

## Senn's Game Theory Approach to Project Prioritization in the Pharmaceutical Industry

The purpose of this presentation is to direct attention to Senn's game theoretic foundation of strategies for the choice and portfolio management of development projects in the pharmaceutical industry. Such strategies have found their application in other than pharmaceutical industries, e.g. in mining. The speaker considers Senn's ideas worthwhile in managing pharmaceutical research, where statisticians are to take a proactive role.

In order to gain a first impression, consider two simplistic games of tossing three fair coins where in both games the player wins if tails turn up three times. In game A the total stake (3 units) is to be paid up front, whereas in game B 1 unit is to be paid to see each toss and the game may be stopped whenever one wishes. Either of the games may be played as long as funds last. This table summarises the games:

	Game A- pay total stake first	Game B - pay stake stepwise
Stake	3	1+1+1 = 3
A priori probability of success	$(1/2)^3 = 1/8$	$(1/2)^3 = 1/8$
Reward	25	20
Net reward if successful	22	17

This summary only *seems* to capture the essentials of the games, but is in fact deeply misleading. Not game A is the more attractive one, but game B. The expected reward for game A is  $25/8$  whereas for game B it is only  $20/8$ . However, the expected cost for game A is 3 whereas for game B it is less:  $1 + 1/2 + 1/4 = 14/8$ . Hence the expected net reward of game B is  $20/8 - 14/8 = 6/8$  which is **six times as high** as that of game A, viz.  $25/8 - 24/8 = 1/8$ .

The Pearson index is introduced and discussed as a measure of the "worthwhileness" of a project and an example of its application assessing four hypothetical pharmaceutical development projects is presented.

### Literature:

Bergman S, Gittins J (1985): Statistical Method for Pharmaceutical Research Planning.  
New York (Dekker)

Senn S (1996): Some Statistical Issues in Project Prioritization in the Pharmaceutical Industry.  
Statistics in Medicine **15**(24) 2689-2702.