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## GEODESIGN FOR DESIGNING THE FUTURE OF OUR CITIES

## GEODESIGN İLE ŞEHİRLERİMİZİN GELECEĞİNİN TASARLANMASI

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**Abstract**

It can be said that city planning is more important than ever. Traditionally, the results of urban planning have been presented in the form of long reports and 2D maps. In the preparation of these maps, the use of Geographic Information Systems (GIS) in developed and developing countries has become standard since the 90s. Now new developments in Geomatics such as 3D city models, virtual reality (VR) and Geodesign provide tools to take urban planning to the next level. The aim of this study is to explain the current situation of geomatics-oriented urban planning, how it has been applied within the framework of different Geodesign projects in the Şanlıurfa region, and which tools have not been applied for different reasons until today.


**Keywords:** GIS, Geomatics, Geodesign, Urban planning, Virtual Reality


**Özet**

Şehir planlamasının her zamankinden daha önemli olduğu söylenebilir. Geleneksel olarak, şehir planlamasının sonuçları uzun raporlar ve 2 boyutlu haritalar şeklinde sunulur. Bu haritaların hazırlanmasında gelişmiş ve gelişmekte olan ülkelerde Coğrafi Bilgi Sistemleri (CBS) kullanımı 90'lı yıllardan itibaren standart hale gelmiştir. Artık geomatikteki 3B şehir modelleri, sanal gerçeklik (VR) ve Geodesign gibi yeni gelişmeler, şehir planlamasını bir sonraki seviyeye taşımak için araçlar sağlıyor. Bu çalışmanın amacı, Şanlıurfa bölgesinde geomatik odaklı şehir planlamasının mevcut durumunu, farklı Geodesign projeleri çerçevesinde nasıl uygulandığını ve hangi araçların farklı nedenlerle uygulanmadığını açıklamaktır.


**Anahtar kelimeler:** CBS, Geomatiks, Geodesign, şehir planlama, sanal gerçeklik


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## 1. INTRODUCTION

During the last half century, the rate of urbanization has sped up at a never seen rate in most regions of the world. Official numbers of the United Nations reveal that in 2007 the turning point when more than the half of the world population lived within the boundaries of cities (UNFPA, 2007) had been reached. This never-seen urbanization has been caused both, by internal migration from rural areas and by international migration rooted in political, security and economic instability. As a big percentage of these displaced people are forced to stay in slum areas at the fringes of cities the already existing environmental, health and transportation problems are enlarged. Here, the question we must ask ourselves is whether these informal or unplanned residential areas are the cause or the symptom of a problem. It can be argued that they are only a manifestation of an issue that has been discussed since centuries: ineffective planning systems and missing implementation of planning regulations. Already in 1839, this issue has been dealt with in Istanbul when it was tried to countermeasure the spreading of fires by imposing construction rules (and it should be added, with not much success) (Ergin, 1995). During these discussions it is often forgotten that almost all countries that had to cope with migration during a certain part of their history. As an example, the then new established republic of Western Germany may serve. In the aftermath of the second World War, more than 12 million refugees originating from former parts of Eastern Germany including German minorities from other Eastern counties had to be accommodated (Kommunalinfo Mannheim, 2017). Still, nowhere slums or similar informal dwellings were erected.

Against the background of pressing social, economic and environmental issues in the world's urban areas and agglomerations, city planning should be more important than ever. For centuries, the final results of the city planning process have been documented in the form of 2D maps and their accompanying lengthy reports. Since the 90ies of the last century, the usage of "Geographic Information Systems" (GIS) has become the standard both, in developed and developing countries (Yeh, A., 1999).

Nevertheless, it must be questioned, to which degree GIS has been applied successfully for solving problems related to urban and spatial planning in the past. Naturally, the answer to this question is not an easy one. On one hand, GIS has become an integral part of planning in most countries of the world for decades (Harris et al., 1993: Klostermann, 1997: Yeh, 2008). On the other hand, the classical usage of GIS is not without limitations. Usually, GIS deals only with the description of the past and current state of the natural and man-made environment. Contrary to some Computer Aided Drawing (CAD) tools, most GIS products currently available on the market are not suited very well for visualizing and analyzing plans of future states. In addition, classical GIS lacks the capability to integrate the cooperation of stakeholders, especially if they differ in terms of computer literacy and professional background. GIS outputs in the form of printed maps are still often used as the only official means during public hearings or as part of lengthy reports in many cities (Healey, 1997; Halvorsen, 2001; Innes & Booher, 2004; Kingston, 2007). During the analysis of the planning process and its results for the Turkish city of Kayseri Bakır et al. (2018) had to conclude that usually, local governments make zoning decisions in an inconsistent manner. Personal requests from landowners, missing participation in planning and the lack of technical staff in municipalities were mentioned as the most important reasons for this deficiency.

Beside the widespread utilization of GIS within academic institutions, local governments and virtually all commercial sectors around the world, availability of the first GIS applications on the Internet laid the foundation for the participation of a wider audience. In 1996, at the meeting of United States National Center for Geographic Information and Analysis (NCGIA) the expression “public participation geographic information system” (PPGIS) was named for the first time. With this expression, a definition of how GIS can facilitate public participation for various situations with the goal of inclusion and empowerment with emphasis on marginalized parts of the population (Nedjeljko, 2011) has been given. This new paradigm of participatory planning can be defined as “the process of decision making and problem solving, involving individuals and groups who represents diverse interests, expertise and point of view and who act for the good of all those affected by the decisions they make and the actions that follows” (cited in Fisher, 2001a, b).

Pettit et al. (2006) investigated how 3D geographical visualization can support communication during the urban and regional planning process. They found out that while the traditional planning process allowed for input and ideas from impacted groups it is far from encouraging the evaluation of ideas and different development scenarios. In contrast, the newest developments in visualization of geographic data offer the key for an effective community engagement during the planning process and the presentation of its results.

To implement participatory planning different methodologies have been developed. Among them, Geodesign integrates tools of design and GIS with web 2.0 to foster participatory planning. After having worked with his colleagues and students over a period of more than 30 years at the Harvard Graduate School of Design, in 1995 Carl Steinitz generated a comprehensive framework for carrying out Geodesign that had been applied to several regional landscape studies (Steinitz, 2012).

In “Geodesign – Case Studies in Regional and Urban Planning” McElwaney (2012) describes Geodesign by means of seven key characteristics: 1. working in a geographic space, 2. relying on science-based design, 3. incorporation of value-based design, 4. maximizing well-being of society while diminishing short- and long-term negative impacts on the natural environment, 5. support for design in multidimensional space, 6. provision of a social and technical framework for detecting issues and resolving conflicts, and 7. enhancing the quality and productivity of design. According to him, Geodesign studies will usually include most of these key characteristics.

With the availability of web 2.0 the stage for participation of a wider audience was set. For example, Ballal (2015) created a web based Geodesign software ("GeodesignHub" (GDH)), which was developed in cooperation with Carl Steinitz by converting his Geodesign framework into a digital design workflow. It was their response to the challenges of 2D and 3D visualization when implemented in large areas for solving regional planning problems. With GDH he tried to address uncertainty issues caused among others by impacts from long planning periods, multiple impacts affecting the area and competing actors and interests involved. Another deficiency lies in the inefficient process of designing that is characterized by a separation from analysis and visualization. He came up with a new seamless process to bridge this gap. The software GDH has been successfully employed during many planning works throughout the world (Rivero et al. 2015; Ballal 2015; Nyerges et al. 2016, Campagna et al. 2016; Moura et al. 2016; Kim, 2017). During workshops, their participants were enabled to cooperate and elaborate designs rapidly and test the design performance. The gap between analysis and design could be removed by means of effective cooperation of various stakeholders.

Another disadvantage of the traditional planning process is that reading through hundreds of report pages is not something everyone can afford to do. In addition, understanding the 2D maps included in these reports in the right way poses even for a Geomatics professional a great challenge. This does not only result in the general public being excluded largely from the planning proceedings, but also leaving decision-makers that often do not have a professional background in engineering in the dark as well.

Therefore, 3D models are not just buzzwords. There is a simple reason why 3D models and especially those of cities if they offer a certain level of detail like the models produced by the Turkish Ministry of Environment, Urbanization and Climate Change at LOD3 have received so much attention from different user groups. The human brain stores information about objects in 3D rather than in 2D. And recalling this information is much easier if you are working in a 3D environment. These findings can be easily understood by, for example, imagining a fruit like banana. Neither does the brain store text information like "banana" nor does it store it in the form of a 2D image. Instead, while thinking of this fruit we see a 3D object that resembles a banana. (Hawkings & Dawkins, 2021). Therefore, although even the layman can easily imagine in its mind how a 10-floor building would look like in reality if he sees it as a 3D model, this becomes much more difficult if to the same person only a 2D picture of even only a text description of this building is presented. Naturally, difficulties increase when moving from one building to more complex structures like a city block or a whole city district. Given these circumstances, it is no wonder that in many cases city planning cannot be considered to be a very efficient process. Fortunately, new developments in

Geomatics like 3D city models, virtual reality (VR) and Geodesign offer the tools to bring city planning to the next level.

VR, if it is deployed in a suitable way, may enable the general public to fully understand proposals for new development projects and thereby opening the opportunity to really get involved in the construction planning process. When stakeholders, such as clients and the public that do not have the required technical background have to view and interpret traditional blueprints, communication can become extremely difficult. Collaboration becomes inefficient and ineffective because some stakeholders will not be able to understand everything. This leads to failures in communication and causes great differences in the portion of influence among the different stakeholders. This problem has been addressed by introducing different presentation-tools such as perspectives and scale models, but VR tools could be of much greater benefit in such cases because they offer the feeling of scale, the possibilities to zoom in to detect the finest details and to walk around like in real life (Sonesson et al., 2008).

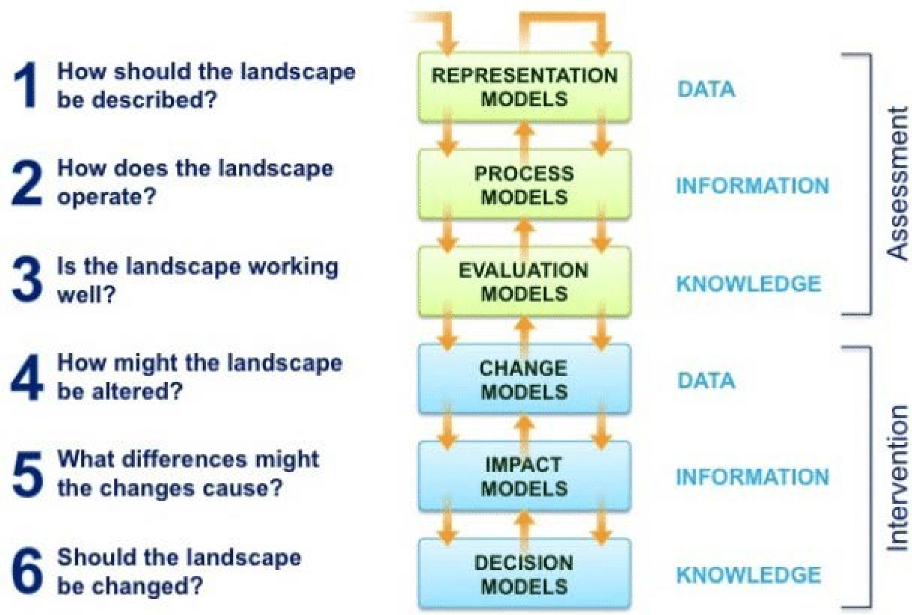
The purpose of this study is to explain the current state of art in Geomatics driven city planning, how it has been applied to the Sanliurfa region within the framework of different Geodesign projects and in which direction further research should proceed.

## 2. **METHODOLOGY**

For this study, Şanlıurfa and its region have been chosen. Despite its glorious history with the UNESCO World Heritage Site of Göbeklitepe exhibiting the oldest sacral monuments of mankind and the archaeological site of Harran that during the Golden Islamic Age was competing with Bagdad for the cultural center of the world, today Şanlıurfa counts for one of the poorest provinces of Turkey in terms of GDP/person. This situation has been worsened by the influx of about one million Syrian refugees during the last years.

With the purpose to introduce a more efficient planning procedure to the region under the leadership of the author several projects using the Geodesign approach, with some of them being published (Ernst et al., 2019; Ernst et al., 2020) and some not, have been carried out. In all these projects, the framework for Geodesign as described by Steinitz (2012) and summarized in Figure 1 was applied. This framework defines methods and provides tools for the collaboration of all stakeholders by combining GIS and design methodologies without the requirement of having prior knowledge of them. Without stepping into the details of this methodology for the following, it is enough to say that during the first three steps the current status of a project's area is researched while in the last three steps future scenarios are elaborated. Common to both processes is that in their last step (step 3 and 6 respectively) evaluations take place. In step 3 this is accomplished through the involvement of subject-matter experts and in step 4 by decision-makers. In both cases, evaluation even if it is based on certain pre-established criteria cannot be done 100 % objectively thus the pure domain of natural science will be left. However, by this the system can offer tools to support the way how people are acting in reality.

**Figure 1**: Geodesign framework (Steinitz, 2012).




In 2017, in the framework of a project sponsored by the Scientific Research Unit of Harran University a new masterplan for the 3000-ha campus area of Harran University was created. Based on different development scenarios regarding student and resident numbers, different alternatives for future growth with emphasis on teaching facilities, housing and agriculture were evaluated. During the consultation process members of the university's higher management were involved in this project right from the beginning. During a final workshop with the participation of the rector and one vice rector several workgroups were formed that came up with their own scenarios that after a fruitful discussion could be combined into one final plan. Software used in this project consisted of ArcGIS, the open-source GIS QGIS and the Geodesign platform GeodesignHub that is free for academic use.

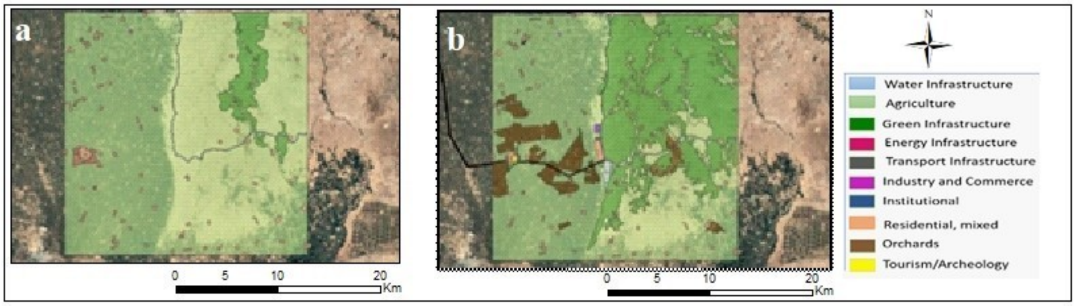
In 2018, in the framework of a project sponsored by the Scientific Research Unit of Harran University and ERASMUS of the EU development scenarios for the Şanlıurfa Region were designed. At the end of this project, a workshop with members of the Metropolitan Municipality of Sanlıurfa, several District Municipalities and municipality owned companies and teaching and administrative staff of Harran University including its rector was held. At this workshop, participants could experience some development scenarios by using a specially developed VR application (Figures 2 and 3). Due to time constraints (only half a day) the main purpose of this workshop was to make the participants acquainted with this new methodology rather than producing any implementable planning solutions. Software used in this project consisted of ArcGIS, CityEngine, the open-source GIS QGIS, the Geodesign platform GeodesignHub, and Unity.

**Figure 2**: Picture from workshop while using VR glasses.

**Figure 3:** One development scenario to be experienced by VR glasses.

In 2020, with the support of Harran Municipality a project aiming on outlining development scenarios for this district with emphasis on the agriculture and tourism sector started. As this project took place in the middle of the pandemic it was not possible to realize the planned workshop with physical presence of participants. Instead, the development scenarios were created and discussed during simulated workshops, in which students of a master class and professors from different departments worked together by deploying the ZOOM platform. Six development scenarios were developed with the “Non-Adapter 2050” and the “Early-Adaptor 2050” being the most diverging ones. Whereas the first scenario could be characterized as “business as usual” with ongoing encroaching of fertile lands and historical sites by settlements the latter one would unleash the potential of tourism based on the cultural heritage of this district and follow more sustainable agricultural practices. The huge difference in the spatial pattern of land use caused by these different scenarios can clearly be seen in the two maps of Figure 4. Software used in this project consisted of ArcGIS, the open-source GIS QGIS, and the Geodesign platform GeodesignHub. The results of this project, in which the cooperation in the framework of the Geodesign methodology was mainly achieved by means of communication via the ZOOM platform, had serious consequences on the speed and overall performance of the project activities.

**Figure 4**: Map of two development scenarios (left: Non-Adaptor 2050, right: Early-Adapter 2050) for Harran District




The results of these works have been analyzed with special focus on their effectivity and deficiencies. In addition, some new planning tools recently made available on the market or being under development as R & D projects have been examined and explained whether they can help to overcome existing obstacles.

## 3. Results and Discussion

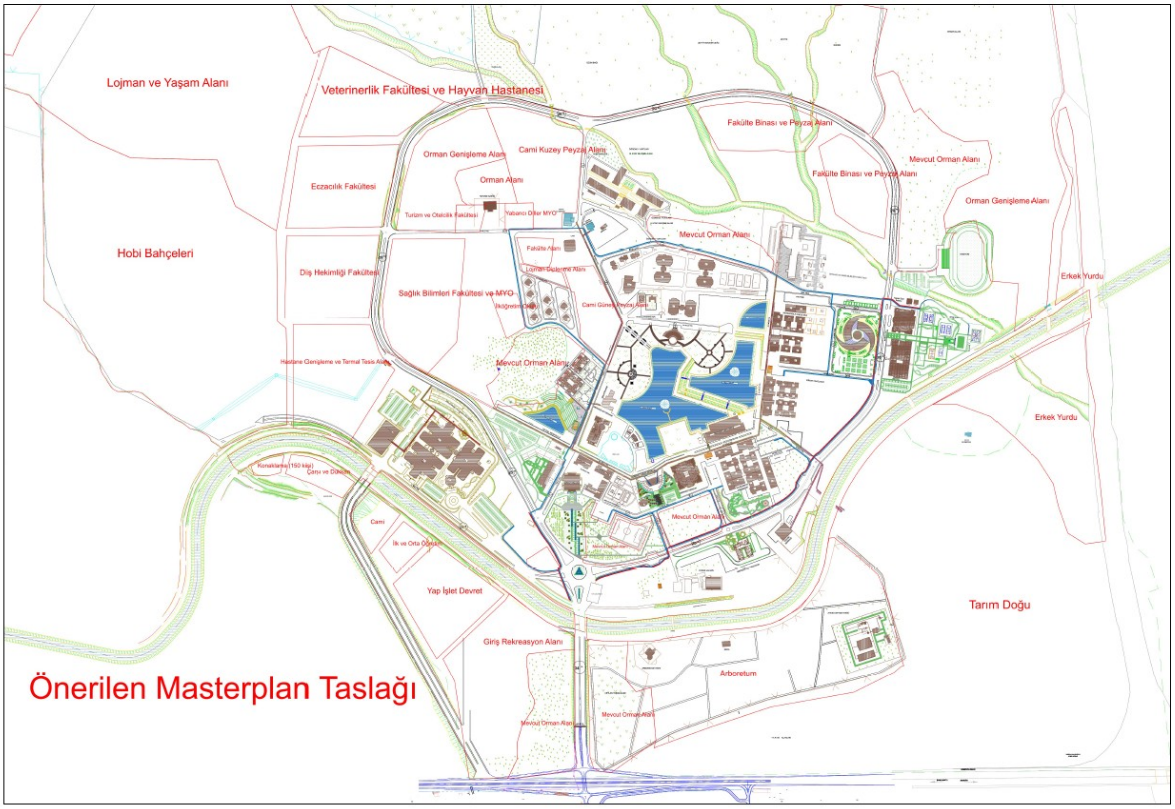
The usefulness of a new methodology can be measured best by the results it is able to deliver. As the ultimate goal of Geodesign is to create a better future by employing Geospatial technologies in a way that even the general public and decision-makers can take profit from them we will take a closer to which degree the goals of the above-mentioned projects could be reached. By this, deficiencies can be detected and conclusions for further research works can be drawn. Although in all the projects used for this study the Geodesign framework as described by Steinitz (2012) was followed they achieved very different results especially, in relation to implementation of the plans that were produced during this process.

### 3.1. New masterplan for Harran University

While drawing a new masterplan for Harran University many of the mistakes contained in the original masterplan could be corrected. First of all, the weakness of a plan that is solely based on CAD drawings became clear after a comprehensive GIS database had been created. Many features shown in the original master plan just did not match the situation on the ground. Important buildings were missing and many streets did not exist in the form they were drawn on the respective maps. Another issue was how the future campus was planned. For example, the Faculty of Law still to be established was in a pine forest. By means of the involvement of subject-matter experts from different university departments during the early phases of the Geodesign process and the active participation of all stakeholders including the higher management of the university during the later phases such planning errors could be corrected (see Figure 5). As one of the results, another more suitable location for the Faculty of Law could be found. Such changes could be made using digital maps on the spot. The usage of the Geodesign web platform proved to be easy even for newcomers to Geomatics because simple maps could be drawn by everyone, and the system computed the impacts of suggested changes in less than two minutes. One of the outputs of this project, a detailed map of the center of Osmanbey Campus created during the Geodesign works with all stakeholders of Harran University is shown in Figure 6 below.

**Figure 5**: Image from a Geodesign workshop at Harran University with different workgroups cooperating on creating a new masterplan.

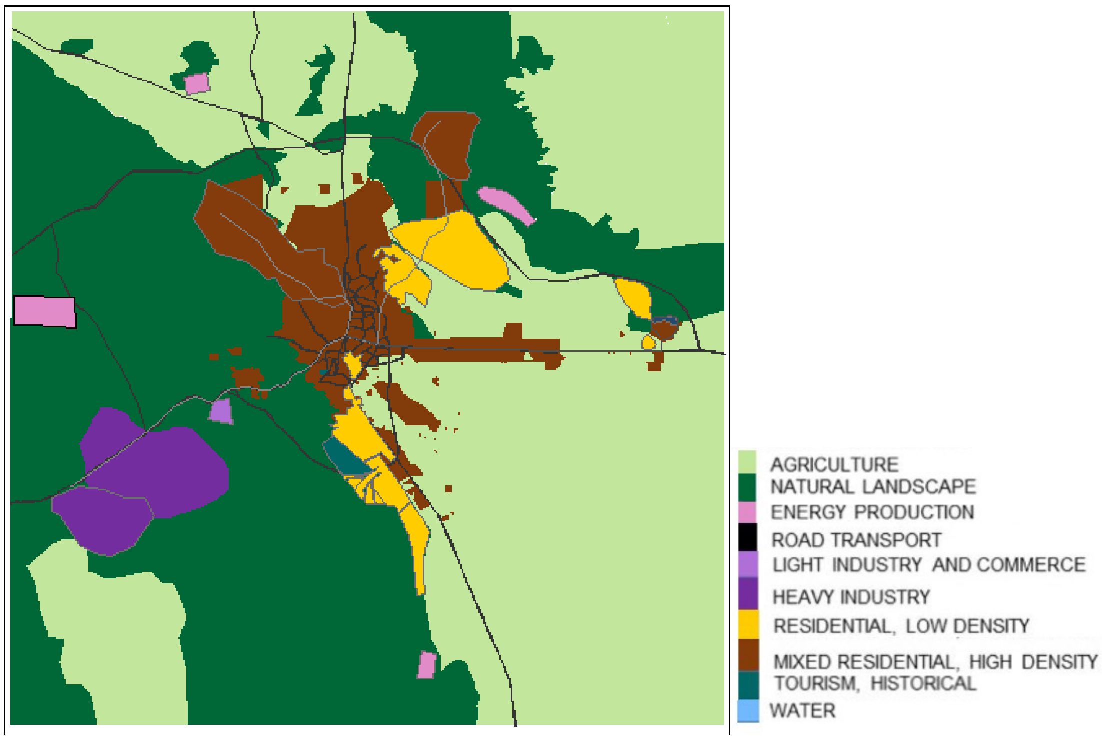
**Figure 6**: Detailed map of the center of Osmanbey Campus created during the Geodesign works with all stakeholders of Harran University.




### 3.2. Alternative Futures for Şanlıurfa - Turkey

The research works for "Alternative Futures for Şanlıurfa - Turkey" went through a thorough preparation and its results were presented in the ESRI book series on Geodesign (Ernst et al., 2020), from which the map of the Early-Adapter Scenario 2050 as shown in Figure 7 has been taken. Until now, no definitive results that would change the physical infrastructure could be achieved. This was due to the approaching local selection when no member of the higher management of the related municipalities could join the final workshop. On the other hand, the participating administrative and planning personnel showed great interest in Geodesign and expressed their wish to work more with this new methodology in the future. A drawback was that the presented VR visualizations were hard-coded meaning they were produced according to some predefined development scenarios in advance prior to the workshop. At that time, it was not possible to display newly created scenarios in real time in a VR environment. Interestingly, those who tried the VR application were so overwhelmed with this new experience that they did not notice this technical drawback. The interest of the participating municipalities in this new planning approach encouraged a team of researchers at Harran University to apply for a research project to further develop the Geodesign technology (for details see further below).

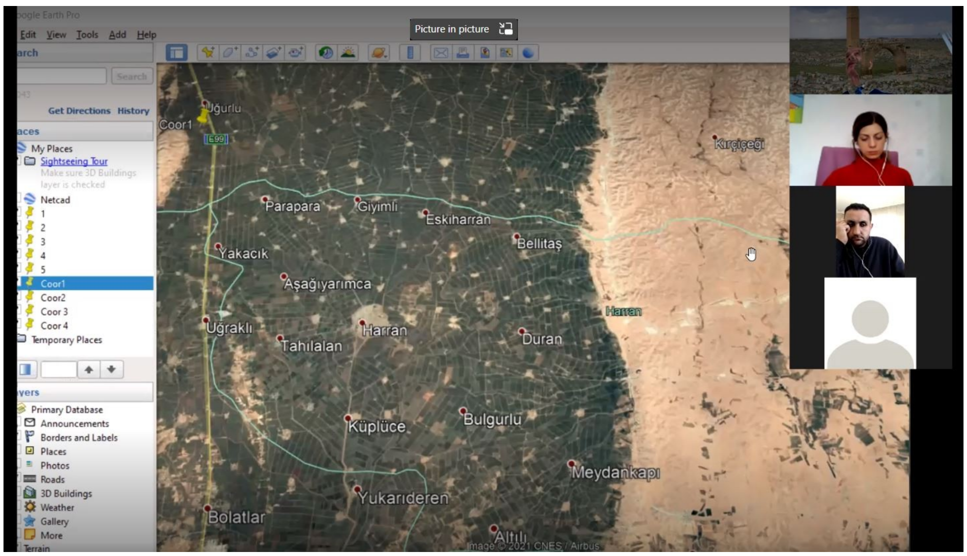
**Figure 7**: Map of Early-Adapter Scenario 2050 created during the Geodesign workshop with the Metropolitan Municipality of Şanlıurfa and some related district municipalities.




### 3.3. Alternative Scenarios for Harran District

The project for Harran district provided valuable insight into the opportunities and shortfalls of a virtual planning set-up (see Figure 8). While this set-up has the big advantage that everyone possessing a computer or smartphone with Internet access can actively participate in the planning process several shortcomings that make such an environment not very suitable at least for the near future have to be mentioned: 1) Without a stable broad bandwidth Internet connection this system does not work. The participating students joined the preparatory lessons and the workshops from their homes distributed over the whole Southeastern part of Turkey. For some of them it was very difficult to contribute in a meaningful way due to their unstable Internet connections. 2) Successful negotiations on big development projects require a certain level of trust between the participating stakeholders. Until now, this cannot only be achieved by means of face-to-face consultation. If instead a virtual workshop shall be hold then, much better Internet connections are needed that allow to show faces of people as if they were present 3) The small screens of smart phones are not suitable for the display of geographic information – no matter whether it is in 2D, or 3D format. Also, it must be reminded that during the Change Model Phase everyone should be in a position to draw new projects on their own, something that is hardly possible on a small screen and without a mouse. 4) The disadvantages of distant learning have been discussed intensively in the context of the COVID-19 pandemic and shall not further addressed in this article.

**Figure 8**: A screen shot from a ZOOM session while working on the Harran project.

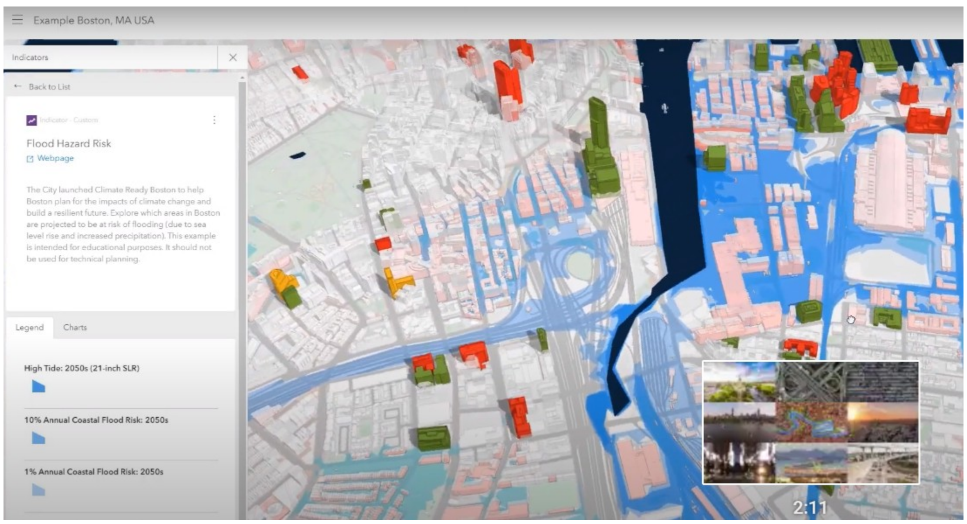



### 3.4. New Geodesign Tools

In the meanwhile, new tools that aim to enable a more efficient planning workflow have been made available. For example, ERI's ArcGIS 360 VR can display new designs created with CityEngine in a VR environment enabling the comparison of "before design" and "after design". CityEngine is a well-proven software for the creation of 3D models up to the level of whole cities deploying the concept of rule-based modeling (Kelly, 2021). Yet, this VR environment can only be produced with the help of experts and is not generated on-the-fly. VR scenes used during the above-mentioned workshop on "Alternative Futures for Şanlıurfa - Turkey" were prepared using CityEngine (Ernst et al., 2020)

In 2019, ESRI released a new web-based 3D application for city planning called ArcGIS Urban. The capabilities of this new planning tool span from zoning and overlay city districts from a GIS layer to modelling household capacity considering current regulations. More important related to our subjects is the feature for storing different rezoning scenarios. This allows the user to compare them with each other in order to find the optimal zoning solution for a defined household unit target (ESRI, 2020). So far, documentation on its application at the municipality level is limited to some cities in the USA like Seattle, Honolulu and Arlington (Soward & Li, 2021). It is a very powerful tool to show the consequences of any changes in zoning, for which a comprehensive range of parameters is available. Besides appealing displays in 3D mode other presentation tools include short reports, dashboards and additional media (see Figure 9).

**Figure 9:** ArcGIS Urban showing flood hazard risk for the city of Boston, USA.




An additional feature of this software is the option to create custom VR templates to be deployed Unreal Engine to gain a better acceptance and ensure that non-GIS experts can experience future scenarios like they were real during community workshops. This software could not be tested yet by our research group at Harran University.

The web based Geodesign platform GeodesignHub has been successfully utilized for the above-mentioned projects and some other smaller projects at Harran University in cooperation with several local organizations. Offered as a SaaS, for commercial purposes fees according to a fee catalog must be paid whereas for academic purposes the usage is free. It has matured during years of ongoing refinement and includes all the features to make it a suitable tool for conducting workshops at the highest administrative level. Handling by a normal user needs very little instruction although its administration requires someone with at least some basic knowledge of Geomatics. Important to know is also that its usage is restricted to steps 4 to 6 of the Geodesign framework (comprising change models, impact models and decision models). Steps 1 to 3 that relate to data preparation and evaluation of the current status (suitability maps) have to be completed using any GIS software. In most of our cases, ArcGIS and the OpenSource software QGIS came into use. Recently, extensions that offer simple functions for creating suitability maps (e.g., from the CORINE database) have been added to GeodesignHub. It is a well-known fact that the operation of ArcGIS and QGIS cannot be done successfully without serious training on these software packages. This fact should not be taken lightly because minor topological errors in the created GIS datasets will hinder their import into GeodesignHub. Even though this platform comes up with several extensions for visualization it does not support direct connection to a VR environment.

More recently, different Opensource tools that facilitate the implementation of the Geodesign methodology as a stand-alone software or in combination with other components have been developed. For example, the GISColab platform is a web-based solution that had originally been put in place for an academic environment. As a flavor of a Web-GIS it enables access to datasets via the Internet, Spatial Data Infrastructures (SDI) by means of WMS, WFS and WPS services or other means adhering to standards of the Open Geospatial Consortium (OGC). Besides supporting access to these data, GISColab enables the participation of the general public through data input from Volunteered geographic information (VGI) sources and applications that automate activities related to Geodesign workshops. GISColab consists of four main components: 1) a GIS based geographical database, 2) the Opensource map server GeoServer, 3) a catalog for metadata, and 4) a WebMap and WebGIS component.

Within the framework of the EU funded project REPAIR the Opensource “Geodesign Decision Support Environment (GDSE)” was developed (Arciniegas et al., 2019). GDSE integrates Geodesign into the Urban Living Labs (ULLs) approach, GIS, Material Flow Analysis (MFA) and Life Cycle Assessment (LCA) of urban waste into a single environment. Its innovation lies in the following fields: 1) MFA can used in a geographical context now: 2) Visualization of the current status early stages DURING the solution creation process: 3) Simulation of the outcomes of proposed changes: and 4) LCA can be used for impact assessment.

On the one hand, OpenSource software for Geodesign comes for free and depending on interest might be further updated and developed by a huge user community. One the other hand, software developed within the framework of on project usually, cannot directly used for a project having different parameters. Therefore, it needs setting-up and customizing, which requires expertise in programming and database administration that in many cases would not be available without hiring new staff.

### 3.5. New Geodesign Research at Harran University

Considering what has been discussed above, Harran University in cooperation with Otto-von-Guericke University (Magdeburg, Germany) and three SMEs applied for a biliteral TUBITAK project within the framework of “International Research Activities in SME (IraSME)” (IraSME, 2022) that just recently started. It aims to remove the above-mentioned deficiencies of

Geomatics based planning systems and create a system in which all components are much closer integrated with each other. The expected results of this project can be summarized as follows:

- A well-documented workflow including UML-diagrams that can directly be used for producing comprehensive plans, tourism master and zoning plans.
- A web-based planning and decision platform that can be used by all stakeholders to draft development scenarios without having to be an expert or to read any manuals.
- A web-based VR platform using VR headsets, with which all plans, scenarios and logistic simulations can be visualized and interactively edited.
- The simulation machine performs tourism targeted transportation and logistics simulations distributes its results on the Internet and can directly be integrated with the Geodesign application and displayed in VR mode; and
- A web-based platform that supports the exchange of spatial and non-spatial data for data formats most important for the urban planning process with only minor data losses.

Eventually, a prototype of an innovative urban planning platform that can be marketed as a Software as a Service solution after some minor adaptations to the local markets will have been produced.

## 4. CONCLUSIONS

Since 2016, a group of researchers is working with the GIS based Geodesign approach. The results of several projects using this approach show that this methodology can deliver promising outcomes that can help to make existing urban and regional planning much more efficient. The different stakeholders can easily participate in the planning process without the requirement of being experts in planning and related Geomatics technology. Especially, decision-makers that usually do not have a professional background in these subjects can have a much better understanding of the consequences of their decisions on major development projects and whether they fil into the overall development goals set for their specific city and region.

One of the purposes of Geodesign is to involve all stakeholders at the early stages of the planning process. This cannot be achieved without taking into consideration the needs of all stakeholders involved in the planning process. Especially, basic needs that are set by human's biology like how the brain works must be addressed. Here, it is a fact that all humans are thinking in at least three dimensions.

Newest Geomatics technologies like highly accurate 3D modeling must play a major role when it comes to displaying spatially related information. In most cases 3D models can only be viewed using 2D monitors or a related display on big screens that again are by nature only two-dimensional. Virtual

Reality is the only means that allows the user to view and experience 3D models - for example by walking around the model - in a direct way and without translating from 2D into 3D and vice versa. In the future, a wider spread of this technology will enable faster viewing of future scenarios and more important without information loss resulting from the complex conversion of 2D models into 3D ones in the human brain. Works on a just recently started project at Harran University will produce a system, in which Geodesign and Virtual Reality will be fully integrated.

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