Science Communication
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"Visual Science Literacy": Images and Public Understanding of Science in the Digital Age

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Abstract

Since its very beginning, modern science has put images at the center of its communicative processes: drawings, diagrams, and schemes, and later photographs, satellite images, and film. In the age of digital communication, specialists and publics live constantly immersed in a visually dense environment, particularly when it comes to science and technology content. Do we have the competence to decipher all these images, often complex and elaborate? If the so-called science literacy has become a standard dimension of public understanding of science at the international level, much less studied so far is visual science literacy. We tested empirical indicators of visual science literacy in the context of three surveys (2014, 2015, and 2016) of public perception in Italy on a representative sample of the population. The results show that respondents fare generally better in recognizing images related to science than in responding to textual questions. Images could offer relevant opportunities for greater public engagement with scientific results.

Keywords

visual science literacy, images, science communication, public understanding of science, science in society

Since Robert Hooke's *Micrographia*—a collection of drawings, mostly from observations at the microscope, that astonished readers when it appeared in 1665—modern science has put images at the center of its communicative

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processes: drawings, diagrams, and schemes, and later photographs, satellite images, and film. In the age of digital communication, specialists and publics live constantly immersed in a visually dense environment, particularly when it comes to science and technology content (Barrow, 2008; Bucchi & Canadelli, 2015; Pauwels, 2006).

The quality—and sometimes even the beauty—of images has acquired great importance in order to publish articles in academic journals in areas like the physical, astronomical, and life sciences (Madhusoodanan, 2016; Nelkin, 1994; Rödder, Franzen, & Weingart, 2012). In the popular domain, a pervasive role is played by the presentation of data in sophisticated/interactive form, which has become commonplace for leading digital outlets (Tufte, 1997, 2002). Do we have the competence to decipher all these images, often complex and elaborate?

The so-called science literacy (H. H. Bauer, 1994; Miller, 1983, 1992) has become a standard dimension in studies and discussion of public understanding of science at the international level; longitudinal trends, comparison across different publics and countries, have also been extensively used to invoke policies and strategies for public engagement with science (M. W. Bauer, Shukla, & Allum, 2012; Bucchi & Trench, 2014, 2016). However, science literacy has so far always been defined in terms of the ability of respond to questions about scientific content, largely neglecting the fact that the visual has historically been central to science communication; this is even more so in the context of contemporary circulation of information through digital media (Bucchi, 2016; Frankel & DePace, 2012; Ione, 2004; Struken & Cartwright, 2009). One methodological reason for this limitation might have been the fact that during the past decade, many surveys of public understanding of science were conducted through CATI (Computer-Assisted Telephone Interviewing) techniques (Allum, Sturgis, Tabourazi, & Brunton-Smith, 2008; M. W. Bauer, Allum, & Miller, 2007; M. W. Bauer & Falade, 2014).

We tested empirical indicators of visual science literacy in the context of the three latest editions (2014, 2015, and 2016) of a long-term, periodical survey of public perception and opinion about science and technology conducted since 2003 on a cross-sectional, representative sample of 1,000 Italian citizens aged over 15 years (Bucchi & Saracino, 2016). The sample is designed to represent the Italian population by gender, age, area of residence, and educational level.

Through CAWI (Computer-Assisted Web Interviewing), in each edition of the survey a portion of respondents (30% in 2014 and 2015, 60% in 2016) were asked to recognize images related to science; in 2016, images of visible scientists were also introduced. The selection of proposed images to be tested for recognition by interviewees followed the same principle that historically guided the definition of traditional indicators of science literacy—that is, submitting items that can be considered part of the broad science culture. In visual terms, this means looking for classical images that have become standard references—if not “icons”—of science communication in the public arena. As for textual items used as traditional indicators of science literacy, empirical testing could also help identify those images whose recognition appears robust enough across different samples or data collections, as well as those that can be better used to assess different degrees of visual literacy among the population.

The results indicate that an image like the “double helix” of DNA—originally drawn by Francis Crick’s wife, Odile, for the 1953 *Nature* article by James Watson and Francis Crick—and the image of the Earth taken during the NASA (National Aeronautics and Space Administration) Apollo 8 mission of 1968 are familiar to most respondents (94% and 95%, respectively, a consistent result both in 2014 and 2015 surveys). About 8 and 7 respondents out of 10 are also able to recognize, respectively, an image of a comet surface taken during the recent ESA (European Space Agency) “Rosetta” mission (81% in 2016) and a widespread (yet anonymous) image of IVF (in vitro fertilization; 80% in 2015 and 70% in 2016). Other images, like Niels Bohr’s original model of the hydrogen atom (proposed in the 2015 survey), appear much less familiar to the public (44%). With regard to familiarity with visible scientists (items introduced only in 2016), not surprisingly, more than 90% correctly recognize the face of Albert Einstein. It seems more noticeable, however, that a high proportion of respondents are also familiar with the portrait of physicist and CERN (European Organization for Nuclear Research) Director Fabiola Gianotti (76%) and two thirds with Nobel laureate in physics and chemistry Marie Curie (Figure 1). The relevant role of images is also confirmed by the fact that before actually seeing her portrait, only 57% of respondents declared they were familiar with the name of Gianotti.

If we compare results from items about visual science literacy with results from standard science literacy questions, the difference is quite remarkable. Although science literacy as measured by textual questions has slightly improved in recent years, in 2014, 16% of interviewees could not respond correctly to any of the standardized textual items seeking to assess science literacy. With regard to visual science literacy, in the same year only 0.8% of respondents could not recognize correctly any of the submitted images; this percentage has dropped to almost zero (0.1%) in 2016 when scientists’ portraits were included (Figures 2 and 3).

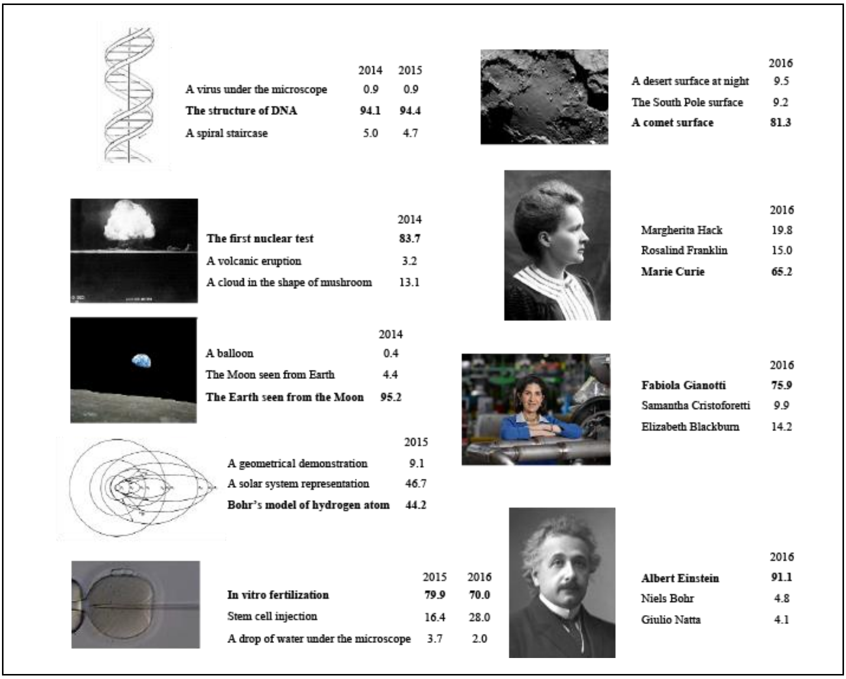

Figure 1. Familiarity with some images related to science.
Note. Percentage of valid responses—2014: n = 240; 2015: n = 244; 2016: n = 525.

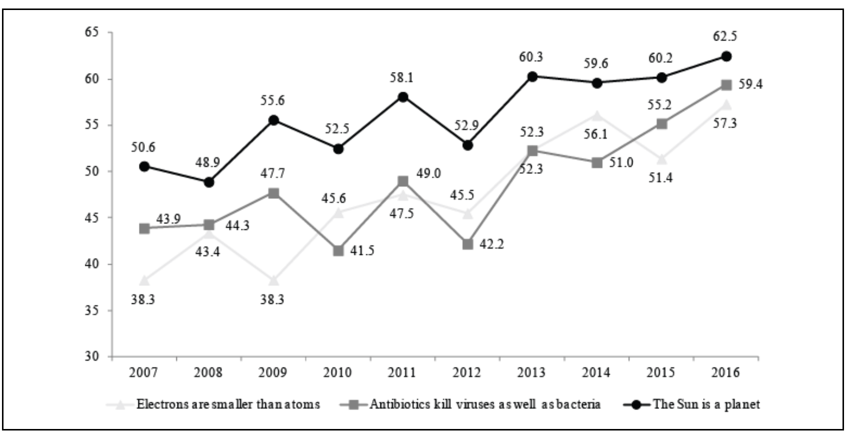

Figure 2. Standard science literacy items.
Note. Percentage of correct answers—2007: n = 988; 2008: n = 996; 2009: n = 1,020; 2010: n = 985; 2011: n = 1,001; 2012: n = 995; 2013: n = 1,005; 2014: n = 1,040; 2015: n = 999; 2016: n = 1,002.

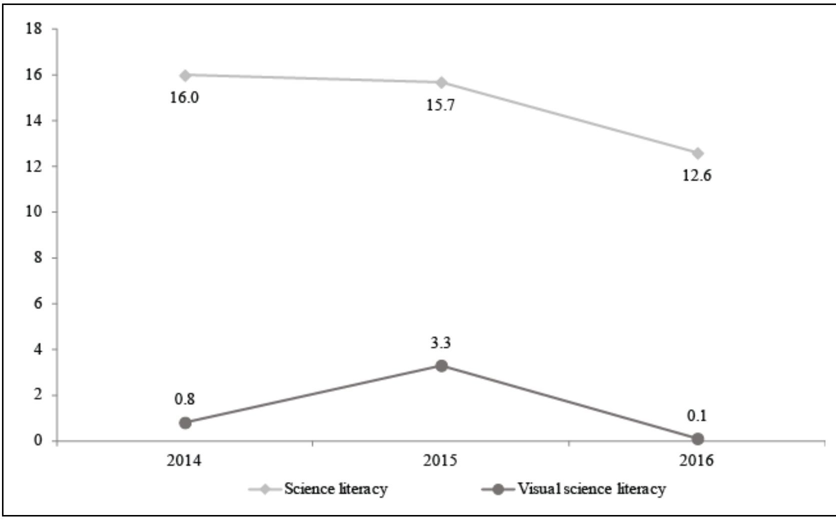

Figure 3. Science literacies compared.
Note. Percentage of 0 correct answers—2014: *n* = 1,040; 2015: *n* = 999; 2016: *n* = 1,002.

It is also interesting to note that visual science literacy and "traditional" science literacy do not depend in the same way on the respondents' sociodemographic features. Both dimensions of science literacy increase with the general education level: 50% of interviewees with a university degree could correctly recognize all five visual items submitted in 2016. Traditional science literacy significantly correlates with age as well: The highest percentage of respondents failing to answer correctly all textual items set to measure traditional science literacy is concentrated among citizens aged over 60 and with low education. The same does not hold for visual science literacy, which appears rather homogenously distributed across age groups.

Of course recognizing an image associated with science like the DNA double helix or Einstein's face does not necessarily imply conclusions on specific knowledge of content on the part of interviewees. Still, familiarity with science images could provide a relevant hook for science communication strategies, by anchoring more substantial information to already familiar images across different sectors of the general public.

We see our study mainly as a preliminary methodological exercise, aiming at sparking discussion on indicators of visual science literacy and at stimulating other empirical studies that could help develop, as for traditional science literacy, standardized and robust items that could be used internationally to monitor differences and trends in visual science literacy. Such indicators appear increasingly needed in the visually dense—and visually challenging—communicative environment of contemporary science communication.

Methodology

Period during which survey was conducted: From April 2, 2014, to April 14 2014; from April 9, 2015, to April 14, 2015; from April 12, 2016, to April 29, 2016

Geographic coverage: Italy

Data collection methods: CATI for 30% of the sample and CAWI for the remaining 70% in 2014 and 2015; CATI for 40% of the sample and CAWI for the remaining 60% in 2016

Sampling: Sample proportional to Italian population aged 15 or older by gender, age class, and area of residence

Representativeness of results: Representative sample of the corresponding population

Units interviewed: 1060 cases (2014), 1011 cases (2015), 1013 cases (2016); the total number of cases becomes 1040 (2014), 999 (2015), 1002 (2016) after statistical weighting applied in order to for the sample structure to correspond to that of Italian population with regard to gender, age, and education level

Supplementary materials: Requests for other materials and data should be addressed to the authors.

Authors' Note

The authors contributed equally to this work.

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