The potential of interactive infographics: gamification and edutainment

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Abstract.
Interactive infographics, developed taking into account all comprehensive principles of gamification and edutainment, have extended informational capabilities that maximize their overall effectiveness for a variety of pro-social purposes. The interaction between infographic projects and recipients allows to achieve increased interest, the level of involvement and improve the assimilation of the material. In the near future, the author of this scientific article predicts an increase in examples of high-quality interactive infographics in open access and its popularization among the main target groups that are directly involved in transformative global sociocultural processes.

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INTRODUCTION

The enlightenment of various groups of recipients regarding socially significant problems in society occurs with the help of implementation and usage of social infographics as a tool of neurovisual programming in the field of visual communications.

The author of this article introduces the concept of neurovisual programming into scientific lexicon in the segment of infographic design, which should be understood as an approach to visual communication, to the expansion of the range of personal knowledge and the transformation of the subject's worldview, which combines neuroarchitecture as a multidisciplinary approach, visual components and further behavioral patterns based on personal experience gained through different modes of learning.

The study of extended properties and potentials of infographics represents the special scientific importance due to the fact that variable infographic materials open up significant opportunities for visual coding of sociocultural arrays of information. The straight interest for scientific research is concentrated on interactive information graphics, which have additional artistic and imaginative perspectives.

THE STATIC INFOGRAPHICS AND THE INTERACTIVE INFOGRAPHICS: UNLIMITED VISUAL VARIABILITY

Infographics can be static or interactive. An interactive infographic is a design information product that interacts with the user, that is, in this process there is a program response to certain user actions, such as scrolling the page, clicking a button, moving a slider, and other actions included in the programmed range of interactive opportunities.

In those cases, when it comes to static infographics, regardless of the format in which it is presented, analog or digital, the information is fixed in static versions of the infographic, interaction with the audience is limited only to viewing and reading.

With all that, interactive infographics have various applications open to user interaction. Interactive infographics, which can contain much more information compared to their static versions, are adapted to various programs open to user interaction, and thus they invite the
user inside the arrays of information and provide the opportunity to establish more connections with the information (Banu, Uyan, 2014).

User interaction includes what and how much information to view and at what level of detail, with features such as information selection, search, and active shaping of the content viewed. To get the specific information that the user is looking for, he determines his own paths, goes through the depths of the infographic and discovers the information himself.

The user, who can receive content in the direction he determines, takes a leading position in the process of receiving information. There are many options for interactive infographics depending on the content, purpose, audience and task: from simple programs that display information in pop-up windows when the image is moved, to complex ones that automatically update every second. Leading newspapers and magazines often use interactive infographics in Internet media (Banu, Uyan, 2014).

In the examples of infographics of the interactive type, the user as the subject of interaction can be guided in the certain desired way, choosing the technology and method of data presentation that serves his purpose. Sometimes the infographic design is such that the user looks at specific information to get a meaning that is interesting or relevant to them.

A designer can use an interactive infographic to guide someone through a specific narrative in a linear fashion so that they capture the specific story the designer wants to tell. It should be critically borne in scientific mind that this is not a software choice decision "a or b"; a designer can use a narrative/editorial perspective to tell people what he finds meaningful, interesting, or useful, to encourage them in a proper way to view the arrays of content, and then encourage them with the guarantee to explore the represented data further to find targeted information that is highly relevant to a particular block of related knowledge (Banu, Uyan, 2014).

THE PHENOMENON OF GAMIFICATION IN THE EXPERIENCE OF COMMUNICATION DESIGN

The interactivity of infographics means the mandatory
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presence of the factor of linear duration in the process of learning infographic content, precisely because of this, interactive infographics have a significant potential for even greater maximization of their positive properties in the case of introducing a game option into the process of knowledge acquisition, which is implemented according to the basic principles of game design.

Gamification is actively used in the educational process, and since one of the main functions of social infographics is educational, it can be logically assumed that the straight effectiveness of interactive infographics will reach a qualitatively new level if already tested gamification tools of education are introduced into it.

Gamification refers to the application of “game dynamics, mechanics, and frameworks in non-game settings. Many teachers, with varying degrees of success, try to effectively use game dynamics to increase motivation and success in learning. The analysis of this process shows that the main dynamics that make games exciting are already recognized and used in modern pedagogical practice, albeit under different designations. This lends some programmed legitimacy to a post-knowledge practice that is sometimes dismissed as superficial, and even provides a way to formulate useful guidelines for those who wish to use games to motivate student achievement (Stott, Neustadter, 2013).

The first documented use of the term "gamification" was in 2008 and was defined simply as “the use of game design elements in non-game contexts”.

Since 2008, gamification as a concept has been expanded and defined by various authors as follows:

1. The process of using game thinking and game mechanics to solve problems.
2. The trend of using game mechanics in non-game environments such as innovation, marketing, learning, employee productivity, health and social change.
3. Gamification uses game mechanics basis, perceptive aesthetics and some components of game thinking to engage the variety of people, motivate a straight action, promote productive learning and problem solving (Miller, 2013).

Another prominent aspect of the scientific core of game
design that can potentially and positively impact learning is the integration of storytelling. It has been noted that people absorb new knowledge better when it is embedded in a story rather than a bulleted list, a fact that is a good represented example of how even minimalist simple narrative integration can be used to positive effect.

Providing a unifying story within infographic learning can place learning elements in a realistic and existentialistic context in which particular actions and tasks can be naturally practiced, which is highly effective in increasing the engagement and motivation of infographic users (Stott, Neustadter, 2013).

The educational environment is changing at a very fast pace. The ubiquity of information and communication technologies and our growing dependence on them is affecting how teaching, learning and interaction takes place, and part of this change can be attributed to the changing profile of today's students.

An important lesson of gamification is that the structure and dynamics of the game must have an appropriate relationship with the content. There is a lot of research that identifies a number of benefits associated with gamification, and it can be seen that in addition to the benefits of learning, gamification improves learning, student engagement and is a technological approach that is necessary and relevant for today's student.

Augmented learning through gamification not only engages learners, but also creates learning situations and environments that build a high-demand understanding through straight immediate and highly instructive loops of feedbacks.

It found that there is empirical evidence that games can be effective tools for improving learning and understanding of complex subjects. Some academics believe that gamification helps the acquisition of practical skills and hinders the theoretical concept, as “there is no clear evidence on how best to use gamification for assessments and exams” (Surendeleg et al., 2021).

Research allows us to quantify learning improvement without finding out the reasons, ways of solutions and posteffects, and the strategy of extention of gamification in
education, that actually improves learning (Surendeleg et al., 2021).

Interactive infographics should be included in information systems. The discipline of information systems has traditionally been characterized as a pursuit of knowledge related to productivity and efficiency and their improvement.

A significant body of knowledge has emerged from this rational, utility-oriented premise of helping to develop and build effective and managed organizations and the information systems within them. However, this utility-oriented lens of information systems was oriented towards the use of a variety of non-utilitarian information systems that began to actively appear when information technology advanced enough in its graphics and computing power.

Information systems that seek to satisfy entertainment-oriented needs have challenged the utilitarian premise that previously dominated information systems research and understanding. Thus, the field of information systems science has been expanded by studying hedonic information systems that deviate from the utility/rational core segment of information systems (Koivistoa, Hamaria, 2019).

A first wave of literature began to broaden the perspective of information systems research on intrinsic and hedonistic motivation in the early 1990s, examining the concepts of playfulness and enjoyment in relation to technology adoption and use by developing models related to the adoption and use of hedonistic motivation.

In the same period, there was also a surge in research into the hedonic aspects of consumption in the field of marketing research and in the literature. Since then, however, the divide between rational and hedonic strands in the information systems literature has existed until recent publications on dual and multi-objective systems (Koivistoa, Hamaria, 2019).

When considering information systems, it seems that gamification plays a rather interesting and peculiar role. Traditionally, the field of information systems differs between two types of systems that are designed to address different needs, or primarily utilitarian in nature. From the point of view of motivation, the use of utilitarian systems
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can be considered as external motivation.

This system helps the user achieve a goal that is separate from the system that uses itself. The systems of using hedonism in education are mostly entertaining in nature. These systems allow you to create a pleasurable experience and are used for the purpose of relaxation and entertainment. Therefore, the use of hedonistic systems is considered autotelic and internally motivated in contrast to systems with utilitarian purposes of use.

Examples of hedonistic systems include entertainment-oriented websites and services, video games, blogs, and social networking sites. In recent years, information systems have increasingly been developed to meet the various motives and orientations of users (Koivisto & Hamaria, 2019).

In an attempt to capitalize on the growing passion of young people for games, gamification is a popular phenomenon that aims “to motivate people by applying elements common to games in different contexts”.

Although the first applications of gamification exist in finance, healthcare, education and entertainment, the utility of gamification in different contexts is not well studied.

In an effort to understand how different levels of gamification can be effectively applied to certain information systems to potentially increase the quality end-user motivation, researchers conducted a systematic literature review to identify the game elements in gamification. Their research is a hi-end synthesis of principes of mechanics and dynamics in five clusters: approach to system design, problems, rewards, social factors, and user characteristics. Although this study shows that gamification can motivate end users of information systems, potential risks are also discussed (Thiebes et al., 2014).

Future research should analyze specific implementations of gamification in the context of information systems and examine the associated long-term effects. From a practical point of view, scientists present gamification as an innovative approach to increase the motivation of end users to use information systems and illustrate various options that can be applied to the development of gamification applications (Thiebes et al., 2014).
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The concept grid consists of three categories of gamification design elements: task support, motivation, and attraction. This was determined by scientists taking into account a comprehensive review of the literature together with an experiment on the perception of gamification by designers (Marache-Francisco, Brangier, 2013).

Indeed, the first classification was refined based on a better understanding of how to teach with gamification to match the designers' perceptions.

So, this gamification algorithm is defined as follows:
1. Task support: adaptation of the interaction to a specific user with the help of targeted communication, similar to a game, in order to increase his knowledge and abilities;
2. Motivation: motivating the user with the help of emotional and persuasive elements (solving personal and social problems and corresponding feedback; mechanisms of self-expression and relationships);
3. Attractiveness: elements designed to evoke positive emotions with an engaging universe, engaging interactions, and the use of surprises (Marache-Francisco, Brangier, 2013).

For most educational institutions, information systems are important factors for success in teaching and learning. Although many institutions direct huge investments in educational projects designed to develop or adapt existing information systems, most of their investments are in line with the purpose of the institution.

The success of these information systems in education is that students or end users use the implemented systems. So, the question arises how gamification can motivate end and potential users to use information systems. This has stimulated several studies to explain the adoption and user perception of information systems in education and, importantly, to predict user behavior.

Therefore, researchers have focused on the hedonic aspect of systems, studying intrinsic and extrinsic motivation to improve user experience and sustain ongoing behavior.

In this regard, gamification in information systems attempts to use elements of game design to improve learning outcomes, make monotonous classes more exciting, and make tasks and student learning more interesting. Thus,
gamification can bring benefits in education, especially for Generation Z, who expect interaction between learning and games, and for the institution in cost savings and improved productivity (Ofosu-Ampong, 2020).

EDUTAINMENT IS AN UTOPIA THAT HAS COME TRUE

Another term related to the potential future of interactive infographics is edutainment. Edutainment is a derived word meaning a mixture of entertainment and education or a combination of education and entertainment. The main purpose of this synthesis is to support education through entertainment. Edutainment has been used as a classic formula for creating educational computer games based on learning theories since the 1970s.

It is known that the person who first proposed the idea of learning and entertainment is Robert Heyman of the American National Geographic Academic Union. Robert Heyman called the film about game-type education "Learning through entertainment". David Buckingham, an expert in mass education in England, pointed out that the concept of learning and entertainment, which requires visual material, is a style of learning mixed with play (Aksakala, 2015).

Using these definitions, the general qualities of edutainment can be listed as follows:

1. Fun and interaction, which is thought to be missing in education, attracts the attention of students because of its playful nature.
2. Combining learning and entertainment, as well as increasing the enthusiasm of students when teaching them subjects and information that are difficult to learn.
3. Simplify the learning process by making the subjects and information to be taught more interesting.
4. Attracting students' attention and ensuring the continuity of learning due to the awakening of students' feelings.
5. Facilitate the learning of complex subjects using simulation methods or graphs and visual methods, as in real life.
6. Teaching how to use resources and methods on the value of life, combining educational goals and measurements.
7. Learning how people in the learning environment apply
their own knowledge.

8. Ensuring that people understand or assimilate what they learn.

9. Used to teach students by combining what they perceive or evaluate what they learn.

10. Finally, it gives students an opportunity to spend time creating and experiencing (Aksakala, 2015).

Using decision-making games in sustainability education is a step towards raising the cultural level. Games offer great opportunities as means of learning and entertainment (educational entertainment) for teaching and learning, which has a positive effect on learning outcomes. The researchers' results show that games used to teach sustainability generally improved players' understanding of sustainability issues and improved their knowledge of sustainability strategies (Katsaliaki, Mustafee, 2015).

The connection between game design principles and game mechanics is extremely important. Scholarly research and reviews would benefit from unpacking the elements of game design and looking clearly at what game mechanics are used and what game design principles they serve.

The relationship between game design elements and instructional design elements is very significant. In addition to a more precise analysis of game design elements used in research studies, it is equally important in terms of results to consider learning design elements or pedagogical principles, learning objectives and learning activities that are gamified.

The coincidence of two sets of gamification principles is clearly possible. For example, "rapid feedback" is a principle of game design and pedagogy, while "levels" and "access" go well with "mastery learning", but the mechanics do not overlap.

This raises the attractive proposition that gamification of learning is most effective when the principles of play and learning are shared, aligned, or even equivalent and put into action through game mechanics. At most, the effectiveness of educational game activities seems to be an obvious prerequisite for the effectiveness of gamification. Finally, all types of learning objectives can be gamified equally
effectively. A more thorough analysis of these factors will help to understand which types of learning are effectively gamified (Rabah et al., 2018).

Ideas for edutainment from educators in both European and other countries have shown that technologies and innovations used to enhance edutainment include robotics, the Internet, games, movies, music and television programs. Environmental factors include play activities, classroom design, and campus facilities.

Teaching and learning management included activity-based curriculum development, learning support with an emphasis on a learning-by-doing approach and leisure tourism.

After implementing the Edutainment format, the results showed that all control questions were rated at a high level. Regarding opinions about the implementation of the Edutainment format, the results in each domain and for all items were rated as very favorable to the best level (Pasawano, 2015).

Thus, since gamified and educational-entertainment formats are gaining more and more popularity in the educational process in recent years due to the proven effectiveness of these models, the possibility of developing interactive infographics as an information system opens up, applying the above-mentioned principles not only to meet the expectations of the younger generation, but also to enhance the possibilities of assimilating infographic material in order to achieve the goals of educating the public on socially significant topics.

CONCLUSIONS

Interactive infographics, developed taking into account all comprehensive principles of gamification and edutainment, have extended informational capabilities that maximize their overall effectiveness for a variety of pro-social purposes. The interaction between infographic projects and recipients allows to achieve increased interest, the level of involvement and improve the assimilation of the material. In the near future, the author of this scientific article predicts an increase in examples of high-quality interactive infographics in open access and its popularization among the main target groups that are directly involved in transformative global sociocultural processes.
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