Exceptional service in the national interest

Sandia National Laboratories

Sandia National Laboratories

An Overview

U.S. DEPARTMENT OF ENERGY | NNSA

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND No. 2012-5130P

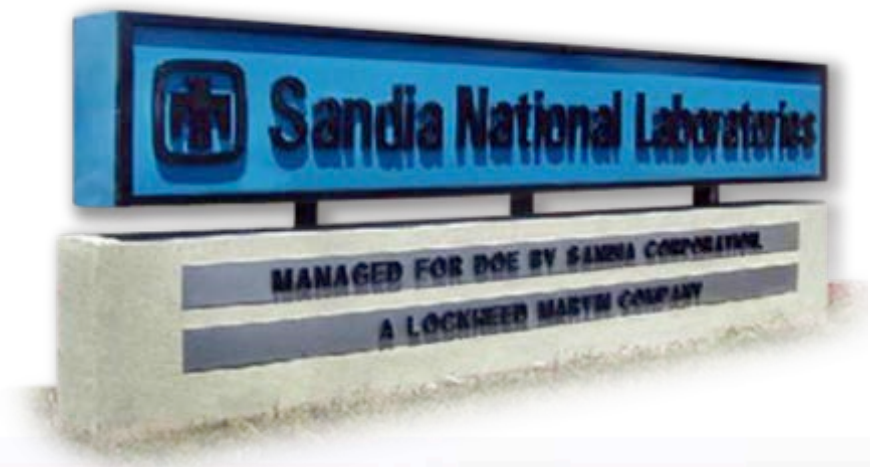
Presentation Agenda

Sandia National Laboratories

- Background on Sandia National Laboratories
- Background on the Robust Automated Knowledge Capture Study (RAKC) & EEG defined
- *Initial correlation analysis
- *Visual baseline using 3D scatter plot comparisons
- *First pass neural networking analysis
- *Hypothesis testing (two sample t-test)
- *Second pass Neural Networking demonstrating higher model predictability scores
- *Profiler / Simulator Analysis using JMP derived transfer function
- *3D scatter plot of the optimal EEG profile
- Lessons Learned
- Q&A

***=presentation will be given "real-time" via JMP 10 applicable platform**

Sandia



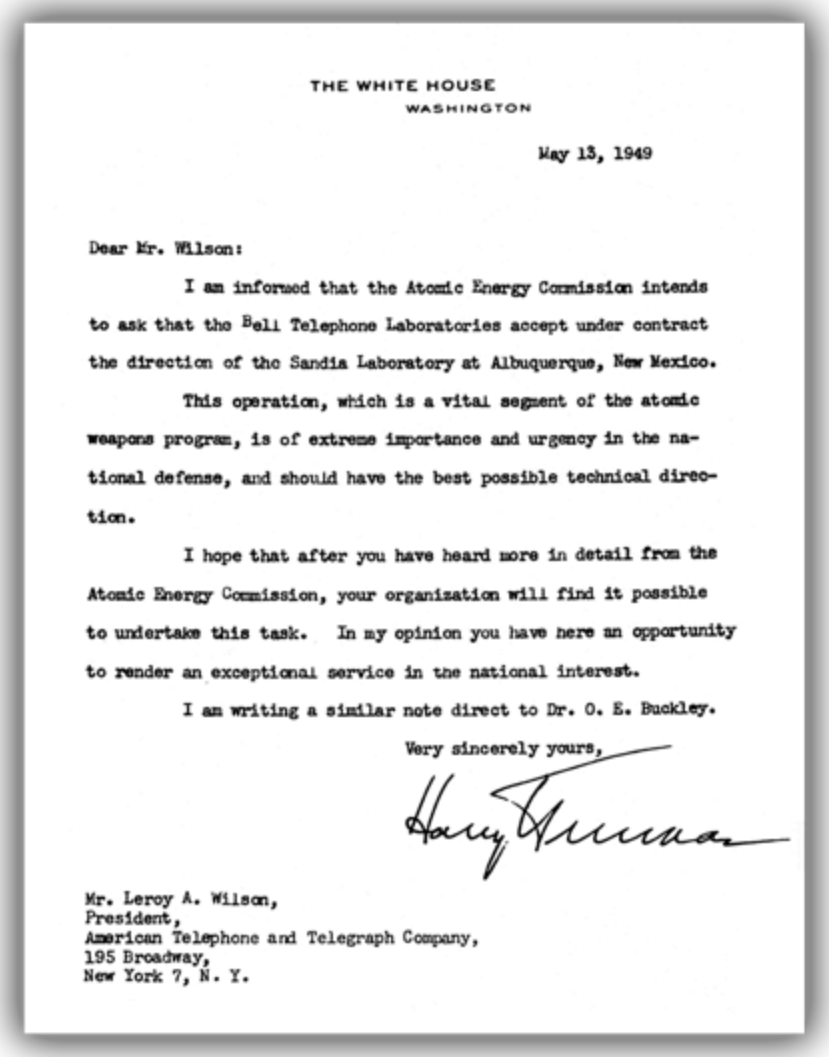
Sandia Corporation

- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–present
- Existing contract expires: Sept. 30, 2012
- One-year contract extension: Sept. 30, 2013

Government-owned contractor-operated

Federally funded research and development center

Sandia's History



THE WHITE HOUSE
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

Harry Truman

Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.

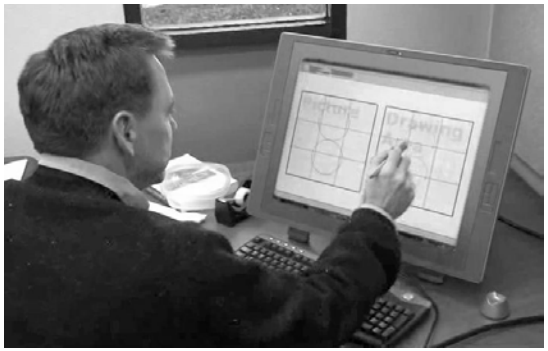
Sandia National Laboratories

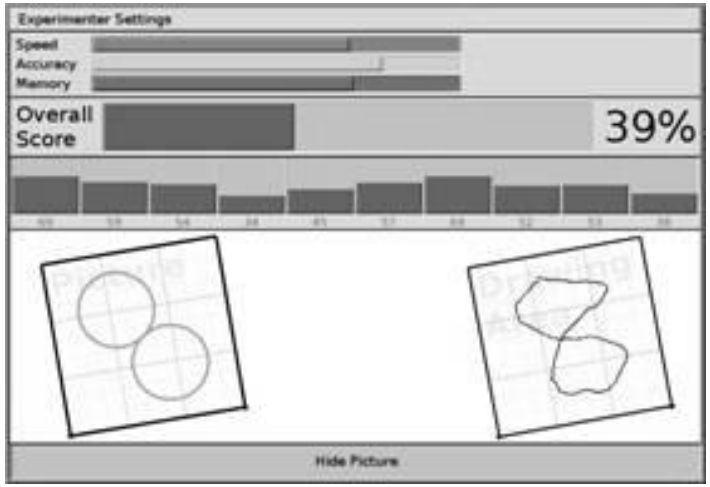
Robust Automated Knowledge Capture Study

EEG Defined - An electroencephalogram (EEG) is a test that measures and records the electrical activity of your brain

Sandia RAKC Study –

- **Several cognitive problem solving tests conducted**
- **Subjects fitted with an EEG sensor**
- **Resting EEG data taken with eyes open & closed**
- **Tests graded against a standard.**

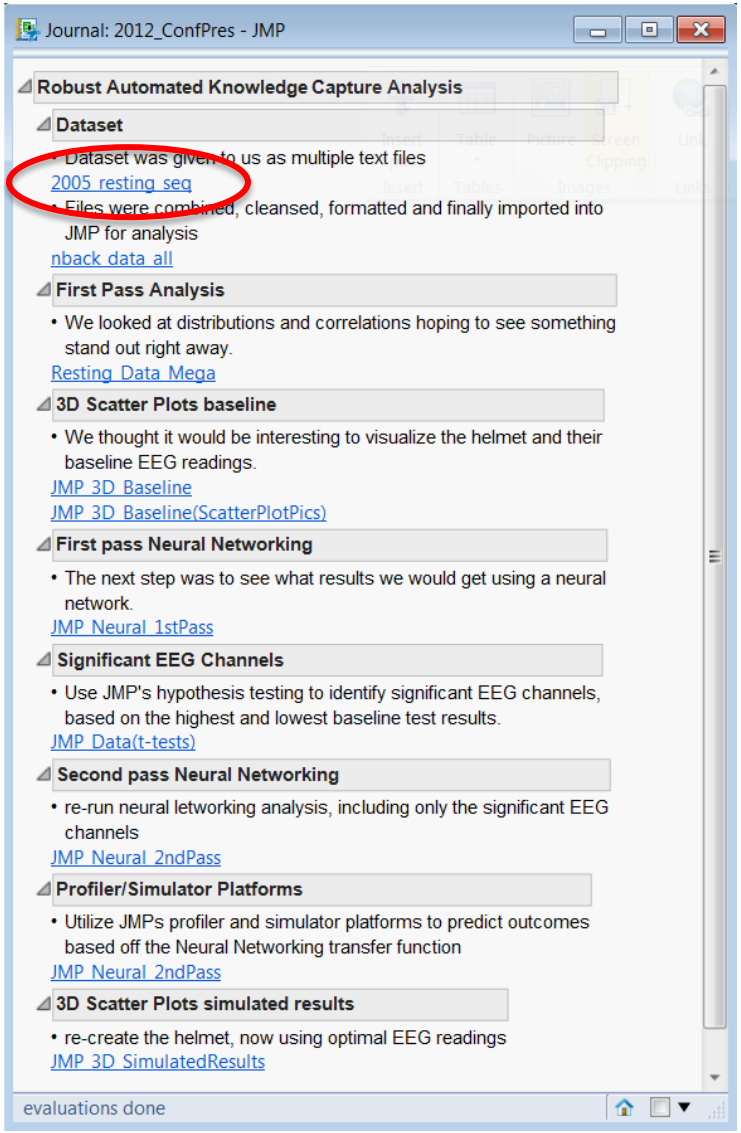




Dataset We were given

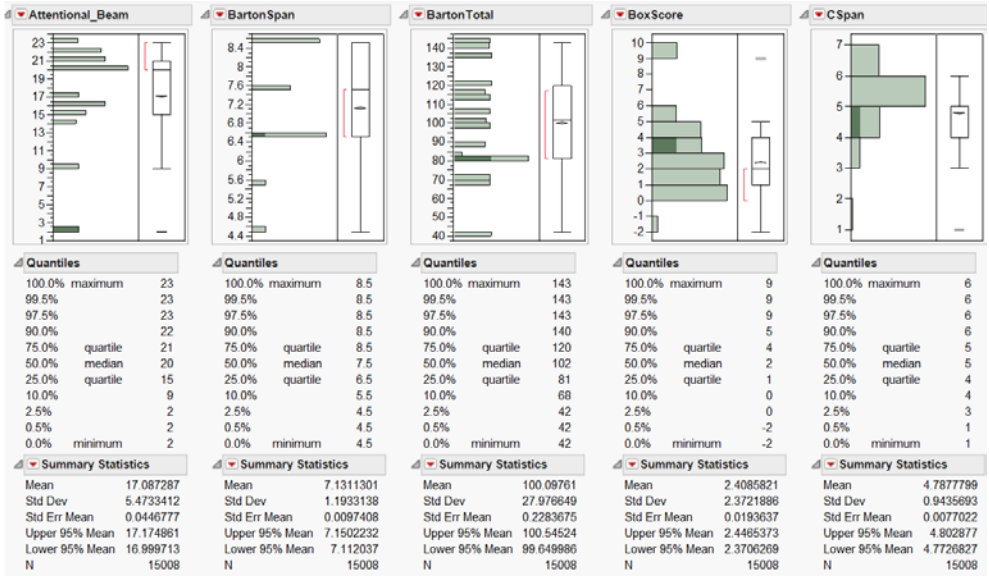
Initial data received and imported into JMP

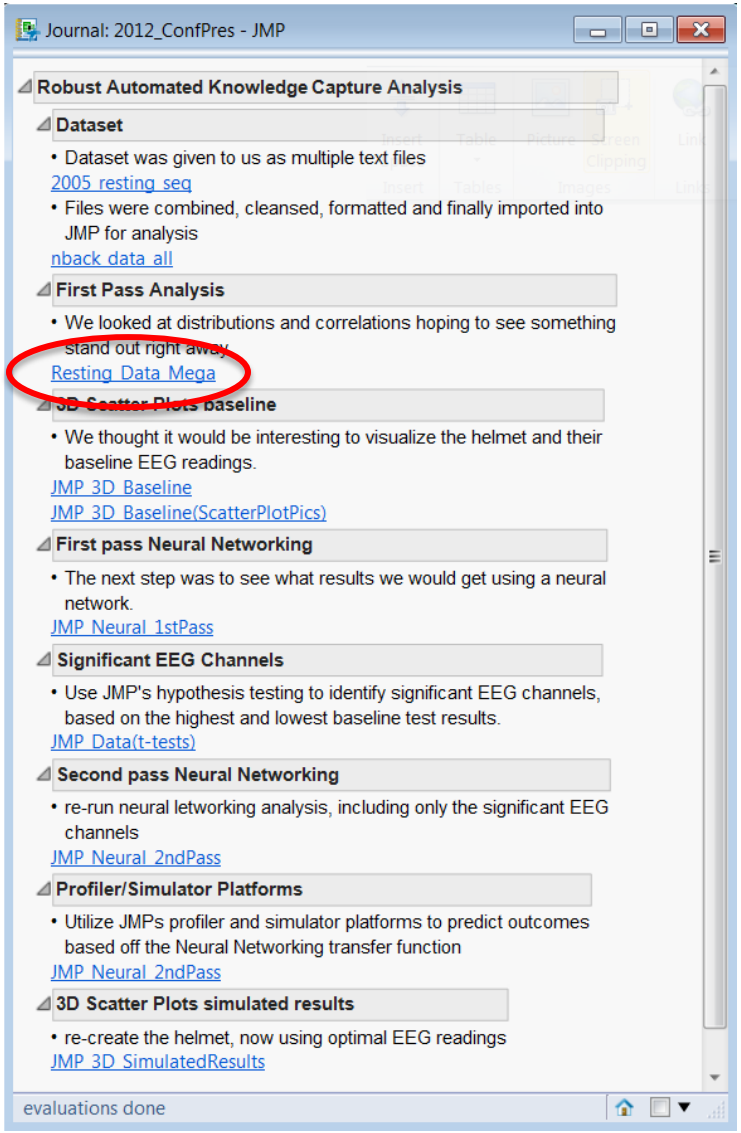
	site=SNL	subject=2005	experiment=EEG_IDM	session=2011_07_01__09_49_16	condition=resting
1	1309513756.000	0.976			
2	1309513815.000	0.976			
3					
4	site=SNL	subject=2005	experiment=EEG_IDM	session=2011_07_01__09_49_16	condition=resting
5	1309513756.000	0.950			
6	1309513815.000	0.950			
7					
8	site=SNL	subject=2005	experiment=EEG_IDM	session=2011_07_01__09_49_16	condition=resting
9	1309513756.000	0.971			
10	1309513815.000	0.971			
11					
12	site=SNL	subject=2005	experiment=EEG_IDM	session=2011_07_01__09_49_16	condition=resting
13	1309513756.000	0.991			
14	1309513815.000	0.991			
15					
16	site=SNL	subject=2005	experiment=EEG_IDM	session=2011_07_01__09_49_16	condition=resting
17	1309513756.000	0.947			
18	1309513815.000	0.947			
19					
20	site=SNL	subject=2005	experiment=EEG_IDM	session=2011_07_01__09_49_16	condition=resting
21	1309513756.000	0.826			
22	1309513815.000	0.826			



First-Pass Analysis

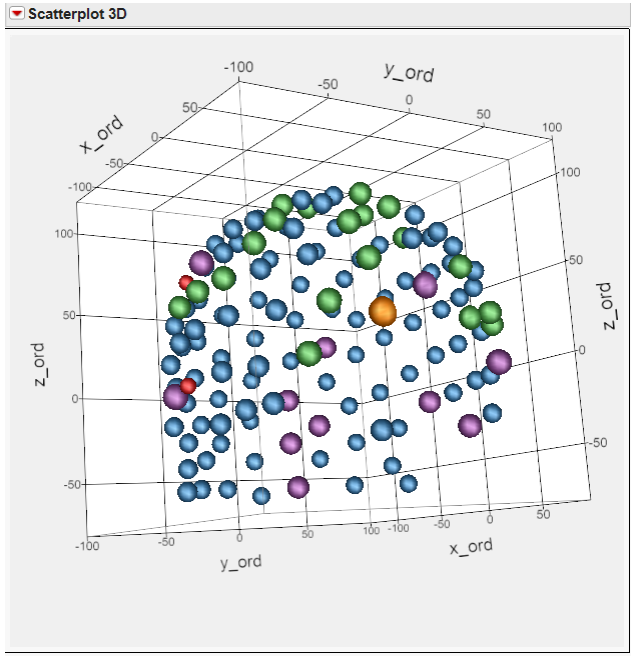
We looked at the dataset in several different ways to see if we could find any obvious correlations.

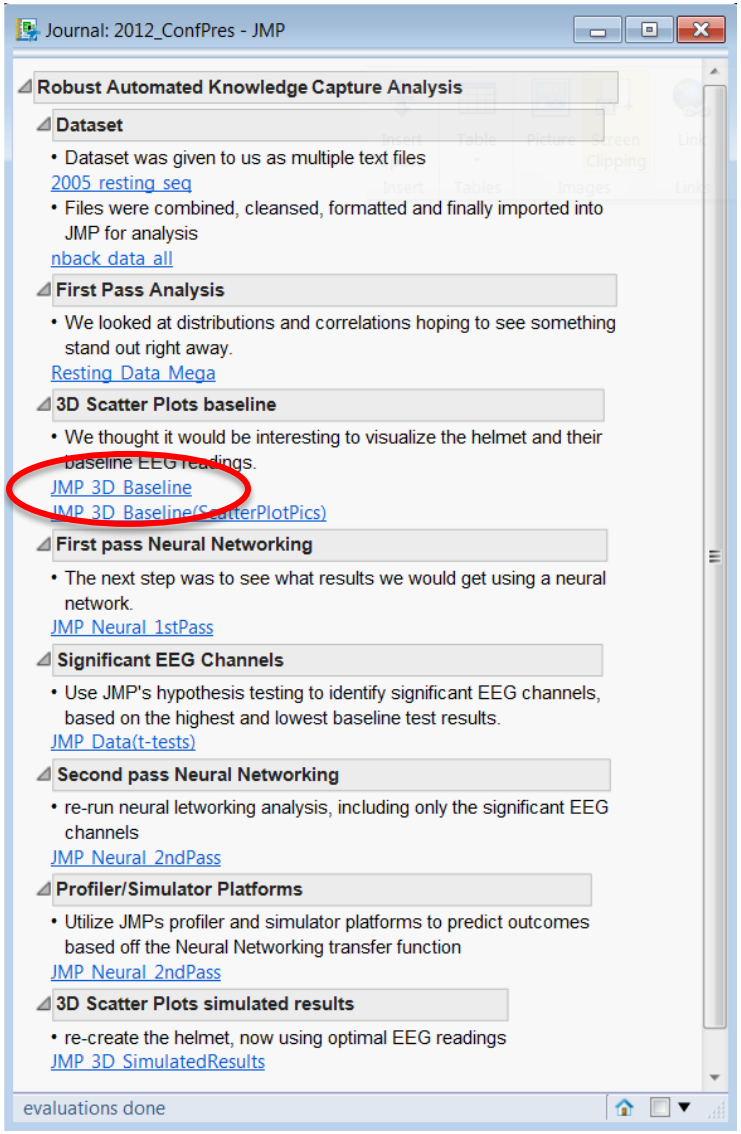




Baseline 3D Scatter Plots

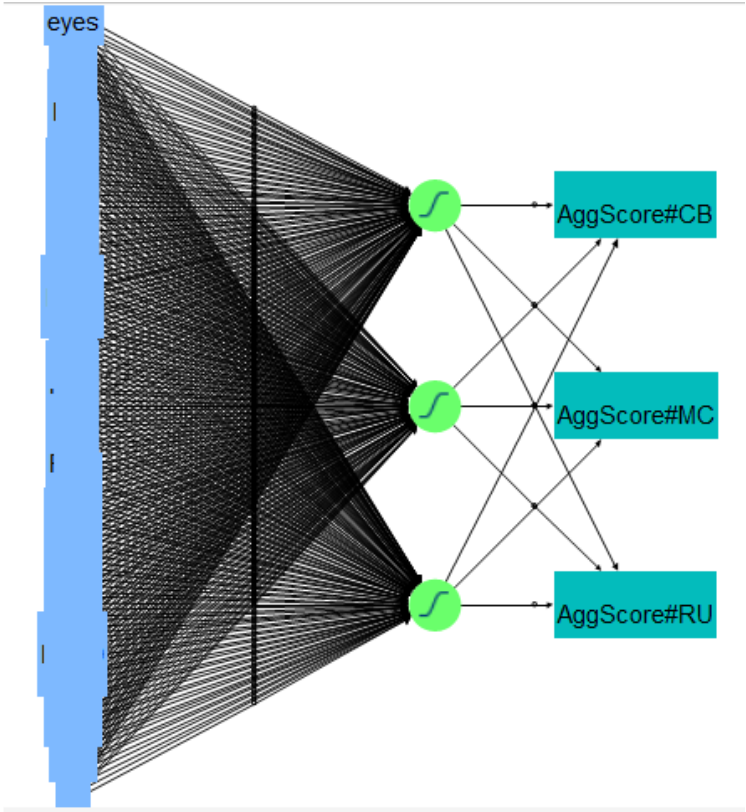
Using the EEG signal data and positional ordinates, we were able to "re-create" a virtual representation of the test helmet in JMP

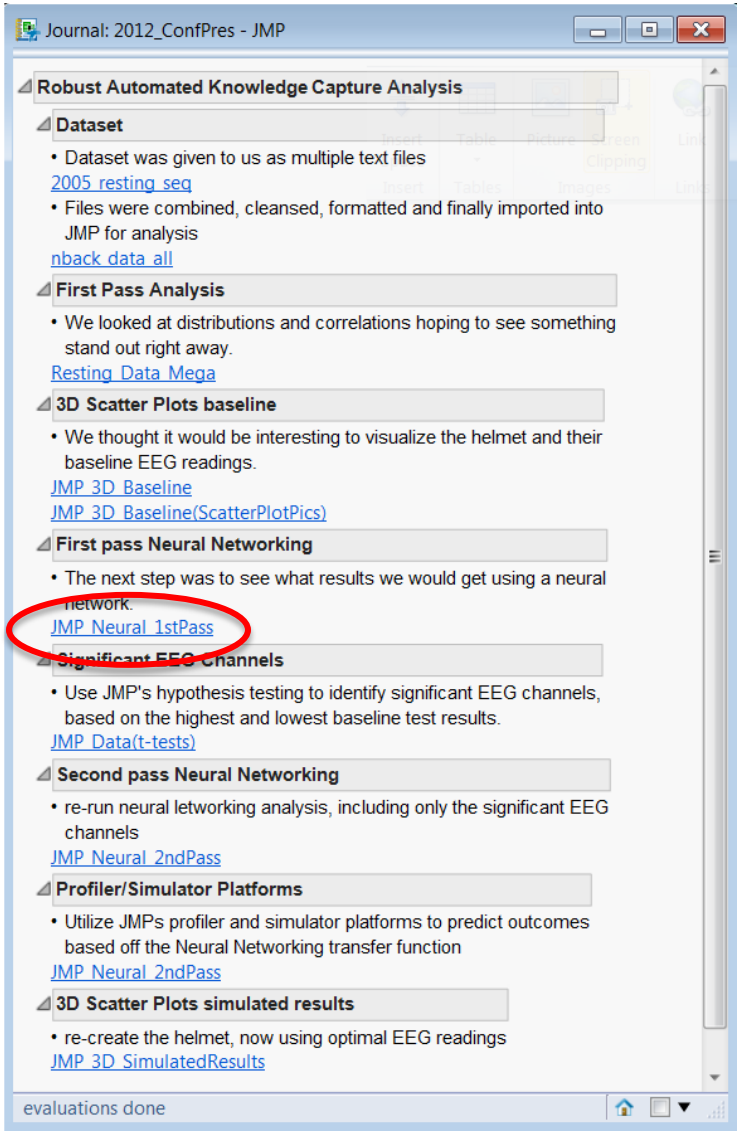




First-Pass Neural Networking

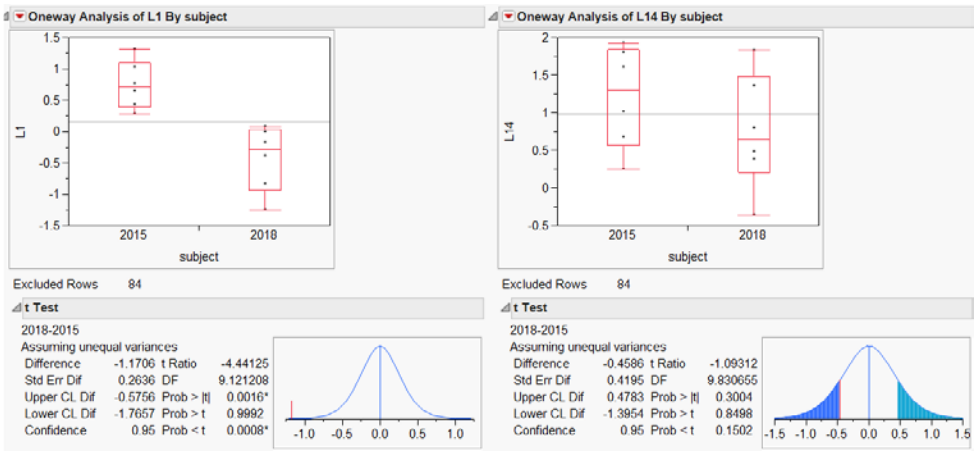
We analyzed the EEG data using JMP's Neural Networking platform

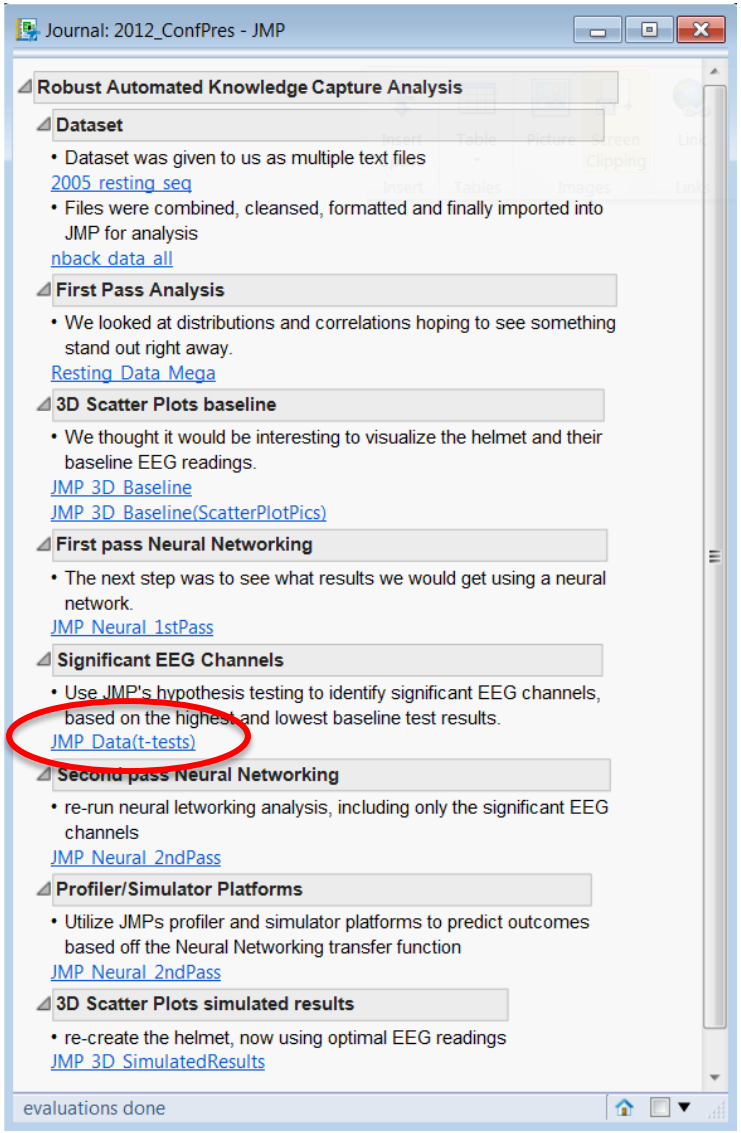




Test to Find Significant EEG Channels

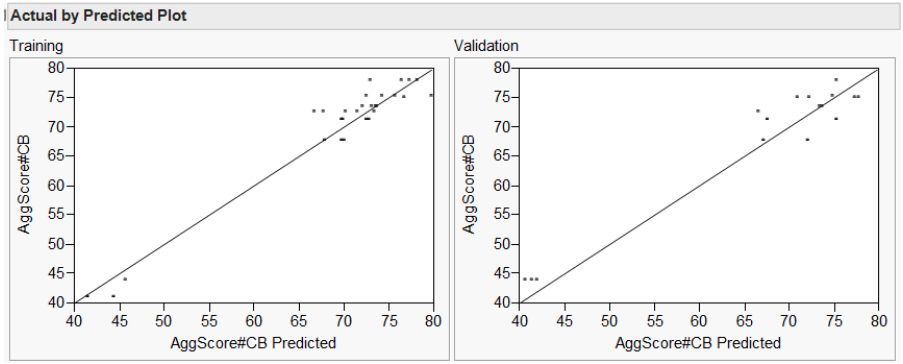
After an unsuccessful 1st Pass Neural Networking analysis, we decided to reduce the number of variables by only including the channels that were statistically significant.



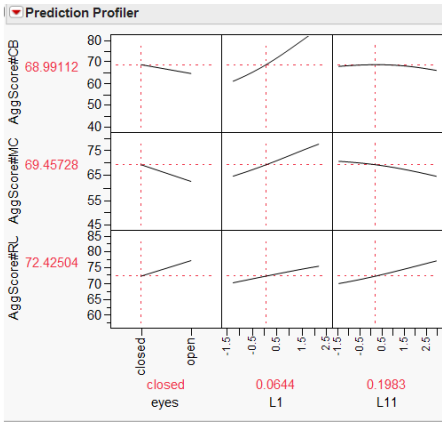


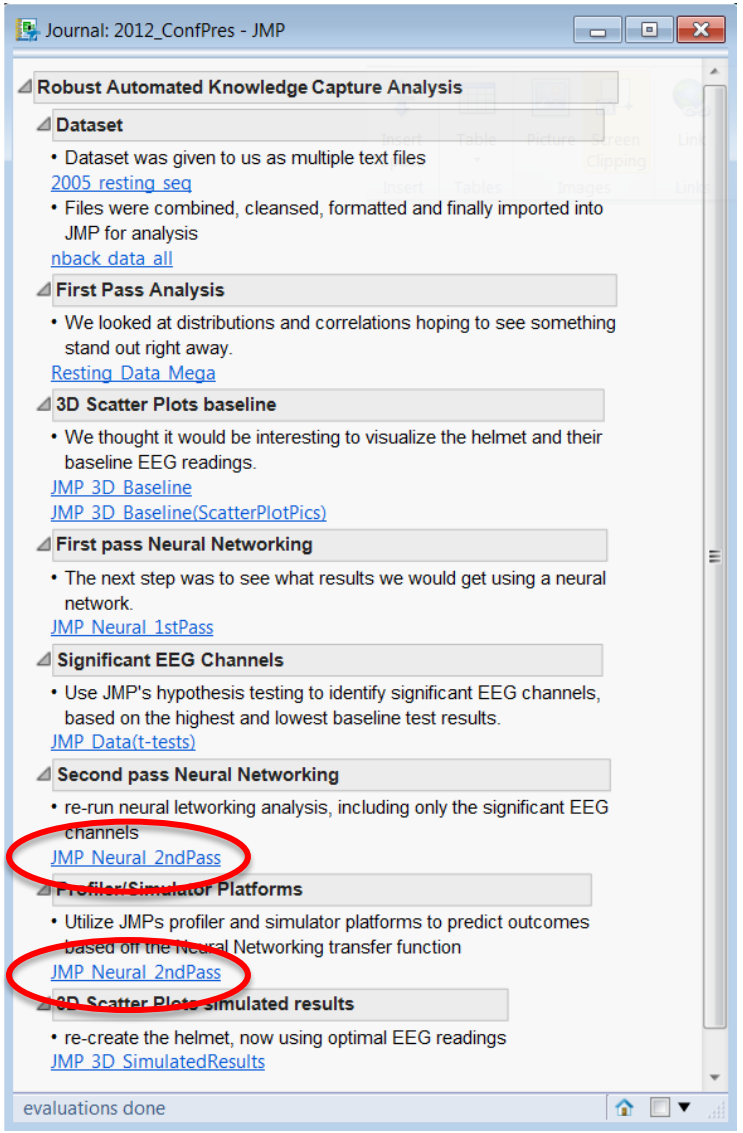
Second Pass Neural networking

The new model has a much higher ability to predict, based on the variables



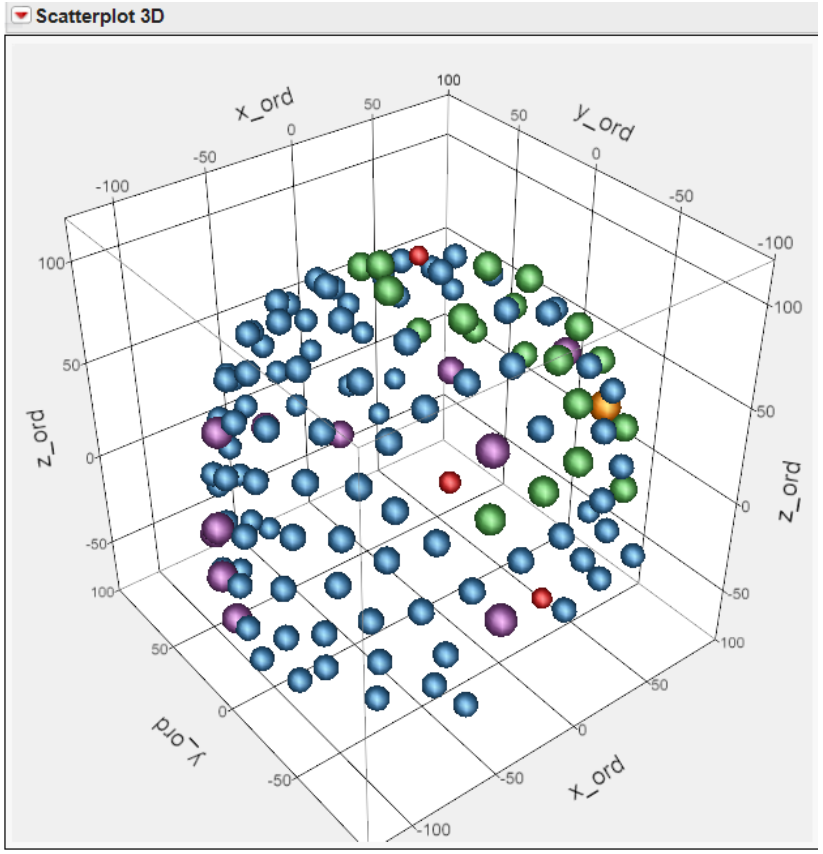
Based on the Neural Networking analysis, JMP can provide a transfer function to produce multiple "what if" scenarios

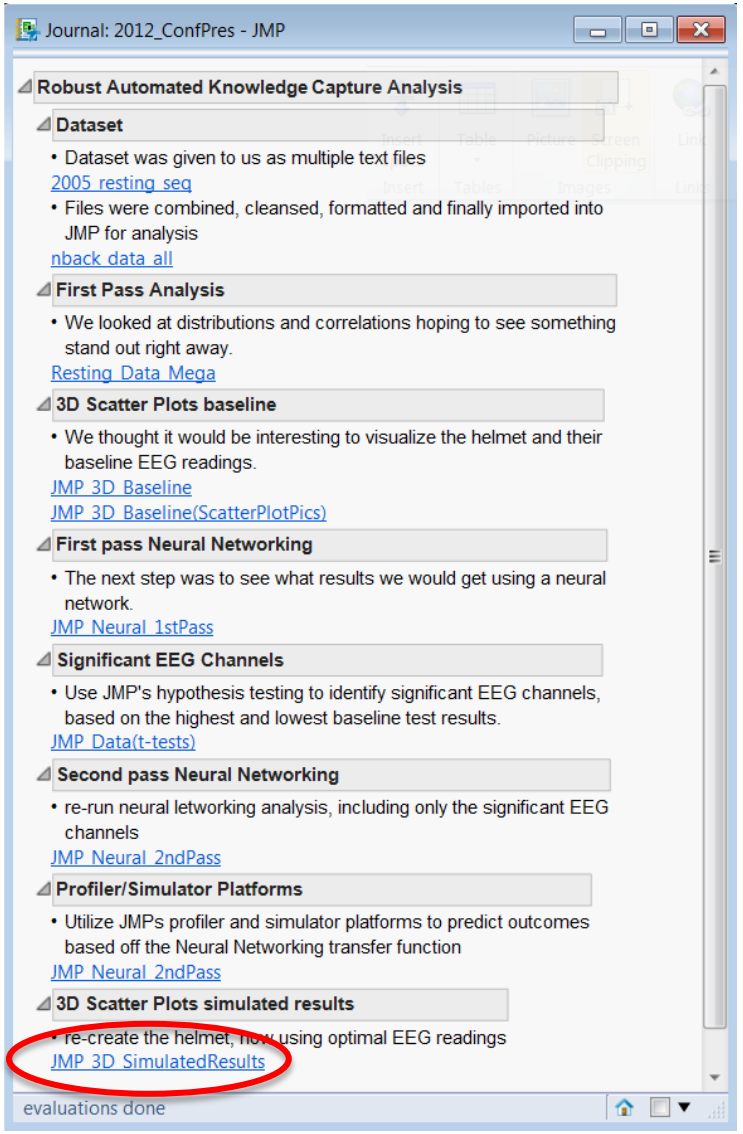




3D Scatter Plots

A 3D scatter plot created to show the "ideal" EEG brain profile





Lessons Learned

- Do not have to know a lot about the data to derive a significant analysis.
- Visualizing the data is key when exploring.
- JMP allows you to look at the data in many different ways.
- Having your customer available during the analysis is extremely helpful.
- Interested to continue learning about applications in Neural Networks (JMP Pro)
- Taking on a project like this allows the user to quickly learn and get familiar with JMP software.
- Teaming and having multiple JMP users provide input helped with our progress and motivation.

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Q & A