**Title:**
Yule's "Nonsense Correlation" Solved!

**Speaker:**
Philip Ernst  
Assistant Professor  
Department of Statistics  
Rice University

**Time & Place:**
Wednesday, October 19, 2016, 4:00–5:00pm  
Room 331 SMI  
(Cookies and Coffee @ 3:30 in Rm 1210 MSC)

**Abstract:**
In this talk, we speak about our resolution of a longstanding open statistical problem. The problem is to mathematically prove Yule's 1926 empirical finding of "nonsense correlation" (\cite{Yule}). We do so by analytically determining the second moment of the empirical correlation coefficient

\[
\theta := \frac{\int_0^1 W_1(t)W_2(t) dt - \int_0^1 W_1(t) dt \int_0^1 W_2(t) dt}{\sqrt{\int_0^1 W_1^2(t) dt - (\int_0^1 W_1(t) dt)^2} \sqrt{\int_0^1 W_2^2(t) dt - (\int_0^1 W_2(t) dt)^2}},
\]

of two \textit{independent} Wiener processes, $W_1, W_2$. Using tools from Fredholm integral equation theory, we successfully calculate the second moment of $\theta$ to obtain a value for the standard deviation of $\theta$ of nearly .5. The "nonsense" correlation, which we call "volatile" correlation, is volatile in the sense that its distribution is heavily dispersed and is frequently large in absolute value. It is induced because each Wiener process is "self-correlated" in time. This is because a Wiener process is an integral of pure noise and thus its values at different time points are correlated. In addition to providing an explicit formula for the second moment of $\theta$, we offer implicit formulas for higher moments of $\theta$. 

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UW-Department of Statistics  
(608) 262-2598