Lafayette Instrument.

Tech Talk: Using the Lafayette ESS Report Generator

Raymond Nelson

Included in LXSoftware is a fully featured manual score sheet that can be used with any validated comparison question test format. Included in the manual score sheet utility of LXSoftware version 11.3 is a tool to generate a printable interpretation and report of the test result using the Empirical Scoring System (ESS; Nelson, Krapohl & Handler, 2008; Nelson & Handler, 2010; Nelson *et al.*, 2011). The ESS is an evidence-based, norm-referenced, standardized rubric for test data analysis, and it allows the examiner to formulate both categorical test results (e.g., DI/NDI or SR/NSR) in addition to quantifying the probabilistic or statistical test result. The ESS Report Generator can be used with any of the comparison question test formats in contemporary use, including event-specific diagnostic examinations with 2 or 3 relevant questions, and multiple issue screening exams consisting of 2, 3, or 4 relevant questions. The ESS Report Generator can be used with examinations consisting of three to five presentations of the test stimuli, and includes a useful set of advanced options for professionals who wish to optimize the analysis and report for their needs.

The LXSoftware 11.3 ESS Report Generator uses scores from the manual score sheet to automatically execute an exact replication of the procedures and result that would be achieved by a human expert using the ESS (Nelson & Handler, 2012), including the formulation of summary conclusion paragraph to describe the test results of event-specific and multiple-issue exams. The printable report includes both a categorical result and a statistical classifier in the form of a p-value, confidence level, or odds ratio, and also includes the manual scores and information about test accuracy.

Using the ESS Report Generator

After recording and scoring the examination data, the ESS Report Generator can be accessed by selecting the *Score* -> *Open Score Sheet...* from the *Series* menu, as shown in Figure 1. This will open the dialog shown in Figure 2. Score sheets can also be accessed directly from menu buttons if the *Scores toolbar* is displayed.

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Figure 1: *Score -> Open Score Sheet...* menu item.

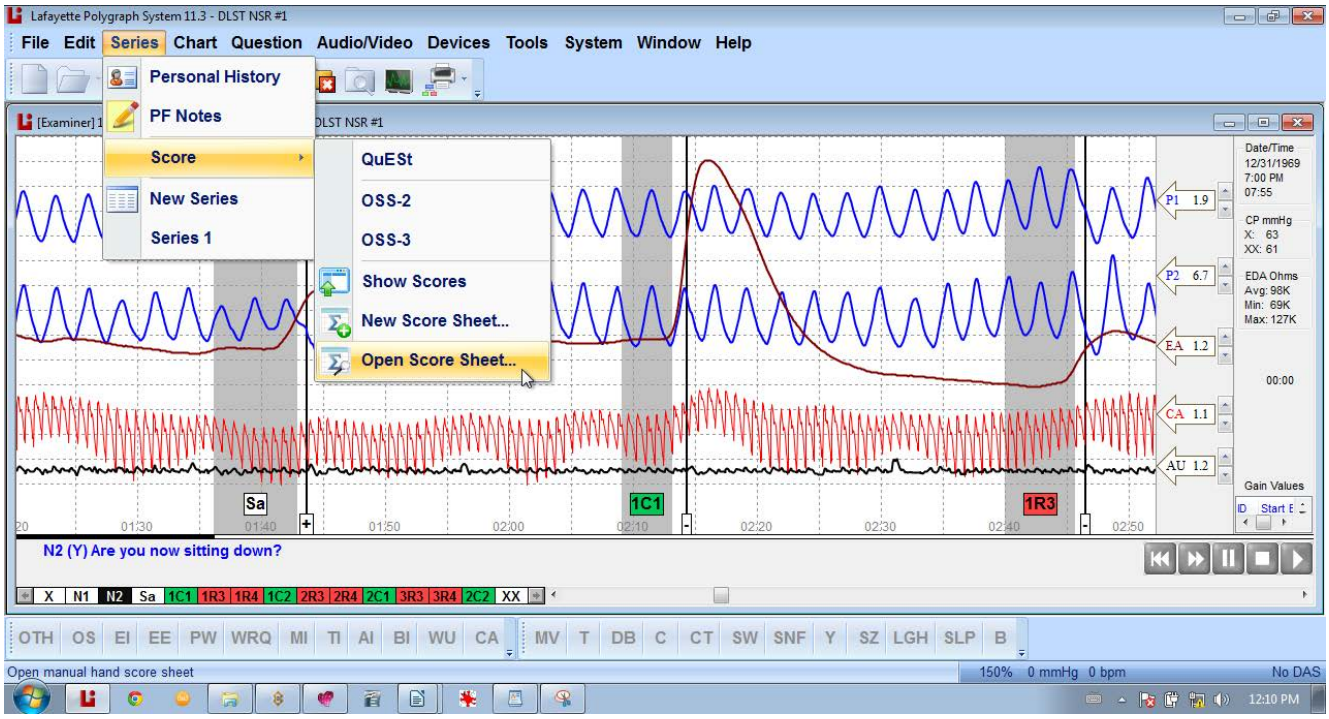
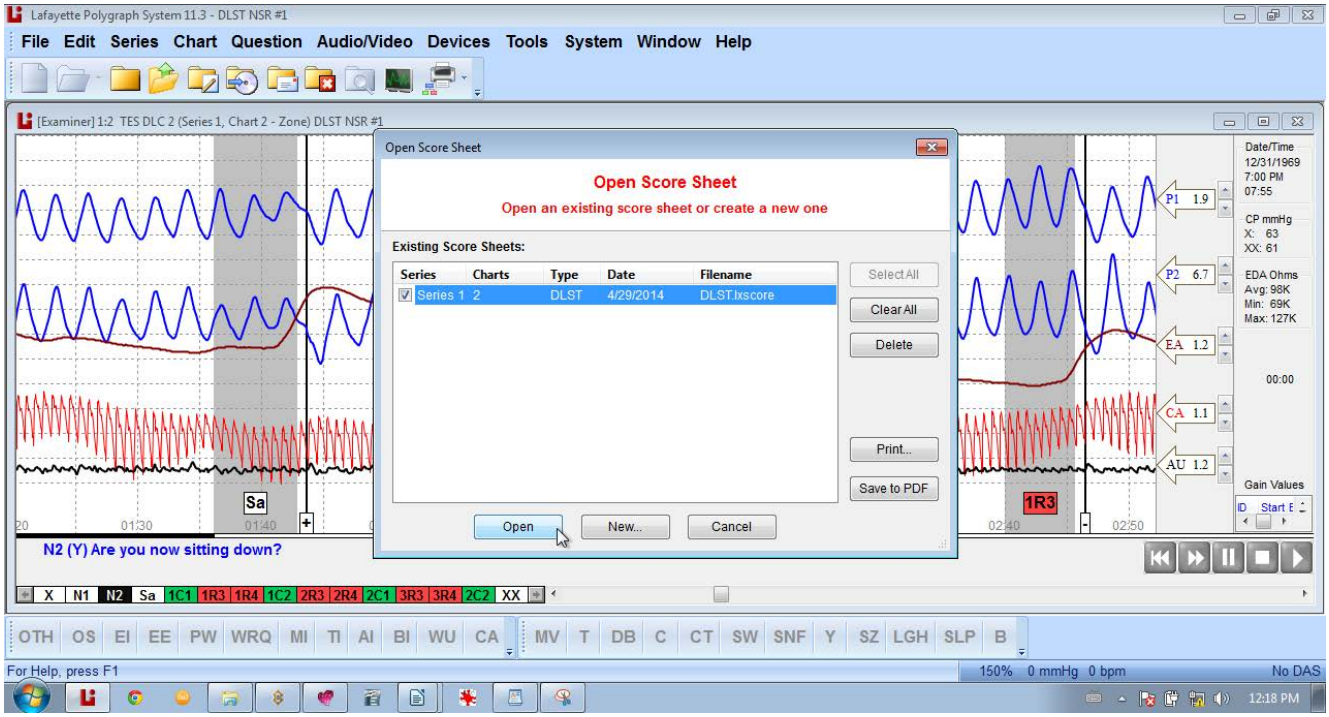


Figure 2: Score sheet dialog.



It is important to select the correct examination format when making a new score sheet. The ESS Report Generator will require that all question formats are assigned to one of two basic examination

types: 1) event specific diagnostic examination formats, and 2) multiple issue screening formats. The ESS Report Generator will use the correct normative data and decision rules depending on the type of examination and the number of relevant questions. Select the desired score sheet and then click the *Open* button to see the score sheet. You can also double-click the desired score sheet to open it. The *New Score Sheet Dialog* is shown in Figure 3. The manual score sheet is shown in Figure 4.

Figure 3: New score sheet dialog.

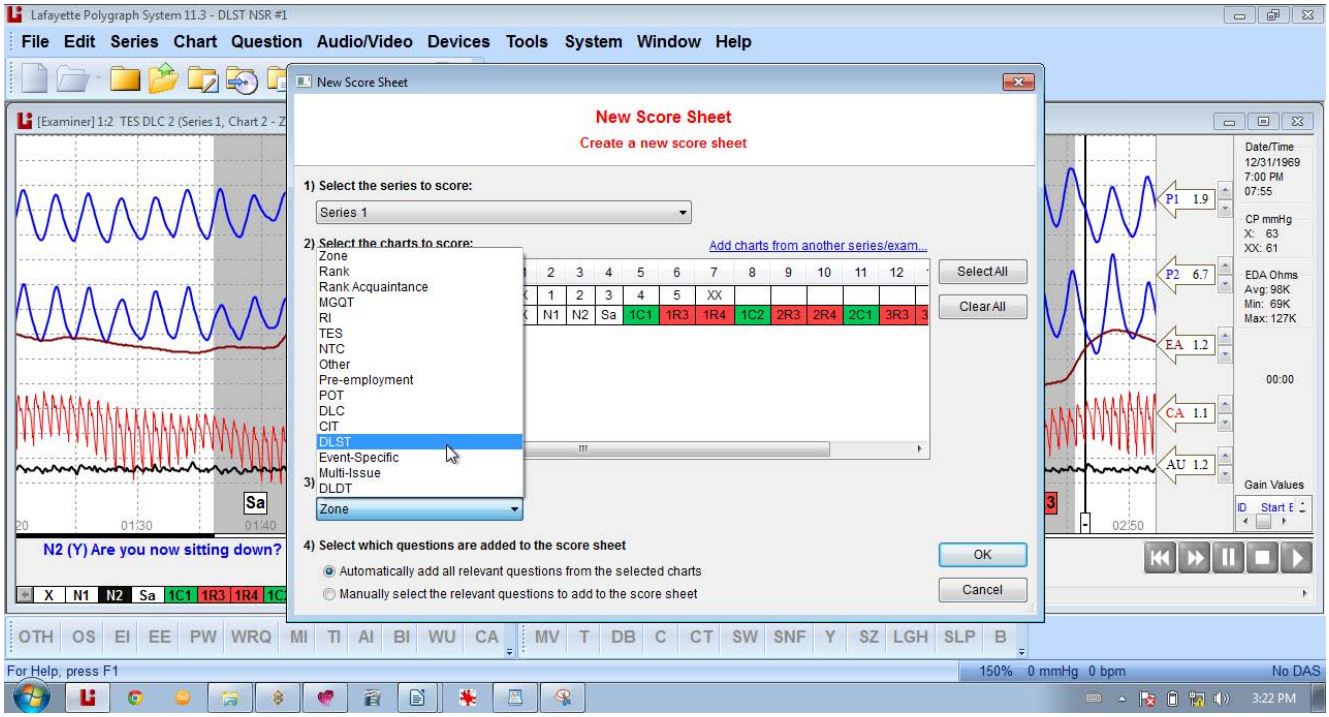
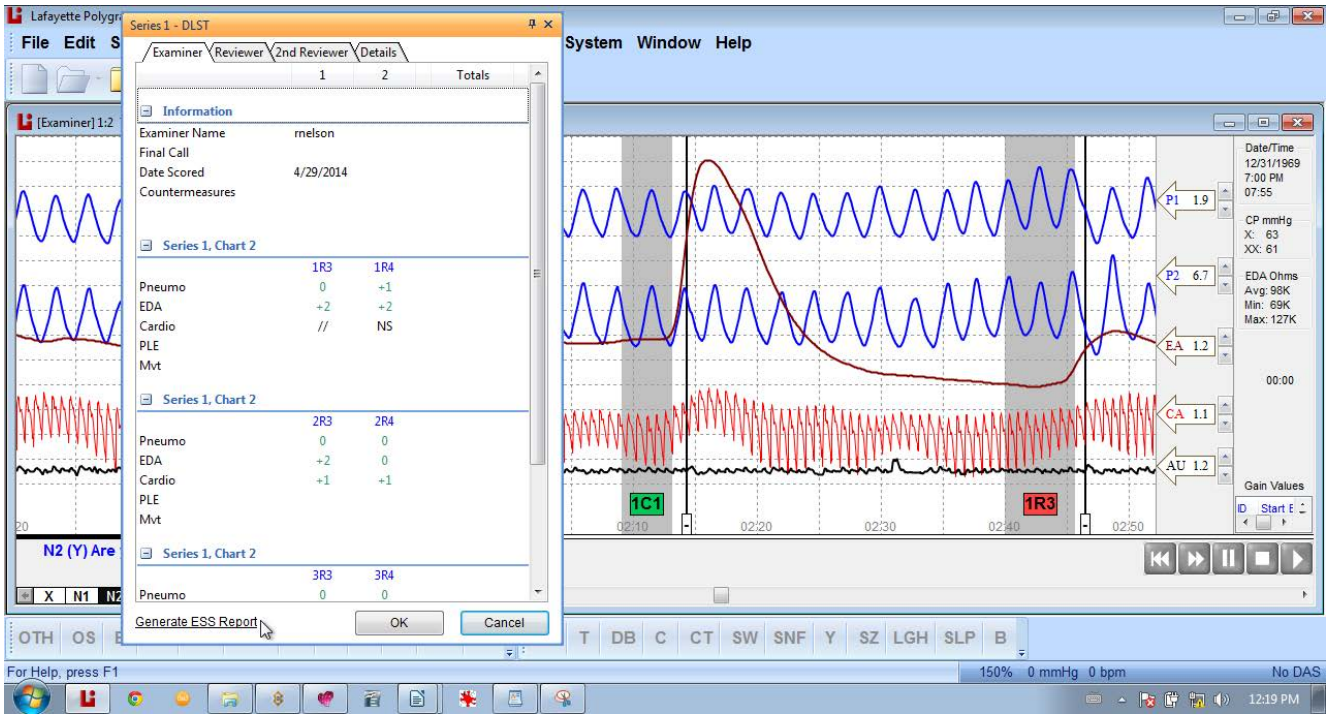


Figure 4: Manual score sheet.



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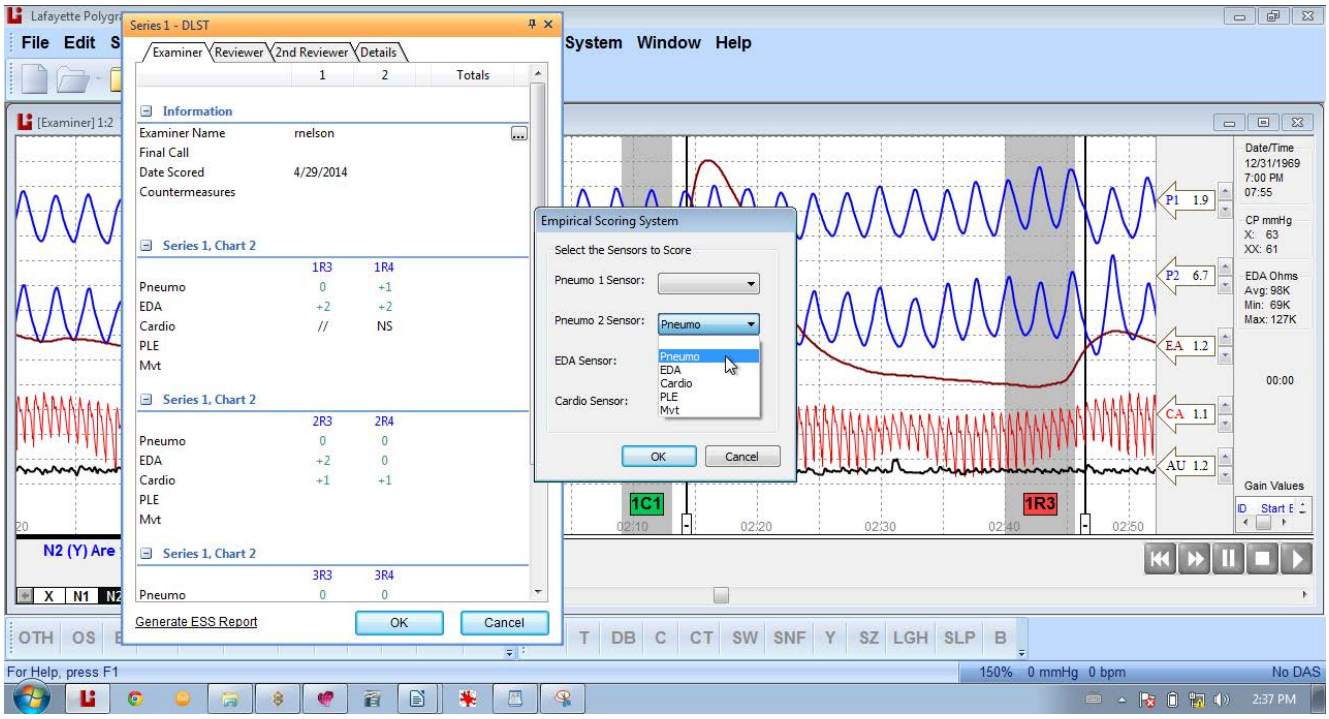
Click on the *Generate ESS Report* hyperlink, located at the bottom left of the manual score sheet, to proceed to the ESS Report. You may see a small dialog, shown in Figure 5, depending on your score sheet configuration, requesting you to select the sensors for the ESS Report Generator. The primary reason for this flexibility is to facilitate use of the ESS Report Generator by examiners with differing approaches to naming and scoring the two respiration channels. Some examiners record only one pneumograph score for both respiration channels. Other examiners record score for each respiration channel.

Regardless of the preferred score sheet method, only one respiration score is included in the scored result for each presentation of each stimulus question when the data are summed in the form of ESS sub-total and grand-total scores. The ESS Report Generator will reduce the data to a single pneumograph score regardless of whether one or two respiration scores are entered on the score sheet. If two pneumograph scores exist in the score sheet the scores are transformed in a three step process: 1) the score is transformed to a zero value if the product of the two scores is negative, 2) the score is transformed to a positive value if the sum of the two results in a positive integer, and 3) transformed to a negative value if the sum is negative. If the examiner has transformed the recorded data into a single respiration score, then the ESS Report Generator will use that single respiration score (in this case the examiner has transformed the two channels to a single score).

Figure 5: ESS Sensor selection dialog.

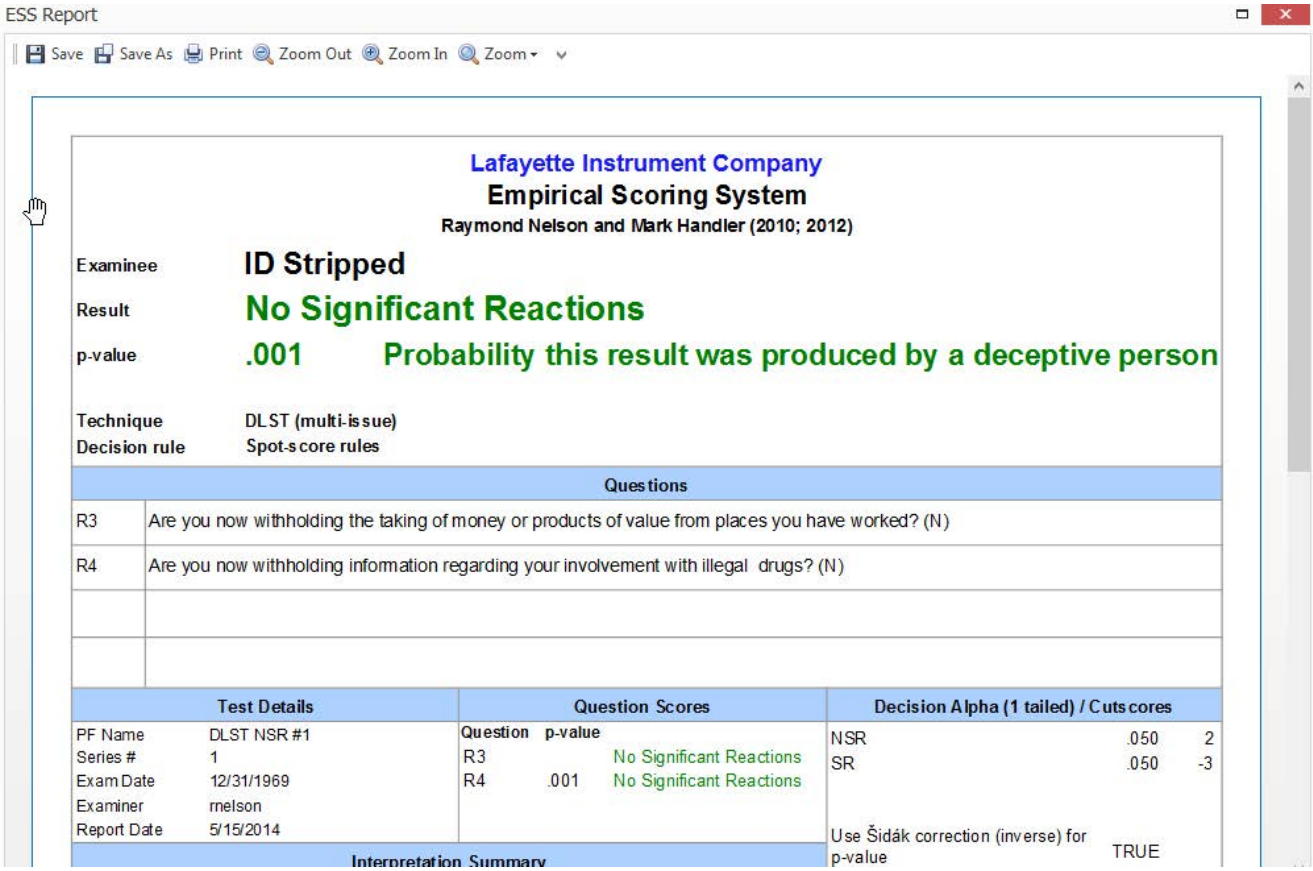


The ESS Report

Click on the *OK* button after selecting the correct sensors. Figure 6 shows the upper portion of the ESS Report. The ESS Report can be saved to the examination PF folder as a .pdf document (ESSReport.pdf) by clicking the *Save* button. The ESS Report can also be saved to any other location by clicking the

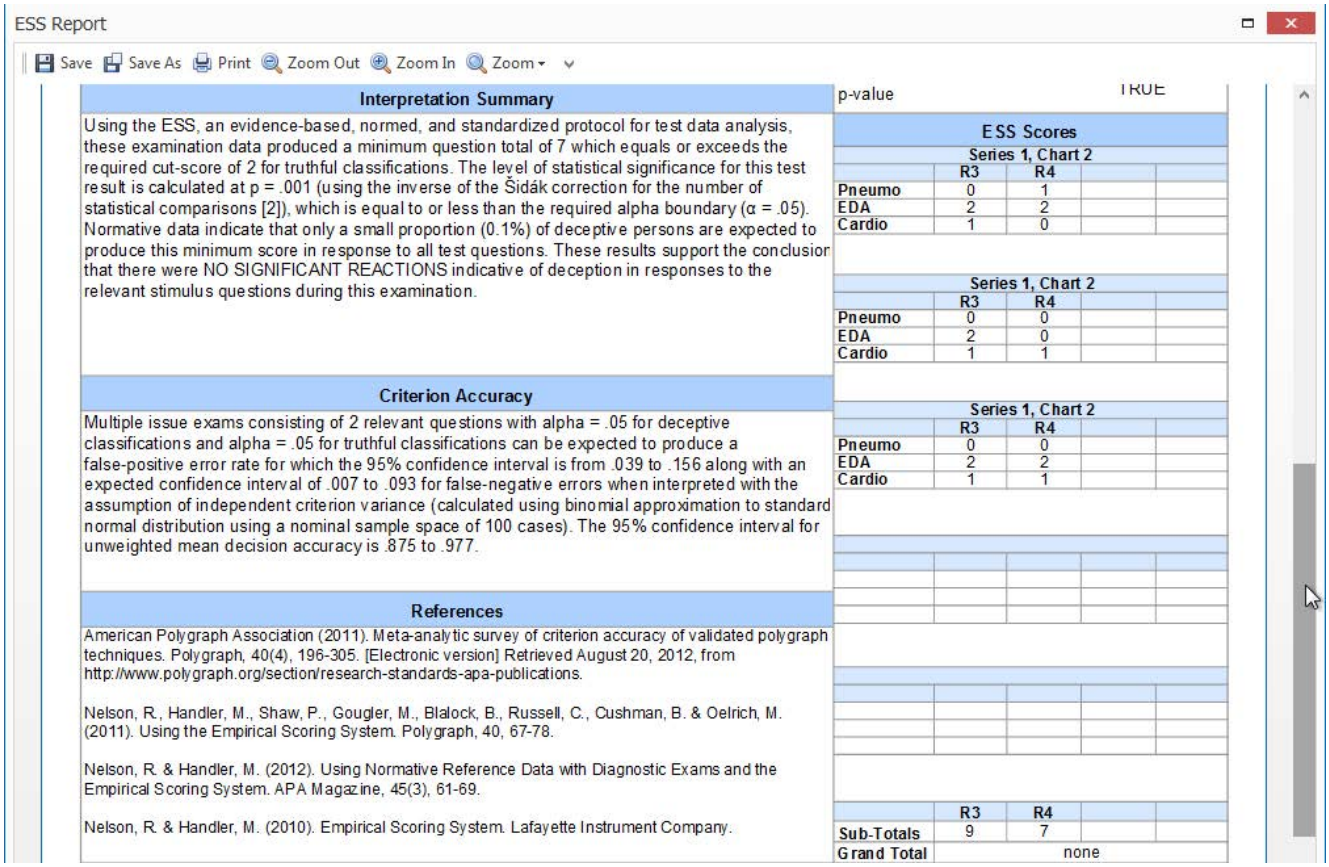
Save-as button. The *ESSReport.pdf* document, saved in the examination PF or other location, can be opened with Adobe Acrobat or another application program suitable for this file format. The ESS Report summarizes the examination data, including the examinee name, examination data, type of examination, examination questions, and categorical test result. The ESS Report also includes all of the scientific information pertaining to the test result, including the examination sub-total and grand-total scores where applicable, and test results, including: scores, cut-scores, p-values, alpha boundaries, decision rules, and statistical corrections used to determine the level of statistical significance of the categorical test result.

Figure 6: ESS Report, upper portion.



Categorical test results, along with the most commonly requested information that is useful to referring professionals and referring agencies, are at the top of the ESS Report. Information of interest to examiners, researchers, scientists, administrators, and quality-control professionals can be found lower on the ESS Report. Figure 7 shows the lower portion of the ESS Report.

Figure 7: Lower portion of the ESS Report.



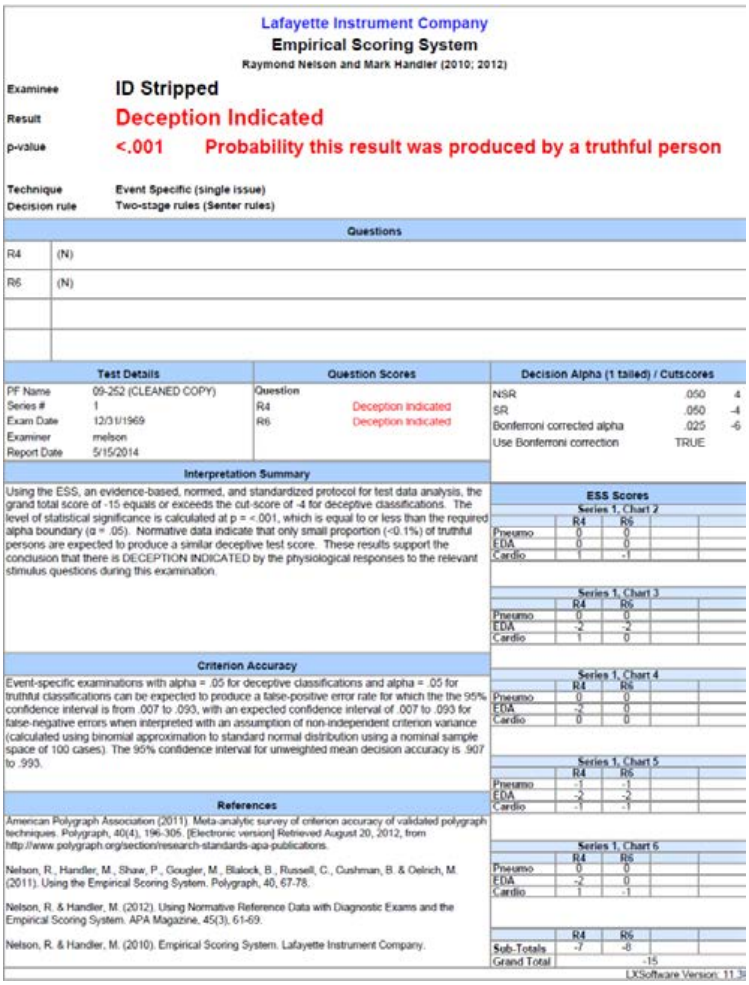
ESS scores from the manual score sheet are included in the ESS Report. All scores from the manual score sheet are transformed into ESS scores regardless of whether they are entered as tradition three-position or seven-position scores. ESS scores are integer-weighted three-position scores, with integer weights of +/-1 for respiration scores, +/-2 for electrodermal scores, and +/1 for cardiovascular scores. In practice, respiration data are found to result in a score of zero more often than electrodermal and cardiovascular data, resulting in manual scores with average weighting coefficients of respiration $\approx$ .20, electrodermal $\approx$ .50, and cardiovascular $\approx$ .30. These weighting coefficients approximate statistical and mathematical functions that have been shown to maximize the geometric/Euclidian distance, or the difference in variance, between the scores normally observed among deceptive and truthful persons.

Also included in the ESS Report is a summary paragraph that provides a narrative description of the scientific basis and interpretation of the examination result. This summary paragraph is written individually for each examination, depending on a number of factors, including the type of examination, decision rules, and number of relevant questions. The summary will also contain information regarding the analytic model that was used to obtain the result, along with information about what should be assumed or expected of that analytic model. In addition, the summary will include the test scores, cut-scores, p-values, and alpha boundaries for statistical significance. Use of any mathematical formulae used to correct for multiple statistical comparisons is also described, followed by an explanation of the scientific and statistical meaning of the test scores. Finally, a

categorical interpretation is provided based on the level of statistical significance of the test data.

The ESS Report also includes information about the 95% confidence intervals that describe the expected range of precision and error associated with the desired alpha boundaries that were used to determine the categorical test result. This can be useful whenever it is necessary to answer questions about basis of scientific knowledge regarding test accuracy and the potential for error. Figure 8 shows the entire ESS Report.

Figure 8: ESS Report.



Lafayette Instrument Company

Empirical Scoring System

Raymond Nelson and Mark Handler (2010; 2012)

Examinee: **ID Stripped**

Result: **Deception Indicated**

p-value: **<.001** **Probability this result was produced by a truthful person**

Technique: Event Specific (single issue)

Decision rule: Two-stage rules (Senter rules)

Questions

R4	(N)
R6	(N)

Test Details

PF Name	09-252 (CLEANED COPY)
Series #	1
Exam Date	12/31/1969
Examiner	melson
Report Date	5/15/2014

Question Scores

Question	
R4	Deception Indicated
R6	Deception Indicated

Decision Alpha (1 tailed) / Cutscores

NSR	.050	4
SR	.050	-4
Bonferroni corrected alpha	.025	-6
Use Bonferroni correction	TRUE	

Interpretation Summary

Using the ESS, an evidence-based, normed, and standardized protocol for test data analysis, the grand total score of -15 equals or exceeds the cut-score of -4 for deceptive classifications. The level of statistical significance is calculated at p = <.001, which is equal to or less than the required alpha boundary (α = .05). Normative data indicate that only small proportion (<0.1%) of truthful persons are expected to produce a similar deceptive test score. These results support the conclusion that there is DECEPTION INDICATED by the physiological responses to the relevant stimulus questions during this examination.

ESS Scores

Series 1, Chart 2

	R4	R6
Pneumo	0	0
EDA	0	0
Cardio	-1	-1

Series 1, Chart 3

	R4	R6
Pneumo	0	0
EDA	-2	-2
Cardio	1	0

Series 1, Chart 4

	R4	R6
Pneumo	0	0
EDA	-2	0
Cardio	0	0

Series 1, Chart 5

	R4	R6
Pneumo	-1	-1
EDA	-2	-2
Cardio	-1	-1

Series 1, Chart 6

	R4	R6
Pneumo	0	0
EDA	-2	0
Cardio	1	-1

	R4	R6
Sub-Totals	-7	-8
Grand Total	-15	

Criterion Accuracy

Event-specific examinations with alpha = .05 for deceptive classifications and alpha = .05 for truthful classifications can be expected to produce a false-positive error rate for which the the 95% confidence interval is from .007 to .093, with an expected confidence interval of .007 to .093 for false-negative errors when interpreted with an assumption of non-independent criterion variance (calculated using binomial approximation to standard normal distribution using a nominal sample space of 100 cases). The 95% confidence interval for unweighted mean decision accuracy is .907 to .993.

References

American Polygraph Association (2011). Meta-analytic survey of criterion accuracy of validated polygraph techniques. Polygraph, 40(4), 196-305. [Electronic version] Retrieved August 20, 2012, from http://www.polygraph.org/section/research-standards-apa-publications.

Nelson, R., Handler, M., Shaw, P., Gougler, M., Blalock, B., Russell, C., Cushman, B. & Oelrich, M. (2011). Using the Empirical Scoring System. Polygraph, 40, 67-78.

Nelson, R. & Handler, M. (2012). Using Normative Reference Data with Diagnostic Exams and the Empirical Scoring System. APA Magazine, 45(3), 61-69.

Nelson, R. & Handler, M. (2010). Empirical Scoring System. Lafayette Instrument Company.

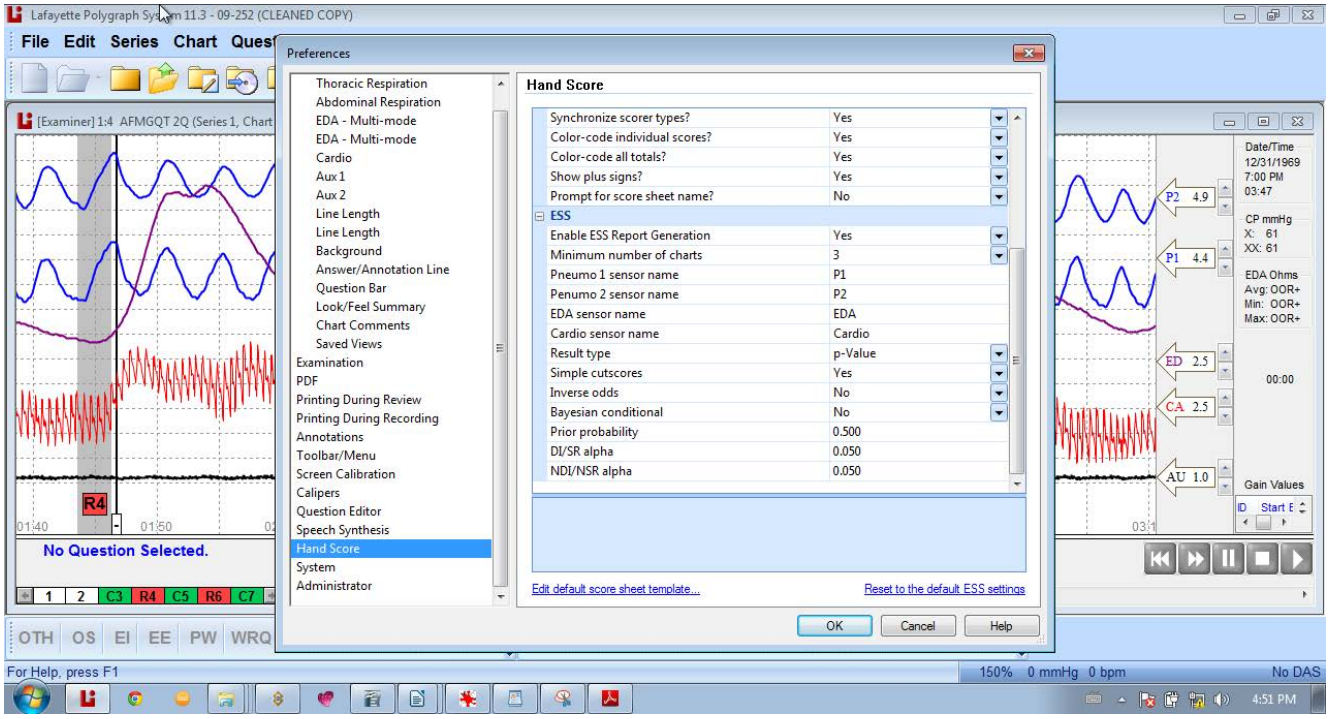
LXSoftware Version: 11.3

Figure 9 shows the user options, which can be accessed by selecting the *Preferences* item from the *Tools* menu. Available options include the ability to set the default sensor selections and to present categorical results as odds-ratio or confidence level instead of traditional p-value. One of the options is the ability to set any desired alpha level.

Alpha boundaries, which control the precision and error of scientific test results, are commonly set at .05, corresponding to a desired maximum error tolerance of 5%. Results of scientific tests and scientific experiments are said to be *statistically significant* when p-value (probability of error), corresponding to the numerical test score, is less than a maximum tolerance for error, expressed as an

alpha boundary which corresponds to a numerical cut-score. Field examiners will rarely, if ever, need to change the default alpha boundaries. Instead, Alpha boundaries, error tolerance, requirements for precision, and corresponding cut-scores are concerns for which referring professionals, including investigators, program administrators, risk evaluators, and risk managers may make strategic decisions to decrease the rate of inconclusive results (e.g. alpha = .10), or increase the level of precision expected from statistically significant test results (e.g., alpha = .01). An option to use simple cut-scores will impose a single numerical cut-score for multiple issue exams regardless of the number of relevant questions. Options also allow the use of a Bayesian condition probability model to further clarify the probability of deception or truth-telling with regard to knowledge or assumption about the prior incidence rate.

Figure 9: ESS preferences.



Summary

The practical purpose of polygraph examination results is to inform the examiner and referring professional about whether the examinee has been truthful or untruthful about an issue of concern. Accurate and well-documented results permit the examiner and referring professionals to make better informed and more effective decisions about subsequent action, including additional interviewing, investigation, testing, or other risk management decisions.

The scientific purpose of polygraph examination results, like the results of other scientific tests, is to establish a basis of test data as a form of evidence to guide and support a professional opinion or conclusion. Test results can be thought of as an interpretation (i.e., translation) of the test data, using structured quantitative and procedural rules, into simple human categorical and conceptual language that is useful to the referring professional. Underlying all scoring and interpretation tasks is the

fundamental obligation of all forms of scientific testing: to quantify the degree of uncertainty associated with the test result by describing the data with respect to the basis of published evidence, including basic knowledge that describes the generally expected performance of the analytic model, and normative data that describes test performance with the reference samples and intended population. The ESS Report Generator is a powerful yet simple tool designed to assist with this purpose and obligation.

The ESS Report serves to reinforce our awareness of the fact that virtually all scientific test results are probability statements with some potential for error. This is important because, although it is often said that there is no such thing as a perfect test, human pressures and the acuity of many ongoing risk assessment and risk management tasks can sometimes have the effect of encouraging both overconfidence in test accuracy and excessive frustration surrounding the potential for observed errors. Another oft heard maxim is that there is no such thing as free accuracy, and this is reflected in the ability to make thoughtful and informed decisions about ESS alpha boundaries for statistical significance. The ESS Report serves the additional function of teaching and reminding both examiners and referring professionals how to correctly view and understand the meaning of scientific test results. In this way, polygraph examiners and referring professionals can be prepared if a need arises to account for the basis of scientific evidence that describes the potential accuracy or error associated with the results of an individual examination.

LXSoftware 11.3 provides the examiner with an exceptional level of stability and power, along with many convenience and usability features designed to expedite basic tasks and technical operations necessary to conduct an examination. Among these tasks are the need to score each examination, determine the test result, provide a written report to the referring professional or agency, and maintain a record of the test data and analysis that support the test result. Used effectively, the Lafayette ESS Report Generator provides the examiner with 21st century technology that will automate the repetitive structured tasks of summarizing the test data, formulating an interpretation of the test result, quantifying the level of statistical significance, and preparing a presentable document to explain and account for both the analysis and our present knowledge-base. As always, no automated procedure can substitute for the need for a competent interview and test data acquisition phase, and the ESS Report Generator relies on the expert examiner to ensure that test scores are obtained using validated feature extraction criteria and that are applied to test data of adequate usable and interpretable quality.

The ESS Report Generator provides the examiner with a powerful and simple to use automated algorithm that will expeditiously execute an exact replication of the result and interpretation achieved by ESS procedures used by human experts. Automation of these simple and repetitive tasks may increase the availability of professional energy and attention to important human activities that cannot be replicated by automated processes.

References

Nelson, R. & Handler, M. (2010). *Empirical Scoring System*. Lafayette Instrument Company.

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Nelson, R., Krapohl, D. & Handler, M. (2008). Brute force comparison: A Monte Carlo study of the Objective Scoring System version 3 (OSS-3) and human polygraph scorers. *Polygraph*,(*37*), 185-215.