Chapter 46
Probability and Game

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ABSTRACT

Probability is generally concerned with dealing with problems of a random or uncertain nature. The fact that it arises and develops from the analysis of gambling is something that cannot be overlooked. From the point of view of teaching, in addition to historical aspects, it is important to point out the importance of putting students in front of situations that, if not known, can lead to incorrect behavior and pathological attitudes. For this reason, the authors tried to emphasize not only the theoretical aspects, but above all the certainty that you always play "against the dealer" with an expected loss assessable for the various games.

INTRODUCTION

The probable is what usually happens. ~ Aristotle

Probability has historically been created precisely to study the game and in particular gambling, in general to deal with problems of a random or uncertain nature, the so-called aleatory problems. It is not surprising that the etymology of the word gambling and the word aleatory are similar: both derive from the word dice (*az-zahr* in Arabic and *alea* in Latin). Dice and betting were also well known in ancient Greece. An example is provided by mythology: playing dice, the gods divide the universe: Zeus gets the sky, Poseidon gets the sea, Hades loses and finds himself in the underworld.

Even the Romans can be regarded as remarkable gamblers. It is known that they bet almost everything, from gladiator fights to chariot races, from the launch of astragals to lottery tablets during the holidays dedicated to the god Saturn.

One of the most famous treatises on the game dates back to 1283. Alfonso X (2007), King of Castilla and Leon (Spain) wrote the *Libro de los Juegos*. In the text it is said that an Indian king had proposed to three wise men to reflect on what is worth more between luck and intelligence. One wise man takes the side of intelligence, another of luck, and the third argues the importance of both. The king asks to

demonstrate these positions concretely, and the three wise men take chess, dice and the last one games based on a board (such as backgammon) as proof.

In the Middle Ages, gambling became compulsive in Europe. The chronicles of the time speak of numerous edicts aimed at limiting the game, which, in places as bad as taverns, but also special gambling dens had taken on an incredible dimension. The Italian term *baratteria* (barratry) indicated precisely who kept a gambling dealer; the term was born in the 13th-14th century and the chronicles tell us that many municipalities taxed the game. *Barattiere* was also the one who, having a public role, was bribed for money. The accusation of barratry could be profoundly serious and also used to strike political enemies. At the State Archives of Florence is preserved the book where all the court sentences issued in that period were recorded. On March 10, 1302 it reads: "Alighieri Dante is condemned for barratry, fraud, falsehood, malice, unfair extortion practices, illicit proceeds, pederasty, and is sentenced to 5000 florins of fine, perpetual disqualification from public office, perpetual exile, and if you take him, at the stake, so that he dies. In the fourteenth century, with the introduction of modern cards, an adaptation of the previous ones coming from the East, new forms of game appear.

As time goes by, the games find an accommodation in small pavilions, called *casine*, a term that then evolves into "casino". The first real modern casino was built in 1861 in the Principality of Monaco and only in 1931 did the state of Nevada legalize gambling, making Las Vegas the gaming city par excellence. Other states followed suit and today gambling is widespread almost everywhere.

These few considerations would be enough to highlight how rich the history of gaming is and the space that would deserve analysis in the school environment. As Siew Pei Hwa (2018) says: "Play-way method involves act of seeing, hearing, saying and doing, which makes it easier to remember". Some difficulties, however, arise because many teachers do not have a clear picture of the spread of the phenomenon while students are frequently the protagonists, especially since the possibilities of online gaming became more popular. The study of gambling must consider both mathematical and psychological aspects. The study of gambling must consider both mathematical and psychological aspects. It is now well established among scholars that the accuracy of probability judgments is poor, as is familiarity with numbers. Some scholars such as Cosmides & Tooby came to explain the fact in evolutionary terms: according to them evolution has not consolidated *ad hoc* processing tools. Another interesting aspect is that, according to Drazen Prelec (1988), the human mind tends to overestimate small probabilities and underestimate high ones, which determines that the point of coincidence between probability and its estimate is for a value that is not, as one might suppose, 0.5 but coincides with a mathematically more interesting value: $p = 1/e$. The author has constructed a non-linear transformation of probabilities into "decision weights" $w(p)$. If we try to represent this characteristic we get the following graph (Figure 1):

This mechanism makes the individual think he can win with greater probability than the real one, plus the *sunk cost bias* that consists of continuing in the game because you have already invested a lot of money, energy, time.

An interesting field of research concerns a behavior that involves our cognitive system. Let's just think about the difference in attitude between finding a four-leaf clover in the meadow (unlikely event) and finding a poppy (much more likely event). In the first case the event, linked to luck, creates a short circuit between improbability and mental representation of desirability, probable events are instead easily structured in terms of rationality. A similar mechanism occurs in the game, if one wins, he thinks he is "lucky" and therefore can continue to play without taking into account that the probability of continuing to win may be extremely low. It is this behavior that contributes to what has been called *gambler's ruin*, widely described in literature. To give an idea we use a simple example.

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