Eight Tips for the Theme, "Data and Forecasts"

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INTRODUCTION

Paul was a common octopus living (January 2008, October 2010) in a public aquarium at the marine life center in Oberhausen, Germany. Paul experienced some international notoriety during the 2010 World Cup when it was used to "predict" the results of football matches in which the German national football team was involved and the final (that was not played by Germany). Paul's predictions were all correct.

The octopus belongs to Octopodidae family and has eight tentacles, therefore we imagine that each of these gives us an indication as to which are the best strategies to analyze resources and obstacles of teaching probability and statistics.

Mathematical artifacts shown in the figures are the basis of a project that could be called educational gaming. The collection of materials found, purchased, and constructed is the result of many years of research work (Drivet, 2013). They are taken from https://sites.google.com/site/oggettimatematici/home site. Currently there are 210 objects and, of these, 40 relate to the mentioned subject (Figure 1).

BACKGROUND

Numbers, geometry, relations and functions, data and forecasts are the four themes that characterize the classic division that has gradually made its way (albeit with some linguistic difference) within the Programme for International Student Assessment (PISA), the TIMMS (Trends in International Mathematics and Science Study) and, with regard to Italy, the UMI (Italian Mathematical Union), the INVALSI (National institute for the evaluation of the education and training system) and the National Guidelines for the curriculum.

This text will tackle issues related to data and forecast, only partially similar to the traditional concepts of probability and statistics.

A first starting point is provided by this quote: "Probability is the theory which organizes the world of chance phenomena. One has to start with phenomena which beg to be organized: intuition about unpredictable events, games of chance, occurrences which seem to happen without regularity etc. One then has to teach the learner to constitute the mental object for himself/herself. This is the stage preceding concept attainment but too often ignored" (Kapadia & Borovcnik, 2012).

As a matter of fact, there is a difference between the theory of probability and the theme of the data and forecasts. The task of data and forecasts means analyzing and interpreting data, developing conclusions and reasoning also with the aid of graphic representations, consciously using the calculation tools and the potential offered by IT applications.

EIGHT TIPS

First Idea: The Different Registers

The following quote makes it perfectly clear the key concept.

"For example, if you throw an ideal dice cube and one wonders what is the probability of getting either 1 or 6, it can be answered in different ways,

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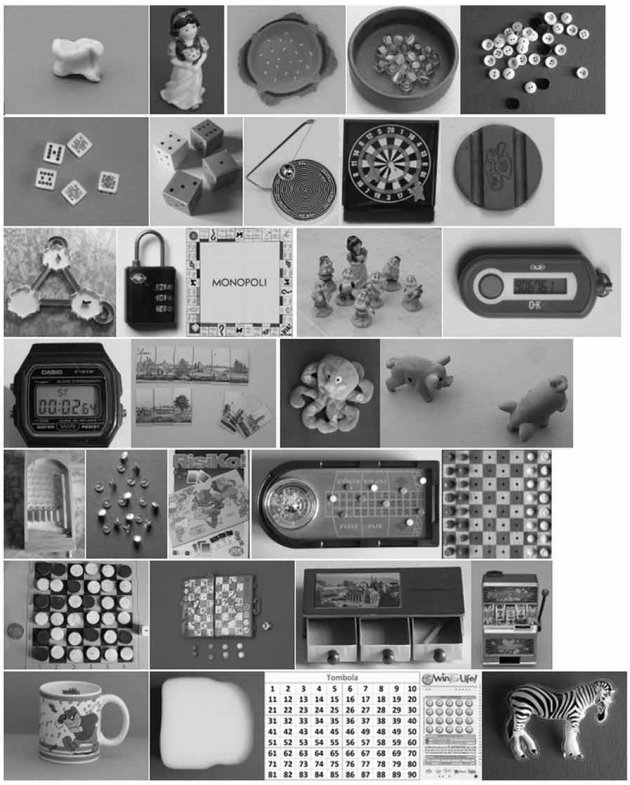
Figure 1. Data and Forecasts Objects



using different registers or different representations within the same register. In the register of native language: "There are two possibilities on six." By conversion to the fractional register "the probability is 2 /6" or by treatment within the fractional register the probability is 1/3, by conversion to the decimal register "the probability is 0.3", or yet by conversion to the proportion register "the probability is 33.3%". (Arrigo, 2010).

If you start with the dice (Figure 2) it is useful to show these different registers by using, for example, the different types of format available in a spreadsheet (Table 1).

The example of the dice may seem trivial and indeed it is, if it is limited to standardized exercises. In reality, the problem is more complex and we can agree with the following quote: "Studying the patterns that occur in purely random behavior (such as dice rolls and card selections) helps us to understand the patterns that occur in real-life data sets (such as lists of patients' pulse rates or baseball players' batting averages)"(Pfenning, 1998).

Figure 2. Dice