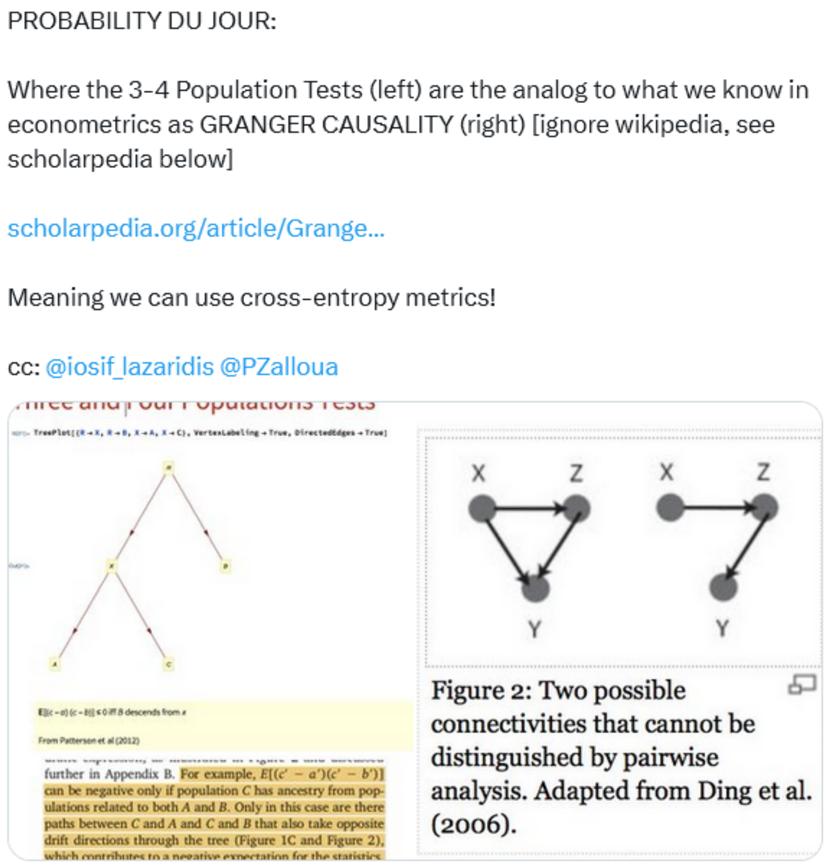
Three and Four Population Tests

http://www.scholarpedia.org/article/Granger_causality
https://twitter.com/nntaleb/status/1043463993648545792



PROBABILITY DU JOUR:

Where the 3-4 Population Tests (left) are the analog to what we know in econometrics as GRANGER CAUSALITY (right) [ignore wikipedia, see scholarpedia below]

scholarpedia.org/article/Grange...

Meaning we can use cross-entropy metrics!

cc: @iosif_lazaridis @PZalloua

Three and Four Populations Tests

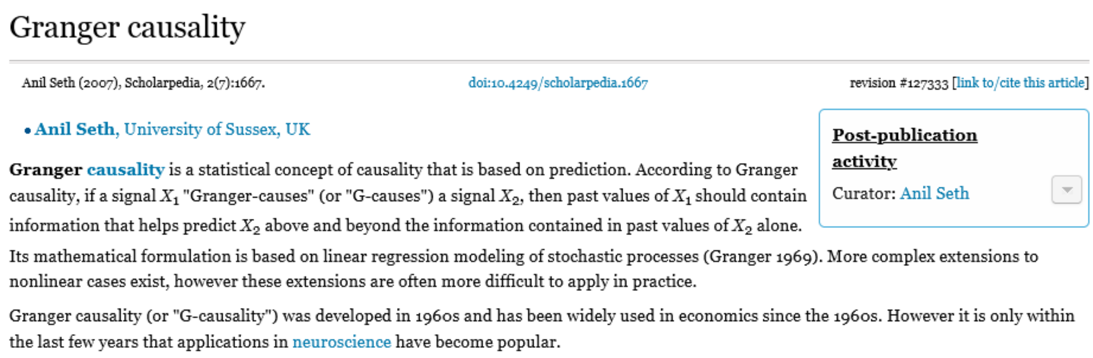
```
TreePlot[{R→X, R→B, X→A, X→C}, VertexLabeling→True, DirectedEdges→True]
```

E[(c − a) (c − b)] ≤ 0 iff B descends from x

From Patterson et al (2012)

further in Appendix B. For example, $E[(c' - a')(c' - b')]$ can be negative only if population C has ancestry from populations related to both A and B. Only in this case are there paths between C and A and C and B that also take opposite drift directions through the tree (Figure 1C and Figure 2), which contributes to a negative expectation for the statistics

Figure 2: Two possible connectivities that cannot be distinguished by pairwise analysis. Adapted from Ding et al. (2006).



Granger causality

Anil Seth (2007), Scholarpedia, 2(7):1667. doi:10.4249/scholarpedia.1667 revision #127333 [link to/cite this article]

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Post-publication activity

Curator: Anil Seth

Granger causality is a statistical concept of causality that is based on prediction. According to Granger causality, if a signal X_1 "Granger-causes" (or "G-causes") a signal X_2, then past values of X_1 should contain information that helps predict X_2 above and beyond the information contained in past values of X_2 alone. Its mathematical formulation is based on linear regression modeling of stochastic processes (Granger 1969). More complex extensions to nonlinear cases exist, however these extensions are often more difficult to apply in practice.

Granger causality (or "G-causality") was developed in 1960s and has been widely used in economics since the 1960s. However it is only within the last few years that applications in neuroscience have become popular.

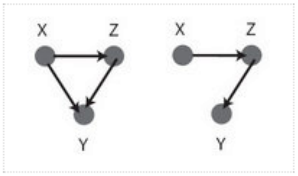
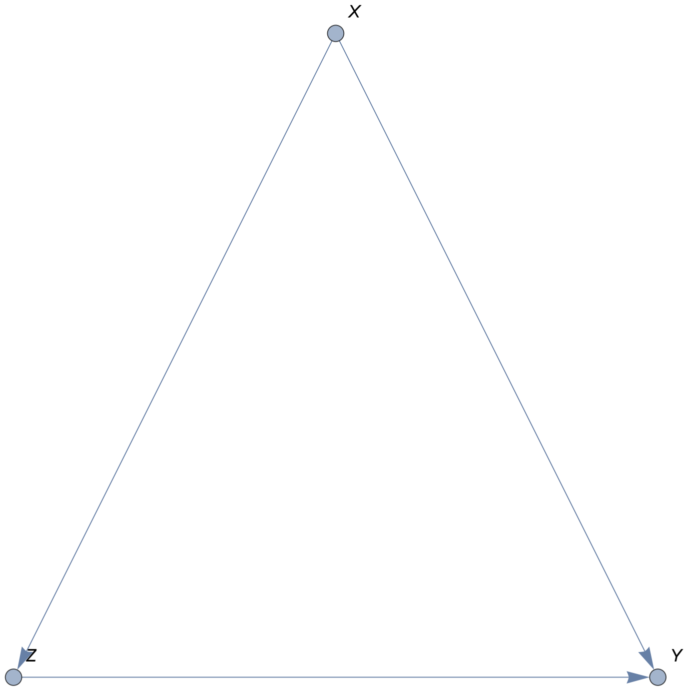


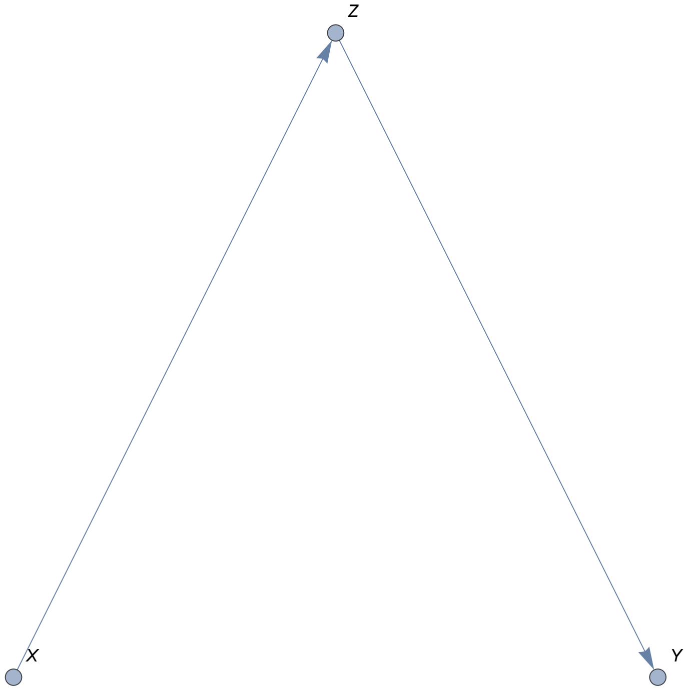
Figure 2: Two possible connectivities that cannot be distinguished by pairwise analysis. Adapted from Ding et al. (2006).

The following two configurations cannot be distinguished between pairwise analysis.

```
In[]:= TreePlot[{X → Z, X → Y, Z → Y}, VertexLabeling → True, DirectedEdges → True]
Out[]=
```



```
In[•]:= TreePlot[{X → Z, Z → Y}, VertexLabeling → True, DirectedEdges → True]
Out[•]=
```



```
In[•]:= TreePlot[{R → X, R → B, X → A, X → C}, VertexLabeling → True, DirectedEdges → True]
Out[•]=
```