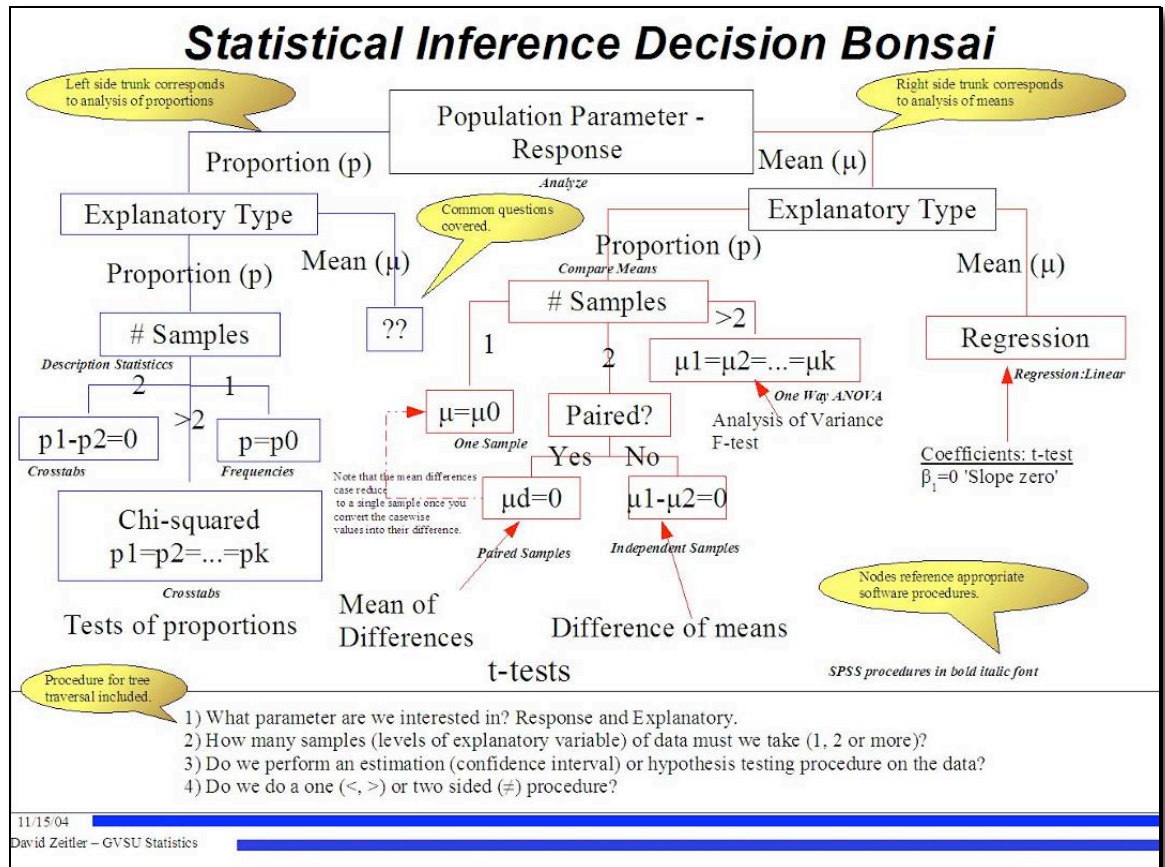# Decision Bonsai Provide Students a Glimpse of Structure

Many of us recall the flash of insight when we began to see the structure behind the forest of equations and parameters that our first statistics course often seemed to be. With a little pruning, this forest can become a Decision Bonsai, providing students a first critical glimpse of structure.


Attempting to help students in an introductory statistics course sort through the sea of equations and statistical software procedures lead naturally to the idea of developing a decision tree to aide them. Initial attempts at the decision tree resulted in a decision bush! The complexity was far too great to be of any use. Pruning of the bush was clearly called for and the idea of the Japanese art of Bonsai came to mind.

Like the Bonsai tree which is carefully pruned as it grows, we can grow an image of the structure and process of statistical inference in the student's minds. The full grown decision bonsai is a mixture of decision tree and concept map, providing both a view of conceptual relationships and at the same time a decision structure which the student can use to arrive at an appropriate inference procedure.

Major trunks of the tree correspond to major concepts with branching occurring at points where the student needs to make decisions about classes of inference procedures.

A similar approach illustrated to the right uses more concept map characteristics to illustrate probability models, including model relationships and approximation paths.

Both of these full grown diagrams are initially too complex for a student (or instructor☺) to grasp in one glance. As the instructor develops the Decision Bonsai, it grows in a fashion similar to the Bonsai tree. Growth is carefully kept in check to bring out the intended structure of the tree. An early mistake was to present the full Bonsai without allowing it to grow with the students understanding. Later use grows the tree gradually on the whiteboard with the final tree provided in PDF format only after it has been drawn and discussed on the board and in notes.

An example of this growth process is illustrated in the sequence at the right. The tree starts from a simple bifurcation between single parameter proportions and means testing. The second tree has grown, both in the two trunks by adding examination of the number of samples of interest and correspondingly in the minor branches and leaves which represents the original single parameter inference as well as now two parameter inference.

Growth continues at a pace determined by the students grasping of the concepts and can progress breadth first as shown or depth first. In depth first, the proportions trunk might be fully grown before budding out the means trunk of the tree. The third illustrated tree is the full tree used for an introductory statistics course, including multi-parameter inference in proportions and means.

A final illustration shows the budding growth of a third major trunk along the right side of the tree which begins to address inference on variance along side that of proportions and means. This last tree is used in a quality methods course which has the introductory course as a prerequisite.
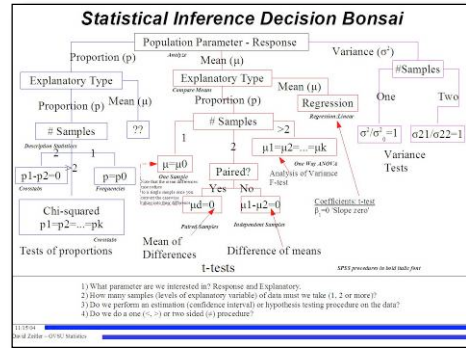
Conclusions:
- Decision Bonsai provide a useful tool for developing, articulating and retaining structural relationships in statistical concepts and procedures.
- The complexity of the Bonsai is controlled, but best understood through the analogies of the process of growth.
- Growth and structure of the tree can easily be tailored to course objectives and planning.
- Like true Bonsai, the Decision Bonsai is a living thing, growing and changing continually over time with proper care of the instructor.
- While not replacing standard tabular representations of formulas, the Decision Bonsai provides a critical means for many students to understand and remember the reasoning behind choices from the sea of formulas and statistical software procedures necessarily presented to them in an introductory statistics course.

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Decision Bonsai web resources:
http://faculty.gvsu.edu/zeitlerd/DecisionBonsai
-- *And Bonsai web resources thanks to Google of course!*
Introduction to Bonsai - http://www.bonsaisite.com/
A Bonsai Primer - http://www.bonsaiprimer.com/
A little fun with Bonsai - http://www.bonsaipotato.com/