

# Data Visualization and Infographics in Visual Communication Design Education at the Age of Information

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## ABSTRACT

Scientific and technologic developments in the last century facilitate people's lives while also causing them to face more information. Information design has become much more important as a result of the chaos created by the unprocessed heap of data and information traffic. Therefore, people need designed information like infographics and data visualisation today. Design of information, which is among the most significant requirements of our age, has become a subject which needs to be dealt with more systematically in the education of visual communication design. Visual design of information and data is important not only for increasing perceptibility but also revealing the patterns within complex information, and being educative, persuasive and guiding depending on the content and objective. In this sense, incorporating data visualization and infographics works into the education of visual communication design would have significant contributions to train designers with sufficient qualification to meet the requirements of today's world. This study examines the current/potential expansion of data visualization and infographics in the education of visual communication design at the age of information. With respect to students, it deals with its effects to the design method, process and perception and its contributions to the multidisciplinary design approach.

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## 1. Introduction

The fact that visual communication design has become a domain based on interdisciplinary cooperation also affects the content of education programs. Visual communication design education attempts to keep pace with the rapidly developing technology and also includes a transformation to allow multidisciplinary work. A designer equipped to meet the requirements of the age should be able to accord with the progress speed of technology and have the experience to work together with the professionals from different disciplines. Icograda's Design Education Manifesto announced in the Taipei meeting in 2011 underlines the multidimensional and multidisciplinary structure of the communication design: "Communication design has become more and more a profession that integrates the idioms and approaches of other disciplines into a multi-dimensional and hybrid visual competence. ... As the multiplayer working process assumes a higher complexity, communication designers need to redefine their role and purpose for an expanded media context dominated by a many to many conversation mode" (Icograda Design Education Manifesto, 2011).

In this context, it is necessary for the education programs to aim for raising students who may adapt to the nature of this multidisciplinary domain which is renewed too fast and which is constantly transforming. Programs thus planned will also have differences in the way of learning. Learning should be constructed in a manner enabling students to have more active role to discover, understand, interpret information and use it for its intended purpose rather than acquiring knowledge in a passive way. This way of learning is considered to be close to the constructivist learning theory which is based on the internal construction of information with respect to the experiences of the individual. "The idea that information is the outcome of a non-standardized constructivist process goes back to Dewey who study on learning and to Kerschensteiner who revealed the fundamentals of learning. Within the constructivist education psychology, information is not a copy of reality but its reconstruction by human being" (Kurtulus, 2001, 204). The result from that is that "learning" in design education should be in a manner to support students to construct the information himself/herself rather than transferring information to students. Design education of today should teach

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students to learn. Only by such an approach it will be possible to educate students that comply with the mobile and multidisciplinary structure.

Education programs should follow the developments of the age and renew curriculum by determining relevant needs. In this case, we face the question about the requirements of the age we live in with respect to communication design. Generally, 2011 IcoGrada Design Education Manifesto outlining the communication design tells about the qualities to be possessed by a communication designer in the turning point of the age. Accordingly: "A communication designer: practises identity design; editorial and book design; typography; information design; advertising; illustration; photography; calligraphy; signage and pictogram systems; packaging; animation design; broadcast graphics and film titles; product, web and game interface design; interaction, environmental and exhibition graphics; data visualisation; and any other activity of online and offline shaping of visual form" (IcoGrada Design Education Manifesto, 2011).

Information design and data visualisation that are considered among the study areas in the manifesto are intended for the design of information which is actually the most important requirement of the age. While the outcome of the scientific and technological developments facilitate people's life, it also cause them to face more information. Today, people face data and information flow more than ever. Information design has become much more important as a result of the chaos created by the unprocessed heap of data and information traffic. It is observed in various media that use of data visualisation and infographics is increased to ensure more comprehensible presentation of information.

## **2. Requirements of the Age, Data Visualization and Infographics**

According to a study by Dr. Martin Hilbert from the University of Southern California, one person was exposed to 40 newspapers worth of information in a day in 1986 while this number increased to 174 newspapers in 2007 (Krum, 2013, 11). It won't be hard to estimate this number would be greater in 2014 and will grow every day. The role of visual communication cannot be ignored in the design of data and information that we are heavily exposed to. Human mind is able to perceive the visual information transfer in a short time and in a more efficient and permanent way compared to written or verbal information transfer. Many researches so far prove the fact that visual communication is much stronger than all of the other communication methods. Therefore, with respect to the design of information which is one of the most important requirements of today and future, an important part is taken by data visualization and infographics which present information visually. The increase of researches and works on the design of information in recent years is not a coincidence but a requirement of the age.

Data visualization and infographics aim to visually present intense and sophisticated information on a certain subject in a more comprehensible manner. They have other important qualities as well as providing more comprehensible and permanent information by visual transfer. Data visualisations and infographics that are well designed in terms of visibility, content and usefulness are important tools to persuade, direct and mobilize people. Visualization of information ensures the ability to see events and connection between them in new and different ways and to reveal other invisible patterns. Kim Tanyoung& Carl DiSalvo(2010) describes the significance of visualization of information in their paper "Speculative Visualization: A New Rhetoric for Communicating Public Concerns" as follows: "The expanded access of data allowed us to categorize visualizations by its ultimate purposes, which are impacting on people's ways of thinking, believing and further acting. With the involvement of Human-Computer Interaction (HCI) and interaction design, visualization has become a research topic that is more omnipresent and proximate to everyday life. For example, if personal health data are represented in more graspable visualization rather than its apparently unrecognizable numbers, the visualization can help the person change their habits to favourable state".

Communication design has gained a more important position in our age and the responsibilities of the communication designers increased proportionately. Among these responsibilities, important role is played by the capacity of data visualization and infographics to make information comprehensible and to use the power of persuasion and direction. This power may shape the movements of societies. In a paper called "Changing the World with Visualization", Robert Kosara, Sarah Cohen, JérômeCukier& Martin Wattenberg (2009) provide the following information on the power of visualization of power: "Coming from a governmental organization (Organisation for Economic Cooperation and Development, OECD), the most obvious way I see in which data visualization can change the world is through transmission of knowledge

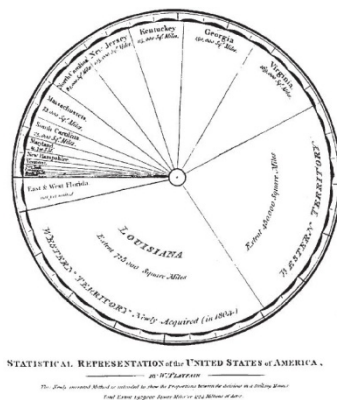
from experts to the people. If all citizens had perfect information each time they made a decision, our economy and society would be stronger. People could have access to the same quality of information that their elected officials use when making policies”.

### 3. Relations between Data Visualization and Infographics

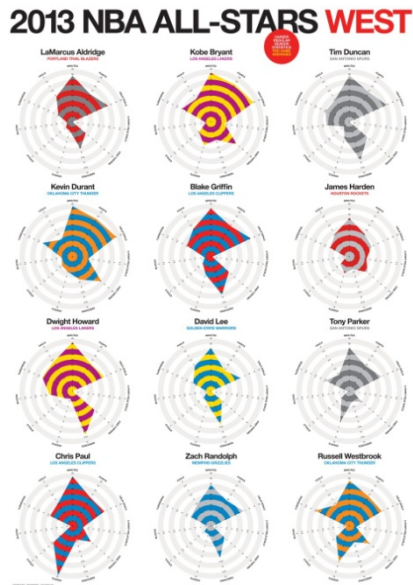
The purpose of data visualization and infographics is to provide visual presentation of complex and irregular information in a planned and comprehensible manner. Both terms have different meanings despite this joint purpose. Infographics involve visual and story like presentation of a certain subject which provides various data in a simultaneous manner and which sometimes include processes. This visual story like presentation can be used various elements like image, illustration, typography, map and visualization. “In this use of the word, data visualizations by themselves are no longer considered to be complete infographics but are a powerful tool that designers often use to help tell their story visually in an infographics” (Krum, 2013, p.6). Data visualization can be defined as visualization of numeric values with charts, tables and graphics and as transformation of raw data information to visual presentations. Its most important quality is that it includes clear information based on measurable statistical data. According to Friendly, “data visualization is the science of visual representation of ‘data’, which has been abstracted in some schematic form, including attributes or variables for the units of information” (2008, p. 2). Data visualizations as a broad field of study in its own are addressed in this study as an element of infographics.

#### 3.1. Data Visualizations

Graphic forms that we currently use date back to long years ago. However, we see similar forms of present graphics like bar charts, column charts, doughnut charts and pie charts in the books “The Commercial and Political Atlas” and “Statistical Breviary” published by William Playfair respectively in 1786 and 1801 (Picture 1). As data visualizations have such a long history and have been frequently used in daily newspapers, people developed capacities to understand graphics used in such data. Data visualizations present numeric values in comparison while they are hard to understand when given in a plain text. Here comparison is very important as independent data gain importance this way. For instance, data visualization poster detailing the stats for each of the players on the 2013 NBA All-Star teams. The data visualization uses radar charts to highlight each player’s strongest areas (Picture 2).



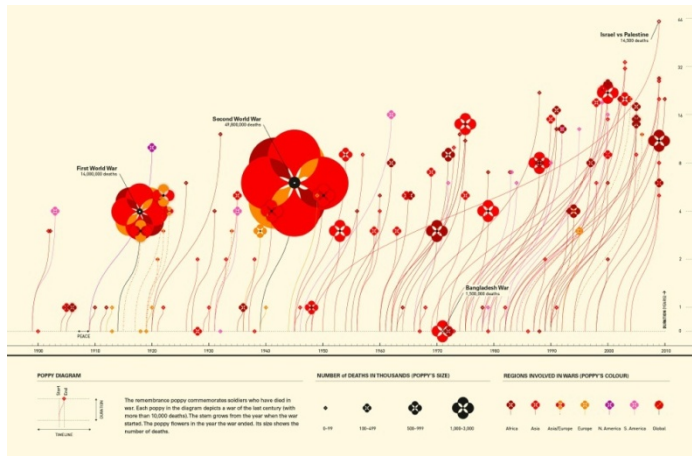
Picture 1: The pie chart made by William Playfair in 1805, titled “Statistical Representation of the United States of America”.



Picture 2: Radar charts, detailing the stats for each of the players on the 2013 NBA All-Star teams (<http://ramimo.com/2013-NBA-All-Stars>).

Data visualizations are among the strongest elements used in infographics. It has direct effect on the credibility and persuasiveness of infographics as it provides clear and objective information based on numeric data. At this point, we need to state that the data visualizations are within the scope of research and study of the fields of statistics and data analysis. Of course, specialists of these fields study data visualization by their own methods and state that graphics may occasionally become speculative when designers are involved. The fact that the effect of data graphics may vary based on the design is an indication of the power held by a communication designer. Communication designer can exaggerate the points of emphasis and attraction by using elements like dimension, colour or texture and can dramatize data.

“When data visualization and graphic design meet together, each actively fills its absent traits with the advantages of the other; graphic design strengthens its arguments with objective and real data, while data visualization emphasizes visual aesthetics adopting the principles of graphic design. Interconnecting the two realms in this way, speculative visualization makes data meaningful, insightful, and influential” (Tanyoung&DiSalvo, 2010). The study of Valentina D'Elfilippo, author of *The Infographic History of the World*, awarded at The Kantar Information is Beautiful Awards presented loss of 95 million people due to wars in the 20th century in a very dramatic visual language (Picture 3). Data made available by The Polynational War Memorial make clear that war was a near-constant characteristic -allowing just two years of peace - in the last century. Given the sheer magnitude of war's toll, this visualisation only considers conflicts exceeding 10,000 deaths - yet, in the static form, it is still not feasible to label every conflict. The overall composition reveals patterns in the timing, duration, involvement and human toll of war (<http://www.informationisbeautifulawards.com/2013-winners/>).



Picture 3: Valentina D'Ef Filippo , 2013 (<http://www.informationisbeautifulawards.com/2013-winners/>).

### 3.2. Infographics

Use of writings, image, illustration, map and data visualization in infographics vary by content. In any case, infographics design is about storytelling. Infographics present viewers a story by visualizing intense, even complex information and processes on a certain subject in a manner to be easily understood and to create attention and curiosity. This visual story is expected to create a change in the viewer. This is intended to persuade viewer to a certain idea, sometimes to direct his/her perception and sometimes to directly mobilize him/her. "...the best infographics tell complete stories. Infographics have become more like articles or speeches than charts. Their purpose can be categorized into the same three objectives as public speaking: to inform, entertain, or persuade the audience. They have introductions to get readers' attention, so the readers know why they should take the time to read the infographics. They end with conclusions and calls to action, so the readers have some indication of what they should do with the information they have just learned" (Krum, 2013, 6). For instance, the infographics on "How will you vote on 2014 local elections" designed for Turkish local elections, 2014 by YunusEmreHatunoğlu give detailed explanation on the voting process (Picture 4). Considering the fact that voting process covers the Turkish citizens over 18 years old and from all education levels, it will be clear that this infographics published on a daily newspaper is very useful.

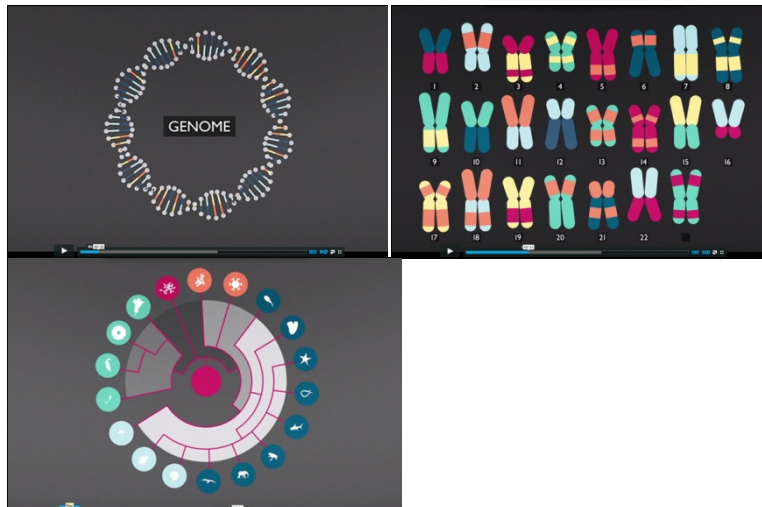


Picture 4: "How will you vote in 2014 local elections?",YunusEmreHatunoğlu, 2014 ([http://www.zaman.com.tr/politika\\_oyunuzu-nasil-kullanacaksiniz\\_2206810.html](http://www.zaman.com.tr/politika_oyunuzu-nasil-kullanacaksiniz_2206810.html)).

#### **4. Media Formats of Data Visualizations and Infographics**

Data visualizations and infographics are designed in different formats like static, motion and interactive. Infographics that previously exist only by static versions in the printed media have also technology based interactive and motion formats that become very popular. Static formats of data visualizations and infographics are stable and the person is a viewer. Such static format works can be used in printed or screen forms.

Motion format works may vary from simple animations on certain places of infographics to totally video format infographics. Motion format works may be present in all kinds of digital environment with their nature of including motion and audio. For instance, the motion infographics prepared by Territory Studio ([territorystudio.com](http://territorystudio.com)) for BBC Knowledge provides audio description of the structure and function of DNA with an effective visual (Picture 5).



Picture 5: BBC Knowledge Explainer DNA, Territory Studio, 2013 (<http://vimeo.com/60747882>).

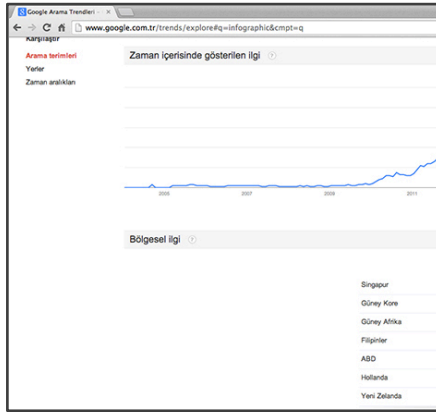
Will Samuel, chief designer of the project for the infographics prepared as a 3-minute animation, says that their goal is not only to look at scientific future. “We needed to find a graphic style to communicate the beauty and intricacy of DNA. We wanted to create nostalgia; taking the audience back to the days of textbook diagrams and old science documentaries, such as Carl Sagan’s COSMOS and IBM’s Power of Ten (1977). Using the double helix circular theme as a core design we focused on form, movement and colour to create a consistent flow to the animation, drawing on references from nature, illustrating how DNA is the core to everything around us” (<http://vimeo.com/60747882>).

In static and motion formats the person is just a viewer while the person is active user in interactive data visualization and infographics applications. Interactive infographics that may bear more information than static versions have various applications open to user interaction, attract user more into the information and ensure more connections with information. User interaction includes controls like information selection, searching, active shaping of the content to be shown. The user controls the time and detail of information to be shown. Interactive data visualization and infographics applications may be web-based as well as be used in the interface of a software product, in an application guiding table or on the dashboard of kiosk. Interactive data visualization and infographics may vary from simple applications providing information through pop-ups when touched on the image to more complex applications where information is updated simultaneously from a data feeding centre.

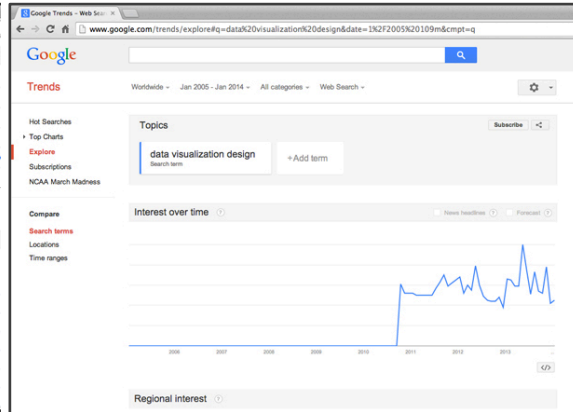
#### **5. Data Visualization and Infographic Works in the Education of Visual Communication Design**

Due to increasing data and information transfer, people of today need more of designed information like infographics and data visualization. In parallel to this development, it is seen that there is a remarkable increase in the search rate of the terms “infographics” and data visualization in recent years (2010-2014)

according to the Google Search Trends (Picture 6, 7). Therefore, design of information, one of the most important needs of today, is a matter that needs to be handled in a more systematic way in the education of visual communication design.



Picture 6: Table showing Google search rate of the term “infographics” all over the world between 2005-2014 (<http://www.google.com/trends/explore#q=infographic>).

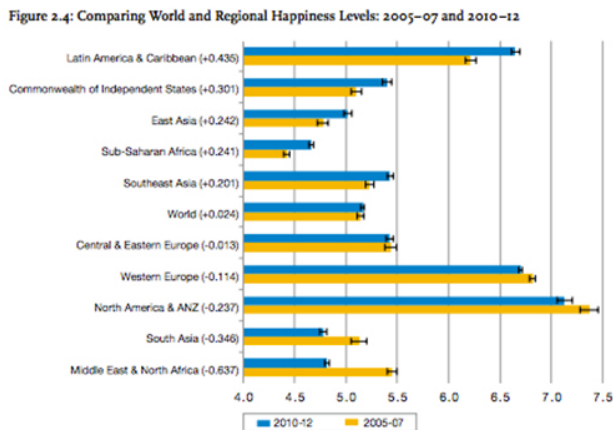
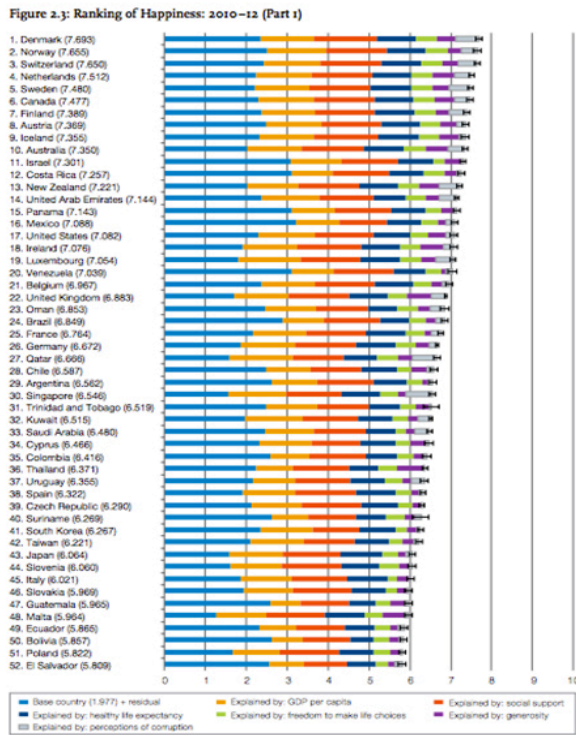


Picture 7: Table showing Google search rate of the term “data visualization design” all over the world between 2005-2014 (<http://www.google.com/trends/explore#q=data%20visualization%20design&cmpt=q>).

Projects on infographics and data visualization will provide students with benefits in many respects and bring new skills. To obtain an effective result in such projects, first the subject of study needs to be understood very well by the student. Infographics is a visual story presentation of a certain subject. To be able to tell a story, the said subject needs to be understood in detail. This will make the student look for the best ways to study the subject matter and to tell target audience well about the subject. In this process, the most important point is the fact the only subject to work on, think about and study is not related to the visual design on infographics. Student will review the information structuring by going through process like study to be done on the subject of infographics, data to be obtained by this study and systematic classification of this data. Information structuring is an engagement far beyond the visually oriented mission of the designer. Here it can be said that the study process is related to the “information architecture”. “Information architecture is a professional practice and field of studies focused on solving the basic problems of accessing, and using, the vast amounts of information available today” (Resmini&Rosati, 2012).

Data should be analysed very well to ensure proper organization of content and to introduce meaningful structures during data visualization works. Of course, this huge and detailed data analysis goes beyond the responsibility of a designer but normally professionals are employed in such situations. In higher education, projects for data visualization can be selected on a level where the students can solve by individual or group work. For example, within the scope of “The World Happiness Report 2013”, tables showing the “Ranking of Happiness Between 2010-2012 by Country” and “Comparing World and Regional Happiness Levels: 2005-07 and 2010-12” can easily be understood by design students (Picture 8).



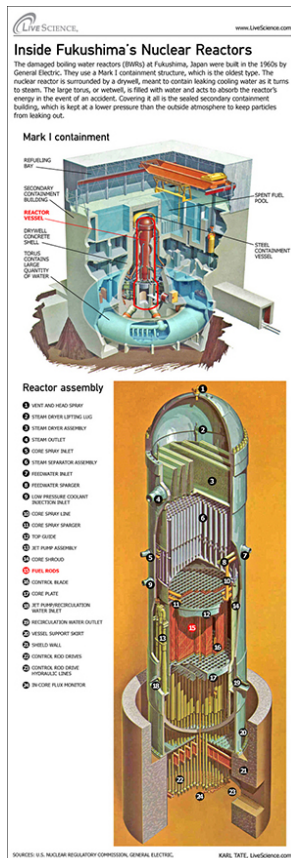


Picture 8: Tables showing “Ranking of Happiness Between 2010-2012 by Country” and “Comparing World and Regional Happiness Levels: 2005-07 and 2010-12”, ([http://unsdsn.org/wp-content/uploads/2014/02/WorldHappinessReport2013\\_online.pdf](http://unsdsn.org/wp-content/uploads/2014/02/WorldHappinessReport2013_online.pdf))

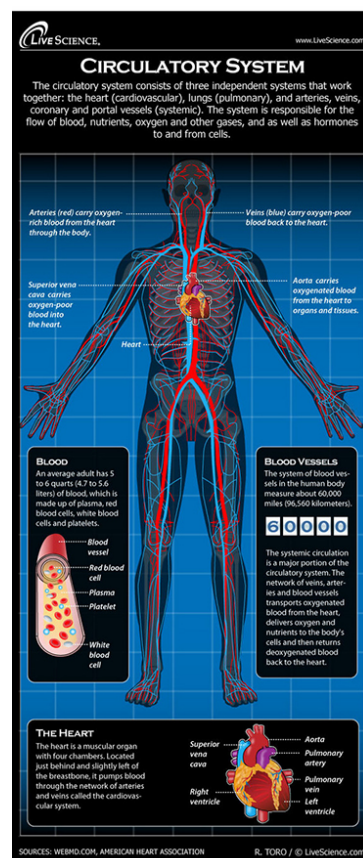
Similar current and attractive subjects ensure easier focus of students on the subject matter. Student examines the visualization methods for numeric values throughout the project and makes searches to find new graphic explanation languages to present subject matter in the most efficient and comprehensible way. Alberto Cairo, author of the book *The Functional Art: An Introduction to Information Graphics and Visualization*, shared comprehensive content of the Information Graphics and Visualization lesson at the University of Miami with the educators for guidance (2012). Cairo provides students with raw data and states that this raw data should be used as the starting point of a story asking them first express their ideas through sketches. Cairo (2012) tells about this process: “I show the students how I move from raw data to a graphic representation, step by step, explaining the different ways of representing numbers (bar charts, line charts, scatter plots, maps) and why they work or not depending on what your goals are. The key element in this lecture is for them to understand that form should be guided and limited by function”.



In infographics and data visualization works which aim to design complex information, students are expected to provide quality visual design solutions as well as systematic thinking, solving and constructive attitude. Such works educate students on the requirement that the designer should be open to learn subjects other than his/her own field, interpret the subject being rapidly engaged in it and revisualize it effectively with respect to aesthetics. Another income of the multidisciplinary structure of the communication design is team work. Communication designer will be included in the working life as a member of a team carrying out productions usually for a certain target. For this purpose, carrying out a team work consisting of different disciplines in infographics works may be a simulation of the working life that the students will face in the future. For instance, students may be encouraged to meet and work together with the specialist of a subject matter for a project with scientific content similar to the infographics “Inside Fukushima’s Nuclear Reactors” and “Human Circulatory System” (Picture 9, 10).



Picture 9 : Infographic of Inside Fukushima's Nuclear Reactors(<http://www.livescience.com/13230-infographic-japan-nuclear-reactors.html>).



Picture 10: Infographic of Human Circulatory System (<http://www.livescience.com/27585-human-body-system-circulation-infographic.html>).

In order to finalize a similar work like the example, a serious study on the subject to be visualized should be made and cooperation should be ensured with the professionals of the subject. It is clear that the strength of designer will be increased with the addition of this interdisciplinary approach and a skill of more systematic thinking within the education of visual communication design.

## 6. Technological Infrastructure of Data Visualization and Infographic Works

Inclusion of interactive or motion formats to the study calendar into the infographics and data visualization projects together with static formats will develop students' skills to use technology. A programmer can be added to the group in interactive infographics done with technologies like HTML5, JavaScript and Ajax and

basic coding information can also be taught within the project. Enrico Bertini, Assistant Professor at the NYU Polytechnic School of Engineering and editor of FILWD blog ([felinlovewithdata.com](http://felinlovewithdata.com)), stated in his article about data visualization as the best teaching method that knowledge of coding will provide more people with freedom. "...there is the issue coding vs. noncoding. I know a lot of people do great visualization without writing a single line of code. Yet, I think coding gives much more freedom. I now believe it is much more effective to give tools the role they deserve and teach one (max two) core tools in my future courses" (Bertini, 2013). Even a team includes a programmer in the working life, a communication designer should have coding knowledge even basic.

As it is possible to reach more and more information on infographics and data visualization on the internet every day, it is now much easier to reach quality examples in terms of both theory and practice. Newspapers like New York Times, the Guardian and periodicals like National Geographic have been pioneers of mainstreaming data visualization and infographics in the media thanks to their design teams for years ago. The works of such publications which were awarded many times by Society for News Design and The Malofiej Awards can be given as example to students. Also, a useful expansion can be achieved by combining students with professionals producing in these areas.

## **7. Evaluation Criteria of Data Visualization and Infographic Works**

In infographics and data visualizations, data should be analysed very well by the designer for proper organization of content and divided by the level of importance and associated by meanings. For this organization, proper and effective visual coding is a guide for focus of viewer/user and the order to follow the information flow. Infographics and data visualization works will include colour, typography, illustration and various graphics and improve design capabilities of students guiding them to more effective and proper design searches for both functional and aesthetic way. Amanda Cox, graphics editor of New York Times, who develops visualizations across platforms, from simple print infographics to highly complex online interactive data tools, states the importance of typography, information and hierarchical order. "...we have design principles. Design and typography do matter. It's about hierarchy of information and how people perceive information. Done properly, that clean up work really matters" (<http://blogs.hbr.org/2013/03/power-of-visualizations-aha-moment/>, 2013).

If infographics projects include data visualization, first of all students should be given sufficient time for data to be properly analysed and interpreted. This doesn't change if the subject is an infographics work that doesn't require data visualization element. Adequately understanding the subject matter is important for correct and effective story making. In this process, it should be ensured that students do as many sketches as possible and search to find effective visualization method. In the end of the work process, students are expected to produce clear, comprehensible, functional and creative solutions. Cairo allows 40% share to clarity when evaluating the works out of the Information Graphics and Visualization lesson.

"40% Clarity: I usually define the audience each project will be aimed at, and where it will be published. You should evaluate if the graphic can be understood, if the information is well organized, etc. Pay attention to the layout and, in the case of interactive projects, to the interface and navigation.

20% Type and colour consistency: Are they using them to create a better hierarchy, to organize the information correctly, to give emphasis to those elements that are most relevant?

20% Quality of the execution: As I explain how to use the software, I expect a certain level of sophistication in the final look of the graphics students turn in.

20% Creativity: This doesn't mean that students should go crazy with styles and special effects. It *does* mean, though, that I reward students that surprise me with an unexpected piece of information gathering, or with an unusual graphic form that is perfectly adapted to the data it encodes" (Cairo, 2012).

## **8. Conclusion**

Infographic and data visualization works are strong tools that present information systematically, reveal hidden patterns and have qualities like persuasive and guiding. In the education of visual communication design, infographics and data visualization works can provide students with many gaining like searching, studying, systematic thinking, looking for functional, unique and aesthetic solution methods and doing team works. Development process of students will be positively affected by requirements like being able to

properly organize information, present the subject in effective story forms, use creative visual design and technology effectively.

Design of information is getting more important among the flow of data and information increasing every day. In this case, it is clear that the trend of increase will continue in both theoretical and applied works related to infographics and data visualization. It will bring a more multidisciplinary approach to design method, process and perception and having different lessons in the education curriculum for the infographics and data visualization works will ensure that the subject of designing information will be addressed in a more systematic way. Especially, interactive infographics works will involve more technological information and areas like interaction design and interface design, the best way would be to organize separate lessons in two or three stage periods, at least one of them being compulsory. It is clear that inclusion of data visualization and infographics works in the education of visual communication design would have important contribution to the education of designers sufficiently qualified to meet the requirements of the age of information.

## References

- Berinato, S. (2013) The Power of Visualization's "Aha!" Moments. *Harvard Business Review*. Retrieved from <http://blogs.hbr.org/2013/03/power-of-visualizations-aha-moment/>
- Bertini, E. (2013). *What's the best way to teach visualization?* Retrieved from <http://felinlovewithdata.com/reflections/teach-visualization>
- Borkin, M.A., Vo, A.A., Bylinskii, Z., Isola, P., Sunkavalli, S., Oliva, A. & Pfister, H. (2013). What Makes a Visualization Memorable? *IEEE Transactions on Visualization and Computer Graphics*, Proceedings of InfoVis 2013.
- Cairo, A. (2012). *Instructor's Guide*. Retrieved from <http://www.thefunctionalart.com/p/instructors-guide.html>
- Helliwell, J., Layard, R., & Sachs, J. (Eds.). (2013). *The World Happiness Report 2013*. New York: Sustainable Development Solutions Network (SDSN). Retrieved from [http://unsdsn.org/wp-content/uploads/2014/02/WorldHappinessReport2013\\_online.pdf](http://unsdsn.org/wp-content/uploads/2014/02/WorldHappinessReport2013_online.pdf)
- Icograda Design Education Manifesto 2011. Retrieved from <http://www.icograda.org/education/manifesto.htm>
- Kosara, R. (2007). Visualization Criticism: The Missing Link Between Information Visualization and Art. *IV '07 Proceedings of the 11th International Conference Information Visualization*, Washington: IEEE Computer Society.
- Kosara, R., Cohen, S., Cukier, J. & Wattenberg, M. (2009). Panel: Changing the World with Visualization. *IEEE Visualization Conference Compendium*.
- Krum, R. (2013). *Cool Infographics: Effective Communication with Data Visualization and Design*. Indiana: John Wiley & Sons, Inc.
- Kurtuluş, Y. (2001). Sanat Eğitiminde İşbirlikli Öğrenme , Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, vol. 20, 201 -205.
- Pousman, Z., Stasko, J. & Mateas, M. (2007). Casual Information Visualization: Depictions of Data in Everyday Life. *IEEE Transactions on Visualization and Computer Graphics*, vol. 13, no. 6, 1145-1152.
- Resmini, A. & Rosati, L. (2012). A Brief History of Information Architecture. *Journal of Information Architecture*. Vol. 3, No. 2, 33-45. Retrieved from <http://journalofia.org/volume3/issue2/03-resmini/>

Tanyoung, K. & DiSalvo, C. (2010). Speculative Visualization: A New Rhetoric for Communicating Public Concerns. *Design Research Society International Conference Design & Complexity*, Montreal: DRS Conference Proceedings.

The Kantar Information is Beautiful Awards. Retrieved from <http://www.informationisbeautifulawards.com/2013-winners/>