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Appeal to the Scientific Community: let's take care of Quality of published papers

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Abstract: They say that good papers are published only in “Peer Reviewed Trusted Journals (PRTJ)”, while low quality papers are published in the “Predatory Publishing Journals”. Here we use some cases to show that this is not true, because the quality of papers depends on the quality of the authors in the same manner that quality of teaching depends on the quality of professors. It seems that Peer Reviewers and Editors did not take care of the quality of published papers, because they missed Quality of Methods (Deming, Juran, Gell-Mann, Shewhart, Einstein, Galilei). This is very diffused in documents about Confidence Intervals and Control Charts [especially for Rare Events, where the data are assumed to follow the Weibull (or exponential) distribution]. Since generally the authors are professors it is important to see the two sides of the “publishing medal”: authors and professors. Software (JMP, Minitab, SAS, ...) get wrong Control Limits and do not find that processes are Out Of Control: this causes costs of dis-quality. The cases analysed here are from PRT Journals and teaching documents.

Keywords: Quality of Methods, Quality Education, Peer Review, Methods for Quality, Rational Manager, Quality Tetralogy, Intellectual Honesty, Reliability Integral Theory

1. Introduction

In any activity we need to analyse information; information can be either given by words or by numbers (data provided by a measurement system). The analysis of information is done by suitable methods devised by competent scholars, working either in Universities or in Companies. Many times the methods are presented in papers published in Magazines and Journals or in books. Journals are broadly divided in two categories: 1) the Good and Reputed Journals and 2) the so-called “*Predatory publishing*” {Open Access Journals which publish papers and ask for a fee for that [named APC (Article Processing Charge) or a similar acronym]}.

The author, in his working life as Manager in Companies, as Professor in Universities and as Consultants, had the opportunity to read many wrong papers about data analysis.

For this reason, we titled this paper “*Appeal to the Scientific Community: let's take care of Quality of published*

papers” because the people have the right of knowing the truth about the “*Quality of published papers*”.

Unfortunately, the Universities, as said by Einstein «*An Academic career poses a person in an embarrassing position, asking him to produce a great number of scientific publications...*», ask the researchers for publications if they want to become professors; several times, the author asking the applicants (for professorship) “Why did you write such a statement...” got the answers either “My colleague wrote that,,” or “I found it in Wikipedia” or “I read it in that book...”: in spite of their incompetence, they became professors!

We will show some fundamental ideas about the analysis of data collected in scientific experiments, based on the Scientific way of reasoning through Mathematics, Probability Theory and Statistics.

We start with the data in table 1, gathered in an experiment. A scholar must find the best from them.

Table 1. Data gathered in an experiment: two samples of size 10. Higher values are better.

Sample 1	286	948	536	124	816	729	4	143	431	8
Sample 2	2837	596	81	227	603	492	1199	1214	2831	96

If the reader links to the three “forums” [1-3] iSigSigma, Academia.edu, Research Gate and looks at the discussions there (about statistical subjects) he can find a lot of people

unable to correctly analyse the data in Table 1, writing wrong ideas on Probability and statistics Methods. They are not in line with the concepts provided in the documents

[4-15].

Suppose that a scholar ask himself the following questions:

- (1) Do the two samples provide the same information about the process?
- (2) Do the two samples are distributed in the same way?
- (3) Do the sample 2 shows an improvement versus the sample 1?

To answer the scholar either uses his intuition or uses a method. Since intuition can be fallacious he must use a sound method.

Let's see the steps he has to do:

- (i) The data x_{ij} (numbers, $i=1, 2; j=1,2, \dots, 10$) are to be considered the “determinations” of the Random Variables (RV) X_{ij}
- (ii) Each RV X_{ij} has a pdf (probability density function) $f_X(x; \theta_1, \theta_2, \dots, \theta_k)$ which depends on k “parameters” θ_m , $m=1, 2, \dots, k$, which characterise the pdf
- (iii) The “parameters” θ_m can be (a) either the “determinations” of the RV θ_m , distributed with a “known” pdf $g_{\theta_m}(\theta_m)$, or (b) “unknown” quantities θ_m (real numbers) and known type of pdf $f_X(x; \theta_1, \theta_2, \dots, \theta_k)$, or (c) pdf “completely unknown”
- (iv) An “estimation function” $\varphi_{\theta_m}(X_{ij}; \theta_m)$ is sought out to find the “best” value to be attributed to the parameter θ_m , for the cases (a) or (b)
- (v) While for the case (c), and for “Complete Samples” (as those in table 1), Probability and Statistics provide the ways to find “estimation functions” $\varphi(X_{ij})$ of the Mean (of the “Complete Samples”), of the Standard Deviation (of the “Complete Samples”), and other Moments (of the “Complete Samples”), ...

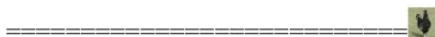
Case (c) is the easiest situation of computing the “estimation functions” $\varphi(X_{ij})$ for “Complete Samples”.

In spite of that we find professors teaching wrong ideas.

Notice the following wrong attached statement (excerpt 1) taken from a course on Quality Management, where Professors of Politecnico (of the Quality engineering Group) suggest Montgomery books to students. Any good student knows that the formula holds for any distribution and any sample size n : the Central Limit Theorem does not have any importance for that, BUT QEG professors do not know that!!!

===== **MEDITATE** ===== SPQR ===== IXΣ ===== 📌

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \quad \text{(from statistics: central limit theorem)}$$



Excerpt 1 Wrong statement (from a course on Quality Management at Politecnico of Turin) [given by the QEG (Quality Engineering Group)]

Remember: that formula holds for any distribution and

any “Complete Samples” of sample size n .

For both the cases (a) and (b) we have a tool, based on the Likelihood Function (formula 1), for “Complete Samples”

$$L(D; \theta_1, \theta_2, \dots, \theta_k) = \prod_j^n f_X(x_{ij}; \theta_1, \theta_2, \dots, \theta_k) \quad (1)$$

The “estimation function” $\varphi_{\theta_m}(X_{ij}; \theta_m)$ of the “best” value to be attributed to the parameter θ_m , is different for the two cases.

For the case (a), let's see the figure 1, depicting the Bayesian method for estimation, because it is based on the Bayes' Theorem

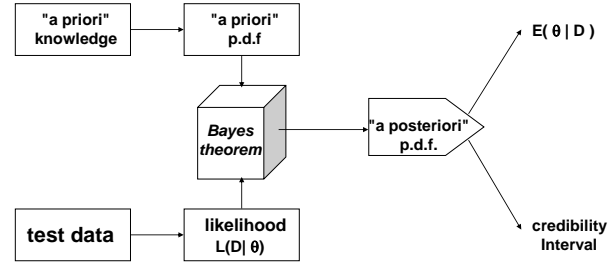


Figure 1. The Bayesian method for estimation

In this case, the “parameter” θ_m is the “determination” of the RV θ_m , distributed with a “known” pdf $g_{\theta_m}(\theta_m)$, named “a priori (or Prior)” pdf, related to the scholar “a priori (or Prior)” knowledge (or experience). The test data $D\{x_{ij}, i=1, 2; j=1,2, \dots, 10\}$ in table 1 provide the Likelihood that is “mixed”, via the *Bayes' Theorem*, with the Prior pdf: the “a posteriori (or Posterior)” pdf is computed; from that we can compute the Mean $E(\theta_m|D)$ which estimates the mean value (a real number) $\hat{\theta}_m$ of the Posterior pdf. From the Posterior pdf we can compute two quantities (real numbers) $\hat{\theta}_{m,Lower}$ and $\hat{\theta}_{m,Upper}$ such that there is the “stated” probability $1 - \alpha$, as in the formula (2)

$$P[\hat{\theta}_{m,Lower} \leq \theta_m \leq \hat{\theta}_{m,Upper}] = 1 - \alpha \quad (2)$$

The interval $\hat{\theta}_{m,Lower} \dots \hat{\theta}_{m,Upper}$, named *Credibility Interval*, is a numerical interval which has a stated probability $1 - \alpha$ of comprising the RV θ_m , related to the “parameter” θ_m .

For example we could assume that the pdf of the data of table 1 is the exponential, where the parameter λ is the failure rate

$$f_X(x; \lambda) = \lambda \exp(-\lambda x) \quad (3)$$

We can reparametrize (3) with $\lambda = 1/\theta$ and assume θ as the parameter.

To use the Bayesian estimation we must define either the “known” Prior pdf $g_{\theta_m}(\theta_m)$ either with $\theta_m = \Lambda$ and $\theta_m = \lambda$ or $\theta_m = \theta$ and $\theta_m = \theta$; if we, from Prior knowledge, use the Prior (with a specified value a , for the RV θ)

$$g_{\theta}(\theta) = a(1/\theta)^2 e^{-a/\theta} \quad (4)$$

we can compute the Mean of the Posterior pdf and the Credibility Intervals, both for Sample 1 and Sample 2.

We can then compare the means and the Credibility Intervals and take decisions.

It is clear that using another Prior pdf we get a different estimation and a different Credibility Interval. Therefore, two scholars have different estimations and different Credibility Intervals from the same data.

On the other and, with the data of table 1 and without assuming any distribution we can compute the means and the standard deviations (sd) of both samples and decide only through our intuition.

	Mean	sd
Sample 1	402.50	344.57
Sample 2	1017.60	1035.35

The numbers are different; it seems quite “certain” that they are different. Can we assess our “certainty”? Yes, if we are able to assume a pdf of the data.

And what can we do if we do not have the Prior pdf $g_\theta(\theta)$ or $g_\lambda(\lambda)$?

We must find a theory: the theory of Confidence Intervals. We use the SPQR Principle [*Semper Paratus ad Qualitatem et Rationem* (“Always Ready for Quality and Rationality”)], *Engineering and Applied Sciences*. Vol. 2, No. 3, 2017] invented by the author as the way to analyse both books and papers, because only very few people have been carefully considering Quality of the Methods: e. g., Deming, Juran, Gell-Mann, Shewhart [4-10]: professors, researcher, managers, scholars and students have been learning wrong ideas, in the Quality field: there is worldwide used book with many wrong concepts {e.g., D. C. Montgomery falls in *contradiction*! He spreads wrong concept on Quality [16]}.

2. The Theory of Confidence Intervals

This section is written to explain the method of approach to the problem of estimation especially designed for all cases in which the Prior distribution of the “parameter” to be estimated is not known: the parameter is then treated as an unknown constant and not as a RV.

Since we cannot use the Bayes Theorem we must find a new way for the estimation.

It is important that we do that because after almost one century from the first ideas on the CI (Confidence Intervals) they are not still understood [9-13]. It is dramatic seeing that many books and papers do not give the correct Theory of CIs!

The Scientific road to building the CIs (Confidence Intervals) can be found in [10-13, 17-25]. Here we show the various steps.

To make the presentation very easily we consider only one “parameter” and the exponential pdf, with mean θ

$$f_X(x; \theta) = (1/\theta) \exp(-x/\theta) \quad (3b)$$

We consider the data of Sample 1 in the Table 1.

Here are the steps (related to the Sample 1):

- We name $D = \{x_{1j}; j=1,2, \dots, 10\}$ the set of the data to be considered for the estimation of the parameter θ , with each RV X_{1j} following the pdf (probability density function) $f_X(x; \theta)$
- We write the Likelihood Function (formula 1), for the “Complete Sample 1”

$$L(D; \theta) = \prod_{j=1}^{10} f_X(x_{1j}; \theta) = (1/\theta)^{10} \exp[-\sum x_{1j}/\theta] \quad (1b)$$

- We find the Maximum of $L(D; \theta)$ by setting

$$\frac{\partial L(D; \theta)}{\partial \theta} = 0 \quad (5)$$

whose solution is the quantity

$$\hat{\tau} = \sum_{j=1}^{10} x_{1j} \quad (6)$$

- $\hat{\tau}$ is the determination of a RV T , sum of the RVs X_{1j} ,

$$T = \sum_{j=1}^{10} X_{1j} \quad (7)$$

whose pdf can be derived, via Probability Theory [10-13, 17-25], from that of the sum of the 10 RVs X_{1j}

- We write the *Probability statement* for the RV T which depends on the parameter θ

$$P[L \leq T \leq U] = 1 - \alpha \quad (8)$$

where L and U are two numbers and α is a stated probability that the RV T is out of the *probability interval* $L \dots U$ [since the exponential distribution is often used for “life data” (Time To Failure)] T is named “Total Time on Test”

- From (8) we derive the equivalent Probability statement

$$P[K_L T \leq \theta \leq K_U T] = 1 - \alpha \quad (9)$$

where we see the random probability interval $K_L T \dots K_U T$ that covers (includes) the unknown “true” value θ_0 of parameter θ ; see the figure 2 where the abscissa is the parameter, and the ordinate is the RV T

- We can define the two probability intervals $L \dots U$ and $K_L T \dots K_U T$ before any collection of the data D
- When we compute the number $t_0 = \hat{\tau}$, named the “observed total time on test”, the random interval $K_L T \dots K_U T$ becomes the “real” interval $\theta_L \dots \theta_U$ “determination (of the Random Interval)” as it is shown in the figure 3: notice that the result holds also for Uncomplete Samples of n items and r failures (there are $n-r$ ties)
- The “real” interval $\theta_L \dots \theta_U$, “determination (of the Random Interval)”, is named *Confidence Interval (CI)*, and has the property that, *in the long run*, the $(1 - \alpha)\%$ of the CIs covers the unknown “true” value θ_0 of parameter θ
- The probability that $[\theta_0 \in \theta_L \dots \theta_U]$ is either 1 or 0, because θ_0 is not a RV

For EXPONENTIAL density $f(t, \theta)$

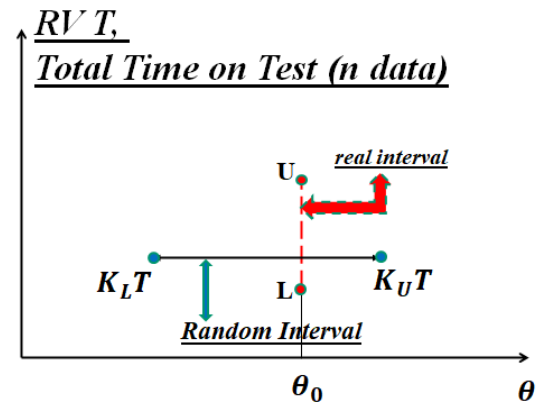


Figure 2. The two Probability Intervals connected to the RV T (Total Time on Test)

Many scholars do not know the Theory; you find them in the forums [1-3] and in many papers, in good and respected Journals, as the ones in the following “*Ocean full of errors by...*”.

The “ocean full of errors by...”

Dovoedo and Chakraborti, “Boxplot-based Phase I Control Charts for Time Between Events”, *QREI*, Kumar, Rakitzis, Chakraborti, Singh (2022), “Statistical design of ATS-unbiased charts with runs rules for monitoring exponential time between events”, *CS-TM*, Jones, Champ, “Phase I control charts for times between events”, *QREI*, Fang, Khoo, Lee, “Synthetic-Type Control Charts for Time-Between-Events Monitoring”, *PLoS ONE*, Kumar, Chakraborti, “Improved Phase I Control Charts for Monitoring Times Between Events” *QREI*, Dovoedo “Contribution to outlier detection methods: Some Theory and Applications”, (*found online, 2021, March*), Liu, Xie, Sharma, “A Comparative Study of Exponential Time Between Event Charts”, *QT&QM*, Frisé, “Properties and Use of the Shewhart Method and Followers”, *SA*, Woodall “Controversies and Contradictions in Statistical Process Control”, *JQT*, Kittlitz “Transforming the exponential for SPC applications”. *JQT*, Schilling, Nelson “The effect of non-normality on the control limits of X charts”, *JQT*, Woodall “The use of control charts in health-care and public health surveillance”, *JQT*, Xie, Goh, Kuralmani, “Statistical Models and Control Charts for High-Quality Processes”, (Boston, MA: *Kluwer Academic Publisher*, 2002), Xie, Goh, Ranjan, “Some effective control chart procedures for reliability monitoring”, *RE&SS*, Xie, “Some Statistical Models for the Monitoring of High-Quality Processes”, Boston, chapter 16 in the book *Engineering Statistics (Pham Editor): Springer-Verlag*, Zhang, Xie, M., Goh, “Economic design of exponential charts for time between events monitoring”, *IJPR*, Zhang, Xie, Goh “Design of exponential control charts using a sequential sampling scheme”, *IIE Transactions*, Zhang, Xie, Goh, Shamsuzzaman “Economic design of time-between-events control chart system”, *CIE*, Santiago, Smith, “Control charts based on the Exponential Distribution”, *QE*, Nasrullah, Aslam, “Design of an EWMA adaptive control chart using MDS sampling”, *JSMS*, Balamurali, Aslam, “Variable batch-size attribute control chart”, *JSMS*. On September 2022, the author looked (in the web) for other TBE papers and books to see their way of dealing with “Rare Events” Control Charts; he copied 77 pages of documents (several from Consultants) and downloaded 32 papers (Open Source). Several Journals asked from 15 \$ to 60 \$, to download a paper. The Open Source are: “Control Chart: Charts for monitoring and adjusting industrial processes”, “TOOL #6 - XBar & R Charts”, “Integrating Quality Control Charts with Maintenance”, “A Brief Literature Review”, “Paper SAS4040-2016, “Improving Health Care Quality with the RAREEVENTS Procedure Bucky Ransdell, SAS Institute Inc.”, “Performance Criteria for Evaluation of Control Chart for Phase II Monitoring”, “(Thesis) A Comparative Study of Control Charts for Monitoring Rare Events in Health Systems Using Monte Carlo Simulation”, “A study on the application of control chart in healthcare”, “Control Charts for Monitoring the Reliability of Multi-State Systems”, “Part 7: Variables Control Charts2, “A Control Chart for Gamma Distribution using Multiple Dependent State Sampling”, “A Variable Control Chart under the Truncated Life Test for a Weibull Distribution”, “Plotting basic control charts: tutorial notes for healthcare practitioners”, “Appendix 1: Control Charts for Variables Data – classical Shewhart control chart”, TRUNCATED ZERO INFLATED BINOMIAL CONTROL CHART FOR MONITORING RARE HEALTH EVENTS”, “Comparison of control charts for monitoring clinical performance using binary data”, “A number-between-events control chart for monitoring finite horizon production processes”, “Rare event research: is it worth it?”, “Quality Improvement Charts: An implementation of statistical process control charts for R”, “Control Chart Overview”, “Statistical Process Control Monitoring Quality in Healthcare”, “A Control Chart for Exponentially Distributed Characteristics Using Modified Multiple Dependent State Sampling”, “Synthetic-Type Control Charts for Time-Between-Events Monitoring”, “A systematic study on time between events control charts”, “Lifestyle Management through System Analysis Monitor Progress”, “Multivariate Time-Between-Events Monitoring – An overview and some (overlooked) underlying complexities”, “A Comparison of Shewhart-Type Time-Between-Events Control Charts Based on the Renewal Process”, “Control Charts for Monitoring Time-Between-Events-and-Amplitude Data”, “How to Measure Customer Satisfaction Seven metrics you need to use in your research”.

The “ocean full of errors by...”

We informed the authors and the Journals who published wrong papers; we wrote various letters to the Editors: they have been not published so far; Editors cannot acknowledge

their errors. The same happened for Minitab: so people continue taking wrong decisions...

For EXPONENTIAL density $f(t; \theta)$

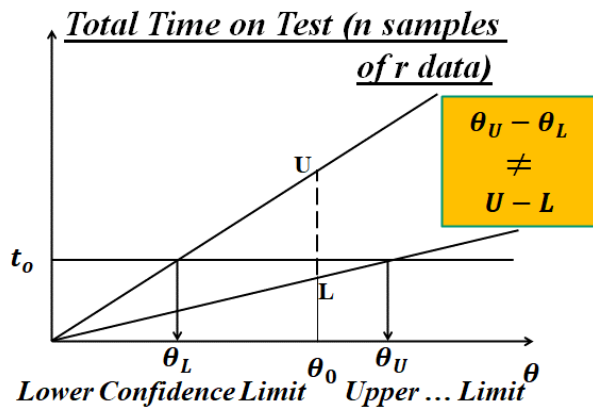


Figure 3. The Confidence Interval $\theta_L \dots \theta_U$ and the Probability Interval $L \dots U$ [for the RV T (Total Time on Test)]

3. The “NHSTP” (null hypothesis significance testing procedure)

This point is largely debated, with wrong ideas, as well. The road shown in the section 2 can be depicted as in the figure 4.

J. Juran, at the 1989 *EOQC Conference* in Vienna, highlighted the content of the paper [26] about the importance of the Quality of the methods for making quality: the paper shows the only good methods are crucial for suitable decision taking.

Since the data are unfortunately always variable we must consider all the uncertainties because they have consequences on our decisions: we face “*decision-making under uncertainty*”.

That’s why, before carrying out any testing we must think about the following points:

- I. We define the pdf (probability density function) $f_X(x; \theta)$ followed by the RV X_{ij} (j to be determined), for the estimation of the parameter θ
- II. We state the so-called “Null Hypothesis” $H_0 = \{\theta = \theta_0\}$ with a chosen risk α (risk of 1st type) that H_0 is Rejected, while it is actually true, and an “Alternative Hypothesis” $H_1 = \{\theta = \theta_1\}$ is wrongly considered to be true [the type of H_1 can have different forms as $H_1 = \{\theta \neq \theta_0\}$, $H_1 = \{\theta > \theta_0\}$, $H_1 = \{\theta < \theta_0\}$]
- III. From the Theory we derive a *test statistic* \underline{S} (which is a RV depending on the pdf of the RVs X_{ij}) and a *critical region* \underline{C} [Rejection Region], an interval of the real line (real numbers), such that $(1 - \alpha)$ is named *Significance Level*

$$P[\underline{S} \in \underline{C} | H_0 \text{ is true}] = \alpha \quad (10)$$

$$P[\underline{S} \notin \underline{C} | H_1 \text{ is true}] = \beta \quad (11)$$
- IV. The probability β (risk of 2nd type) of deciding that H_0 is true (when actually it is false), due to the “future” collected data, can either be fixed, before the test, or we can compute the probability $1 - \beta$ (named

The case depicted in the figure 3 can be described as follows: the failure of electronic components while in use can be regarded as events of Poisson type with intensity $1/\theta$ which is to be determined from experiment. A convenient sample size n being chosen, n items are put into service simultaneously and kept in operation until exactly r items have failed.

Some Journals that have wrong methods for computing the Confidence Interval are *Journal of Quality Technology*, *Kluwer Academic Publisher*, *Reliability Engineering & System Safety*, *International Journal of Production Research*, *IIE Transactions*, *Computers and Industrial Engineering*, *Quality and Reliability Engineering International*, *Quality Engineering*, *International Journal of Production Research*, *Computers and Industrial Engineering*, ...

If you go to the three forums [1-3] you find the same situation: scholars do not know the Theory.

the *power of the test*) that we decide to reject H_0 when it is false

- V. When both the risks are fixed, before the test, we can compute the sample size n and the r “failures” needed to satisfy both α and β name $D = \{x_{ij}; j=1,2, \dots, 10\}$ the set of the data to be considered,
- VI. Then we collect the empirical sample $D = \{x_{ij}; j=1,2, \dots, n\}$ (“*Complete Sample*”) which allows us to decide about H_0
- VII. We compute the sample quantity s , determination of the RV \underline{S} ; if s belongs to the Critical Region \underline{C} we reject H_0 ; otherwise we “accept (do not reject) H_0 ”

If the reader visits the three forums iSigSigma, Academia.edu, Research Gate, he can find questions/answers/discussions about NHSTP where “scholars” write a lot of wrong ideas [1-3].

See, e.g., the following questions/discussions: *Does the two-sample t-test provide a valid solution to practical problems? Do scientists really need statistical significance and p-values? Query to Research Gate Scholars about a disaster: why many people do not know the way of computing correctly the Confidence Interval of TBE data. What statistical test to use for not normal distributed data? Is “Statistical Significance” outdated? Average Run Length? How to compute it? Minitab T charts and Confidence Intervals. Should you delete cases that have missing data. Can I perform paired t-test to compare two similar results? 'p' value of 0.000? Sample size, the bigger the better? Which statistical procedure allows analysis of a non-normal distribution? How to calculate "p" value from 95 % confidence interval of two sets of data? “A Statistical Paradox” (Lindley’s paper 1957)? Why, after years and years, some Scholars do not understand Confidence Intervals? About Weibull & Bayes? About “suggested Papers” in RG. How to explain level of confidence and significance? What is the role of “p-value” to validate any results? What is the best software for experimental design using Taguchi method?*

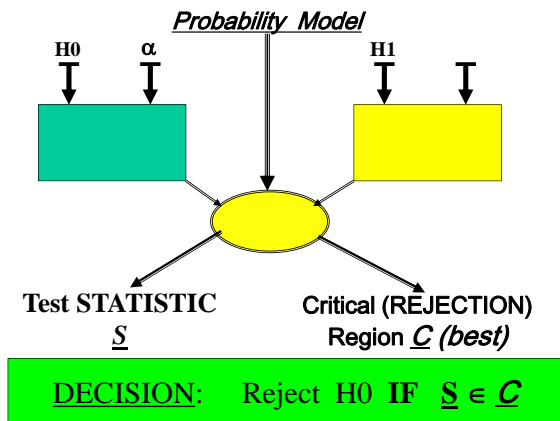


Figure 4. The NHSTP flow chart (see also in the section Conclusion)

Thousands of readers viewed them, and hundreds of scholars discussed them, and no scholar dared to answer some of them, as well.

A desperate proof of incompetence...

See some explanations by the applicants to few questions asked:

- a) Due to growing concerns about the replication crisis in the scientific community in recent years, many scientists and statisticians have proposed abandoning the concept of statistical significance and null hypothesis significance testing procedure (NHSTP). For example, the international journal Basic and Applied Social Psychology (BASP) has officially banned the NHSTP (p -values, t -values, and F -values) and confidence intervals since 2015... The t -test, especially the two-sample t -test, is the most commonly used NHSTP. Therefore, abandoning the NHSTP means abandoning the two-sample t -test. In my opinion, the two-sample t -test can be misleading; it may not provide a valid solution to practical problems...
- b) Is “Statistical Significance” outdated? On the web I found that three scholars wrote (special issue of The American Statistician):
 1. We conclude, based on our review of the articles in this special issue and the broader literature, that it is time to stop using the term “statistically significant” entirely.
 2. Nor should variants such as “significantly different,” “ $p < 0.05$,” and “nonsignificant” survive, whether expressed in words, by asterisks in a table, or in some other way.
 3. Regardless of whether it was ever useful, a declaration of “statistical significance” has today become meaningless.

Do some Research Gate colleagues dare to make some comments? Thank you

- c) Inspection Plan with wrong detection. In a document in Research Gate (about Inspection, written by the QEG) I read the following formula, about a random variable X : the mean value $E(X) = p \cdot \beta$, where

1. “ p is the probability that a product is REALLY defective”
2. “ α is the probability that a product REALLY *NON_defective* is WRONGLY detected as defective”
3. “ β is the probability that a product REALLY *defective* is WRONGLY detected as *NON_defective*”

In my opinion, $E(X)$ cannot be the above formula: the formula is wrong.

- What do the Research Gate experts think?
THANKS in Advance. [nobody dared to answer!].

Deming The result is that Deming
hundreds of people
are learning what is wrong.
 I make this statement
 on the basis of experience
 seeing every day
 the devastating effects of
 incompetent teaching and
 faulty applications.

Figure 5. Deming’s ideas about wrong scholars

The wrong ideas are presented in the paper (THEORETICAL REVIEW) written by five authors (R. Morey, R. Hoekstra, J. Rouder, M. Lee, Eric-Jan Wagenmakers) *The fallacy of placing confidence in confidence intervals*, published in *Psychon Bull Rev* (2016) 23:103–123.

There are various drawbacks..... I mention only a **FIRST Point**:

- The confidence coefficient of a confidence interval derives from the procedure which generated it. It is therefore helpful to differentiate a *procedure* (CP) from a *confidence interval*: an $X\%$ confidence procedure is any procedure that generates intervals cover θ in $X\%$ of repeated samples, and a confidence interval is a specific interval generated by such a process. **A confidence procedure is a random process**; a confidence interval is observed and fixed.

The statement

- **A confidence procedure is a random process** is nonsense.

It is the same type of error as

- **Statistical significance ... is a sample statistic**
.....

The above ideas are connected with a concept, wrongly understood by many people (in the three forums [1-3]), the **p -value**.

NOBODY can know the true values of the mean μ and of the variance σ^2 of the Distribution of the data: one can only estimate the parameters μ and the variance σ^2 from their

estimators [which are Random Variables!!!]. For easiness we consider the previous case of a single parameter θ ; we indicate with Θ the ESTIMATOR and with the $\varphi_{\Theta}(t)$ the density (pdf) of the estimator [which is a RV!].

Consider the area $\int_0^{\infty} \varphi_{\Theta}(t) dt = \Pi(H_0)$, which is a Random Variable because the estimator Θ is Random Variable (written as \underline{S} before). The RV $\Pi(H_0) \in 0^{-----}1$ is uniformly distributed by definition.

The «Test Statistics» \underline{s} , given the data D, is the “determination (=estimate)” of the estimator \underline{S} , is here indicated by $\hat{\theta}$ and the previous formula becomes the number $\pi(H_0|D) \in 0^{-----}1$

$$\int_{\hat{\theta}}^{\infty} \varphi_{\Theta}(t) dt = \pi(H_0|D) \quad (12)$$

that is named *p-value*: it is the *probability of Rejection of the null hypothesis H_0* , given the data D.

The number $\pi(H_0|D) \in 0^{-----}1$ tells us how much we can believe in H_0 , given the collected data D; all the “possible” numbers $\pi(H_0|D)$, which are the determinations of RV $\Pi(H_0)$, are uniformly distributed.

See figure 6: RS1 is the Random Sample of the RVs related to the Sample 1 (sample size n_1 , and g_1 failures). RS2 is the Random Sample of the RVs related to the Sample 2 (sample size n_2 , and g_2 failures). For the table 1, $n_1 = g_1 = 10$ and $n_2 = g_2 = 10$.

Many incompetent scholars make confusion between the RVs related to the Probability Statements and the Confidence Statements (confidence intervals and p-values).

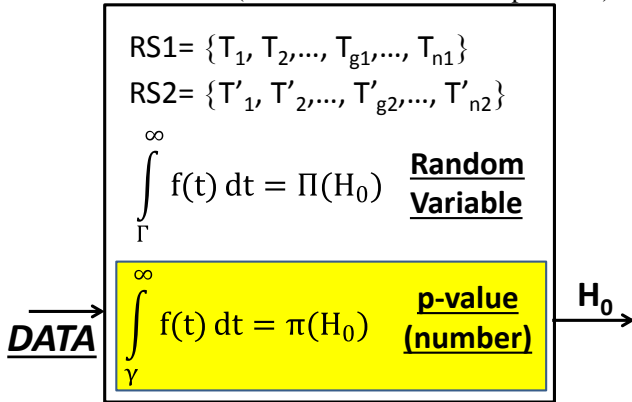


Figure 6. The process of generation of the **p-value** [symbols $f(t) = \varphi_{\Theta}(t)$, $\Gamma = \theta$, $\gamma = \hat{\theta}$]

4. Individual Control Charts (I-CC) and Exponentially distributed data.

The Theory of Control Charts (CC) is shown in the Shewhart's books [6-7] and very appreciated by Deming [4-5] and Juran [8]. The CCs are the “*thermometer for measuring the fever of a Process*”, using the Control Limits [CLs: LCL (Lower CL) and UCL (Upper CL)], used to see if the Process is either “In Control (IC)” or “Out Of Control (OOC) [it has “*fever*”]”. CCs are the tool for assessing the “health” of the process: CCs are a statistical tool for monitoring the “measurable output” of a Process. The “measurable output” (measures on the products provided by the products produced) can be viewed as a “Stochastic Process $X(t)$ ”, ruled by a probability density for any set of n “Random Variables RV” $X(t_1), X(t_2), \dots, X(t_n)$, considered at

the “time instants” t_1, t_2, \dots, t_n , of the Stochastic Process $X(t)$. In many applications the data plotted (on the CC) are the means $\bar{x}(t_i)$, determinations of the RVs $\bar{X}(t_i)$, $i=1, 2, \dots, n$ (n =number of the samples) computed from the data x_{ij} , $j=1, 2, \dots, k$ (k =sample size); x_{ij} are the determinations of the RVs $X(t_{ij})$ at *very close instants* t_{ij} , $j=1, 2, \dots, k$; the RVs $\bar{X}(t_i)$ are assumed to follow a normal distribution *because* (Central Limit Theorem) they are the means of samples with sample size, k , each; usually $k=5$. For each RV $\bar{X}(t_i)$, mean of the process (at time t_i), mean of RVs $X(t_{ij})$ $j=1, 2, \dots, k$, we assume here that it is distributed as $\bar{X}(t_i) \sim N(\mu_{\bar{X}(t_i)}, \sigma_{\bar{X}(t_i)}^2)$: this is the assumption of W. A. Shewhart on page 278 of his book (Shewhart 1931), and justified on page 289. The mean of all the RVs is indicated by $\bar{\bar{X}}$ and its determination is named “grand mean” and indicated by $\bar{\bar{x}}$.

When the process is OOC (it has “*fever*”) we say that it is operating in the presence of “*assignable causes of variation*”.

The Individual Control Charts (I-CC) have sample size $k=1$; see figure 7. The “grand mean” $\bar{\bar{x}}$, in this case, becomes the mean \bar{x} . To compute the CLs (LCL and UCL) we are forced to use the differences $x_{i+1} - x_i$; we compute the $n-1$ ranges and then we can use the usual formulae, for the Normal distributed data [$i=1, \dots, n-1$ (n =total number of data)].

What do the scholar who do not have the right Theory?

They transform the data in order to have the “transformed data” Normally distributed.

Before using any transformation, any scholar should see if it is suitable, because, as said by Deming (1986, 1997), “*Management need to grow-up their knowledge because experience alone, without theory, teaches nothing what to do to make Quality*” and “*The result is that hundreds of people are learning what is wrong. I make this statement on the basis of experience, seeing every day the devastating effects of incompetent teaching and faulty applications.*” and, moreover, “*It is necessary to understand the theory of what one wishes to do or to make.*”

To show how to compute the Control Limits for I-CC we use the following data about the time between failure of air conditioners on a Boeing 720 airplane:

Table 2. Time between failures of air conditioners on a Boeing 720 airplane. Higher values are better.

23	261	87	7	120	14	62	47	225	71
246	21	42	30	5	12	120	11	3	14
71	11	14	11	16	90	1	16	52	95

The data are not “Normally Distributed”; therefore we cannot use the Shewhart Theory.

Fitting a Weibull pdf to the data of Table 2

$$f_X(x; \eta, \beta) = (\beta/\eta) \left(\frac{x}{\eta}\right)^{\beta-1} \exp \left[-\left(\frac{x}{\eta}\right)^{\beta}\right] \quad (13)$$

we find the estimates

- $\hat{\beta} = 0.85$ with Confidence Interval $\hat{\beta}_L = 0.69$ and $\hat{\beta}_U = 1.10$, with Confidence Level CL=80%,
- $\hat{\eta} = 54.61$ with Confidence Interval $\hat{\eta}_L = 42.45$ and $\hat{\eta}_U = 73.69$, with Confidence Level CL=80%.

Individual Control Chart, I-CC

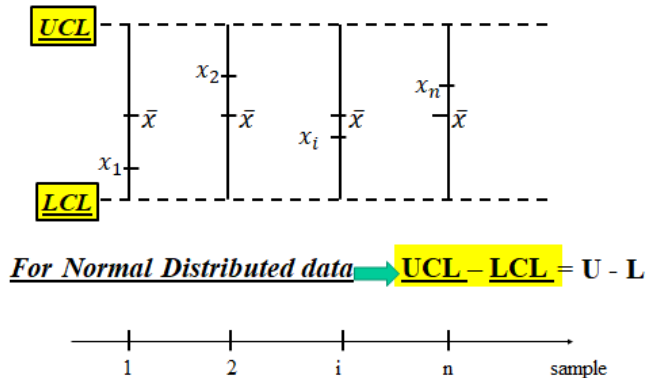


Figure 7. Individual Control Chart. Notice that $k=1$ (sample size)

Had we chosen a higher CL we would have larger CIs.

Since 1 is comprised in the β CI, we can assume the exponential pdf, with 20% risk of being in error.

In this case we estimate the Mean Time To Failure MTTF=59.60.

To find the Control Limits, LCL and UCL, of the I-CC we need a suitable Theory.

We looked for it, by reading several documents [found in the literature and the Web...] and got the “ocean full of errors by ...” (*notice* that one of the authors is very well known; he has more than *7000 Citations!* Does that mean that he wrote good papers? Absolutely not!). *All the papers* in the above “ocean ...” *have the same problem*: wrong CLs; *all the authors confound the concepts*, by stating that LCL and UCL (that actually are the Confidence Limit!) are the limits L and U of the Probability Interval.

The suitable theory is RIT [17-25].

Typical statement by ALL ...

A uniform model the exponential TBE charts is that the occurrence of events is modelled by a Poisson process, and the time between events

X_i ($i=1, 2, \dots$) re independent and identically distributed random variables with pdf $f(x) = \theta^{-1} \exp(-x/\theta)$ for $x \geq 0$,

0 otherwise, where θ is the “mean time between events”.

The Control Chart plots the quantity produced before observing an event;

The Control Limits can be calculated as

$$LCL = \theta \ln(1 - \alpha/2), \quad UCL = \theta \ln(\alpha/2)$$

Liu J., Xie M., Sharma P., “A Comparative Study of Exponential Time Between Event Charts”, *Quality Technology & Quantitative Management*, 2006 Issue 3, pp. 347-359

ACTUALLY LCL=L and UCL=U

Another statement by INCOMPETENTS

To construct a t chart, we determine the control limits based on a false alarm rate (α) of 0.0027, equaling that of an individual chart of normal data, and use the median as the centreline”. Whenever historical estimates are not available, the scale parameter θ can be estimated using maximum likelihood. because both control limits and the centerline are functions of solely θ , by the invariance property of MLEs the estimates are 0.00135 \bar{t} , 6.60773 \bar{t} , and $\log(2) \bar{t}$ ”.

$$LCL_T = 0.00135 \bar{t}, \quad UCL_T = 6.60773 \bar{t}$$

E. Santiago, J. Smith, Control charts based on the Exponential Distribution, *Quality Engineering*, Vol. 25, Issue 2, 85-96

ACTUALLY LCL=L and UCL=U

Typical statement by

Suppose LCL and UCL denote the lower and upper control limits of the Phase II t_r -chart respectively. Then for a given false alarm rate (FAR) α_0 , they can be obtained from $P(T_r < LCL|IC) = P(T_r > UCL|IC) = \alpha_0/2$ according to the equal tail probabilities approach. Thus, we have (see also Kumar and Baranwal (2019))

$$LCL = \frac{\chi_{2r, \alpha_0/2}^2}{2\lambda_0} = \frac{A_1}{\lambda_0} \quad \text{and} \quad UCL = \frac{\chi_{2r, 1-\alpha_0/2}^2}{2\lambda_0} = \frac{A_2}{\lambda_0} \quad (1)$$

where $A_1 = \frac{\chi_{2r, \alpha_0/2}^2}{2}$, $A_2 = \frac{\chi_{2r, 1-\alpha_0/2}^2}{2}$ are the design constants and λ_0 is the known or specified IC rate parameter value. The $\chi_{2r, a}^2$ denotes the a -th quantile of the chi-square distribution with $2r$ degrees of freedom. The center line (CL) of the t_r -chart can be considered as the median of the IC distribution of T_r and it is given by $CL = \frac{\chi_{2r, 0.5}^2}{2\lambda_0}$.

TBE data following Exponential distribution are with $r=1$

ACTUALLY LCL=L and UCL=U

Typical statement by

For the original data, the UCL and the LCL can be calculated as:

$$UCL = -\frac{1}{\lambda} \ln\left(\frac{\alpha}{2}\right) \quad (2) \quad LCL = -\frac{1}{\lambda} \ln\left(1 - \frac{\alpha}{2}\right) \quad (3)$$

Where α is the individual false alarm rate.

From "Statistical Process Control Applied at Level Crossing Incidents", by O. Abdallah et al. *International Journal of Sciences: Basic and Applied Research*, 2023.

ACTUALLY LCL=L and UCL=U

Excerpt 2. Typical wrong formulae picked from the "ocean full of errors..." (10 authors, and one with > 7000 Citations!)

The Deming statements are in order for excerpt 2: "Management need to grow-up their knowledge because experience alone, without theory, teaches nothing what to do to make Quality" and "The result is that hundreds of people are learning what is wrong. I make this statement on the basis of experience, seeing every day the devastating effects of incompetent teaching and faulty applications." and, moreover, "It is necessary to understand the theory of what one wishes to do or to make."

Why the authors in the "ocean full of errors by ..." are so ignorant? Because they did not and still do not know the Theory.

They were (and are) "lead into temptation and delivered into evil" by the (inapplicable) formulae, that are applicable only for the normal data and not for exponential data, in spite of the wrong statements (excerpt 2) about the Peer Reviewers' incompetent statements "limits... typical in the vast literature..." and "The problem ... exponential distribution is well-defined and solved". They use wrongly the Probability Interval L-U as though it were the LCL-UCL and put the estimates, either \bar{t} or $1/\bar{t}$, of the parameters in place of the parameters, θ or $\lambda=1/\theta$. See the excerpt 2: "the temptation and the evil". Notice that an author ("ocean ...") is Associated Editor. of ...

Now, the author is at risk. IF the Peer Reviewers (PRs) are taken from the "ocean ..." they will not acknowledge the errors and could think the "strange statements (above)" and, hence, the paper would get the following evaluation: "Your manuscript is unsuitable for publication in I have attached comments at the bottom of this email. ... Thank you for considering I hope the outcome will not discourage you from the submission of future manuscripts." "The associate editor (notice, perhaps the one with more than 7000 Citations!) has stated that the work lacks sufficient novelty statistically in terms of theory and methods."

Therefore, (1) the readers **can** know the wrong methods that have "sufficient novelty statistically in terms of theory and methods." (see the "ocean ...", > 7000 Citations!) (2) but, on the contrary, they **cannot** know the right methods

that prove how many incompetents published wrong papers, that diverted, are diverting and will divert people from learning scientific methods.

That's the reality we are confronting with... And nobody but F. Galetto seems to take care about it. See, e.g., [26-168].

Peer Reviewers and readers (and Editors, as well) should practice "metanoia" (Deming 1997) and remember his statement "The result is that hundreds of people are learning what is wrong. I make this statement on the basis of experience, seeing every day the devastating effects of incompetent teaching and faulty applications."

Now we see that Reliability Integral Theory (RIT) [17-26] solves the problem of computing the Control Limits for Control Charts, especially for I-CC_TBE, exponentially distributed data.

Being the data exponentially distributed, also the ranges are exponentially distributed (Galetto books) and OOC. We see that actually the process is "Out Of Control".

All the wrong methods in the "ocean full of errors by" (see the Excerpt 2, with 10 authors, and one with > 7000 Citations!) cannot find that actually the process is "Out Of Control".

Using the exponential pdf we can plot the I-CC as in figure 8

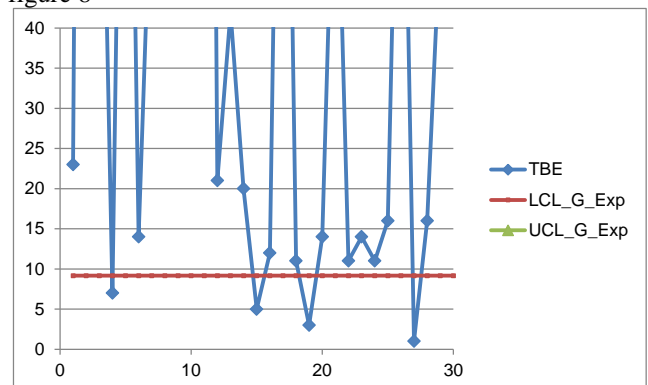


Figure 8. Individual Control Chart of the Time Between Failures of the air conditioners. Notice that $k=1$ (sample size)

The figure 8 shows the Time Between Failures of the air conditioners and the LCL (symbol LCL_G_Exp), when the data are considered exponentially distributed: the Process is OOC (4 points below LCL).

Let θ [the MTTF of any unit] the unknown parameter to be estimated and t_o the “known” observed $t_o = tot(t) = \sum_1^n t_i$ determination of the RV Total Time on Test $T(t)$. Let’s fix the Confidence Level $CL=1-\alpha$; the Lower Limit of MTTF is θ_L and the Upper Limit of MTTF is θ_U : we have to solve the two equations (14) [17-25], where the unknown variables are $\theta_L = K_1^n t_o$ and $\theta_U = K_2^n t_o$, (see fig. 9)

$$R_0(t_o; \theta_L) = \alpha/2, \quad R_0(t_o; \theta_U) = 1 - \alpha/2 \quad (14)$$

$R_0(t; \theta)$ is the reliability of a *stand-by system* [17-25] (“associated to the reliability test, with exponential pdf”) of n units for the interval $0 \dots t$, and $MTTF_{unit} = \theta$. It is also the *Operating Curve* [17-25].

For EXPONENTIAL density $f(t; \theta)$

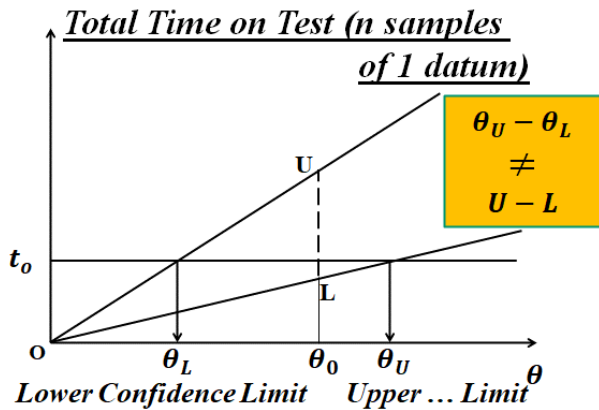


Figure 9. Confidence Interval of the MTTF, $K = K_1^n$ and $K = K_2^n$

For EXPONENTIAL density $f(t; \theta)$

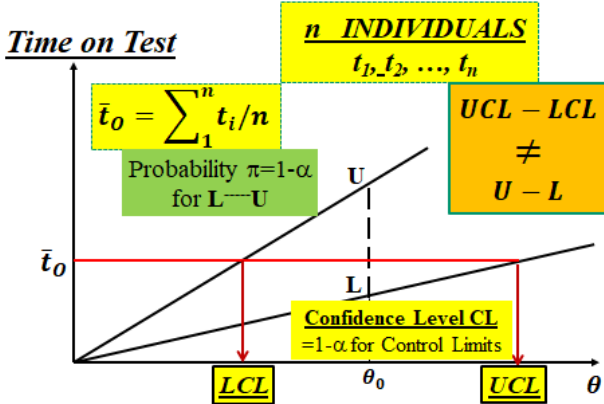


Figure 10. LCL and UCL for the I-CC_TBE, using RIT. $K = K_1^1$ and $K = K_2^1$ Remember that in this case $k=1$ (sample size)

Since the reliability of any unit is exponential $R(t|\theta) = \exp(-t/\theta)$, (see the figures 9 and 10) the function $t/\theta = K$ is a straight line $t = K\theta$, with angular coefficient K in the plane with abscissa θ and ordinate t : for the figure 9 the coefficient K_1^n is related to $\alpha/2$ and n (the number of data) while K_2^n is related to $1-\alpha/2$ and n ; for the figure 10 the coefficient K_1^1 is related to $\alpha/2$ and 1 (the individual datum)

while K_2^1 is related to $1-\alpha/2$ and 1. Thus, we have two lines, passing through the origin O [with linear scale, in figure 9 and 10]; putting $\theta=\theta_0$ the two lines intercept the **vertical segment L-U (probability interval)**, which has probability $\pi=1-\alpha$ that the “time to failure”, Random Variable T, of any unit [vertical axis named “Total Time on Test” (for figure 9), because we consider all the data] is in the interval L-U when $\theta=\theta_0$. The angle $L\hat{O}U$ depends on the values $\alpha/2$, $1-\alpha/2$ and n (the number of data) [17-25]. With the known quantity $t_o = tot(t) = \sum_1^n t_i$ [observed determination of the RV $T(t)$], we can draw the horizontal line intersecting the two lines through the origin: the abscissas of intersections are the two numbers θ_L and θ_U , depending on the values $\alpha/2$, $1-\alpha/2$ and n : θ_L and θ_U are the Lower limit and the Upper limit of the CI of the MTTF of each unit, with $CL=1-\alpha$ [17-25]. It is evident, for any intelligent person, that the two segments L-U (vertical) and $\theta_L \dots \theta_U$ (horizontal) are two different intervals with clear different meaning and obvious different lengths $\theta_U - \theta_L \neq U - L$! All the documents, known to the author, make this BIG ERROR: they confound the segment L-U, a “Probability segment”, with the segment $\theta_L \dots \theta_U$, which is a “Confidence segment” [17-25]! See the “ocean full of” and Excerpt 2 (10 authors).

RIT solves the case (TBE CC). We have to look at the figure 10 (similar to figure 9, but with different lines). Now the angular coefficient K are K_1^1 related to $\alpha/2$ and 1 (the single datum) while K_2^1 is related to $1-\alpha/2$ and 1. As before we have two lines, passing through the origin O [with linear scale, in figure 10]; at $\theta=\theta_0$ the two lines intercept the **vertical segment L-U (probability interval)**, that has probability $\pi=1-\alpha$ that the “time to failure”, Random Variable T, of any unit [vertical axis named “Time on Test”, consider the single data]. The angle $L\hat{O}U$ depends on the values $\alpha/2$, $1-\alpha/2$ and the sample size 1 [17-25].

Acting in figure 10 (as done for figure 9), with the known quantity “mean observed time to failure” $\bar{t}_o = t_o/n = tot(t)/n = \sum_1^n t_i/n$ [observed determination of the RV $T(t)/n$], we can draw the horizontal line intersecting the two lines through the origin: the abscissas of intersections are the two numbers LCL and UCL, depending on the two chosen values $\alpha/2$, $1-\alpha/2$ and 1 (the single datum). As a matter of fact, in the I-CC, the CLs LCL and UCL must be consistent with the “individual” times to failures: we want to analyse if they are significantly different from the “true mean θ ”, estimated by the “mean observed time to failure” $\bar{t}_o = t_o/n$. Therefore the CLs are the values satisfying two equations, for any single unit, [17-25] (“associated to the reliability test, with exponential pdf”) of 1 unit for the interval $0 \dots \bar{t}_o$

$$R(\bar{t}_o; LCL) = \alpha/2, \quad R(\bar{t}_o; UCL) = 1 - \alpha/2 \quad (15)$$

similar to the (14) with t_o replaced by $\bar{t}_o = t_o/n$; so we have 20 CIs [all equal], given \bar{t}_o and $CL=1-\alpha$ [0.9973]; remember that in this case $k=1$ (sample size): I-CC! It is also the *Operating Curve* [17-25].

All that (above) when $\beta=1$. The same ideas, not the same formulae, can be used when the data are “Weibully” distributed.

5. Individual Control Charts (I-CC) and Weibully distributed data.

In the previous section we assumed that the shape parameter had the value $\beta=1$, that is the pdf was exponential.

The same ideas, not the same formulae, can be used when the distribution of the data is Weibull (formula 13).

Now we must estimate the two parameters η and β : with the data of Table 2, we find the estimates $\hat{\beta} = 0.85$ and $\hat{\eta} = 54.61$; both the estimates are determinations of the two estimators \hat{B} and \hat{H} , which have their own distribution to be found.

The variability of the two estimators \hat{B} and \hat{H} has an important effect on the Control Limits of the I-CC.

To find the Control Limits of the I-CC two roads can be followed: 1) we assume that the estimators \hat{B} has a “very small variability” (a very strong assumption!) and then we consider only the value $\hat{\beta} = 0.85$, and 2) we use the distribution of \hat{B} .

The first road (case) is shown in the figure 11.

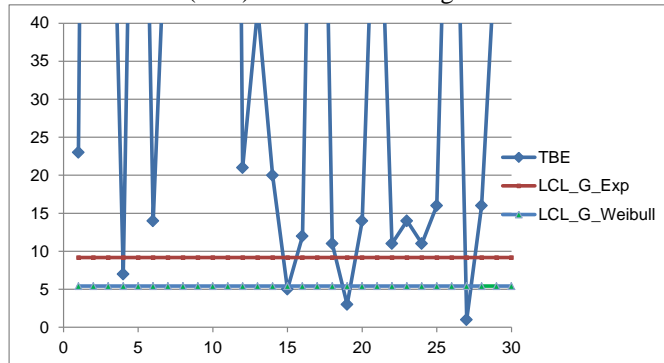


Figure 11. Individual Control Chart of the Time Between Failures of the air conditioners, considering either the values 1 or 0.85 for the parameter β . Notice that $k=1$ (sample size). See also the section Conclusion.

The estimated value $\hat{\beta} = 0.85$, “assumed as a constant parameter”, moves down the LCL. It is very easy to compute it because the transformation $x = (t/\eta)^\beta$ transforms the Weibull pdf into the exponential pdf: so, the previous theory applies to the data and variables.

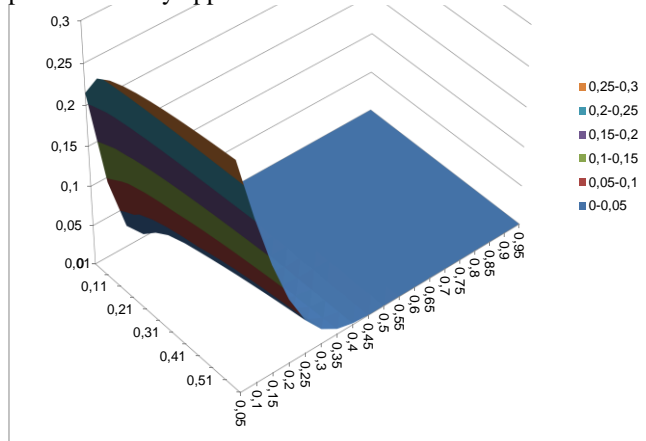


Figure 12. Surface of $R(\bar{t}_0; \eta, \beta)$ versus η, β

The effect of the variability of the estimator \hat{B} (case 2) on the I-CC is very dramatic.

Since the distribution of the RV $\hat{H}^{\hat{\beta}}$ is not easily found we have to revert to simulations. Doing that the result is that the LCL is very near 0 and therefore can be assumed LCL=0. Consequently, there is no OOC in the Individual Control Chart when we consider the variability of the estimator \hat{B} of the shape parameter β . The Minitab and JMP software do not find that!

Using the Theory in [17-25] and simulations we have LCL=0: the figures 12 and 13 show “intuitively the reason.

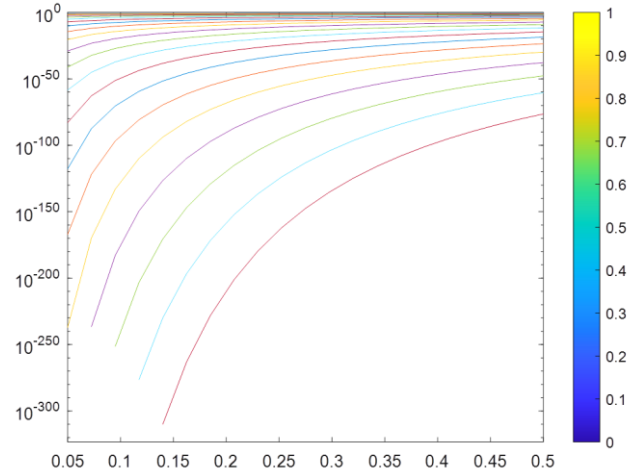


Figure 13. Curves of $R(\bar{t}_0; \eta, \beta)$ versus η (abscissa) and β

We think we have shown the problems arising with I-CC for Weibull distributed data.

Other distributions, but the Normal one, can have the same problems.

6. Conclusion.

We recall some important ideas about the Control Charts and the Individual Control Charts (I-CC).

We are going to show some new cases about I-CC: we consider papers from the “ocean...”; we do not show here their data; we show only the right I-CC. Consider the figure 14 and compare with the figure 4.

This point is largely debated, with wrong ideas, as well. The road shown in the section 2 can be depicted as in the figure 4.

J. Juran, at the 1989 *EQQC Conference* in Vienna, highlighted the content of the paper [26] about the importance of the Quality of the methods for making quality: the paper shows the only good methods are crucial for suitable decision taking.

- (i) For Control Charts the “Null Hypothesis” is $H_0 = \{\text{Process “In Control”}\}$ with a chosen risk of 1st type $\alpha = 0.003$ that H_0 is Rejected, and we declare the process OOC, while it is actually IC, and an “Alternative Hypothesis” $H_1 = \{\text{Process “Out Of Control”}\}$ is wrongly not found [there are OOCs] with a stated probability β (risk of 2nd type)
- (ii) We must define the “probabilistic model” (the pdf) $f_X(x; \theta)$ followed by the RV X_j , for finding the “Statistic of the CC”
- (iii) From the Theory we derive the *statistic* \underline{S} (via the “elaboration formula”, which is a RV depending on

the pdf of the RVs X_j) and the “Control Limits LCL, UCL” that are the “Acceptance Region” [complementary to the Rejection Region, the *critical region C*

- (iv) The probability β of deciding that $H_0=\{\text{Process “In Control”}\}$ is true (when actually it is OOC), with the probability $1-\beta$ (the *power*) that we decide to decide that the Process is OOC, when it is OOC
- (v) When both the risks are fixed, before the test, we can compute the sample size n needed to satisfy both α and β name $D=\{x_j; j=1,2, \dots, n\}$ the set of the data

to be considered,

- (vi) Then we collect m subsequent empirical samples $D_i=\{x_{ij}; i=1, 2, \dots, m; j=1, 2, \dots, k\}$ (“*Complete Samples*”) which allows us to Compute the LCL and UCL and to decide about H_0
- (vii) We compute the sample quantity s , determination of the RV \underline{S} ; if s belongs to the Critical Region C, either $s<LCL$ or $s>UCL$, we reject $H_0=\{\text{Process “In Control”}\}$ and we claim that it is OOC; otherwise we “accept (do not reject) H_0

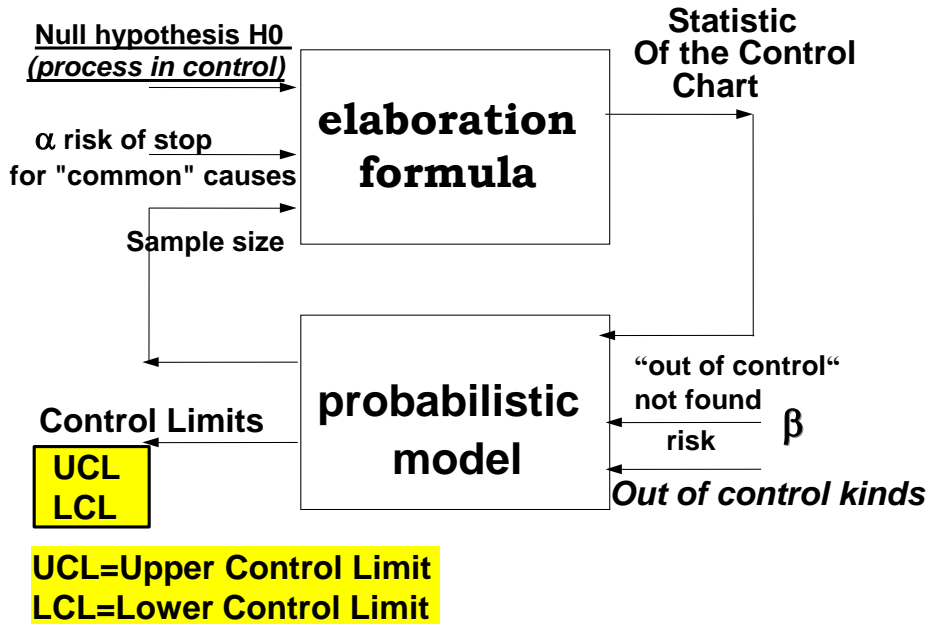


Figure 14. The flow-chart of steps for building control chart

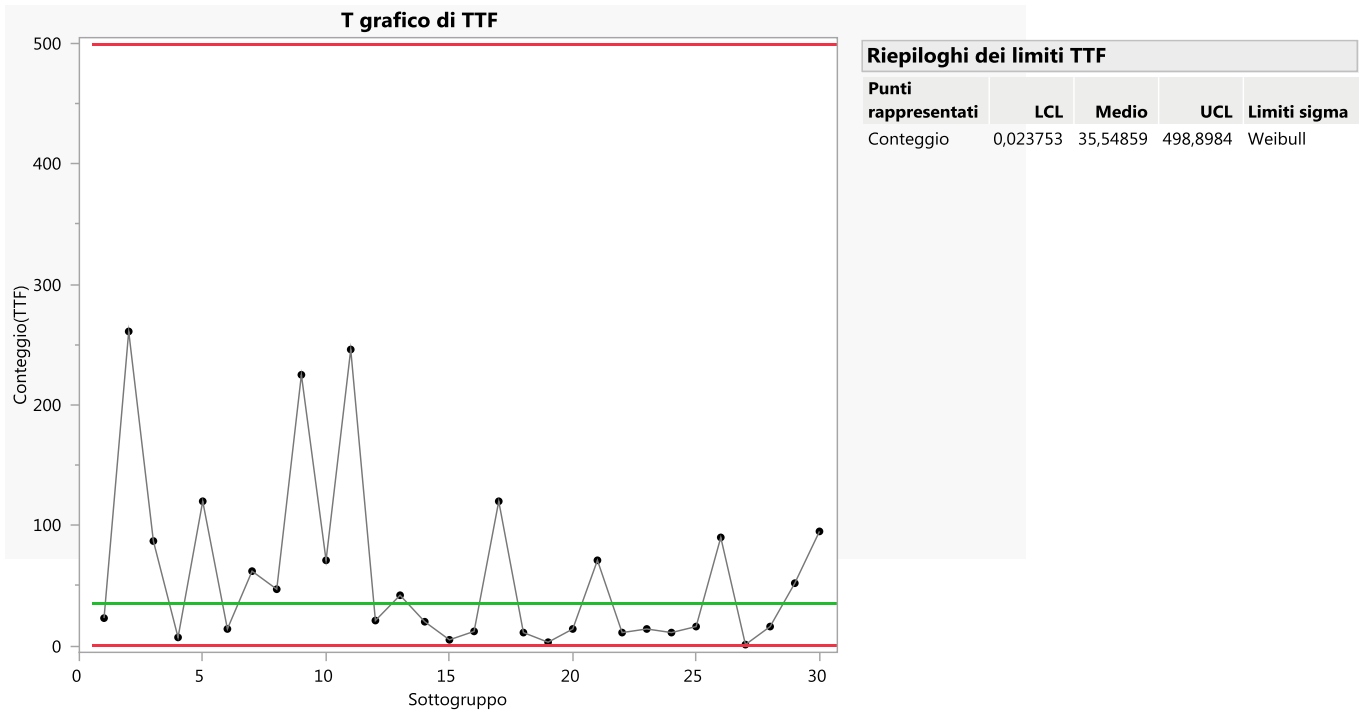


Figure 15. Output of the software JMP (Title “T graph of TTF”, TTF=Time to Failure, distribution Weibull)

Since the data are unfortunately always variable we must consider all the uncertainties because they have consequences on our decisions: we face “*decision-making under uncertainty*”.

That’s why, before carrying out any testing we must think about the following points:

The above points have dramatic consequences for Individual Control Charts, where $k=1$ and $m < 30$.

We had the opportunity to use the software JMP (in Italian).

We analysed the case of table 2 and we got the proof that JMP does not know the true concepts; see the figure 15 and compare it with the figure 11... Notice that JMP does not consider the variability of the RV \hat{H}^B .

LCL and UCL are not in agreement with the Theory (fig. 14). Meditate...

Now we go on by considering some cases from the “*ocean...*”

1st case: “Improved Phase I Events” published by QREI, 2014. The two authors provide a wrong solution found neither by the Peer Reviewers nor by the Editor). The authors say: “... 30 failure time data generated from a Poisson distribution ... $LCL=-53.9213$ and $UCL=47.2320$we set the $LCL=0$. It can be seen from Figure (our 15) that the eleventh observation 52.32 plots outside the UCL, which indicates an OOC situation ... Note that for these data, neither the Dovoedo and Chakraborti nor... indicates any OOC situation.” Notice that the “wrong” CC shows an OOC situation that should not be there and various IC that should not be there... (fig. 16)

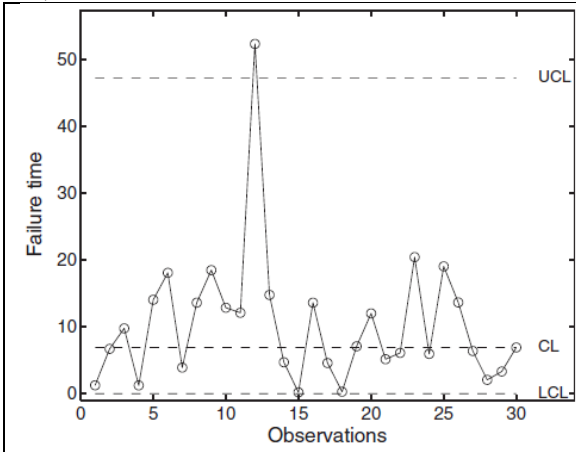


Figure 16. [Excerpt] Control Chart from “Improved Phase... for Monitoring TBE”

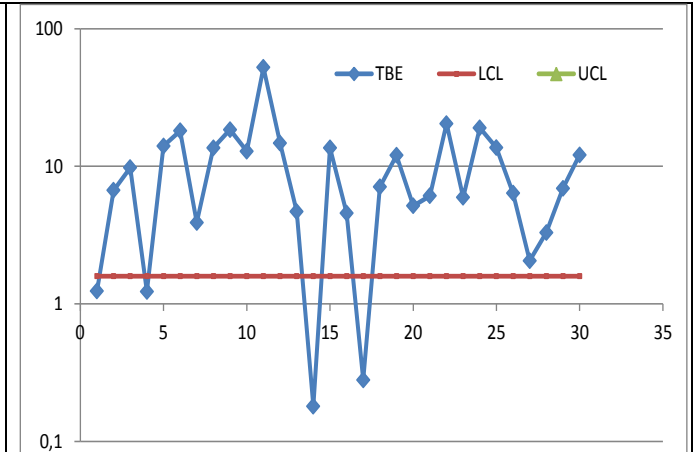


Figure 17. Control Chart, by RIT, for “Improved Phase... for Monitoring TBE” data; vertical axis logarithmic; UCL is >100.

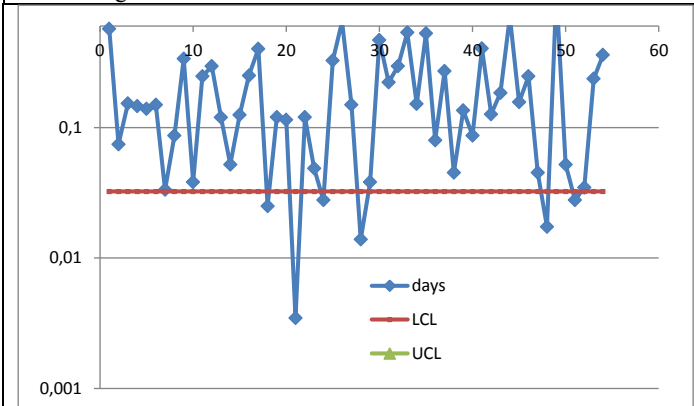


Figure 18. Control Chart of Minitab authors’ paper data (Urinary); vertical axe logarithmic. RIT used (F. Galetto)

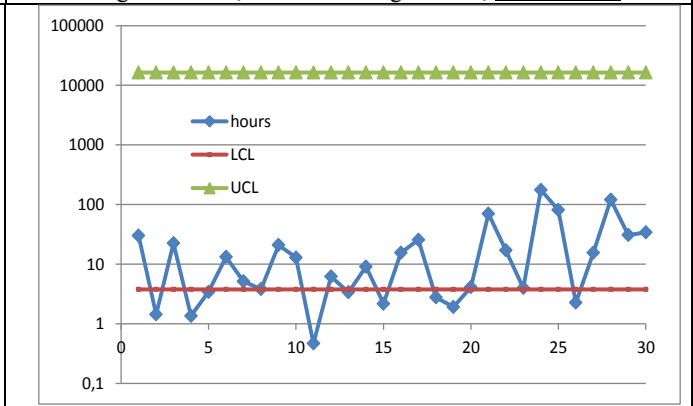


Figure 19. Control Chart of Xie et al. TBF data; vertical axe logarithmic. RIT used (F. Galetto)

Use RIT: the $n=30$ TBE can be considered as the “transition times” (failure times, exponentially distributed) between states of a stand-by system of 30 units. We get the fig. 16 solving the two equations $R(\bar{F}_0; LCL) = \alpha/2$ and $R(\bar{F}_0; UCL) = 1 - \alpha/2$.

Comparing the figures 16 and 17, it becomes very clear that the CC from “Improved Phase...” presents 5 errors about OOC.

Reader, could you think that “Improved Phase...” is scientific and this paper is not? How can the CC from “Improved Phase...” be good?

Simulations (five million!) show that only $\leq 5\%$ of the

computations are correct... We agree with those authors that “*Further work is necessary on the OOC performance of these charts*”: the further Work must be to STUDY (see Deming!).

We ask the reader: do you think that these findings are not supported by Theory and Methods?

2nd case: the paper “Control charts ... Exponential Distribution”, published in *QE* is no better.

The authors find the process IC: actually it is OOC (fig. 18)

3rd case: the paper “Some effective ... for reliability monitoring”, published in *RE&SS*. Qualified authors Xie, Goh, Ranjan. Again WRONG Control Limits! See figure 19.

A very good result for a Peer Reviewed paper! The two Peer Reviewers did not know the Theory. *"It is necessary to understand the theory of what one wishes to do or to make."* [Deming]

4th case: the paper "*Statistical design of ATS-unbiased ... time between events*", we find a new wrong case copied from Santiago and Smith (2013): the CLs are wrong.

According to the Kumar et al. computations, the CLs are: LCL=31.36 and UCL=1943.22, quite different from those of Santiago&Smith. The cause is not explained by the authors... It is interesting what we find with RIT. See Table 3 (where we used the same scale of Kumar et al.). Both the methods, "t1 Chart" and "ATS-unbiased t1 Chart", from the paper "Statistical design of ATS-unbiased ..." provide wrong Control Limits. They say: *"It can be observed that ... detects a signal at the 67th point."* The 67th point is ≤ 0.63 ; obviously it is also < 1.835 (the LCL of Galetto). A very strange conclusion is drawn: *"... ATS unbiased t2-chart gives an OOC for the first time at the 36th point, while using the modified scheme... the chart detects an OOC, at the 30th point."* *"Because the ATS-unbiased t1-chart ... OOC at the 67th point whereas the ATS unbiased t2-chart ... OOC at the 30th point, the example supports ... that monitoring the times to every 2nd event ($r>1$) can speed up the detection of shifts in the process parameter."* It is not clear (to us) why the authors write also: *"ATS unbiased t2-chart gives an OOC for the first time at the 36th point, while using the modified scheme, the chart detects an OOC at the 30th point."* IF there is an OOC at the "36th point" (for the non modified scheme) and there is an OOC at the "30th point" (for the Modified Scheme) why it is NOT OOC the "22nd point" \leq "30th point"? The authors do not tell us. The Peer Reviewers and the editor did not find that!

At this point, it should be clear that several Journals have been going on publishing wrong papers on I-CC_TBE [Individual Control Charts for TBE (Time Between Events)] data, exponentially distributed. Does, now, the reader think that the statement *"The problem of monitoring TBE that follow an exponential distribution is well-defined and solved. I do not agree that "nobody could solve scientifically the cases"* has to be considered a scientific idea? Absolutely not! This is due to lack of knowledge of the Sound Theory of the CC.

Table 3. Comparison of results from the paper "Statistical design of ATS...." and RIT

Type of Method	LCL	UCL	Comment
N. Kumar et al. "t1 Chart"	0.63	2093.69	Both LCL and UCL lower than the Scientific ones
N. Kumar et al. "ATS-unbiased t1 Chart..."	31.36	1943.22	LCL 17 times higher than Scientific and UCL 24% of the Scientific ones
F. Galetto RIT	1.835	7940.01	Scientific

The errors are in papers published by reputed Journals, written by reputed authors and analysed by reputed Peer

Reviewers, who did not find the errors: moreover, they were and are read by reputed readers, who did not find the errors (see the "*ocean full of errors ...*").

Nonetheless, they are wrong.... A true disaster. Their "formulae (wrong)" are used by the Minitab software [also JMP (seen before), SixPack, SAS, ...]. [the users of such software take wrong decisions based on the "wrong formulae"... Worse, "the Software Management", informed of the errors did not take any Corrective Action: a very good attitude towards Quality!

Those Journals publishing wrong papers on CC for "rare events" should, for future research about CC, accept the letters sent to their Editors and provide them to their Peer Reviewers, to avoid costly errors and decisions: the letters are not yet been published: the papers are wrong and obviously the Editors cannot acknowledge that. They did not use *metanoia* (Deming 1997). That is the big real problem: big errors of "well reputed" people make a lot of danger, and nobody (known to the author ...), but the author (FG), takes care of teaching the students to use their own brain in order not to be poisoned by incompetents.

How many [26-168] Statisticians, Professors, Certified Master Black Belts, practitioners, workers, students, *all over the world, learned, are learning and will learn wrong methods and took and will take wrong decisions? If the reader considers that* the author asked many [$>>50$] *"Statisticians and Certified Master Black Belts and Minitab users (you can find them in various forums such as ReasearchGate, iSixSigma, Academia.edu, Quality Digest, ... and in several Universities)"* and *nobody* could solve scientifically the cases, he has the dimension of the problem. The author hopes that the Peer Reviewers of this paper have better knowledge than the discussants (in the various forums and in the "*ocean full of errors ...*"...), otherwise he risks being passed off... [26-168].

In spite of all these proofs, the discussant who suggested the paper of J. Smith did not believe to the evidence (see the "*ocean ...*"). He raised the problem that it could happen only by chance: he believed only in simulations (as do all who do not know Theory)! After ten million of simulations F. Galetto got that T Charts (Minitab, JMP and in all wrong papers) were wrong 93.3% of the times! We think that it should be enough...

The author, many times, with his documents [26-168], tried to compel several scholars to be scientific (from Galetto 1998 to Galetto 2022, in the References): he did not have success. Only Juran appreciated the author's ideas when he mentioned the paper "*Quality of methods for quality is important*" at the plenary session of EOQC Conference, Vienna (Galetto 1989). He always asked his students to *use their own Intelligence*, in order to avoid being poisoned by incompetents. He helped them with his papers presented at the HEI (Higher Education Institutions) Conferences since 1998. We saw that data need to be analysed with suitable methods devised on the basis of Scientific Theory and not on methods in fashion, in order to generate the correct CC. RIT [17-25] is able to deal with many distributions and then usable for many types of data and make Quality Decisions

about Quality matters. We showed various cases (from books and papers) where errors were present due to the lack of knowledge of a Sound Theory of Control Charts and of RIT.

**I am not doing this
for credit.
I am doing it because
it's right and it's necessary**

Figure 20. Necessity

Common (good) sense
is not science!
**Common sense
does not look for
"understanding"**

**"Understanding" is related to
"intelligence"
(Latin: *intus+legere* = **read into**)**

Figure 21. Intelligence vs "common sense"

The author (figures 20, 21) has been always fond of Quality in his activity [17-168]; for that reason, he wrote several papers and books showing scientific methods versus many wrong methods and presented them in several national and International Conferences: he wanted to diffuse Quality (from Galetto 1989 to Galetto 2022, in the References). The truth sets you free!

**TRUTH is ALWAYS the TRUTH
even though NO ONE believes it.**

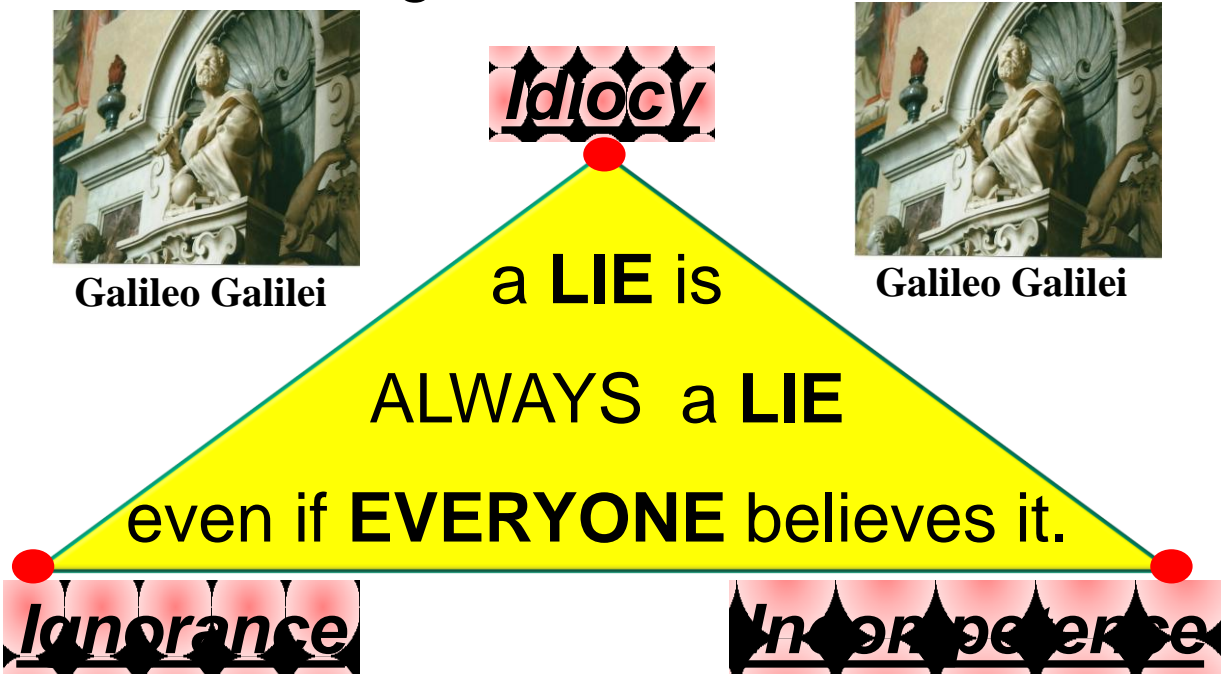


Figure 22. The triple I (I³) about Truth and Lies (and Galileo)

In order to show the several wrong ideas and methods related to financial and business considerations about quality in several books (not given in the references) we would need at least 80 more pages in this paper: we, obviously, cannot do that.

Therefore we ask the readers to look at some of the author's documents.

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Biography

Fausto Galetto (born Italy 1942) received Electronics Engineering (1967) and Mathematics degrees (1973) from Bologna University; from 1992 to 2012 he was Professor of "Industrial Quality Management" at Politecnico of Turin; from 1998 to 2001 he was Chairman of the Working Committee "AICQ-Università" (AICQ) for Quality in Courses about Quality in Universities.

He wrote nine books and more than 200 papers on Reliability, Quality (Management, DOE, Applied Statistics, Testing, Process Control).

Reliability Engineer with General Electric, 2 years, before the *6S [6Sigma] movement*, from 1975 to 1982 Reliability Manager (Fiat Auto, now FCA); Quality Dept. Director (comprising the Reliability, Production Quality Control, and After Sales Department) with Philco Italiana for 3 years. 1985-1990 Director of the Quality/Reliability Dept. at Iveco-Fiat, since 1990 Quality Management consultant. Lecturer with the Italian Organisation for Quality Control (AICQ) and with COREP(1980-2012).

Co-ordinator of: Reliability Working Group of CUNA (until 1989), Scientific and Technical Committee of QUALITAL (1989), Vice-Chairman of Automotive Sector of AICQ (1985-1990).

He left the SIS (Italian Statistical Society) and the AICQ (Italian Association for Quality) due to the ignorance and loss of commitment of their fellows and "Managers" about the Scientific Approach to Quality and to the related Quality Methods (Statistical and not...)

It seems he is one of the very few who take care of "*Quality of Quality Methods used for making Quality*".