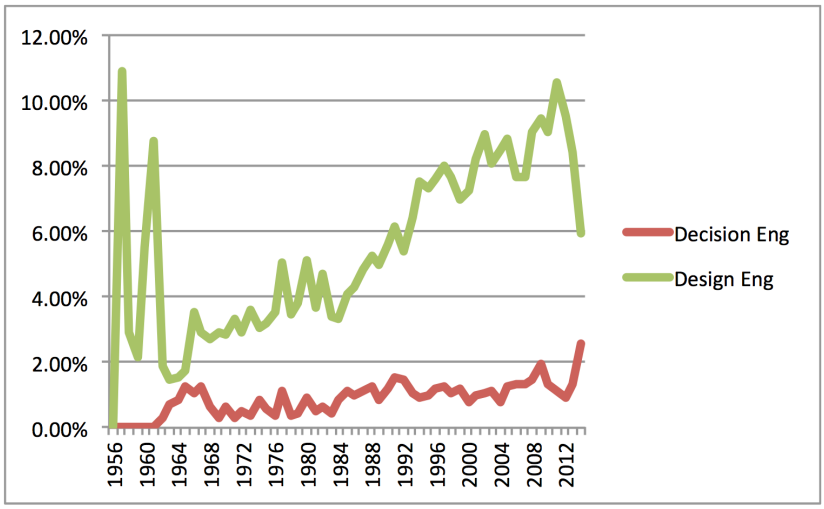

Chart 5 - Comparison between publications in Decision and Design within Industrial & Manufacturing Engineering categories

Source: Data compiled from ISI Web of Science (06/jan/14)

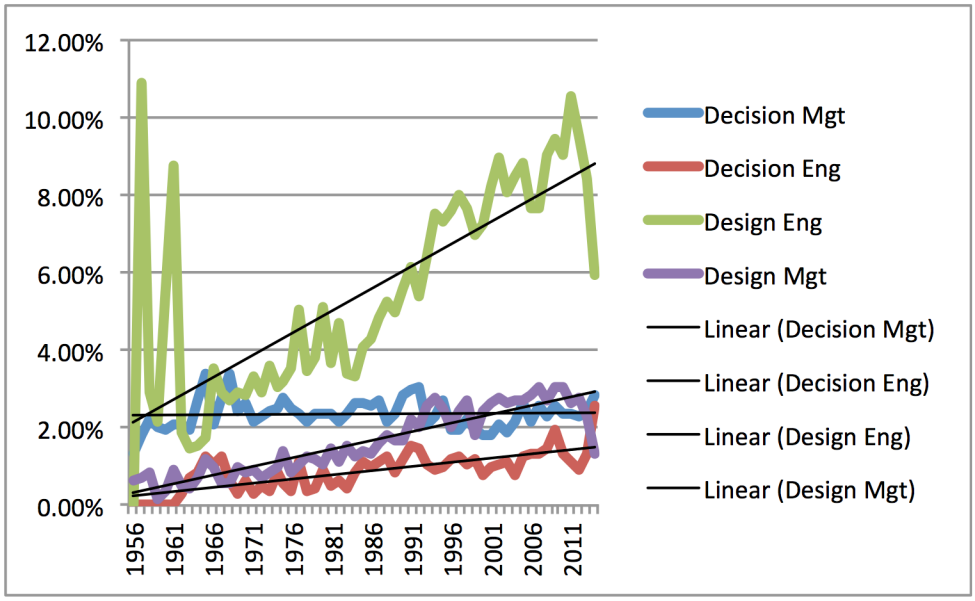

Chart 6 - Linear trendlines for the evolution of publications in Decision and Design for Business & Management versus Industrial & Manufacturing Engineering

Source: Data compiled from ISI Web of Science (06/jan/14)

As Chart 6 (a variant of Chart 1 with linear trendlines added) show, publication space for papers in design have increased more significantly in Industrial & Manufacturing Engineering than in Business & Management. Business & Management publications in design are indeed catching up with publications in decision, but their levels are as low as Industrial & Manufacturing Engineering's from fifty years ago (about 2,3% of all papers published in a year). In that sense, the field of Industrial & Manufacturing Engineering's size is a third of the size of Business & Management, but it gives relatively much more attention to design than Business & Management. Business & Management journals can even be catching up, but has to accelerate whether their intention is to actually include design in their repertoire.

Summing up, it is then possible to infer that Management has given relatively less attention to design and more attention to decision than the field of Industrial & Manufacturing Engineering. There seems to be an increase in publication space given to papers on design in both fields, being the increase in Industrial & Manufacturing Engineering far more significant. Publication space to papers on decision has remained stable in the field of Management, and it has been increasing slowly in Industrial & Manufacturing Engineering.

PART III: DIGGING IN THE WRONG PLACE

"Digging in the wrong place", Part III, seeks to contribute to criticism on Evidence-based Management (EBMgt). The aim is to shed light into EBMgt's conceptual shortcomings, pointing out to its erroneous emphasis on scientific epistemic foundations instead of professional. It argues that EBMgt is a promising solution that fails to deliver. It compares EBMgt with Evidence-based Medicine (EBMed) in chapter 6 ("Of Gaps and Bridges") and with Evidence-based Software Engineering (EBSE) in chapter 7 ("A Tale").

The very idea of Evidence-based Management has been subject to significant criticism (e.g., Learmonth, 2006, 2008, 2009, 2010; Learmonth & Harding, 2006; Ashkanasy, 2007; Morrell, 2008, 2012; Reay, Berta & Kohn, 2009; Tourish, 2013). Actually, as chapter 7 will explain, criticism has focused on Rousseau's EBMgt, that is, Denise Rousseau and her colleagues' understanding of what EBMgt is and should be. EBMgt was first proposed by Tranfield, Denyer & Smart (2003). As president of the American Academy of Management in 2005, her presidential address at the Academy of Management Meeting (published as Rousseau, 2006) ignored Tranfield, Denyer & Smart (2003) and all other studies on EBMgt at that time. As she failed to mention current initiatives, it seemed she was the founder, the mind behind EBMgt. That she failed to cite ongoing initiatives at that time was never explicitly brought to light until recently.

Learmonth (2006), a commentary to Rousseau (2006), was the first to criticize EBMgt. His critics were twofold: "(1) management studies' radical, paradigmatic disputes over legitimate evidence and (2) the rhetoric of science as a mask for the politics of evidence" (Learmonth, 2006: 1089). The second is particularly interesting for this thesis' purposes:

> "Rousseau's evidence-based management can be interpreted as a means to further a particular set of interests and values in organizational life while doing so under cover—the cover provided both by the prestige of science and by the enthusiasm, in certain quarters, for (a narrow rhetoric of) evidence". (LEARMONTH, 2006: 1090).

Learmonth (2006) chooses "Rousseau's evidence-based management" instead of simply evidence-based management to point out that there might exist different views on what EBMgt is and should be ─ although this is left understated. Most interesting is that he criticizes Rousseau's EBMgt use of the prestige of science as a cover for a political plan. This sets the main context of Part III's contribution. The two papers here will discuss the particular set of interests and values in Rousseau's EBMgt. As "Of Gaps and Bridges" focus on the comparison between EBMgt and EBMed, it does not distinguish the different strands of EBMgt, which will be dealt with in "A Tale".

6 Of Gaps and Bridges[8]

6.1 Prologue

"Of Gaps and Bridges" compares the volcanic temple of Management with the Temple of Asclepius, the Greek god of Medicine (the Roman equivalent is Aesculapius). The rod of Asclepius, a snake-entwined staff, remains the symbol of Medicine today. Volcanus is perhaps too ugly to be associated with Management ─ until now.

The comparison between the Temple of Asclepius with the temple of volcanoes is devastating. Medicine is perhaps the most well-organized profession ─ even more than engineering. Evidence-based Medicine (EBMed) is the gold standard of evidence-based approaches to bridge the gap that naturally exist between sciences and professions, and the gaps within the profession that naturally derive from it. The Temple of Asclepius works with unparalleled beauty. Asclepius is the father of four daughters, among which are Hygieia, the goddess of cleanliness and sanitation, and Panacea, the goddess of universal remedy. Perhaps the unparalleled beauty of Medicine comes from the cleanliness-seeking, decontaminating methods Evidence-based Medicine develops and promotes. Evidence-based Medicine is an effort to control and reduce biases that may affect ─ contaminate ─ research results (Howick, 2011).

The proto-scientists travestied as proto-professionals from Evidence-based Management captured Asclepius' daughter and took her to the temple of volcanoes. But unfortunately they kidnapped the wrong daughter. "Of Gaps and Bridges" shows that EBMgt decided to capture Panacea, the goddess of universal remedy. But Evidence-based practice is no universal remedy, neither could it ever be a university's remedy. "A Tale", the second of the two chapters, will show that Hygieia, the goddess

[8] This paper was originally written in October, 2013 by the author, by Prof. Roberto Bartholo and by Prof. Domício Proença Jr. It is currently submitted to the *Journal of Management Inquiry*.

of decontamination from research biases, was left untouched in her place within the Temple of Asclepius ─ although there were a few brave men from Management who decided to bring Hygieia as well. But those, who were led by Tranfield, were progressively silenced and were shown to their place within the church of Rousseau's EBMgt.

"Of gaps and Bridges" further explores a duality between discourse and dialogue, which becomes evident by the contrast between EBMgt's attitude towards practitioners, patients, the public and policy makers, and that of EBMed. Dialogue is a key to mutual respect. Discourse is a key for higher profits. Dialogue leads to the beauty of mental hygiene. Discourse leads to the terror of panacea.

6.2 Full Text

Abstract

We argue that Management has something to learn from the experience of Medicine in its effort to "bridge the gap". The key issue is that of dialogue as opposed to discourse. We reconstruct the experience of Medicine, particularly of Evidence-Based Medicine, to show that there is more than one gap between "research(ers)" and "practi(ce)(tioners)". We underscore the broad inclusiveness of top medical journals, which publish scholarly scientific articles, patient information, statistics, clinical cases, letters, technical images, videos and other heuristics and exemplars. We then contrast "research(ers)-practi(ce)(tioners)" gaps and bridges in Medicine and Management, particularly in Evidence-based Management. We suggest that the real problem is not that there are gaps, but the attitude of Management towards their existence. This has hobbled the emergence of a community of dialogue in Management, and it is the supreme, most important, and most far-reaching lesson of Medicine's experience with EBMed for Management.

1. Introduction

The gap between, say, theory and practice is perceived as an obstacle to the advancement of management and organization research (Hambrick, 1994; Hodgkinson & Starkey, 2011; Starkey & Madan, 2001; Susman & Evered, 1978; Van Aken, 2004). Evidence-based Management (EBMgt) has been proposed as a way to bridge the gap (Pfeffer & Sutton, 2006; Rousseau, 2006; Tranfield, Denyer & Smart, 2003; more recently, Rousseau, 2012a and Rousseau (Ed.), 2012). Like many other evidence-based practice proposals, it derives much of its structure and ambition from the experience of Evidence-based Medicine (Rousseau, 2012c: xxiii; Tranfield, Denyer & Smart, 2003: 208). Evidence-based practices share some of the underpinnings made more widely known by their use in Medicine: principally, the elimination of research biases through systematic literature reviews (CRD, 2009, for Medicine; Petticrew & Roberts, 2006, for the Social Sciences; Gough, Oliver & Thomas, 2012, for a broader perspective). In fact, in Medicine, evidence-based *means* systematicity in this precise sense of elimination of biases (Borgerson, 2009; CRD, 2009; Howick, 2011).

And yet, there seems to be little appreciation of how the issue of "the gap" in Management would benefit from a more analytical appreciation of how the gap, in fact the various gaps (as explained below) would be bridged in Evidence-based Medicine (EBMed). This corresponds to a theoretical appreciation of the issue, that compliments similar efforts such as Whitley (1984) and Nicolai (2004) or, more recently, Kieser & Leiner (2009) and Hodgkinson & Rousseau's (2009) reply. It seeks to supply an exemplar of actual practice in dealing with the gap, in fact, the gaps, in Medicine. It exemplifies a point of view, a current evolving approach, which might make much of the opposition and various shades of priority between being "relevant to practice" or "relevant to scholarship" (Bell, den Ouden & Ziggers, 2006; Grey, 2001; Kieser & Leiner, 2011; Learmonth, Lockett & Dowd, 2012; Wright, Paroutis & Blettner, 2013) moot in Management as it is in Medicine.

Against this broader background, this essay is more finely tuned by two contextual considerations. The first are Kieser & Leiner's (2012) concerns about Management's mistaken attempts at producing scientific knowledge that would be *directly* relevant to

practice, mistaking what *makes* knowledge relevant. This corresponds to the subordination of usefulness in changing reality to rules of academic propriety and progression in academic career tracks. This led, unsurprisingly, to the perception of rigour and relevance as increasingly opposing attributes. We follow Kieser & Leiner (2012) in giving pride of place to Beech, MacIntosh & MacLean's (2010): "Knowledge is not transferred from academic to practitioner or vice versa, rather it is developed in the joint dialogue and applied, through further work, in the home-worlds of the two groups" (Beech, MacIntosh & MacLean, 2010: 1364). We propose to address the various dialogical instances in Medicine as useful lenses for their renewed perception in Management.

This leads to a second consideration that contextualizes this essay: is a parallel with Medicine of any value at all? Perhaps Spender (2007) gives us the best answer on any such use of parallels. Spender (2007) argues that professions are comparable, and that there are two unavoidable kinds of dialogical responses between those that do research and intervene in reality that configure a profession: that of being answerable for their choices before their peers, under various forms of regulation, and being accountable for the outputs and outcomes of their action before the community and society. For Spender (2007), the most fruitful parallel with Management would be with Art. Spender (2007) faces head on the charge that Art would not be a profession. Art possesses neither a core of scientific knowledge, nor a clear division between researchers, practitioners or users, nor yet any institutional regulatory arrangements that would make the flow and use of knowledge of Art answerable or accountable. Spender (2007) argues for a tentative yes, that there is enough to make even this seemingly extreme parallel useful on the rather firm grounds of the need and the reality of imagination and creativity in human professional learning and endeavor. In what concerns Medicine, that affirmative might not need to be qualified as tentative.

While arguing for the possible benefit of closer attention to the way Evidence-Based Medicine addresses the gaps and bridges, a note of caution is required. Howick's (2011) *The Philosophy of Evidence-based Medicine,* admonishes against taking EBMed as accomplished, as a model for ready replication (Howick, 2011: 187-189). He points out the many issues of EBMed that remain unresolved, being careful to show the tentative nature and the evolving delicate relationship among its component parts, for example, the still fragile state of its hierarchy of evidence (Howick, 2011: 119). He argues that EBMed lives or dies on the robustness of its proposed

systematicity in the minimization of biases (Howick, 2011: 24-30). The proofing of EBMed as a superior alternative for the practice of Medicine rests on the recurrent verification of its ability to minimize human, organizational and policy errors of practice *and* research (Howick, 2011: 25).

This somewhat extended introduction seeks to establish the plausibility of what follows as potentially useful, exploring a more sustained appreciation of the gaps and bridges, both plural, in Medicine, and what can be gained by considering them as possible parallels in Management.

Part 2 reconstructs and describes the experience of Medicine in dealing with the gaps that must exist between science and the profession, and among the various participants of the medical community. Item 2.1 considers the experience and practice of Medicine and Evidence-Based Medicine to show that there is more than one gap between "research(ers)" and "practi(ce)(tioners)", and that they require different bridges. A rational reconstruction outlines and discusses gaps between the biological sciences and the medical profession, and between practitioners and researchers within the medical profession. We show that they are dealt with by dialogical bridges that allow appreciation and communication to flow in both directions. Item 2.2 appreciates the breadth of inclusiveness of communication that is found in medical journals, that publish scholarly scientific articles, patient information, statistics, clinical cases, letters, technical images, videos and other heuristics and exemplars. We offer as evidence the editorial policies and recent publications from the two top-ranked medical journals.

Part 3 offers closing remarks that characterize Medicine as a community of dialogue and contrasts it with an authorial appreciation of Management. Recapitulating the presentation of gaps and dialogical bridges in Medicine, we address "research(ers)-practi(ce)(tioners)" gaps and bridges in Management, particularly in Evidence-based Management. This produces a harsh assessment of the absence of dialogue between Management, the science, and Management, the profession, and, arguably, an even harsher one of EBMgt's failure to bridge "the gap". We argue that the real problem in "bridging the gap" in Management is that the various attempts did not cross over, but rather led to half-bridges that allowed Management, the science, to tower over Management, the profession. As such, they have served, and serve, discourse, not dialogue. Thus the real problem is shown to be not that there are gaps but the attitude of Management, the science, including EBMgt, towards their existence. This is the

real problem, which has hobbled, and continues to prevent, the emergence of a community of dialogue in Management.

2. Gaps, Bridges and EBMed

The purpose of this part is to present two usually underappreciated aspects of the complex of relations subsumed in "PubMed/MEDLINE", the front-end of the unified medical knowledge database. The first is a rational reconstruction that seeks to clarify the different gaps that have to be considered when one seeks to deal with "research(er)-practi(ce)(tioner)" relationships. The second takes a hard look of what are the editorial policies and a sample of contents of the two top journals in Medicine according to the Science edition of the *Journal Citation Reports* to demystify, and perhaps to illuminate, the breadth of its inclusiveness in terms of audiences, forms of communication, and the various kinds of knowledge accepted for publication on an equal footing. It outlines the dialogical nature of the relations of a community that goes beyond researchers and practitioners to include patients, the public and policy-makers as full participants.

2.1 Gaps and Bridges I: a rational reconstruction

Evidence-Based Medicine struggles to bridge the several gaps that exist between research(er) and practi(ce)(tioner).

What is the nature of "the gap" remains disputed in Management. It can be referred to, as in our introduction, as the gap between theory and practice, but this term fails to disclose all the relevant issues at stake. A descriptor that seems to have fallen in disuse, rigour-relevance, was, perhaps, the most sincere from the point of view of scholarly researchers who strive to deal with the lack of appreciation of their labors by practitioners (e.g., Hambrick, 1994; House, 1975; Susman & Evered, 1978).

The various alternative constructions around research(er)-practi(ce)(titioner) are not synonymous. Each describes very different gaps, although they are used as more or less equivalent, leading to the risk of confusion. That serves as a starting point to

revisit the issue of the gap by an appreciation of EBMed's efforts: there is more than one gap.

(1.) The gap between research and practice – insurmountable, but bridgeable

There is the gap between research and practice – in the sense of the gap between *science* and *profession*, e.g., between biological sciences and medical profession. This gap expresses the fact that science and profession have different purposes, use different methods, and seek different results (e.g. Weaver, 1917/2012 and Freidson, 1970 for Medicine; see also Rogers, 1983 and Koen, 2003, for Engineering). If bridging the gap means to close it, then this gap is insurmountable.

However, if bridging the gap means building a connection, allowing the transit of knowledge and appreciation from one side to the other, then Medicine operates not one, but two one-way bridges. One leads from science to profession. It corresponds to translational medicine, the effort to improve understanding, develop technology or design treatments in the light of scientific results (Broder, 2010; Cressey, 2010). The other leads from profession to science. It corresponds to the identification of issues, phenomena or problems that seem amenable to the benefits of scientific research or that challenge existing scientific findings (Heneghan & Badenoch, 2006; Straus *et al.*, 2011).

(2.) The researcher-practice gap

There is a gap between researcher and practice – in the sense of the gap between one researcher's understanding of the practice of the profession and the way it is actually taking place, e.g., between research into invasive procedures and increasing reluctance to continue using them (Brocas *et al.*, 2005; Keller, 2007). This gap expresses the fact that researchers may grow distant from practice as an occupational hazard, up to becoming out of synch or even isolated from practice. Medicine acknowledges this gap, and EBMed seeks to remedy it, where appropriate, by espousing adherence to the hierarchy of evidence, where clinical trials (such as Randomized Controlled Trials) take pride of place (e.g., Pemberton, Kraeva & Bhandari, 2007). This leads researchers to interact, even if indirectly, with contemporary clinical practice.

(3.) The research-practitioner gap

There is a gap between research and practitioner – in the sense of the gap between research findings and one practitioner's clinical practice, e.g., the discovery of the collateral effects of a drug and uninformed persistency in its prescription. This gap expresses the fact that practitioners may grow distant from research as an occupational hazard, up to becoming out of synch or even isolated from research. Medicine acknowledges this gap, and EBMed expresses various ways to remedy it. No single solution can address all of the causes for this gap, and different approaches try to deal with each of them. Most try to minimize practitioner's expenditure of time and effort in becoming up to date with research findings. PICO searches, formulated in medical jargon, return results filtered by practice-relevant variables (the Patient/ Problem, Intervention, Comparison, Outcomes). The Cochrane Collaboration offers comprehensive systematic reviews of evidence, which allow practitioners to access the state of the art on specific topics. Efforts like PubMed Central aim at universal, free on-line access to all medical knowledge (Caelleigh, 2000; Gordon, 1999).

(4.) The practitioner-research gap

There is a gap between practitioners and research – in the sense of the gap between practitioners' learning and discovery through their practice and its communication to the common fund of knowledge and research, e.g., McBride's 1961 letter to the *Lancet* that reported the statistically improbable incidence of congenital abnormalities that led to the realization of the collateral effects of Thalidomide (Lerner & Lerner, 2006, p. 291-293; McBride, 1961). This gap expresses the fact that practitioners are practicing, and the record and communication of what they learn or discover in their practice presents an additional burden. Medicine acknowledges this gap, and EBMed seeks to remedy it in various ways, that mirror different perspectives on how best to stimulate this communication. There are longstanding traditions in the medical profession that value and require cooperation and assistance, assessment of errors and successes, lessons learned with either, which leads to diffusion of experiences and knowledge. This has contemporary counterparts in the valued role of individual

reports of clinical experiences and images, as well as the broad understanding that even a single data point, one image by one physician, can be recognized as worthy of publication. This leads practitioners to interact, even if indirectly, with contemporary research.

(5.) The researcher-research gap

There is a gap between researchers and research – in the sense of the gap between what one researcher knows and what is already available from research, e.g., between one's grasp of the field and the latest, or even that one additional relevant finding. This gap expresses the fact that researchers may have access to less than the whole of available findings, or that their efforts are impaired by biased access. Medicine acknowledges this gap, and EBMed seeks to remedy it. PubMed/MEDLINE is the contemporary face of the longwinded ambition of the 19th Century *Index Medicus.* PubMed/MEDLINE aspires to eliminate all search bias, to eventually offer full access to everything that might be medically relevant (Kurata *et al.*, 2013; Lindsey & Olin, 2013; O'Leary, 1997; Wilson, 1997), classified according to a robust and universal controlled vocabulary – Medical Subject Headings, MeSH (Lipscomb, 2000; Richter & Austin, 2012).

(6.) The researcher-practitioner gap

There is a gap between researchers and practitioners – in the sense that one and the other may find little in common, or fail to appreciate that they are part of a shared endeavor. What measure of success may be attributed to EBMed largely mirrors how bizarre such a situation would appear to be in Medicine. Even a popular image of the medical doctor, e.g., the *House, M.D.* TV series, presumes that the supreme practitioner of medicine is in fact nearly undistinguishable from the supreme researcher (granted, House does not like to write up his cases, for which see item 4 above – but his associates are desperate to send their shared clinical cases, with his name on it, to the top medical journals).

2.2 Gaps and Bridges II: publishing policies

Medical journals are dialogically inclusive of the various strands of research and practice. Management journals might have something to gain by an appreciation of how that inclusiveness supports bridging the various gaps in Medicine.

To publish in a medical journal admits more than the publication of a scientific article that is deemed, for instance, to offer scholarly contributions. In fact, medical journals admit a variety of contributions and forms of communication, on equal publishing value to written scientific articles. Let us consider two examples.

CA: A Cancer Journal for Clinicians, had a JCR impact factor of 153.459 in 2012, making it the top ranked journal among the 8,411 journals of the Science edition of the *Journal Citation Reports*. *CA* is free to access online, providing free continuing education for medical professionals based on its contents. *CA*'s aims and scope reads:

> "*CA* provides cancer care professionals with up-to-date information on all aspects of cancer diagnosis, treatment, and prevention. The journal focuses on keeping physicians and healthcare professionals informed by providing scientific and educational information in the form of comprehensive review articles and online continuing education activities on important cancer topics and issues that are important to cancer care, along with publishing the latest cancer guidelines and statistical articles from the American Cancer Society." (CA: A Cancer Journal for Clinicians, n.d.)

Being succinct, neither the regular presentation of basic information to patients about what they can expect or are entitled to (e.g., "Testing for…", 2013) nor the continuing report of statistics (e.g., Desantis, Naishadham & Jemal, 2013) can be considered as scholarly, scientific theoretical contributions, but they are accepted and ranked as full credit publications on equal standing – all included in PubMed/MEDLINE, as part of the evidence base of Medicine.

The New England Journal of Medicine had a JCR impact factor of 51.658 in 2012, making it the second top ranked journal among the 8,411 journals of the Science edition of the *Journal Citation Reports*. It provides free on-line access to 100 low-income countries of its weekly issues, and unlimited access to all scientific articles after a six-month embargo. *NEJM* describes itself as being:

> "… dedicated to bringing physicians the best research and key information at the intersection of biomedical science and clinical practice, and to presenting the

> information in an understandable and clinically useful format. A career companion for physicians, NEJM keeps practicing physicians informed on developments that are important to their patients and keeps them connected to both clinical science and the values of being a good physician." (New England Journal of Medicine, n.d.)

Again, being succinct, neither the publication of individual clinical cases (e.g., Alexander *et al.*, 2013) nor of medically relevant images and videos (e.g., Rao & Crail, 2013; Rosenthal et al., 2013) can be considered as scholarly, scientific theoretical contributions, but they are accepted and ranked as full credit publications on equal standing – all included in PubMed/MEDLINE, as part of the evidence base of Medicine.

This expresses the broader, more practice-oriented conception of what is necessary to the practice of medicine and to the dissemination, appreciation, teaching and criticism of Evidence-based Medicine. This corresponds to an awareness of the various roles and forms of communication between practitioners and researchers, to the place of practitioners in research and the place of researchers to practice. Different kinds of knowledge and various forms of communication are equally valued and legitimate. They serve both design and decision of medical practice, being integral to the broader effort of the advance of medical knowledge and the enlargement of medical practice's state of the art.

It is only logical that this should consider the various instances in which knowledge could become relevant, as much as the various kinds of knowledge that might be relevant. In Medicine this means improved practice through and with research, research for and beyond practice, as well as the foundational and continuing communication among researchers, practitioners, patients, the public and policy makers about the reach and the limitations of Medicine.

Ultimately, scholarly scientific articles, patient information, statistics, clinical cases, letters, technical images, videos and other heuristics and exemplars are equally indispensable. They are all equally valued pieces of evidence for EBMed, playing different roles in educating and supporting an attending physician in the design of the best treatment for a particular patient.

3. Closing Remarks

The above rational reconstruction and theoretical appreciation of the "gaps in Medicine" admits some parallels with the "gap in Management". This is a recurring circumstance in the presentation of the need for EBMgt, for instance in Rousseau's preface to *The Oxford Handbook of Evidence-based Management* (Rousseau, 2012c: xxiii). However, it poses rather different questions about the policy, practice and research choices in Management. The variety of gaps, the insurmountability of the gap between research *qua* research and practice *qua* practice, and the multiplicity of bridges that attempt to deal with the different gaps in Medicine would seem to inevitably pose the question, as to whether to focus on "bridging the (one) gap" was part of the solution or of the problem in Management.

As we argued above, there are many gaps in "the gap". How does Management in general, or Evidence-based Management in particular, appear to consider this issue? The fluent redescription of the gap as "rigor-relevance" (Fincham & Clark, 2009; Vermeulen, 2005; Worrell, 2009), "researcher-practitioner" (Anderson, Herriot & Hodgkinson, 2001; Hodgkinson, 2006; Hueffmeier, Krumm & Hertel, 2011) or "research-practice" (Bansal *et al.,* 2012; Empson, 2013; Rousseau, 2006), among others, suggests a measure of irresolution or indistinction as to what is being named, and hence, understood. To that extent, it is possible to proclaim that all the gaps identified above are implicitly considered in that broader, if more nebulous formulation. Further, the idea of "bridging" the gap often intimates not so much as a connection, as a definitive closing of the gap (Burke, Drasgow & Edwards, 2004; Rousseau, 2006: 265): filling in and paving over the abyss, not building a span through which appreciation and dialogue between alterities might flow. Again, the duality of bridging as transposition or simple elimination admits a similar recourse: that either or both might be meant. Even if we were to accept such qualifiers, strictly for the sake of argument, there might still be something in a brief authorial, interpretative outline of the gaps in Medicine transposed to Management.

(1.) the research-practice gap

The acknowledgement of the research-practice gap and its bridging in Medicine stems from the recognition of the difference between biological sciences and the

medical profession. This is a gap that can neither be closed nor annulled so long as each preserves its own identity, sense and purpose. Medicine is secure in its identity as a profession. Physicians and medical researchers are sides of that same profession, which use and are informed by the results of the various sciences. Neither would mistake themselves as being, for instance, biological scientists. EBMed shows that it is just possible to build connections over the insurmountable gap between the sciences and the professions.

It seems impossible to avoid questioning whether Management's ambition to be simultaneously a science *and* a profession might not be the root cause of the longevity and the apparent intractability of "the gap". If this turns out to be the case, it bodes ill for the prospects of EBMgt in bridging the gap, so long as the tension between most managers and consultants, pulling for the profession, and most scholars and academics, pulling for the science, remains confined to the one same identity. But it would seem to promise a bright future for Management consultants and their "Heathrow literature", who show themselves willing to address the problems of practice with little concern for academic respectability.

In Medicine, the (2.) researcher-practice and (3.) practitioner-research gaps are perceived as unavoidable occupational hazards of the medical profession. It is to be expected that medical researchers may drift away from medical practice; that medical practitioners may distance themselves from medical research. These are gaps *within* the medical profession, and do not entail the loss of a shared professional identity of being *medical* researchers and *medical* practitioners. Practitioners and researchers expect research to be about, and ultimately for, medical practice, either directly or, through the improvement of medical research, indirectly.

(2.) the researcher-practice gap

To the extent that Management academics increasingly defined themselves as social scientists, what would have been a gap within Management, the profession, became a mask of – and, arguably, for – the insurmountable divide between science and profession. Thus the researcher-practice gap was left behind. To that extent, the researcher-practice gap within Management might be seen as becoming a double ditch. One, the gap that would exist between science and profession. The other, that between management professional research and practice. By choosing to define their

identity as scientists and simultaneously denying the legitimacy of professional research, Management academics would have worked to make themselves irrelevant to Management practice. To become social scientists, they had to fashion a language of their own to communicate their own specific content, the language of Management, the science ─ predictably unintelligible and uninteresting to Management, the profession.

The lack of relevance of scientific research to medical practice does not disturb a biological scientist in the least. It is only logical that medical practitioners would not consider scientific results relevant until, and unless, medical researchers found a way of bringing it to practice.

(3.) the research-practitioner gap

As a result, the research-practitioner gap in Management might be seen not so much as practitioners distancing themselves from research as much as the increasing vacuity of research in Management, the profession. To the extent Management academics chose to define themselves as, and *de facto* became, social scientists, this led to a major imbalance. There is considerable research on Management, the science. There is very little research on Management, the profession. Barring consultancy and the forays of "Heathrow literature" authors, practitioners simply do not have useful Management, the profession, research results. Scientific articles on the relations between humans and organizations are written in the language of science, not of the profession. Their relevance, if any, depends on the translation from the language of Management, the science, to that of Management, the profession.

This is not the trite argument of "translation", under the misperceived idea that science needs to be "tuned down" for practitioners (Shapiro, Kirkman & Courtney, 2007; Swan *et al.*, 2010; Thorpe *et al.*, 2011; van de Ven & Johnson, 2006a, 2006b). True dialogue becomes impossible under these conditions. Translation for dialogue must admit two-way exchange. Side by side with the translation of the knowledge of science to the profession, there must be the acknowledgment and appreciation of the knowledge of the profession to science – the role of Management, the profession, researchers. Which raises the issue of the ensuing gap.

(*4.) the practitioner-research gap*

In Medicine, it might suffice to recall McBride's 1961 letter to the *Lancet,* its reception, publication, and consequences – the medical and, then, scientific awareness of the collateral effects of Thalidomide. A single letter, an individual non-scholarly, non-academic communication.

Practitioners are busy enough practicing, and seldom produce scientific knowledge. The practice of a profession is inherently situational – it admits different weights for scientific and non-scientific knowledge case by case. In clinical practice, this means a physician designs the treatment for this individual patient and adjudicates case by case on the best course of action. To offer an illustration, sometimes it is the latest course of treatment; sometimes, it is just a kind word. This is not the case in science, where individual cases or rules of thumb do not belong.

Management, the science, *necessarily* excludes from consideration a large part of what Management, the profession, needs to exist. This is not a problem in itself, so long as it is acknowledged that non-scientific knowledge is necessary, and should be as valued as scientific knowledge, in Management, the profession. The denial that there might be legitimate and worthy non-scientific Management knowledge dooms the collaboration of practitioners with research from the start, and closes the possibility of dialogue with scholars.

Again, this is not another approach to the trite discussion of "translation", in that researchers should learn practitioners' language to better discourse to them. Rather, this is the argument that researchers should learn practitioners' language in order to listen to them. To listen, and then to answer in practitioners' own language. The task of establishing the terms of exchange clearly belongs to researchers – to researchers of the profession, but also, through them, to researchers of science. This illuminates the vast consequences of EBMed's priority for Medical Subject Headings (MeSH) in that it comprises a two-way avenue of communication, allowing jargon from medical practitioners and researchers, and even from scientific researchers, to be less of an obstacle. The absence of any such endeavor, or even the consideration of such an endeavor by EBMgt might indeed tell the whole tale in a nutshell.

(5.) the researcher-research gap

PubMed/MEDLINE is the contemporary face of a longwinded effort to provide an effective and universal dialogical tool, that would offer comprehensive indexing and retrieval (eventually full access) to *anything* that *might* be medically relevant to *anyone* with an interest in it. Its intended community comprises an expanding group of othernesses: researchers, practitioners, patients, the public, policy makers. While it serves researchers in keeping up with research, it aims at much more. It is attentive and appreciative of the differences of its many audiences in terms of context, interest and language. It includes all othernesses as equally pertinent and valuable to its endeavour, for instance, in offering its retrieval in multiple languages – not only in English, and not only in any one particular jargon.

In contrast, how do researchers in Management keep up with research? That is a very delicate question. It seems impossible to avoid the perception of a mismatch between rhetoric and reality. There is a call to include and consider all relevant sources, further intimating the inclusion of all pertinent othernesses, for instance by EBMgt. That is the rhetoric. But in reality there is no consistent effort leading to such comprehensiveness, or valuing such inclusiveness. While PubMed/MEDLINE offers a single-point-of-contact access to all research in Medicine, in Management there are differently formatted and configured databases (e.g., the contrast between EBSCO's Business Source Elite and Proquest's ABI/INFORM Global) that compete with one another by offering different mixes of sources. None promises nor offers comprehensiveness.

The minimization of biases is the defining concern of EBMed: procedures to reduce, ideally to eliminate, biases in the collection and appreciation of all potentially relevant evidence. Procedures do not stand on their own: they require structures that support them. The lack of comprehensiveness of any one Management database, and the absence of any arrangement that would combine them comprehensively and inclusively *ensures* selection bias (CRD, 2009: 39) in Management research. Although EBMgt defines itself as evidence-based, and thus, presumably, as champion of biases' minimization, it stands remiss in striving for the procedures and the infrastructure that this requires. This lack of concern would appear to be evidence that it falls very short of the evidence-based mandate.

(6.) the researcher-practitioner gap

The distance between researchers and practitioners might be best addressed just by the imagery of fiction, a taste of plausible images of public perception. Provocatively, we choose to offer the contrast between two depictions, of Medicine and Management. On the one hand, the depiction of *House, MD*, the supreme practitioner as supreme researcher, with an ethos of utter concern for the patient against all comers and to the very edge of scientific and medical knowledge. On the other, the depiction of *House of Lies,* where academics have no on-screen role at all, and the use of research is that of leveraging a sale, exploiting practitioner gullibility when faced with the rhetorical authority of "evidence". The issue here is neither to say that all physicians are, or should be, as superhumanly competent and committed as Gregory House, nor that all consultants are, or might be, as cynical and conniving as Marty Kaan. It is rather to intimate that the fact that one and the other characterizations are publicly plausible. And that might be a way of expressing our concern succinctly.

The inclusiveness of medical journals (venues that admit far more than written scientific articles) poses a variety of questions concerning Management journals (venues that admit little but written scientific articles). This might offer the opportunity of a new look at editorial accountability. At the very least, it would appear to challenge the idea that Management is "practice-centered", as contributions that do not conform to academic canon are neither valued nor published. This poses the question of how much effort is directed at actually bridging the gap as opposed to bemoaning it.

Researchers and practitioners are not the only members of the community of users and contributors that are published in the top-ranked venues in Medicine. EBMed philosophy expresses this understanding. Top medical journals are a mosaic of communications: respectful, aware, informed, designed to serve all that belong to the community – patients, physicians, scientific and medical researchers, the public, policy makers, among others. Respectful awareness of alterity, seeing publication as dialogical occasions, might be the central notion in this. It acknowledges a community that shares the interest of the pursuit of the mandate of Medicine, made of fundamentally different participants, with distinct concerns and contributions valued and published *on equal standing*.

Academic researchers of Management, the science, might be the whole of the community of contributors of what is published in the top-ranked journals in Management. To argue that this is an inherent, immutable reality of the field of Management would not seem to hold any water – it simply excuses keeping things as they are. It should be clear, with the benefit of EBMed, that the various gaps can be bridged, but that they cannot be closed. Medicine has at least as many dialogical bridges as there are gaps – for which they developed PubMed/MEDLINE as a dialogical tool. The contrast with Management is stark, and that with EBMgt might be even harsher. There is no acknowledgement of the different gaps in Management, nor of the need for different bridges, nor yet of their necessary dialogical character. No use, and thus no concern, for the development of dialogical tools.

EBMgt, as all evidence-based practices, should be committed to the reduction, aspiring to the elimination, of biases. That it does not act vigorously against, e.g., the continued crowding out of practitioners' contributions from publication in Management is thus problematic. EBMgt adheres preponderantly to academic canon and venues. It proposes scientific-informed practice, a one-way street of discourse, not dialogue. It seems unavoidable to conclude that such practice corresponds to *selection bias* – contradicting its self-identification of being evidence-based, and sabotaging efforts to bridge "the gap". It might even be the case that, rather than being committed to bridging "the gap" and failing at it, EBMgt might in fact be engaged in preserving it.

That there are many gaps in "the gap" is not the real problem. Neither are Management's difficulties and disappointments. Nor is EBMgt's failure to deliver on its promises. Rather, the real problem lies in how one chooses to cope with these many gaps.

Medicine, as a community of dialogue, gives evidence of the benefit of a clear-cut distinction between science and profession, as well as of the respectful awareness of different interests and contributions that must belong to such a community. As a result, top medical journals acknowledge, further and value all modes and contents of communication. It was to serve this community of dialogue that PubMed/MEDLINE was conceived – a dialogical tool.

The situation is very much another in Management. The near hegemony of the academic canon of Management, the science, has hobbled the maturity of a

community of dialogue. The many calls and attempts at "bridging the gap" have produced something more akin to half-bridges. A span sprouts from academics but never reaches across. It stops mid-air, towering over the profession, with no concern for the nature of the gaps below. From it, academics from Management, the science, stand aloof, supreme over Management, the profession, to preach its practitioners (who could much improve their decisions if they were "informed by science" as EBMgt proposes, e.g.) and to disdain its researchers ("Heathrow literature", e.g.).

Half-bridges do not lead to dialogue. They are platforms for discourse – lecterns or pulpits. The real problem in Management is the taking of half-bridges for bridges. The real problem is not that there are gaps, but the attitude of Management, the science, including EBMgt, towards their existence – beginning with the failure to acknowledge that there is more than one gap. This is what has hobbled, and continues to prevent, the emergence of a community of dialogue in Management. This is the supreme, most important, and most far-reaching lesson of Medicine's experience with EBMed for Management.

6.3 Epilogue

"Of Gaps and Bridges" was written a few months before the papers in Part I, in which the "proto-" adjective was introduced to characterize the science and the profession of Management. However, the additional discussion on the field's maturity does not change the conclusions "Of Gaps and Bridges" arrived at: that there is more than one gap, each requiring specific dialogical bridges ─ dialogue being the key issue. Given the slightly different approaches to defining "the gap" in the more recent papers from Part I and "the gaps" in "Of gaps and bridges", it seems opportune to synthesize the current understanding of the issue in light of the Science-Profession framework (see section 2.3).

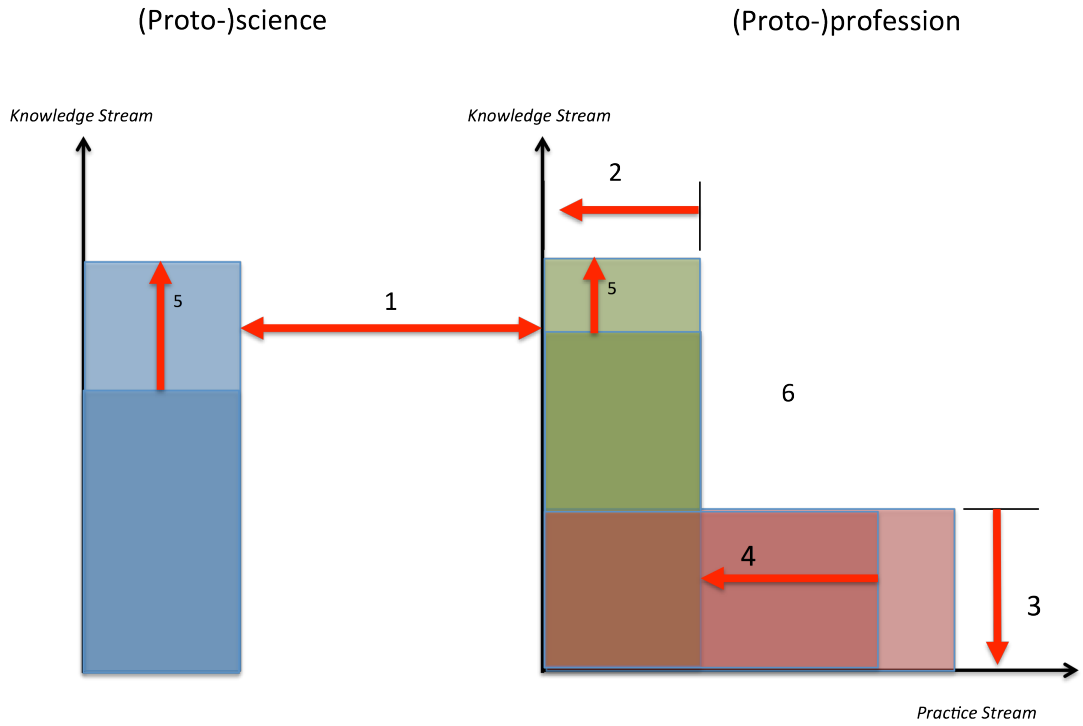

Figure 4 - A synthesis of the gaps within the Science-Profession Framework

Source: The author

Figure 4 presents a synthesis of "the gaps" the paper discussed. The first was framed as "the gap between research and practice" in accordance with the common understanding of the field, but was reframed as a gap between science and profession ─ that is, the main gap the two first papers in Part I discussed. The second was a "researcher-practice gap", which is an occupational hazard, researchers growing

distant from practice as result of specialization (hence, narrowing the practice stream component of a researcher's state of the art). The third, "the research-practitioner gap", is analogous. The fourth, "the practitioner-research gap", refers to the degree in which practical learning is incorporated in the profession's state of the art and, particularly, in professional research. The fifth, "the researcher-research gap", is manifested both in professional and in scientific disciplines. Closing (not bridging) this gap means being up to date with the latest research findings, which is part of a scientist and a researcher's mandates, although this is logically impossible. The sixth, "the researcher-practitioner gap", is not an epistemic gap like the previous ones. Rather, it is a relational gap, a consequence of failures to promote a shared identity and prolific dialogue among researchers, practitioners and scientists.

"The gaps" this chapter framed are not exclusive of management. Neither they are unexpected problems. Rather, they are more akin to challenges professions (but also sciences) have to face in their evolution. What is specific to the field of management is the way the gaps are perceived and the remedies and bridges constructed. There are, logically, many other gaps but the ones we discussed, such as the practitioner-practice gap (which is the gap between a practitioner and the current "best practice" of the field. However, for concision, the author decided to explore those that appeared to be most significant for the thesis' purposes.

7 A tale of two evidence-based approaches:[9] Management and Software Engineering

7.1 Prologue

"A Tale of two Evidence-based Approaches: Management and Software Engineering", or simply "A Tale", compares the first decade of Evidence-based Management (EBMgt) with that of Evidence-based Software Engineering (EBSE). It portrays a picture that resembles Aesop's fable *The Ant and the Grasshopper*.

Since its very beginnings, EBSE engaged in hard work and developed several methodological alternatives to traditional research in the field. Evidence-based practice in Software Engineering under the leadership of Barbara Kitchenham, a genuine leader of the EBSE movement, developed novel methods for systematic literature reviews and systematic mapping of the extant literature on the field. In its first years, Evidence-Based Management engaged in the same trajectory under the leadership of Tranfield and Denyer (Tranfield, Denyer & Smart, 2003). However, EBMgt under Rousseau's influence (Rousseau, 2006) abandoned the same trajectory and decided to sing to practitioners. Perhaps what EBMgt ended up singing was nothing more than a siren song.

The duality "A Tale" expresses is a duality between hope and delusion. Hope, because EBMgt is a much-needed solution for the never-ending crisis. Delusion, because its first decade suggests that something else might have gotten in its way.

[9] Section 3 and part of the conclusions of this paper were originally written in April, 2013 by the author, by Prof. Roberto Bartholo and by Prof. Domício Proença Jr. as the third section of paper submitted to a special issue on "Teaching Evidence-based Management" from Academy of Management Learning and Education. The other sections have been added by the first author in December, 2013.

7.2 Full Text

Abstract

This paper benefits from the experience of Evidence-based Software Engineering (EBSE) to investigate limits and limitations of Evidence-based Management (EBMgt). It reconstructs the history of EBMgt's first decade and identifies three competing proposals for its scope and breadth: (a) a methodological proposal whose focus is the development of methods for better, less biased knowledge production; (b) a proposal whose focus is closing or bridging the "gap of Management"; (c) a proposal whose focus is to be sold to practitioners. Next, we underscore the methodological emphasis EBSE adopted since its very beginnings, highlighting the development of Mapping Studies, its inclusive publication policies and the support for tertiary, panoramic articles. We argue that the problem with Evidence-based Management was its overemphasis on practitioners instead of researchers, on "closing the gap" instead of developing more and better methods for knowledge production. The curious incident of Evidence-based Software Engineering shows that Evidence-based Management can be a good idea, but its first decade reveals a history of unfulfilled promises and irrelevance both to researchers and to practitioners.

1. Introduction

In its decade-long history, many scholars have wondered about the shortcomings of Evidence-based Management (EBMgt). Some, like Learmonth & Harding (2006), say that the problem is the 'very idea' of EBMgt, and Learmonth (2006) considers the hierarchy of evidence a backlash against the methodological pluralism that would characterize the field of Management.

But is there something *wrong* with Evidence-based Management? Mainstream academic research and the world of practice seem largely unaffected by the evidence-based movement, despite the fact that EBMgt has received considerable publication space, both in academic journals (e.g., Rousseau, 2006; Rousseau & McCarthy, 2007; Rynes, Giluk & Brown, 2007; Rousseau, 2009; Briner & Rousseau, 2011) and in

books (Latham, 2011; Locke, 2009; Pfeffer & Sutton, 2006; Rousseau (ed.) 2012). Rather than being a unity, EBMgt would admit at least three foundational variations:

(1) Tranfield and Denyer's EBMgt is a methodological proposition that aims at improving research and focuses on developing better, less biased knowledge.

(2) Rousseau's EBMgt is a desideratta that promises to close (later, bridge) the much maligned divide between research and practice.

(3) Pfeffer and Sutton's EBMgt is described as "sound logic and analysis", unfalsifiable (that is, non-scientific) fundamentals for managerial decisions.

We argue that what might be wrong with EBMgt stems from the preponderance of Rousseau's EBMgt due to its influential proponent and publishing success. Rousseaunian EBMgt became increasingly all-inclusive. This foreswore the *raison d'etre* of evidence-based practices: the elimination of biases.

In stark contrast, Evidence-based Software Engineering (EBSE) made the elimination of biases, systematicity, the core and the guide of its activities. Kitchenham's methodological proposals became the backbone for the development of EBSE:

1. The priority for secondary results, such as mapping studies and subsequent systematic reviews;
2. The support for efforts that can produce tertiary results, both in terms of panoramic surveys of the field and methodological refinement as well; and
3. Publication policies that acknowledged secondary and tertiary results as having the same value as primary, theoretical or empirical texts.

In our concluding thoughts, we argue that the problem with Evidence-based Management was its overemphasis on practitioners instead of researchers, on "closing the gap" instead of developing more and better methods for knowledge production and evaluation. The curious incident of Evidence-based Software Engineering shows that Evidence-based Management can be a good idea; the whole problem is which proposal is to be adopted.

The paper is structured as follows. Section 2 summarizes the first decade of Evidence-based Management. It shows that there are three very different proposals for what EBMgt is and should be: Tranfield and Denyer's, Rousseau's, and Pfeffer and Sutton's. Tranfield and Denyer's EBMgt is methodological, aimed at research, focused on developing better, less biased knowledge production and evaluation processes. Rousseau's EBMgt is science-biased, aimed at the intersection between research and practice, focused on closing or bridging the widely recognized "research-practice" gap of Management by blaming practitioners and making them adopt her (and her collaborators') recommendations. Pfeffer and Sutton's EBMgt was more akin to the fads and fashion they supposedly aimed to substitute, and was abandoned after their 2006 book. The first 10 years of EBMgt are then characterized as the preponderance of Rousseau's EBMgt over Tranfield and Denyer's.

Section 3 summarizes the first decade of Evidence-based Software Engineering. It shows that despite sharing Evidence-based Medicine (EBMed) as model and inspiration, EBSE chose very differently from EBMgt, facing similar constraints. We underscore the methodological emphasis EBSE adopted since its very beginnings, highlighting (a) the methodological developments achieved in, and publication space given to, Mapping Studies, (b) the publication policies that decided to accept for publication on equal standing more than theoretical, academic papers, (c) the support and publication space for tertiary, panoramic articles. In our concluding thoughts, we argue that the problem with Evidence-based Management was its overemphasis on practitioners instead of researchers, on "closing the gap" instead of developing more and better methods for knowledge production and evaluation. The curious incident of Evidence-based Software Engineering shows that Evidence-based Management can be a good idea; the whole problem is which proposal is to be adopted.

2. The first decade of Evidence-based Management

Although it is widely accepted that Evidence-based Management's precursors were Rousseau (2006) and Pfeffer & Sutton (2006) (e.g., Ashkanasy, 2007; Cascio, 2007; Lawler III, 2007; Rynes, Giluk & Brown, 2007), Evidence-based Management was originally proposed in a paper published in 2003 (Tranfield, Denyer & Smart, 2003). A possible reason for such misattribution is that the very expression "Evidence-based Management" was not used by Tranfield, Denyer & Smart (2003), although an earlier

version of the manuscript submitted to EURAM did use it once in the abstract (Tranfield, Denyer & Smart, 2002a) and another to Academy of Management might possibly have used the term as well (Tranfield, Denyer & Smart, 2002b). Rather, they preferred to label it as "Evidence-informed Management" instead of "evidence-based", yet recognizing that the latter was the widely adopted denomination in other fields. This methodological paper discussed the origins and the need for evidence-based approaches in other fields, the paramount importance of the systematic review as a knowledge production method, the key role hierarchies of evidence play in knowledge evaluation, compared the fields of management and medicine (since Evidence-based Medicine, EBMed, is the inspiration for all other evidence-based initiatives) and, last and most importantly, provided six pages of explanation on how to undertake a systematic review, adapting insights from Medicine to Management. One year later, the *International Journal of Management Reviews (IJMR)* published a special issue (vol. 5/6, September-December) in which all reviews adopted the systematic review process outlined by Tranfield, Denyer & Smart (2003) (Denyer & Neely, 2004).

The combination of a seminal methodological paper and its application in one of the most important journals devoted to secondary studies in the field of Management seemed to point out to a promising future for the development and consolidation of Evidence-based Management's knowledge production and evaluation methods. In 2005, however, in her Presidential Address to the American Academy of Management, published a year later (Rousseau, 2006) for some strange reason Denise Rousseau failed to mention Tranfield, Denyer & Smart (2003), Denyer & Neely (2004), the reviews on the 2004 IJMR's special issue (Edwards, Battisti & Neely, 2004; Leseure *et al.*, 2004; Pittaway *et al.*, 2004), or any other literature review citing Tranfield, Denyer & Smart (2003) (which, at that time, also included Buchanan *et al.*, 2005; Farashahi, Hafsi & Molz, 2005; Franco-Santos & Bourne, 2005; Garengo, Biazzo & Bititci, 2005; Micheli & Kennerley, 2005; Thorpe *et al.*, 2005). In the same year, Stanford's Professors Jeffrey Pfeffer and Robert Sutton published their book (Pfeffer & Sutton, 2006), whose subtitle is "Profiting from Evidence-based Management". Largely aimed at practitioners, this book argues to explain, among other issues, why every company needs Evidence-based Management (chapter 1), how to practice Evidence-based Management (chapter 2) and how to profit from Evidence-based Management (chapter 9). As in the case of Rousseau (2006), it also

fails to cite any hitherto developments in Evidence-based Management, at that time leaded by UK researchers and the British Academy of Management journals. Since 2006, three very different interpretations of what EBMgt was and should be emerged:

1. First, by the hands of Tranfield and Denyer, EBMgt aimed at research; it aimed at developing methods for better, less biased knowledge production and evaluation processes. Hence, Tranfield and Denyer's EBMgt was primarily focused on researchers, with little or no concern for the role practitioners, the public and policymakers should play, although acknowledging the benefits of a more robust and less biased knowledge base for all stakeholders.

2. Second, by the hands of Denise Rousseau, EBMgt aimed at the intersection between research and practice; it aimed at "closing the research-practice gap" (Rousseau, 2006: 256). Rousseau's EBMgt blamed practitioners for the growing distance between research and practice, as she saw such gap as "the failure of organizations and managers to base practices on best available evidence" (Rousseau, 2006: 256). Hence, Rousseau's EBMgt was intended for practitioners, with little or no concern for changing knowledge production and evaluation processes. The role she saw for academics in EBMgt was that of providing better education: "manage student expectations" (Rousseau, 2006: 265), "provide models of evidence-based practice" (Rousseau, 2006: 265), "Promote active use of evidence" (Rousseau, 2006: 266) and "build collaborations among managers, researchers, and educators" (Rousseau, 2006: 266).

3. Third, by the hands of Pfeffer and Sutton, EBMgt aimed at practice; it aimed at making practitioners use their recommendations ─ which they limited to the use of sound logic and analysis, providing seven guidelines for practice: "1. Treat old ideas as if they are old ideas" (Pfeffer & Sutton, 2006: 42); "2. Be suspicious of 'Breakthrough' ideas and studies" (Pfeffer & Sutton, 2006: 44); "3. Celebrate and develop collective brilliance, not lone geniuses or gurus" (Pfeffer & Sutton, 2006: 45); "4. Emphasize virtues and drawbacks" (Pfeffer & Sutton, 2006: 47); "5. Use success (and failure) stories to illustrate sound practices, not as a valid research method" (Pfeffer & Sutton, 2006: 48); "6. Take a neutral, dispassionate approach to ideologies and theories" (Pfeffer & Sutton, 2006: 49); "[7.] Wisdom: the most important thing" (Pfeffer & Sutton, 2006: 52).

There is little or no doubt that Rousseau's Evidence-based Management became preponderant over the other proposals. Among the several factors that can explain it, one of the most significant of them was that Rousseau's address as President of the American Academy of Management, published in the highest-ranked journal in the field, found echo in the endless debate on the growing distance between academic research and the practice of Management. Rynes, Giluk & Brown (2007) was among the first to cite Rousseau (2006) (and emulate her silence about Tranfield, Denyer & Smart, 2003 and Pfeffer & Sutton, 2006) in reference to the intersection between "the gap" and "Rousseau's EBMgt", followed by others such as Ashkanasy (2007), Cascio (2007) (that do not cite Rousseau, 2006, but cite Rynes, Giluk & Brown, 2007) and Lawler III (2007) (likewise). In 2007, Rousseau & McCarthy (2007) was Rousseau's second paper on EBMgt, further developing the needs for educating evidence-based Managers but again, with little or no emphasis on knowledge production and evaluation methods. Although Pfeffer and Sutton's proposal was limited to their book (that found little or no echo in later academic discussions on EBMgt besides its role in the beginnings), Denyer and Tranfield went on in their attempts at methodological development and published Denyer & Tranfield (2006), which introduced meta-analysis and qualitative synthesis techniques, Denyer, Tranfield & van Aken (2008), which combined Denyer and Tranfield's research synthesis methods with van Aken's XYZ logic for design propositions, and Denyer & Tranfield (2009), which provided further explanation on how to produce a systematic review. However, such contributions had no repercussion comparable to Rousseau's papers. After 2008, Rousseau and Denyer started coauthoring articles (Rousseau, Manning & Denyer, 2008; Briner, Denyer & Rousseau, 2009), but at that time Denise Rousseau and her interpretation of EBMgt was predominant, as her solo editorship of the recent *"The Oxford Handbook of Evidence-Based Management"* (Rousseau (ed.), 2012) and her several recent articles on the topic (Rousseau, 2009; Rousseau & Barends, 2011; Rousseau, 2012a) show. Another more recent indicative is that Denyer's contribution to the handbook is limited to a chapter on Systematic Literature Reviews (Briner & Denyer, 2012) ─ as a matter of fact, the only methodological chapter, which discusses how researchers can actually practice evidence-based management, whereas the others are focused on discussing aspects such as how to convince practitioners to use research findings (e.g., Giluk & Rynes-Weller, 2012).

Rather than changing over time, Rousseau's EBMgt has continued to adopt the very same principles enunciated in her 2006 paper. Let us draw evidence from the Evidence-based Management Handbook (Rousseau (ed.), 2012), and scrutinize our arguments. That the book is aimed at practitioners is explicit: "this handbook is intended to promote EBMgt's broad use in for-profit businesses, nonprofit organizations, and government" (Rousseau, 2012c: xxiii). That Rousseau's EBMgt is aimed at practitioners is also explicit: "EBMgt is an evolution in management practice and the way professional managers are educated" (Rousseau, 2012b: 3). That it is aimed at bridging the gap is clear by the chapter that points out that EBMgt is a solution to the gap (Leung & Bartunek, 2012) and also by Rousseau herself (Rousseau, 2012b: 20). That it blames practitioners for the existence of the gap is clear by the chapter that points out why practitioners resist to research findings, implying that they should not (Giluk & Rynes-Weller, 2012), although Rousseau herself also recognizes that "closing the gap between research and practice in this and other areas requires greater researcher contact with the problems and decisions practitioners face" (Rousseau, 2012b: 20). Rousseau (2012b, 2012c) identifies three groups involved in EBMgt: practitioners and educators, which she previously identified, and researchers, whose four roles are "conduct research that explicates the actual content and processes of decisions made in organizations" (Rousseau, 2012b: 20), "support evidence use in the ways scholars approach peer review" (Rousseau, 2012b: 20), "support and participate in Systematic Reviews, including meta-analyses, to identify conclusions the evidence supports" (Rousseau, 2012b: 20) and develop "practice-oriented research deliberately undertaken to provide scientific knowledge that informs practice" (Rousseau, 2012b: 20).

3. The first decade of Evidence-based Software Engineering

Despite Herbert Simon's expectation that management, medicine and engineering would all be sciences of the artificial, design sciences or design disciplines (Simon, 1969/1996), it is somewhat surprising how little engineering has served as a reference in Evidence-based Management (EBMgt). This is the more striking since evidence-based practice is so ingrained and constant in engineering as to fail to be an issue (van Aken & Romme, 2012: 46). It would then seem to be doubly opportune to offer a few

remarks on the trajectory of Evidence-based Software Engineering (EBSE), which offers more than one parallel with EBMgt. Software Engineering and Management admit being described as the two sides of sociotechnical systems design: one more focused on technology, the other on the social. Further, both Management and Software Engineering saw the emergence of proposals for evidence-based approaches approximately at the same time, about a decade ago. What makes the EBSE story interesting is that, facing similar constraints, how EBSE chose so differently from EBMgt, despite sharing Evidence-based Medicine (EBMed) as model and inspiration.

Perhaps there is something in the old proverb that a long journey begins with the first step, and that first step sets the tone for the whole journey. The foundational text of EBSE is Kitchenham's (2004) report, that outlined methodological guidelines (some of which were anticipated in Kitchenham *et al.*, 2002). Given support and a welcoming reception, she led its review and expansion (Kitchenham & Charters, 2007), offering suggestions and insights on how to adapt EBMed's practices of hierarchy of evidence, systematic literature reviews and meta-analysis to the realities of software engineering practice. EBSE faced the impossibility of emulating the massive, and traditional apparatus of EBMed in terms of sources and resources by devising solutions that allowed approximations. It sought to remedy the lack of the infrastructure for actual EB software engineering scholarship. This led to three articulated approaches.

The first, and arguably the most significant, was the acknowledgement that Mapping Studies would be prominent in EBSE. This was something required by EBSE's reality. EBMed could rely on an apparatus that was increasingly comprehensive, integrated, indexed, independently mapped and reviewed. While an unbiased systematic map could be a few clicks away from medical researchers or practitioners, there was nothing similar in software engineering for EBSE. This would make systematic literature reviews either impossible or impose the cost and effort of an original systematic map on every practitioner or researcher. Starting from 2004, systematic mapping began to appear. Table 5 summarizes the trajectory of adoption of mapping studies and systematic literature reviews in software engineering. Da Silva *et al.* (2011), Kitchenham *et al.* (2009) and Kitchenham *et al.* (2010) identified 68 software engineering mapping studies published between 2004 and 2009 – a veritable flood. In the same period, 52 systematic reviews were published (Kitchenham *et al.*, 2010). They were supported by methodological commentary and improvements as

well as by many tertiary methodological studies that clarified procedures and sought to evaluate achievements and shortcomings of existing guidelines (e.g., Babar & Zhang, 2009; Dieste & Padua, 2007; Dyba, Dingsoyr & Hanssen, 2007; Dyba & Dingsoyr, 2008; Goulao & Abreu, 2007; Jalali & Wohlin, 2012; Kitchenham, Budgen & Brereton, 2006; Kitchenham, Brereton & Budgen, 2010; Kitchenham, Budgen & Brereton, 2011; Macdonell *et al.*, 2010; Medeiros Dos Santos & Travassos, 2013).

Table 5 –Evolution of Systematic Reviews and Mapping Studies in Software Engineering

	Mapping Studies		Systematic Reviews		% Per Year	
Year	Total	EBSE	Total	EBSE	% MS	% SLR
2004	0	0	6	1	0%	100%
2005	2	0	9	5	18%	82%
2006	2	0	7	6	22%	78%
2007	8	3	7	6	53%	47%
2008	17	14	11	8	61%	39%
2009	39	32	12	9	76%	24%
Total	68	49	52	35	57%	43%

Source: Compiled from Da Silva *et al.* (2011), Kitchenham *et al.* (2009) and Kitchenham *et al.* (2010).

Note: "EBSE" column refers to the amount of studies citing Kitchenham's guidelines or identified as part of the EBSE movement.

The second was facing head-on what this meant in terms of publishing policies in the most important venues, particularly in terms of publication in JCR-indexed journals. Beyond the general acceptance of systematic papers without the requirement of original, theoretical contributions, there were clearer signs that EBSE was being valued, and EB work, stimulated. In 2005, *Information Systems Technology* Journal announced it would support a regular section devoted to mapping studies and systematic literature reviews (Dyer, Shepperd & Wohlin, 2005). *Empirical Software Engineering* became the second destination for EBSE after the publication of a special issue on EBSE (Maldonado & Wohlin, 2008).

The third approach was the support for what can be classified as tertiary, panoramic studies, that assessed the development of the field from a pragmatic, critical point of view. The indefatigable Kitchenham *et al.* (2009) produced a systematic review of systematic reviews in software engineering, updated it a year later (Kitchenham *et al.,* 2010), and then published a similar study on mapping studies in software engineering (Kitchenham, Budgen & Brereton, 2011). Da Silva *et al.* (2011) updated Kitchenham's panoramic tertiary studies in 2011. The EBSE community promoted two international workshops on Realizing Evidence-Based Software Engineering: the REBSE Workshops of 2005 and 2007 (Budgen *et al.*, 2005, 2007). In parallel with such efforts at methodological adaptation, the inspiration from successful experiences of EBMed lives on. Recently, the *Empirical Software Engineering* journal called for industrial experience reports that would allow single-case experiences of application to be published by practitioners on equal standing with articles, mapping studies, or literature reviews by researchers.

It would appear that EBSE is not concerned with the gap, as such, as much as firming its own side of it and throwing over its one-way bridge to invite practitioners over. EBSE seems to trust that, eventually, a similar one-way bridge will appear as practitioners find use for what EBSE has to offer. EBSE's debate on the research-practice gap seems thundering for its silence; it has been the subject of a single paper (Dyba, Kitchenham & Jorgensen, 2005). Researcher-led EBSE would seem to perceive itself primarily as a necessary upgrade on how software engineering organizes, or should organize, the demarcation, production, accumulation, retrieval and evaluation of all knowledge that might be pertinent to research, practice, teaching, and learning. It might well be that EBSE simply adhered more closely to a philosophy akin to that of EBMed. It will succeed, if it succeeds, only if it acknowledges and propitiates dialogue between the differing perspectives and roles of researchers and practitioners. This means a community in which researchers research, practitioners practice, with such bridges between them as opportune and necessary. The inclusion of practitioner experience on the same level and publication-worthiness as scientific papers and mapping studies or systematic reviews would seem most promising.

4. Concluding thoughts

The previous sections characterized the decade-long history of Evidence-based Management (EBMgt) and of Evidence-based Software Engineering's (EBSE). Section 2 characterized the first decade of EBMgt as the abandonment of contributions aimed at developing better, less biased methods for knowledge production and evaluation (such as Tranfield and Denyer's) over contributions aimed at promoting EBMgt to practitioners as a solution to the so-called research-practice gap (such as Rousseau's). Section 3 characterized the first decade of EBSE as the development of better, less biased methods for knowledge production and evaluation. Contrasting both cases, it seems evident that the problem with Evidence-based Management was its change of focus, which started after Rousseau's presidential address and Pfeffer and Sutton's (2006) book, and the repercussion that followed. And this is the problem of Evidence-based Management: it lost its way in 2006, and has been lost ever since.

The experience of Medicine/EBMed and Software Engineering/EBSE might be seen as straddling that of Management/EBMgt in time. Millennium-long medical practice, research, and learning, resulting in a centuries-long effort to articulate and make available the sum of medical knowledge, and further of any knowledge of potential value to medical practice. Decades-long software engineering practice, research and learning, resulting in the recent years' researcher-led effort to outline, map, articulate and induce the maturity and availability of software engineering knowledge, considering even at this early stage the need to consider varied sources and types of knowledge. Century-old managerial practice has no clear proposal for a counterpart as yet. Considering these aspects, and taking into account the very different profiles of EBMed and EBSE, it becomes possible and opportune to discuss what might be learned from them that would benefit EBMgt. This is a vast subject. It needs to avoid the hopeless ambition of simple replication of, say, EBMed, for which there are no resources in EBMgt. It also needs to avoid its converse, the inertia of simple refusal, dismissing potentially useful parallels on the grounds of differing subjects, forms of communication, or methodological preferences.

The emulation of EBMed by EBSE poses a variety of questions concerning what researchers prioritize in their research, and the extent to which relevance can, or should, be considered in some sort of opposition to rigor. It is unavoidable to contrast

EBSE's choices with EBMgt's priorities. EBSE's concerns have focused on firming its own side of the gap, and of late, with opening the valued venue of publication for practitioners as a first, tentative bridge. EBMgt's concerns about the quality or capacity of practitioners to appreciate the worth of what it can offer might be altogether relevant. However, it might have subtracted resources from the task of firming EBMgt's researchers' side of the gap. It is even conceivable that this might express the idea that "the gap" could be altogether closed, not bridged. If that would indeed be the case, this should be discussed more explicitly – as it does not seem to stand.

When it comes to comparing EBSE's efforts to "firm its side of the gap" with EBMgt's, a grim picture seems to emerge. Although there have been attempts at emulating EBMed's systematicity of reviews by EBMgt (e.g., Denyer, Tranfield & van Aken, 2008; Denyer & Tranfield, 2009; Rousseau, Manning & Denyer, 2008; Tranfield, Denyer & Smart., 2003), there seems to have been comparatively little appreciation of the utility of mapping studies – and all that implies. EBMgt does face the challenge of adopting the evidence-based approach to a design discipline so connected to the social sciences. Rather than make EBMgt timid, perhaps the example of EBSE should be a call to make it bold.

7.3 Epilogue

This chapter makes use of the case of Evidence-based Management as a proxy to discuss the proto-science of Management's ideology. It presses charges against mainstream Evidence-based Management initiatives, highlighting the abandonment of a more methodological endeavor in favor of advertisement and selling to practitioners. It shows how Evidence-based Software Engineering chose differently, and collectively decided to develop better research methods and to mitigate the gaps pointed out in "Of gaps and Bridges".

"A Tale of Two Evidence-based Approaches" is perhaps the most provocative paper against Evidence-based Management (EBMgt). It exposes EBMgt as a rhetorically progressive, yet in practice conservative, initiative. It provides evidence that EBMgt ignores the insurmountability of the gap between science and profession (as in "Of gaps and Bridges") and also that EBMgt ignores the very existence of the difference between science and profession ─ further, it seeks to show that EBMgt's mainstream is sheer *Gerede* - empty rhetoric. EBSE aimed at strengthening its research methods without adhering to a scientific canon, whilst mainstream EBMgt abandoned methodological rigor to focus in spreading its discourse to practitioners.

The problem is not with Evidence-based Practice, or with Evidence-based Management, or even with Evidence-based Management's supporters. The root cause for this problem is the dominance of the scientific epistemic foundation. As EBMgt's supporters follow the scientific epistemic foundation and see themselves as having a lot to teach, but little or nothing to learn from practitioners' nonscientific competence.

In its very beginnings, Evidence-Based Management was a promising aid for the evolution of both the proto-science and the proto-profession. It was a methodological proposal aimed at reducing research biases. The problem came later, when an alternative proposal led by Rousseau anchored at the scientific epistemic foundation changed EBMgt's focus, introducing the superiority of science over non-science and relegating methodological developments for an appendix.

EBMgt is a deception and a delusion. It is a delusion because it is a deception. If "A Tale" were to have a more provocative, fashionable title, it could be, "You were the Chosen One!", in reference to Obi Wan Kenobi's exclamation to Anakin Skywalker

in the Duel on Mustafar, the last duel in Star Wars Episode III.[10] Evidence-based Management could bridge the volcanoes in the Temple of Volcanus, but it decided to aim at advertising and selling their activities as they were, and to mask them as science. And that is precisely Bunge's (1983) criterion to identify a pseudoscience. This is the deception. The delusion comes when one recognizes how useful the evidence-based approach was in transforming Medicine (as in "Of Gaps and Bridges", the previous chapter) and Software Engineering ("A Tale", this chapter), and how useful it could be to Management. EBMgt had to serve the proto-profession of Management if it were to transform Management. EBMgt had chosen to serve its own interests. This is the delusion.

[10] Obi Wan said, "You were the Chosen One! It was said that you would destroy the Sith, not join them! Bring balance to the Force, not leave it in darkness!" (http://starwars.wikia.com/wiki/Duel_on_Mustafar, 06/jan/14).

8 Conclusions

8.1 The Realm of the Nonscientific: Professions versus Mythology

For the sake of clarity, let us review what is perhaps the most contradictory argument in the thesis: that the dominance of scientific epistemic foundations is bad for Management.

To argue that science is bad requires courage, and above all, clarification. It is unquestionable that Science, and the scientific method, are of paramount importance to the cultural evolution of mankind. The point is that, as Petroski (2010) claims, we cannot expect that science alone will solve our problems. Science is not a complete substitute for ingenuity, creativity, and for whatever nonscientific means to achieve desired ends. Science uses ingenuity and creativity. What Feyerabend ultimately means is that Science even uses nonscientific methods to evolve (Feyerabend, 2010). Science helps whenever it is available, but the progress of civilization cannot be confined to the progress of science.

The whole problem with criticisms to Science is the opposition between Science and myth, religion, magic. To criticize Science and to affirm an equal standing between scientific epistemic foundation and professional epistemic foundation is not to level scientific knowledge and method with those of magic, myth, or religion. Professions involve mythology and religion, including management's use of saints (Rousseau, 2009) and spiritualistic procedures (Rousseau, 2012a), this thesis' use of the myth of Hephaestus/Volcanus, and the various instances of the medical aid of religious beliefs to strengthen a patient's moral forces in recovery and rehabilitation. However, it seems important to point out that the thesis' arguments have nothing to do with legitimizing magic, myth or religion, or with delegitimizing Science. The thesis aims at putting things in their proper places and to spread the word that professions are another animal: it aims at legitimizing professional epistemic foundations for professions, and scientific epistemic foundations for sciences. Myth, magic and religion are yet another story.

8.2 Doing Science, Using Science, Being Science

A final reflection on the thesis' conclusions is about the difference between *doing* science, *using* science, and *being* science. In what concerns our discussion on the relationship between professions and sciences, it must be clear that professionals can do science, professions can use (in the sense of benefitting from) science, but that professions are not science: to be is not to do or to use ─ quite an obvious formulation, but which can lead to the misunderstandings the thesis attempted to expose.

Doing science is an act of people with formal education in scientific disciplines ("scientists"), but also of people without it ("nonscientists", professionals included). Professionals may engage in doing science whenever it becomes necessary, whenever one needs or wants to expand what is known about a specific phenomenon. Doing science requires adherence to knowledge production standards ─ "the scientific method" ─ although what "scientific method" consists of is questionable. Einstein's famous thought experiments are instances of unorthodox scientific method: his findings are more associated with an inventive, brilliant mind, than with careful and systematic experimentation. The Higgs boson is another example. But both the acceptance (or the non-refutation, to be more precise) of Einstein's theory and of the Higgs boson can take time, because systematic experimentation is required. The key issue with "doing science" is that, to paraphrase what Lakatos (1978) once said about science as a whole, to attribute to an individual contribution the title of "under the scientific method" and hence that one is "doing science", either by thought experimentation or by systematic experimental research, may be a category mistake (Lakatos, 1978: 34 in the original).

Using science is incidental, and as such, it is not an intrinsic part of Science's mission. If a scientific theory, or even a scientific field as a whole, has any utility for practice, that may be the fortune of a profession, but not to the science in question. Practical implications does not, and cannot, direct Science's efforts in unveiling the unknown.

Being science is essentially a philosophical discussion, a problem of classification. It depends fundamentally on the demarcation criteria being used, which is the subject *per excellence* or philosophy of science. It is not our intention to engage in this debate, but it seems sufficient to add to Bunge's (1983) demarcation criteria (see

section 3.3) a few remarks on Lakatos' demarcation criteria, for this seems to be the most comprehensive criteria, with which Bunge's (1983) arguably converges and which Bunge (1983) arguably expands:

> "The idea of competing scientific research programmes leads us to the problem: how are research programmes eliminated? It has transpired from our previous considerations that a degenerating problemshift is no more a sufficient reason to eliminate a research programme than some old-fashioned 'refutation' or a Kuhnian 'crisis'. Can there be any objective (as opposed to socio-psychological) reason to reject a programme, that is, to eliminate its hard core and its programme for constructing protective belts? Our answer, in outline, is that such an objective reason is provided by a rival research programme which explains the previous success of its rival and supersedes it by a further display of heuristic power" (LAKATOS, 1978: 69, emphasis in the original).
>
> "My account implies a new criterion of demarcation between 'mature science', consisting of research programmes, and 'immature science' consisting of a mere patched up pattern of trial and error. For instance, we may have a conjecture, have it refuted and then rescued by an auxiliary hypothesis which is not ad hoc in the senses which we had earlier discussed. It may predict novel facts some of which may even be corroborated. Yet one may achieve such 'progress' with a patched up, arbitrary series of disconnected theories. Good scientists will not find such makeshift progress satisfactory; they may even reject it as not genuinely scientific. They will call such auxiliary hypotheses merely 'formal', 'arbitrary', 'empirical', 'semi-empirical" or even 'ad hoc'" (LAKATOS, 1978: 87, emphasis in the original).
>
> "Mature science consists of research programmes in which not only novel facts but, in an important sense, also novel auxiliary theories, are anticipated; mature science ─ unlike pedestrian trial-and-error ─ has 'heuristic power'. Let us remember that in the positive heuristic of a powerful programme there is, right at the start, a general outline of how to build the protective belts: this heuristic power generates the autonomy of theoretical science" (LAKATOS, 1978: 87, emphasis in the original).

Lakatos' account of what science is applies to *series of theories*, not to *isolated theories* (LAKATOS, 1978: 33-34). Hence, the problem of defining whether management is a science or not depends on examining whether there are theories, and whether there is more than one theory in the same problem, a series of theories.

On the other hand, it must also be clear that the concept "profession" is used in a specific sense in the thesis. Of course scientists are dedicated, formally educated specialists ─ the common use of the word "professional" (the second entry in the Oxford English Dictionary, which reads "[p]ertaining to, proper to, or connected with a or one's profession or calling"). In the thesis, however, "profession" and "professional" relates to the third meaning of the word in the Oxford English Dictionary, and to the third meaning only: "[e]ngaged in one of the learned or skilled professions, or in a calling considered socially superior to a trade or handicraft", to which the proposed Science-Profession framework adds detail.

8.3 Agenda for Future Research

From the author's point of view, a thesis on the crisis of Management is a relevant subject for two main reasons. The first is that the author's main research interest is philosophy of engineering, and Management and its crisis provides a singular case from which implications can be drawn and positions within the philosophy of engineering debate can be tested. A personal objective for the years to come is to create some sort of sequel to Koen's (2003) *Discussion of the Method*, that would expand the discussion from engineering to a broader category ─ professions (although Koen is not limited to Engineering, especially in the third part of his book), with special attention to the evolution of professions ─ of which the Science-Profession framework is a seed. Hence, this is a first agenda for future research: to continue studying professions, not necessarily Management, focusing on a *Discussion of the Evolution,* the logic of professional evolution (which is supposedly different from the logic of scientific evolution). Therefore, it is not of the author's intention to keep working specifically on Management and its crisis indefinitely. To the author, Management is simply a case to philosophy and history of engineering (professions), which are the author's research areas.

The second reason for personal interest in this thesis is that it provides a cautionary tale to Brazilian Production Engineering. Management seems largely ignorant of Koen's (2003) contribution, and for this reason they arguably cannot frame the problem they face, and are consequently lost in the search for solutions. There are indicatives that Management's crisis can happen with Brazilian Production Engineering, particularly the current focus on publishing scientific papers and on the scientific aspects of engineering. Engineering, and Brazilian Production Engineering in particular, is the realm of art, science, craftsmanship and of a systematic evolutionary process which guides the production and accumulation of heuristics. The art of the engineer cannot be sacrificed in name of some sort of scientific purity based on a misplaced scientific epistemic foundation and held hostage to a fashionable brand of scientometrics. A second agenda for future research is to write a paper sharing the story of how Brazilian Production Engineering avoided (partially by chance) "the gap". There is no crisis in Brazilian Production Engineering, although its topics overlap with Management's. This paper would share the reasons for the absence of a gap, which are grounded in Brazilian Production Engineering's

engineering epistemic foundation and in Brazilian academic incentives systems ─ whose low salaries force professors to work in consultancy projects as a means to increase incomes.

8.4 Final Remarks

The picture that emerges from the thesis shows that the science-oriented epistemic foundation that dominated Management since 1959, coexisting with a profession-oriented initiative that lacks a clear epistemic foundation, is a root cause for the half-century long crisis. It proposes that a house divided cannot stand: it is of the nature of scientific disciplines to be less relevant for professional practice, or even not relevant at all. Hence, the dream of getting the best of both worlds, being both scientific (instead of proto- or pseudo-scientific) and directly relevant for practice (up to the point in which students decide to pursue an academic degree on management the science because of its practical importance, or to the point in which companies fund business schools for its short-term business potential) is an impossible dream. The picture painted in this thesis is of a temple of volcanoes. The hope to which the thesis expects to contribute is the reconstruction of a Temple of Volcanus.

The thesis calls for a change in the dominance of the scientific epistemic foundation over both the proto-science and the proto-profession of Management. It calls for the replacement of Simon's dichotomy between *kinds of science*, in which Management sees itself as a science (of the artificial), for Koen's dichotomy between *equal-standing sciences and professions*, in which the conflicts between the proto-science (and its scientific epistemic foundation) and the proto-profession (and its professional epistemic foundation) becomes apparent ─ *and hence, solvable*. This is why, poetically, the thesis argues that Management is currently a temple of volcanoes, but that Management (the proto-profession) should become once again *a Temple of Volcanus*: a temple of the mythological god of engineering, a temple in which the father of our dear Production Engineering, the great Frederick Winslow Taylor, can once again have his rightful place.

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APPENDIX 1: Brief Summary of the Systematic Mapping Procedure and Results

The thesis' Systematic Mapping adopted an intensive search approach, in which the roots and branches heuristics were used (Silva & Proença Jr., 2013). The categories of heuristics are explained in Table 6, which also includes the number of times each heuristic was used and the total amount of references retrieved by each category of heuristics.

Table 6 – Categories of Heuristics used for the Systematic Mapping

Category of Heuristics	Explanation	Times used	Number of references retrieved
Citing	Search for references citing a particular reference (also known as forwards snowballing)	41	3247
Title	Search for a specific keyword in the title of the reference	10	2134
By	Search for references published by a specific author	13	665
From	Search for references from a specific source (e.g., a special issue, a journal)	20	321
Cited by	Search for references cited by a particular reference (also known as backwards snowballing)	19	207
Related	References found by recommendations from databases (e.g., Amazon's related books)	2	43
Fortuna	References found by chance and alternative methods (e.g., peer recommendation)	continuous	114

Source: The Author

Table 6 suggests that cited reference searches ("Citing") were most predominant in the Systematic Mapping, followed by traditional keyword search in databases

("Title"). For categories "Citing", "Title" and "By", ISI Web of Science (predominantly) and Google Scholar were used. For "From" and "Cited by", the own reference's full text and the reference's web page were the main source.

Table 7 provides additional information on the heuristics used, their source and the amount of references retrieved from each source.

Table 7 - Heuristics used for the Systematic Mapping and their respective results and sources

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
By	6	By: Denise Rousseau	**107**	88			19
By	7	By: Joan Van Aken	**21**				21
By	18	By: Mark Learmonth	**50**	24	50		
By	29	By: Donald C Hambrick	**95**	95			
By	33	By: Lauri Koskela	**123**		177		
By	34	By: David Wastell	**7**				7
By	36	By: Richard J. Boland, Jr.	**63**	63			
By	39	By: David Tranfield	**26**	26			
By	60	By: Mie Augier	**10**				10
By	74	By: Rakesh Khurana	**22**	22			
By	85	By: David Denyer	**15**	15			
By	86	By: Jeffrey Pfeffer	**92**	92			
By	87	By: Richard Sutton	**50**				50
Cited by	5	Cited by: Morrell 2012	**1**	1			
Cited by	16	Cited by Brown 2011, "Do we Ignore our own Research?"	**7**	6			1
Cited by	17	Cited by Hodgkinson & Rousseau 2009, "Bridging the Gap is Happening"	**18**				18

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
Cited by	28	Cited by: McKay, Marshall & Health 2010	**1**				1
Cited by	35	Cited by: van Aken, Berends & van der Bij 2012	**64**				64
Cited by	41	Cited By: Khurana & Spender 2012	**29**				29
Cited by	44	Cited by: Wastell 2012a, Management as Designing	**6**				6
Cited by	45	Cited by: Koskela 2011a, 50 years of irrelevance	**19**				19
Cited by	47	Cited by: Koskela 2012, Is Production outside Management	**13**				13
Cited by	48	Cited by: Koskela 2008, Which kind of science is production management?	**13**				13
Cited by	51	Cited by: Susman & Evered, 1978, There is a crisis.	**1**				1
Cited by	59	Cited by: Dulek 1992, Why fight the system?	**13**				13
Cited by	61	Cited by: Koontz 1980	**1**				1
Cited by	62	Cited by: Fendt & Kaminska-Labbe, 2011	**0**				0
Cited by	63	Cited by: Kaufman 2012	**1**				1
Cited by	64	Cited by: Vermaas 2013	**8**				8
Cited by	73	Cited by: House 1975	**3**				3
Cited by	75	Cited by: Khurana 2007	**7**				7
Cited by	77	Cited by: Slack, Lewis & Bates, 2004	**20**	20			
Citing	4	Citing: Rousseau 2006, "Is There Such a Thing as	**122**	122			

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
		EBMgt?"					
Citing	15	Citing Hambrick 2007, "The Field of Management's Devotion to Theory"	**115**	110			5
Citing	21	Citing: Reay, Berta & Kohn 2009	**32**	6			26
Citing	22	Citing: Van Aken	**282**	282			
Citing	23	Citing: Rousseau	**809**	809			
Citing	24	Citing: Tranfield et al 2003	**198**	198			
Citing	27	Citing: Wastell 2010	**4**	4			
Citing	30	Citing: Hambrick 1994	**162**	162			
Citing	38	Citing: Boland & Collopy 2004	**90**	90			
Citing	49	Citing: Davies 2006, Relevance, EBMgt, DSR or both?	**8**	2			6
Citing	50	Citing: Susman & Evered, 1978, There is a crisis.	**439**	439			
Citing	52	Citing: Gordon & Howell, 1959	**283**	283			
Citing	53	Citing: Pierson, 1959	**283**	283			
Citing	54	Citing: Heracleous & DeVoge 1998, Bridging the gap of relevance	**2**	2			
Citing	55	Citing: Dehler 1998, 'Relevance in Management Research'	**5**	5			
Citing	56	Citing: Larsson 2001, A Design View on Research in Social Sciences	**4**	4			
Citing	57	Citing: Worren, Moore, &	**22**	22			

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
		Elliott, 2002					
Citing	58	Citing: Dulek 1992, Why fight the system?	**8**	8			
Citing	67	Citing: Porter & McKibbin, 1988	**246**	246			
Citing	68	Citing: Schlossman, 1998	**59**	10			49
Citing	72	Citing: Bennis & O'Toole 2005	**311**	311			
Citing	76	Citing: Khurana 2007	**243**	243			
Citing	78	Citing: Slack, Lewis & Bates, 2004	**32**				32
Citing	81	Citing: Burrell, 1989	**49**	49			
Citing	82	Citing: Denyer & Tranfield, 2006	**21**	21			
Citing	88	Citing: Denyer, Tranfield & Van Aken, 2008	**40**	40			
Citing	89	Citing: Denyer & Tranfield, 2009	**19**	19			
Citing	90	Citing: Rousseau, Manning & Denyer 2008	**61**	61			
Citing	91	Citing: Briner & Denyer, 2012	**3**	3			
Citing	92	Citing: Zumsteg, Cooper & Noon 2012	**1**	1			
Citing	93	Citing: Colicchia & Strozzi, 2012	**8**	8			
Citing	94	Citing: Seuring & Gold 2012	**1**				1
Citing	98	Citing: Armitage & Keeble-Allen 2008	**1**	1			
Citing	99	Citing: Burke 2011	**2**	2			

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
Citing	100	Citing: Denyer & Neely, 2004	**18**	18			
Citing	101	Citing: Hoon, 2013	**0**	0			
Citing	102	Citing: Pfeffer & Sutton, 2006-2008	**259**	259			
Citing	103	Citing: Rauch & Frese, 2006	**3**	3			
Citing	104	Citing: Rojon, McDowall & Saunders, 2011	**0**	0			
Citing	105	Citing: Tranfield, Denyer & Smart, 2002	**3**	3			
Citing	106	Citing: Wilding & Wagner, 2012	**0**	0			
Fortuna	1	Fortuna	**114**				114
From	3	From: Center for Evidence-Based Management (www.cebma.org)	**63**				63
From	8	From: SI Org Stud 2010, The Gap	**8**				8
From	9	From: Special Issue AMJ 2001	**5**				5
From	10	From: Special Issue Acad Man Rev 2006	**3**				3
From	11	From: Special Issue Administrative Science Quarterly 2002	**4**				4
From	12	From: Special Issue British Journal of Management 2011	**21**				21
From	13	From: Special Issue British Journal of Management 2001	**10**				10
From	14	From: SI JMI 1997, The Gap	**15**				15

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
From	20	From: Journal of Nursing Management	**20**				20
From	25	From: SI ISeBMgt 2011, DSR IS	**6**	6			
From	26	From: Lee & Cassell 2010 - Challenges and Controversies in Management Research	**25**				25
From	31	From: AMR 1989, Epistemology	**19**				19
From	32	From: ASQ 1995, Epistemology	**3**				3
From	37	From: SI Org Stud 2008 DSR	**8**				8
From	40	From: SI EMJ 2002, Mode 2, DSR & The Gap	**6**				6
From	42	From: SI ISJ 2007, Epistemology	**5**				5
From	43	From: JBP Special Issue "The State of Practice", 2011	**15**				15
From	46	From: SI HR Mgt 2004, The Gap	**12**				12
From	83	From: Organization 2003(10,1)-2013(20,6)	**44**				44
From	84	From: Scand J of Mgt 2013 (29,4)-2011(26,1)	**33**				33
Related	66	Amazon related: History of Management and Business Schools	**30**				30
Related	69	Amazon related: Philosophy of Management	**13**			13	13
Title	2	Title: Evidence-Based Management	**30**	30			

Heuristic category	Order	Heuristic	Total refs.	ISI WoS	Google Scholar	Amazon	Other sources
Title	19	Book Title: Evidence-Based Management (Business & Investing)	**95**			598	95
Title	65	Title: History management, HISTORY OR MANAGEMENT OR BUSINESS)	**207**	207			
Title	70	Title: Philosophy of Management	**31**	31			
Title	71	Title: Business School	**816**	816			
Title	79	Title: Management guru	**47**	47			
Title	80	Book Title: Management guru	**18**			14	4
Title	95	Title: Systematic From: IJMR	**9**				9
Title	96	Title: Systematic WOS Categories: Management, Business	**368**	368			
Title	97	Topic: Systematic Review WOS Categories: Management, Business	**590**	590			

Source: The author

NOTE: "Other sources" may refer to the author's CV, personal or institutional Web page, the journal's web page, the references of a reference, or the reference's web page.

After progressive filtering and selection of 6216 references included in the database by the above-mentioned heuristics, 791 selected references on the topics the thesis addressed were categorized and read. Table 8 provides details on the amount of papers in each category.

Table 8 - Number of references for each category

Category	**References**
The Gap	467
Evidence-Based Management	136
Design Sciences Research (Management)	64
Evidence-based Medicine	45
History of Management	29
Secondary Studies	26
Mode 2	22
Systematic Literature Reviews	22
None	19
Design Sciences Research (Information Systems)	17
Epistemology	13
Total Categorized References	**791**

Source: The author

NOTE: Categories are not exclusive (the same reference can be categorized in more than one of the above).