

**“STATISTICA ENIGMISTICA”: AN ISTAT PUZZLE MAGAZINE TO INTRODUCE
NON-SPECIALISTS TO STATISTICS THROUGH A LUDIC APPROACH**

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Spreading the culture of data as a means of understanding and evaluating reality, and of making informed decisions, is one of the missions of Istat, the Italian National Institute of Statistics. Istat promotes statistical literacy also for non-professional audiences. Therefore, researchers' efforts are aimed at finding appealing proposals to emphasize the importance of having statistical skills in every-day life. Recently, Istat created "Statistica enigmistica": a puzzle magazine designed to play with concepts, definitions and data, and to encourage the use of the cognitive tools of Statistics when observing and comprehending society. The games have been designed to involve a wide audience, ranging from children to adults. The topics have been selected to offer an overview of the main statistical data regarding Italian society, and to give useful references for further insights.

INTRODUCTION: THE CULTURAL FRAMEWORK AND THE OBJECTIVES

Over the past few decades many changes have affected our society and the current scenario highlights the central role of information. For this reason, knowledge is considered to be the answer to the new challenges of globalization. Therefore, all citizens will need a wide set of skills in order to deal with the changes properly, and to participate as fully responsible citizens (European Parliament and Council, 2006).

The emerging needs in the knowledge society necessarily cover multiple cultural fields; all of them contribute towards the common goal of providing everyone – from policy makers, to public administrators, to individual citizens - with critical thinking in problem solving. In fact, it is increasingly necessary to be able to trigger informed decision-making processes at all levels, even in everyday life, in order to make evidence-based decisions (Franklin et al., 2007) (UNESCO, 2005). Among the various key competences, quantitative literacy plays a vital role, due to the growing importance of quantitative information in the analysis of social phenomena. In fact, the quantitative component of information is particularly relevant for the objective evidences that it makes available, which allow us to better understand society through data and statistics (UNECE, 2012).

It is not surprising that OECD, in identifying *key information-processing competencies* relevant to adults, recognizes, among others (literacy and problem solving in technology-rich environments), the role of numeracy, and states that: "These skills are relevant to adults in many social contexts and work situations, and necessary for fully integrating and participating in the labour market, education and training, and social and civic life" (OECD, 2013). Indeed, statistical literacy is a key component of the numeracy conceptual framework: "to thrive in the modern world, statistical skills are required" (NCED, 2001).

Acting as the largest public body producing official statistics in Italy, the Italian National Institute of Statistics (Istat) works towards addressing everyone's informational needs, by elaborating high-quality statistics on Italian society. The Institute provides essential support to the in-depth understanding of reality, to the study of the evolution of phenomena over time and to enable comparisons at all territorial levels (both at a local, and at an international level). Istat thus helps to develop a deep knowledge of the quantitative aspects of reality, and has the ultimate goal of supporting the decision-making processes of society's stakeholders. In fact, official statistics are addressed both to specialists, who use data in their institutional activities (researchers, policy makers, public administrators), and to individual citizens.

In order for statistics to reach a wider audience, and to advocate a more conscious use of official statistical information and a widespread culture of data, Istat considers it one of its primary duties to promote statistical literacy in Italy to non-specialists. (Schield, 2011). For this reason, new strategies must be designed to engage and approach occasional users and those who currently don't use statistics, but could become potential users (M. Vichi et al., 2015).

To achieve this goal, in the last few years research interests in Istat have also been orientated towards the study of appealing, friendly, and involving proposals, that would help in promoting the value added of official statistics to the understanding of social phenomena among non-professional audiences. The goal is to raise awareness that official statistics provide the coordinates that can guide our decisions in modern society: they are relevant because they affect each of our lives, and they can improve our everyday decision-making ability. In short, official statistics are one of the key tools for a better understanding of reality and of its complex evolution. Therefore, succeeding in arousing the interest of a wider public for data becomes a strategic goal. In this sense, games can be an attractive means for stimulating new questions and seeking answers. A simple and accessible tool is represented by puzzle games, which can provide data and statistics in an easy and appealing way, through the solution of rebuses or crossword puzzles.

The aim of this paper is to describe the realization of a puzzle booklet proposed by Istat to promote the understanding of statistics about society to non-specialists, using a ludic approach and to highlight the powerful role of official statistics to better understand social phenomena.

IMPROVING LEARNING WITH GAMES: SOME SIGNIFICANT EXPERIENCES IN ITALY AND ABROAD

Since the early stages of life, play represents a fundamental learning tool. A recreational approach is considered an efficient learning method also in formal environments, such as school. Indeed, some authors state that: “Using games in the classroom is a desirable learning method, which can transform learning into a less threatening and more enjoyable process for students and instructors alike” (Zapata Jaramillo C. M. et al. 2012; Davis T. M. et al. 2009).

Official state institutions too consider the use of games and of informal presentations to be an effective means of conveying institutional messages to citizens, and in particular to young people. The *Carabinieri*, and the *Guardia di Finanza* are examples of best practices in Italy. The former use fairy tales, and comics to give advice on topics which are particularly close to children’s lives (bullying, drugs, internet, etc.); the latter use a fantasy character who is the star of a comic book and some cartoons aimed at promoting economic legality in schools (for reference, please see the “website list” section of the article).

Relevant experiences in the statistical field can also be found abroad, where leading organizations have chosen games to promote the use of statistics as a tool to understand reality, even in its daily aspects. Eurostat offers an interactive online quiz on its institutional website. The quiz offers an insightful look into various aspects of EU Member States and tests the participant's knowledge of the European Union in nine thematic areas. In the United States, the Bureau of Census offers scholastic material on its website, among which there are several interactive games (memory games, word searches, quizzes, etc.) aimed at educating children in the value and use of statistics in everyday life. The main goal of these innovative tools is to convey a message, to teach new concepts and to introduce new words in a fun and exciting way. The games are designed to stimulate curiosity and new questions on social phenomena in the users, and to promote an active involvement and interaction through the resolution of the various tests. This type of learning method also works on an emotional level: it develops self-esteem by stimulating the improvement of skills and competences.

In light of the above, Istat also proposed, besides several initiatives, the publication of “*Statistica Enigmistica*” during the organization and realization of the first Festival of Statistics in Italy (StatisticAll) held in Treviso in September 2015. *Statistica Enigmistica* is a puzzle magazine that deals with data collected by the Institute, with metadata (mostly definitions and sources) and also with the statistician's instruments. The main goal of the magazine is to arouse curiosity and to encourage an interpretation of reality through the numbers of official statistics. In particular, it is addressed to those who don’t know statistics or who believe it is too challenging and it is designed in order for them to grasp the importance of official statistics to understand the world we live in, to act consciously in our society, and to assess the consequences of our choices.

METHOD: THE DESIGN CRITERIA

With reference to the framework and the objectives set out above, the idea was developed around some core issues which guided its implementation: the identification of the recipients, the choice of the contents to be included and the typology of games to be offered.

The recipients

Regarding the first of the three core issues, it was considered necessary to focus the work on obtaining an outcome suited for as wide as possible an audience, both in terms of age groups (from children to adults) and cultural profile.

In order to create an inclusive and engaging proposal for non-specialists, with heterogeneous profiles, it was fundamental to not require specific prerequisites of the users. No specific skills involving data knowledge or statistical analysis techniques are needed to grapple with the games. In fact, “*Statistica enigmistica*” aims at promoting the cognitive process of discovery: the data and all other interesting information is revealed once the games are solved. An additional benefit of this methodological approach is that it promotes official statistics as an informational tool available to everyone. As a matter of fact, official statistics are not a privilege for experts: they are also produced for an in-depth knowledge of social phenomena, and to support all citizens, even the youngest ones, to act consciously in everyday life.

The information contents

The second key aspect concerned the contents of the magazine. The publication is centred on data produced by Istat, but at the same time it leaves adequate space for metadata. This approach helps to spread awareness that, in order to extract useful information from data, it is necessary to know how to interpret quantitative information correctly and how to use the “words of Statistics” properly. The choice of data to be used in the games was crucial for the pursuit of various objectives. In particular, the selection of statistics included in the puzzle magazine had to represent the plethora of statistical output produced by Istat, in order to convey the message that official statistics can provide answers to a wide range of social phenomena. For this reason, data related to a large number of thematic areas was selected: environment, territory, population, living conditions and well-being, health, education, culture and tourism, labour market, economy, agriculture. Furthermore, priority was given to data that was as close as possible to the public’s experience, even of the youngest, in order to stimulate curiosity towards the topics, to elicit new questions, and to kindle their interest in furthering their studies. Therefore, Istat chose to use statistics which were easy to find on its institutional website: www.istat.it, in particular those available on I.Stat – the Istat data warehouse: <http://dati.istat.it/> – and those provided by flagship editorial products, also available online in pdf format. More specifically, the most recent editions of “Italy in figures” (ISTAT, 2015) and of “Noi Italia” (ISTAT, 2015) were preferred due to their informative nature and their suitability for a wide audience.

The games

The selection of the games was dictated by several considerations. Priority was given to those types of games which are usually available in current puzzle magazines; it was also decided to offer a fairly wide set of different games. These choices gave the product a very similar layout to that of the puzzle magazines currently in circulation, in order to make it as appealing as possible. Moreover, Istat preferred games that had free set-up applications available online. As a matter of fact, the Internet gives the possibility to find and use several websites that allow to build and then easily export crossword puzzles, sudoku, mazes, word searches, and much more. Thus, it allowed us to manage the creation of the publication internally and to optimize production time, by not hiring external professionals in the field.

The games have been designed with different levels of complexity in order to involve a wide audience, ranging from children to adults. The games can be divided according to three levels of difficulty: low level (6-11 years old), intermediate level (11-16 years old), and upper-intermediate level (16+ years old). This classification is not expressed explicitly in the publication, so that no one is precluded *a priori* the possibility of resolving all the puzzles: neither children the most difficult games, nor adults the easiest ones. Indeed, children could use the help of an adult to

solve the puzzles and, at the same time, adults may be intrigued by the simplest games. The very nature of puzzle games, in fact, can bring an adult audience to challenge itself with the easiest games, just for recreation or leisure regardless of the level of complexity.

In Figures 1 and 2 there are two games from the magazine, to help explain the design guidelines behind the realization of the project.

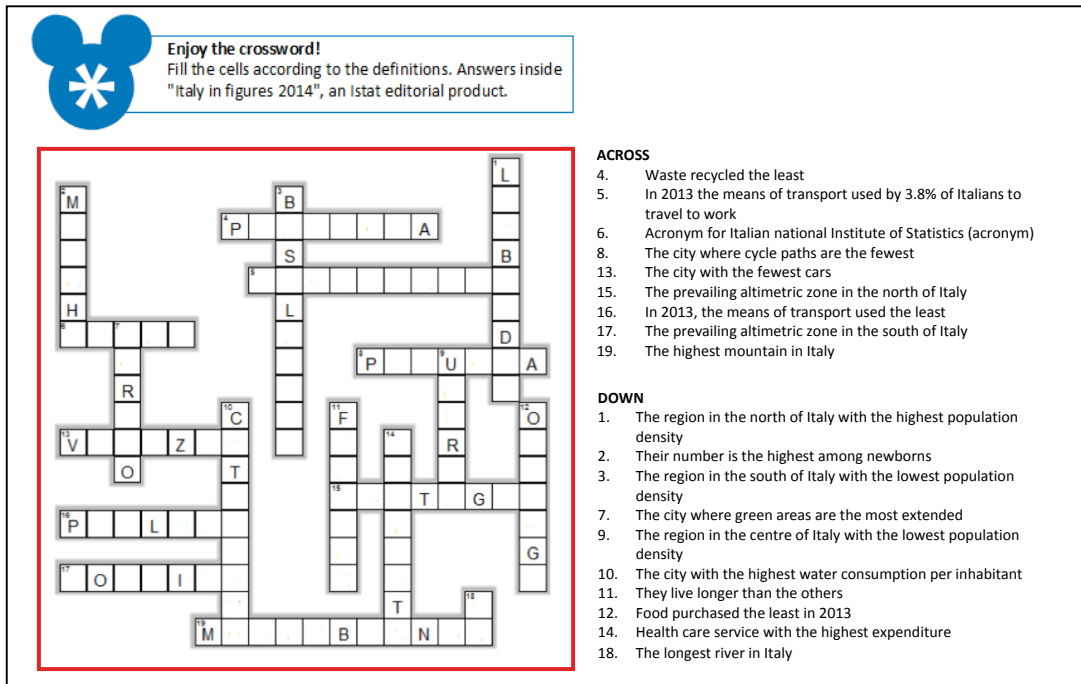


Figure 1. a crossword to discover one of the main Istat editorial products



Figure 2. A simple game to discover the typical choice of holiday for an Italian family

RESULTS

“*Statistica enigmistica*” is thus presented as a proper puzzle booklet on statistics, in which the solutions to the games allow you to have a quick and easy overview of some data related to Italy, such as relevant facts about the resident population, average monthly household consumption and expenditure, most common household appliances, most popular names, most used modes of transport to go to work, favourite holiday destinations etc.

The dossier is composed of 32 coloured A4 pages. The first twenty-two pages display several games; a page follows called “*Few people know that*”, which contains snippets of relevant curiosities of the history of statistics. The final pages of the publication (pages 24-30) reveal the solutions to all the puzzles. Page 31 leaves an empty space for notes. Finally, the back cover is

dedicated to a brief reference to the mission of Istat and to its commitment to disseminate statistical literacy. The following table provides a brief description of the array of games divided by type, level of complexity and topic.

Type of games	Nr.	Level of complexity *	Main topics
Word search puzzles	3	1; 3	Economic trends; Themes of Istat's database Noi Italia
Crosswords	4	1; 2; 3	Publication Italy in figures; Statistical tools; Well-being
Cryptograms	1	2	Famous statistical quotes
Anagrams	1	2	Statistical tools and glossary
Mazes	4	1	Environment; Family living conditions
Join the dots	3	1; 2	Family living conditions; Demography
Illustrated quizzes	4	1; 2	Environment; Family living conditions; Agriculture
Rebus puzzles	6	1; 2	Statistical tools; General themes of Istat's database
Sudoku puzzles	3	2; 3	Population; Household expenditure; Agriculture
Total	29		

* 1=upper-intermediate; 2= intermediate; 3= low

The introductory text of each of the games provides the references to trace meta-information (glossary, sources), such as links to the institutional website and publications of Istat. All additional elements to further studies are also provided so that users may satisfy curiosities on data and surveys conducted by the Institute. For this reason, the instructions given throughout the booklet tend to enhance accessibility to the data and the great variety of topics. As a matter of fact, it was important to stress that accessibility to official statistical information – developed objectively and independently – is one the most significant features of data production, since it makes statistical information available to everyone in an easy and quick way.

Three thousand copies of the publication were published, and more than five hundred were distributed on the occasion of the StatisticaAll Festival. The remaining copies were then distributed all around Italy during a series of territorial events linked to the 2015 “World Statistics Day”.

Moreover, the online version is available on the Istat website at the link: <http://www.istat.it/it/files/2012/08/statisticaEnigmistica.pdf>. From the release date until the end of January 2016, the pdf version was downloaded circa 900 times. It is not a big number, but it must be taken into account that no effort has been made to advertise the online product, since it was preferred to focus on the hard copy edition.

IMPLICATIONS

The present paper has focused on the description of the design of a puzzle magazine realized by the Italian National Institute of Statistics, with the aim of introducing a non professional audience - through a ludic approach - to the understanding of the effectiveness of official statistics to deeply comprehend society.

“*Statistica enigmistica*” is an innovative and non-conventional tool, designed to realize educational scientific projects intended for a wide audience. It can contribute to a general growth of statistical literacy in the country, since the structure of the games eases the approach to statistics for non-specialized and heterogeneous audiences. The friendly setup of the magazine may help to reduce the gap between citizens and the institutions in charge of statistical production and consequently to increase the citizens' sense of trust towards the quality of the work carried out by Istat. Although indirectly, this may encourage the active participation of citizens and households in all the social surveys conducted by the Institute.

“*Statistica enigmistica*” can be effectively used as an innovative tool to draw the public closer to the National Institute of Statistics, as the major producer of official statistics concerning Italian society. Indeed, the magazine allows us to highlight the importance of the quantitative dimension in the analysis of social phenomena and, more specifically, to stress the contribution to the understanding of society given by official statistics. In this sense “*Statistica enigmistica*” may also encourage considerations on the production process of statistics regarding society and on the contribution that each one of us, through our behaviours and lifestyles, gives to statistical information.

Especially in the case of young students, the puzzle magazine can serve as a friendly first approach to the study of Statistics; it is an important instrument because it may be used by teachers as a learning tool to introduce and stimulate questions on statistical information as a means of understanding social phenomena (for example on environmental or health-related topics), and to trigger the processes at the basis of critical reasoning (search of data and information, analysis, comprehension, and evaluation) in the classroom. In this sense, the use of “*Statistica enigmistica*” in the classroom can foster an inquiry-based learning approach among students, due to its ability to induce questions related to real-life situations (Franklin et al., 2007); it can also be of valid support to teachers who intend to use a teaching approach based on lab activities and workshops, since it can be used by students as an input to access official statistics and to find data they are interested in. It can help teachers to introduce students to the study, from a quantitative point of view, of some particular topics regarding society, such as growth and wellbeing, poverty and the distribution of wealth, demographic trends. Moreover, it can help teachers to stress the key role of official data for a robust analysis of many social aspects, thanks to the high-quality level guaranteed by the producer of official statistics. In this sense, “*Statistica Enigmistica*” can help students to familiarize themselves with data providers and with the main dissemination channels of official statistics.

Istat in the near future will have to undertake specific actions to test the effectiveness of this booklet as a learning instrument, among students and teachers. In case of positive test results, it will be necessary to advertise it among teachers to promote the use of this tool for their work.

Thus, a simple and playful tool makes it possible to raise awareness among citizens of the importance of possessing adequate statistical competences for their engagement in modern society, and to make all citizens aware of the importance of the role played by quantitative information, and in particular by official statistics, in the understanding of society.

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WEBSITE LIST

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- Eurostat: <http://ec.europa.eu/eurostat/quiz/>
- Financial Police: <http://www.gdf.gov.it/documenti-e-pubblicazioni/pubblicazioni/le-avventure-di-finzy>
- U. S. Census Bureau: <https://www.census.gov/schools/index/research/By-Type/play.html>