

Agendas for 21st Century Engineers

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Edited by

Caroline Brandt and David Prescott

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P U B L I S H I N G

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TABLE OF CONTENTS

Preface vii

Chapter One: Reading Engineering

Why Should Engineers Read Widely?
Caroline Brandt..... 2

The Art of Reading: Evidence, Relevance and Detection
Roger Nunn..... 16

Chapter Two: Engineering Education

In With the Old: Sketching and Journaling Serve Engineering
Students Well
Linda Schmidt..... 28

Reforming Engineering Education to Meet the Needs of a Knowledge-
based Economy
Brian Bielenberg 45

Chapter Three: Competencies for Engineering

An Australian Study of the Importance of Communication
for Engineers
Sally Male..... 64

On the Criticality of Communication and Team Skills for Modern
Engineering Practice
David Bowen 85

Chapter Four: Engineering and Gender

A Wise Model for a WiSE Program <i>Nadia M. Alhasani</i>	104
Ways of Knowing: The Rationale for a Preliminary Study of Female Engineering Students in the UAE <i>Linda Schmidt and Caroline Brandt</i>	118

Chapter Five: Engineering Ethics

Ethical Issues for Practicing Engineers <i>Tim Ross</i>	138
The Aspirational Ethics Project <i>Charles E. Harris Jr</i>	151

Chapter Six: Preparing for the Engineering Workplace

Preparation for Effective Workplace Participation <i>Bob Matthew and Jane Pritchard</i>	172
Preparing Engineers in the UAE for the Oil and Gas Engineering Workplace <i>Ghaniya S. Bin-Dhaaer Al-Yafei</i>	186

Chapter Seven: Engineering the Future

Planning for the 21 st Century <i>Lawrence Man</i>	206
Innovation in Education and Professional Development in Engineering <i>David Prescott</i>	218
Afterword	232
Caroline Brandt and David Prescott	
Contributors.....	235

PREFACE

We present in this book a selection of original scholarly and professional articles related to the education and practice of engineers, from the perspective of diverse social, educational and cultural contexts. We selected the articles for their anticipated interest to engineers across a range of disciplines, such as chemical, electrical, petroleum, mechanical and civil engineering. The articles were also selected for their likely interest and benefit to those at various points in their careers, from students at different stages of higher education to those with significant industrial experience. For all readers, our primary purposes in constructing this book are to promote pleasure and interest in reading widely within the discipline, and to complement the technical discourse of engineering with social, educational and cultural discourse on professional engineering-related topics.

The articles we present address such topics as the communication needs of engineers, ethics in engineering, educating engineers, engineering and gender, and induction into the engineering workplace. In Chapter 2, for example, Linda Schmidt, an Associate Professor in the Department of Mechanical Engineering at the University of Maryland in the US, draws on years of experience and award-winning research to discuss why engineering students should retain and develop the ability to sketch designs freehand. In Chapter 3, Sally Male, a Research Associate Professor at the University of Western Australia, reports on the first large-scale quantitative study in Australia of the competencies of engineers across all disciplines of engineering, focusing in particular on results that contribute to understandings of the importance and nature of communication for engineering practice.

Nadia Alhasani, founding Dean of the Women in Science and Engineering (WiSE) Program at an engineering institute in the Arabian Gulf, has lectured and published widely in the fields of building production, technology, and women in science, technology, engineering and mathematics. In Chapter 4, she explores, from the perspective of female Emirati engineering students, a highly successful gender-specific approach to their education. Charles Harris, Professor of Philosophy and Sue and Harry Bovay Professor of the History and Ethics of Professional Engineering at Texas A & M University, argues in Chapter 5 that

promoting ‘aspirational’ ethics is important both for engineering students and for the engineering profession in general. By ‘aspirational’ ethics, Harris refers to the ability of engineers to promote human well-being through their professional activities, and he argues that this may be best articulated as a set of virtues.

Chapter 6 is concerned with preparation for the engineering workplace. Bob Matthew, a civil engineer and Director of the Centre for Academic Practice and Learning at the UK’s University of Stirling, and Jane Pritchard, who has a background in materials science and engineering and works in educational development at the London School of Economics, write about the need to achieve a balance in the preparation of engineers between the “ics” (the study of subjects like mathematics, mechanics, thermodynamics and physics) and the “ings” (areas such as communicating, team working and thinking as an engineer). Chapter 6 continues with an article by Ghaniya S. Bin-Dhaaer Al-Yafei, who was the first female Emirati reservoir engineer to join Abu Dhabi National Oil Company (ADNOC) in the United Arab Emirates, progressing rapidly within the organization and receiving the ‘Middle East Women Award for Excellence in Technology and Engineering’ in 2010. Mrs Al-Yafei discusses ADNOC’s response to the need to achieve unified competence standards in the development of newly recruited engineering graduates within the organization.

The two articles in Chapter 6 provide an interesting and considered contrast in terms of research presented and the authors’ backgrounds and writing styles. We took the same approach to the organization of all chapters, that is, each chapter contains two articles that we deliberately juxtaposed, and which are written from contrasting or complementary perspectives and which exemplify contrasting styles. This juxtaposition is one of the distinguishing features of the book, and we anticipate that it will provoke critical thinking. To support and encourage this, we precede and follow each article with questions aimed at prompting consideration, reflection, evaluation or discussion, a design feature that we have extended to the complete book.

Below, therefore, we present a few questions to consider prior to reading on, a feature that is echoed at the end of the book:

1. Why do you think the editors of this book included the word ‘Agendas’ in the title of the book?
2. Besides the ‘agendas’ that are included in this book, can you think of others that might have been included?

3. The authors whose writing is included here work either in a university or in industry. What differences to writing style do you think this might make?
4. Why might it be instructive to read the biographies of the authors whose writing is presented here (all of which are to be found towards the end of the book)?
5. Flick through the pages of this book. Do any of the contents surprise you in any way?

We hope that both experienced and novice engineers will enjoy these scholarly articles and the approach taken to their presentation, and that all readers will be encouraged to continue to pursue reading material that complements their profession's technical discourse.

Caroline Brandt and David Prescott

CHAPTER ONE

READING ENGINEERING

WHY SHOULD ENGINEERS READ WIDELY?

CAROLINE BRANDT

Forethoughts

1. Do you read widely? Why / why not?
2. What material do you most enjoy reading?
3. How is what you read of benefit to you?
4. Does the Lufkin and Miller quote below surprise you?

Introduction

It now appears that the superior engineer reads a good deal more than the average engineer.

Lufkin and Miller (1966, p. 182)

This book draws on the intellectual resources of the engineering community with the specific aim of promoting pleasure, interest and ability in reading widely and critically within the field of engineering and related areas. It provides a selection of articles that are concerned with the education and practice of engineers, in each case accompanied by questions designed to promote critical reading and thinking. We selected the articles, all of which relate to engineering in its wider social, educational and cultural contexts, for their likely appeal to engineers in a range of disciplines (chemical, electrical, petroleum, mechanical, materials, civil) and in different stages of education or career (first year degree students, postgraduate students, novice to experienced professionals). Our aim is to complement the technical discourse of engineering with social, educational and cultural discourse on engineering related topics, enabling engineers to broaden their knowledge base while consolidating a professional reading habit.

A primary feature of this book is that all of the authors whose work is presented here have experience of living and working in multicultural and multilingual contexts. Consequently, each article has been developed with the needs and likely interests in mind of engineers who are practicing in such contexts, or who are preparing to enter such contexts. Readers may

describe themselves as monolingual but find themselves working alongside others who are bilingual or multilingual; or the reverse may be the case. Readers may have varying degrees of proficiency in additional languages; in relation to English, it has been assumed that the reader is able to meet the linguistic day-to-day demands of an academic or professional context in which English is either the norm or a lingua franca. We expect that the needs of those readers for whom English is an additional language will be accommodated by the style of writing throughout this book, as authors have made clarity of expression one of their priorities.

The Professional Reading Requirements of Engineers

Reading is a significant activity for engineers, regardless of English language proficiency, both in terms of time spent engaged in reading during the course of a career and in terms of the range of genres engineers are expected to read. Spretnak (1983), investigating over 1000 engineering alumni from the University of California at Berkeley in the US, found that:

...on the average, engineers spend twenty-five percent of their job-related time writing, twenty-three percent reading technical and business material, eleven percent supervising the writing of others, and seven percent giving oral presentations—that is, more than half of an engineer's work is comprised of communication tasks.

Referring specifically to reading, she noted that:

Once an engineer progresses beyond entry level, he or she spends a good deal of time reading technical material, analyzing it, and responding to it. According to the [data], supervisors spend an average of ten percent of their time critiquing the writing of others, but this amount nearly doubles, i.e., nineteen percent, when engineers move into positions such as project head, department head, or division director. Critical reading skills, then, may be seen as a requisite for such advancement. Moreover, engineers at all levels must be able to assimilate written technical information efficiently.

More recent research conducted by Cunningham, Stewart, Ness and Webb (2010) investigated the reading, writing and evaluation habits and requirements of 185 professional engineers across seven states in the US. They found that professional engineers spend a significant amount of their time engaged in reading and writing, with priorities being job-related correspondence, technical reports and proposals, in that order. Other

writers have focused on the value for engineers of scholarly reading in particular. Tenopir and King (2007, p. 24), for example, analyzing the results of readership surveys conducted from 2000 to 2005 at five universities and a research facility in the US, found that: "...engineers [...] read many types of information resources, including standards, technical reports, books, and [scholarly] articles. When engineers read articles, they rate the importance to their job as very high." Scholarly journals, therefore:

...are an important source of high quality and convenient information for engineers in their work [...] [S]cholarly articles from a variety of sources serve an important role in research, current awareness, and teaching for engineers [...] the average number of articles read is increasing.

The continuing value of article readings is demonstrated by the time that engineers spend on reading and their observations that the articles contribute to their work. [...] Engineers will continue to read from article sources that are convenient and that bring value to their work.

Tenopir and King (2007, p. 27)

Reading and writing clearly play key roles in the capture and transfer of knowledge for engineers, and so it is worthwhile considering briefly what reading is, as well as where it is situated in the whole that is language.

Reading as (Inter)activity

...reading is characterized by active engagement through which meaning is created.

Zamel (1992, p. 463)

Investigations into reading have led to the development of models of the reading process, often organized into three categories. "Bottom-up" (also known as or micro-level) models focus on decoding the written word, from letter level, to word, text and finally meaning (e.g. Gough, 1985; LaBerge and Samuels, 1985); movement is unilateral and from part to whole. "Top-down" models (e.g. Goodman, 1985; Smith, 1994), on the other hand, suggest that readers initially approach a text not by decoding letters and words, but from the perspective of determining meaning, or of testing hypotheses about meaning. "Top-down" models "all have in common a viewing of the fluent reader as being actively engaged in hypothesis testing as he [sic] proceeds through a text" (Stanovich, 1980, p. 34). The reader's task is to integrate information in the text (e.g. with prior

knowledge) to arrive at understanding, and only once there is comprehension do readers employ bottom-up decoding in order to confirm this understanding.

The third category, referred to as “interactive”, is generally considered the most comprehensive, as it attempts to integrate the strengths of both models (e.g. Ruddell and Speaker, 1985; Barr, Sadow and Blachowicz, 1990). Rather than emphasizing decoding (bottom-up) at the expense of interpretation (top-down) or vice-versa, both sets of processes are acknowledged as essential. “Bottom-up” processes, which include decoding words and structures, are the basis for the “top-down” or macro-level processes that involve understanding and relating this understanding to what the reader already knows about the language and content of the text. Advocates of top-down models understood this latter point: that readers themselves have input into the process, bringing background knowledge to the text and interacting with it in such a way that each reader’s ultimate interpretation of a text may be unique, an insight that is preserved in interactive approaches. The reader, therefore, is understood to construct meaning by employing his or her own resources and drawing selectively on all available levels of data (letters, words, syntax, sentence and paragraph structure etc.) as needed, possibly simultaneously, without precluding the possibility of one source of meaning predominating at any point, as information extracted from one level may be used to compensate for shortfall in another. In so doing he or she integrates receptive processes with active ones.

Current theory therefore describes reading as a synchronized, interactive process that relies on “bottom-up” processes which “top-down” processes draw upon; some of these processes may be receptive; others active (Haussamen, 1995; Alderson, 2000; Grabe, 2009; Koda, 2005). In interactive approaches:

- levels of data are seen not as discrete or necessarily interpreted methodically or unilaterally, but as interacting with one another;
- readers, utilizing both perception and cognition, are understood to interact with their texts.

Views of language as a complex, dynamic system accommodate interactive approaches to reading. A significant body of research has recently emphasized the complex and dynamic nature of language, countering views previously held of reading as a subsystem of language skill (with other subsystems being writing, speaking, grammar, phonology and so forth). Larsen-Freeman and Cameron (2008), for example, point out that language cannot usefully be broken down into discrete components.

They adopt a complexity theory perspective to support their observation that:

... it is impossible to understand the whole of a complex system by attempting to understand its parts independently... The behaviour of the whole of a complex system arises out of the interaction of the elements or agents that comprise it. When this notion is applied to language, it is clear that it will not work to treat the subsystems of language as autonomous, unravel the mysteries of each subsystem in turn, and then compile all we have learned about each in order to understand the whole of language. Because language is complex, what is evident at any one time is the interaction of multiple complex dynamic systems, working on multiple timescales and levels.

Larsen-Freeman and Cameron (2008, pp. 94-95).

This view of language makes it likely that understandings of reading should be extended to include not only decoding and interaction between reader and text, but also interaction within the system of language, as one element of the system is likely to influence another. Language (and its use and learning) is understood to involve a complex of “cognition, consciousness, experience, embodiment, brain, self, human interaction, society, culture, and history – in other words, phenomena at different levels of scale and time [which] are all inextricably intertwined in rich, complex, and dynamic ways” (Ellis and Larsen-Freeman, 2009, p. 91). It therefore makes sense that development of skill through practice in one area should support the development of linguistic skills or knowledge in other areas. For example, reading can provide an opportunity to develop second language writing skills (Grabe, 2001; Hirvela, 2001, 2004; Tsai, 2008) and vice-versa (Zamel, 1992). Hirvela (2004), for example, observes that reading can facilitate language acquisition and that this may support the internalizing of rules and conventions, which in turn may develop writing skills:

We may be better served in the writing classroom by providing reading materials and activities that allow learners meaningful exposure to writing in the target language. Through this exposure and the natural processes at the heart of acquisition (as opposed to conscious learning), learners are better able to internalize L2 writing rules and conventions.

Hirvela (2004, p. 112)

Writing reflects specialized rules and conventions, and reading offers exposure, which may be the first step towards their internalization. Zamel (1992) argues that not only can reading assist with writing, but writing can

assist with the development of reading skills, because both require purposes and goals, involve heurism, interpretation and “work in tandem to promote and enhance one another” Zamel (1992, p. 481-2).

I teach communication skills to first year engineering degree students at the Petroleum Institute in the United Arab Emirates, and a large part of this work is concerned with the development of my students’ literacy skills. I find that “interaction” is the most useful concept in relation to reading and writing as processes, and the development of their skills in these areas. While my students recognize easily that speaking and listening involve interaction, the notion that reading and writing do so too is novel for these students in the early stages. I have observed that as soon as students begin to appreciate this, their writing is enhanced as they become more sensitive to their purpose and their audience. They similarly begin to understand that if they interact more with a text they are reading (e.g. by annotating) then their learning is more effective.

To summarize, we find that successful reading takes place as the result of interactivity that occurs:

- among levels of data in a text (which are seen not as discrete or unilateral, but as interacting with one another);
- between reader and text (where readers utilize both perception and cognition, or reception and activity);
- among areas of linguistic skill, for example, literacy skills; oral/aural skills; grammar; semantics (which interact by complementing, influencing, benefitting and/or compensating for one another).

Reading as Transformative

At the center are the readers’ responses ... to the meanings they make and re-make as they read.

Atwell (1987) in Zamel (1992, p. 467)

Interactivity between reader and text occurs as the reader makes connections between what he or she already knows about the context of the text, and uses the new information to expand or modify existing knowledge. This level of processing requires the reader to access the meanings expressed in the message (such as the ideas and evidence presented, for example). While there is no doubt that bottom-up processes are critical for fluent reading (a large extensive vocabulary is particularly essential (Alderson, 2000, p.35; Laufer, 1998, p.1; Liu and Nation, 1995), being one of the best predictors of text comprehension), the ability “to

integrate text and background information appropriately and efficiently” (Grabe and Stoller, 2002, p.28), in order to construct and negotiate new meanings, is a key skill.

A significant body of research in the area of schema theory indicates that overall comprehension and reading skills are improved when the reader has some prior knowledge which is activated. Schema theory suggest that our knowledge of the world is organized into abstract mental networks and structures, or schemata, which are embedded and organized, and which can be developed or refined as information is received (Carrell, 1983a and 1983b; Anderson, 1984). While meaning is contained in the written word, reading is not the absorption of symbols by the mind, but the transformation of those symbols into meaning as they are mediated by what is known already. Construction and negotiation, and the new meanings that are the result of this process, are what makes the process transformative: the information is transformed as it moves from printed word to interpretation, which entails the transformation of the reader him / herself. The term “interpretation” (as opposed to “comprehension”) is suggestive of this transformation.

Reading requires cognitive skills which, following Bloom (1965), may be classified into lower-order and higher-order skills. Bloom developed his taxonomy for classifying educational objectives in relation to three overlapping domains: knowledge, skills (manual or physical) and attitude. Within the domain of knowledge, or cognitive, objectives, he distinguished six levels which are organized from the most concrete (lower-order) to the most abstract (higher-order):

1. Knowledge (concerned with remembering facts and basic concepts);
2. Comprehension (understanding facts and concepts by, for example, organizing, comparing and interpreting them);
3. Application (applying knowledge, facts, techniques and rules);
4. Analysis (breaking information down into its parts, identifying reasons or causes, for example);
5. Synthesis (bringing information together in different ways);
6. Evaluation (making judgments about information or ideas based on criteria).

The six domains are associated with different verbs and with different question types; for example, domain 1 is associated with verbs such as *define, find, list, relate, recall, show, select* and with questions that ask *who, when* or *why*, for example. Domain 6, on the other hand, is associated with verbs such as *compare, estimate, evaluate, justify, prioritize, recommend* and with questions such as *What evidence is there*

for ... or How would you explain ... Such verbs and questions can be used to develop critical thinking skills (“critical” in the sense of “appraising”, not “criticizing”), which are a necessary part of all six domains, as they involve both obtaining information (lower-order skills) and using that information to influence behavior (higher-order skills). Critical thinking may be defined as “the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.” (Scriven and Paul, 1987). It has two components:

1) A set of information and belief generating and processing skills, and 2) the habit, based on intellectual commitment, of using those skills to guide behavior. It is thus to be contrasted with: 1) the mere acquisition and retention of information alone, because it involves a particular way in which information is sought and treated; 2) the mere possession of a set of skills, because it involves the continual use of them; and 3) the mere use of those skills (“as an exercise”) without acceptance of their results.

Scriven and Paul (1987)

In relation to reading, critical thinking skills enable the reader to decide if what he or she is reading is worth remembering and thinking about. An important part of this process is metacognition, a term most often associated with Flavell (1979). Theories of metacognition have enabled understandings of cognition to be developed and expanded to encompass individuals’ awareness of and control over their cognition (Devine, 1993). While the abstract nature of the term “metacognition” can make it seem a daunting concept, it is frequently referred to in the literature simply as “thinking about thinking” (Anderson, 2002, p.1). Distinguishing between cognition and metacognition, Flavell (1979) observed that cognitive strategies *facilitate* learning, while metacognitive strategies *monitor* the learning process. Anderson (2002) discusses what is involved in monitoring the learning process, and identifies five primary components: “1) preparing and planning for learning, (2) selecting and using learning strategies, (3) monitoring strategy use, (4) orchestrating various strategies, and (5) evaluating strategy use and learning.” These components emphasize the *overseeing* and *regulation* of cognitive processes.

Full engagement with a text, therefore, is understood to include the application of both lower-order and higher-order thinking skills, all of which contribute to critical thinking, while metacognitive strategies monitor and regulate the process. The activation of prior knowledge is particularly important for improving overall comprehension and

interpretation. For these reasons, for each article in this book, we have prepared pre- and post- questions or prompts (*Forethoughts* and *Afterthoughts*) that variously:

- relate to one or more of the six domains of Bloom’s taxonomy of cognitive objectives;
- encourage critical thinking skills;
- encourage appropriate metacognitive skills and strategies;
- activate prior knowledge.

Why Engineers Should Read Widely

Engineers must be society wise as well as technology wise.

Warren Viessman, Jr., Hon. M.ASCE and Civil Engineer, cited in American Society of Civil Engineers Body of Knowledge Committee (2008)

When I think of the term “reading widely”, I think of reading material that is not required professionally, and this extends to reading for pleasure. Such distinctions however are far from clear-cut and it is perhaps more useful to think in terms of a spectrum. As an applied linguist, I sometimes choose to read articles or books about language in my free time; browsing through the *Economist*, for example, I am always attracted first to articles related to language. I would describe such reading as “reading for pleasure”, yet it clearly brings professional benefits too. I also read a wide range of literature; for example, I have just completed Wharton’s *House of Mirth*. This is also “reading for pleasure”, with less obvious professional benefits. Nevertheless, studies have shown that reading for pleasure can provide both educational and personal development benefits. Educational benefits that have been identified include:

- improving reading fluency as those who read more, read better and those who read better, read more (Cunningham and Stanovich, 1998);
- enhancing schema (general, background knowledge), which enhances reading ability (Anderson and Pearson, 1984; Cunningham and Stanovich, 1998);
- developing knowledge of the target language and text types (Day and Bamford, 1998, p.16);
- triggering interest in a new area (Usherwood and Toyne, 2002, p. 37)
- a positive impact on writing ability for those writing in English as a second language (Grabe, 2001; Hirvela, 2001, 2004; Tsai, 2008);

- developing vocabulary size (Nagy and Anderson, 1984; Day and Bamford, 1998, p.16)

Personal benefits include developing knowledge of the world (Day and Bamford, 1998, p.16; Usherwood and Toyne, 2002, p. 37) and acquiring a greater understanding of other cultures (Meek, 1991); both of which can be particularly enriching to engineers whose professional reading matter will lean towards the technical.

Habitually reading widely, given the benefits above, is likely to be of particular value to anyone interested in developing his or her skills of thinking creatively, as the skills that are required for reading are closely associated with those required for creative thinking (McVey, 2008). Wang (2012) observes various parallels between creative thinking and literacy. She notes “To prepare a creative mind means to encourage the habitual act of learning something new, seeking constructive criticism, thinking and incubating, and putting knowledge to work. These elements are actually part of the everyday reading and writing experience: reading to accumulate knowledge, and writing that puts knowledge and personal ideas to work.” Wang also found that habitual reading (and writing) has a positive relationship with creative thinking, finding that the ability to elaborate, that is, the ability to develop the details of an idea, was particularly enhanced in those who read widely. She concludes, therefore, that “To promote creative thinking, it is best to read and write extensively, especially in different languages.” (Wang, 2012).

A significant body of research emphasizes the need for today’s engineers to be highly creative and innovative, to solve today’s increasingly complex individual, societal and universal problems and retain global competitiveness (e.g. Brown, 2007; Felder, 1987). Charyton et al. (2011, p. 782), define creativity in an engineering context as requiring originality, adaptability, problem solving and, in particular, usefulness or applicability of ideas. The same authors quote research indicating that “87% of current engineering students agreed that creativity was a skill that is necessary for engineering (Zampetakis, Tsironis, & Moustakis, 2007). Furthermore, 77% of engineering students stated that they would like to take a course in creativity and creative problem solving (Zampetakis, Tsironis, & Moustakis, 2007)” (Charyton et al., 2011, p. 779).

Those who read widely acquire greater world knowledge and understanding of other cultures and contexts; they become “society-wise”. This enrichment is highly likely to enhance creativity. The reading material itself could contain original ideas or prompt original ideas; the

different experiences described or referred to in a text may compel an engineer to consider other situations; the problems that are solved in one context may be applied in another or adapted to it; and finally a design that is useful in one context may be adapted or improved for use in further contexts. The benefits extend beyond the professional, however; as Strong (2003, p. 6) notes: “When engineers can think out of the engineering box, they become more creative, they relate more effectively to non-scientists, and they become better people in general.” It is rational to conclude, therefore, as I started, with the observation that “the superior engineer reads a good deal more than the average engineer.” This book is aimed at encouraging a good deal more reading.

Afterthoughts

1. What would you personally expect to gain from reading more widely?
2. Which of the articles in the other chapters in this book are you most looking forward to reading, and why?

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THE ART OF READING: EVIDENCE, RELEVANCE AND DETECTION

ROGER NUNN

Forethoughts

1. Do you enjoy reading detective fiction (Agatha Christie's novels are examples)? Why / why not?
2. Can you see a connection between academic writing and detective fiction?
3. When you read an academic paper, how do you evaluate the evidence the author presents?

Introduction

As academics, we might not choose to read academic papers in our field when reading for leisure. However, I will argue in this paper that certain types of leisure reading are not only enjoyable, but they also help us to hone our reading skills. I will focus on detective stories, arguing that academic reading has a great deal in common with the kind of reading we do when we try to work out who was responsible for the crime in a detective novel. Academic study has many things in common with fictional detective work. Journal article authors make claims about why their research is significant and useful. If they fail to do this, it will be difficult for them to have their paper published in a good journal, because good journals tend to insist that a paper must contribute something new to the field. Readers have to sift through the evidence that is provided, and come to their own conclusions about what is true. In this chapter I will first look at some extracts from a few famous works of fiction, before looking at some claims made in an applied chemistry paper. My aim is to convince you, the reader, that academic readers can not only broaden their horizons while enjoying themselves reading fiction, but that they can also improve their academic reading ability by doing so.

A Detective Story: *The Mysterious Affair at Styles*

In this section I would like to discuss how you as the reader of a detective story can pit your wits against a famous writer, whose main aim is to prevent you from finding out the truth until the last pages of the novel. Agatha Christie wrote *The Mysterious Affair at Styles* in 1916. It features the famous Belgian detective Hercule Poirot and his assistant Captain Hastings for the first time. Poirot has the habit of keeping his thoughts to himself, but he does frequently drop hints about how to be a successful detective, as in the following extract:

(1) “It is certainly curious,” I agreed. “Still, it is unimportant and need not be taken into account.”

A groan burst from Poirot.

“What have I always told you? Everything must be taken into account. If the facts will not fit the theory – let the theory go.”

Agatha Christie, *The Mysterious Affair at Styles*, p.76.

However, Poirot never explains his thinking about the case under investigation, even to Hastings, until the end of the case. Any regular reader of Agatha Christie’s stories involving her most famous detective knows that Hastings is a rather poor detective who does the groundwork for Poirot, but rarely understands what is happening around him. Indeed, he is rather stupid. Poirot learns more from his reports than Hastings himself is able to. As Captain Hastings is the first person narrator of this story, Agatha Christie is able to use her narrator to misdirect us. On the other hand, we always hear what Poirot hears so we are also able to compete with Poirot in solving the mystery, instead of just reading Hastings’s account.

In extract 2 below, Captain Hastings is convalescing after a war injury by staying with an old acquaintance at *Styles*, where he had frequently been a house guest in the past.

(2) John noticed my surprise at the news of his mother’s remarriage and smiled rather ruefully.

“Rotten little bounder too!” he said savagely. “I can tell you, Hastings, it’s making life jolly difficult for us. As for Evie – you remember Evie?”

“No.”

“Oh, I suppose she was after your time. She’s the mater’s factotum [mother’s servant], jack of all trades! A great sport – old Evie! Not precisely young and beautiful, but as game as they make them.”

“You were going to say....?”

“Oh this fellow! He turned up from nowhere on the pretext of being a second cousin or something of Evie’s though she didn’t seem particularly keen to acknowledge the relationship. The fellow is an absolute outsider, anyone can see that.”

Agatha Christie, *The Mysterious Affair at Styles*, pp. 3 & 4

In this extract, the narrator Hastings, who is taking part in this conversation, is not interested in Evie as evidenced by his attempt to redirect the conversation back to something he feels to be more relevant, which is the marriage of his friend’s mother to a man twenty years younger than herself. However, in a detective novel every small detail is relevant. At this stage of the novel, no murder has been committed; but as avid detective novel readers, we know that it will not be long until there is a murder, and that something apparently irrelevant but slipped in skillfully by Agatha Christie early in the novel, will turn out to be very relevant later. Therefore, I need to remember everything for future reference. Evie’s relationship with the new fortune-hunting husband is only mentioned in passing before the murder, but it may turn out to be vital. We may legitimately suspect that Evie has an ulterior motive for the effort made to distance herself from her cousin, and, as a potential murderer (as virtually every character in an Agatha Christie novel is) we might need to suspect she was faking this hostile attitude. In this way, a detective writer hides the most relevant information away, where only the most alert reader will manage to retrieve it.

The Mysterious Affair at Styles was Christie’s first detective novel. In her autobiography (1993, p. 262) Agatha Christie indicates that she considered how to give her readers clues. In relation to the killer in the *The Mysterious Affair at Styles*, she explained: “... you would be seeing this man from the outside – so you could only see what he liked to show – not as he really was – that ought to be a clue in itself.” This is not just a writer of detective fiction. It is an author playing an intellectual communication game with her readers, of the kind that Wittgenstein (1953) calls “language games”.

Laura Thompson (2007, p.104) suggests that “Agatha Christie’s first detective novel was, in a sense, her only “cheat”. She justifies this by arguing that “the reader may guess right as to the culprit, but the guess cannot be proved without the knowledge of the properties of strychnine and bromide” (pp.103 & 104). While this may strictly speaking be true, I believe it misses the point. As a reader, I am not looking for scientific proof. Wittgenstein argues that “[t]he kind of certainty is the kind of language game” (p. 191). Wittgenstein also makes it clear (pp. 33-34) that he does not believe that language games have definite rules: “But what

does a game look like that is everywhere bounded by rules? Whose rules never let a doubt creep in, but stop up all the cracks where it might?"

In the detective novel reading game I like to play, I am simply trying to guess who the murderer is before the final solution is revealed, basing my guess on the weight of the evidence provided about the different suspects. I have also come to know that Agatha Christie was a specialist in poisons who had worked in a dispensary (Morgan, 1997) and I know nothing about poisons. However, my experience of reading her novels has taught me to trust her to give me the clues that will allow me to engage fairly in the language game we are playing. Poirot himself addresses this issue constantly, as this detecting hint supplied in the same novel illustrates:

(3) "Yes, yes, too conclusive," continued Poirot, almost to himself. "Real evidence is usually vague and unsatisfactory. It has to be examined –sifted. But here the whole thing is cut and dried. No, my friend, this evidence has been cleverly manufactured – so cleverly it has defeated its own ends." Agatha Christie, *The Mysterious Affair at Styles*, pp. 95-96.

Relevance

The notion of relevance I evoked to give my interpretation above about a fictional detective story is also one of the most important aspects of academic thinking. Theories have been written about it by famous language philosophers such as Paul Grice (1989) and Sperber and Wilson (1995). We as readers need constantly to consider the evidence in front of us to decide if something truly adds to our knowledge. Authors can indicate that something is relevant in various ways. In extract (1) above, Poirot suggests that everything is relevant. If a small piece of evidence defeats our theory, we need to look for a new theory.

Grice's Maxim of Quantity refers to the quantity of information that is required in any communication context. In order to be efficient in communication, we should not give more information than is needed; but we should give enough. How much information is enough must be worked out by the people engaged in communication. From the perspective of "language games", it depends on the game being played. In academic communication, when writing a journal article, I must only provide what is necessary to make my point concisely, adding enough relevant evidence to convince my reader that I have made a reasonable claim and that I have not overstated my claim.

The First Detective Novel

While Agatha Christie was a prolific author of detective fiction, there are other sources that may be classified as literature, rather than as popular fiction, which set up a similar communication game of “hide and seek” with the reader. Wilkie Collins is often credited with writing the first detective novel in the English language. A contemporary and travelling companion of Charles Dickens, his novel *The Moonstone* rivaled Dickens’ own novels in popularity, and continues to be read to this day. This novel constitutes a real challenge to the reader. While with some pride I ask you to believe that I beat Agatha Christie in the game I played with her as a reader of *The Mysterious Affair at Styles*, based on the kind of clues I illustrated above, I must admit to having been absolutely defeated by *The Moonstone*. Yet I believe Collins played a very fair game. Each section of the novel is narrated in the first person by a different character in the story. It is one of the main suspects who instigates this game, as he himself is not sure if he committed the crime or not. The reason he asks so many other protagonists to become the narrator is that each one of them was the only person with first-hand experience of a particular part of the story, and the potential suspect is as keen as we are to discover the truth. How the “crime” was actually committed provides one of the most surprising endings to any novel I have ever read.

Jane Austen’s Novels

While Wilkie Collins lays claim to being the first author of detective novels, he is not the first novelist to challenge the reader to work out the truth based on a very careful reading of the text. Jane Austen’s famous novels *Pride and Prejudice*, *Sense and Sensibility* and *Emma* have recently been huge box office successes as films, but it is the novels themselves that set up the critical interaction with her readers which accounts for their popularity to this day. Here I will consider *Emma* because it is similar in many ways to a detective novel. When the beautiful and accomplished Jane Fairfax arrives in the small community of Highbury, we gradually become aware that she is not quite what she seems to be. Emma, who has ruled over her small community undisturbed by outside influence since an early age, suddenly finds she has competition. Jane is not her social equal but rivals her in beauty and surpasses her in accomplishments. *Emma* is not a first person narrative, but much of the story is related from Emma’s point of view and her ability to misread a situation, while being convinced