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Use of Augmented Reality in Illustrated Children's Books and an Application Example

Resimli Çocuk Kitaplarında Artırılmış Gerçeklik Kullanımı ve Bir Uygulama Örneği

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Abstract

This study aims to examine the relationship between augmented reality technology and illustrated children's books and convey the importance of children's literature by being supported with an application example. With the developments in digital technology deeply transforming visual media and the internet becoming an indispensable part of our lives, along with the widespread use of portable devices such as smartphones and tablets, it has also had an impact on traditional children's books. The opening of impressive visual worlds for children through augmented reality applications also reflects all of these. The study collected and presented data related to the history of augmented reality technology and the historical process of pop-up books, considered the predecessor of books designed with augmented reality. A literature review was conducted in chronological order to present the development of illustrated children's books produced with augmented reality technology. As part of the study, an augmented reality application was developed for a children's book project inspired by Hezârfen Ahmet Çelebi's flight from the Galata Tower, featuring traces of miniature art. The creation process and technical infrastructure of this application were also provided. Based on the information collected during the research and the experience gained from the illustrated book project, the study highlights the importance of using augmented reality technology in children's literature and provides suggestions to address the shortcomings in this field.

Keywords: *Illustration, Children's Book, Augmented Reality, Pop-Up Books*

Öz

Bu çalışmanın amacı artırılmış gerçeklik teknolojisi ile resimli çocuk kitapları arasındaki ilişkinin incelenmesi, bir uygulama örneği ile desteklenerek çocuk edebiyatındaki öneminin aktarılmasıdır. Dijital teknolojideki gelişmelerin görsel medyayı derinden değiştirmesiyle, internetin hayatımızın vazgeçilmez bir parçası haline gelmesi ve paralelinde akıllı cep telefonları, tablet gibi taşınabilir araçların geniş kitleler tarafından kullanılıyor olması, geleneksel çocuk kitaplarında da etkisini göstermiştir. Artırılmış gerçeklik uygulamalarının çocuklar için etkileyici bir görsel dünyanın kapılarını açması da bütün bunların bir yansımasıdır. Çalışmada artırılmış gerçeklik teknolojisinin geçmişine ve artırılmış gerçeklikle tasarlanmış kitapların atası sayılabilecek hareketli kitaplarla ilgili tarihsel sürece ait veriler toplanarak ortaya konmuştur. Artırılmış gerçeklik teknolojisi ile üretilmiş resimli çocuk kitaplarının gelişimini aktarmak amacıyla literatür taraması yapılmış ve

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kronolojik olarak sunulmuştur. Çalışmanın dâhilinde, Hezârfen Ahmet Çelebi'nin Galata Kulesi'nden uçuşuyla ilgili bir hikâye olan ve minyatür sanatından izler taşıyan çocuk kitabı projesi tasarlanarak, artırılmış gerçeklik uygulaması yapılmıştır. Yapılan bu uygulamanın yaratım süreci ve teknik altyapısı ile ilgili bilgilere yer verilmiştir. Araştırmanın sonucunda toplanan bilgiler ve resimli kitap projesi deneyimi ışığında, artırılmış gerçeklik teknolojisinin çocuk edebiyatında kullanımının önemi aktarılmış, bu alandaki eksikliklerden bahsedilerek bazı öneriler sunulmuştur.

Anahtar Kelimeler: *İllüstrasyon, Resimli Çocuk Kitapları, Artırılmış Gerçeklik, Pop-Up Kitaplar*

Introduction

Illustrated children's books designed for kids explain the concepts and stories within the book through illustrations. There is little or no text in preschool children's books. The simple explanation that children are not yet literate is not enough to explain this. A common point agreed by most pedagogues is that all children, whether in pre-school or when they are of school age, develop visual perception through images. The illustrated children's books, which are one of the first communication tools for children, and which they encounter at the beginning of their lives, directly affect the feelings and thoughts of children through the images and text they contain (Güleç Çakmak & Gönen Sofuoğlu, 1997: 43).

During early childhood, the first stimulus that directs children to the book is the pictures/illustrations of the book, and the book's overall visual value is the primary factor in how much kids love it (Şahin, 2014: 1312). The importance of high-quality illustrations in books for children cannot be emphasized enough not only in terms of education, but also for the visual perception and memory of young readers. Starting from the 18th century, with the advances in modern pedagogy and printing techniques developed in parallel with it, illustrated children's books have taken their place as a special genre in the field of literature. Indeed, today there are writers who write only for children and illustrators who illustrate for them.

The idea of digital printing was introduced in the final quarter of the 20th century, and with the turn of the millennium, printing underwent a rapid evolution process. The developments in electronic press, broadcasting and information technology have started to affect children's books as well. Beginning in the first decade of the 21st century, the process of converting the traditional book form, which was created by printing ink on paper in a printing press with roots in the Gutenberg era, into electronic books (e-books) that can be read on smartphones and tablets has begun. While printed illustrated children's books still exist in all their colors, those read via portable devices continue to gain new dimensions with the technological developments in this field. Especially with the Web 3.0 technology allowing interaction between the reader and the book, such books provide different experiences to their readers in the fields of education and entertainment. In the first part of this study, information about the definition and history of augmented reality will be provided. In the second part, the process extending from pop-up books to children's books designed with augmented reality will be discussed. Following that, various children's books designed with augmented reality will be reviewed. The study will conclude by discussing the design of an example; an application for illustrated children's books created with augmented reality.

2. The Definition and Brief History of Augmented Reality

The term augmented reality can be defined as digital technology that is enriched by adding virtual objects generated by computer technologies to the actual world. The origin of the word “augmented reality” comes from the word *augere* in Latin and means to increase, to expand (Dictionary, 2023). The phrase "augmented reality" was initially employed by Tom Caudell and David Mizell to refer to the superimposition of digital content over the actual environment (Arth, et al., 2015: 3). Caudell and Mizell, in their article published in 1992 with the title “Augmented Reality: An Application of Heads-Up Display Technology to Manual” state that Heads-up display technology is used to “increase” the user's visual field with the necessary information to perform the current task, and therefore they describe the technology as “augmented reality” (AR) (Caudell & Mizell, 1992: 660).

In 1968, Ivan Sutherland, a researcher in computer science at Harvard University, developed the first three-dimensional AR technology with an overhead display, called the Sword of Damocles. This was followed in 1974 by Myron Kueger's development of the Videoplace system, which produced shadows in the user display. In 1998, AR was used for the first time in an American football game. In 1999, NASA used the AR assisted navigation system on the X-38 spacecraft, and in the same year US army began research on AR system uniforms for soldiers. In 2000, ARToolKit that reflects computer images on the camera feed was developed. In 2008, a German automobile company used the AR application in its advertisements. In 2014, Google introduced its AR glasses, Google Glass, but this technology was withdrawn two years later. In 2016, Microsoft introduced its own AR glasses called HaloLens. In 2009, Esquire Magazine became the first print media to use augmented reality on its pages. The prevalence of smartphones and tablets along with the Internet in recent years has allowed the use of AR to spread to the masses, and according to 2018 data, the size of the global AR market has reached $11 billion 140 million, and this figure is estimated to exceed 60 billion dollars in 2023 (ThinkTech, 2019: 4). Presently, AR technology finds its application across diverse sectors such as military, healthcare, marketing, entertainment, and creative arts.

In addition to augmented reality technology’s rational history –based on scientific developments and figures– according to some commentators, the first idea about AR has been literature-based and has been shaped around a children's book (Norman, 2001). In 1901, the American author of *The Wizard of Oz*, Frank Baum, in his book *The Master Key: An Electrical Fairy Tale* mentioned an electronic marker called “character marker” that allows data to overlap with real life (Chen & Xue, 2022: 576). The protagonist of the book - Rob Joslyn - asks the Genie - who materializes whenever he comes into contact with electricity - to grant him the ability to see letter on people's foreheads whenever he encounters them (Bal, 2016: 168). Just as Jules Verne mentioned spaceships and submarines in his books *From the Earth to the Moon* and *20,000 Leagues Under the Sea* years ago, it is not surprising that augmented reality technology has emerged from the imagination reflected in a children's book.

3. From Pop-Up Books to Books Designed with Augmented Reality

Interactive books did not originally emerge with electronic books; their origin is based on three-dimensional or interactive, animated books that have been in existence for about 800 years, which are called “pop-up” in English and *açılır kitap, hareketli kitap, üç boyutlu kitap* in Turkish (Keş & Sarıca, 2014: 268). Since most illustrated books consist of two-dimensional illustrations, the appearance of cut or folded pages creating a three-dimensional effect when such books are opened creates a surprise effect for both adults and children alike (see **Hata! Başvuru kaynağı bulunamadı.**.

Figure 1. Leaves: An Autumn, pop-up book (upwithpaper.com/product/leaves-an-autumn-pop-up-adven/ Date of Access: 11.03.2022).

When the history of pop-up books is examined, it is observed that they had been mostly prepared and used for adults to express layered structures in astronomy and anatomy sciences. In 1765, publisher Robert Sayer produced the first of a series of pop-up books specifically for children (see ***Figure 2***). These simple brochure-like books are embedded with split-page illustrations. When part of the drawing is lifted up or down, a new illustration is created that advances the plot (Rubin, 2005). Classics including *Moby Dick*, *Pinocchio*, *Alice in Wonderland*, and *Puss in Boots* were introduced to readers as pop-up books around the end of the 19th century thanks to advancements in children's literature and publishing. In the following years, pop-up books designed for educational purposes on subjects such as the world of animals and plants, space vehicles, and geography were added to this list (Keş & Sarıca, 2014: 278). Pop-up books brought an alternative perspective not only to the concept of books but also to the ordinary appearance and use of objects, with the feelings of surprise, discovery, and curiosity they created.

Figure 2. en Mab or The Tricks of Harlequin, Robert Sayer, 1771 (collections.library.yale.edu/catalog/2046740 / Date of Access: 20.03.2022).

With their characteristics, dimensional or interactive books, which surprise the reader when the book page is opened, bring to mind books created using augmented reality (AR) technology. However, while it is possible to touch pop-up books physically, AR books can only be perceived through devices such as tablets and smartphones.

In 2001, as one of the prominent examples that combine virtual content with a book, The MagicBook made the dreams of children to fly through fairy tale pages and be a part of the story a reality by using a regular book as the main interface object (see ***Figure 3***). The pages of the book can be turned, the illustrations can be viewed, and the text is legible without requiring any supplementary technology. Nonetheless, as the reader's gaze upon the pages with AR glasses, they see three-dimensional virtual models emerge from the pages. Models appear attached to the printed pages, so users can move around or move the book to see the AR scenes from every possible point of view. Virtual content can be of any size and is animated, so the augmented reality view is an enhanced version of a traditional pop-up book (Billinghurst, Kato, & Poupyrev, The MagicBook–Moving Seamlessly between Reality and Virtuality, 2001: 6).

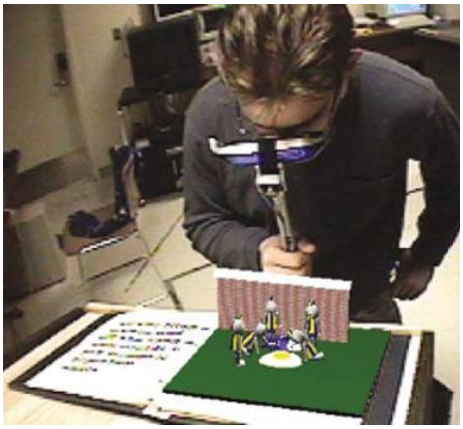

Figure 3. Using the MagicBook interface. (Billinghurst, Kato, & Poupyrev, 2001: 7)

Following the MagicBook, Disney Research introduced a fresh approach to this field by combining children's coloring books with AR and three-dimensional design technology. In this AR coloring book application, which provides a bridge between the animated characters and their colorful drawings, children can color the characters in the printed coloring book using mobile devices such as tablets or smartphones. Once the illustration is captured and monitored, the video feed is enhanced with a textured, animated, and 3D representation of the character, tailored to the child's color choice (Magnenat, et al., 2015: 1201) (see ***Figure 4***). In these coloring books, which are an example of interaction with the user, the image reflected on the smart device can be colored digitally while the physical book is being colored. Additionally, some book designs communicate with the reader through sound, or “talk to” them. Perhaps the most interesting feature of AR books is not only the image that appears on the page, but the movement of these images, that is, the possibility of animation. Animation can be designed in two or three dimensions, or it can be supported by effects such as smoke, light and sound. In terms of interaction, AR books become entertaining just like computer games and engage their readers in the subject.

Figure 4. An example of an augmented reality coloring book algorithm showing the captured texture and colored drawings applied to both the visible and invisible regions of the corresponding 3D characters (Magnenat, et al., 2015: 1201).

4. Augmented Reality-Applied Children's Books

Children's books created with augmented reality (AR) have become more prevalent in bookstores and online stores, particularly in recent years. Books designed to teach the alphabet to preschool children are one of them. The article titled “Fun Learning with AR Alphabet Book for Preschool Children”, one of the first studies on alphabet book design using AR technology, was published by researchers in 2013. The “AR Alphabet Book” in this study was created to advance the existing alphabet learning process using AR technology. ARToolkit software was used in the development of the “AR Alphabet” application. To view the virtual patterns, the user needs a webcam to capture a video image of the real world, pattern markers, and a computer monitor to view the virtual pattern superimposed over the pattern markers. After the AR application is started, users can use pattern markers to view virtual objects according to the provided instruction (see ***Figure 5***). The study revealed that engaging technologies such as AR create excitement, pleasure, and a will to participate in the learning process (Rambli, Matcha, & Sulaiman, 2013: 218). In contrast to the "AR Alphabet Book" and comparable ones, which require desktop-based computer support, in a study published in 2013, the tale *Thirsty Crow*, written for preschoolers learning numbers, offered a fresh perspective on technology-based children's books by combining mobile AR application with the design of the printed book (Tomi & Rambli, 2013: 123) (see ***Figure 6***).

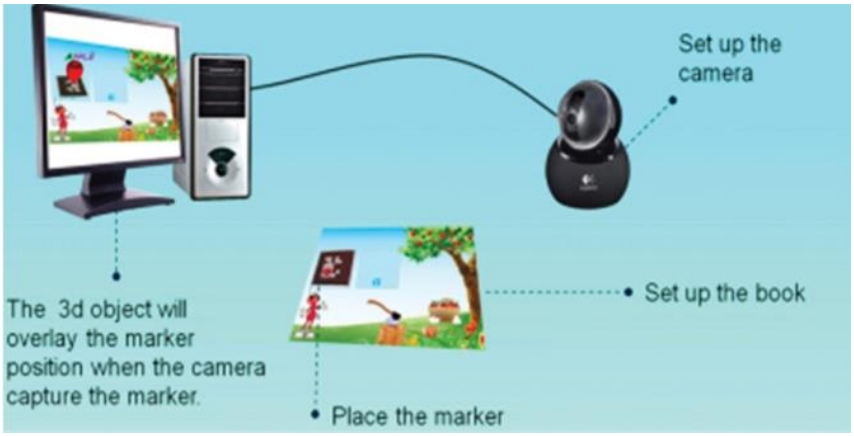

Figure 5. AR Alphabet Book working system (Rambli, Matcha, & Sulaiman, 2013: 214).

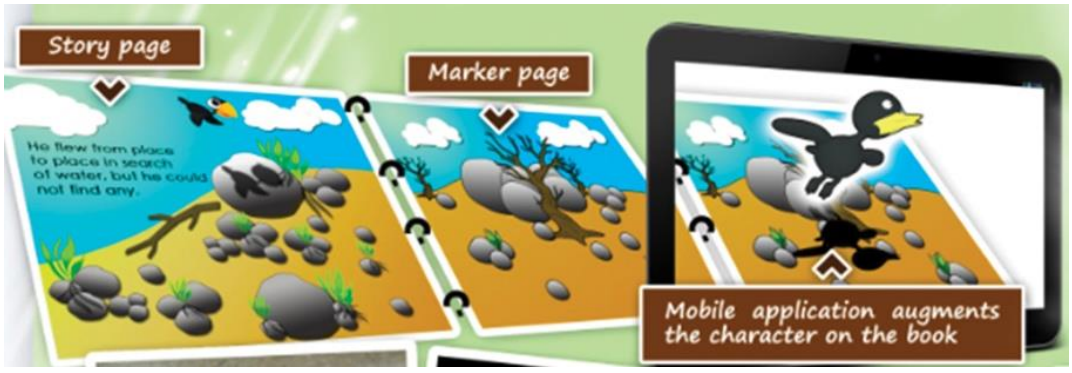

Figure 6. The general structure of the Thirsty Crow book (Tomi & Rambli, 2013: 125).

Later, researchers continued to publish numerous studies that contributed to the development of AR technology and its benefits to education. In 2014, South Korean researchers published a storybook called *AR Petite Theater* using AR technology to improve children's drama skills (Gil, Rhim, Ha, Doh, & Woo, 2014: 13). The 2012 hardcover edition of Martin King's book *French Connection* from the adventure series *Jack Hunter* was updated in 2014 with augmented reality (AR) technology, giving the stories new meanings (Freeman, 2014).

The year 2016 marked the introduction of 'MyVision AIR,' an interactive AR application geared towards enhancing the way adult learners experience reading by fostering greater engagement between the user and conventional printed materials. The book included 3D models, animations, music, and videos (Alousify & Mstafa, 2022: 265). Another study in 2016 described the process of creating AR-enhanced flashcards for Arabic language learning. Based on the research results, it was observed that it made it easier for students to learn Arabic by supplementing their knowledge with flashcards enriched with AR (Zainuddin & Idrus, 2016: 5). In 2016, TeachAR was introduced as a research initiative aimed at providing non-native English speakers with an augmented reality (AR) solution that facilitates the acquisition of basic English vocabulary, including colors, shapes, and prepositions. As stated in the article, TeachAR is the first AR language learning system targeting children under the age of 7, and is also the first study to use AR, 3D shapes and spatial relationships for English learning (Dalim, Dey, Piumsomboon, Billinghurst, & Sunar, 2016: 83).

In 2018, a kindergarten-focused mobile app utilizing marker-based AR technology has been employed to improve children's comprehension or understanding of vowel usage and numerical concepts. When focusing on a letter or number using the camera of the smartphone application, an image related to the subject is projected in augmented reality. The results of the research suggest that the mobile education application of AR improves the level of learning of letters and numbers in children over the age of four (Cieza & Lujan, 2018: 358).

In 2019, a study was published with the aim of exploring the significance of technology use in early childhood education by comparing AR-generated flashcards with traditional printed flashcards. With this aim, a study was conducted involving 98 children aged 5-6 years and four teachers. One group of kids used words from the AR flashcards while the other used traditional flashcards when addressing the topic of animals. To assess the efficacy of both methods, children were given vocabulary tests and interviews were conducted with teachers. The findings demonstrated that vocabulary acquisition in children was significantly enhanced by both the AR and traditional flashcard approaches, with no notable difference in effectiveness observed between the two methods (Chan & Chen, 2019: 1812).

In 2022, the proposed AR Supported Children's Book for Intelligent Teaching and Learning of Turkish Letters was presented. This book teaches young readers the Turkish alphabet and provides a sample word using each letter. When the target image is encountered, the software exhibits three-dimensional objects, sequentially presents the sound of each letter's pronunciation, and showcases a 3D representation of a word that encompasses that particular letter (Alousify & Mstafa, 2022: 275).

AR books are also available and produced in the Turkish book market. In the book titled *One Child One Miracle* prepared by Gaga Publishing in both Turkish and English in 2019, computer game addict Maya begins to explore nature with the experiment set she was given as a gift (see ***Figure 7***) (Bir Çocuk Bir Mucize, 2019). Another AR-supported book from Gaga Publications published in 2021 is titled *AKUT Taught Me This*, prepared for AKUT Search and Rescue Association to make children understand the importance of first aid and to inform them about first aid (see ***Figure 8***) (AKUT Bana Bunu Öğretti, 2021). In addition to classic storybooks such as *The Little Prince* in the Turkish market; books supported by AR that educate children on subjects such as the alphabet, animals, space, dinosaurs, cooking, and human anatomy are offered for sale. These augmented reality books are activated by downloading an application from the address on the inside or back page of the printed book to a portable device. Some books can only be read on a limited number of devices, while others are available to anyone who downloads the app.

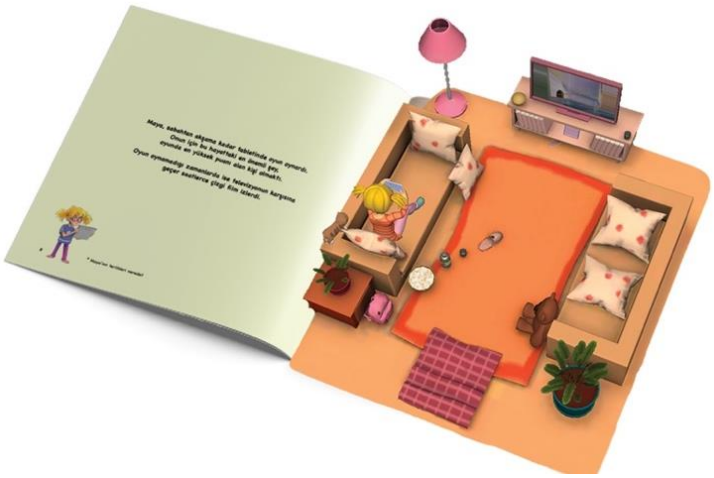

Figure 7. An image from the book One Child One Miracle (https://gagayayinlari.com/urun/bir-cocuk-bir-mucize/ / Date of Access: 25.04.2022).

Figure 8. A view from the book AKUT Taught Me This (https://gagayayinlari.com/urun/bana-bunu-akut-ogretti/ / Date of Access: 27.04.2022).

5. An Example of Illustrated Children's Books Application Designed with Augmented Reality

The most crucial component for a well-designed children's book, regardless of the technique—traditional or technological—is imagination. This illustration experiment with AR technology is based on the one-paragraph story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar, written by Evliya Çelebi, who lived hundreds of years before Frank Baum and Jules Verne, who lived during the years of the industrial revolution (Gökyay, 1996: 318) (see ***Figure 9*** and ***Figure 10***).

For smart portable tools to generate a virtual image in a real environment, it is essential that the target image they identify is two-dimensional, meaning it lacks depth and is flat. This flat image can also be provided with a QR (Quick Response) code, a photograph, graphic design, or drawing. This two-dimensional surface is naturally chosen as an illustration in children's books. In the story of Hezârfen Ahmet Çelebi, miniature art was chosen both for its two-dimensional quality and its relevance to the historical period (Konak, 2014: 46).

Figure 9. Illustration experiment with AR technology based on the story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar (Personal archive).

Figure 10. Illustration experiment with AR technology based on the story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar – Maiden's Tower (Personal archive).

Miniature, which is identified with Eastern art today, was a book illustration technique that was also used in the West until the Renaissance. However, starting from that century on, Western art has taken another path from the East as it began using elements such as perspective, light and shadow. The miniature painters [*nakkash*] of the East, who were not interested in leaping innovations and art movements, transferred the traditions they inherited from their masters to their students without much change (Toprak, 2020: 63). While some critiques attribute the non-use of perspective and shadow in miniature painting to religious reasons, most of them explain that the image is more important than the form in Eastern painting. Like their colleagues in China, India, Central Asia and Iran, Ottoman miniature painters also raised great masters while painting historical events. One of these masters is Matrakçı Nasuh, who lived during the reign of Suleiman the Magnificent. The artist participated in expeditions with the sultan and created drawings of the cities he went to and left us significant works. The miniature of Istanbul, which shows Pera and the historical peninsula, drawn by Matrakçı in 1530, was a source of inspiration for the augmented reality experiment (Selvi & Keskin, 2017: 33) (see ***Figure 11***). In the Hezârfen Ahmet Çelebi project, which has been interpreted from a contemporary standpoint, the urban changes taken place in Istanbul after five centuries have been reflected ironically. The diminished Pera's walls, historical wooden houses, sailing boats have been replaced by modern architecture and ferries. In this case, Hezârfen Ahmet Çelebi's flight attempt comes to an end by crashing into a high-rise building in the Maslak district of Levent, where the city's skyscrapers are located, because of a change in the wind while Hezârfen is flying over the Maiden's Tower (see ***Figure 12***).

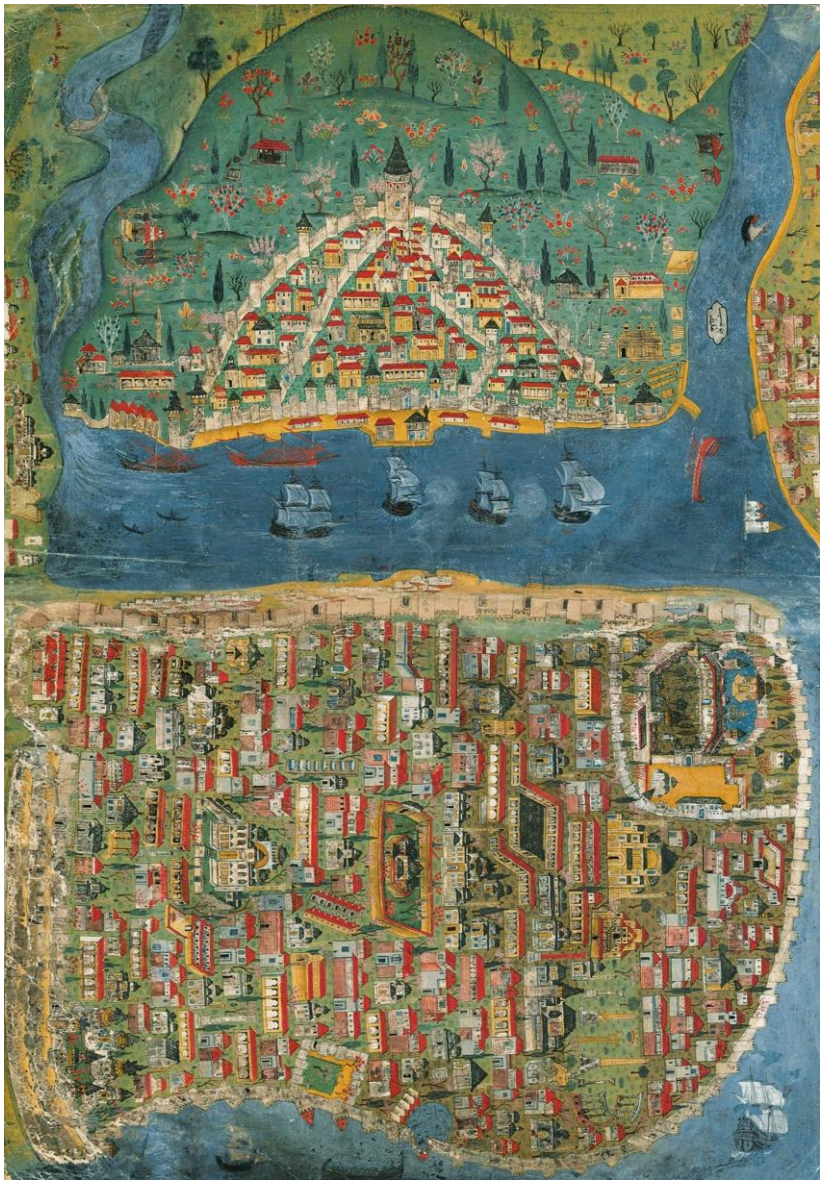

Figure 11. Matrakçı Nasuh – Miniature of İstanbul (http://bit.ly/3Uxn3mV / Date of Access: 12.05.2022).

The visual style of the work has been derived by examining Matrakçı Nasuh's maps, color palettes, and pictorial language. The aim here is to create a correct synthesis by visually nourishing this aerial experiment of Ottoman history with the language of traditional arts. Elements belonging to miniature art, which is entirely produced by hand using traditional crafts, have been combined with digital illustration techniques in the initial stage and transferred to the computer screen. Then, this art, which is two-dimensional and devoid of perspective, has been brought together with the third dimension and ultimately brought to a new awareness through augmented reality technology. Although traditional arts have been referenced in this work, it is important in terms of facilitating a connection with their own cultures for artists to evolve together and produce different works. There are many artists such as Bedri Rahmi Eyüboğlu, Nurullah Berk, Yüksel Arslan, and Devrim Erbil

who have merged the past understanding of art with contemporary topics and claimed their place in art history, arguing that artists who produce works detached from their roots cannot be original. Nazan Erkmen, who approaches this subject with sensitivity in the field of illustration, is seen to carry many traces from Anatolia and Mesopotamia in her drawings (Karaata, 2018). Murat Palta, a prominent name among young artists who combine miniature art with illustration, stands out. The artist's drawings, which depict popular films such as "Kill Bill" in a miniature style using both digital and traditional methods, have sparked a lot of discussion, thus bringing the relationship between past and contemporary art back into the spotlight (Palta, 2014).

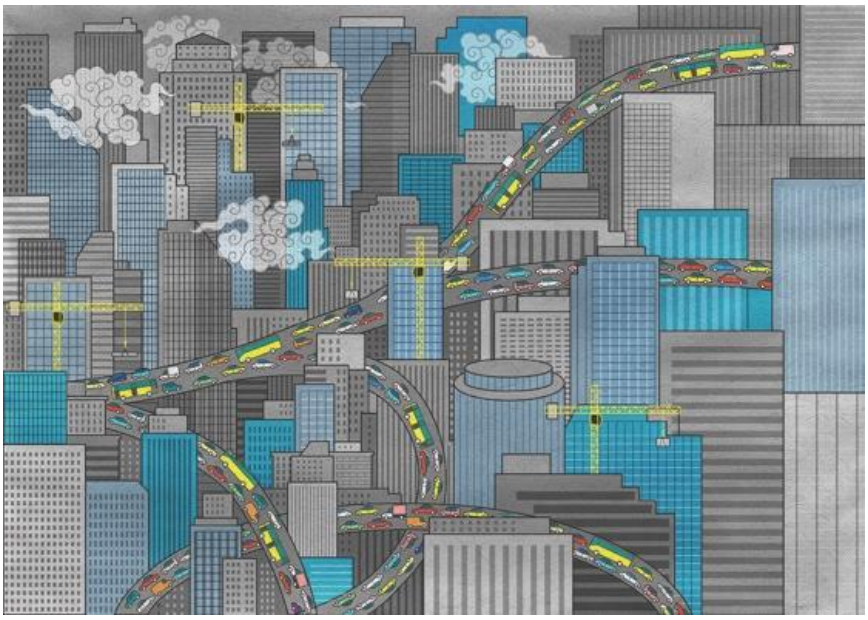

Figure 12. Illustration experiment with AR technology based on the story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar – The high-rise district (Personal archive).

In the story, Hezârfen Ahmet Çelebi and the seagulls were modeled and animated in the Cinema 4D program due to both the augmented reality application in which the three-dimensional feature can be used and the fact that this technology is of Western origin. However, to match the style of the background, his outfit is designed with an embroidery pattern used in miniatures (see ***Figure 13***).

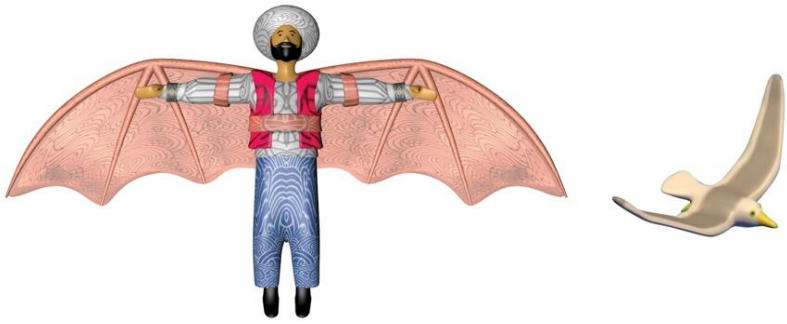

Figure 13. AR children's book experiment 3D Character designs (Personal archive).

Apart from Adobe Photoshop and Cinema 4D, the Artivive application was initially used for augmented reality experiments, but later Unity, which works with C + software –used especially for game design programs– was preferred due to the requirements for three-dimensional animation (see ***Figure 14***).

Figure 14. Examples of the working principle of the AR children's book experiment (Personal archive).

Conclusion

Art and printing have always been closely linked and have evolved together with technological advancements. Children's books have always been a prime example of this relationship, where the techniques used by artists and illustrators have changed significantly over time. The advancements in technology have given rise to new ways of creating illustrations and bringing them to life. One such technology that has emerged in recent years and has been gaining momentum in the children's book industry is augmented reality.

Augmented reality has opened up new avenues of interactive and immersive experiences that can enhance the reading experience for children. AR allows digital elements to be overlaid onto real-world images or objects, thus creating a mixed reality experience. This technology can make illustrations come alive, provide additional information, and even create interactive games within the book. With AR, children can engage with the book in a way that is impossible with traditional books. For example, they can see characters jump off the page and come to life, explore a setting in 3D, or solve a puzzle to progress in the story.

AR technology in children's books can provide a unique and dynamic experience that can increase engagement, improve retention, and encourage exploration. It is especially useful for children who are visual learners or have difficulty with traditional reading methods. AR can make reading more accessible and enjoyable, which can help foster a love for reading and learning in children. AR technology in children's books also has the potential to make learning fun and engaging by providing interactive and immersive experiences.

However, there are some challenges in implementing AR in children's books. The industry requires technical expertise, specialized equipment, and content creation, which can be expensive and time-consuming. There is also a lack of awareness among readers and publishers about the benefits of AR. Additionally, the technology is still in its early stages of development, and the cost can be prohibitive for some publishers.

To fully realize the potential of AR in children's books, art and design schools must incorporate this technology into their curricula alongside traditional techniques. By providing training in three-dimensional modeling, animation, and other related software, schools can help prepare the next generation of illustrators and artists for the digital Renaissance. This will also ensure that the industry has a supply of talented artists who can create engaging and interactive content for children's books.

In conclusion, augmented reality is a game-changer in the world of children's books. AR technology can create a more engaging, interactive, and educational reading experience that can capture the imaginations of young readers. With the potential to make learning fun, accessible, and enjoyable, AR in children's books has the power to foster a lifelong love for reading and learning. The challenges may seem daunting, but with the right investment and training, augmented reality in children's books can become a new standard, pushing the boundaries of storytelling and creativity.

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Image References

Figure 1. Leaves: An Autumn, pop-up book (upwithpaper.com/product/leaves-an-autumn-pop-up-adven/ Date of Access: 11.03.2022).

Figure 2. en Mab or The Tricks of Harlequin, Robert Sayer, 1771 (collections.library.yale.edu/catalog/2046740 / Date of Access: 20.03.2022).

Figure 3. Using the MagicBook interface (Billinghurst, Kato, & Poupyrev, 2001: 7).

Figure 4. An example of an augmented reality coloring book algorithm showing the captured texture and colored drawings applied to both the visible and invisible regions of the corresponding 3D characters (Magnenat, et al., 2015: 1201).

Figure 5. AR Alphabet Book working system (Rambli, Matcha, & Sulaiman, 2013: 214).

Figure 6. The general structure of the Thirsty Crow book (Tomi & Rambli, 2013: 125).

Figure 7. An image from the book One Child One Miracle (https://gagayayinlari.com/urun/bir-cocuk-bir-mucize/ / Date of Access: 25.04.2022).

Figure 8. A view from the book AKUT Taught Me This (https://gagayayinlari.com/urun/bana-bunu-akut-ogretti/ / Date of Access: 27.04.2022).

Figure 9. Illustration experiment with AR technology based on the story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar (Personal archive).

Figure 10. Illustration experiment with AR technology based on the story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar – Maiden's Tower (Personal archive).

Figure 11. Matrakçı Nasuh – Miniature of İstanbul (http://bit.ly/3Uxn3mV / Date of Access: 12.05.2022).

Figure 12. Illustration experiment with AR technology based on the story of Hezârfen Ahmet Çelebi's flight from Galata Tower to Üsküdar – The high-rise district (Personal archive).

Figure 13. AR children's book experiment 3D Character designs (Personal archive).

Figure 14. Examples of the working principle of the AR children's book experiment (Personal archive).

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