COGNITIVE PRODUCTIVITY

USING KNOWLEDGE TO BECOME PROFOUNDLY EFFECTIVE

Luc P. Beaudoin

CogZest™

Cognitive Productivity

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In memory of Pierre-Elliot Trudeau, Sir Winston Churchill, Jacques Brel and their cognitive zest.

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Cognitive Productivity: Using Knowledge to Become Profoundly Effective Published by CogZest[1] of British Columbia.

Prior to 2014-07-10, this book was published as *Cognitive Productivity: The Art and Science of Using Knowledge to Become Profoundly Effective*.

Release notes for this book (errata of previous revisions) are published on the CogZest web site[2]. If you discover an error in this book please email cz-info@cogzest.com about it.

Examples Given that people learn better with examples than without, I use many different types of examples in this book. For example, I use fictional characters in this book to illustrate the cognitive productivity framework. However, any resemblance between these fictional characters and real persons is strictly coincidental. I also refer to a few, diverse well-known, high-caliber concepts and books to illustrate my framework. My descriptions of example theories are terse; however, I encourage readers to consult the original works in order to benefit from them. Rather than merely refer to product categories, I mention specific products. For example, when talking about book holders, I refer to Book Gem®.

Disclaimers. This book is not meant to provide legal, medical, psychological or any other type of advice in regulated domains.

The Acknowledgments below constitute an extension to the copyright page.

[1] http://cogzest.com

[2] http://cogzest.com/books/release-notes-for-cognitive-productivity-book-by-luc-p-beaudoin/

Preface

We've all had this experience: We've read a factual or practical book that had the potential to make us more effective in some specific respects. Several months later, however, we can hardly remember the content. Worse, years go by and we have yet to apply the gems of knowledge it contains. There is no simple solution to this problem; but there are things we can do to address it.

I have written this book primarily for *self-directed learners* and those who study them. My objective is to help effective people systematically use knowledge and technology to become increasingly effective. This is the problem of "knowledge potentiation": How to release the potential of knowledge in ourselves. This book addresses this problem by leveraging the most progressive attempt humanity has made to understand the human mind: cognitive science, broadly speaking. *Broad* cognitive science is not restricted to the narrow, classical concept of "dry" information processing. It also seeks to explain *affective* information processing: motivation, emotions, moods and attitudes.

To prepare you for this book, let me briefly recapitulate the journey of which it is a part. While taking a high school course on history, I "discovered" a simple yet potent algorithm to master a body of knowledge:

1. Review the materials to ensure full comprehension.
2. Formulate a collection of questions that can only be adequately answered by someone who sufficiently understands the matter.
3. Practice answering these questions, at spaced intervals until and beyond the point of manifest mastery.

Of course, the system worked like a charm. It helped me gain a deep understanding of all kinds of academic problem spaces. I aced papers and exams. It helped me to earn more scholarships and Ph.D. placement offers than I could accept. I got to study in one of the finest cognitive science programs with my top choice of a Ph.D. thesis supervisor, Prof. Aaron Sloman.

Cognitive psychology had decades earlier formally discovered some key data and principles that lend credence to my "algorithm". Some of the keywords to that literature are *test-enhanced learning*, *test-effect*, *distributed recall practice*, *self-regulated learning* and *deliberate practice*.

I contributed to the "Cognition and Affect Project" at the universities of Sussex and Birmingham. We developed a deep, new theory of how minds process goals, motives and emotional states.[3] This has informed my understanding of all aspects of psychology and this book.

Like that of many other knowledge workers, my career has required that I develop expertise in a wide variety of areas. I have been an Assistant Professor of Military Psychology and Leadership, a semiconductor technical writer (Tundra Semiconductor), an element-management software developer and team lead (Abatis Systems),[4] a project manager, an Adjunct Professor of

[3] Beaudoin & Sloman (1993), Beaudoin (1994). See Hawes (2011) for a review of this theory.

[4] Tundra Semiconductor Corp. and Abatis Systems Corp. were both co-founded by Sir Terry Matthews, Newbridge Networks Corp. and their employees. I was an employee of Tundra Semiconductor and Abatis Systems at the founding of these companies.

Education and the founder of two businesses that apply cognitive science, CogZest[5], which provides publications and services, and CogSci Apps Corp., which develops software. Each one of my roles has called upon me to rapidly transform myself with knowledge and technology. In each role, I tried to understand how what I knew could help me to learn more effectively.

As I began to rely mainly on electronic documents, it struck me that the potential for technology to support learning with cognitive science was scarcely exploited. I had written, in 1991, a little Smalltalk program to help me acquire technical concepts and (being French Canadian) augment my English vocabulary, using principles of test-enhanced learning (as described in chapter 7). Web browsers and PDF readers later made it possible to read about most of what I needed to learn. Then came software to listen to podcasts and audiobooks, read ebooks, participate in conferences, and more. Yet, none of these applications included support for test-enhanced learning! Annotation mechanisms were (and still are) very rudimentary and fragmentary. It also struck me that whereas public performance experts engage in deliberate practice, knowledge workers seem to ignore deliberate practice and many other cognitive potentiators. Cognitive science was, and still is, not sufficiently exploited.

So, after my second exhilarating (and successful) experience in high-tech startups, I decided to tackle, head on, the problems we knowledge workers face in learning with technology. I contributed my prior analyses to Phil Winne's Learning Kit and nStudy projects, and worked with him from 2002 to 2009. We built a couple of general-purpose learning platforms and learned a great deal.

In 2010, I struck out on my own again, founding CogZest and becoming Adjunct Professor at Simon Fraser University. I continued to focus on the cognitive productivity problems addressed in this book.

In January 2010, just before Apple's much anticipated tablet was announced, I wrote a blog article for SharpBrains[6] detailing the cognitive productivity requirements I felt it should address.[7] When the iPad was announced it received mixed reviews; but I was truly impressed! I could see its potential to improve cognitive productivity. So, I wrote another blog post for SharpBrains[8], briefly assessing the iPad and pointing out ways in which it could be improved to further augment cognitive productivity. Wanting to put a "dent in the universe", as Steve Jobs used to say, I emailed Jobs to congratulate him on Apple's most recent innovation and suggest ways in which Apple could better support cognitive productivity. I offered Apple a white paper on the subject; Steve Jobs asked me to send him one. This book expands considerably on the 30+ page document I sent to Steve Jobs in February 2010.

While I am still not satisfied with today's technology, we must use the tools we have at our disposal. This book is meant to help self-directed learners do that.

- Part 1 describes the problems and opportunities we face when trying to use knowledge to become more effective people. I refer to the ability and propensity to use knowledge for this purpose as "meta-effectiveness". Meta-effectiveness is one of the most significant contributors

[5] http://cogzest.com/

[6] http://cogzest.com/2011/10/steve-jobs-and-the-topic-of-cognitive-productivity/

[7] On the CogZest web site, I've collated the two posts and some notes about them.

[8] http://cogzest.com/2011/10/steve-jobs-and-the-topic-of-cognitive-productivity/

to personal success and happiness. It is the key aspect of cognitive productivity with which this book is concerned.

- Part 2 describes cognitive science that is pertinent to addressing meta-effectiveness. If you are only interested in applications, skip this part of the book and go straight to Part 3. In order to benefit from what we read (and other information we process), we need to learn to see the world in new ways *with knowledge* and to respond with the right motivation and emotions. Self-directed learning involves *mental development*. We develop "monitors" (internal and external perceptual mechanisms), "motive generators" (mechanisms to generate new evaluations, goals, wishes, wants and desires) and other mental mechanisms. If I am successful, then by delving this chapter, you will think of your mind and the learning you do in a new, more powerful way.
- Part 3 provides concepts and guidance for using knowledge to become more effective. This framework will, I hope, help you
  - "know your way around" information and your information processing tasks,
  - systematically evaluate knowledge resources (ebooks, podcasts, videos, etc.),
  - delve knowledge resources, and
  - practice with knowledge gems in order to perceive, understand and respond to the world with the knowledge you acquire.

I believe that self-directed learning from high-caliber, potent information requires more effort than people typically realize. This leads me, in the conclusion of this book, to elaborate on an important overlap between self-directed learning, education, self-help and clinical psychology.

I hope this book helps us to discharge our privilege and duty—to further understand and improve the most sophisticated power in the world, the human mind.

Acknowledgements

I have many people to thank for *Cognitive Productivity*.

I am grateful to my peers who kindly reviewed parts of this book: Sharon Bratt (MacEwan University), Eva Hudlicka (University of Massachusetts-Amherst), Jeffrey Karpicke (Purdue University), Mary Pyc (Washington University in St-Louis) and Aaron Sloman (University of Birmingham). Christopher Stone (Harvey Mudd College) also provided helpful feedback.

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Claude Lamontagne, Phil Winne, Steve Leach, and Peter Brems provided feedback on ideas presented here. I appreciate the feedback I have received from readers of this book, clients, participants in my workshops, and lecture and seminar attendees. I've been encouraged by knowledge workers across disciplines who agreed with me that cognitive productivity is critical to the modern pursuit of excellence.

Thanks to Lisa N. Eisen for deep insights into some of the psychological principles alluded to in chapter 15.

Damien Elmes kindly reviewed the text in chapters 13 and 14 about his deliberate practice application, Anki[9].

Lam Wong[10] created the fabulous front and back covers. He also convinced me to apply the principle of parsimony by removing "The science and art of" from the subtitle of this book. Carrie Spencer of Royal Rhodes University was instrumental to me choosing to develop the eponymous concept of this book, *cognitive productivity*, in 2010.

Thanks to James Cullin[11] for carefully reviewing all the citations and correcting the bibliography. Thanks also to Brian Holmes of GradeAEdits, for proofreading this book.

Several ideas in Part 3 have their roots in R&D projects led by Phil Winne at Simon Fraser University, where I was research associate and software development leader. We developed the StatStudy, gStudy and nStudy applications to understand and address learners' cognitive requirements. Some of the ideas presented in this book have also been implemented in software by my colleagues at CogZest and CogSci Apps Corp.[12] (of British Columbia). I'm grateful to all the contributors to these projects.

The Leanpub team[13] has reliably provided an amazing platform to evolve this book according to lean principles.

I greatly appreciate the support of Simon Fraser University, where I am Adjunct Professor in the Faculty of Education.

[9] http://ankisrs.net

[10] http://www.lamwong.com

[11] https://www.linkedin.com/profile/view?id=182612691

[12] http://CogSciApps.com

[13] http://leanpub.com

Some of the theoretical roots of this book are in my Ph.D. research, which was part of the Cognition and Affect Project at Sussex University and the University of Birmingham in England. Hence my gratitude to all contributors to that project. I am also grateful to my external Ph.D. thesis examiner, Prof. Margaret Boden[14], for encouraging me to publish my thesis research in the form of a book. Thanks also to Prof. Aaron Sloman[15] for encouraging me, in 2008, to resume research on the intersection of cognition and affect. This book contains extensions and applications of our "H-CogAff" framework and the perturbance theory of emotion.

Thank you to Ian Hand (Managing Director, VentureLabs), John Siu (Engineering Director, In Motion Technology), Paul Terry (Entrepreneur in Residence at SFU Venture Labs) and Renwei Li (Senior Director, Software Engineering at Huawei) for permission to refer to them personally in this book. Interactions with them helped me shape this book.

Carol Woodworth was a sounding board, editor and companion throughout this project.

I am deeply grateful to countless authors who shaped my thinking, whether or not I have cited them in this book.

[14] http://en.wikipedia.org/wiki/Margaret_Boden
[15] http://en.wikipedia.org/wiki/Aaron_Sloman

I Challenges and opportunities

Only the ideas that we actually live are of any value.
Hermann Hesse

1. Introduction

> *The essence of knowledge is, having it, to apply it; not having it, to confess your ignorance.*
> **Confucius**

We live in an era of ineffable opportunities to use knowledge to become more effective. The information cornucopia is at our finger tips. We are served the latest knowledge in print, ebooks, audiobooks, web pages, podcasts, videos, screen casts, webinars, and other forms.

For example, books by relationship expert Dr. John Gottman can improve your marriage and other close relationships. The principles of rationality conveyed by cognitive scientists like Dr. Keith Stanovich can help you avoid costly mistakes. Agile product-development principles conveyed by the likes of Eric Ries can help you develop products customers will actually like and pay for. High caliber investment advice from writers like TSI Network's Pat McKeough can protect and grow your investments. Applying health and nutrition information from Center for Science in the Public Interest[1]'s *Nutrition Action*[2] newsletter might help you live a healthier and longer life. The open-access movement provides public access to information hitherto only available to select knowledge workers. Many universities are now even offering massive, open (free) online courses—MOOCs!

To be sure, there is more irrelevant information than text worth reading, let alone delving. But there is no denying the abundance of potent knowledge to help us solve problems and develop ourselves. This bodes well for the exercise of the seventh habit of highly effective people, which—according to the late Stephen R. Covey—is to "sharpen the saw"®. It is to improve ourselves—our productive capacity—through regular reading and related pro-active activity (Covey, 2004). If we properly conduct our research and apply ourselves, then we can develop personal effectiveness: understanding, skills, attitudes, habits and dispositions. I agree with Aristotle, who laid the foundations for Western ethics, that in the balanced pursuit of excellence lies the route to happiness.

Alas "the shallows", intellectual defeatism, naive optimism and cognitive miserliness each in their own way threaten our knowledge-based and technology-enabled pursuit of effectiveness. In his best selling book, *The Shallows,* Nicolas Carr laments the effects he supposes the Internet has on our brains, minds and behavior. He suggests that our usage of information technology causes us to have shorter "attention spans" and more difficulty learning. He claims that the distractions, hyperlinks and other features of technology (and our way of using it) not only interfere with our productive use of technology, they alter our brains and minds. "The tools of the mind amplify and in turn numb the most intimate, the most human, of our natural capacities—those for reason, perception, memory, emotion." From the neuroplasticity bandwagon, Carr professes that our new technological vices "rewire our brains". We are, he seems to believe, becoming inextricably stuck in the shallows.

However, Carr's apparent defeatism overshadow his legitimate concerns. Let us "consider the opposite", a reasoning strategy discussed below. If plasticity (i.e., modifiability) is as important a

[1] http://www.cspinet.org
[2] http://www.nutritionaction.com

characteristic of the brain as Carr believes, then an opposite conclusion might just as well be right: We can "mold" our brains to become more focused and productive by habitually using the Internet in focused, productive ways. Carr alludes to this possibility, but he shuns it. "It's possible to think deeply while surfing the Net, just as it's possible to think shallowly while reading a book, but that's not the type of thinking the technology encourages and rewards." One might as well say that automobiles encourage us to speed and so we should stay out of them. In the spirit of the people to whose memory this book is dedicated, I reject cognitive defeatism in favour of informed, productive ways of using technology to improve ourselves.

Carr's book is part of a trend amongst popular writers to try to describe, explain and predict psychological processes using neuroscience. Of course, understanding the brain is ultimately essential to understanding the mind. Alas, it is very difficult even for neuroscientists to make detailed sense of human behavior in neurological terms. Neuroscientist Seth Grant defines systems biology as "a new branch of biology aimed at understanding biological complexity" (2003). Grant has identified eight interacting layers in the system to consider. The bottom layer is genetics and the top layer is behaviour. Synaptic connectivity is just one of the components of systems biology. Synapses themselves are now considered as complex computers (Grant, 2007). We can expect learning to happen at multiple layers and not to be faithfully approximated by any "hard wiring". The mind itself must be considered as having multiple layers capable of learning. Between the brain and behavior there are complex virtual machines—"the mind".[3] Mapping mental phenomena to brain mechanisms is a challenging task for scientists. As Stephen Pinker put it "Psychology, the analysis of mental software, will have to burrow a considerable way into the mountain before meeting the neurobiologists tunneling through from the other side." (Pinker, 1999)

Many popular "brain-based" claims originated in psychology—whether it be folk or scientific psychology. They mainly concern psychological matters. For example, many of the principles in John Medina's popular *Brain Rules* book, such as the importance of repetition, are mainly psychological matters. The neuroscience of distributed practice effects has a long way to go — as does its cognitive science. These matters usually need to be assessed, if at all, with the rigorous research methods of empirical psychology. We need to be as careful when we draw inferences from neuroscience as other sciences; however, the luster of neuroscience can be particularly distracting.[4]

In particular, I reject the notion that the Internet is "rewiring our brains". As Pinker put it:

> Critics of new media sometimes use science itself to press their case, citing research that shows how "experience can change the brain." But cognitive neuroscientists roll their eyes at such talk. Yes, every time we learn a fact or skill the wiring of the brain changes; it's not as if the information is stored in the pancreas. But the existence of

[3]Thus, multi-scale modeling of the brain must include virtual machines. See Sloman (2009a) for a description of the mind as a layered virtual machine that is itself layered on top of physical machines (themselves layered). The concept of layering is well understood in telecommunications (the Internet Protocol being one of several examples http://en.wikipedia.org/wiki/Internet_protocol_suite) and computer software. However, it is still rarely explicitly invoked in relation to the mind. Yet to think in terms of "wiring" obscures the many layers at which learning may flexibly occur. Compare also Section 8-4 of Minsky (2006).

[4]While neuroscience is an important contributor to cognitive science, too many people are duped into thinking we understand more about mind-brain interactions than we do. One of the difficulties with neuroscience is statistical power, linked to low sample sizes (Button et al., 2013.) There are also problems with frequent non-blind studies. Button et al. lament the lack of reproducibility in swaths of neuroscience. See also Stix (2013) on the subject. Satel & Lilienfeld (2013) warn their readers about the *seductive appeal of mindless neuroscience*,, particularly given the psychological (if not rational) compellingness of neuroimaging. See also the discussion of "neuromania" in Changeux & McGinn (2013). Epistemic exuberance needs to be bridled by skeptical thinking (compare chapter 11, "Assess".)

> neural plasticity does not mean the brain is a blob of clay pounded into shape by experience. (Pinker, 2010)

Cognitive neuroscience is a difficult discipline. It is, nevertheless, an important member and contributor to cognitive science. It is indirectly represented in this book.

Carr is right to call our attention to the shallow use of technology and information. We face real challenges to our cognitive productivity[5]; many of them predate the web. To have studied cognitive psychology is to know that our perception, understanding, attention, ability to recall and utilize information, indeed all mental functioning is biased, limited and error prone. Furthermore, ostensibly learning something in one domain or context is no guarantee of being able or disposed to apply it when one should in another. For example, a person who aced mechanical physics may fail to realize (or value) that she is not keeping a safe distance from the car ahead of her. Likewise, we may read the work of Gottman, Stanovich and Ries, which I describe below, and yet still be blind to too many of our partners' bids, make too many biased decisions and be insufficiently agile. Psychologists refer to these issues as problems of "inert knowledge"[6] and "transfer". They have been studying them at least since 1901 (Haskell, 2000). In chapter 3, I describe our cognitive productivity challenges so that we may remedy them with the rest of the book.

The Internet is not the root cause of human information-processing fallibility. Nor are our limitations a fluke of evolution discovered by attentive empirical psychologists.[7] I do not believe natural selection (or any intelligent mechanism) could evolve a machine that meets the awesome requirements of the human mind without this resulting machine having severe challenges to cognitive productivity described above. Design, human or Darwinian, is a matter of trade-offs.[8] But we, intelligent machines, can nevertheless improve.

The majority of people who read this book, I assume, are knowledge workers. Knowledge workers are people who spend a significant portion of their lives understanding, assessing, modifying, building and using knowledge. They solve problems with knowledge and often create and share knowledge in so doing. One can be a golfer without earning one's living as a golfer. One can be a knowledge worker without being a scientist. Explicit knowledge-intense work need not occupy all of one's time for one to be considered a knowledge worker. A surgeon may spend most of his time delivering services and administering his business. But the portion of time he spends acquiring and building knowledge provides significant value. A lawyer creates and processes knowledge as argument in service to her clients. An effective trades person reads about his profession, communicates with colleagues about it, and develops and shares new techniques and strategies. All these people are knowledge workers.

The staggering abundance of knowledge has increased expectations for many of us to exploit knowledge to develop our own effectiveness, more effective products, and better solutions for our clients. In order to meet this challenge, one needs a propensity to develop effectiveness and consequently competence. This is something that the late psychologist of Harvard University, Robert

[5] Chapter 3 discusses the obstacles we face.

[6] Below, I describe a new way of thinking about the so called "transfer" problems and how to address them.

[7] Empirical psychologists are research psychologists who attempt to resolve psychological problems of understanding by collecting, analyzing and interpreting data in studies involving real animals, whether human or not.

[8] Dawkins (1996), Sloman, (1978).

White, referred to as "effectance" (White, 1959). Effectance plays a large role in determining which of two people of equal intelligence will be more effective. It pushes people to develop expertise to overcome limitations in fluid intelligence.[9] Effectance drives one to develop thinking dispositions and skills to become increasingly effective. White articulated his concept of effectance in relation to children and before our transition to a knowledge society. In this book, I improve his critical but largely overlooked concept[10].

But even effectant people may be unsettled by the pressures to tame an exponentially expanding knowledge base. Faced with the cognitive demands of the knowledge economy, they often turn to productivity systems and software. Ironically, these categories of solutions are themselves expanding so fast productivity experts are finding them hard to track. That expanse, however, is not the major obstacle between effectant people and the effectiveness they pursue.

Unfortunately, productivity systems, like David Allen's popular Getting Things Done® (GTD®), and productivity software, are not for the most part designed to meet the specific requirements of *cognitive* productivity. A *cognitive* productivity solution is one that addresses the constitutive problems of knowledge work: to understand, assess, modify, create and apply knowledge. While I believe the GTD system contains useful general productivity concepts, it clearly was not designed specifically for knowledge-intense work. For example, Allen's seminal book contains examples of managing grocery lists and cleaning one's garage. GTD is supposed to free its user's mind for cognitive work, but it has little to say about the particularities of mental processes or cognitive work. In contrast, the framework I develop in this book is specifically targeted at cognitive productivity challenges: to exploit knowledge to productively develop products, solutions, and oneself.

Steve Jobs said of Apple, "We believe that it's technology married with the humanities that yields us the result that makes our heart sing" (Isaacson, 2011). As I suggested in a white paper and email exchange with him in 2010[11], cognitive science—the interdisciplinary, information processing study of mind—also needs to be included in the intersection. Medicine is informed by biology. Mechanical engineering by physics. Likewise, we cannot adequately address difficult problems of cognitive productivity without exploiting the results of cognitive science.

Consider an example of how we suffer as a result of such neglect. Today, we read documents in web browsers, ebook readers and other applications that in many respects are worse than paper. For example, no operating system yet provides a uniform way for users to annotate text across diverse applications—such as email, PDFs, and web pages. Their designers do not seem to consider basic principles of cognitive science. I will describe these problems in chapter 3 and show how to work around them in Part 3.

The opposite of Carr's intellectual-technical defeatism, a macho attitude towards learning, is no better. The implicit idea here is that everyone who has proven their intellectual capabilities at

[9]Fluid intelligence is the ability to solve novel problems using general purpose reasoning without depending on specialized knowledge. Crystallized intelligence is composed of our abilities to use what we have learned (skills, factual knowledge, etc.). However high one's fluid intelligence, it is necessarily limited, and it tends to decrease in adulthood.

[10]See in particular the Section on Effectance, below. My extensions are based on Bereiter & Scardamalia (1993), Sloman (2009b) and Stanovich (2009). For example, White focused on the implicit motivation for competence. He did not explore other targets of effectiveness (developing better products, solutions and self). He restricted his analyses to children. He did not explore the creation and use of objective knowledge for effectance. He could not explore the architectural, information-processing bases of motivation. He did not frame effectance as a propensity, a key concept in this book.

[11]Steve Jobs, like Winston Churchill, extended himself by asking other people to help him accomplish his goals and he said no to fear. He kindly repaid the favor by responding to emails from people he did not know, such as myself. Cf. McBurney (2013).

university or work knows how to read, and more generally process knowledge resources, in such a way that they can derive the benefits they seek. Provided the information is well presented, they will understand it after processing it once or twice. Thereafter, they will be able to use it. They need not systematically and effortfully apply themselves to master knowledge gems. Their skills, understanding, attitudes, propensities, habits, etc. will follow from their own unaided abilities to learn. To be sure, students and public performers (musicians, athletes) may need to practice and rehearse. But competent professionals do not. Such are the beliefs floating in the bubble atop my cartoon of the intellectual macho.

Alas, cognitive nonchalance flies in the face of cognitive science. I suspect that such cavalier attitudes, and the superficial strategies they entail, are the main causes of what Carr described as "the shallows". However, *contra* defeatism, the "shallows", where they exist, are correctible. Productive strategies *can* be learned.

How? We cannot solely rely on motivational books or productivity systems. Cognitive science provides relevant material for our problems, though scholarly books are either too technical or general to satisfy the needs addressed by this book. Several recent popular books have drawn attention to the cognitive science of expertise[12]. This primes my reader to the importance of effortful practice. These books, however, do not deal with specific problems of exploiting knowledge for enhanced effectiveness. Expertise is an important technical concept in cognitive psychology that is related to, but different from the fundamental concept of effectiveness. Nor are the abundant study-strategy books aimed at college students particularly relevant to knowledge workers.

There is a need for a coherent, cognitive-science based framework specifically to help self-directed learners exploit knowledge and technology to improve their effectiveness. The novelty of this quest partly explains why I have had to coin several terms, utilize several others that have yet to reach their memetic potential, and develop new concepts.

I have in this introduction referred to a critical quality of people who pursue excellence with knowledge. Like the concept of acceleration in physics, this concept is a second-order (derivative) one. I call it *meta-effectiveness*: abilities and dispositions to use knowledge to become more effective. To a first approximation, meta-effectiveness is simply what it takes to be an effective lifelong learner. Naming, characterizing and applying this concept may help people become more meta-effective.

If we are to draw deeply from the cornucopia of knowledge and be transformed by it, if we are to systematically develop effectiveness from knowledge rather than merely become vaguely familiar with information, then we need a meta-effectiveness framework—one that is informed by cognitive science and that, in turn, informs it. One that is designed to meet the requirements of effectant people in the Knowledge Age. It must eschew defeatism and machismo in favor of effectance. Those are the objectives of the framework I have set out to describe in this book; they are the standards by which I would like this book to be judged.

1.1 Broad cognitive science

> *There are no subject matters; no branches of learning–or, rather, of inquiry: there are only problems, and the urge to solve them.*

[12]For example Gladwell (2008), Coyle (2009), Foer (2011).

16. Delve and instill the knowledge of your choice

The relevance of the opening quotation of this book, "Only the ideas that we actually live are of any value", should now be evident. Potentially useful, high-caliber knowledge too often lies wasted in superficial mindware. It would be difficult to overstate the importance of that which enables and motivates you to instill knowledge: meta-effectiveness. With the right mindware one can intelligently perceive the world, prevent predicaments and solve problems.

Having reached the conclusion of this long book, how are you supposed to instill the knowledge expressed in Part 3 to bootstrap your learning?

I recommend that you start by choosing a helpful resource—something potent, useful and of high caliber that appeals to you. It may be as broad or narrow in scope as you like. Look at your library for inspiration. For reasons discussed in chapter 12, select a resource that you can access electronically, preferably with a PDF reader or Apple's iBooks. It's important to pick a challenging resource the mastery of which will immediately give you significant benefits. The expected yield will motivate you to apply the required effort. Applying your new mindware will be inspiriting. This might motivate you to sharpen your meta-effectiveness "saw" with other resources too. You need not master all aspects of the resource. Focus on its gems. Selecting and mining will help you sharpen your assessment skills and dispositions.

While the topics of Part 3 are presented in natural order, you can focus on areas of competence (and hence chapters) in the order of your choice: learning your way around, assessing, delving, or practicing. It's best to focus on one skill set at a time with one resource. Then repeat with other resources. That way you will get the benefits of spacing.

Further, I recommend that before or as you delve into your chosen knowledge resource, you also apply delving techniques to *Cognitive Productivity* itself. By regularly applying cognitive productivity concepts and techniques, you will get the benefits of practice that are described throughout this book.

When world champions rework some of their core competencies, their performance degrades temporarily. Thus, your own information-processing velocity will decrease temporarily as you develop your meta-effectiveness. That is to be expected and accepted. What previous quotation of Marvin Minsky is relevant here? Oh yes, "No matter what one's problem is, provided that it's hard enough, one always gains from learning better ways to learn".

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