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ASSURE: Adopting Statistical Significance for Understanding Research and Engineering

Fausto Galetto

Independent Scholar, Past Lecturer at Politecnico di Torino, Turin, Italy

ABSTRACT

We start with the question "Is Statistical Significance outdated?" The question is originated by a set of papers suggesting leaving out the use of Statistical Significance; the cause of that idea depends on the fact that many researchers identify the "bad p-values" with the concept of Statistical Significance.We will consider the various concepts involved, we will show the idea of Confidence Interval (with a larger view that in the Statistics and Probability books), we will give examples related to Control Chart with Non_Normal distributed data [and the wrong T Charts, very much considered in medical settings, using Minitab, SPSS, SAS, …]; we will suggest to abandon the p-values by showing that they discard the degrees of freedom used to compute them, when one wants to pool the results of various samples.Many Statisticians, Certified Master Black Belts, practitioners, workers, students, all over the world, are learning wrong methods and will take wrong decision.We suggest the form of Confidence Interval to be CI(H0, n, g, 1-CL, Distribution), where H0=Null Hypothesis, n=the physical sample size, g=the number of the random variables that provided the collected data (form which we get the Degrees of Freedom), CL=the Confidence Level (used to compute the CI, 1-CL=α) and Distribution=the type of the distribution of the random variables that provided the collected data (e.g., Normal Exponential, Poisson, Inverse Normal, Weibull, …)

***Corresponding author**

Fausto Galetto, Via Aldo Moro 8, 20090 Buccinasco (Milan), Italy, E-mail: fausto.galetto@gmail.com

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Introduction

On the web, one can find a discussion about the "Statistical Significance", like the following

Is "Statistical Significance" outdated?

On the web you can find 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 "non significant" 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 A larger set of opinions can be found in the papers [1-12] (they are only a few out of the many one can find); five are published by "The American Statistician", six are related to Medical Issues and one is related to Machine Learning; they are generally against the concept of "Statistical Significance".

In this paper, the author will share his ideas on this important (both theoretical and practical) concept: "Statistical Significance". Unfortunately all the many papers, books and documents the author read suffer of a great problem: they, generally, provide the methods for "Normally (almost Normally, due to the Central Limit Theorem) distributed data"; therefore, people know all the "recipes" for the Normal Distribution (and related ones, like Student and F).

They are incapable of dealing with anything else; at most, they learn how to transform the data so that they become "Normally Distributed"!This can change the importance of the analysis! Those scholars (often professors) love very much the use of "statistical software" like Minitab, SPSS, SAS, JMP, R, thinking that they can substitute knowledge. Those ones never considered the word of Deming [13, 14] "There is no substitute for knowledge".

Look at this case that shows the true of the Deming's statement: in order to let the Researchers in the RG understand the BASICS, many and many times Fausto Galetto suggested considering problems like the following:

> You say "Statistical softwares such as **SPSS, SAS etc. can calculate the CI**. The CI shows the precision of the estimate, if it is narrower so the estimate is more precise."
> Will those softwares provide the CI for the 2 cases?
> 1. You have 10 neutrons: 5 decay and 5 do not. Compute the CI (you can invent the data, as you like)
> 2. You have 100 neutrons: 5 decay (same time to decay as in 1.) and 95 do not. Compute the CI (you can invent the data, as you like)
>
> Which estimate is more precise?
> The same is for "people dying"!

Notice: FG did not state any parameter to be estimated; he left the choice to the reader; the **question was valid for any parameter** the researchers wanted to analyze. NOTICE the following answer (upvoted!) of Jochen Wilhem:

> Fausto, I used R to calculate the CIs you requested:
> 5 of 10 atoms disintegrate. The estimated probability for disintegration for this data is p=0.5 with a 95%CI from 0.19 to 0.82.
> 5 of 100 atoms disintegrate. The estimated probability for disintegration for this data is p=0.05 with a 95%CI from 0.016 to 0.113.
> However, your question "Which estimate is more precise?" cannot be answered for your example, because the variance is not constant and depends on the mean. From the presented data it seems that p=0.05 is a more precise estimate (the width of the CI is 0.094, whereas it is 0.63 for p=0.5. However, in simple terms, the relative precision (like the CV) is 1.9 for p=0.05 and 1.3 for p=0.5. Generally, proportions (binomial data) are analyzed on the logit scale, and there the width of the CIs are 2.0 for p=0.05 and 2.9 for p=0.5, indicating a higher precision in terms of the logits for p=0.05. This is only a rough estimate. A proper comparison is possible only for similar values of p, like comparing 5/10 with 50/100 (what has a width of the CI on the logit scale of 0.82).

Excerpt 1 (Jochen Wilhem)

NOTICE: the answer, in Excerpt 1, DOES NOT take into consideration the phenomenon "decay": the probabilities of disintegration depend from the interval considered (!!!), while the ones computed by Jochen are NOT time dependent that is they are related to DIFFERENT time intervals: the right way to compute the probability of decay is through the "decay rate" λ! For the same time t, the probability of decay of a neutron is the same for the interval 0-----t !

> The very upvoted (31 upvotes) does not serve anything for this case! Why people upvoted it?

They UPvoted the excerpt 1 due to their ignorance. There is so vast ignorance in the RG that NOBODY accepted and considered that THERE IS a PROBLEM when the SAMPLES are INCOMPLETE and the distribution is NOT Normal!
Many and many scholars, researchers and professors are BLIND AND DEAF.

> Very sorry, BUT it is TRUE!

NOTICE also what you can find in an Editorial of **nature methods** | VOL.10 NO.9 | SEPTEMBER 2013 at page| 805 (verbatim):
"To discuss sampling, we need to introduce the concept of a population, which is the set of entities about which we make inferences. The frequency histogram of all possible values of an experimental variable is called the population distribution. We are typically interested in inferring the mean (μ) and the s.d. (s) of a population, two measures that characterize its location and spread. The mean is calculated as the arithmetic average of values and can be unduly influenced by extreme values. The median is a more robust measure of location and more suitable for distributions that are skewed or otherwise irregularly shaped. The s.d. is calculated based on the square of the distance of each value from the mean. It often appears as the variance (s^2) because its properties are mathematically easier to formulate. The s.d. is not an intuitive measure, and rules of thumb help us in its interpretation. For example, for a normal distribution, 39%, 68%, 95% and 99.7% of values fall within ± 0.5s, ± 1s, ± 2s and ± 3s. These cut-offs do not apply to populations that are not approximately normal, whose spread is easier to interpret using the interquartile range."As one can easily see that there is a knowledge problem: every calculation refers to "Complete Samples": the above statement "the mean is calculated as the arithmetic average of values" do not consider that in the case of neutrons decay the sample of the Random Variable "Time to decay" is incomplete, i.e. less than the physical sample size: in such a case nobody can use the usual formulae that he can find in almost all the books; only the books [112-121] provide the Theory for the solution.

The concept of Statistical Significance

Before assessing Statistical Significance we must act as shown in the figure 1, related to the Test of Hypothesis. Some documents refer to it as NHST (Null Hypothesis Significance Testing). The Null Hypothesis is indicated by the symbol H_0. Sometimes we fix only H0 but it is important to remember that there is always the (hidden) Alternative Hypothesis H_1; this last is the "opposite" of H_0.

Statistical Significance is claimed when the Null Hypothesis H_0 is REJECTED.

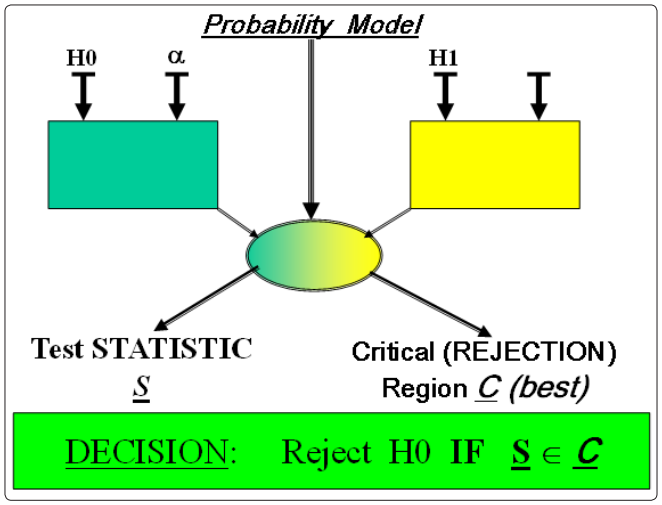

Figure 1: Test of Hypothesis flow chart

We must be very clear about the definitions, because there are people thinking that "Statistical significance is a statistic" by saying (Jochen Wilhem, again Upvoted!) "Statistical significance is calculated from sample data and thus is a sample statistic".

The name "Statistic" means both a quantity computed from data (collected during an experiment) and a Random Variable (RV) related to the Random Variables (RVs) providing the data (we collect during an experiment).
Significance is a concept.Statistical significance is a concept too. Therefore it is NOT "a sample statistic"Significance is assessed through information.Statistical significance is assessed through information too. The information is provided by the "sample (collected) data". Therefore it is NOT "a sample statistic"…
Statistical significance is a statement CLAIMED, about the Null Hypothesis H0, after having computed (according a sensible Theory) a sample statistic [S in figure 1] from the "sample (collected) data", that suggests us to REJECT H_0. Therefore Statistical Significance is NOT "a sample statistic", while S is a sample statistic!
It is OUR decision to claim Statistical Significance, or not, on the ground of both the collected data and of "the physics" of the phenomenon we are studying.

The reason that caused Jochen Wilhem error was his identification of Statistical Significance with the p-values!
Notice: in the figure 1 we FIXED H_0, α, H_1, and we had to ASSUME the distribution of the "RANDOM VARIABLES" that will in future provide the data.
The width of the Rejection Region C, depends on the "number g of the RANDOM VARIABLES" providing the data we are going to collect; if g is "small" C is small (the acceptance region A, complementary set of C is large) and the probability $\beta(H_1)$ of rejecting H_1, in favor of H_0, will be "high": in this case, IF one computes the Confidence Interval, with Confidence Level CL=α+β, he will find that H_0 and H_1 will be BOTH in the CI: one has NOT enough data (information) to distinguish between H_0 and H_1.

IF g increases C gets larger (the acceptance region A, complementary set of C is gets smaller) and the probability $\beta(H_1)$ of rejecting H_1, in favor of H_0, will be "smaller": in this case, IF one computes the Confidence Interval, with Confidence Level CL=α+β, he will find that H_0 and H_1 can be either BOTH in the CI or **one alone** ∈ A: one has enough data (information) to distinguish between H0 and H1. BUT, at this point, the probability $\beta(H_1)$ [that is related to C], can be > β(WANTED):

$\beta(H_1)$ > β(WANTED) ("small, as the researcher wants")
IF this is the case, we NEED to INCREASE the "number g of the RANDOM VARIABLES" providing the data we are [NOT n] going to collect UNTIL we have
$\beta(H_1)$ < β(WANTED) ("small, as the researcher wants")
The number g and the interval A are such that that we can distinguish H0 and H1 with the stated risks α and β, by using the RULE "ACCEPT the Null Hypothesis H_0: [$\pi=\pi_0$] IF s ∈ **A**". (π is the parameter we want to estimate and test)

Fo EXAMPLE… Let's assume H_0: [$\pi(100)=\pi_0=0.90$], versus H_1: [$\pi(100)=\pi_1=0.73$], where π(100) is the probability that an atom survive 100 years; we want to test our hypotheses with stated risks α=0.05 and β=0.10.
We MUST assume a distribution for the "time to disintegration" of the atoms: according to Physics we assume exponential distribution.
Following what we said, we need that 8 atoms disintegrate; then we sum all the lives of the atoms we put on "test of disintegration"; this is the STATISTIC s; and we have to get s > 3781!
The formula for s is $s=t_1+t_2+t_3+t_4+t_5+t_6+t_7+(n-7)t_8$, where n [physical sample size] is the number of atoms we analyse for disintegration. The Acceptance Region is

|3781----------→----------∞

NOTICE The sample size is n, while the number of random variables **g** is **8**! The calendar time to get the decision depends on n; the POWER of the test depends on g! IF we put on test n=100000 atoms, we can decide about H_0 in 3871/100000 years that is 14 days…..
Many people, with little statistical knowledge, base their decision about Statistical Significance with the p-value. This is a very bad attitude, as shown in the paper [114].
The author's firm conviction is the following: Do not report statistical significance with p-values. Use, instead, Confidence Intervals in the following form, CI (H_0, n, g, 1-CL, Distribution). The form, CI(H_0, n, g, 1-CL, Distribution) provides the information about the Acceptance Region

1. The physical sample size n
2. The number g of the random variables that provided the collected data (g provide the way to find the "degrees of freedom", from the point 4)
3. The Confidence Level used to compute the CI, 1-CL=α
4. The Distribution of the random variables that provided the collected data

In the previous case we have CI (100000, 8, 0.05, Exponential)=[LL, UL], where LL and UL are computed from the collected data, $t_1+t_2+t_3+t_4+t_5+t_6+t_7+t_8$. Remember that to find 8 and 3781 we used both the stated risks α=0.05 and β=0.10.

The concept of CI is important for the Control Charts [13-15, 17, 18, 23, 115-123, 125-134], as we shall see in the next section.

Control Charts, T Charts and Exponentially distributed data
Statistical Significance is used a lot in the analysis of Process Performance, to see if a process is In Control (stable and predictable, under "Common Causes") or Out of Control (unstable and unpredictable, under "Special Causes") [13, 14, 17, 18].
The papers [1-12] do not consider this important issue.

The Control Charts, were devised almost a century ago by W. A. Shewhart for monitoring the performance of production process [17, 18]. They can be used also for services. The Shewhart ideas were greatly appreciated by Deming [13, 14] and Juran [15].

They are based on the concept that in any process there is a "background noise", the cumulative effect of many small, essentially unavoidable causes, which makes the process to provide a variable output: a certain amount of inherent or natural variability will always exist in the output (also named "chance causes of variability"); such a process is said to be in "statistical control". If a product (output of the process) has variability, in its quality characteristics, greater than the natural variability we say that the process suffers of "assignable causes of variation"; a process that is operating in the presence of assignable causes is said to be an Out-Of-Control process (OOC).

The Control Charts are a tool used to understand if a process is IC (In Control) or OOC.
We consider here only Variable Control Charts used when the quality characteristics of the output are measured. Such control chart is a graphical display of a quality characteristic that has been measured or computed from the data of a sample versus the sample number or time. It is made by four elements: the data plotted and 3 lines, a centre CL, a lower line LCL (Lower Control Limit) and an upper line UCL (Upper Control Limit). If a point plots outside of the control limits then we interpret it as evidence that the process is out of control: investigation is needed.

The Control Limits are determined in such a way that if the process output has only chance (random) variability then the data plotted in the control chart are 99.7% between LCL and UCL.

Generally the data plotted are assumed to follow a normal distribution because they are the means of samples with k sample size each; usually k=5. The RV (random variable) $\overline{X}$ mean of 5 RVs X_i, i=1,2,..,5, is distributed as $\overline{X}\sim N(\mu_{\overline{X}}, \sigma^2_{\overline{X}})$ with mean μ_X and variance σ^2_X; with this assumption the three lines of the control chart are

$$LCL=\mu_{\bar{X}}-3\sigma_{\bar{X}} \qquad CL=\mu_{\bar{X}} \qquad UCL=\mu_{\bar{X}}+3\sigma_{\bar{X}} \qquad (1)$$

Unfortunately the parameters of the Normal distribution are not known in advance before collecting the data form the process: they must be estimated from the data. Since the beginning of

control charts a misdeed has been made: the Control Limits were, have been and are computed with the formulae (1), as though the parameters were completely known! We can view the interval LCL-------UCL as a "probability interval" comprising 99.97% of the Random Variable (mean) X.

Since the parameters $\mu_{\bar{X}}$ and $\sigma_{\bar{X}}$ are unknown, we estimate them from the data and we make a "mental leap" and use the formulae (1) [which are probabilistically true] in the statistical formulae where we have determination of RVs, where $\bar{\bar{x}}$ is the "grand mean" and $\bar{R}$ is the "mean of the ranges" (the coefficient A_2 depends on the sample size k of any sample drawn; n is the numbers of samples).

$$LCL_X = \bar{\bar{x}} - A_2\bar{R}\ CL_X = \bar{\bar{x}}\ UCL_X = \bar{\bar{x}} + A_2\bar{R} \qquad (2)$$

A similar control chart is drawn for the range making a "bigger mental leap" [because the distribution of $\bar{R}$ is not normal!] and using the formulae (1) [which are probabilistically true] in the statistical formulae where we have determination of RVs (the coefficient D_3 and D_4 depend on the sample size k).

$$LCL_R = D_3\bar{R}\ CL_R = \bar{R}\ UCL_R = D_4\bar{R} \qquad (3)$$

It is customary to use formulae (2) and (3) also for NON_ normal data: in such a case, generally the NON_normal data are transformed in order to "produce Normal data" so to apply formulae (2) and (3).

Sometimes we have few data and then we use the so called "individual control charts": for such charts k=1 and n is the number of collected data; an example is given in the table

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

The data (lifetime) are exponentially distributed. The data are given in Example 7.6 of the Montgomery book Introduction to Statistical Quality Control, 7th edition, Wiley & Sons; he writes "A chemical engineer wants to set up a control chart for monitoring the occurrence of failures of an important valve. She has decided to use the number of hours between failures as the variable to monitor". Since the data are few (20) and exponentially distributed one cannot use formulae (2) and (3). If one would [wrongly] do use formulae (2) and (3) he would find a wrong Control Chart.

Let be y_i the original (exponential) data; Montgomery transformed the data $x_i=y_i^{1/3.6}$ into Weibull distributed data (almost normal) and used a I-MR Chart where in the upper graph the individual xi are plotted with their mean $\bar{x}$ and control limits and in the lower graph the individual $MR_i=|x_i - x_i+1|$ (moving ranges) are plotted with their mean ($\overline{MR}$) and control limits.
The result, **for him**, is that "the Process is In Control". This is a wrong decision.

Using the Minitab T Charts, whose wrong theory can be found in many wrong papers [125-134], again one draws the wrong decision that "the Process is In Control".
See the following figure:

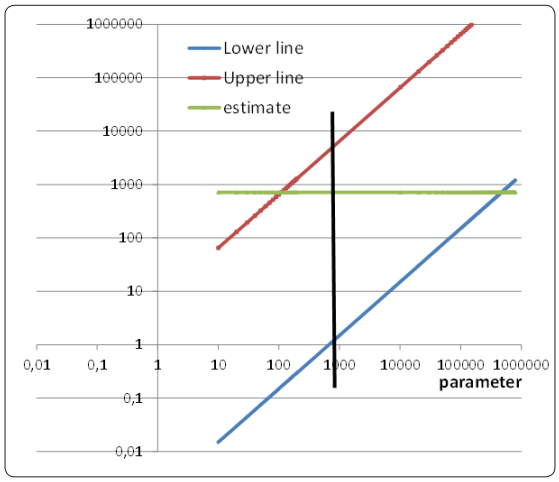

Figure 2: (F. Galetto) LCL and UCL for the T Chart of Montgomery data, using RIT. [logarithmic scales]

We used the Reliability Integral Theory [112-123] to find the CI (in figure 2) since the Control Limits, LCL and UCL, in the Control Charts are the limits of the Confidence Interval of the "grand mean" of the data, with k=1 as sample size of the various samples.

The author, using Minitab 19 and the last release Minitab 20 (with the same drawbacks of the previous release!) found the following figure 3; it is the I Chart (Chart for Individuals); it is important to analyse correctly it.

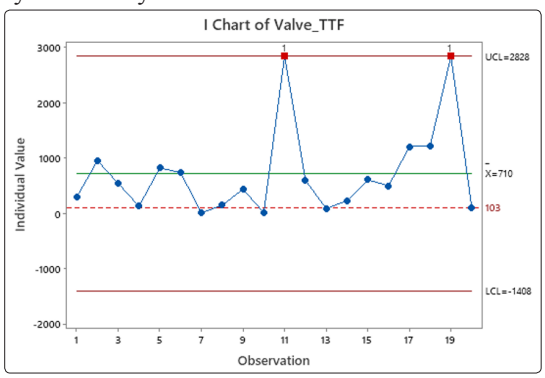

Figure 3: (F. Galetto) I Chart (Control charts) for valves data [Montgomery book], using Minitab 19 and 20. The dotted line is the right correct LCL when RIT is used

The reason for the use of I Chart is the fact that it is possible to draw the right LCL computed with RIT, the dotted line. The I Chart shows the wrong control limits computed with the "Normal Formulae". Compare figure 3 with figure 4, the T Chart.

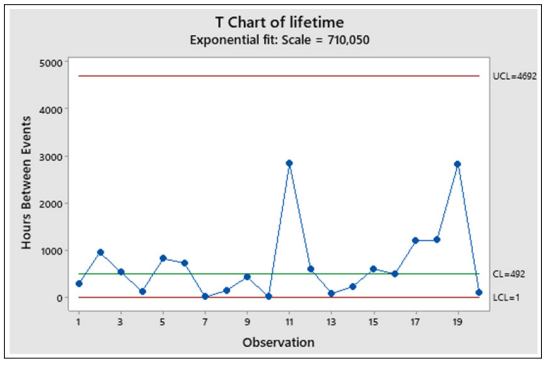

Figure 4: T Chart of Montgomery data. Minitab 19 used (F. Galetto)

In figure 4 it is impossible to draw the correct (RIT) Lower Control Limit dotted line (of figure 3).

Notice the behaviour of the data: obviously is the same.

The UCL is very large and it is not reported in figure 5, where you can see the LCL, both for the Time To Failure (lifetime) and for the Ranges (of lifetime): both are Exponentially Distributed, as one can prove by reading [112, 113, 115-119].

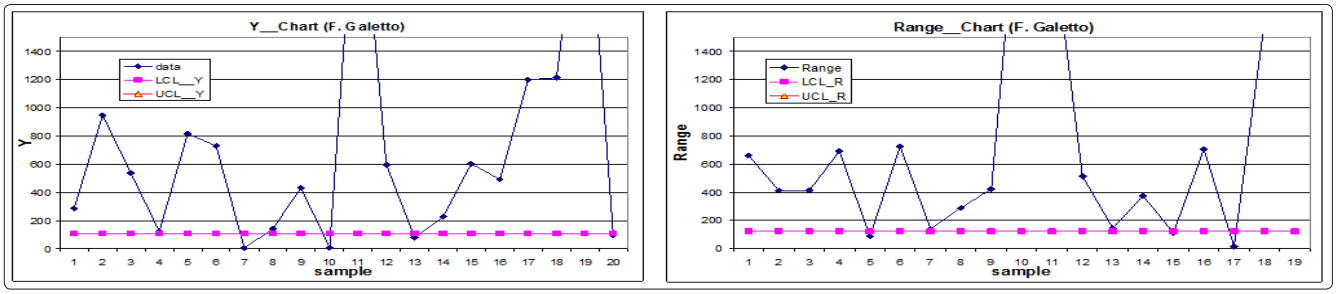

Figure 5: (F. Galetto) Scientific Control charts for valves [wrong control charts in Montgomery books].

The Control Charts show graphically the Statistical Significance of an Out of Control Process.
It is an important concept in any application, from manufacturing to services, to medical contexts. [1-12, 13, 14, 16, 17, 24-43, 125-134].

This case shows the ignorance of the "experts" participating to the author post at site iSixSigma:https://www.isixsigma.com/control-charts-non-normal-distribution related to control charts [124]; the author wrote: "I would like to get solution to the cases shown in the file. THANKS in advance. Fausto Galetto, with the attachment: ISIXSIGMA-INSIGHTS_Two-cases-for-Master-Black-Belts-dec-2019.docx" and of the authors in [125-134].

They should read several papers of the author. [48-111, 122, 123]

Abandoning p-values
The author conviction is that researchers have to be very careful about using mechanically p-values as a prove of statistical evidence of effects. The scholars and researchers think that if they have two replications of the same experiments (each with n1 and n2 data) and they find a p-value p1=0.1 (for the effect of a factor in the 1st experiment) and p2=0.05 (for the effect of the same factor in the 2nd experiment), then that factor is more important in the 2nd experiment.

If they use the concept of Confidence interval for the effects of the factor they could find that actually there is no reason to consider the effects as different: the process generating the effects is "In Control" or "Out of Control"? They do not know the subject [112-123].

Unfortunately, researchers set often only H_0 (nearly always "predicting" zero effect) but do not quantitatively define the alternative H1. Hence, power cannot be calculated (as we outlined before) for most tests which is a crucial omission in the Neyman–Pearson framework. They compute the p-value (as Fisher did) but they mechanically reject H_0 and accept the undefined H_1 if $p \leq \alpha$ (e.g. $\alpha=0.05$). They interpret the p-value and use it as a relative measure of evidence against H_0, as we can see in the following case.

Let $H_0=\{MTTF_0<100$ h$\}$ and let's assume that we have a reliability test and we test two samples, getting the data

sample	size	failures	total time on test	p-value
1	13	5	925.263	0.0470587
2	17	10	1521.565	0.0631008

The p-values are obtained by the Reliability Integral Theory because the usual Statistical Software (like SPSS, SAS, JMP, Statistica, Minitab, …) **cannot** provide the solution!
According to the rule given the result for the 1st sample is significant [we reject that MTTF<100], while it is not for the 2nd [we accept (i.e. we do not have enough evidence) that MTTF<100].

Since physically there is no reason to expect difference in the mean life, an Engineer (Manager) tests "statistically" the difference: at $\alpha=0.05$ there is no evidence of difference. Then he is allowed to pooling the data of the two samples.

The **pooled** p-value, obtained by the Reliability Integral Theory,

pooled sample	size	failures	total time on test	pooled p-value
	30	15	2446.828	0.01513

shows that H_0 should be rejected: the MTTF is better than 100 h. If the Manager would have computed the Confidence Intervals for the 3 samples of data (sample 1, 2 and pooled) he would have found no difference between 1 and 2

sample	MTTF_L	MTTF_U	MTTF_goal	Decision by p-value<0.5
1	90.34	569.92	100	Reject
2	89.06	317.30	100	Accept
pooled	104.17	291.45	100	Reject $H_0=\{MTTF_0<100$ h$\}$

However, poling the data, he could have estimated a better MTTF, so getting that the MTTF_goal was overcome, as shown by the 3rd row of the previous table.

If one use the Fisher's method, he has to combines extreme value probabilities from each test, p-values, into one test statistic (X^2, chi square) using the formula $-2\ln(p_1p_2)$ yielding 11.64; the right p-value via RIT is 8.38; **Fisher's method is 38% in error, in this simple case**!
The figure show the CIs

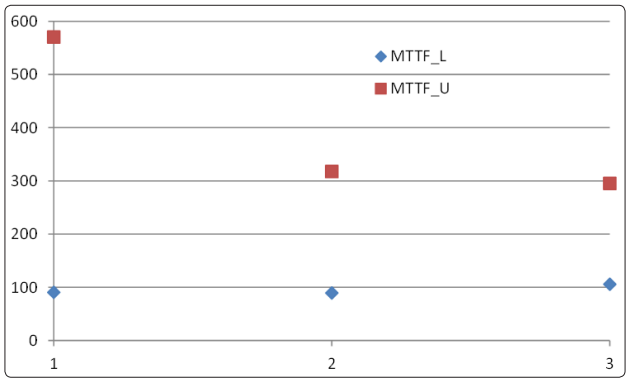

Figure 6: Confidence Intervals (using RIT)

From the above analysis it is clear that Seo Young Park, PhD, [5] is in error when she writes "Replacing P values with confidence intervals may not achieve anything".

Also Six Sigma fans use p-values a lot… but they are fond of Normal Distribution; then they cannot deal with many real problems during products and processes development [23-33]; the must learn [13, 14, 60, 69, 78, 88, 104, 105, 109-123, 159,,,]

Conclusion

Our analysis started with the question "Is Statistical Significance outdated?"

The question was originated by a set of papers suggesting leaving out the use of Statistical Significance; the cause of that idea depends on the fact that many researchers identify the "bad p-values" with the concept of Statistical Significance.

In our tour we considered the various concepts involved, we showed the idea of Confidence Interval (with a larger view that in the Statistics and Probability books), we gave examples related to Control Chart with Non_Normal distributed data [we saw the wrong T Charts, very much used in medical settings, using Minitab, SPSS, SAS, …]; we suggested to abandon the p-values showing that they discard the degrees of freedom used to compute them, when one wants to pool the results of various samples.

How many Statisticians, Certified Master Black Belts, practitioners, workers, students, all over the world, are learning wrong methods and will take wrong decisions?

At Politecnico of Milan, Professors and Students can use, Free of Charge, Minitab.

How many users, there, know the T Charts drawbacks?

Ignorance is flooding and overflowing (due to incompetent professionals)…, like Covid 19…

Therefore, we think that we helped people to avoid being cheated by …

We think the producers of the Vaccine AntiCovid19 had assessed the Statistical Significance of the positive effect of the Vaccine. Otherwise, we all are in great danger.

The form we suggested is CI(H0, n, g, 1-CL, Distribution), where n=the physical sample size, g=the number of the random variables that provided the collected data (and from it the number of the degrees of freedom related to the distribution involved), CL=the Confidence Level (used to compute the CI, 1-CL=α) and Distribution=the type of the distribution of the random variables that provided the collected data (e.g., Normal Exponential, Poisson, Inverse Normal, Weibull, …)

We think that the figure 7 of M. Sivo gives the right basic point of view to deal with the matter.

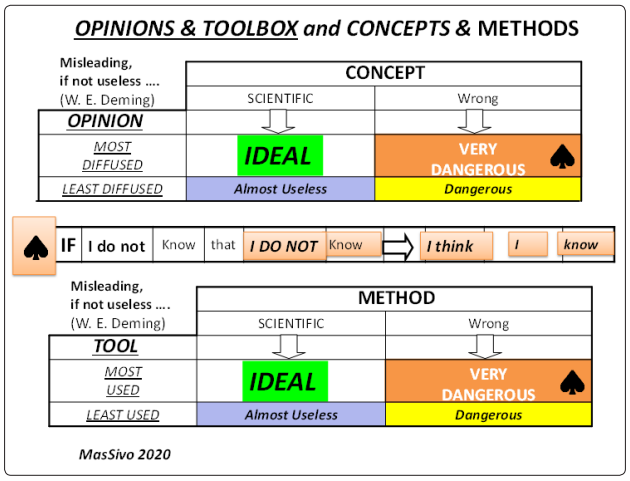

Figure 7: Opinions and Tools versus Methods (according to M. Sivo).

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163. F Galetto, ANOVA and Least Squares Estimation Some BASICS! Quality MUST be loved, DISquality MUST be hated.
164. F Galetto, Case n° TWENTYONE; A WRONGLY AWARDED wrong paper of on DOE, awarders are NOT reliable! Quality MUST be loved, DISquality MUST be hated.
165. F Galetto, Quality Engineering vs "mathematicians" - QFG: case n° TWENTY, QE wins!_MANY WRONGS do not make a right; Quality MUST be loved, DISquality MUST be hated.
166. F Galetto, Case n° NINETEEN, a WRONG Taguchi application AGAIN, REFEREES are NOT reliable! Quality MUST be loved, DISquality MUST be hated.
167. F Galetto, Second Addendum to Case n° EIGHTEEN, PEERS INCOMPETENT; Quality MUST be loved, DISquality MUST be hated for RG-2014
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169. F Galetto, Case n° EIGHTEEN, PEERS INCOMPETENT; Quality MUST be loved, DISquality MUST be hated for RG-2014
170. F Galetto Case n° SIXTEEN; SECOND PART, other WRONG ideas of D.C. MONTGOMERY!!!!! Quality MUST be loved, DISquality MUST be hated.
171. F Galetto, Case n° FIFTHTEEN; the G-Method for MANOVA versus INCOMPETENT REFEREES !!!! (WRONG Taguchi applications) [ANOVA dealt in cases n° NINE and ELEVEN], THIRD part
172. F Galetto Case n° FOURTEEN; MANOVA of another WRONG Taguchi application [ANOVA dealt in case n° ELEVEN], REFEREES_INCOMPETENT!!!! SECOND part
173. F Galetto Case n° THIRTEEN; some WRONG ideas of PROFESSOR D.C. MONTGOMERY!!!!! FIRST PART_ Quality MUST be loved, DISquality MUST be hated.
174. F Galetto Quality Education on Quality and Design Of Experiments
175. F Galetto Case n° TWELVE; MANOVA of a WRONG Taguchi application, REFEREES are NOT reliable! Quality MUST be loved, DISquality MUST be hated.
176. F Galetto Case n° ELEVEN; another WRONG Taguchi application, REFEREES_INCOMPETENT!!!! FIRST part Quality MUST be loved, DISquality MUST be hated
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DISquality MUST be hated.
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