**Speaker**: Abraham Neyman

**Title**: Is the sunk cost principle universally valid?

## Abstract

The sunk cost principle is a normative prescription for an optimizing decision maker: future choices should depend only on future consequences, not on past, irrecoverable costs. Violations of this principle are typically illustrated by everyday stories—bad movies, failing R&D projects, long queues—and are presented as purely behavioral errors or biases. In this talk we ask to what extent such a principle can be justified within a standard optimization framework, by treating it as a requirement of time consistency in sequential decision problems.

We consider a single decision maker who, at each stage, chooses an action from a finite set and observes a finite signal about a fixed "state of nature" $b$. The payoff is a number

$$P(a, b) \in [0, 1],$$

a function of the sequence $a$ of actions and the state of nature $b$, interpreted as the probability of winning a desirable prize. The *worst-case guaranteed payoff* of a strategy $\sigma$ of the decision maker is

$$v(\sigma) := \inf_{b} \mathbb{E}_{\sigma}[P(a, b)],$$

where the infimum is taken over all states of nature $b$. The decision maker's robust objective is then to maximize this quantity, that is, to look at the value

$$v(P) := \sup_{\sigma} v(\sigma) = \sup_{\sigma} \inf_{b} \mathbb{E}_{\sigma}[P(a, b)].$$

For a finite set of states of nature the infimum over $b$ is attained (it is a minimum); with infinitely many states it may fail to be attained, but the infimum is well defined. Similarly, for a finite set of strategies the supremum over $\sigma$ is attained (it is a maximum); with infinitely many strategies it may fail to be attained, but the supremum is well defined.

The sunk cost principle ties the behavior in a multistage decision problem to the behavior in each of its subdecision (continuation) problems. Therefore it cannot be formulated for a single problem in isolation: it only makes sense relative to a class of problems that is closed under taking continuation (subdecision) problems. Within such a class, a strategy is *sunk-cost independent* if, at every finite history, its continuation depends only on the remaining decision problem and not on the past sunk costs; strategies that violate this requirement are *sunk-cost dependent*.

Within this framework we present two kinds of results. For finite-horizon problems, and for some infinite-horizon ones (for example, with suitably continuous payoff functionals), the sunk cost principle can be fully rationalized: one can select maxmin-optimal strategies that are dynamically consistent across all subproblems and hence sunk-cost independent, so adhering to the principle "does no harm." In contrast, in many natural infinite-horizon classes such a global rationalization fails. We illustrate this failure on a simple Big-Match–type decision problem in which the robust sup–inf value is $v(P) = 1/2$, yet every sunk-cost independent strategy has worst-case guarantee 0, whereas for every $\varepsilon > 0$ there exist sunk-cost dependent strategies whose worst-case payoff is at least $1/2 - \varepsilon$. Thus the talk aims to delineate not only the rationale, but also the structural limits, of the sunk cost principle.