

# Review of Pitard & Pitard (2026): “Theory of Sampling and Sampling Practice”, 4th Edition (2026)

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A much-awaited renewal of Francis Pitard’s monumental *Theory of Sampling and Sampling Practice*, 3rd edition (2019) was launched in February 2026. The fourth edition is the work of Francis and his son Maxime A. Pitard. This review compares the third and new fourth editions before assessing their scientific contents.

While the 3rd ed. totalled 693 pages (incl. References and Index), it is now achieved in 683 pages in the 4th. The core scientific text (38 chapters) has shrunk by 24 pages, but this is entirely due to a slightly smaller font and a denser layout and text deployment. While four references have been added in the 4th ed., the identical Index is still formidable and very useful (see why below). Two chapters are new, penned by the main author’s son Maxime Pitard.

## Unexpected surprise

The first 38 chapters of the 4th ed ... are identical to the 38 chapters in the 3rd ed! Both editions are massive, the List of Contents (LoC) alone comes to 20 pages! At first sight, this is overwhelming with a 4-tier organisation hierarchy: Part / Section / Subsection / Sub-Subsection. Indeed 20 pages is a bit exaggerated, since following the book’s XIII Parts listing its 40 chapter titles gives a perfectly fine first overview with much less fuss. Still, for readers with a systematic mind, this level of detail may be welcome – and for any second (or third) reading, this meticulous detailing serves an important navigation purpose: any vaguely remembered topic can be found immediately.

The only organisational difference between the 3rd and the 4th edition (apart from adding the two new chapters) concerns minor, but important reorganisations within Part I “Introduction and a Management Strategy”, in which certain preface, introduction and historic summary sections have been stirred up a bit and served in a partly new order, which gives a better reading flow – as a much needed introduction to the

monumental task ahead of all readers. It is imperative to pay very close attention to this Part. For both editions, the last 2.5 pages of Part I becomes the vade mecum for the reader: “Subdivisions of the Text” is the booster rocket that propels the reader into getting off the ground right away. This is where an inspiring overview is to be found, a map for the reader’s excursion into TOS: theory, practice and project management. The route through this vast terra incognita is unique to Francis Pitard.

For this reviewer it has always been a mystery why this highly circuitous route through all the core TOS presentations was devised this way. But this simply reflects the fact that there are many didactic roadmaps towards full comprehension of the Theory and Practice of Sampling. There exist other introductions to TOS’ theory and practice on the sampling textbook market as well. Diversity is good for a discriminate readership with different abilities to follow the serious mathematical and statistical exposé in (the 3rd) the 4th edition.

## Scientific scope

This is a scientific publication par excellence! It is a systematically worked through textbook, providing a complete introduction and very well-written development of the Theory of Sampling (TOS) and its application to a number of typical sampling objectives, e.g., sampling of precious metals and other analytes in trace concentrations, environment, moisture determination, particle size distribution metallurgical accounting, process control, blending monitoring a.o. with derived principles for ‘correct’ equipment design, implementation, usage, cleaning, maintenance and quality control. It is a pleasure for the reader to be treated to a com-

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prehensive historical view of the development of TOS through the lens of Francis Pitard's close collaboration with the founder of TOS, Pierre Gy through many decades, and to be invited in on the main author's unique grasp of the logical way to tie this together with the works of I. Visman and C.O. Ingamells into a single comprehensive framework. Nobody else could have done this without Pitard's enormous insight and experience, which is second to none in the world sampling community.

The 4th ed. is notable because of the two new chapters, one of which widens coverage of process sampling significantly and presents the all-important variographic data analysis and modelling tool in a renewed educational way. The 4th ed concludes with a refreshing graphic view on bias testing.

## Scientific content

After having read the entirety of this book, this reviewer tried to come up with a condensed assessment of the 631 core pages involved but failed – it was simply too much. So instead, why not listen to the Maestro – it cannot be more focused than when it comes from author himself. THIS is the inspiring overview that compels you to want to read this book – and read all of it!

## Addendum

The two last chapters are written by Pitard's son Maxime Pitard. Chapter 39 is an offering to the many readers without specific geostatistical training and competence, deriving the essential variographic understanding of the many variability components in process data, showing how variographics opens up for detailed insights in i) optimal sampling, ii) process monitoring and iii) process quality control. This didactic introduction is truly helpful for all novices to the intricacies of process sampling. Chapter 40 present a new educational packaging for bias testing, also giving a wider perspective on how sequential bias testing allows new insights regarding this critical characteristic: Is a particular sampling procedure biased, or not – but over which process interval does this conclusion hold up? This concluding chapter is a refreshingly new presentation of an approach originally proposed by Pierre Gy himself. This modern re-telling plus a highly informative graphic software (illustrated with instructive interpretations) is very useful for the reader. Bravo to the addendum!

### Part I: Introduction and a Management Strategy

Because the prevention of any misunderstanding is essential, Chapter 1 has been devoted entirely to the definition of basic terms and notations.

Chapter 2 suggests a more effective management strategy based on a clear definition of structural problems (i.e., causes of problems) and circumstantial problems (i.e., effects generated by structural problems). The confusion between these two kinds of problems is costing alarming financial losses for many corporations around the world.

### Part II: The Necessary Statistical Methodology

Chapter 3 is a refreshing presentation of important statistical concepts for the mining engineer, geologist, metallurgist, chemist, manufacturer of sampling equipment, regulator, or scientist who had little exposure to statistics. A careful reading of this chapter is essential before entering the complex subject of sampling.

Chapter 4 is a logical introduction to the components of the Overall Estimation Error OEE.

### Part III: Heterogeneity and Homogeneity

Chapter 5 is a logical introduction to the notion of heterogeneity because it is a primary structural property of all materials we want to sample.

Chapter 6 is devoted to the heterogeneity of a zero-dimensional lot where a good understanding of Constitution Heterogeneity  $CH$ , and Distribution Heterogeneity  $DH$  is essential.

Chapter 7 is devoted to the heterogeneity of a one-dimensional lot and the notion of variography is introduced that is a critically important tool used throughout the book.

### Part IV: Sampling Errors Introduced by Various Forms of Heterogeneity

Chapter 8 is an in-depth study of one-dimensional lots and an introduction to the continuous model.

Chapter 9 is an in-depth study of zero-dimensional lots and an introduction to the discrete model.

Chapter 10 is devoted to the Fundamental Sampling Error  $FSE$ , which is the minimum error possible involved in a sampling process of particulate materials. If something goes wrong there, then the sampling process becomes useless and vastly misleading.

Chapter 11 shows how to minimize the variance of the Fundamental Sampling Error  $FSE$  in sampling protocols, and an introduction to sampling nomographs.

Chapter 12 is devoted to the sampling for particle size distribution analysis. This chapter has a strong connection to Chapters 10 and 11 in its critically important applications.

Chapter 13 is an introduction to the Grouping and Segregation Error  $GSE$  and an in-depth study of segregation and its negative effects in sampling protocols and in processing plants.

### Part V: Integration of Visman and Ingamells' Works into the TOS

Chapter 14 is an introduction to Visman's work.

Chapter 15 is an introduction to Ingamells' work.

Chapter 16 is an in-depth demonstration that Visman and Ingamells' works can be easily linked to the Theory of Sampling and actually add to it in a beneficial way.

### Part VI: The Special Case of the In-Situ Nugget Effect

Chapter 17 is an introduction to a difficult problem in geostatistics when a constituent of interest clusters in an excessive way to the point that it becomes a sampling problem as well, although it is not the sampling of particulate material but the sampling of isolated clusters in unbroken materials.

### Part VII: The Capital Notion of Sampling Correctness

Chapter 18 is an in-depth introduction to the Increment Materialisation Error  $IME$ .

Chapter 19 is a discussion about the various sampling modes that can be selected to implement a sampling protocol.

Chapter 20 is an in-depth study of the Increment Delimitation Error  $IDE$  taking place during exploration, mining and also when sampling the environment.

Chapter 21 is a review of the Increment Delimitation Error  $IDE$  taking place within processes.

Chapter 22 is a review of the Increment Delimitation Error  $IDE$  taking place at the laboratory.

Chapter 23 is an in-depth study of the Increment Extraction Error  $IEE$  taking place during exploration and mining.

Chapter 24 is a review of the Increment Extraction Error  $IEE$  taking place within processes.

Chapter 25 is a review of the Increment Extraction Error  $IEE$  taking place at the laboratory.

Chapter 26 is devoted to the Increment Preparation Error  $IPE$  and the notion of sampling integrity and the many problems it creates for contamination, losses, alteration of physical and chemical properties, training of personnel and possible fraud during the sampling of valuable commodities.

### Part VIII: The Increment Weighting and Weighing Errors

Chapter 27 is an in-depth study of the Increment Weighting Error  $IWE$ , as good sampling systems and protocols must be reasonably proportional. Proportional sampling is the future of good sampling systems.

Chapter 28 is a review of weighing systems the incorrectness of them is indirectly connected to sampling problems. They are often a major source of reconciliation as people may not know exactly how much tonnage they process.

### Part IX: Review of Some Notorious Sampling Problems

Chapter 29 is a review of a problem with a bad reputation in commercial sampling, which is the sampling for the determination of the moisture content. Companies often have severe disputes and even litigation on this subject.

Chapter 30 addresses the many peculiarities about the sampling of precious metals and other very heavy minerals.

Chapter 31 is a review of sampling practice for liquid and solid wastes and sampling of the environment.

Chapter 32 is a discussion about solvable and unsolvable sampling problems.

### Part X: Chronostatistics

Chapter 33 suggests a strategy to take better advantage of existing chronological data.

Chapter 34 is devoted to the use of the variogram to elaborate meaningful process control charts.

Chapter 35 shows case studies where variography was an effective tool to discover sources of problems.

### Part XI: Homogenization

Chapter 36 is an introduction to homogenizing processes.

Chapter 37 is devoted to bed-blending techniques.

### Part XII: Recommendations to Manufacturers of Sampling Equipment and to Engineering Firms

Chapter 38 is a list of recommendations based on the contents of this fourth edition and will provide a quick check list to users of the TOS.

### Part XIII: Addendum

Chapter 39 is a deep dive into the derivation of the variographic equation used throughout this textbook.

Chapter 40 is an introduction to an approach developed by Pierre Gy to visualize and interpret the results of a bias test.

## Highlight (for this reviewer)

After the full theoretical and technical treatment in this excellent, indeed perfect textbook, chapter 32 shows up with quite a different tenor: “Solvable and Unsolvable Sampling Problems”.

After a very long career of practicing and teaching sampling science theory and the technology needed for solving practical sampling problems, Francis Pitard here vents quite an impressive amount of accumulated frustration as to why an overwhelming proportion of the world’s practical samplers, technicians, engineers, Original Equipment Manufacturers (OEM), management of individual companies and corporations, economists, regulators – you name it – have not gotten it yet: the benefits and the value of the Theory and Practice of Sampling. The main author has been involved in countless consulting projects, audits, and educational outreach enterprises – he knows the practical field intimately better than any other colleague (or competitor in the business realm). By way of the candid writing in this chapter, the reader comes away ‘feeling the same pain’. Anybody who manages to read the book this far will immediately feel the need to sign up for membership in the International Pierre Gy Sampling Association (IPGSA).

## Conclusion

This textbook is unique, the only fully up-to-date, complete introduction to TOS. It is the most advanced written treatise on all aspects of sampling, at the highest scientific level. But it also states its intention to be comprehensible for any-and-everybody having understood that proper sampling is needed, for example the industrial engineer, metallurgist, geologist, miner, chemist, environmental scientist, academics too (TOS is still only taught as part of university curricula in but a few places worldwide) – as well for management (company, corporation) and for regulators and other relevant authorities. This is a tall order! This goal will depend on the effort the reader is willing to put in. Be this as it may, this book’s content cannot be recommended enough. It is clear Francis Pitard writes for his legacy – and the result could not be a finer scientific gift to the world!

And for those who might balk at its 683 pages and its elevated math and stat – get it anyway: It belongs on everybody’s professional shelf or desktop; it is (also) the ultimate HANDBOOK of sampling.

## A grumpy postscript

There can be observed a few misquoted year-dating springled around, and some literature survey summaries appear to stop abruptly at the year 2017 (the 3rd edition was published in 2019). This could have been avoided, updating in an age where use of AI for mundane editorial work is acceptable.

However, the publication of a global standard: *DS 3077:2024 Representative Sampling – Horizontal Standard*, a significant achievement for the sampling community, especially for those seeking a condensed introduction to proper sampling in practice (which is the objective of international standards). But this standard is totally overlooked in this textbook, which is all the more surprising given that Pitard is the first author of a call for community action<sup>2</sup>: “IPGSA sampling competence: Crucial added value to international standards”. This a major disappointment!

This textbook is massive! Can one truly comprehend this monolithic curriculum by reading (it) alone? Besides, what can you do? Winston Churchill once stated: “You want me to speak – for how long? I can give a one-hour speech tomorrow, but if you only want a 10-minute speech, I must prepare for a week”.

It is not only that the book is massive, so is its price. For those brave enough to join forces with this reviewer in this mild criticism, every September you’ll find the evergreen Pitard grand course at Colorado School of Mines (CSM): “Sampling Theory, Sampling Practices and Their Economic Impact”<sup>3</sup>, a 5-day didactic bonanza covering the very same topics as found in the book – in fact the book is the course curriculum, handed out to all active paid-up participants. This course is second to none – see you there?

<sup>2</sup> [https://www.saimm.co.za/Conferences/files/wcsb11-2024/30\\_WCSB05-Pitard.pdf](https://www.saimm.co.za/Conferences/files/wcsb11-2024/30_WCSB05-Pitard.pdf)

<sup>3</sup> <https://proed.mines.edu/courses/sampling-theory-sampling-practices-and-their-economic-impact-c75n>