Changing and Developing Museology: Assessments on the Museums of the Future and the Possibilities

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Abstract

The increasing (foreign trade-oriented) competitiveness with the production of technology provides local governments with a number of facilities both in terms of export and administration. In this respect, almost all developed countries have established technological infrastructures and integrated them into the corporate organizations in their homelands. The situation we are talking about has made "technology alliances", one of the popular definitions of the recent period, a necessity. In this way, changes and transformations focused on speed, practicality and ergonomics related to technology have reached the potential to have a global-scale impact. We are aware of the point reached in the 20th century of postmodernism. It is possible to say that the effect it evoked in the last quarter of the century has left it with a similar one. However, technology has a use area that appeals to the collective consciousness by creating widespread effects with its renewed and interdisciplinary features. There is now a situation that should be foreseen in decisions on national policies and that affects the sustainability of large-capital institutions. On the other hand, today, the emphasis is on information and the information societies that come with it. Information societies are societies that have the ability to assimilate the benefits provided by the information of information urgently. Due to these characteristics, while their intellectual needs deepen day by day, their expectations from the culture industry are different. Museums, one of the indispensable actors of the cultural industry, closely follow technology while striving to meet the intellectual needs of information societies among their target groups. In line with their functions, there are already many "current" technologies that they have added to their fixture lists. Their knowledge in the process signals that they will continue their current approach in the coming years. Research; It has a flow that sets out from the technologies that museums have acquired/continue to acquire and evaluates and interprets the later stages of the process. The technologies discussed in the subheadings range from augmented reality to NFT and Metaverse. In the last part, where this diversity is examined, there are a number of suggestions for museums that want to benefit from the benefits of Industry 4.0.

Keywords: Museums, Museology, Exposition, Technology, History of Technology.

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Değişen ve Gelişen Müzecilik: Geleceğin Müzeleri ve Olasılıklar Üzerine Değerlendirmeler

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Öz

Teknoloji üretimi ile artan (dış ticaret odaklı) rekabet gücü yerel yönetimlere hem ihracat konusunda hem de idari açıdan bir takım kolaylıklar sağlamıştır. Bu açıdan gelişmiş ülkelerin hemen hepsi teknolojik altyapılar kurmuş ve bunları ana yurtlarındaki kurumsal organizasyonlara entegre etmiştir. Bahsini geçirdiğimiz durum son dönemin popüler tanımlamalarından "teknoloji ittifaklarını" bir gereklilik haline getirmiştir. Bu sayede teknolojiyi ilgilendiren hız, pratiklik ve ergonomi odaklı değişim ve dönüşümler küresel ölçekli bir hâl alabilme potansiyeline erişmiştir. Gelinen noktanın bizleri postmodernizmin 20. Yüzyılın son çeyreğinde uyandırdığı etkinin bir benzeri ile karşı karşıya bıraktığını söylemek mümkündür. Çünkü teknoloji yeni ve disiplinlerarası özellikleri ile yaygınlaşıp kolektif bilince hitap edebilecek bir kullanım alanı kazanmıştır. Artık ulusal politikalara yönelik kararlarda öngörülmesi gereken ve büyük sermayeli kurumların sürdürülebilirliğine tesir eden bir vaziyet söz konusudur. Öte yandan bugün bilgi ve onun getirisi olan bilgi toplumları üzerinde durulmaktadır. Bilgi toplumları bilginin enforme edilmesi ile sağlanan getirileri ivedilikle özümseyebilmektedir. Bu özelliklerinden dolayı entelektüel ihtiyaçları günden güne derinleşmekte ve kültür endüstrisinden beklentileri farklılaşmaktadır. Kültür endüstrisinin vazgeçilmez aktörlerinden müzeler hedef kitleleri arasında yer alan bilgi toplumlarının entelektüel ihtiyaçlarını karşılama yönünde gayret gösterirken teknolojiyi yakından takip etmektedir. İşlevleri doğrultusunda daha şimdiden demirbaş listelerine katmış oldukları pek çok "güncel" teknoloji bulunmaktadır. Süreç dâhilindeki birikimleri mevcut yaklaşımlarını ileriki yıllarda da devam ettireceklerinin sinyallerini vermektedir. Araştırma, müzelerin edindiği/edinmeyi sürdürdüğü teknolojiler üzerinden yola çıkan ve sürecin ileriki aşamalarını değerlendirip, yorumlayan bir akış ile ilerlemektedir. Alt başlıklarda ele alınan teknolojiler artırılmış gerçeklikten NFT ve Metaverse'e uzanan bir çeşitlilik arz etmektedir. Söz konusu çeşitliliğin irdelendiği son kısımda ise Endüstri 4.0'ın getirilerinden faydalanmak isteyen müzeler için bir takım öneriler yer almaktadır.

**Anahtar Kelimeler:** Müzeler, Müzecilik, Sergileme, Teknoloji, Teknoloji Tarihi.

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Introduction

Simple hand tools have been used by many civilizations in the historical process. The ancient Greeks increased their maritime skills to higher levels with these tools. With the transfer of the applied methods from generation to generation, the fishing profession and maritime trade in the Aegean region have progressed and the maritime culture has been enriched. Over time, the equipment and information available; It has been moved to other geographies accompanied by movements such as trade, migration and war. For example; victories of Alexander the Great, one of the greatest commanders in history, did not only allow for cross-cultural sharing. With these victories, the sharing of ongoing teachings was also realized, and a brilliant period was opened for civilization. Centuries after the dissolution of Alexander the Great's empire, a prominent name emerged in the Anatolian geography with its vision. Al-Jazari combined his knowledge with imagination to create wonders in engineering, and the robots he designed became an inspiration for the great masters after him. Leonardo Da Vinci's enormous paintings and the technical notes he left behind have enabled us to sail to new horizons both aesthetically and intellectually. As Nikola Tesla strives to take us one step further, he has proven that having a foresight and focusing on the future are things that can make a difference.

When the path to technical knowledge is put on the table, many more names can be found that directly or indirectly touch and contribute to this phenomenon. However, in order to talk about the next steps of our development process, it is necessary to examine the technology mainly. The age we are in is the information age. Leading role in information age technologies; computers, smartphones, internet and social media. These tools, which are communication technologies at their core, are now frequently encountered in our home and work environments. However, they are in a transformation/metamorphosis with continuity (Çubukçu, 2011, p. 1024). Current computers have more ergonomic and more minimal designs than in the past. Smartphones have already outpaced the keys. Popular devices of a period with the functions they have gained; digital cameras and portable music players (walkmans) have been removed to drawers. At the moment, there is no need for cables to use the Internet. With the increasing number of Wi-Fi networks, connections can be established almost anywhere. Social media continues to be updated. The orientation purposes no longer include only the need to communicate and have a pleasant time (Figure 1). Such environments are wrapped in a structure that promises professional careers and offers economic returns to account holders (Karaçor, 2009, p. 124).
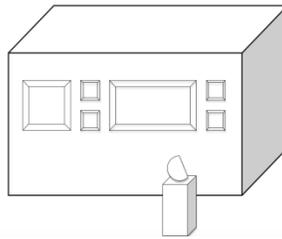
Figure 1. Today's museums have multiple functions and technology is in a position to serve many of these functions.

As can be understood, the momentum for the progress of civilization has not yet slowed down. Therefore, it is essential to observe and experience technological changes in order to be successful in the professions we have and to move forward in the areas we are interested in. Because the inferences we will gain from these observations and experiences will enable us to make the right investments by taking the right decisions on behalf of our future. However, in today's conditions, whether utopian or dystopian, it is very difficult to make comprehensive predictions about technology. The benefits of this concept have not been able to evoke the same effect in all societies due to social, cultural and economic differences. In addition, when technology is mentioned, it is not possible to talk about a single use area or a single stage of daily life. In this context, it is necessary to act with a limitation when conducting research on technology (Akıncı Vural & Sabuncuoğlu, 2008, p. 7-8).

Considering the distance traveled by the phenomenon of technology and the opportunities it provides, it is likely that we will come across many creative initiatives of extraordinary nature in the coming years. In this respect, the sub-titles of the article have been written in a way to appeal to museums, which are one of the cultural channels. Accompanied by literature review; tools to help with exhibition, archives, educational events, etc. were touched upon, and "horizon lines" containing references from recent technologies were produced for them.

1. Definitions and Regulations

Global organisations such as ICOM strive to ensure that definitions of museums point to current situations and have general validity (İşçi et al. 2020, p. 30). But definitions aren't the only things that need to be updated. In the face of the changes that have taken place, laws and regulations are obliged to review themselves. For example, the subject of private museums (foundation museums) is a concept that does not contain definite lines in Turkey, which was known for the richness of its cultural assets until forty years ago. However, with a regulation written in 1984 (in the face of the increase in attempts to enrich and exhibit independent collections and the desire to formalize the collections of legal and real persons), first the qualifications that private museums should have were determined and then the operating criteria of such museums were declared (Artan, 2012, p. 109). Since then, the number of private museums in Turkey has exceeded two hundred. This number is ahead of the number of state museums. So, as museums proliferate, the percentage of private museums in the total number of museums increases (which is likely to increase in the future), what effects can the consumption of technology have on laws and regulations?

If we start with a time frame that is not too far away, "new normals" have been declared in almost every country with the COVID-19 pandemic, which has started to have an impact on a global scale since the first quarter of 2020. In accordance with the social distance rules based on the new normals, education and training were suspended, the wearing of masks in multiple environments was compulsory and access to public spaces was restricted. When the periodically announced curfew restrictions / prohibitions and QR code follow-up practices are added to these, daily living conditions have become more and more negative. However, the measures have paved the way for other practices. The phenomenon of distance education made a breakthrough during the pandemic period, and with the acceleration of the relevant infrastructures of the

institutions, a large number of students took over the computer to meet their cultural needs and complete their homework/research. Within the process, museum doors remained closed for a long time. But during the restrictions/ prohibitions, the demand for virtual museums increased, with the access of archives away from the eyes, the visits began to take place entirely from homes, web pages (Kasapoğlu Akyol, 2020, p. 77-79)..

It is not possible to see how long mass events such as pandemics will last or to guarantee that such events will not be encountered once again. However, with the experience and observations gained in 2020, it is not difficult to predict that museums will remain in greater interaction with virtual media in the future. Many countries now have laws and regulations that address cultural, historical and natural riches. These are primarily focused on maintenance and protection, that is, to make the condition of existing collections or objects sustainable. The current articles touch on a number of issues, from sanctions to be encountered if their culture and nature assets are damaged, to copyright issues. But to what extent do the laws and regulations we have cover technology, the phenomenon of remote access and virtual museums? In order for cultural and aesthetic needs to be interrupted, the orientation of museums to virtual museum practices is likely to become a general validity in the future. Of course, this brings with it discussions about what criteria the relevant applications, namely virtual environment exhibitions, should have. Virtual media exhibitions are three-dimensional (3D) applications that provide a 360-degree perspective to visitors at the beginning of the computer and allow them to move some objects under the lens by directing them to specific points. However, many digital content has started to be launched with virtual museums or virtual exhibition titles, from photo albums on social media of individuals or institutions to one-minute videos on web pages of art galleries. This situation is likely to mislead the visitor and waste time with applications far from expectation. Therefore, drawing a descriptive framework is an issue that should be emphasized in adding the parser definitions or principles of such practices to the relevant regulations (Figure 2).
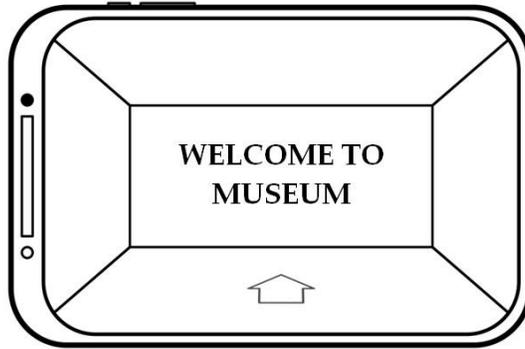
Figure 2. Portable computers and smartphones, facilitate access to museum web pages or virtual museums

As another matter, internet media are open to communication today. However, virtual exhibitions accessible via the internet are applications that do not allow visitors to communicate with each other and keep the profiles separate (independent) by not hosting derivative tabs. These applications are designed to appeal only to individual visits. However, there is no technical obstacle to moving group trips to virtual

environments (multiple visits) in a time period when communication technologies are progressing. So the main question to be asked is what sanctions can be made in the negative events that can be confused if the communication tabs are adapted to virtual museums, virtual exhibitions and if this becomes widespread (cyber crime attempts). In virtual museum applications with a communication tab open to interpretation and contact, where profiles can communicate with each other, a visitor is likely to exhibit inappropriate, unpleasant attitudes towards another visitor. All criminal acts and behaviors in the virtual environment concern the security units of the countries concerned, the information and cybercrime offices. However, it is also the responsibility of the moderators within the institution to take measures that will not give a place to the occurrence of these situations or to take the necessary steps if they occur. The essence of the word museums may remain in the future to prepare a regulation or a protocol for virtual museums and virtual exhibitions to protect their visitors and brand values in the future. From a broader perspective, it can be among the alternatives to creating emergency plans that focus solely on the virtual world.
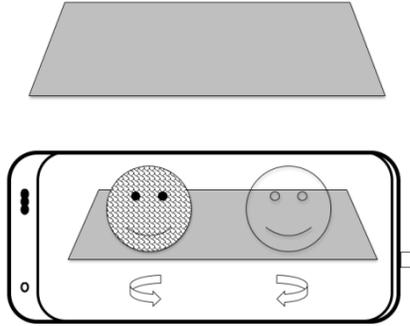
2. Augmented Reality (AR) Archives

Vivariums are scientific sites where creatures such as reptiles, rodents, fish and insects are housed in environments suitable for their nature and visitors can observe them. Today, there are vivarium in many countries of the world. While these can serve as sub-units in museums, there may also be research-oriented institutions supported by foundation capitals.

Sustainability of flora in vivariums is a quite tough work and requires attention. The heat and nutritional balances of living things should be followed precisely. Periods such as breeding times or hibernation should be considered with continuity. Security measures should be in line for both visitors and creatures under control.

One of the most important developments in displaying (or presentation) in the 21st century is augmented reality (AR). Such applications are available in the form of portable equipment (smartphones, tablet computers, wearable technologies). During their use, virtual models are superimposed on the depth of the visitor viewfinder or screen. It is possible to examine these models from different angles and from different distances (Coşkun, 2021, p. 104).

For example, in Germany, there is an extremely deep variety of sea and land creatures in the vivarium in the Landesmuseum Hannover (See. www.landesmuseum-hannover.de). However, this diversity brought with it some responsibilities. In the previous paragraph, we talked about the heat balance of living things. In the vivarium in the Landesmuseum Hannover, this balance was observed and multifaceted from general air conditioning to microclimates. However, this situation required periodic checks and increased spatial expenses. Unexpected and long-term heat changes can lead to damage to living things. Another risk is that if visitors exhibit unusual behavior, the creatures are damaged. Not all living things are behind glass walls in vivariums. There is only one wire mesh, fence or short barrier between the people and the visitors. These barriers can sometimes be supported by a ditch and sometimes a puddle. However, rarely, visitors try to touch the creatures with the excitement created by the environment in which they are located, and attempt to feed them.

Similar initiatives that do not have any risks for visitors are likely to be accepted and widespread in societies with high technology consumption. In such a situation, institutions such as museums may invest more in augmented reality, where they can save both space and responsibility, rather than soft and costly vivariums (Figure 3).

Figure 3. Augmented Reality (AR) applications are among the popular technologies of today. In addition, such technologies are rapidly integrated into smartphones.

Thanks to the augmented reality technologies of the future, the chance to observe without encountering the negativities at the top can be accessed. For example, learning about anatomy and mobility by examining a flashy and poisonous frog native to Amazon forests from close plan and from different angles may not be as easy as thought under normal circumstances. A derivative review can put both the visitor and the creature who does not want to interfere with the habitat in a difficult situation. Augmented reality technologies can stand out in this type of review, thanks to their progress and new ergonomic features to gain. In such an examination, a detailed and anatomically fidelity model of the frog can function the same.

If we offer a different perspective, one of the main functions of museums today is documentation. This function, which points to more archiving works, is the task of sorting and registering existing collections. If museums leave vivariums in the background and focus on augmented reality, a different type of digital archive can be created for visitors. If it is necessary to be more descriptive, there are different breeds of Amazon frogs that we have mentioned. This also applies to other reptiles, fish, insects, birds and mammals. If museums adopt augmented reality and decide to use it instead of vivariums that stand out with its vibrant diversity, it may be possible to talk about classified augmented reality archives that host digital models of related creatures. Within this prediction, visitors can have the chance to study the creatures they wonder through the increased reality archives. It can reflect those creatures to their visors or screens, and even compare multiple creatures on the same plane at zero risk (Boyraz, 2020).

(This part of the text is also included in the blog page of Bahariye Art Gallery in Istanbul. "Ufuk Çizgileri: Geleceğin Müze Teknolojileri, Vivaryum Arşivleri", bahariyesanat.com. [25.06.2020]).

3. Mobile Games at Educational Events

John Hanke, the founder of Niantic, made a big voice in the mobile game world when he launched Pokémon GO in 2016. In a short time, thousands of people downloaded the

game and the streets were filled with Pokémon hunters (Yalçınkaya et al. 2017, p. 91). The most important feature of the game was that smartphones take advantage of augmented reality that can be compatible with operating systems IOS and Android. Taking advantage of real media maps, this game encouraged players to go to new places and to be in different venues. In this way, stronger and rare Pokémons were discovered and caught (Ertel et al. 2017, pp. 277-278).

Today, the educational events of the museums are in a pedagogical infrastructure. Most museum educators are individuals who graduate from relevant fields and have experience in the subject. Museums prepare various training packages under the supervision of these individuals and organize educational events with certain gains. Treasure hunt is one of these events. In the treasure hunt, children of certain age groups try to find hidden items and objects of replication based on the rope tips given to them in a safe environment within the museum area. Such events direct participants to research and discovery. It gives experience in catching tips and concluding through these tips (Figure 4).
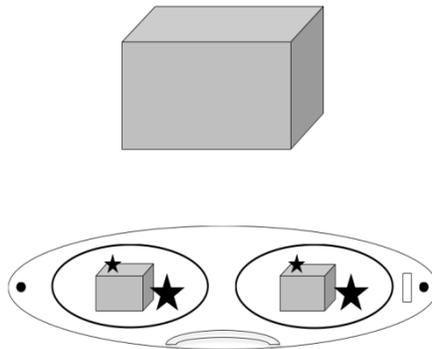
Figure 4. Augmented Reality (AR) technology, which is compatible with IOS and Android, has also brought a new breath to the gaming industry.

If technology consumption increases in subsequent years, digital initiatives are likely to be channeled to educational activities. In this context, it is necessary to follow mobile game technologies well. Because today, the generation born after 2000, known as the "Z" generation, has gained habits for mobile games. This generation takes a warm look at technology and the use of technology at almost every stage of everyday life. Further research on mobile games in the future is likely to emerge innovations that will adapt and integrate these games to the training field. On the other hand, some materials are provided to the participants in the educational events in the museums today. These materials can also be digitized as technology advances and moved to virtual environments.

For example, events such as treasure hunting in future museums are smart glasses provided by the institution instead of printed maps (See. Google Glass) and mobile game software whose license belongs to the museum. Essentially, game designers have reached the ability to shape derivative games from today in line with educators' expectations and targeted gains. On this axis, visitors can be involved in adventures where they will look for a sword or a sacred stone with smart glasses that are claimed to be much more ergonomic or even transferred to artificial lenses, creating their own avatars (as Metaverse). One step ahead, young age group students can participate in

such events in home settings with remote access under the supervision of their parents. Thus, they can search for dinosaur eggs in their rooms with their families using their own equipment to complete the museum's duties to them. So they can learn while having fun.

It should be noted that the start of adoption of mobile games by cultural institutions will also lead to the self-update of the corporate structure. Museums are developing day by day in education. When mobile games are added to this, more work will fall on the museum's marketing and legal units when licensed characters begin to be adopted and a group of bony players is formed. All these elements we count are the fields that have the potential to create their own economies and where legal measures should be taken in the face of violations of rights.
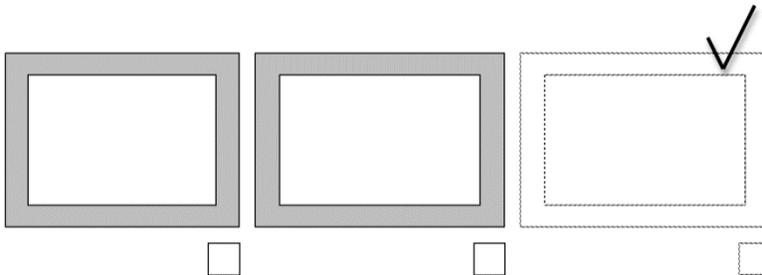
4. Artificial Intelligence (AI) Curators

Curatorship is among today's respected professions. Curators are people who prepare and carry out new exhibition concepts for museums and galleries with their original research. Today, there is a share of higher education institutions in the adoption of curation as a profession. The first thing taught in the trainings given in these institutions is to think in a multi-faceted way. Today's curators explore and examine the collections at hand in the preliminary stages of exhibition preparations. Examining the historical connections, physical states and legal frameworks of existing collection objects is the first step in multi-faceted thinking. After collecting information and documents on these, it is proceeded to produce texts and make spatial evaluations. Situations such as the preliminary impact of the exhibition on the public, making business plans, reviewing and reviewing promotional materials are the curator's responsibility. As can be understood, what affects the success of an exhibition is not just a qualified collection. The curator's attention and effort have an important share in the relevant success.

Many researchers working on computers and cybernetics argue that artificial intelligence is the key to the future (Pirim, 2006, p. 82). There is a sense of justification in this regard. Artificial intelligence is used in a remarkable part of the control mechanisms that drive everyday life today. Again, artificial intelligence is preferred in more than one profession, from banking to industry, from education to science. The advantages of artificial intelligence, whose roots date back to 1940s, will not end with counting. Because artificial intelligence is in their simplest form; it allows us to save labor, economy and time. However, looking back, it is possible to observe that such technologies threaten or eliminate the need for manpower in some professional groups (Arslan, 2020, p. 77). Culture and art environments have not felt a deep need for artificial intelligence to the present day. However, it is difficult to guarantee that this situation will remain so in the future. Because as science progresses, as new findings and new methods are identified, culture and art media are likely to turn to science more. Indeed, it was not known that harmful radiation in daylight had an effect on the deterioration of collection objects a hundred years ago. Numerical calculations were not used to prevent such damages. In addition, risk and probability calculations were not so deep and comprehensive. However, today it is possible to calculate many things that concern collections, from moisture in the interior to pollution, and to take measures accordingly. The relevant approach also applies to history research. A remarkable part of the curators today prefer virtual environments to dusty shelves in order to save time and workforce in their research. Virtual environments allow you to be able to research

on issues that require care, such as preparing chronology, in a short time and over more resources (Özcan & Çağlar, 2020, p. 646-647).

So what if artificial intelligence adopted the curator identity? Would an artificial intelligence be useful, for example, in the name of situations that detect risky points about harmful irradiation in exhibition venues and require periodic control, such as insecticides, to remind museum staff, to control and report air conditioning? How functional would this artificial intelligence go a step further and scan all the collections owned by the museum with keywords in a short time and make exhibition suggestions focused on " time, space and collection"? (Figure 5).

Figure 5. Curatorship is among today's respected professions. Curators are people who prepare and carry out new exhibition concepts for museums and galleries with their original research.

Considering the size of collection objects while doing all this, it prepares mathematically compatible display suggestions, it deviates useful display technologies. How much would we need curators if they created cost breakdowns on their behalf and designed promotional materials on the templates they host and presented them to the interest of the institution managers?

In fact, programs and interfaces that can perform the above jobs are available in today's technologies. But their widespread adoption is again related to technology consumption. Therefore, it is worth remembering once again that technology consumption for museum players is an issue that needs to be carefully studied.

5. Three Dimensional (3D) Printers, Replications and Commemorative Objects

In the definitions pointing to the museum, it is emphasized that such institutions are not for profit. However, museums can organize paid seminars or educational events for their visitors. In fact, marketing units can prepare and sell various publications for collections. It is necessary to add souvenirs with them. Such objects are commemorative (or useful) objects that often refer to an archaeological relic or an art object that stands out in collections. For example, tiny replicas or commemorative objects of Ancient Greek sculptures are offered for sale in the shops of archeology museums. These attracte visitors. So if Heracles, the symbol of the visitor gift shop, is interested in a Roman period glass whose name is not much heard instead of bust, is it possible that it has a replica or commemorative object "right at that moment "? When answering this question, it is important to consider which museum collections may have an inventory book series that occasionally contains hundreds of works. It is quite burdensome to produce a unit amount of replica or commemorative object of all collection objects, to

have them ready and market them in warehouses. At this point, a much more practical approach can be driven.

When three-dimensional (3D) printers were released, many suggestions were developed for the intended use of these printers. These suggestions underline that three-dimensional printers will work faster in the long run and produce more durable materials. The point that comes is to support the statement in question. The process of printing "small-scale objects", which initially took eight to nine hours, is now up to two, two and a half hours. In addition, " outputs " are much more robust than the old with the new components used (Çelik & Çetinkaya, 2016, p. 152-153). When it is like this, It can be seen that three-dimensional printers that started to stand out in the 21st century may take a more functional position in the future than today. It is likely that the marketing units of museums will turn to innovative initiatives to take advantage of the possibilities offered by three-dimensional printers (Gül, 2018, p. 86). As we exemplified with the Roman glass, not all visitors may be interested in the same object during the museum visit. Some visitors may see out-of-view objects closer to them, internalize them, and want to have replicas or commemorative objects of related objects. In the face of this situation, museums can move their existing collections to virtual environments in harmony with three-dimensional printers. Visitors can detect objects they adopt (inventory code, blunt information or keywords) and send their virtual models to the three-dimensional printer thanks to the interfaces loaded on kiosks. It can even choose from size or coloring options with a slightly more innovative approach. When the process is completed or their visit is ended, they can receive their replicas or commemorative objects.

A similar approach can be adapted to educational activities. For example, the student attending an event held at the American Museum of Natural History in the United States may be interested in a prehistoric creature where he learned his name at this event. So he may want to get a replica or souvenir object (for this creature, for example, a T-Rex tooth or a Raptor claw). At this point, the visitor can quickly obtain a replica thanks to the three-dimensional printer (Figure 6).
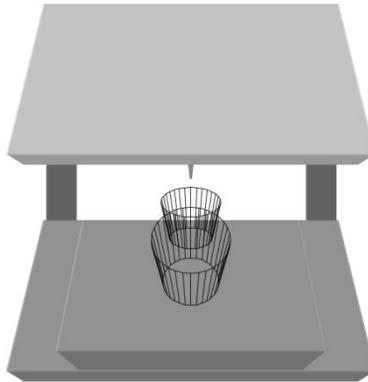
Figure 6. Today, many projects related to 3D printers are carried out under the roof of universities. For example, Yıldız Technical University in Istanbul has a 3D printer project that concerns museums and dioramas. See: YTU, Scientific Research Projects Coordination Unit / Project Code: SBA-2023-5758.

6. New Applications in Visitor Acceptance

Today, entering museums, participating in crowded tours and benefiting from audio guides is subject to ticket. These tickets are divided into many categories for different visitor groups, such as student-teacher or young-old. However, current identity studies have signaled what kind of large use of biometric data in the future. Biometric data is used in border security and transportation sector with their current status. Since these data take reference to their physical characteristics, their margin of error is low. They also save time. For example, it was inevitable to enter the rows that did not appear to be the tip bug to pass certain stages at any airport on behalf of travel thirty years ago. At the point that comes, there are technologies that enable the passenger not to encounter any obstacles until he gets out of the taxi and gets on the plane, thus making it possible to devote more time to himself or other works. It is even possible to obtain information about the current health and psychology of the passenger with these Technologies (Figure 7).

It seems that biometric data will replace ticket transition systems in the future and do so within different institutions. Museums are one of the institutions that can benefit from this situation. There will be no need to join the long lines of dissuasive nature when museums adopt transition systems based on biometric data. In this sense, the automatic realization of wage collections, while making these collections, (on behalf of the wage separation) is among the long-term technological possibilities of observing the many qualities of visitors' current data, such as their age (Aygün et al. 2016, p. 16).

Visitors will be able to be directed to groups of similar people, with their personal information in this data, where they can easily adapt to group visits.
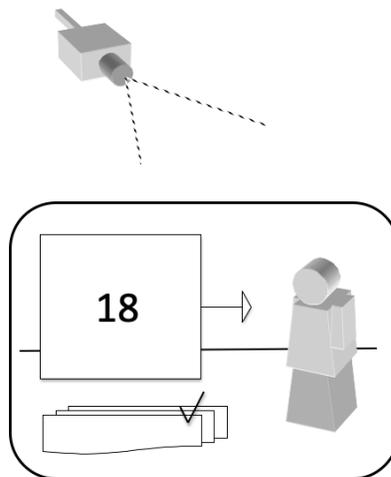

Figure 7. Nowadays, biometric data is used in many fields.

7. New Scanning Technologies in Conservation and Restoration

In the early 20th century, there was not as much technical equipment as today in the maintenance and protection environments in the museums. Inventories in the first laboratories often consisted of chemical solvents and simple hand tools. However, as

science and technology progressed, these spaces made progress as the field of care and protection discovered the benefits of these areas. The progress in question has been primarily in scanning technologies. Today, most of the qualified conservation and restoration laboratories have equipment such as X-Ray and UV lamps. An example of painting restoration can be given to explain the ways they are used. The first step in the restoration of painting today is to observe and examine the painting. In this step, situations such as the level of pollution of the painting, whether it consists of different layers or whether the interventions are new can be detected. X-Ray technology ensures that the bottom layers of the painting are noticed if they exist. UV lamps help detect subsequent interventions such as signatures. With the help of other analysis technologies added to these, the route required to bring a painting to its original state can be drawn (Ersen & Verdön, 2010, p. 10-11). So what technologies can conservation and restoration integrate into the future? To answer this question, you can go through scanning technologies again. Research on scanners has revealed that these technologies can operate in a long run in a fast, high-resolution and three-dimensional format. MR technology is a screening technology that is already involved in medicine and used to detect patients problems. This technology can reveal the state of brain functions in about an hour. Doctors can observe these functions and make the right diagnosis and apply the right treatment.

Today, various studies are being carried out to combine MR technology with augmented reality. If these studies give an ergonomic result, it will be opened that different layers of the scanned object can be followed through digital models that can be viewed with wearable technologies. Thus, problematic parts can be examined from different angles and with remote-close options. Such technologies, which need a large area in a natural volume, will crumble in the future and perhaps turn into an application. Thus, it will be possible for restorers to scan a painting that has been subjected to distortion within a few seconds and divide it into different layers and perform digital media analyzes on the divided layers (Figure 8).
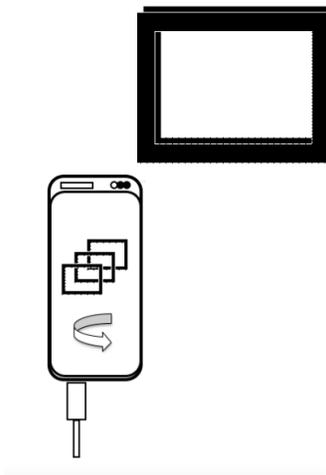
Figure 8. The impact of scanning technologies on the field of culture and art will increase in the future.

Another situation that concerns the areas of conservation and restoration is recycling. In this approach, which is essentially a principle of care and protection, all interventions for the painting should be done with recycled materials. Because if an error is encountered or the expected effect cannot be created, the painting will be cleansed from practice and will be able to receive a more profesional hand. In the future, it is likely that interventions will be made primarily in virtual environments and digitally. Transferring images to the corresponding application after scanning the painting has the potential to be the first step in such applications. After that restorer will be able to perform its analysis and interventions in these environments and will be able to observe their results without physical intervention in the work.

When talking about conservation and restoration, it is necessary to touch artificial intelligence with the same degree of importance. Artificial intelligence can also be included in these areas. Accordingly, artificial intelligence can analyze a painting loaded into the system in different ways by scanning. Thus, artificial intelligence-supported data can be obtained for situations such as the distribution of pollution, subsequent interventions, detection of signs of insectization and the nature of the paint used. In fact, artificial intelligence can plan a restoration on these data, where risks are taken into account and the right steps are listed. It is possible to learn about the directional determination of the brush strokes of the painter at more advanced levels and their distribution, or to match the painting with experts who can make appropriate interventions through databases is only one way to communicate with them.

8. Digital Platforms of Museums

There were those who adopted this technology as well as those who opposed it when the televisions appeared. According to their people, television was a costly technology with the potential to exceed privacy limits. The time passed, televisions developed beyond expectation. Today, there are one or more televisions in almost every household in Western countries. However, many features of televisions have recently been transferred to portable computers or smartphones. Thus, the front of both a mobile and personal process was opened. Now viewers can follow the movies they wish through their portable devices during their journey or a dinner outside. Moreover, thanks to the possibilities provided by platforms such as Netflix, Disney+ or HBOMax, they can finish the productions they are interested in one sitting. Again, they can make comments on interfaces for them and leave emojis (Can et al. 2021, p. 330).
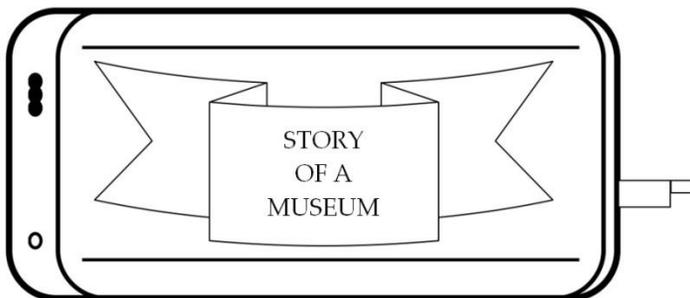

Figure 9. Today, digital platforms can be accessed with portable computers and smartphones. This allows users/members to save time.

The number of subscribers of digital platforms is increasing a little more day by day. Large-budget museums are likely to make such an initiative in the future. Because digital platforms appeal to a wide segment day by day, attracting more attention. On this axis, museums can create digital platforms and prepare thematic productions for visitors who prefer remote access and mostly work from home. These productions can be documentaries, animations, and even flashy films supported by CGI technology (Computer-Generated Imagery). Virtual question answer applications or puzzles can be added to these productions in the name of learning by having a pleasant time. When derivative initiatives reach a dimension where certain museums cannot stand alone, more than one museum can divide the responsibility for production (Figure 9).

9. Digital Tour Guides

Group visits held in museums today are accompanied by expert guides. These guides introduce visitors to existing collections and provide brief information about their history. Emerging technology has already integrated audio guides into these guides. However, progress continues. Today, smartphones host digital assistants such as SIRI. These assistants are updated certain periods and gain new features. These assistants, who are familiar with voice commands, can send and direct information to users. With the advancement of cloud technology and the distance of wireless communication, digital assistants will be able to quickly download data on the characteristics of their environment (plan, routing information, key points, etc.). If this system is adapted to museum venues, the guide accompanying the visitor in the exhibition halls will be their own digital assistants, which the visitor is familiar with (Göksel Canbek & Mutlu, 2016, p. 118).
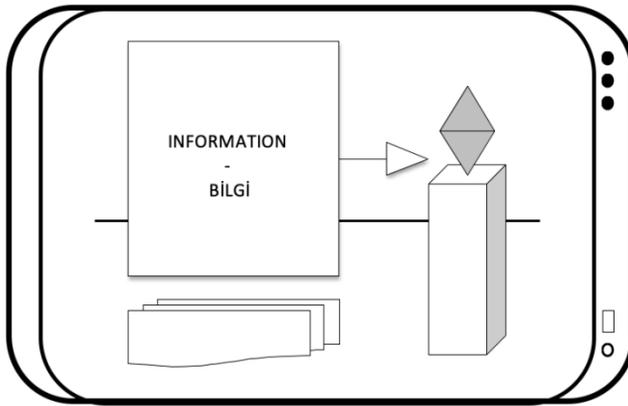

Figure 10. In fact, portable computers have long been used in museums. However, as time progressed, its functions became richer. In addition, their designs are also ergonomic.

As functions develop, visitor habits are grasped and expectations are analyzed, the situation of directing them towards museums, exhibitions or collection objects within their interests will appear. Digital guides should of course not be considered one-sided. Because these guides will be able to transfer some information not only to the visitor but also to the museum managers. It will be possible to share the physical characteristics, expectations, feedback on the approach of the exhibition, accompanied by instant data,

of these visitors. The available data can provide museums with the opportunity to evaluate their exhibitions more objectively (Figure 10).

10. Continuity Supply Consciousness & Artificial Intelligence (AI)

Museum managers are individuals who have grown not only in their specialty but also in administrative sciences. These individuals are obliged to ensure that the corporate functioning continues smoothly as they are taxpayers by making the collections sustainable. Managers are individuals who know their institutions well, master processes and have experience and ability to solve problems. One of the possible initiatives to stand out among the technologies of the future is the transfer of long-standing consciousness to virtual environments, despite the new popularization of the Netflix series Black Mirror or similar productions. According to the theories about this initiative, the consciousness features we have, our thinking structure and the reactions we have in the face of certain situations can be reflected in the codes. Thus, existing experiences will not disappear and personal gains will be made sustainable. If the target is reached, it seems that the people who will benefit most from the situation will be the managers of large budget family companies. Because there is a management style in family businesses that stands close to the "ancestor cult". Within the framework of this concept, family elders who founded the company or brought the company to certain points are the leading managers. Corporate functioning depends mainly on them. A similar approach applies to museums. Long-running museum directors may be individuals who have personally witnessed the progress of their institutions and signed under the decisions that guide the institution. Therefore, in cases such as death or dismissal by "saving" the management skills of those who have assumed the key task for the success of the institution, to put these records into effect, that is, delivering the task to artificial consciousnesses is already a situation that needs to be included in the possibilities (İyigün, 2021, p. 676).
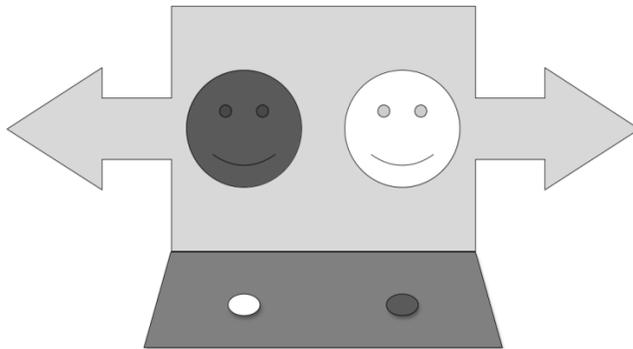

Figure 11. Continuity Supply Consciousness and Artificial Intelligence (AI) have also been the subject of many recent science fiction productions. In such productions, the main characters sometimes had to make a choice.

This issue originally contains a dilemma in itself. This dilemma is why there will be a breakthrough in this direction while artificial intelligence prone to self-improvement are present. Artificial intelligence has the ability to make decisions. To study this, it is necessary to approach the bet in two frameworks. The theme of the first framework is

state museums. In this context, the manager who contributes most to the benefit of the institution and who has the possibility to provide it should come. It is the sustainability of a public institution. In this sense, artificial intelligence can be preferred. The theme in the second frame is private museums. Trustees and families with foundations in such museums may want to continue the institution's administration with the artificial consciousness of their managers, where they nurture a sense of trust and appreciate their work. Therefore, at this point, an orientation towards the consciousness transferred to virtual environments can take place (Figure 11).

11. New Applications in Redirects

Today's museums use technology in many areas, especially promotion and display. These technologies range from high resolution digital displays to kiosks. However, current studies have led to new approaches to indoor spaces. These approaches are already shaped by the preliminary view that expensive but needs-to-meet technologies will be more economical and ergonomic in the future. For example, holography devices are still expensive for countries outside the Western geography. However, this technology is likely to become much more convenient and available in the near future. When this happens, the suggestions of the designers that center the holography technology will increase because holography technology is a highly effective technology if used for the right purposes (Işık, 2014, p. 381).
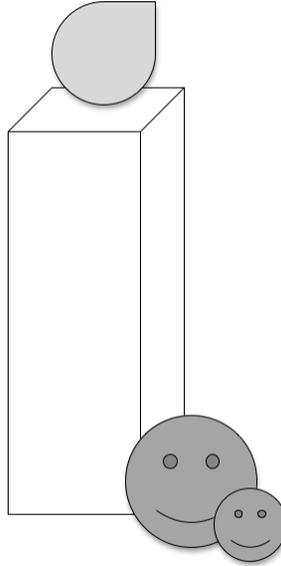
Figure 12. Holography devices are still expensive for countries outside the Western geography. However, this technology is likely to become much more convenient and available in the near future.

Holography technology is currently used as an item to help exposition more in museums. Its main task is to contribute to thematic expressions and to support these narratives with artificial images that can be observed from different angles. But holography technology can also be used in the museum to guide visitors indoors. It is

possible to express this as the current orientation approach being applied by an unusual method. Thanks to the relevant technology, the visitor can be indirectly guided by a white rabbit or an emoji. The visitor following the holographic rabbit or emoji can complete the tour on the route. The rabbit or emoji we have mentioned may be a licensed character of the museum. The designed character can also be supported by sound equipment in the environment. In this way, general rules can be taught to visitors of the young age group, such as not touching the works or pressing the fire alarm (Figure 12).

12. Smart Buildings

Inspiration or cabinet of curiosities are institutions that tend to protect collections, wherever museums come from names or roots. What is protected here can be works of the local cultures of nations or objects that constitute universal value. The efforts of international organizations, especially International Council of Museums (ICOM), have led to the concept of contemporary museology. In this concept axis, it has been added to the protection mission of museums such as research, documentation, education and exposition, and these have been brought to the fore a little more day by day (Karadeniz, 2020, p. 113).

The biggest lesson we took from the COVID-19 pandemic, which broke out in 2020, is that we can be helpless in the face of all the information and technology we have, such as natural disaster, epidemic and war. In this sense, can the world of the future enter an apocalyptic process without seeing all those glorious days we have dreamed of? Can museums leave all their functions aside and acquire a strict protection mission within certain periods of time?
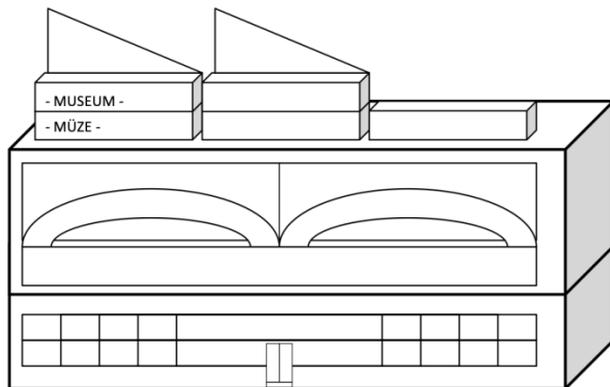

Figure 13. Today, museum architecture is a discipline that considers the functions of the museum.

To study this, it is necessary to look at a not too distant past. The First and Second World Wars are the most devastating wars in human history. In these wars that took place in the first half of the 20th century and touched the future of many countries, some museums moved their collections to metro stations in order to protect them. Some replaced their works with their fakes and entrusted the originals to reliable experts. Some museums relied solely on local law enforcement agencies, and thought it would be enough to place a guard in the exhibition halls. Emergency plans have an important place in museology today. These plans contain guidelines, which concern different units

of the museum, grinding synchronous behavior when needed, and cover many details in which order the objects are evacuated in adverse situations. But are these enough for the museums of the future? What else can institutions do to protect their collections from negativity? In the long run, smart buildings can stand out. The subject of museum architecture can be drawn to a different discussion platform. Thus, new planning can be made in line with needs and forecasts (Figure 13).

13. Reflection Applications

One of the popular digital-based initiatives of recent times is reflection practices. "Projection Mapping, 3D Projection or 3D Mapping" and grouping studies are ongoing on the basis of reflecting such spaces and object textures on real surfaces (Figure 14). Such practices, which are preferred due to the atmospheres it provides in thematic expressions, have already attracted the attention of art and design media or even museums (Ekim, 2011, p. 10-11).
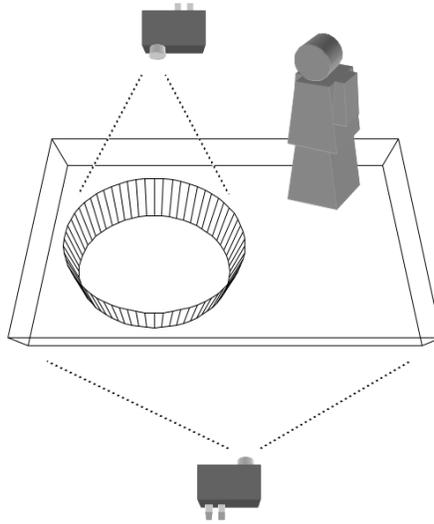
Figure 14. One of the popular digital-based initiatives of recent times is reflection practices.

Research on behalf of reflection practices is focused on topics such as texture similarity and resolution, just as in augmented reality. These applications, which managed to take part in many exhibitions after 2010, promise a pleasant and extraordinary experience for visitors. Again, as Güler and Erdem stated (2014): " *use of 3D technology for students to learn by doing and living in a virtual environment LIFE (Learning In Future Education) project started to be explored since 2010 and France, Germany, Italy, Netherlands, Turkey, the United Kingdom and the pilot schools in the Swedish countries ". Such technologies require powerful computers and special hardware in their current state* (p. 2).

In line with developments and innovations, related software and equipment can gain a more practical, ergonomic and economical dimension. Thus, museums may be more willing to transfer these practices to sites other than exhibiting them in the future. Games such as treasure hunt, for example, that we have mentioned, can be adapted to environments equipped with these technologies within the educational activities.

14. Metaverse, Blockchain & NFT

Political and social developments in the 20th century had a significant impact on the art aesthetics of the period. This manifested itself in its leanest form by the rectification of the First and Second World Wars (1914-1918 and 1939-1945). The role played by science and technology within the process was beyond underestimation. Especially with the information technology investments that appeared after 1960, mass media-centered breakthroughs were the elements that paved the way for innovative approaches in art media. The phenomenon of exhibiting at the same time began to go beyond historical sites because the works that pushed the boundaries of post modernism led many curators to the White Box, so that was given a chance to alternative perspectives before the space relationship with the art structure.

Today, there is a virtual universe. Artists are in the bustle of a visible and sustainable place in vast lands ranging from pixel-based images to famous avatars. NFTs where you bet the closest time works where the defect effort can be observed. NFTs based on the popular technology cryptography based Blockchain technology of recent years are a pardon of interest from artists from different disciplines. This ongoing interest challenged a wide variety, from moving images to stationary visuals. The mentioned variety points to a transfiguration, "that is, the transition from the White Box to the Black Screen", beyond being a technology contempt. Museums are institutions that closely observe derivative transitions. In this context, it is possible to come across applications that are referenced by commodities such as Metaverse, Blockchain and NFT in the museums of the future (Figure 15).
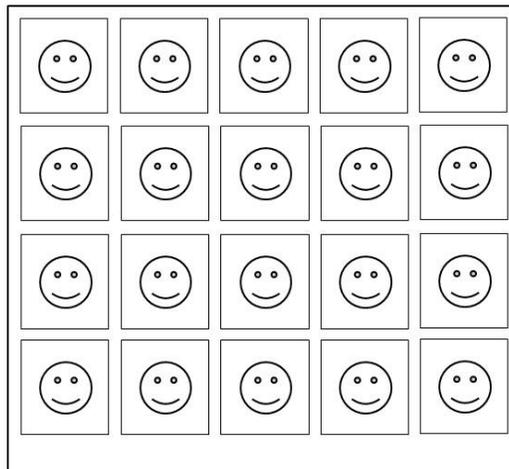
Figure 15. NFTs have attracted attention with the pandemic period. In this sense, a new source of income has emerged for artists.

Conclusion

The question-answer reviews we have presented by dividing them into specific topics may have followed the process in some matters. On some issues, may have described situations far from reality. The important thing at this point is to show a reflex and make an effort to be included in the right route. As we mentioned under the

Introduction, it is a very difficult task to predict the technologies of the future. It is necessary to analyze existing technologies and technology consumption well to qualify for relevant forecasts. The period expressed since 2010 is the Industry 4.0 period. Museums wishing to be included in Industry 4.0' should first "dream" for their collections and visitors. Then, they should study the dreams they have established within the possibilities and seek correct and effective collaborations.

a) Having a clear vision,

b) To follow innovative developments closely,

c) Taking advantage of the experience of different professional groups by sending representatives to workshops, congresses on technology, design and sustainability,

d) To be included in the networks of organizations that share current developments in technology,

e) Regularly review target audience profiles and expectations.

Museums that want to capture the requirements of the time are of course waiting for troublesome obstacles. What we count are suggestions that will contribute to museums in their journey of overcoming obstacles and help make their decisions hit. It is necessary to underline that museums should not be used for their future quest. They should not leave their ways halfway. It should be noted that technology is developing. It will be our own preference to be a part of this progress and to transfer the flag to the next generations by completing the process with positive acquisitions.

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